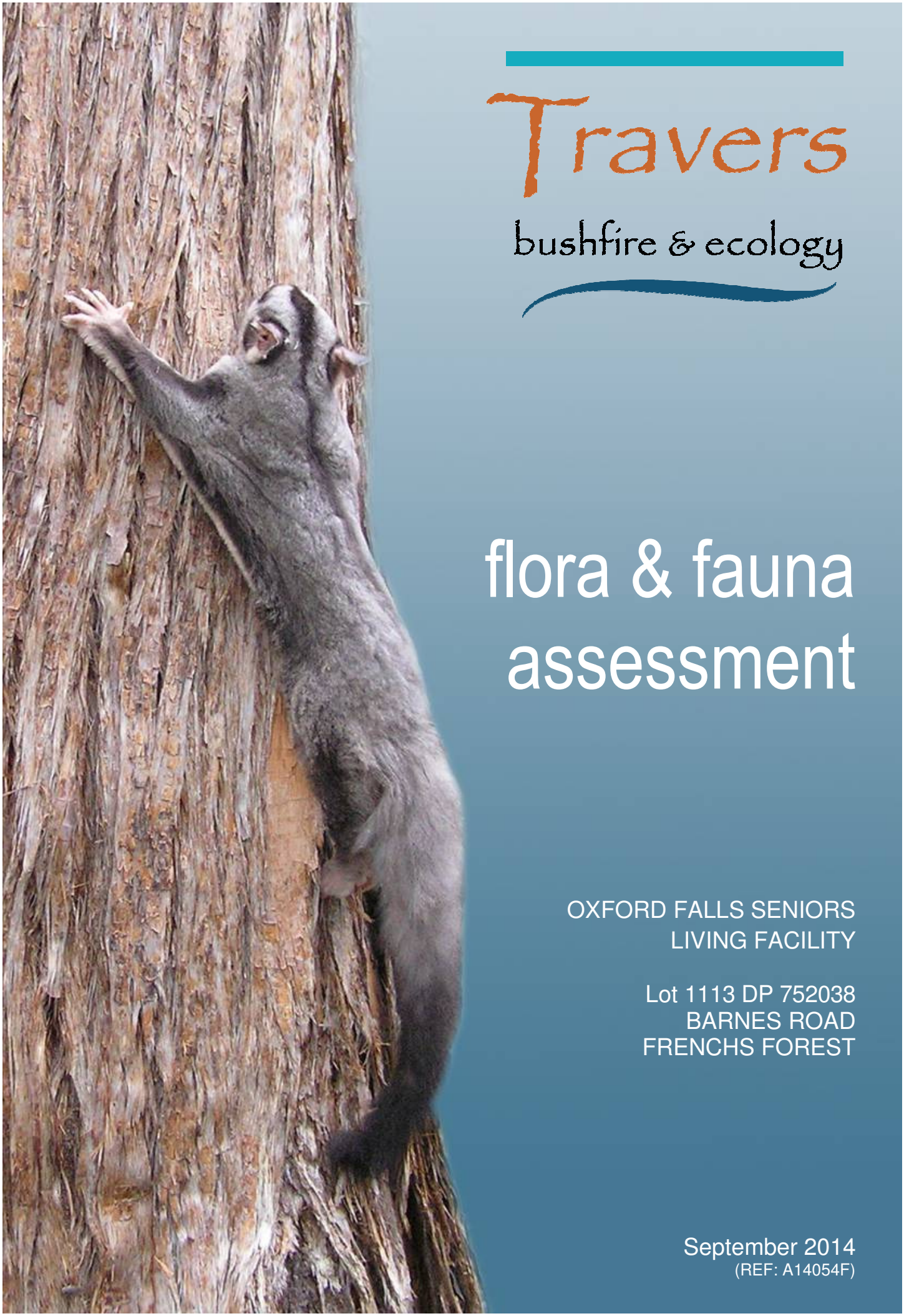

Travers

bushfire & ecology

flora & fauna assessment

OXFORD FALLS SENIORS LIVING FACILITY

Lot 1113 DP 752038
BARNES ROAD
FRENCHS FOREST

September 2014
(REF: A14054F)

Flora & Fauna Assessment

Oxford Falls Seniors Living Facility
Lot 1113 DP 752038
Barnes Road, Frenchs Forest

Report Authors:	John Travers *B. App. Sc. / Ass. Dip. / Grad. Dip.*
	Lindsay Holmes *B. Sc.* - Botanist
	Corey Mead *B. App. Sc.* - Fauna Ecologist
Plans prepared:	Peter Tolley, Trent Matheson
Checked by:	John Travers
Date:	05/09/2014
File:	A14054F

Disclaimer:

This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person including the client then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be interpreted without reference to the entire report.

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.

ABN 64 083 086 677
PO Box 7138
Kariong NSW 2250

38A The Avenue
Mt Penang Parklands
Central Coast Highway
Kariong NSW 2250

t: 02 4340 5331
f: 02 4340 2151
e: info@traversecology.com.au

Executive Summary

Travers bushfire & ecology has been engaged by *Dukor 24 Pty Limited* to undertake a flora and fauna assessment for a proposed seniors living facility located within Lot 1113 DP 752038 off Barnes Road, Oxford Falls.

The proposal involves expanding the capacity of an approved residential aged care facility on the site from 10 beds within the existing dwelling house, to a 45 bed facility contained within the existing building and proposed additional buildings on site.

Flora and fauna surveys have been previously undertaken by *Conacher Travers* (2004) and *Travers bushfire & ecology* (2010) across the subject site, as well as on additional lands to the north and south for a previous seniors living proposal. Threatened fauna species selected for assessment in this report include all those previously identified by the Director General's Requirements (DGRs) (DoP 2006) and / or DECCW (2009) raised by DECCW and the DGRs as part of the previous development.

Ecological survey and assessment has been undertaken in accordance with relevant legislation, including the *Environmental Planning and Assessment Act 1979 (EP&A Act)*, the *Threatened Species Conservation Act 1995 (TSC Act)*, the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* and the *Fisheries Management Act 1994 (FM Act)*.

In respect of matters required to be considered under the *EP&A Act* and relating to the species / provisions of the *TSC Act*, four (4) threatened fauna species, including Powerful Owl (*Ninox strenua*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*) and Eastern Bentwing-bat (*Miniopterus orianae oceansis*) were recorded within the study area. No threatened flora species, endangered ecological communities (EECs), or threatened populations were recorded within the study area.

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

In respect of matters required to be considered under the *EPBC Act*, no protected migratory bird species, no threatened flora species, and no EECs were recorded within the study area. One (1) threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*) was recorded.

The proposed development was not considered to have a significant impact on matters of national environmental significance (NES). As such, a referral to *Department of Environment (DOE)* is not required.

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

It is concluded that the proposed development of Lot 1113 DP 752038 off Barnes Road, Oxford Falls, is unlikely to result in a significant impact on any threatened species, populations or EECs or their habitats. As such, no further assessments are considered to be required under the *EP&A Act*, the *EPBC Act* or the *FM Act*.

List of abbreviations

APZ	asset protection zone
BPA	bushfire protection assessment
CLUMP	conservation land use management plan
DCP	Development Control Plan
DEC	NSW Department of Environment and Conservation (superseded by DECC from 4/07)
DECC	NSW Department of Environment and Climate Change (superseded by DECCW from 10/09)
DECCW	NSW Department of Environment, Climate Change and Water (superseded by OEH from 4/11)
DGRs	Director General's Requirements
DoE	Department of Environment (previously SEWPAC)
EEC	endangered ecological community
EPA	Environmental Protection Agency
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESMP	ecological site management plan
FF	flora and fauna assessment
FM Act	*Fisheries Management Act 1994*
FMP	fuel management plan
HTA	habitat tree assessment
IPA	inner protection area
LEP	Local Environment Plan
LGA	local government area
NES	national environmental significance
NPWS	NSW National Parks and Wildlife Service
NSW DPI	NSW Department of Industry and Investment
OEH	Office of Environment and Heritage (Part of the NSW Department of Premier and Cabinet)
OPA	outer protection area
PBP	*Planning for bush fire protection 2006: A Guide for Councils, Planners, Fire Authorities and Developers*
POM	plan of management
RF Act	*Rural Fires Act*
RFS	NSW Rural Fire Service
ROTAP	rare or threatened Australian plants
SEPP 44	*State Environmental Protection Policy No 44 – Koala Habitat Protection*
SEWPAC	Federal Department of Sustainability, Environment, Water, Population and Communities
SIS	species impact statement
SULE	safe useful life expectancy
TPO	tree preservation order
TPZ	tree preservation zone
TRRP	tree retention and removal plan
TSC Act	*Threatened Species Conservation Act 1995*
VMP	vegetation management plan

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Introduction 1

Travers bushfire & ecology has been engaged by *Dukor 24 Pty Limited* to undertake a flora and fauna assessment for a proposed seniors living facility located within Lot 1113 DP 752038 off Barnes Road, Oxford Falls, within the Warringah local government area (LGA).

The proposal involves expanding the capacity of an approved residential aged care facility on the site from 10 beds within the existing dwelling house, to a 45 bed facility contained within the existing building and proposed additional buildings on site.

Flora and fauna surveys have been previously undertaken by *Conacher Travers* (2004) and *Travers bushfire & ecology* (2010) across the subject site as well as on additional lands to the north and south for a previous seniors living proposal. The total area covered in previous surveys will hereafter be referred to as the 'study area' and incorporates the total area subject to a previous planning proposal including Lots 1110, 1111, 1113 & 1336 DP 752038, Lot 20 DP 842523 and Lot 80 DP 846099.

Threatened fauna species selected for assessment in this report include all those previously identified by the DGRs (DoP 2006) and / or DECCW (2009) raised by DECCW and the DGRs as part of a previous development project.

1.1 Aims of the assessment

The aims of the flora and fauna assessment are to:

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

1.2 Statutory requirements

1.2.1 Threatened Species Conservation Act 1995

The specific requirements of the *TSC Act* must be addressed in the assessment of impacts on threatened flora and fauna, populations and ecological communities. The factors to be taken into account in deciding whether there is a significant effect are set out in Section 5A of the *Environmental Planning and Assessment Act 1979 (EPA Act)* and are based on a 7

part test of significance. Where a proposed activity is located in an area identified as critical habitat, or such that it is likely to significantly affect threatened species, populations, ecological communities, or their habitats, a species impact statement (SIS) is required to be prepared.

1.2.2 Fisheries Management Act 1994

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

1.2.3 Environment Protection and Biodiversity Conservation Act 1999

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

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

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

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

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

A significant impact is regarded as being:

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

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

1.3 Proposed works

In 2013 Council approved the development of a low care seniors living facility on the site. The approval involved the refurbishment of the existing dwelling as well as bushfire protection measures, including asset protection zones both within the site and the adjoining land (Barnes Road Reserve and Lot 1336 DP 752038).

The proposal involves expanding the capacity of an approved residential aged care facility on the site from 10 beds within the existing dwelling house, to a 45 bed facility contained within the existing building and proposed additional buildings on site (refer Figures 1.1 – 1.2).

The proposal also involves the refurbishment of the existing residence located within the north-western portion of the site. This building will be used as a manager's residence.

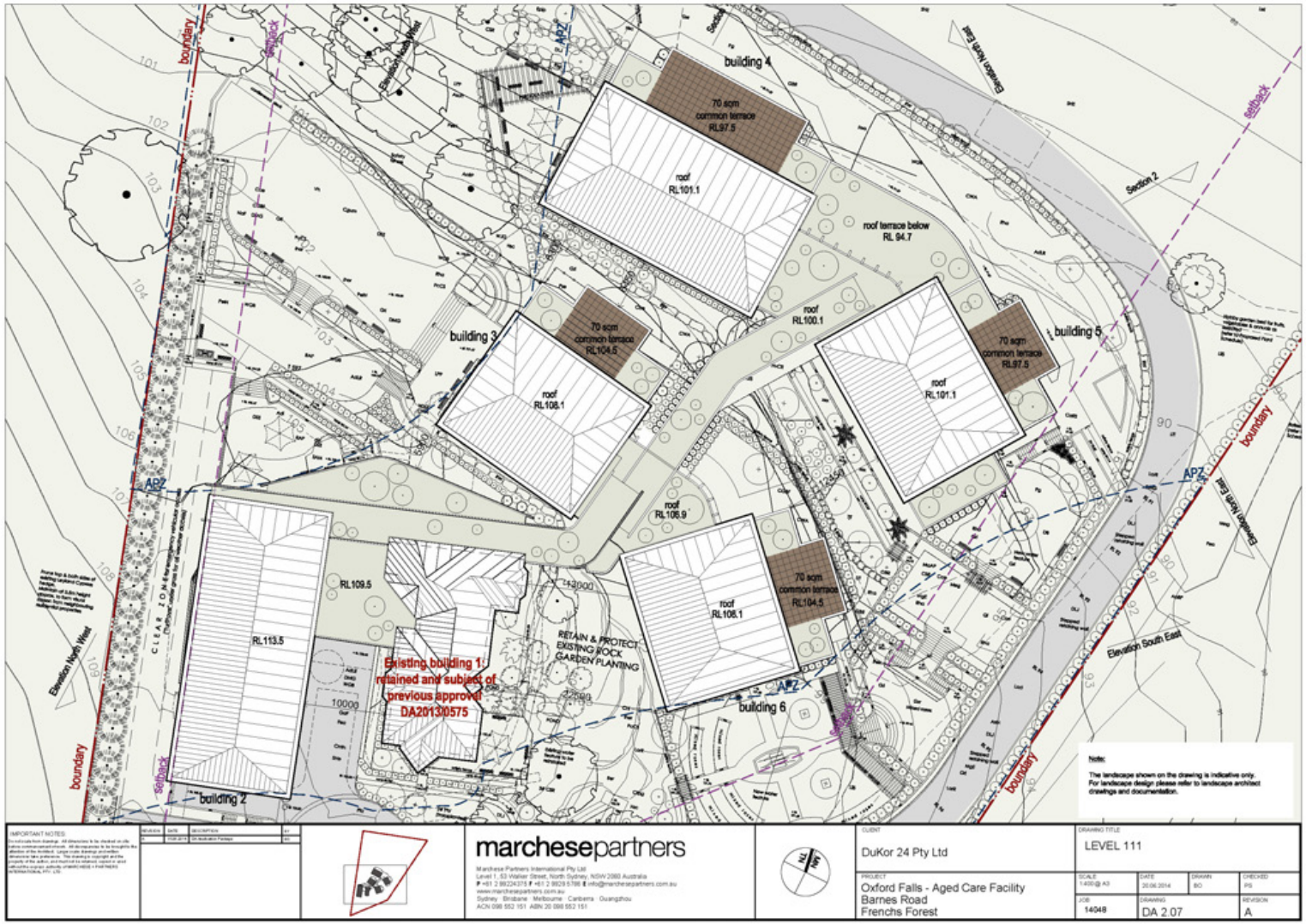

Figure 1.1 – Site plan

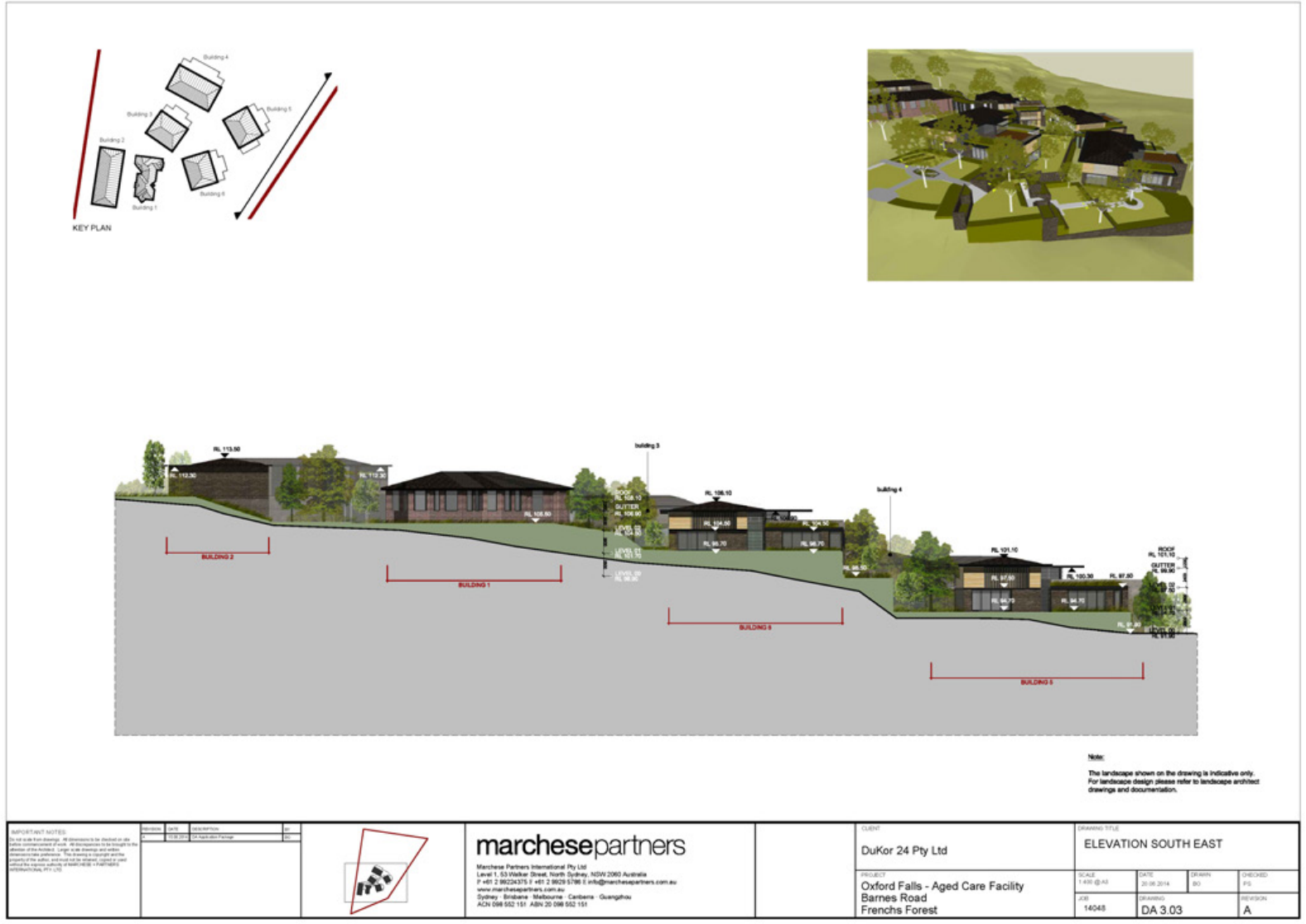

Figure 1.2 – Elevations

1.4 Site description

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

Table 1.1 – Site features

Location	Lots 1113 DP 752038 Barnes Road, Oxford Falls
Local government area	Warringah
Grid reference	337700E and 6264700N
Elevation	Approximately 78-114m AHD
Topography	Situated on flat to undulating land. Gradients are generally 0-15%, with steeper grades of up to approximately 70% in the west.
Geology and soils	Soils; Oxford Falls – Moderate to deep soils in valleys with underlying Sandstone. Lambert – Generally shallow soils over Hawkesbury Sandstone. Hawkesbury – Steep inclines, shallow soils. Geology; Hawkesbury Sandstone.
Catchment and drainage	Surface flows within the subject site flow into an unnamed tributary that cuts within the north eastern portion of the subject site, Middle Creek.
Vegetation	Open Forest, scrub / heath and cleared areas. Refer to Sections 3 & 4.
Existing land use	Residential (rural) and grazing by horses
Clearing	Approximately 75% of the subject site is cleared vegetation for paddocks, landscaping, a tennis court and homestead.

Survey Methodology 2

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

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

Client documents reviewed include:

- Riparian Areas Assessment, *GHD* (April 2010)
- Letter to NOW, *Travers bushfire & ecology,* (April 2010)
- Stormwater Concept Plan for Revised Development Application, *JMD Development Consultants* (September 2008)
- Water Quality Management, Oxford Falls Road, Frenchs Forest*, Strategic Environmental and Engineering Consulting* (May 2010)
- Bushfire advice provided by *Australian Bushfire Protection Planners* (2009/10)
- Ecological Assessment, Oxford Falls Seniors Living Resort, Oxford Falls Road and Barnes Road, Oxford Falls, *Travers bushfire & ecology* (2010)
- Bushfire Protection Assessment, Oxford Falls Seniors Living Facility Lot 1113 DP 752038 Barnes Road, Frenchs Forest, *Travers bushfire & ecology* (2014)
- Unpublished Flora and Fauna Report, Oxford Falls Road and Barnes Road, Oxford Falls, *Travers environmental* (2008)
- Flora and Fauna Report, Oxford Falls Road and Barnes Road, Oxford Falls *Conacher Travers Pty Ltd* (2004)

Standard Technical Resources utilised:

- *Planning for bushfire protection, NSW Rural Fire service (2006)*
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities 2004* (working draft), Department of Environment and Conservation (DEC)
- Aerial photographs (*Google Earth Pro / Spatial Information Exchange/ Near Maps*)
- Topographical maps (scale 1:25,000)
- *Threatened Species Conservation Act 1995* (TSC Act)
- *Fisheries Management Act 1994* (FM Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Rare or Threatened Australian Plants (ROTAP)

Desktop Assessment:

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

- ***A literature review*** – A review of readily available literature for the area was undertaken to obtain reference material and background information for this survey.

- ***A data search*** – A search of the *Atlas of NSW Wildlife* (OEH 2014) was undertaken to identify records of threatened flora and fauna species located within a 10km radius of the site. Searches were also undertaken on the DOE 'protected matters search tool' website to generate a report that will help determine whether matters of national environmental significance or other matters protected by the *EPBC Act* are likely to occur in the area of interest. The search was broadened to a 10km radius in accordance with the *Atlas of NSW Wildlife* (OEH) database search. These two searches combined, enabled the preparation of a list of threatened flora and fauna species that could potentially occur within the habitats found on the site (Tables A2.1, A2.2 and A2.3).

Accuracy of identification:

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

Scat and hair samples collected were sent to identification experts Barbara Triggs and Robyn Carter for identification.

***Licences*:**

Individual staff members of *Travers bushfire & Ecology* are licensed under Clause 20 of the *National Parks and Wildlife (Land Management) Regulation 1995* and Sections 120 & 131 of the *National Parks and Wildlife Act 1974* to conduct flora and fauna surveys within service and non-service areas. NPWS Scientific Licence Numbers: S10359.

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

2.2 Flora survey methodology

2013/2014 Survey

Additional survey was undertaken on the 4th March 2013 in the vicinity of the proposed APZ off Barnes Road and within the remnant vegetation within a 100m radius of the existing dwelling which included two (2) additional flora quadrats. The flora survey targeted all vegetation communities present within the study area. The location of the vegetation communities relevant to the current subject site is shown in Figure 2.

On the 29th May 2014, a brief target threatened species search was undertaken for relevant flora species within the riparian zone and in vegetation remnants along the north-eastern boundary near the access driveway.

2010 Survey

A full flora survey was undertaken on the 7th April 2010, in accordance with the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (working draft)* as set out by *Department of Environment & Conservation 2004.* This entailed some 4.5 hours of targeted threatened species searches within the study area in those areas considered to contain any potential threatened species habitat, in near-to-linear-lines of 7-10m separation, subject to rock extrusions. Five (5) standardised quadrats and three (3)

transects were also undertaken, as well as a wide ranging random meander (not part of the targeted survey). The locations of the 2010 survey plots are presented on Figure 2. Further targeted work was also undertaken on both 5 and 12 May 2010, around the perimeter of the proposed development area. Targeted *Tetratheca glandulosa* survey was conducted in the spring of 2010.

2004 Survey

The flora survey was undertaken on 8 January 2004 across the study area. Each of the identified vegetation communities were assessed using 20x20m quadrats and 10x40m quadrats for linear vegetation communities along the Middle Creek tributary. Within each quadrat vegetation structure, vegetation floristics and physical attributes were recorded for the upper, middle and lower stratums. Random meanders were also conducted across the whole of the study area. Field assessment of vegetation within the forested escarpment and heath vegetation community was undertaken on 27 September 2004. Tree surveys were undertaken on 14 and 19 September 2004; and again on 1 September 2006.

2.3 Fauna survey methodology

Previous surveys were undertaken in in 2010 by *Travers bushfire & ecology* and in 2004 by *Conacher Travers*. In addition, this report has been compiled taking into account APZ surveys undertaken by *Travers bushfire & ecology* in 2013 based on the current development proposal.

Site survey effort accounting for techniques deployed, duration, and weather conditions are outlined in Table 2.1 and are depicted on Figure 2. The sections below illustrate the level of survey undertaken.

2.3.1 Diurnal birds

Visual observation and call identification of birds was carried out during visits to the site.

Opportunistic bird counts were also made, whilst undertaking other survey work and during spotlight surveys of the site.

Based on the comments made by Dr Stephen Ambrose in his peer review of 2004 surveys, bird quadrats were undertaken. Dr Ambrose suggested that it would be appropriate to have selected at least four (4) 2ha areas on site and to undertake area search surveys (30 minutes per area) and record bird species heard or seen.

Five (5) 1ha (approx. 50m x 200m) area search surveys were considered adequate due to the linear nature of the remnants. These were undertaken within the major vegetation areas of the site. These corresponded with hair tube transects (see Figure 2); as one person placed and collected tubes on 30 March and 6 April 2010, a second person undertook area search surveys for a minimum of 30 minutes.

Birds were observed and identified using handheld binoculars. Calls were generally identified in the field by the observer. If an unknown call was heard it was cross matched to bird call reference libraries taken into the field.

2.3.2 Nocturnal birds

The presence of nocturnal birds was first determined by quiet listening after dusk for calls by individuals emerging from diurnal roosts. Following this, and provided no calls were heard,

call-playback techniques were employed. This involves broadcasting recorded calls through a 15 watt *Toa Faunatech* amplifier to evoke a response from species known to reply.

Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*) and Barking Owl (*Ninox connivens*) were targeted. Each call was played for 5 minute periods with 5 minute intervals of quiet listening for a response. This was followed with spotlighting and periods of quiet listening throughout the nocturnal survey.

Call playback stations are provided in Figure 2 and survey effort and weather conditions are outlined in Table 2.1. A third night's effort was undertaken for various nocturnal species during 2010 surveys, due to inclement weather on the second night's effort.

Searches for evidence of Owl roosts and potential Owl roosting / breeding hollows, were made during surveys of the subject site. Any whitewash, or regurgitated pellets found, were noted.

Given the recording of a Powerful Owl during 2010 surveys, habitat trees providing potential for nesting (HT9, HT11 & HT19) were targeted during the early nesting period on 3 June 2010. Active stag watching of HT11 was undertaken on this occasion, whilst passive remote surveillance cameras were placed at HT9 and HT19. Surveillance cameras used are *Reconyx HC500 Hyperfire* with infra-red and motion sensing capabilities with an illumination range up to 15m. The camera at HT19 was set up on a tripod and the camera set up at HT9 was strapped to a nearby tree with a bungee cord. Both cameras were placed within 7m of the hollows targeted.

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

2.3.3 Arboreal and terrestrial mammals

2004 Survey

Elliott Type A and B Traps were used for trapping arboreal and terrestrial mammals. Trapping consisted of a total of 200 trap nights, including 100 arboreal trap nights and 100 terrestrial trap nights.

Arboreal trap lines using 10-20m separations were placed in the most suitable trees along approximately 80m transects. *Elliott* Type A traps were placed onto platforms, that were attached to the trunks of trees 2-3m above the ground at an incline of 10 degrees, to facilitate drainage during inclement weather. A mixture of honey and water was then sprayed onto the trunk 3-5m above the trap and around the platform as a lure.

Terrestrial trap lines consisting of Type A and B *Elliott* traps, using 10-20m separations were placed along the same line as the arboreal traps in the most suitable terrestrial habitats. *Elliott* traps were baited with a mixture of rolled oats, honey and peanut butter.

Five (5) trap lines were set on the nights of 12, 13, 14 and 15 January 2004. The location of the trap lines is shown in Figure 2, located after the bibliography of this report. Each trap line consisted of five (5) Type-A arboreal traps, three (3) Type-B terrestrial traps and two (2) Type-A terrestrial traps.

Cage trapping was conducted within the subject site to target the threatened species, Southern Brown Bandicoot (*Isoodon obesulus*) and Spotted-tailed Quoll (*Dasyurus maculatus*). The cage traps used were 18cm x 18cm x 45cm long.

Ten (10) cage traps were set on the nights of 12, 13, 14 and 15 January 2004. Cage trapping consisted of a total of forty (40) trap nights. Cage traps were placed in suitable in areas of dense shrub and ground cover. Cage traps were baited with a mixture of rolled oats, honey and peanut butter for the Southern Brown Bandicoot and uncooked chicken meat for the Spotted-tail Quoll.

2010 survey

Hair tubes were used to survey for arboreal and terrestrial mammals from 30 March – 6 April 2010.

Five (5) hair tube transect lines (approx. 200m) were set for five (5) nights. Each line consisted of fifteen (15) tubes (five (5) arboreal and ten (10) terrestrial) for a significant total of 375 trap nights. All hair tubes were baited with a mixture of rolled oats, honey and peanut butter. Five (5) terrestrial tubes were also baited with white truffle oil to target Southern Brown Bandicoot (*Isoodon obesulus*) and were suitably spaced on the transect lines. Five (5) terrestrial tubes were also baited with sardines to target Spotted-tailed Quoll (*Dasyurus maculatus*) and alternatively spaced along the transect lines. Small arboreal tubes were used to target the Eastern Pygmy Possum (*Cercatetus nanus*) and placed in the most appropriate foraging area, such as within Banksias.

Arboreal hair tubes were attached to the trunks of trees using rubber bands. A mixture of honey and water was then sprayed onto the trunk up to 8m above the tube as a lure. Terrestrial hair tubes were placed in suitable areas of dense shrub and ground cover and often near signs of foraging e.g. burrows or shelters.

Double sided tape was attached around the entry of tubes so hair samples of animals entering the tube were collected. Hair samples collected were sent to noted hair and scat identification experts, Barbara Triggs or Robyn Carter for identification.

Hair tube transects were placed throughout the subject site as well as extending into connective habitats. Hair tube trapping effort amounted to a total of 175 small arboreal and 350 large terrestrial hair tube nights. See Figure 2 for hair tube transect locations.

Cage trapping was conducted within the subject site to target the threatened Southern Brown Bandicoot (*Isoodon obesulus*). The cage traps used were 18cm x 18cm x 45cm long.

Ten (10) cage traps were set for ten (10) nights between 20-30 April 2010. Cage trapping consisted of a total of 100 trap nights. Cage traps were placed in suitable in areas of dense shrub and ground cover. Cage traps were baited with a mixture of rolled oats, honey and peanut butter for the Southern Brown Bandicoot and sprinkled with truffle oil drops.

Stag watching within the subject site

Habitat trees HT9, HT11 and HT19 providing large hollows were targeted for early nocturnal activity on 3 June 2010. This was undertaken to target Powerful Owl, however, this method also contributes to arboreal mammal surveys. Active stag watching of HT11 was undertaken on this occasion whilst passive remote surveillance cameras were placed at HT9 and HT19. A description of surveillance camera and stag watching methodologies is provided in Section 2.3.2 above.

Spotlighting within the subject site

Spotlighting for nocturnal mammalian fauna was carried out using a hand held lamp of (75W halogen globe). This technique involved walking on the fringes of the forested areas of the subject site so that a maximum number of trees could be observed.

Call playback techniques for nocturnal mammals

The presence of Koala (*Phascolactos cinereus*), Yellow-bellied Glider (*Petaurus australis*) and Squirrel Glider (*Petaurus norfolcensis*) were targeted by broadcasting taped calls through a 15-Watt *Toa Faunatech* amplifier. Calls were played for 5 minute periods during nocturnal surveys. This was followed by quiet listening and spotlighting. Call playback stations are shown on Figure 2.

Secondary indications within the subject site

Assessment was made of found scats, markings, diggings, runways and scratches during visits to the site. Any scats or pellets not readily identifiable were collected and sent to noted hair and scat identification experts, Barbara Triggs or Robyn Carter for the identification of any contents, such as hair or bone fragments. Habitat was also assessed to determine the likelihood of threatened native species of fauna occurring within the subject site.

Koala assessment

The subject area was assessed for activity by Koalas using the following methods:

- A search of the *Atlas of NSW Wildlife* (OEH 2014).
- Identification and assessment of the density of tree species listed as Koala feed trees in *State Environmental Protection Policy No. 44 – Koala Habitat Protection* (SEPP 44), was undertaken across the site. An estimate of the percentage density of each tree species within vegetation communities was determined by averaging the percentage of stems counted.
- The site was surveyed on foot, with known Koala food trees being inspected for signs of use. Trees were also inspected for characteristic scratch and claw marks on the trunk and scats around the base of each tree. The proportion of trees showing signs of Koala use was calculated. Additionally, the location and density of droppings, if found, were documented.
- Koalas were also targeted during spotlight surveys which included the use of call playback techniques described above.

2.3.4 Bats

Micro-chiropteran bats were surveyed by echolocation, using *Anabat Mk 2* and SD-1 detectors in fixed passive monitoring positions, throughout the subject site. Fixed *Anabat* stations were determined in order to represent different available foraging structures for various micro-chiropteran bat species. Detectors were placed in the same locations on different nights, where indicated on Figure 2, for the 2010 surveys.

Roving recordings were undertaken along spotlighting transects during previous 2004 surveys. Mobile active monitoring, using a PDA connected to an SD-1 recorder to identify bats in real time, was also undertaken along spotlighting transects during updated survey on 7 April 2010.

All bat call recordings were interpreted through *Anabat V* and *Anabat CF* Storage and Interface Module ZCAIM devices and analysed using *Anabat 6* and *Analook 3.3q* computer software packages.

Anabat recording stations and mobile recording transects are shown on Figure 2.

Mega-chiropteran bat species, such as the Grey-headed Flying-fox (*Pteropus poliocephalus*), were surveyed by targeting flowering / fruiting trees during spotlighting activities.

2.3.5 Amphibians

Amphibians were surveyed by opportunistic vocal call identification, spotlighting and by targeting call activity along and adjacent to drainages, both during and following rainfall. For similar calling species, male calls were compared to recorded calls from a field reference library, for accuracy of identification. Amphibians were also surveyed by habitat searches.

Habitat searches targeting Red-crowned Toadlet (*Pseudophryne australis*) were undertaken along four (4) drainages of varying suitability for the species during surveys undertaken on 29 and 30 March and 6 April 2010.

Twenty (20) minute searches were undertaken at each drainage line on each day. This consisted of searching pools for tadpoles, turning rocks and litter, listening for calls and clapping for a call response. Searches were undertaken at each location either during or following rainfall within the previous 24 hour period.

Searches for Red-crowned Toadlet were also incorporated into 3 hours and 20 minutes of habitat searches undertaken during previous surveys in January 2004.

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

2.3.6 Reptiles

Searches for reptiles in likely localities such as under logs, rubbish debris and in deep leaf litter were undertaken during diurnal visits to the site. Spotlighting of terrestrial habitats suitable for reptiles occurred during nocturnal surveys.

Funnel traps were used to target Rosenberg's Goanna (*Varanus rosenbergii*). This method was indicated to be suitable for this species by Gerry Swan during recent works on a separate site within the Warringah LGA. Three (3) funnel trap lines each consisting of four (4) funnel traps were set for three (3) days between 7 and 9 April 2010 (see Figure 2 for locations). Funnels were placed in pairs on either side of a 10m long fence line. The fence, made of damp proof course, was 270mm wide and held tight and upright by wooden and steel pegs.

Weather conditions for funnel trapping effort are provided in Table 2.1

2.3.7 Habitat trees

Hollow bearing trees were identified and recorded within the subject site on a *Trimble* handheld GPS unit during surveys. All data such as hollow types, hollow size, tree species, diameter at breast height, canopy spread and overall height, were collected and a metal tag with the tree number placed on the trunk for field relocation purposes.

Other habitat features, such as nests and significant sized mistletoe for foraging, were also noted.

A summary of hollow bearing tree results is provided in Table 3.4 and locations are provided on Figure 2.

2.3.8 Trees

Trees located within the subject site and nearby surrounds incorporated into current or future APZs have been assessed according to their safe use life expectancy (SULE) *(Barrell, 1993)*. The purpose of the SULE information shall be used to selectively remove trees in poor condition and health to APZ requirements, as well as determine which trees will be required for removal within or close to the development footprints. Several factors are considered in determining this rating such as species, location, age, condition and health of the tree. The four (4) SULE categories are outlined in detail within Appendix 6.

Trees were selected with a DBH (diameter at breast height) of greater than 15cm. Most of the trees were assessed in 2010 as part of the previous proposal or as part of recent 2013 survey, however, trees 147-161 located to the further north west fringe away from the dwelling were assessed by *Conacher Travers* in 2004. Tree SULE data is provided in Table 3.3 and with definitions provided in Appendix 6.

All individual trees surveyed were marked using metal tags and labelled with their respective number identification with the exception of trees planted in rows and close to the dwelling which are easily located on map. Trees assessed in previous years may have had tags fall off following seasonal bark shedding.

2.4 Field survey effort

Tables 2.1 details the fauna survey effort undertaken for the subject site.

Table 2.1 – Fauna survey effort

Fauna group	Date	Weather conditions	Survey technique(s)	Survey effort / time (24hr)
Diurnal birds	12/01/04	8/8 cloud, no wind, temp 26°C, no rain	Diurnal opportunistic	3hr 45min 1245-1630
	13/01/04	2/8 cloud, no wind, temp 21°C	Diurnal opportunistic	4hr 50 min 0730-1220
	14/01/04	5/8 cloud, no wind, temp 22°C	Diurnal opportunistic	1hr 30min 0730-0900
	15/01/04	8/8 cloud, no wind, temp 20°C, no rain	Diurnal opportunistic	1hr 30min 0730-0900
	16/01/04	8/8 cloud, no wind, temp 18°C, light rain	Diurnal opportunistic	1hr 50min 0740-0930
	29/03/10	8/8 cloud, no wind, light shower, temp 26.5°C	Diurnal opportunistic	5hr 20min 1400-1920
	30/03/10	8/8 cloud, no wind, raining, temp 19-22°C	Diurnal opportunistic	6hr 15min 1215-1830
			Area Search Surveys (5x1ha for min 30min)	Min 2.5 hours
	06/04/10	7/8 cloud, no wind, no rain, temp 23.8°C	Diurnal opportunistic	6hr 1145-1745
			Area Search Surveys (5x1ha for min 30min)	Min 2.5 hours
	07/04/10	6-8/8 cloud, no wind, previous rain, temp 22.5 -26°C	Diurnal opportunistic	3hr 20min1110-1430
		8/8 cloud, no wind, no rain, temp 24°C	Diurnal opportunistic	1hr 1600-1700
Nocturnal birds	12/01/04	5/8 cloud, no wind, temp 22°C	Owl call playback	50min 2045-2135
	15/01/04	1/8 cloud, no wind, temp 19°C	Owl call playback	50min 2040-2130
	29/03/10	8/8 cloud, no wind, no rain, temp 24-23°C	Listen, Owl call playback & spotlighting	3hr 5min 1835-2140
	06/04/10	8/8 cloud, no wind, light showers, temp 21-19°C	Listen, Owl call playback & spotlighting	1hr 25min 1835-2000
	07/04/10	7-8/8 cloud, no wind, no rain, temp 22°C	Listen, Owl call playback & spotlighting	1hr 50min 1835-2025
	03/06/10	8/8 cloud, no wind, light rain, temp 16°C	Stag watching (1x active, 2x passive surveillance cameras)	2hr 30min 1700-1755

Fauna group	Date	Weather conditions	Survey technique(s)	Survey effort / time (24hr)
Arboreal mammals	12/01/04	5/8 cloud, no wind, temp 22°C	Spotlighting	55min 2045-2140
	12/01/04	2/8 cloud, no wind, temp 21°C	*Elliott* trapping	25 trap nights
	13/01/04	5/8 cloud, no wind, temp 22°C, scattered showers	*Elliott* trapping	25 trap nights
	14/01/04	8/8 cloud, no wind, temp 20°C, scattered showers	*Elliott* trapping	25 trap nights
	15/01/04	1/8 cloud, no wind, temp 19°C	Spotlighting	1hr 0840-0940
	15/01/04	8/8 cloud, no wind, temp 18°C	*Elliott* trapping	25 trap nights
	29/03/10	8/8 cloud, no wind, no rain, temp 24-23°C	Spotlighting + call playback (Koala, Yellow-bellied Glider & Squirrel Glider)	2hr 55min 1845-2140
	30/03/10-06/04/10	Various	Hair tubes (small)	175 trap nights
	06/04/10	8/8 cloud, no wind, light showers, temp 21-19°C	Spotlighting	15min 1945 – 2000
	07/04/10	7-8/8 cloud, no wind, no rain, temp 22°C	Spotlighting + call playback (Koala, Yellow-bellied Glider & Squirrel Glider)	2hr 10min 1815 – 2025
	03/06/10	8/8 cloud, no wind, light rain, temp 16°C	Stag watching (1x active, 2x passive surveillance cameras)	2hr 30min 1700-1755
Terrestrial mammals	12/01/04	5/8 cloud, no wind, temp 22°C	Spotlighting	55min 2045-2140
	12/01/04	2/8 cloud, no wind, temp 21°C	*Elliott* trapping	25 trap nights
			Cage trapping	10 trap nights
	13/01/04	5/8 cloud, no wind, temp 22°C, scattered showers	*Elliott* trapping	25 trap nights
			Cage trapping	10 trap nights
	14/01/04	8/8 cloud, no wind, temp 20°C, scattered showers	*Elliott* trapping	25 trap nights
			Cage trapping	10 trap nights
	15/01/04	1/8 cloud, no wind, temp 19°C	Spotlighting	1hr 0840-0940
	15/01/04	8/8 cloud, no wind, temp 18°C,	*Elliott* trapping	25 trap nights
			Cage trapping	10 trap nights
	29/03/10	8/8 cloud, no wind, no rain, temp 24-23°C	Spotlighting	2hr 55min 1845-2140
	30/03/10-06/04/10	Various	Hair tubes (large)	350 trap nights
	06/04/10	8/8 cloud, no wind, light showers, temp 21-19°C	Spotlighting	15min 1945 – 2000
	07/04/10	7/8 cloud, no wind, no rain, temp 22°C	Spotlighting	2hr 10min 1815 – 2025
	20/04/10	0/8 cloud, no wind, no rain, 1/4 moon, temp 15°C	Cage trapping SBB	10 trap nights
	21/04/10	0/8 cloud, no wind, no rain, 2/4 moon, temp 15°C	Cage trapping SBB	10 trap nights
	22/04/10	0/8 cloud, no wind, no rain, 2/4 moon, temp 14.5°C	Cage trapping SBB	10 trap nights
	23/04/10	0-8/8 cloud, no wind, no rain, 3/4 moon, temp 19°C	Cage trapping SBB	10 trap nights
	24/04/10	5/8 cloud, light S wind, showers, 3/4 moon, temp 14°C	Cage trapping SBB	10 trap nights

Fauna group	Date	Weather conditions	Survey technique(s)	Survey effort / time (24hr)
	25/04/10	1/8 cloud, no wind, no rain, 4/4 moon, temp 11°C	Cage trapping SBB	10 trap nights
	26/04/10	0/8 cloud, no wind, no rain, 4/4 moon, temp 10.5°C	Cage trapping SBB	10 trap nights
	27/04/10	8-0/8 cloud, no wind, no rain, 4/4 moon, temp 10°C	Cage trapping SBB	10 trap nights
	28/04/10	0/8 cloud, no wind, no rain, 4/4 moon, temp 12°C	Cage trapping SBB	10 trap nights
	29/04/10	0/8 cloud, no wind, no rain, 4/4 moon, temp 12.5°C	Cage trapping SBB	10 trap nights
Bats	12/01/04	5/8 cloud, no wind, temp 22°C	*Anabat II*	1hr 25min 2015-2140
	15/01/04	1/8 cloud, no wind, temp 19°C	*Anabat II*	1hr 20min 20.20-2140
	29/03/10	8/8 cloud, no wind, no rain, temp 24-23°C	*Anabat II* x2 / SD-1 passive monitoring	7hr 15min 1900 – 2140
			Spotlighting	2hr 55min 1845-2140
	06/04/10	8/8 cloud, no wind, light showers, temp 21-19°C	*Anabat II* x2 / SD-1 passive monitoring	4hr 20min 1755 – 2000
			Spotlighting	15min 1945 – 2000
	07/04/10	7-8/8 cloud, no wind, no rain, temp 22°C	*Anabat II* x2 passive / SD-1 active monitoring	6hr 45min 1750 – 2025
			Spotlighting	2hr 10min 1815 – 2025
Reptiles	12/01/04	5/8 cloud, no wind, temp 22°C	Spotlighting	55min 2045-2140
	13/01/04	2/8 cloud, light SE wind, temp 26°C	Habitat searches	3hr 20min 0900-1220
	15/01/04	1/8 cloud, no wind, temp 19°C	Spotlighting	1hr 0840-0940
	29/03/10	8/8 cloud, no wind, light shower, temp 26.5°C	Habitat search, opportunistic	5hr 20min 1400-1920
	30/03/10	8/8 cloud, no wind, raining, temp 19-22°C	Habitat search, opportunistic	6hr 15min 1215-1830
	06/04/10	7/8 cloud, no wind, no rain, temp 23.8°C	Habitat search, opportunistic	6hr 1145-1745
	07/04/10	6-8/8 cloud, no wind, prev rain, temp 22.5 -26°C	Habitat search, opportunistic	3hr 20min 1110-1430
		8/8 cloud, no wind, no rain, temp 24°C	Funnel traps	12 trap days
	08/04/10	0-2/8 cloud, light W wind, no rain, temp 21-26°C	Funnel traps	12 trap days
	09/04/10	0/8 cloud, light SE wind, no rain, temp 15-22°C	Funnel traps	12 trap days
Amphibians	12/01/04	5/8 cloud, no wind, temp 22°C	Spotlighting + call detection	55min 2045-2140
	13/01/04	2/8 cloud, light SE wind, temp 26°C	Habitat searches (incorporating Red-crowned Toadlet survey)	3hr 20min 0900-1220
	15/01/04	1/8 cloud, no wind, temp 19°C	Spotlighting + call detection	1hr 0840-0940
	29/03/10	8/8 cloud, no wind, light shower, temp 26.5°C	Target searched (Red-crowned Toadlet)	Min total 1hr 20min
	30/03/10	8/8 cloud, no wind, raining, temp 19-22°C	Target searched (Red-crowned Toadlet)	Min total 1hr 20min
	06/04/10	7/8 cloud, no wind, no rain, temp 23.8°C	Target searched (Red-crowned Toadlet)	Min total 1hr 20min

2.5 Survey limitations

It is important to note that field survey data collected during the survey period is representative of species occurring within the subject site for that occasion. Due to effects of fire, breeding cycles, migratory patterns, camouflage, weather conditions, time of day, visibility, predatory and / or feeding patterns, increased species frequency or richness may be observed within the subject site outside the nominated survey period.

Habitat assessments based on the identification of micro-habitat features for various species of interest, including regionally significant and threatened species, have been used to minimise the implications of this survey limitation.

Given the extent of previous surveys undertaken across the entire study area, it is unlikely that there are any significant survey limitations.

Whilst some flora species are difficult to identify unless flowering, the presence of some species on site may have been overlooked. Care has been taken to target any area where native vegetation was present, traversing in a zig zag pattern. Specific field surveys for targeting threatened flora species were undertaken at appropriate times such as *Tetratheca glandulosa* survey in spring, 2010.

Fauna was opportunistically observed as part of 2013 tree surveys but no formal fauna survey has been undertaken since April 2010. This is not considered a significant time lapse for changes in fauna activity and the previous surveys covered all areas subject to direct and / or indirect impacts.

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Survey Results 3

3.1 Vegetation communities

Four (4) vegetation communities were identified within the study area through ground truthing. Each of these communities is represented within the subject site with only a very small portion of Community 4 entering the north west portion of the site.

- Vegetation Community 1 – Peppermint – Angophora Woodland / Open Forest
- Vegetation Community 2 – Exotic Grassland with Scattered Trees
- Vegetation Community 3 – Aquatic Herbfield (Creek line and dams)
- Vegetation Community 4 – Kunzea – Tea-tree Tall Heath

The following community descriptions are applied to the study area as a whole.

3.1.1 Vegetation Community 1 – Peppermint – Angophora Woodland / Open Forest

Occurrence – This vegetation community occurs in sections of the subject site which do not contain arable soil.

Structure – Woodland or Open Forest with a canopy cover of approximately 10-35% and height of approximately 15-23m. The understorey consists of a variable, but generally moderate, shrublayer to 10m high and sparse to moderate groundcover of herbs, ferns and grasses in drier areas. In the moister areas, where the soil depth is skeletal, the understorey consists mostly of dense fern and sedge species, whilst the overstorey cover is reduced and the mid storey replaced with those species favouring wetter conditions such as *Banksia ericifolia.* The height of the tree species in areas exposed to a high incidence of rock outcropping is reduced, as is the density of trees. This is evident in the central section of the western escarpment area.

Disturbances – This vegetation community has been disturbed by the construction of access roads and moderate to severe incursions of weeds such as Pampas Grass, Senna and Lantana.

This community would have once been equivalent to Sydney Sandstone Gully Forest.

Common Species

Trees: *Eucalyptus piperita* (Sydney Peppermint), *Angophora costata* (Smooth-barked Apple) and *Corymbia gummifera* (Red Bloodwood).

Shrubs: *Acacia parramattensis* (Sydney Green Wattle), *Banksia ericifolia* (Heath-leaved Banksia), *Banksia spinulosa* (Hairpin Banksia), *Ceratopetalum gummiferum*, *Elaeocarpus reticulatus* (Blueberry Ash), *Leptospermum polygalifolium* (Tantoon), *Phyllanthus hirtellus* (Thyme Spurge), *Pittosporum undulatum* (Sweet Pittosporum) and *Platylobium formosum* (Handsome Flat-pea).

Groundcovers: *Cryptostylis erecta* (Bonnet Orchid), *Entolasia marginata* (Bordered Panic), *Gonocarpus teucroides* (Raspwort), *Imperata cylindrica* (Blady Grass), *Lepyrodia scariosa*, *Lomandra longifolia* (Spiky-headed Mat-rush), *Smilax glyciphylla* (Sarsparilla) and *Xanthosia pilosa*.

Weeds: *Ageratina adenophora* (Crofton Weed), *Centaurium erythraea* (Pink Stars), *Conyza albida* (Tall Fleabane), *Cortadeia selloana* (Pampas Grass), *Hedychium gardnerianum* (Ginger Lily), *Hypochaeris radicata* (Flatweed), *Ipomoea indica* (Blue Morning Glory), *Lantana camara* (Lantana), *Ligustrum sinense* (Small-leaved Privet), *Lonicera japonica* (Honeysuckle), *Nephrolepis cordifolia* (Fishbone Fern), *Plantago lanceolata* (Ribwort) and *Senna pendula* var. *glabrata*.

***Photo 1** – Peppermint – Angophora Woodland / Open Forest vegetation adjacent to Oxford Falls Road, part of the better condition vegetation.*

Photo 2 *– Peppermint – Angophora Woodland / Open Forest vegetation in the central western portion of the subject site containing a high level of exotic plant disturbance.*

Photo 3 *– Heavily impacted zone in the middle of the Peppermint – Angophora Woodland / Open Forest*

3.1.2 Vegetation Community 2 – Exotic Grassland with Scattered Trees

Occurrence – This vegetation community occurs in the sections of the subject site with arable soil. This community is highly disturbed and it is likely that it was previously Peppermint – Angophora Woodland / Open Forest.

Structure – Dense groundcover of herbs and grasses with scattered trees and shrubs.

Disturbances – This vegetation community is the result of agricultural activities.

Common Species

Trees: *Angophora costata* (Smooth-barked Apple), *Casuarina cunninghamiana* (River Oak), *Eucalyptus piperita* (Sydney Peppermint) and *Eucalyptus punctata* (Grey Gum).

Shrubs: *Acacia parramattensis* (Sydney Green Wattle), *Ceratopetalum gummiferum* (Christmas Bush) and *Pittosporum undulatum* (Sweet Pittosporum).

Groundcovers: *Centella asiatica* (Swamp Pennywort) and *Cynodon dactylon* (Common Couch).

Weeds: *Acacia saligna* (Golden Wreath Wattle), *Axonopus fissifolius* (Narrow-leaf Carpet Grass), *Callistemon sp.* Cultivar (Crimson Bottlebrush), *Centaurium erythraea* (Pink Stars), *Conyza sumatrensis* (Tall Fleabane), *Euphorbia peplus*, *Hydrocotyle bonariensis* (Pennywort), *Hypochaeris radicata* (Flatweed), *Ligustrum sinense* (Small-leaved Privet), *Modiola caroliniana* (Red-flowered Mallow), *Nephrolepis cordifolia* (Fishbone Fern), *Pennisetum clandestinum* (Kikuyu), *Plantago lanceolata* (Ribwort), and *Trifolium repens* (White Clover).

This community would have once been equivalent to Sydney Sandstone Gully Forest. There are many planted specimens of trees within this community, particularly in the northern portion of the subject site in close proximity to the tennis courts.

***Photo 4** – Some scattered trees (mostly planted) in close proximity to one of the existing dwellings.*

3.1.3 Vegetation Community 3 – Aquatic Herbfield

Occurrence – This vegetation community occurs along the tributary of Middle Creek including the drainage line and immediate embankments, generally between the top of bank on each side of the drainage line.

Structure – Moderate to dense herbfield to a height of approximately 1-2m, together with occasional exotic shrubs.

Disturbances – This community has been disturbed by modification of sections of the watercourse (more so north of the current study site) and incursions of weeds.

Common Species

Native: *Hydrocotyle peduncularis* (Pennywort), *Juncus usitatus* (Common Rush), *Panicum bisulcatum* (Blackseed Panic), *Persicaria hydropiper* (Water Pepper) and *Typha orientalis* (Cumbungi).

Weeds: *Ageratina adenophora* (Crofton Weed), *Erythrina sykessii* (Coral Tree), *Ligustrum* spp. (Small and Broad-leaved Privets), *Colocasia esculenta* (Taro), *Cyperus eragrostis* (Umbrella Sedge), *Hydrocotyle bonariensis* (Pennywort), *Ludwigia peruviana*, *Ranunculus repens* (Creeping Buttercup), *Salix sp.* (Willow) and *Tradescantia fluminensis* (Wandering Jew).

***Photo 5** – Riparian vegetation along the drainage line.*

3.1.4 Vegetation Community 4 – Kunzea – Tea-tree Tall Heath

Occurrence – This vegetation community occurs mostly within Lot 80 to the west of the subject site, with a small portion entering the site.

Structure – Heath or scrub type vegetation with a height of generally 2.5-4m. There are very few emergent trees within this community. The shrublayer is thick and dense to approximately 50-75% foliage cover. The understorey is variable in density but usually sparse with very few grasses but does contain low growing shrubs, herbs and sedges.

Disturbances – This vegetation community has some weed influences but not to the extent of Vegetation Community 1.

Common Species

Shrubs: *Acacia longifolia* (Sydney Golden Wattle), *Banksia ericifolia* (Heath-leaved Banksia), *Epacris crassifolia, Epacris microphylla* (Coral Heath), *Grevillea buxifolia* (Grey Spider Flower), *Kunzea ambigua* (Tick Bush) and *Leptospermum polygalifolium* (Tantoon).

Groundcovers: *Dianella caerulea* (Flax Lily), *Empodisma minus, Imperata cylindrica* (Blady Grass), *Lepidosperma filiforme* and *Lomandra longifolia* (Spiky-headed Mat-rush).

Weeds: *Agapanthus praecox* (Agapanthus), *Andropogon virginicus* (Whisky Grass), *Aristea ecklonii* (Blue Stars), *Asparagus aethiopicus* (Asparagus Fern), *Cortaderia selloana* (Pampas Grass) and *Ligustrum sinense* (Small-leaved Privet).

Photo 6 *– Tall Heath vegetation looking westerly on the eastern edge.*

3.2 Flora species

A total of two hundred and seventy six (276) flora species, (157 native, 119 exotic), were observed within the study area during the surveys in 2013, 2010 & 2004. Note that the species list is for the entire study area and not just the current subject site.

The plants observed within the vegetation communities of the subject site are listed in Table 3.1 below. Column 4 depicts the location of plants in communities.

Table 3.1 – Flora observations for the study area

Scientific name	Common name	Family	Community
Trees			
Acacia implexa	Hickory	Mimosaceae	1 2
Allocasuarina littoralis	Black She-oak	Casuarinaceae	1 4
Allocasuarina torulosa	Forest Oak	Casuarinaceae	2
Angophora bakeri	Narrow-leaved Apple	Myrtaceae	2
Angophora costata	Smooth-barked Apple	Myrtaceae	1 2
Archontophoenix alexandrae	Alexandra Palm	Arecaceae	2
Brachychiton acerifolius	Illawarra Flame Tree	Sterculiaceae	2
Casuarina cunninghamiana	River Oak	Casuarinaceae	2
Casuarina glauca	Swamp Oak	Casuarinaceae	2
Corymbia gummifera	Red Bloodwood	Myrtaceae	1
Corymbia maculata	Spotted Gum	Myrtaceae	2
Eucalyptus botryoides	Southern Bangalay	Myrtaceae	1 2
Eucalyptus deanei	Mountain Blue Gum	Myrtaceae	1 2
Eucalyptus haemastoma	Scribbly Gum	Myrtaceae	1
Eucalyptus paniculata	Grey Ironbark	Myrtaceae	2
Eucalyptus piperita	Sydney Peppermint	Myrtaceae	1 2
Eucalyptus punctata	Grey Gum	Myrtaceae	1
Eucalyptus robusta	Swamp Mahogany	Myrtaceae	2
Eucalyptus sieberi	Silvertop Ash	Myrtaceae	1
Glochidion ferdinandi	Cheese Tree	Euphorbiaceae	4
Livistona australis	Cabbage Tree Palm	Arecaceae	2
Melaleuca quinquenervia	Broad-leaved Tea Tree	Myrtaceae	2
Syzygium sp.	Lillypilly	Myrtaceae	2
Shrubs			
Acacia decurrens	Black Wattle	Mimosaceae	1
Acacia floribunda	Sally Wattle	Mimosaceae	2
Acacia linifolia	Flax Wattle	Mimosaceae	1
Acacia longifolia	Sydney Golden Wattle	Mimosaceae	1 2 4
Acacia parramattensis	Sydney Green Wattle	Mimosaceae	1 2
Acacia stricta	-	Mimosaceae	1
Acacia suaveolens	Sweet Scented Wattle	Mimosaceae	1
Acacia terminalis	Sunshine Wattle	Mimosaceae	1 4
Acacia ulicifolia	Prickly Moses	Mimosaceae	1
Allocasuarina distylla	-	Casuarinaceae	4
Banksia ericifolia	Heath-leaved Banksia	Proteaceae	1 4
Banksia integrifolia	Honeysuckle	Proteaceae	1
Banksia oblongifolia	-	Proteaceae	1
Banksia serrata	Old Man Banksia	Proteaceae	1 2
Banksia spinulosa	Hairpin Banksia	Proteaceae	1
Bauera rubioides	River Rose	Cunoniaceae	1
Boronia ledifolia	Sydney Boronia	Rutaceae	1
Bossiaea heterophylla	-	Fabaceae	1
Bossiaea scolopendria	-	Fabaceae	1
Callicoma serratifolia	Black Wattle	Cunoniaceae	1
Callistemon citrinus	Crimson Bottlebrush	Myrtaceae	2
Ceratopetalum gummiferum	Christmas Bush	Cunoniaceae	1 2
Crowea saligna	Lance-leaf Crowea	Rutaceae	1
Dillwynia floribunda var. *floribunda*	Parrot Pea	Fabaceae	4
Dillwynia retorta	Eggs and Bacon	Fabaceae	1 4
Dodonaea triquetra	Hop Bush	Sapindaceae	1
Elaeocarpus reticulatus	Blueberry Ash	Elaeocarpaceae	1
Epacris crassifolia	-	Epacridaceae	1 4

Table 3.1 – Flora observations for the study area

Scientific name	Common name	Family	Community
Epacris microphylla	Coral Heath	Epacridaceae	1 4
Eriostemon australasius	Pink Wax Plant	Rutaceae	1
Grevillea buxifolia	Grey Spider Flower	Proteaceae	1 4
Grevillea speciosa	Red Spider Flower	Proteaceae	1 2 4
Hakea sericea	Silky Hakea	Proteaceae	1
Hakea teretifolia	Dagger Hakea	Proteaceae	1
Hibbertia aspera	-	Dilleniaceae	1 4
Hibbertia bracteata	-	Dilleniaceae	1 4
Hibbertia empetrifolia	-	Dilleniaceae	1 4
Homalanthus populifolius	Bleeding Heart	Euphorbiaceae	1 2 4
Kunzea ambigua	Tick Bush	Myrtaceae	1 2 4
Lambertia formosa	Mountain Devil	Proteaceae	1 4
Lasiopetalum ferrugineum	Rusty Velvet-bush	Sterculiaceae	1
Leptospermum polygalifolium	Tantoon	Myrtaceae	1 4
Lomatia silaifolia	Crinkle Bush	Proteaceae	1
Melaleuca armillaris	Bracelet Honeymyrtle	Myrtaceae	1 2
Melaleuca ericifolia	Swamp Paperbark	Myrtaceae	2
Melaleuca styphelioides	Prickly-leaved Tea Tree	Myrtaceae	1 2
Micrantheum ericoides	-	Picrodendraceae	1 4
Ozothamnus diosmifolius	Ball Everlasting	Asteraceae	1
Persoonia lanceolata	Lance-leaved Geebung	Proteaceae	1 4
Persoonia levis	Broad-leaved Geebung	Proteaceae	1
Persoonia pinifolia	Pine-leaved Geebung	Proteaceae	1
Phebalium squamulosum subsp. *squamulosum*	-	Rutaceae	1
Pimelea linifolia	Slender Rice Flower	Thymeleaceae	1
Phyllanthus hirtellus	Thyme Spurge	Euphorbiaceae	1
Pittosporum undulatum	Sweet Pittosporum	Pittosporaceae	1 2
Platylobium formosum	Handsome Flat-pea	Fabaceae	1
Platysace linearifolia	Narrow-leafed Platysace	Apiaceae	1
Pultenaea retusa	-	Fabaceae	1
Pultenaea stipularis	-	Fabaceae	1
Viminaria juncea	Native Broom	Fabaceae	2
Woollsia pungens	Woolsia	Epacridaceae	1
Zieria laevigata	-	Rutaceae	1
Vines			
Billardiera scandens	Apple Dumplings	Pittosporaceae	1 4
Cassytha pubescens	Devil's Twine	Lauraceae	1 4
Cayratia clematidea	Slender Grape	Vitaceae	1 2
Cissus hypoglauca	Water Vine	Vitaceae	1
Eustrephus latifolius	Wombat Berry	Luzuriagaceae	1
Kennedia rubicunda	Dusky Coral-pea	Fabaceae	1
Smilax glyciphylla	Sarsparilla	Smilacaceae	1
Herbs			
Actinotus helianthi	Flannel Flower	Apiaceae	1
Austrodanthonia sp.	Wallaby Grass	Poaceae	1
Austrostipa pubescens	Tall Spear Grass	Poaceae	1
Calochilus gracillimus	Beared Orchid	Orchidaceae	1
Caustis flexuosa	Curly Sedge	Cyperaceae	1 4
Centella asiatica	Swamp Pennywort	Apiaceae	1 2 4
Commelina cyanea	Scurvy Weed	Commelinaceae	2
Cryptostylis erecta	Bonnet Orchid	Orchidaceae	1 4
Cyathochaeta diandra	-	Cyperaceae	1 4
Cynodon dactylon	Common Couch	Poaceae	2 4
Dianella caerulea	Flax Lily	Phormiaceae	1 4

Table 3.1 – Flora observations for the study area

Scientific name	Common name	Family	Community
Dianella prunina	-	Phormiaceae	1
Dichelachne crinita	Long-hair Plume Grass	Poaceae	1 2
Dipodium punctatum	Hyacinth Orchid	Orchidaceae	1
Dipodium variegatum	Hyacinth Orchid	Orchidaceae	1
Drosera spatulata	Sundew	Droseraceae	2
Echinopogon caespitosus	Tufted Hedgehog Grass	Poaceae	1 2
Empodisma minus	-	Restionaceae	1 4
Entolasia marginata	Bordered Panic	Poaceae	1 2 4
Entolasia stricta	Wiry Panic	Poaceae	1
Eragrostis brownii	Brown's Lovegrass	Poaceae	1
Gahnia clarkei	Saw Sedge	Cyperaceae	1 4
Gonocarpus micranthus	Creeping Raspwort	Haloragaceae	2
Gonocarpus teucroides	Raspwort	Haloragaceae	1 2 4
Guringalia dimorpha	-	Restionaceae	1
Hydrocotyle peduncularis	Pennywort	Apiaceae	2 3
Hypericum gramineum	Little St Johns Wort	Clusiaceae	2
Imperata cylindrica	Blady Grass	Poaceae	1 2
Juncus caespiticius	-	Juncaceae	2
Juncus remotiflorus	-	Juncaceae	1
Juncus usitatus	Common Rush	Juncaceae	2 3
Lachnagrostis filiformis	Blown Grass	Poaceae	1
Lepidosperma filiforme	-	Cyperaceae	1 4
Lepidosperma laterale	Variable Sword-sedge	Cyperaceae	1
Lepyrodia scariosa	-	Restionaceae	1
Lomandra filiformis	Wattle Matt-rush	Lomandraceae	1
Lomandra glauca	Pale Matt-rush	Lomandraceae	1
Lomandra longifolia	Spiky-headed Mat-rush	Lomandraceae	1 4
Lomandra obliqua	-	Lomandraceae	1
Lomatia silaifolia	Crinkle Bush	Proteaceae	1 4
Lythrum hyssopifolia	Hyssop's Loosestrife	Lythraceae	2 3
Microlaena stipoides	Weeping Grass	Poaceae	2
Mitrasacme polymorpha	Mitrewort	Loganiaceae	2
Oplismenus imbecillis	-	Poaceae	
Panicum bisulcatum	Blackseed Panic	Poaceae	3
Patersonia sericea	Wild Iris	Iridaceae	1 4
Persicaria hydropiper	Water Pepper	Polygonaceae	3
Pterostylis nutans	Nodding Greenhood	Orchidaceae	1
Schoenus imberbis	Beardless Bog-rush	Cyperaceae	1
Schoenus lepidosperma	-	Cyperaceae	1
Schoenus melanostachys	Black Bog-rush	Cyperaceae	1
Stackhousia viminea	Slender Stackhousia	Stackhousiaceae	1
Typha orientalis	Broad-leaved Cumbungi	Typhaceae	3
Veronica plebeia	Creeping Speedwell	Scrophulariaceae	1
Xanthorrhoea arborea	Blackboy	Xanthorrhoeaceae	1
Xanthorrhoea media	-	Xanthorrhoeaceae	1 4
Xanthosia pilosa	-	Apiaceae	1 4
Ferns			
Adiantum aethiopicum	Common Maidenhair	Adiantaceae	1
Adiantum diaphanum	Filmy Maidenhair	Adiantaceae	1
Blechnum cartilagineum	Gristle Fern	Blechnaceae	1
Calochlaena dubia	Common Ground Fern	Dicksoniaceae	1
Cyathea australis	Rough Tree Fern	Cyatheaceae	1
Cyathea cooperi	Straw Treefern	Cyatheaceae	2
Gleichenia dicarpa	Pouched Coral Fern	Gleicheniaceae	1
Gleichenia rupestris	Coral Fern	Gleicheniaceae	1

Table 3.1 – Flora observations for the study area

Scientific name	Common name	Family	Community
Histiopteris incisa	Bat's-wing Fern	Dennstaedtiaceae	1
Hypolepis muelleri	Harsh Ground Fern	Dennstaedtiaceae	1 2 3
Lindsaea linearis	Screw Fern	Lindsaeaceae	1
Psilotum nudum	Skeleton Fork-fern	Psilotaceae	1
Pteridium esculentum	Bracken Fern	Dennstaedtiaceae	1 2
Selaginella uliginosa	Swamp Selaginella	Selaginellaceae	1
Sticherus urceolatus	-	Gleicheniaceae	1
Todea barbara	King Fern	Osmundaceae	1
Exotic species			
-	Exotic Palm	Arecaceae	2
Acacia excelsa	Ironwood	Mimosaceae	1
Acacia podalyriifolia	Queensland Silver Wattle	Mimosaceae	1
Acacia saligna	Golden Wreath Wattle	Mimosaceae	1 2
Acer negundo	-	Aceraceae	2
Acer sp. (cultivar)	Maple	Aceraceae	2
Acetosa sagittata	Turkey Rhubarb	Polygonaceae	1 2
Agapanthus praecox	Agapanthus	Amaryllidaceae	1 2 4
Ageratina adenophora	Crofton Weed	Asteraceae	1 2 3 4
Ageratum houstonianum	Mist Flower	Asteraceae	1 2
Amaranthus spinosus	Needle Burr	Amaranthaceae	1
Anagalis arvensis	Scarlet Pimpernel	Primulaceae	1 2
Andropogon virginicus	Whisky Grass	Poaceae	1 2 4
Anredera cord folia	Madiera Vine	Basellaceae	1 2
Araucaria heterophylla	Norfolk Island Pine	Araucariaceae	2
Aristae ecklonii	Blue Stars	Iridaceae	1 2 4
Arundo donax	Giant Reed	Poaceae	1
Asparagus aetheopicus	Asparagus Fern	Asparagaceae	1 2
Avena sativa	Oats	Poaceae	1 2
Axonopus fissifolius	Narrowleaf Carpet Grass	Poaceae	1 2
Bidens pilosa	Cobblers Pegs	Asteraceae	2
Briza maxima	Quaking Grass	Poaceae	1 2
Bromus cartharticus	Prairie Grass	Poaceae	2
Callistemon sp. (cultivar)	Crimson Bottlebrush	Myrtaceae	2
Callitris sp.	-	Cupressaceae	2
Centaurium erythraea	Pink Stars	Gentianaceae	1 2
Centaurium tenuiflorum	-	Gentianaceae	2
Cestrum parqui	Chilean Cestrum	Solanaceae	2
Chlorophytum comosum	Spider Plant	Liliaceae	1
Cinnamomum camphora	Camphor Laurel	Lauraceae	1 2
Cirsium vulgare	Spear Thistle	Asteraceae	1 2
Citrus limonia	Bush Lemon	Rutaceae	2
Colocasia esculenta	Taro	Araceae	3
Conyza sumatrensis	Tall Fleabane	Asteraceae	1 2
Coreopsis lanceolata	Coreopsis	Asteraceae	1 2
Cortaderia selloana	Pampas Grass	Poaceae	1 2 4
Cotoneaster pannosus	-	Malaceae	1
Crocosmia X crocosmiiflora	Montbretia	Iridaceae	1 2
Cyperus congestus	-	Cyperaceae	2 3
Cyperus eragrostis	Umbrella Sedge	Cyperaceae	1 2 3
Delairea odorata	Cape Ivy	Asteraceae	2
Ehrharta erecta	Panic Veldtgrass	Poaceae	1 2
Erechtites valerianifolia	Brazilian Fireweed	Asteraceae	2
Erythrina crista-galli	Coskspur Coral Tree	Fabaceae	2 3
Erythrina X sykesii	Coral Tree	Fabaceae	2
Eucalyptus microcorys #	Tallowwood	Myrtaceae	2

Table 3.1 – Flora observations for the study area

Scientific name	Common name	Family	Community
Euphorbia peplus	-	Euphorbiaceae	1 2
Ficus pumila	Creeping Fig	Moraceae	1
Fumaria muralis	Wall Fumitory	Fumariaceae	2
Gamochaeta sp.	Cudweed	Asteraceae	1 2
Gamochaeta spicata	Cudweed	Asteraceae	1 2
Harpephyllum caffrum	Kaffir Plum	Anarcardiaceae	2
Hedychium gardnerianum	Ginger Lily	Anthericaceae	1 2
Hydrocotyle bonariensis	Pennywort	Apiaceae	2 3
Hypochaeris radicata	Flatweed	Asteraceae	1 2 4
Impatiens walleriana	Busy Lizzie	Balsaminaceae	3
Ipomoea indica	Blue Morning Glory	Convolvulaceae	1 2
Jacaranda mimosifolia	Jacaranda	Bignoniaceae	2
Juncus articulatus	-	Juncaceae	2
Juncus capillaceus	-	Juncaceae	1 2
Lantana camara	Lantana	Verbenaceae	1 2
Leptospermum sp.	-	Myrtaceae	2
Ligustrum lucidum	Broad-leaved Privet	Oleaceae	1 2
Ligustrum sinense	Small-leaved Privet	Oleaceae	1 2 4
Lilium formosanum	-	Liliaceae	1
Lonicera japonica	Honeysuckle	Caprifoliaceae	1 2
Lotus suaveolens	Hairy Birds-foot Trefoil	Fabaceae	2
Ludwigia peruviana	-	Onagraceae	3
Modiola caroliniana	Red-flowered Mallow	Malvaceae	2
Monstera deliciosa	-	Araceae	2
Musa acuminata	Banana	Musaceae	2
Nephrolepis cordifolia	Fish-bone Fern	Davalliaceae	1 2
Paspalum dilatatum	Paspalum	Poaceae	1 2
Paspalum urvillei	Vasey Grass	Poaceae	2 3
Passiflora edulis	Passionfruit	Passifloraceae	1 2
Pennisetum clandestinum	Kikuyu	Poaceae	2 3
Phyllostachys sp.	Bamboo	Poaceae	1 2
Phytolacca octandra	Inkweed	Phytolaccaceae	2
Pinus sp.	Exotic Pine	Pinaceae	2
Plantago lanceolata	Ribwort	Plantaginaceae	1 2
Plantago major	Large Plantain	Plantaginaceae	2
Plantanus x acerifolia	Plane Tree	Plantanaceae	2
Populus alba	White Poplar	Salicaceae	2
Populus nigra	Lombardy Poplar	Salicaceae	1 2
Ranunculus repens	Creeping Buttercup	Ranunculaceae	1 2 3
Ricinis communis	Castor Oil Plant	Euphorbiaceae	1 2
Robinia pseudoacacia	Black Locust	Fabaceae	2
Rubus fruticosus ssp. agg.	Blackberries	Rosaceae	1 2
Rumex crispus	Curled Dock	Polygonaceae	2 3
Salix babylonica	Weeping Willow	Salicaceae	2 3
Salix sp.	Willow	Salicaceae	2 3
Schefflera actinophylla	Umbrella Tree	Araliaceae	1 2
Senecio madagascariensis	Fireweed	Asteraceae	1 2 3
Senna pendula var. *glabrata*	-	Fabaceae	1 2 3
Setaria parvifolia	Slender Pigeon Grass	Poaceae	1 2
Sida rhombifolia	Paddy's Lucerne	Malvaceae	2
Silene pratensis	White Campion	Caryophyllaceae	1 2
Solanum americanum	Glossy Nightshade	Solanaceae	2
Solanum mauritianum	Tobacco Bush	Solanaceae	1 2
Stenotaphrum secundatum	Buffalo Grass	Poaceae	1 2
Taraxacum officinale	Dandelion	Asteraceae	1 2

Table 3.1 – Flora observations for the study area

Scientific name	Common name	Family	Community
Tibouchina sp.	-	Melastomataceae	2 4
Toxicodendron succedaneum	Rhus Tree	Anacardiaceae	1
Tradescantia albiflora	Wandering Jew	Commelinaceae	2 3
Trifolium dubium	Yellow Suckling Clover	Fabaceae	1 2
Trifolium fragiferum	Strawberry Clover	Fabaceae	2
Trifolium repens	White Clover	Fabaceae	1 2
Verbascum virgatum	Twiggy Mullein	Scrophulariaceae	2
Verbena bonariensis	Purple Top	Verbenaceae	1 2 3
Verbena quadrangularis	Flaxleaf Fleabane	Verbenaceae	1 2
Zantedeschia aethiopica	Arum Lily	Araceae	2
# denotes species native to Australia but exotic within the locality.			

3.3 Fauna results

Fauna species observed throughout the duration of fauna surveys are listed in Table 3.2 below.

Table 3.2 – Fauna observations for the study area

Common name	Scientific name	Method observed	
Birds		**Jan 2004**	**Mar-Apr 2010**
Australasian Grebe	*Tachybaptus novaehollandiae*	O	
Australian King Parrot	*Alisterus scapularis*		O C
Australian Magpie	*Gymnorhina tibicen*	O C	O C
Australian Raven	*Corvus coronoides*	O C	C
Australian White Ibis	*Threskiornis molucca*		O
Australian Wood Duck	*Chenonetta jubata*	O C	O C
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O C	O C
Common Koel	*Eudynamys scolopacea*	O C	
Common Myna *	*Acridotheres tristis*	O	O C
Common Starling *	*Sturnus vulgaris*	O C	
Crested Pigeon	*Ocyphaps lophotes*	O C	O C
Dollarbird	*Eurystomus orientalis*	O	
Dusky Moorhen	*Gallinula tenebrosa*	O	O
Eastern Rosella	*Platycercus eximius*	O C	C
Eastern Spinebill	*Acanthorhynchus tenuirostris*	O	C
Eastern Whipbird	*Psophodes olivaceus*	C	O C
Eastern Yellow Robin	*Eopsaltria australis*		C
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	C	C
Galah	*Cacatua roseicapilla*	O C	
Glossy Black-Cockatoo [TS]	*Calyptorhynchus lathami*		O C
Golden Whistler	*Pachycephala pectoralis*		C
Goose (domestic)	*Anser anser*		O
Grey Butcherbird	*Cracticus torquatus*	O C	O C
Grey Fantail	*Rhipidura fuliginosa*		O C
Laughing Kookaburra	*Dacelo novaeguineae*	O C	O C
Lewin's Honeyeater	*Meliphaga lewinii*		O C
Little Pied Cormorant	*Phalacrocorax melanoleucos*	O	
Little Wattlebird	*Anthochaera chrysoptera*		O C
Magpie-lark	*Grallina cyanoleuca*	O C	O C
Masked Lapwing	*Vanellus miles*	O C	O C
New Holland Honeyeater	*Phylidonyris novaehollandiae*	O	C[PR]
Noisy Miner	*Manorina melanocephala*	O C	O C
Pacific Black Duck	*Anas superciliosa*	O	O C
Pied Currawong	*Strepera graculina*	O C	O C
Powerful Owl [TS]	*Ninox strenua*		P Sp C
Rainbow Lorikeet	*Trichoglossus haematodus*	O C	O C
Red-browed Finch	*Neochmia temporalis*		O C
Red Wattlebird	*Anthochaera carunculata*	O C	O C
Red-whiskered Bulbul *	*Pycnonotus jocosus*	O C	C
Restless Flycatcher	*Myiagra inquieta*		O C
Rock Dove *	*Columba livia*		O
Sacred Kingfisher	*Todiramphus sanctus*	O C	
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*		O C[PO]
Scarlet Honeyeater	*Myzomela sanguinolenta*		C
Silvereye	*Zosterops lateralis*	O C	O C
Spangled Drongo	*Dicrurus bracteatus*		O
Spotted Turtle-Dove *	*Streptopelia chinensis*	O	C

Table 3.2 – Fauna observations for the study area

Common name	Scientific name	Method observed	
Striated Pardalote	*Pardalotus striatus*		C
Sulphur Crested Cockatoo	*Cacatua galerita*	O C	O C
Superb Fairy-wren	*Malurus cyaneus*	O C	O C
Tree Martin	*Hirundo nigricans*		O^{PR}
Welcome Swallow	*Hirundo neoxena*	O	O C
White-browed Scrubwren	*Sericornis frontalis*		O C
Willie Wagtail	*Rhipidura leucophrys*	O C	O C
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	C	
Mammals			
Black Rat *	*Rattus rattus*	E	HT E
Brown Antechinus	*Antechinus stuartii*	E	HT
Bush Rat	*Rattus fuscipes*		E
Common Brushtail Possum	*Trichosurus vulpecula*	Sp E	Sp E
Common Ringtail Possum	*Pseudocheirus peregrinus*	Sp	Sp HT
Domesticated Cat *	*Felis cattus*		O HT
Domesticated Dog *	*Canis familiaris*	O	O C
Eastern Bentwing-bat ^{TS}	*Miniopterus orianae oceansis*		A
Eastern Freetail-bat	*Mormopterus ridei*		A^{PO}
Gould's Wattled Bat	*Chalinolobus gouldii*	A	A
Grey-headed Flying-fox ^{TS}	*Pteropus poliocephalus*	Sp	Sp
Horse *	*Equus caballus*	O Sc	O
House Mouse *	*Mus musculus*	E	
Little Forest Bat	*Vespadelus vulturnus*	A	A
Long-nosed Bandicoot	*Parameles nasuta*	E	HT E
Rabbit *	*Oryctolagus cuniculus*	Sc O	O Sp Sc
Swamp Wallaby	*Wallabia bicolor*		HT
Reptiles			
Cream-striped Shining Skink	*Cryptoblepharus virgatus*		O
Delicate Skink	*Lampropholis delicata*		O E
Eastern Blue Tongue Lizard	*Tiliqua scincoides*	E O	O
Eastern Water Dragon	*Physignathus lesueurii*	E O	O
Eastern Water Skink	*Eulamprus quoyii*	E O	O
Grass Skink	*Lampropholis guichenoti*	E O	
Red-Bellied Black Snake	*Pseudechis porphyriacus*		E
Southern Leaf-tailed Gecko	*Phyllurus platurus*		E
Amphibians			
Common Eastern Froglet	*Crinia signifera*		C E
Dusky Toadlet	*Uperoleia fusca*		C
Peron's Tree Frog	*Litoria peronii*	C	
Striped Marsh Frog	*Limnodynastes peronii*	C	C E

Note: * indicates introduced species
^{TS} indicates threatened species

All species listed are identified to a high level of certainty unless otherwise noted as:

^{PR} indicates species identified to a 'probable' level of certainty
^{PO} indicates species identified to a 'possible' level of certainty

A	-	*Anabat II/SD-1*	C	-	Call identification
O	-	Observation	P	-	Call playback response
E	-	Trap (*Elliott*, cage, etc)	S	-	Habitat search
Sp	-	Spotlight	Sc	-	Scat, track or sign identification
HT	-	Hair tubes / scat analysis			

3.4 Habitat trees

Habitat trees were previously identified across the study area in 2010. Additional habitat trees were assessed as part of recent tree survey in 2013. Habitat trees located within the subject site or APZs for the current proposal are listed in Table 3.3 and shown on Figure 2.

The subject site contains no highly significant or notable habitat trees and it appears that no habitat trees will require removal as part of the proposal.

Table 3.3 – Habitat tree data

Tree no.	Scientific name	Common name	DBH (cm)	Spread (m)	Height (m)	Vigour (%)	Hollows and other habitat features recorded
HT23	*Eucalyptus piperita*	Sydney Peppermint	75/60/50	13	22	70	1x 10-15cm broken trunk
HT24	*Corymbia citriodora*	Lemon-scented gum	60	17	27	90	1x 5-10cm branch
HT30	*Eucalyptus sieberi*	Silver-top Ash	40/20	9	7	30	1x 0-5cm branch
HT36	*Eucalyptus sieberi*	Silver-top Ash	75	8	18	55	1x 0-5cm branch
HT38	*Eucalyptus piperita*	Sydney Peppermint	130	17	17	30	1x 0-5cm branch, 1x 5-10cm trunk base
HT39	stag	stag	35	5	11	0	1x 0-5cm branch
HT40	stag	stag	45/45	5	7	0	2x 0-5cm branch
HT41	*Eucalyptus piperita*	Sydney Peppermint	50	10	17	65	1x 10-15cm trunk (good quality)
HT42	*Eucalyptus punctata*	Grey Gum	60/27	18	16	60	1x 0-5cm branch
HT43	*Eucalyptus piperita*	Sydney Peppermint	55/ 55	13	18	80	1x 10-15cm trunk
HT44	*Eucalyptus piperita*	Sydney Peppermint	40/40	20	30	50	1x 15-20cm trunk split

3.5 Tree assessment

Trees located within the subject site and nearby surrounds incorporated into current or future APZs have been assessed *(Barrell, 1993).* The safe use life expectancy (SULE) information shall be used to selectively remove trees in poor condition and health to APZ requirements, as well as to determine which trees will be required for removal within, or close, to the development footprints.

A total of 340 trees have been assessed according to their SULE. Tree SULE data is provided in Table 3.4 with definitions provided in Appendix 6. The calculated required extent of the APZ does not incorporate all the nearby trees assessed and included in data tables.

Some exotic Camphor Laurel trees were located within the open forest portions to the south of the site, with the remaining trees in this community being mostly native. Alternatively, the majority of trees surrounding the house and other cleared areas were mostly exotic or planted.

Generally, the landscaped planted trees on site were in good condition. Trees with open forest / woodland portions were found to be in a moderate condition, mostly due to impacts of competition for light and space which mostly results in suppression to one or more aspects of the tree canopy. Where trees have been downgraded with respect to health, a comment as to the reasons for the downgrade is generally provided.

Table 3.4 – Tree SULE data

No.	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour %	SULE	Comments and recommendations
147	*Eucalyptus robusta*	Swamp Mahogany	25	15	8	90	2A	
148	*Eucalyptus piperita*	Sydney Peppermint	30	18	9	80	4C	epicormic growth at base of trunk, roots exposed
149	*Eucalyptus robusta*	Swamp Mahogany	40	22	8	80	2D	damaged at base
150	stag	stag	35	16	8	0	4A	dead
151	*Populus sp*	Poplar	25	18	10	90	2A	
152	*Populus sp*	Poplar	25	18	10	90	2A	
153	*Eucalyptus piperita*	Sydney Peppermint	150	18	14	60	4C	1x large broken trunk, poor form
154	*Pinus elliotti*	Slash Pine	30	15	10	90	2A	
155	*Pinus elliotti*	Slash Pine	40	15	12	90	2A	
156	*Toxicodendron succedanium*	Rhus Tree	10,10,10 ,10,15	6	6	80	4C	poor form, toxic hazard
157	*Toxicodendron succedanium*	Rhus Tree	15,15,10	7	7	80	4C	poor form, toxic hazard
158	*Toxicodendron succedanium*	Rhus Tree	10,15,10 ,15	7	7	80	4C	poor form, toxic hazard
159	*Araucaria heterophylla*	Norfolk Island Pine	25	8	8	90	2A	
160	*Eucalyptus piperita*	Sydney Peppermint	20	6	6	90	2A	
161	*Eucalyptus piperita*	Sydney Peppermint	25	7	6	90	2A	
200	*Eucalyptus sieberi*	Silvertop Ash	43	13	8	80	2B	in powerlines
201	*Eucalyptus sieberi*	Silvertop Ash	25	13	3	80	2D	leans s
202	*Eucalyptus sieberi*	Silvertop Ash	28, 25	14	6	50	3D	larger trunk rotten
203	*Eucalyptus sieberi*	Silvertop Ash	33, 27	13	12	70	2D	slight lean
204	*Angophora costata*	Smooth Barked Apple	75	22	15	80	2A	minor dead wood, small kino
205	*Eucalyptus piperita*	Sydney Peppermint	60, 30, 20	17	15	90	1A	good health and form
206	*Eucalyptus piperita*	Sydney Peppermint	55	18	13	75	2D	slight lean e
207	stag	stag	25	11	3	0	4A	dead
208	*Eucalyptus sieberi*	Silvertop Ash	35	21	10	85	1A	good form
209	*Eucalyptus piperita*	Sydney Peppermint	35	17	7	60	3D	moderate dead wood
210	*Eucalyptus sieberi*	Silvertop Ash	40	21	9	40	3D	moderate dead wood
211	stag	stag	35	21	5	0	4A	dead
212	*Angophora Costata*	Smooth Barked Apple	40	17	15	15	4A	declined health
213	*Erythrina sykesii*	Coral Tree	40, 35	9	16	60	3D	stabilising creek bank
214	*Eucalyptus sieberi*	Silvertop Ash	40, 15	18	7	55	3D	large dead branch
215	*Angophora Costata*	Smooth Barked Apple	40	26	11	55	3D	moderate dead wood
216	stag	stag	50	23	6	0	4A	dead
217	*Eucalyptus sieberi*	Silvertop Ash	38	22	8	60	3D	moderate dead wood, good form
218	*Eucalyptus sieberi*	Silvertop Ash	30	21	5	80	2D	slight lean e
219	*Eucalyptus piperita*	Sydney Peppermint	20	16	4	90	1A	good form
220	*Eucalyptus sieberi*	Silvertop Ash	42	15	15	60	3D	moderate lean nw
221	*Eucalyptus sieberi*	Silvertop Ash	35, 15	23	5	0	4A	dead
222	*Eucalyptus sieberi*	Silvertop Ash	35	22	10	70	2D	slight lean sw, minor dead wood
223	*Eucalyptus sieberi*	Silvertop Ash	45, 25	16	8	25	3D	large trunk dead, smaller, healthy
224	*Eucalyptus sieberi*	Silvertop Ash	27	7	3	0	4A	dead
225	stag	stag	27	14	5	0	4A	dead
226	*Eucalyptus sieberi*	Silvertop Ash	27	11	9	75	2A	good form

Table 3.4 – Tree SULE data

No.	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour %	SULE	Comments and recommendations
227	*Angophora costata*	Smooth Barked Apple	38	23	16	85	2A	kino excretion on trunks
228	*Eucalyptus piperita*	Coast Grey Box	55	22	12	75	2A	good form
229	*Eucalyptus piperita*	Coast Grey Box	60	22	18	85	1A	good form
408	*Eucalyptus piperita*	Sydney Peppermint	38	22	7	70	2A	Slight lean south
409	*Eucalyptus piperita*	Sydney Peppermint	55	17	6	50	3B	Strong lean south west over dam edge
410	*Eucalyptus piperita*	Sydney Peppermint	55,35	22	7	65	2A	Minor deadwood. Moderate health
411	*Eucalyptus piperita*	Sydney Peppermint	45,20,15	21	6	60	2D	Minor deadwood. Minor decay on main trunk
412	*Corymbia gummifera*	Red Bloodwood	30	20	3	50	2C	Kino on main trunk, minor deadwood. Suppressed
413	stag	stag	40	7	4	0	4A	Dead tree
414	*Angophora costata*	Smooth-barked Apple	37	20	5	80	1A	Good health and form. Kino at 4m
415	*Eucalyptus sieberi*	Silvertop Ash	75	18	8	55	2B	Strong lean north east. Minor deadwood
416	*Angophora costata*	Smooth-barked Apple	45	18	7	55	2C	Suppressed canopy and western side
417	*Eucalyptus piperita*	Sydney Peppermint	28,28,20	12	5	20	3B	Declining health
418	*Angophora costata*	Smooth-barked Apple	60	23	10	75	1A	Minor deadwood
419	*Eucalyptus piperita*	Sydney Peppermint	85	18	13	55	2B	Minor deadwood. Strong lean north
420	*Angophora costata*	Smooth-barked Apple	50	17	9	50	2B	Moderate deadwood. Strong lean east
421	*Angophora costata*	Smooth-barked Apple	30	8	6	40	3C	Strongly suppressed
422	*Eucalyptus piperita*	Sydney Peppermint	75,55	22	9	40	3B	Major deadwood and some trunk rot
423	*Eucalyptus piperita*	Sydney Peppermint	45	17	6	50	3B	Moderate deadwood. Strong lean south east
424	*Eucalyptus piperita*	Sydney Peppermint	40,28	15	4	35	3B	Roots exposed. Moderate lean west
425	*Eucalyptus piperita*	Sydney Peppermint	60	15	7	60	2A	Minor deadwood
426	*Eucalyptus sieberi*	Silvertop Ash	40,20	7	9	30	3B	Poor form. Previously trimmed
427	*Angophora costata*	Smooth-barked Apple	25,25	8	6	50	2C	Suppressed
428	*Schefflera actinophylla*	Umbrella Tree	25	7	3	75	1A	Exotic species
429	*Eucalyptus robusta*	Swamp Mahogany	23	12	4	70	2A	Slightly suppressed
430	*Eucalyptus punctata*	Grey Gum	75,30	18	10	65	2D	Minor deadwood
431	*Eucalyptus piperita*	Sydney Peppermint	40	9	5	50	2C	Heavily suppressed
432	*Eucalyptus piperita*	Sydney Peppermint	42	18	6	70	4E	Growing through powerlines
433	*Eucalyptus piperita*	Sydney Peppermint	42	15	6	40	3B	Canopy dieback
434	*Melaleuca armillaris*	Bracelet Honeymyrtle	30	6	4	70	2A	Good health and form
435	*Eucalyptus piperita*	Sydney Peppermint	75,60,50	22	13	70	1A	Good health. Minor deadwood
436	*Eucalyptus piperita*	Sydney Peppermint	27	16	5	80	1A	Good health and form
437	stag	stag	42	14	4	0	4A	Dead tree
438	*Corymbia gummifera*	Red Bloodwood	55	18	10	75	1A	Minor deadwood
453	*Eucalyptus punctata*	Grey Gum	33	17	4	60	2A	Some suppression
454	*Angophora costata*	Smooth-barked Apple	50	22	7	80	1A	Kino on lower part of main trunk
455	*Eucalyptus punctata*	Grey Gum	25	12	4	60	2C	Suppressed
456	*Eucalyptus punctata*	Grey Gum	28	10	4	40	3C	Strongly suppressed

Table 3.4 – Tree SULE data

No.	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour %	SULE	Comments and recommendations
457	*Eucalyptus punctata*	Grey Gum	38	12	6	50	3A	Suppressed
458	*Eucalyptus punctata*	Grey Gum	35,25	14	6	55	2D	Moderate deadwood. Slightly suppressed
459	*Angophora costata*	Smooth-barked Apple	40	25	6	75	1A	Good health and form
460	*Eucalyptus punctata*	Grey Gum	40	17	6	60	2D	Moderate deadwood
461	*Eucalyptus punctata*	Grey Gum	40	15	7	60	2A	Minor deadwood
462	*Angophora costata*	Smooth-barked Apple	50	24	8	60	2A	Minor deadwood. Burl at 2m
463	*Eucalyptus sieberi*	Silvertop Ash	23,18	8	4	70	2A	Slight lean south
465	*Eucalyptus punctata*	Grey Gum	35	16	8	65	2A	Minor deadwood
466	*Eucalyptus sieberi*	Silvertop Ash	28	8	5	70	2A	Slight lean east
467	*Eucalyptus sieberi*	Silvertop Ash	45	14	4	40	3B	Strong lean south. Moderate deadwood
468	*Eucalyptus sieberi*	Silvertop Ash	45,30	22	7	70	2A	Slight lean south east
469	*Eucalyptus sieberi*	Silvertop Ash	70,70	21	11	65	2D	Minor deadwood
470	*Eucalyptus sieberi*	Silvertop Ash	22	8	4	75	2A	Twisted main trunk
471	*Eucalyptus sieberi*	Silvertop Ash	25	13	2	50	2C	Heavily suppressed
472	*Eucalyptus sieberi*	Silvertop Ash	25	9	4	50	2B	Strong lean south west
473	stag	stag	25	13	2	0	4A	Dead tree
474	*Eucalyptus sieberi*	Silvertop Ash	35	15	6	60	2A	Some suppression
475	*Eucalyptus sieberi*	Silvertop Ash	60,32	20	10	70	2D	Smaller trunk to remove, leans strongly
464	*Angophora bakeri*	Narrow-leaved Apple	35	17	6	20	3B	Heavy dieback. Possibly mis-identified
476	*Eucalyptus punctata*	Grey Gum	30,30	14	7	70	2A	REMOVED. Previously had minor deadwood
477	*Eucalyptus punctata*	Grey Gum	27,25	11	6	60	2A	REMOVED. Previously had average form
478	*Eucalyptus punctata*	Grey Gum	30	12	5	40	3B	REMOVED. Previously had moderate suppression and deadwood
479	*Eucalyptus sieberi*	Silvertop Ash	50	18	7	80	1A	REMOVED. Previously had good health and form
480	*Acacia parramattensis*	Parramatta Green Wattle	27	14	7	90	2A	Good health and form. Short lifespan
481	*Eucalyptus punctata*	Grey Gum	30	13	5	50	2C	Suppressed
482	*Eucalyptus sieberi*	Silvertop Ash	35,12,7	9	8	30	3B	Main trunk is parallel to ground
483	*Eucalyptus punctata*	Grey Gum	32	14	5	60	2A	REMOVED. Previously was slightly suppressed
484	*Eucalyptus punctata*	Grey Gum	30	10	5	30	3B	Poor form
485	*Angophora costata*	Smooth-barked Apple	50,30	16	10	75	1A	REMOVED. Previously had minor deadwood
486	*Callitris sp*	Callitris Pine	28	7	4	65	2A	REMOVED. Exotic species
487	*Angophora costata*	Smooth-barked Apple	22	9	3	70	2B	REMOVED. Previously was growing 1m from overhead wires
500	*Glochidion ferdinandi*	Cheese Tree	35	10	8	90	1a	good shape & form
501	*Eucalyptus punctata*	Grey Gum	15	9	6	15	3c	little foliage, bent trunk, small deadwood, glider scratches
502	*Corymbia gummifera*	Red Bloodwood	25/25/15	11	10	75	2c	small kino, mallee structure
503	*Glochidion ferdinandi*	Cheese Tree	15	7	6	90	1a	good shape & form
504	*Angophora costata*	Smooth-barked Apple	30	17	3	70	2c	narrow suppressed canopy, no lower foliage

Table 3.4 – Tree SULE data

No.	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour %	SULE	Comments and recommendations
505	*Angophora costata*	Smooth-barked Apple	20	13	4	70	2a	narrow canopy from suppression
506	*Eucalyptus sieberi*	Silver-top Ash	30	12	4	75	2a	lean, narrow suppressed canopy
507	*Eucalyptus sieberi*	Silver-top Ash	15	6	7	55	3c	heavy lean then bending trunk, epicormic growth, suppressed above
508	*Eucalyptus sieberi*	Silver-top Ash	45	17	12	65	2c	lean
509	*Eucalyptus sieberi*	Silver-top Ash	50/30	16	11	70	2c	lean, one trunk heavy bend & small epicormic growth
510	*Eucalyptus sieberi*	Silver-top Ash	40	14	10	5	4a	dying
511	*Eucalyptus punctata*	Grey Gum	45	15	10	65	2c	canopy tilt, deadwood, numerous heavy scratches
512	*Eucalyptus punctata*	Grey Gum	45	12	8	70	2c	deadwood, lean, suppressed tilted canopy, possum& glider scratches
513	*Eucalyptus piperita*	Sydney Peppermint	130	17	17	30	1c	significant tree growing off rocks next to waterfall, manage large amount of deadwood 1x 0-5cm branch hollow, 1x 5-10cm trunk base hollow
514	*Eucalyptus punctata*	Grey Gum	30	11	3	45	3c	deadwood, narrow suppressed canopy, no lower foliage
515	*Angophora costata*	Smooth-barked Apple	25	12	12	65	2c	narrow & tilted canopy from suppression
516	*Banksia serrata*	Old Man Banksia	15/20	7	6	55	2a	one trunk has bark rot & a broken crown
517	*Eucalyptus sieberi*	Silver-top Ash	40/45/45 /30	18	20	50	3b	diseased tree, small burl growths on outer limbs, one other trunk broken at base, small deadwood, large dominant mallee
518	*Eucalyptus punctata*	Grey Gum	30	12	7	40	3c	epicormic growth, deadwood, dieback
519	*Eucalyptus punctata*	Grey Gum	40	12	11	70	1a	small deadwood, small epicormic growth, many heavy scratches
520	*Eucalyptus punctata*	Grey Gum	45	12	9	70	2c	deadwood, narrow suppressed canopy, scratches
521	*Eucalyptus punctata*	Grey Gum	30	14	8	90	1a	good shape & form, scratches
522	*Casuarina glauca*	Swamp Oak	20	7	5	25	3a	dieback
523	*Corymbia gummifera*	Red Bloodwood	25	14	3	10	4a	mostly epicormic growth, small kino
524	*Pittosporum undulatum*	Sweet Pittosporum	25	7	3	80	1a	good shape & form
525	*Acer negundo*	Box Elder	20	10	5	85	1a	good shape & form
526	stag	stag	35	11	5	0	4a	dead, 1x 0-5cm branch hollow
527	*Eucalyptus piperita*	Sydney Peppermint	70/65	20	16	75	1a	leaning trunks separated at base
528	stag	stag	18	7	4	0	4a	dead
529	*Cinnamomum camphora*	Camphor Laurel	17	11	6	90	1a	good shape & form
530	*Cinnamomum camphora*	Camphor Laurel	22	12	7	90	1a	good shape & form
531	*Cinnamomum camphora*	Camphor Laurel	28	12	7	90	1a	good shape & form
532	*Eucalyptus sieberi*	Silver-top Ash	55	22	9	80	1a	good shape & form
533	*Angophora costata*	Smooth-barked Apple	20	15	6	60	2c	suppressed to the side & from above, narrow canopy
534	*Angophora costata*	Smooth-barked Apple	30	18	10	100	1a	good shape & form
535	*Acacia sp.*	Wattle	15	8	6	90	1a	good shape & form

Table 3.4 – Tree SULE data

No.	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour %	SULE	Comments and recommendations
536	stag	stag	45/45	7	5	0	4a	dead, 2x 0-5cm branch hollows
537	*Cinnamomum camphora*	Camphor Laurel	25	9	5	80	1a	good shape & form
538	*Pittosporum undulatum*	Sweet Pittosporum	25	12	8	85	1a	good shape & form
539	*Eucalyptus piperita*	Sydney Peppermint	50	17	10	65	2a	rotten hollowed base, old epicormic growth, 1x good quality 10-15cm trunk hollow
540	*Eucalyptus piperita*	Sydney Peppermint	55	18	11	70	2c	hollowed base
541	*Angophora costata*	Smooth-barked Apple	25	14	7	80	1a	kino
542	*Eucalyptus piperita*	Sydney Peppermint	30	14	8	80	1a	good shape & form
543	*Angophora costata*	Smooth-barked Apple	40	22	11	80	1a	Deadwood
544	*Eucalyptus piperita*	Sydney Peppermint	30	13	9	40	3c	Removed since 2010 - suppressed above, tilting canopy, dieback, deadwood
545	*Elaeocarpus reticulatus*	Blueberry Ash	35/25/25 /25/10	12	11	70	3a	Removed since 2010 - choked by lantana, deadwood, water dragon in tree
546	*Pittosporum undulatum*	Sweet Pittosporum	20/10	9	7	75	2a	Removed since 2010 choked in lantana, manage under powerline, not tagged
547	*Pittosporum undulatum*	Sweet Pittosporum	15	11	5	70	2a	Removed since 2010. choked in lantana, not tagged
548	*Pinus sp.*	exotic pine	22	9	4	90	1a	good shape & form, inactive? small bird nest
549	*Pinus sp.*	exotic pine	30	11	5	90	1a	good shape & form
550	*Pinus sp.*	exotic pine	30	13	4	95	1a	good shape & form
551	*Pinus sp.*	exotic pine	30	13	6	80	1a	slightly suppressed below
552	*Araucaria heterophylla*	Norfolk Island Pine	30	16	5	95	1a	good shape & form
553	*Pinus sp.*	exotic pine	30	12	6	90	1a	good shape & form
554	*Pinus sp.*	exotic pine	25	11	5	90	1a	suppressed below
555	*Livistona australis*	Cabbage Tree Palms	25	3	2	95	2a	Removed since 2010. good shape & form
556	*Syagrus romanzoffiana*	Cocos Palm	28	13	5	90	2a	Removed since 2010. good shape & form
557	*Syagrus romanzoffiana*	Cocos Palm	15	8	2	70	3a	Removed since 2010. trunk splits, suppressed above
558-595	*Pinus sp.*	exotic pines	25	12	3	75	2c	suppression from neighbouring trees
596	*Eucalyptus sieberi*	Silver-top Ash	50	18	16	95	1a	good shape & form
597	*Eucalyptus punctata*	Grey Gum	32	9	9	80	1c	deadwood, small kino on each branch, possum scratches
598	stag	stag	45/30	9	3	0	4a	dead, covered in vine
599	*Morus alba*	Mulberry	35	7	8	85	2a	good shape & form
600	*Quercus sp.*	White Oak	16	7	7	85	2a	good shape & form
601	*Eucalyptus punctata*	Grey Gum	60/27	16	18	60	2a	dieback, much small deadwood, small epicormic growth, 1x 0-5cm branch hollow
602	*Quercus sp.*	White Oak	23	9	7	80	2a	small suppression
603	Eucalyptus microcorys	Tallowwood	55	17	15	90	1a	good shape & form

Table 3.4 – Tree SULE data

No.	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour %	SULE	Comments and recommendations
604	*Eucalyptus punctata*	Grey Gum	55	15	11	75	2c	suppressed to south by T603, small deadwood
605	stag	stag	25/30	9	9	0	4a	dead
606	*Jacaranda mimosifolia*	Jacaranda	15	7	6	70	3c	suppressed all round & above
607	*Eucalyptus sieberi*	Silver-top Ash	30	16	4	60	3c	suppressed all round lower canopy, broken crown
608	*Eucalyptus punctata*	Grey Gum	25	15	5	45	3c	suppressed around, canopy dieback , small deadwood
609	*Acer negundo*	Box Elder	15/15/12	8	6	70	2a	suppressed below & above
610-612	*Livistona australis*	Cabbage Tree Palms	25	5	2	80	2a	next to house, suppressed by house & each other
613-642	*Syagrus romanzoffiana* & *Livistona australis*	Cocos Palms & Cabbage Tree Palms	20-40	~9	3	85	2c	Removed since 2010. some suppression from neighbouring trees, not tagged
643-661	*Pinus sp.*	exotic pines	10-20	9	3	75	2c	suppressed by each other, wind break
662	*Eucalyptus punctata*	Grey Gum	40	10	7	75	2a	small dieback, deadwood, possum scratches
663-679	*Syagrus romanzoffiana*	Cocos Palms & other palm sp.	30	9	3	89	2a	suppressed by each other and other neighbouring trees
680	*Eucalyptus punctata*	Grey Gum	25/30	9	6	70	3a	dieback, deadwood
681	*Eucalyptus punctata*	Grey Gum	25	9	5	75	2c	dieback, deadwood, suppressed
682	*Eucalyptus punctata*	Grey Gum	35	9	6	70	2a	deadwood
683	*Eucalyptus sieberi*	Silver-top Ash	40/50	12	9	65	2a	epicormic growth, small deadwood
684	*Pinus radiata*	Radiata Pine	50	14	9	90	1a	good shape & form
685	*Pinus sp.*	exotic pine	40	18	6	85	1a	good shape & form
686	*Pinus sp.*	exotic pine	40/25/50	14	4	85	1a	good shape & form
687	*Melaleuca styphelloides*	Prickly-leaved Paperbark	12/20/14 /15	11	7	80	1a	good shape & form
688	*Melaleuca styphelloides*	Prickly-leaved Paperbark	20/25	11	6	80	1a	good shape & form
689	*Melaleuca styphelloides*	Prickly-leaved Paperbark	15	7	5	85	1a	good shape & form
690	stag	stag	30	15	4	0	4a	dead
691	*Eucalyptus sieberi*	Silver-top Ash	45	9	8	60	3a	dieback
692	*Corymbia gummifera*	Red Bloodwood	35	16	6	65	3a	suppressed around, deadwood, epicormic growth
693	*Cinnamomum camphora*	Camphor Laurel	35	13	6	45	3a	suppressed by vine
694	*Pittosporum undulatum*	Sweet Pittosporum	15	7	5	65	2a	suppressed around
695	*Angophora costata*	Smooth-barked Apple	60	17	22	15	4a	dying, epicormic growth, much dieback
696	*Eucalyptus sieberi*	Silver-top Ash	25	11	6	15	3c	previously fallen, lower trunk lying across ground, leaning against and growing up T695, dieback
697	*Pittosporum undulatum*	Sweet Pittosporum	20	10	6	70	2a	suppressed around
698	*Eucalyptus sieberi*	Silver-top Ash	25/15	12	13	20	3c	previously fallen, lower trunk lying across ground, deadwood, highly suppressed
699	*Angophora costata*	Smooth-barked Apple	15	11	6	30	3c	fungus attack on small branches, lower deadwood

Table 3.4 – Tree SULE data

No.	Scientific name	Common name	DBH (cm)	Height (m)	Spread (m)	Vigour %	SULE	Comments and recommendations
700	*Eucalyptus sieberi*	Silver-top Ash	20/25	13	13	15	3c	heavy lean, highly suppressed, deadwood
701	*Angophora costata*	Smooth-barked Apple	30	17	10	80	1a	small kino
702	*Eucalyptus sieberi*	Silver-top Ash	40	14	12	40	2c	heavy lean
703	*Eucalyptus sieberi*	Silver-top Ash	40	13	9	30	3c	heavy lean, epicormic growth, suppressed above
704	*Eucalyptus sieberi*	Silver-top Ash	45	15	11	55	2a	deadwood, burl at base of trunk, large dead branch,
705	*Angophora costata*	Smooth-barked Apple	30	16	11	85	1a	good shape & form
706	*Eucalyptus piperita*	Sydney Peppermint	65	20	12	70	1a	lean upslope from suppression
707	*Angophora costata*	Smooth-barked Apple	30	15	8	65	2c	suppressed above, kino,
708	*Eucalyptus piperita*	Sydney Peppermint	55	18	8	60	2c	large dead branch, suppressed
709	*Elaeocarpus reticulatus*	Blueberry Ash	30/20/10	12	8	70	3a	
710	stag	stag	30	13	10	0	4a	dead, not tagged
711	*Eucalyptus sieberi*	Silver-top Ash	35	20	9	70	1a	small epicormic growth, not tagged
712	*Eucalyptus botryoides*	Bangalay	40	9	8	85	1a	good shape & form
713	*Eucalyptus piperita*	Sydney Peppermint	45	17	20	55	3c	heavily suppressed around & above, both trunks leaning opposite ways
714	*Eucalyptus punctata*	Grey Gum	35/40	12	12	30	3c	heavily suppressed above & around, deadwood, tilt & bent trunks
715	*Eucalyptus piperita*	Sydney Peppermint	45	16	9	70	2a	small deadwood, narrow canopy
716	*Angophora costata*	Smooth-barked Apple	30	15	7	55	3c	much emerging epicormic growth, tilted canopy, small kino
717	*Eucalyptus piperita*	Sydney Peppermint	35	19	11	60	2c	twisted trunk from lower suppression, narrow canopy
718	*Eucalyptus botryoides*	Bangalay	25	17	10	45	3c	bending narow canopy from suppression, small epicormic growth
719	*Eucalyptus punctata*	Grey Gum	30	11	8	05	4a	dieback, dying
720	*Eucalyptus piperita*	Sydney Peppermint	55/ 55	18	13	80	1a	small deadwood, 1x 10-15cm trunk hollow
721	*Eucalyptus sieberi*	Silver-top Ash	35/25	19	9	70	2c	small deadwood, epicormic growth
722	*Angophora costata*	Smooth-barked Apple	20	9	4	45	35	suppressed above, deadwood
723	*Eucalyptus piperita*	Sydney Peppermint	25	11	5	20	3c	epicormic growth, leaning, deadwood, suppressed all round
724	stag	stag	30	12	10	0	4a	dead
725	*Eucalyptus piperita*	Sydney Peppermint	40/40	30	20	50	2c	suppressed, 1x 15-20cm trunk split hollow
726	*Angophora costata*	Smooth-barked Apple	35	13	7	45	2c	fungal attack, die back, possum scratches
727	*Angophora costata*	Smooth-barked Apple	35	20	8	80	1a	kino
728	*Eucalyptus piperita*	Sydney Peppermint	55	20	9	50	3c	much epicormic growth, dieback

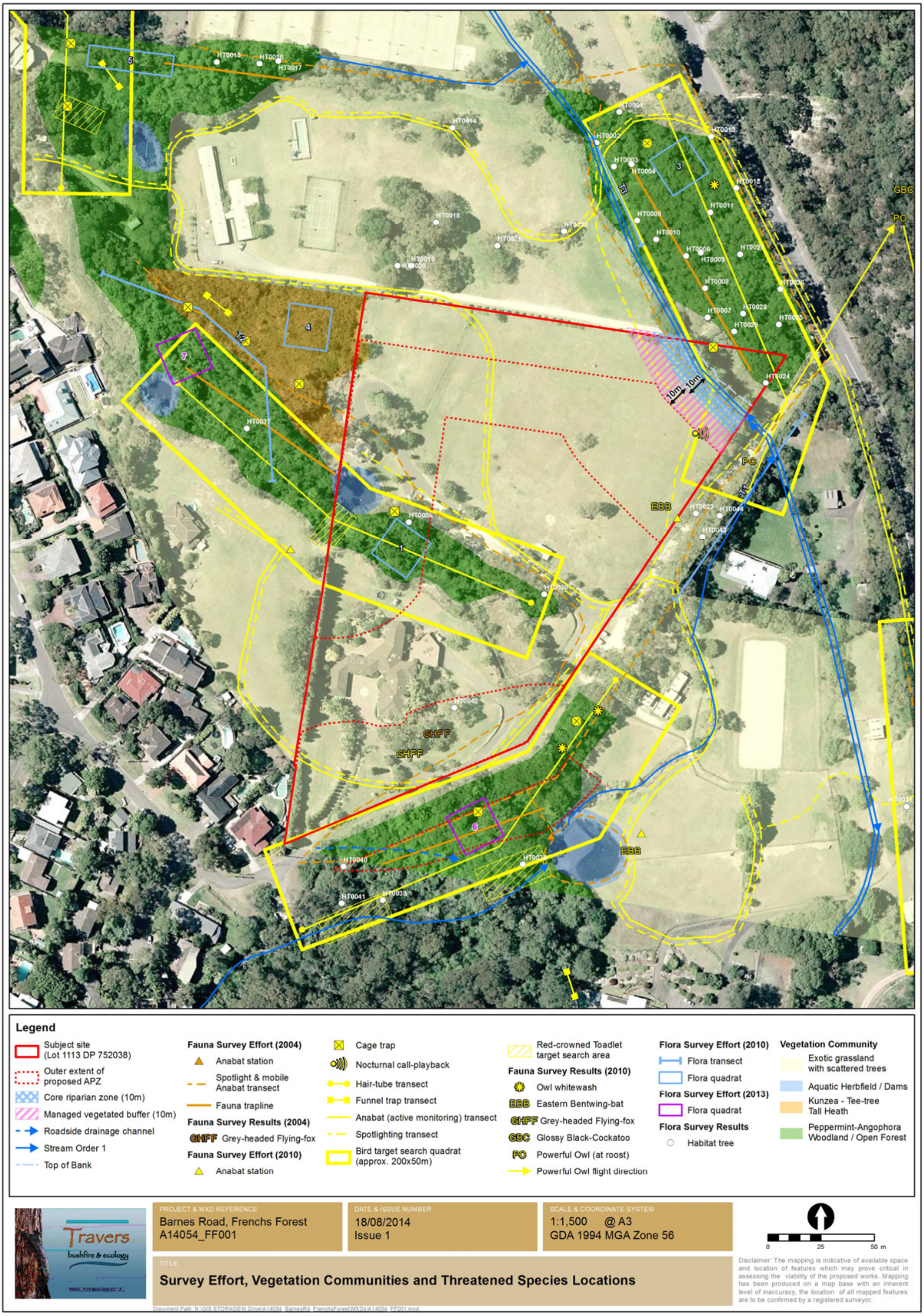

Figure 2 – Survey effort, vegetation communities and threatened species locations

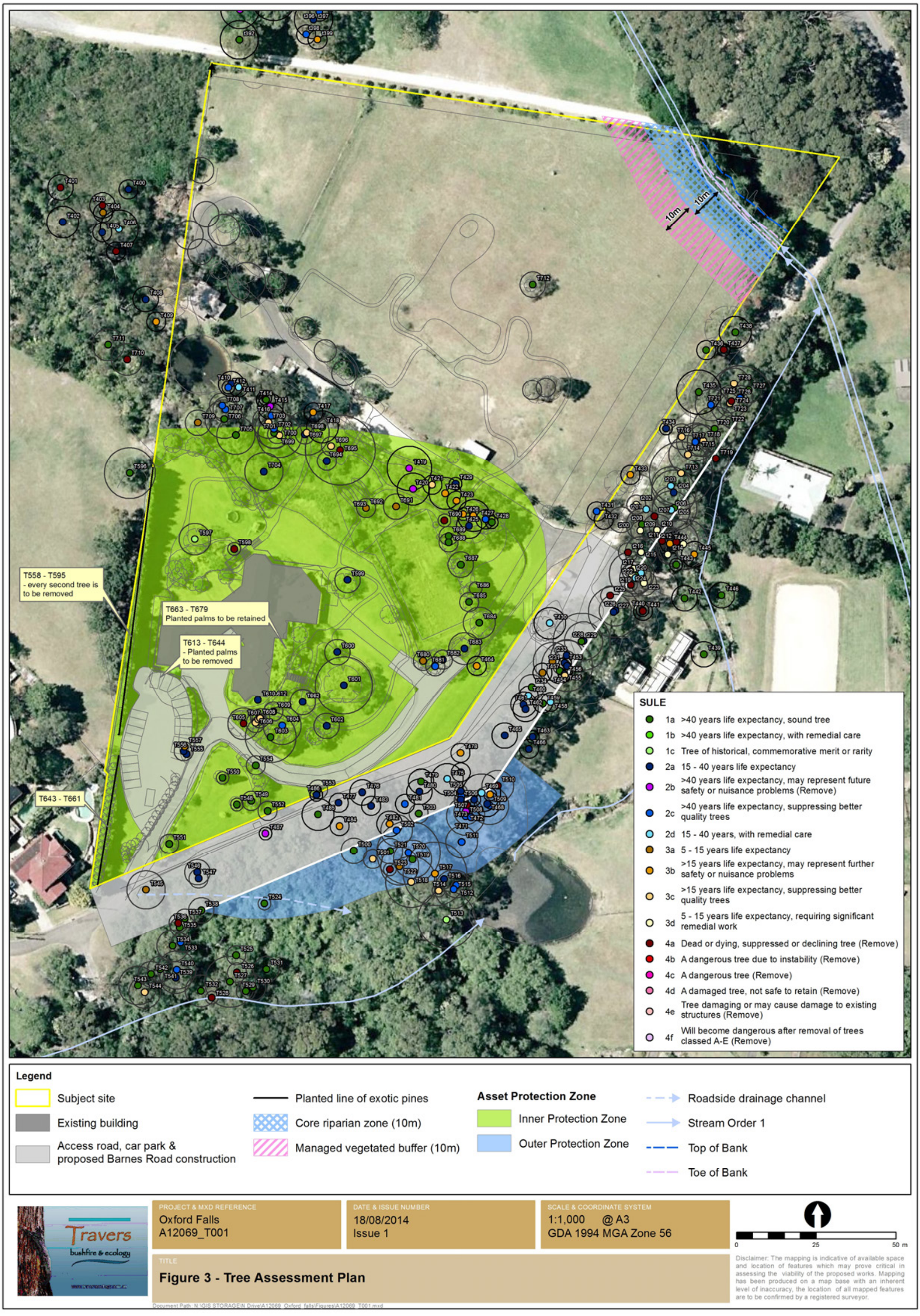

Figure 3 – Tree data and locations

Ecological Assessment 4

4.1 Previous surveys reviewed

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

- *Survey of the Duffys Forest Vegetation Community (Smith and Smith, 1999)* - This was an extensive vegetation mapping survey covering parts of coastal northern Sydney. The report and associated maps did not show that the subject site contains Duffys Forest Vegetation.

- *Warringah Natural Area Survey (Smith and Smith, 2005)* - The pre-European (1750) vegetation for the subject site was shown to have most likely been commensurate with Sydney Sandstone Gully Forest. The 2000 vegetation map shows the site as containing *Disturbed Vegetation.*

4.2 Flora

A total of two hundred and seventy six (276) flora species (157 native, 119 exotic) were observed within the study area during previous surveys. Not all planted specimens around existing buildings and site features were surveyed.

No threatened flora species were observed.

All species are listed in Table 3.1.

4.2.1 Local / regional flora matters

Significant plant species recorded within the study area considered significant in the Warringah LGA include:

- *Corymbia maculata*
- *Eucalyptus robusta*
- *Lythrum hyssopifolia*

All three (3) species are considered threatened in the northern Sydney region, however, none have been listed as a ROTAP species or fall under the schedules of threatened species legislation.

There were five (5) *Eucalyptus robusta* within the study area. These were most likely planted specimens and appear to be retained within the proposal.

The *Corymbia maculata* trees occur near the western boundary of the study area away from any area proposed for development.

The *Lythrum hypssopifolia* specimens occur within the riparian zone and may be disturbed during the creek restoration works however, in the long term with weeds removed, the potential for re-establishment will be largely increased.

4.2.2 State legislative flora matters

(a) Threatened flora species (NSW)

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH 2013) indicated a list of species that have been recorded within a 10km radius of the study area. Those species are considered for suitable habitat and potential to occur in Table A2.1 (Appendix 2).

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

Table 4.1 – State listed threatened flora species with suitable habitat present

Common name	TSC Act	Potential to occur
Acacia bynoeana	E	✓
Epacris purpurascens var. *purpurascens*	V	✓
Eucalyptus camfieldii	V	low
Tetratheca glandulosa	V	✓
Persoonia hirsuta	E	✓
Pimelea curviflora var. *curviflora.*	V	✓

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

No threatened flora species of state significance were recorded within the study area during survey(s) undertaken.

Summary of other threatened species requiring target survey by the DGRs (DoP 2006) and / or DECC (2009)

- *Acacia bynoeana*
- *Grevillea caleyi*
- *Persoonia hirsuta*
- *Pimelea curviflora* var. *curviflora*
- *Syzygium paniculatum*
- *Tetratheca glandulosa*
- *Duffy's Forest Endangered Ecological Community*

Acacia bynoeana – A small shrub occurring mainly in heath or woodland from Lake Macquarie to Ku-ring-gai Chase NP and the Blue Mountains. Known from about 30 locations with most populations of 1-5 plants. Typically occurs west of Frenchs Forest *(Harden, 1992).*

Parts of the study area were considered to contain potential habitat for this species. Further targeted survey work was undertaken on 7 April 2010 to rule out the presence of this species.

Grevillea caleyi – A shrub of 1-3m tall which flowers from August – April. This species grows in woodland landscapes on laterised sandstone ridgetops in the Terrey Hills to Belrose area.
It was considered that the study area did not provide potential habitat for this species due to the lack of laterised soils, amount of weed presence and the subject site being just outside of

the known geographic distribution of the species. Additionally, the remnant vegetation is more commensurate with gully vegetation as opposed to ridgetops.

Persoonia hirsuta – A spreading to decumbent shrub growing in woodland and dry sclerophyll forest, usually on sandstone. It is known from Royal National Park to Gosford on the coast and Hill Top to Glen Davis and inland to Putty.

Parts of the western escarpment area provide marginal patchy habitat for this species. A further target search on 7 April 2010 was undertaken to rule out the presence of this species.

Pimelea curviflora* var*. curviflora – A small sub-shrub which is confined to coastal areas around Sydney on sandstone. It is often difficult to observe due to its small size and habit of often growing amongst grasses and sedges, but would have been relatively easy to observe in the sparse understorey of the study area.

The weed infested areas and higher moisture content areas would not provide habitat for this species. This reduces the potential for occurrence quite significantly and it was thought initially that only a small proportion of the western woodland / open forest area may contain potential for the species. A target search was undertaken for this species on 7 April 2010.

Syzygium paniculatum – A rainforest tree which occurs in littoral rainforest and in subtropical or gallery rainforest on sandy alluvium. Given the absence of rainforest vegetation on site, this species has no potential to occur. However, the species was targeted during the 2004 survey and again in the 2010 survey, with no specimens observed.

Tetratheca glandulosa – A low growing spreading shrub which is restricted to the area between Port Jackson and Gosford and inland to the foothills of the Blue Mountains. It grows in heath and woodland in sandy soil amongst sandstone outcrops.

Potential habitat may occur in western (high elevation) drier areas of the woodland / open forest within the study area that are not highly disturbed through weed invasion.

(b) Endangered flora populations (NSW)

There are no endangered flora populations in the Warringah LGA.

(c) Endangered ecological communities (NSW)

No EECs have been identified within the subject site or study area.

There has been no previous mapping to suggest the vegetation on site is commensurate with Duffys Forest EEC or any of the riparian / floodplain EECs. Species such as Casuarinas, Melaleucas and the lone Swamp Mahogany tree would often form a riparian / floodplain EEC, however, most of these trees have been planted.

4.2.3 Matters of national environmental significance - flora

(a) Threatened flora species (national)

A review of the schedules of the *EPBC Act* indicated the potential for a list of threatened flora species to occur within a 10km radius of the site. These species have been considered for habitat presence and potential to occur within Appendix 2.1.

Based on the habitat assessment within Appendix 2.1, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened flora species:

Table 4.2 – Nationally listed threatened flora species with suitable habitat present

Common Name	TSC Act	Potential to occur
Acacia bynoeana	V	✓
Eucalyptus camfieldii	V	low
Tetratheca glandulosa	V	✓
Persoonia hirsuta	E	✓
Pimelea curviflora var. *curviflora.*	V	✓

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

(b) Endangered ecological communities (national)

No nationally listed EECs were recorded within the study area.

4.2.4 Flora and EEC assessment conclusions

In accordance with Section 5A of the *EP&A Act*, the 7 part test of significance (Appendix 3) concluded that the proposed development will not have a significant impact on any state listed threatened species, populations or EECs. Therefore, a species impact statement should not be required for the proposed development in respect to flora.

The proposed development was not considered to have a significant impact on matters of NES listed under the *EPBC Act*. As such, a referral to DoE should not be required in respect to flora.

4.3 Fauna

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

4.3.1 Fauna habitat

The vegetation communities provide a variety of habitat resources. They include:

- *Peppermint-Angophora Woodland / Open Forest* – The open forest areas do not contain arable soil. This community is dominated by the November to December flowering *Eucalyptus piperita* (Sydney Peppermint) and *Angophora costata* (Smooth-barked Apple), and the January to April flowering *Corymbia gummifera* (Red Bloodwood). This provides foraging habitat for birds, bats and arboreal mammals. Hollow bearing trees / habitat trees (Figure 2), were observed within this community. Hollows present provide potential roosting and nesting habitat for birds, micro-chiropteran bats, arboreal mammals, some arboreal reptile species and a low potential for owls. This community has good structural dimension between over-storey and mid-storey foliage within the eastern portion that provides suitable roosting habitat for *Ninox* owl species. A sparse to moderate shrublayer provides suitable protective and foraging habitat for birds, arboreal mammals and terrestrial mammal species. A moderate groundcover of herbs and grasses, leaf litter, fallen timber and occasional hollow logs provide suitable habitat for small terrestrial mammals, reptiles and amphibians.

- *Exotic Grassland with Scattered Trees* – This community is dominated by a variety of flowering trees which provide foraging habitat for birds, bats and arboreal mammals.

Hollow bearing trees / habitat trees were observed scattered within this community in the study area but not within the subject site itself. Scattered areas of sparse shrub layers provides limited protective and foraging habitat for small birds, small arboreal mammals and terrestrial mammal species. A dense groundcover of herbs and grasses, as well as tree litter, provides open foraging habitat for large mammals and limited habitat for small terrestrial mammals, reptiles and amphibians. This community was observed to provide foraging habitat for a very high density of rabbits throughout.

- *Aquatic Herbfield / Farm dams* – Occurs along the tributary of Middle Creek and represented by three (3) farm dams within the study area; only one occurring within the subject site itself. This community is characterised by a moderate to dense herbfield to a height of 1-2m with occasional exotic shrubs and aggregations of leaf litter. This provides suitable foraging habitat for birds, protective and foraging habitat for small terrestrial mammals, reptiles and amphibians. Vegetated central areas and fringes of dams provide suitable breeding habitat for amphibian species. Open surface water provided by the central and southern dams provides drinking resources for microchiropteran bats and foraging habitat for waterfowl.

- *Kunzea–Tea-tree Tall Heath* – Does not occur within the subject site area, however, does occur to the immediate north west as the only patch within the study area. This community has a total area of approximately 0.36ha and provides dense foliage structure, which in turn provides protective habitat for small to large terrestrial mammals, small birds and, to a lesser extent, reptiles.

It appears that none of the identified habitat trees will be removed as part of the proposal.

4.3.2 State legislative fauna matters

(a) Threatened species (NSW)

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH, 2013) provided a list of threatened fauna species previously recorded within a 10km radius of the subject site. These species are listed in Table A2.2 (Appendix 2) and are considered for potential habitat within the subject site. Strictly estuarine and oceanic threatened species found within 10km have not been included as no marine / aquatic habitats occur within the subject site.

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

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

Common Name	TSC Act	Potential to occur
Glossy Black-Cockatoo	Vulnerable	recorded
Powerful Owl	Vulnerable	recorded
Grey-headed Flying-fox	Vulnerable	recorded
Eastern Bentwing-bat	Vulnerable	recorded
Rosenberg's Goanna	Vulnerable	Possible
Little Lorikeet	Vulnerable	Possible
Swift Parrot	Endangered	Possible
Barking Owl	Vulnerable	Possible
Varied Sittella	Vulnerable	Possible
Scarlet Robin	Vulnerable	Possible
Spotted-tailed Quoll	Vulnerable	Possible
Southern Brown Bandicoot	Endangered	Possible

Common Name	TSC Act	Potential to occur
Eastern Pygmy Possum	Vulnerable	Possible
East-coast Freetail Bat	Vulnerable	Possible
Little Bentwing-bat	Vulnerable	Possible
Greater Broad-nosed Bat	Vulnerable	Possible
Red-crowned Toadlet	Vulnerable	Possible
Little Eagle	Vulnerable	low
Gang-gang Cockatoo	Vulnerable	low
Masked Owl	Vulnerable	low
Yellow-bellied Sheathtail-bat	Vulnerable	low
Large-footed Myotis	Vulnerable	low
Regent Honeyeater	Critically Endangered	unlikely
Eastern Falsistrelle	Vulnerable	unlikely

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

Four (4) state listed threatened fauna species, Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Powerful Owl (*Ninox strenua*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and Eastern Bentwing-bat (*Miniopterus orianae oceansis*) were recorded within the subject site during surveys. These species have been assessed in detail within Appendix 3.

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

(b) Endangered populations (NSW)

There are no endangered fauna populations within the Warringah LGA.

(c) SEPP 44 Koala Habitat Protection

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

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

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

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

Step 1 – Is the land PKH?

Four (4) Koala food tree species Grey Gum (*Eucalyptus punctata*), Scribbly Gum (*Eucalyptus haemastoma*), Tallowwood (*Eucalyptus microcorys*) and Swamp Mahogany (*Eucalyptus robusta*) listed on Schedule 2 of SEPP 44 were recorded within the study area. *Eucalyptus microcorys and Eucalyptus robusta* were recorded within the Grassland with

Scattered Trees likely as planted specimens and not part of connective woodland forest habitats.

Grey Gum (*Eucalyptus punctata*), Scribbly Gum (*Eucalyptus haemastoma*) made up approximately 5% of trees within Vegetation Community 1 – *Peppermint – Angophora Woodland / Open Forest*. This is less than the 15% and, as such, the study area is not considered to comprise PKH as defined under SEPP 44 and no further assessment under this Policy is required.

4.3.3 National environmental significance - fauna

(a) Threatened species (national)

EPBC Act – A review of the schedules of the *EPBC Act* identified a list of threatened fauna species or species habitat likely to occur within a 10km radius of the subject site. These species have been listed in Table A2.2 (Appendix 2), and those with potential habitat within the subject site are considered in the 7 part test of significance within Appendix 3.

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

Table 4.4 – Nationally listed threatened fauna species with suitable habitat present

Common Name	EPBC Act	Potential to occur
Grey-headed Flying-fox	Vulnerable	recorded
Swift Parrot	Endangered	✓
Spotted-tailed Quoll	Endangered	✓
Southern Brown Bandicoot	Endangered	✓
New Holland Mouse	Vulnerable	low
Regent Honeyeater	Endangered	unlikely

One (1) nationally listed threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*), was recorded foraging within the subject site during surveys undertaken in 2004 and 2010.

Grey-headed Flying-fox

In consideration of the assessment criteria applied to vulnerable species, as outlined in Appendix 4, there is not likely to be any significant impact on the Grey-headed Flying-fox from the proposed development.

(b) Protected migratory species (National)

The *EPBC Act Protected Matters Report* provides additionally listed terrestrial, wetland and marine migratory species of national significance likely to occur, or with habitat for these species likely to occur, within a 10km radius of the subject site. These migratory species are considered in Table A2.3 (Appendix 2). Threatened migratory species are assessed in Table A2.2 (Appendix 2).

4.3.4 Fauna assessment conclusions

In accordance with Section 5A of the *EP&A Act*, the 7 part test of significance (Appendix 3) concluded that the proposed development will not have a significant impact on any state

listed threatened fauna species or threatened fauna populations. This is provided that the mitigation measures outlined with the recommendations of this report are undertaken. Therefore, a species impact statement should not be required for the proposed development in respect to fauna.

The proposed development was not considered to have a significant impact on threatened or migratory fauna species listed as matters of NES under the *EPBC Act*. As such a referral to DoE should not be required in respect to fauna.

4.4 Vegetation connectivity and wildlife corridors

The study area is bounded to the north and south by rural residential land, to the north west, north east and east by natural vegetation and to the south west by residential land (see Figure 2). Natural vegetation adjoining the study area to the north east includes recreation reserves which extend along Wakehurst Parkway and eventually into Garigal National Park.

Natural vegetation adjoining the north west boundary of the study area forms a vegetation corridor along Wakehurst Parkway to the west. This corridor extends along Wakehurst Parkway towards the south, across Frenchs Forest Road and Warringah Road into an extensive area of natural vegetation, including Manly Dam Reserve and Garigal National Park.

The study area contains two (2) existing vegetation corridors which pass through the subject site.

- The main riparian corridor – Middle Creek tributary runs north-south within the eastern confines of the study area and cuts the north eastern corner of the subject site. This Middle Creek tributary corridor is largely cleared on its western embankment which will be significantly enhanced by riparian revegetation works, inclusive of landscaped buffers. An existing natural forest area exists on the eastern side of the Middle Creek tributary. Oxford Falls Road along the edge of this remnant provides the only barrier between this corridor and extensive vegetation further north.

- Sandstone escarpment – This fragmented and weed infested corridor runs north-south along the western side of the study area and starts to head in an easterly direction within the subject site where it becomes severely dissected by a tennis court and road (approximately a 50-75m gap) from vegetation continuing on the south side of Barnes Road. This corridor currently previously contained a mixture of Kunzea Tall Heath, Peppermint and Angophora Woodland / Open Forest. It is noted the Kunzea is now not present.

- Miscellaneous corridor links - Minor canopy connectivity also occurs along existing road reserves and minor drainage lines through the site.

All corridors associated with the site have no direct linkages to extensive natural habitats and are all bound by roads, as well some small cleared patches and weedy areas along their nearby extent.

Reason for Wildlife Corridors

A corridor is used to ensure wildlife can move between vegetation parcels that contain suitable habitat characteristics for insitu wildlife. Corridors are also required for mating opportunities. For some wildlife, movement opportunity is quite small as they are territorial, whilst others are more opportunistic and migrate over larger areas. For some wildlife, the dispersal (home) range is quite small, whilst others migrate over larger areas. Where wildlife

numbers, particularly some populations, and diversity are in large quantities and require movement to and from large areas (ecosystems), then a suitable large corridor linkage should be provided. Likewise, if a small quantity of wildlife is known to be present then a smaller corridor may accommodate these species / populations adequately.

Proposed Corridors

The proposed development within the subject site will result in a further fragmented gap of the western corridor to the north of Barnes Road where a new building construction is proposed. This will include management along this corridor for APZ purposes (see Figure 1). To offset this loss, the proposal also proposes to completely restore east-west connectivity through the study area by providing a ~24m wide corridor along the northern site boundary, together with restoration of the western embankment of the Middle Creek tributary. The riparian restoration will also include restoring a 10m managed vegetation buffer to the riparian area. The APZs will be landscaped to include canopy vegetation, and planting of native landscape beds to retain a degree of north-south connectivity.

There will be some restoration works along the Middle Creek tributary in the north eastern corner of the site that will assist in strengthening this corridor.

Other measures, such as habitat enhancement with artificial nest boxes, will further enhance the insitu habitat for breeding on site for common and threatened fauna species.

4.5 Potential ecological impact

- Clearance/underscrubbing of surrounding minor corridors. Whilst these are narrow and partially fragmented they currently facilitate some degree of cross site movement for tolerant fauna species.
- Removal of weeds within the Peppermint / Angophora Open Forest over sandstone habitat and retention of native trees but located within an APZ.

4.6 Mitigation measures

- Construction of a cross site corridor to improve east west connectivity. The revegetation area is ~24m in width and has a length of approximately 130m (just over 0.3ha). This area is currently cleared of native vegetation and would require a revegetation strategy in place for its management.

- A core riparian buffer of 10m has been applied to the Middle Creek tributary that drains across the north eastern corner of the subject site (refer Figure 2). A managed 10m vegetated buffer will be applied on top of the core riparian buffer for additional protection.

Conclusions & Recommendations 5

5.1 Conclusions

The document forms the basis of assessment required under Section 5A of the *EPA Act*. This assessment determines if future development of the site is likely to have a significant effect on threatened species, populations and / or EECs.

EPA Act and TSC Act

In respect of matters required to be considered under the *EPA Act* and relating to the species / provisions of the *TSC Act*.

- Four (4) threatened fauna species, Powerful Owl (*Ninox strenua*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*) and Eastern Bentwing-bat (*Miniopterus orianae oceansis*) were recorded within, or in close proximity to, the study area
- No threatened flora species were recorded within the study area
- No EECs were recorded within, or in close proximity to, the study area
- No endangered populations are likely to utilise the study area

The 7 part test of significance (Appendix 3 of this report) has concluded that the proposed development will not have a significant impact on any threatened species, populations or EECs. Therefore, an SIS should not be required for the proposed development.

EPBC Act

In respect of matters required to be considered under the *EPBC Act:*

- One (1) threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*), was recorded within the study area
- No protected migratory fauna species listed under the *EPBC Act* were recorded within, or in close proximity to, the study area
- No threatened flora species were recorded within the study area
- No endangered populations or EECs listed under the *EPBC Act* were recorded within the study area

Consideration of these species within Section 4 of this report concluded that the proposed development was not considered to have a significant impact on matters of NES. As such, a referral to DoE should not be required.

FM Act

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

Conclusion

It is concluded that the proposed development of Lot 1113 DP 752038 Barnes Road, Oxford Falls is unlikely to result in a significant impact on any threatened species, populations or EECs or their habitats. As such, no further assessments are considered to be required under the *EPA Act, EPBC Act* or *FM Act.*

5.2 Recommendations

It is recommended that a vegetation management plan be prepared to identify the ongoing management of habitat resources, weeds, future landscaping and site works to retain mature trees and habitat movement corridors.

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Fauna Survey Methodologies

A1

Survey Effort Table Descriptors:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Active *Anabat* monitoring - is a method of active microbat recording during stag-watching or during complete nocturnal survey. Active monitoring involves an SD-1 recorder allied with a PDA for viewing call-sequences in real-time. When calls are heard the transducer microphone is actively directed towards the calling animal with the aid of a spotlight, so

longer and clearer call sequences may be recorded. When calls of a potential threatened species are observed on the PDA screen a view by spotlight of the bat size and wing morphology is attempted for greater identification accuracy.

Active vehicle *Anabat* monitoring - is a method of active microbat recording deployed when large distances need to be covered in a nocturnal survey period. A Hi-mic extension cable allows the transducer microphone to be placed on a bracket on the roof of a travelling vehicle so calls may be viewed whilst driving. The vehicle travels at no more than 40km/h to prevent wind interference. When calls of a potential threatened species are observed on the dash mounted PDA screen active spotlighting is undertaken.

Harp trapping - is used to capture microchiropteran bats. Harp traps have an aluminium frame with a two-bank 4.2m^2 area and calico capture bag set along the base area.

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

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

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

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

- Air temperature
- Cloud cover
- Rain (e.g. none, light drizzle, heavy drizzle, heavy rain)
- Recent rain events (where relevant)
- Wind strength e.g. calm, light (leaves rustle), moderate (moves branches), strong (moves tree crowns)
- Wind direction
- Moon (where relevant) (e.g. none, 1/4 moon, 1/2 moon, 3/4 moon, full moon)

Threatened & Migratory Species Habitat Assessment

A2

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

Table A2.1 – Threatened flora habitat assessment

Scientific name DATABASE SOURCE	**TSC Act**	**EPBC Act**	**Growth form and habitat requirements**	**Recorded on site (✓)**	**IF NOT RECORDED ON-SITE**				**Considered in 7 part test (✓)**
					Suitable Habitat Present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Acacia bynoeana OEH EPBC	E1	V	Erect or spreading shrub to 0.3m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides. Distribution limits N-Newcastle S-Berrima.	×	✓	✓	×	✓	✓
Acacia terminalis subsp. *terminalis* OEH EPBC	E1	E	Erect shrub to 2m tall, flowers from March to July. Occurs in eucalypt woodland or forest, usually in sandy soil on creek banks, hillslopes or in shallow soil in rock crevices and sandstone platforms on cliffs. Typically restricted to the Port Jackson and eastern suburbs of Sydney.	×	×	-	-	×	×

Scientific name DATABASE SOURCE	**TSC Act**	**EPBC Act**	**Growth form and habitat requirements**	**Recorded on site (✓)**	**IF NOT RECORDED ON-SITE**				**Considered in 7 part test (✓)**
					Suitable Habitat Present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Allocasuarina glareicola OEH 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.	×	×	-	-	×	×
Allocasuarina portuensis OEH	E1	E	A shrub of 3-5m tall, similar to other *Casuarinaceae* species. Grows in tall shrubland on sandstone headland at Nielsen Park, Vaucluse.	×	×	-	-	×	×
Apatophyllum constablei EPBC	-	E	A small shrub up to 40cm tall that grows in dry sclerophyll forest on slopes with a north to north-westerly aspect usually near cliffs. It flowers from August to December. Most populations are restricted to Wollemi National Park near the town of Glen Davis. The species has been removed from the TSA Act since 2007.	×	×	-	-	×	×
Asterolasia elegans OEH EPBC	E	E	Erect shrub 1-3m high growing in moist sclerophyll forests on Hawkesbury sandstone slopes hillsides. Distribution limits Maroota region.	×	×	-	-	×	×
Caladenia tessellata OEH EPBC	E1	V	Terrestrial orchid. Clay-loam or sandy soils. Distribution limits N-Swansea S-south of Eden.	×	×	-	-	×	×
Callistemon linearifolius OEH	V	-	Shrub to 4m high. Dry sclerophyll forest on coast and adjacent ranges. Distribution limits N-Nelson Bay S-Georges River.	×	×	-	-	×	×

Scientific name DATABASE SOURCE	**TSC Act**	**EPBC Act**	**Growth form and habitat requirements**	**Recorded on site (✓)**	**IF NOT RECORDED ON-SITE**				**Considered in 7 part test (✓)**
					Suitable Habitat Present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Chamaesyce psammogeton OEH	E1	-	Prostrate herb. Coastal dunes. Distribution limits N-Tweed Heads S-Jervis Bay	×	×	-	-	×	×
Cryptostylis hunteriana OEH EPBC	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S-south of Eden.	×	×	-	-	×	×
Darwinia biflora OEH EPBC	V	V	Erect or spreading shrub to 0.8m high. Grows in heath or understorey of woodland on or near shale-capped ridges underlain by Hawkesbury sandstone. Distribution limits N-Gosford S-Cheltenham.	×	marginal	×	×	unlikely	✓
Deyeuxia appressa OEH EPBC	E1	E	Erect grass to 0.9m high. Grows on wet ground. Distribution limits N-Hornsby S-Bankstown.	×	×	-	-	×	×
Diuris bracteata OEH	E1	Extinct	An orchid that grows in dry sclerophyll woodland. Was thought to be extinct until approximately 10yrs ago. Found in the Sydney Basin Bioregion. Flowers in September.	×	×	-	-	×	×
Epacris purpurascens var. *purpurascens* 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.	×	✓	×	×	✓	✓

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	IF NOT RECORDED ON-SITE				Considered in 7 part test (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Eucalyptus camfieldii OEH EPBC	V	V	Stringybark to 10m high. Grows on coastal shrub heath and woodlands on sandy soils derived from alluviums and Hawkesbury sandstone. Distribution limits N-Norah Head S-Royal NP.	×	✓	×	✓	low	✓
Eucalyptus nicholii OEH	V	-	This species is widely planted as an urban street tree and in gardens but is quite rare in the wild. It is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property.	×	×	-	-	×	×
Eucalyptus scoparia OEH	E1	V	Smooth-barked tree only known from vicinity of Bald Rock.	×	×	-	-	×	×
Genoplesium baueri OEH	E1	-	A terrestrial orchid that grows in sparse sclerophyll forest and moss gardens over sandstone. Distribution limits N – Hunter Valley S – Nowra	×	×	-	-	×	×
Grammitis stenophylla OEH	E1	-	A small lithophytic fern with fronds generally <5cm. Occurs in rainforest and wet sclerophyll forest in the coastal divisions of NSW.	×	×	-	-	×	×
Grevillea caleyi OEH EPBC	E1	E	Shrub mostly 1-3m high. Grows in laterite. Distribution limits Terrey Hills-Belrose area.	×	×	-	-	×	×
Grevillea shiressii OEH EPBC	V	V	Shrub 2-5m high. Flowers mainly spring. Grows along creek banks in wet sclerophyll forest. Sandy soil on Hawkesbury sandstone. Restricted to the Gosford area.	×	×	-	-	×	×

Scientific name DATABASE SOURCE	**TSC Act**	**EPBC Act**	**Growth form and habitat requirements**	**Recorded on site (✓)**	**IF NOT RECORDED ON-SITE**				**Considered in 7 part test (✓)**
					Suitable Habitat Present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Haloragodendron lucasii OEH EPBC	E1	E	Straggling shrub to 1.5m high. Grows in open forest on sheltered slopes near creeks. Distribution limits Ku-ring-gai Plateau & Mt Wilson.	×	×	-	-	×	×
Hibbertia puberula OEH	E1	-	Shrublets with branches up to 30cm long. Has not been seen for 40 years, however, early records are from Hawkesbury River area in Sydney and the Blue Mountains.	×	×	-	-	×	×
Hibbertia superans OEH	E1	-	Small spreading shrub to 0.3m high. Grows on sandstone, usually in or near SSTF. Distribution limits N-Glenorie S-Kellyville disjunct Mt Boss.	×	×	-	-	×	×
Kunzea rupestris OEH EPBC	V	V	Shrub to 1.5m high. Grows in cracks and fissures on Hawkesbury sandstone rock platforms. Distribution limits N-Maroota S-Glenorie.	×	×	-	-	×	×
Lasiopetalum joyceae OEH	V	V	Erect shrub to 2m high. Grows in heath and open forest on Hawkesbury sandstone. Distribution limits Hornsby Plateau.	×	marginal	×	×	unlikely	×
Leptospermum deanei OEH EPBC	V	V	Shrub to 5m high. Grows on forested slopes. Distribution limits Near watershed of Lane Cove River.	×	×	-	-	×	×
Melaleuca biconvexa OEH EPBC	V	V	Tall shrub. Grows in wetlands adjoining perennial streams and on the banks of those streams, generally within the geological series known as the Terrigal Formation. Distribution limits N-Port Macquarie S-Jervis Bay.	×	×	-	-	×	×

Scientific name DATABASE SOURCE	**TSC Act**	**EPBC Act**	**Growth form and habitat requirements**	**Recorded on site (✓)**	**IF NOT RECORDED ON-SITE**				**Considered in 7 part test (✓)**
					Suitable Habitat Present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Melaleuca deanei OEH EPBC	V	V	Shrub to 3m high. Grows in heath on sandstone. Distribution limits N-Gosford S-Nowra.	×	marginal	-	-	-	-
Microtis angusii OEH EPBC	E1	E	Terrestrial orchid which is known from two populations, Mona Vale and Sunny Corner.	×	×	-	-	×	×
Pelargonium sp. *Striatellum* EPBC	E1	E	Herb to 90cm tall which grows in damp places especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. Varied distribution from SE NSW to QLD.	×	×	-	-	×	×
Persoonia hirsuta 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.	×	✓	✓	✓	✓	✓
Persoonia laxa OEH	E4	Ext.	Decumbent or prostrate shrub. Not been seen since 1908. Once recorded in Newport and Manly.	×	×	-	-	×	×
Persoonia mollis subsp. *maxima* OEH EPBC	E1	E	Erect to prostrate shrub. Grows in moist to wet sclerophyll forests on Hawkesbury sandstone. Distribution limits N-Cowan S-Hornsby.	×	×	-	-	×	×
Pimelea curviflora var. *curviflora* OEH EPBC	V	V	Woody herb or sub-shrub to 0.2-1.2m high. Grows on Hawkesbury sandstone near shale outcrops. Distribution Sydney.	×	✓	✓	✓	✓	✓

Scientific name DATABASE SOURCE	**TSC Act**	**EPBC Act**	**Growth form and habitat requirements**	**Recorded on site (✓)**	**IF NOT RECORDED ON-SITE**				**Considered in 7 part test (✓)**
					Suitable Habitat Present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Pimelea spicata 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.	×	×	-	-	×	×
Prostanthera junonis OEH	E1	E	Small shrub. Grows in sclerophyll forest and heath in shallow soil on sandstone. Distribution limits Somersby region.	×	×	-	-	×	×
Prostanthera marifolia OEH EPBC	E4a	Critic . E	Erect shrub to 0.3m high. Woodland dominated by Eucalyptus sieberi and Corymbia gummifera. In deeply weathered clay soil with ironstone nodules. Has been recorded previously in the Sydney Harbour region.	×	×	-	-	×	×
Sarcochilus hartmannii OEH	V	V	An orchid which grows on volcanic rocks, often in shallow soil in sclerophyll forest or exposed sites usually at an elevation above 500m. Distribution – north from the Richmond River in the far north of NSW.	×	×	-	-	×	×
Senecio spathulatus OEH	E	-	A low growing daisy that prefers primary dunes. Known to occur at Cape Howe and between Kurnell north to Myall Lakes National Park. Also occurs in coastal locations in eastern Victoria.	×	×	-	-	×	×
Streblus pendulinus EPBC	-	E	Tree or large shrub to 6m tall. Coastal species along watercourses in warmer rainforest area.	×	×	-	-	×	×

Scientific name DATABASE SOURCE	TSC Act	EPBC Act	Growth form and habitat requirements	Recorded on site (✓)	IF NOT RECORDED ON-SITE				Considered in 7 part test (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Syzygium paniculatum OEH	V	V	Small tree. Subtropical and littoral rainforest on sandy soil. Distribution limits N-Forster S-Jervis Bay.	×	×	-	-	×	×
Tetratheca glandulosa OEH EPBC	V	V	Spreading shrub to 0.2m high. Sandy or rocky heath or scrub. Distribution limits N-Mangrove Mountain S-Port Jackson.	×	✓	✓	✓	✓	✓
Thesium australe OEH EPBC	V	V	Erect herb to 0.4m high. Root parasite. Grassland or woodland often damp. Distribution limits N-Tweed Heads S-south of Eden.	×	×	-	-	×	×

OEH	- Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife*
EPBC	- Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
V	- Denotes vulnerable listed species under the relevant Act
E or E1	- Denotes endangered listed species under the relevant Act
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the *Atlas of NSW Wildlife* 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle.

A detailed assessment in accordance with Section 5A of the *EPA Act* will be completed for these species in Appendix 3 of this report.

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

Table A2.2 – Threatened fauna habitat assessment

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 (✓)**
					Suitable Habitat Present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Giant Burrowing Frog *Heleioporus australiacus* OEH EPBC	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. *Distribution Limit: N-Near Singleton S-South of Eden.*	×	marginal	×	×	not likely	×
Stuttering Frog *Mixophyes balbus* EPBC	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. *Distribution Limit: N-near Tenterfield S-South of Bombala*.	×	×	-	-	×	×
Giant Barred Frog *Mixophyes iteratus* OEH EPBC	E	E	Terrestrial inhabitant of rainforest and open forests. *Distribution Limit: N-Border Ranges National Park. S-Narooma.*	×	×	-	-	×	×
Red-crowned Toadlet *Pseudophryne australis* 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. *Distribution Limit: N-Pokolbin. S-near Wollongong.*	×	✓	×	✓	✓	✓

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 (✓)
					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	
Green and Golden Bell Frog *Litoria aurea* OEH EPBC	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. *Distribution Limit: N-Byron Bay S-South of Eden.*	×	marginal	×	×	not likely	×
Littlejohn's Tree Frog *Litoria littlejohnii* EPBC	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. *Distribution Limit: N-Hunter River S-Eden.*	×	marginal	×	×	not likely	×
Rosenberg's Goanna *Varanus rosenbergi* OEH	V	-	Hawkesbury sandstone outcrop specialist. Inhabits woodlands, dry open forests and heathland sheltering in burrows, hollow logs, rock crevices and outcrops. *Distribution Limit: N-Nr Broke. S-Nowra Located in scattered patches near Sydney, Nowra and Goulburn.*	×	✓	✓	✓	✓	✓
Broad-headed Snake *Hoplocephalus bungaroides* OEH EPBC	E	V	Sandstone outcrops, exfoliated rock slabs and tree hollows in coastal and near coastal areas. *Distribution Limit: N-Mudgee Park. S-Nowra.*	×	×	-	-	×	×

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 (✓)
					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	
Cotton Pygmy-goose *Nettapus coromandelianus* OEH	E	-	An aquatic species found in tropical to subtropical coastal lagoons, swamps and large bodies of calm fresh water with abundant vegetation. *Distribution Limit: N-Tweed Heads. S-Pambula.*	×	×	-	-	×	×
Wompoo Fruit-dove *Ptilinopus magnificus* OEH	V	-	Inhabits large undisturbed patches of lowland and adjacent highland rainforest and moist eucalypt forests where it feeds on fruit. *Distribution Limit: N-Tweed Heads. S-Sydney*.	×	×	-	-	×	×
Superb Fruit-dove *Ptilinopus superbus* OEH	V	-	Rainforests, adjacent mangroves, eucalypt forests, scrubland with native fruits. *Distribution Limit: N-Border Ranges National Park. S-Bateman's Bay.*	×	×	-	-	×	×
Australasian Bittern *Botaurus poiciloptilus* 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. *Distribution Limit: N-North of Lismore. S- Eden.*	×	×	-	-	×	×

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 (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Black Bittern *Ixobrychus flavicollis* OEH	V	-	Found in shadowy, leafy waterside trees such as callistemons, casuarinas, paperbarks, eucalypts, mangroves and willows along tidal creeks, freshwater & brackish streams & ponds, sheltered mudflats and oyster slats. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Little Eagle *Hieraaetus morphnoides* OEH	V	-	Utilises plains, foothills, open forests, woodlands and scrublands; river red gums on watercourses and lakes. *Distribution Limit - N-Tweed Heads. S-South of Eden.*	×	✓	×	×	low	✓
Osprey *Pandion haliaetus* OEH	V	-	Utilises waterbodies including coastal waters, inlets, lakes, estuaries and offshore islands with a dead tree for perching and feeding. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Red Goshawk *Erythrotriorchis radiatus* EPBC	E	V	Inhabits tall open forests and woodlands. Breeds in tall trees adjacent to watercourses of wetlands. *Distribution Limit: N-Border Ranges National Park. S-Foster.*	×	×	-	-	×	×
Bush Stone-curlew *Burhinus grallarius* OEH	E	-	Utilises open forests and savannah woodlands, sometimes dune scrub, savannah and mangrove fringes. *Distribution Limit: N-Border Ranges National Park. S-Near Nowra.*	×	×	-	-	×	×

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 (✓)
					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	
Australian Painted Snipe *Rostratula australis* OEH EPBC	E	V	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Gang-gang Cockatoo *Callocephalon fimbriatum* OEH	V	-	Prefers wetter forests and woodlands from sea level to > 2000m on Divide, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. *Distribution Limit: mid north coast of NSW to western Victoria.*	×	✓	×	×	low	✓
Glossy Black-Cockatoo *Calyptorhynchus lathami* OEH	V	-	Open forests with *Allocasuarina* species and hollows for nesting. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	✓	-	-	-	-	✓
Little Lorikeet *Glossopsitta pusilla* OEH	V	-	Inhabits forests, woodlands; large trees in open country; timbered watercourses, shelterbeds, and street trees. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	✓	✓	✓	✓	✓
Swift Parrot *Lathamus discolour* OEH EPBC	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	×	✓	✓	✓	✓	✓

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 (✓)
					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	
Superb Parrot *Polytelis swainsonii* EPBC	V	V	Inhabits open woodland and riverine forests of inland NSW. *Distribution Limit: N-Near Walgett. S-South of Deniliquin.*	×	×	-	-	×	×
Orange-bellied Parrot *Neophema chrysogaster* OEH EPBC	E	E	Favours small islands, peninsulas in coastal areas; with saltmarsh plants; coastal pastures, golf courses; crops of millet and sunflowers; dunes, beaches. *Distribution Limit: N-Southern Sydney coast. S-South of Eden.*	×	×	-	-	×	×
Barking Owl *Ninox connivens* OEH	V	-	Inhabits principally woodlands but also open forests and partially cleared land and utilises hollows for nesting. *Distribution Limits: N-Border Ranges National Park. S-Eden.*	×	✓	✓	✓	✓	✓
Powerful Owl *Ninox strenua* OEH	V	-	Forests containing mature trees for shelter or breeding & densely vegetated gullies for roosting. *Distribution Limits: N-Border Ranges National Park. S-Eden.*	✓	-	-	-	-	✓
Masked Owl *Tyto novaehollandiae* OEH	V	-	Open forest & woodlands with cleared areas for hunting and hollow trees or dense vegetation for roosting. *Distribution Limit: N-Border Ranges National Park. S-Eden.*	×	✓	×	×	low	✓

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 (✓)**
					Suitable Habitat Present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Eastern Bristlebird *Dasyornis brachypterus* OEH EPBC	E	E	Coastal woodlands, dense scrubs and heathlands, especially where low heathland borders taller woodland or dense tall tea-tree. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	✓	×	×	Not likely	×
White-fronted Chat *Epithianura albifrons* OEH	V	-	Found in open damp ground, grass clumps, fencelines, heath, samphire saltmarshes, mangroves, dunes, saltbush plains. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	✓	×	×	unlikely	×
Regent Honeyeater *Xanthomyza Phrygia* OEH EPBC	E4A	E	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. *Distribution Limit: N-Urbanville. S-Eden.*	×	✓	×	×	unlikely	✓
Varied Sittella *Daphoenositta chrysoptera* OEH	V	-	Open eucalypt woodlands/forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golf courses, shelterbelts, orchards, parks, scrubby gardens. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	×	✓	✓	✓	✓	✓
Scarlet Robin *Petroica boodang* OEH	V	-	Found in foothill forests, woodlands, watercourses; in autumn-winter, more open habitats: river red gum woodlands, golf courses, parks, orchards, gardens. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	✓	✓	✓	✓	✓

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 (✓)
					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	
Diamond Firetail *Stagonopleura guttata* 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. *Distribution Limit: N-Rockhampton Q. S-Eyre Pen Kangaroo Is. SA.*	×	✓	×	×	unlikely	×
Spotted-tailed Quoll *Dasyurus maculatus* OEH EPBC	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. *Distribution Limit: N-Mt Warning National Park. S-South of Eden.*	×	✓	✓	✓	✓	✓
Southern Brown Bandicoot *Isoodon obesulus* OEH EPBC	E	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. *Distribution Limit: N-Kempsey. S-South of Eden.*	×	✓	✓	✓	✓	✓
Koala *Phascolarctos cinereus* OEH EPBC	V	V	Inhabits both wet & dry eucalypt forest on high nutrient soils containing preferred feed trees. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×

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 (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Eastern Pygmy Possum *Cercatetus nanus* 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. *Distribution Limit: N-Tweed Heads. S-Eden.*	×	✓	✓	✓	✓	✓
Yellow-bellied Glider *Petaurus australis* OEH	V	-	Tall mature eucalypt forests with high nectar producing species and hollow bearing trees. *Distribution Limit- N-Border Ranges National Park. S-South of Eden*.	×	✓	×	×	unlikely	×
Long-nosed Potoroo *Potorous tridactylus* EPBC	V	V	Coastal heath and dry and wet sclerophyll forests with a dense understorey. *Distribution Limit: N-Mt Warning National Park. S-South of Eden.*	×	✓	×	×	unlikely	×
Brush-tailed Rock-wallaby *Petrogale penicillata* EPBC	E	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. *Distribution Limit: N-North of Tenterfield. S-Bombala.*	×	×	-	-	×	×

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 (✓)
					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	
Grey-headed Flying-fox *Pteropus poliocephalus* 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. *Distribution Limit: N-Tweed Heads. S-Eden.*	✓	-	-	-	-	✓
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris* OEH	V	-	Rainforests, sclerophyll forests and woodlands. *Distribution Limit: N-North of Walgett. S-Sydney.*	×	✓	×	×	low	✓
East-coast Freetail Bat *Micronomus norfolkensis* 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. *Distribution Limit: N-Woodenbong. S-Pambula.*	×	✓	✓	✓	✓	✓
Large-eared Pied Bat *Chalinolobus dwyeri* 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. *Distribution Limit: N-Border Ranges Nation Park. S-Wollongong.*	×	✓	×	×	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 (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Eastern Falsistrelle *Falsistrellus tasmaniensis* OEH	V	-	Recorded roosting in caves, old buildings and tree hollows. *Distribution Limit: N-Border Ranges National Park. S-Pambula.*	×	✓	×	×	unlikely	✓
Little Bentwing-bat *Miniopterus australis* OEH	V	-	Roosts in caves, old buildings and structures in the higher rainfall forests along the south coast of Australia. *Distribution Limit: N-Border Ranges National Park. S-Sydney.*	×	✓	✓	✓	✓	✓
Eastern Bentwing-bat *Miniopterus orianae oceansis* OEH	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well-timbered areas. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	✓	-	-	-	-	✓
Large-footed Myotis *Myotis macropus* OEH	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. *Distribution limits: N-Border Ranges National Park. S-South of Eden.*	×	✓	✓	×	low	✓
Greater Broad-nosed Bat *Scoteanax rueppellii* OEH	V	-	Inhabits areas containing moist river & creek systems especially tree lined creeks. *Distribution Limit: N-Border Ranges National Park. S-Pambula.*	×	✓	✓	✓	✓	✓

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 (✓)
					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	
New Holland Mouse *Pseudomys novaehollandiae* EPBC	-	V	Occurs in heathlands, woodlands, openforest and paperbark swamps and on sandy, loamy or rocky soils. Coastal populations have a marked preference for sandy substrates, a heathy understorey of leguminous shrubs less than 1m high and sparse ground litter. Recolonise of regenerating burnt areas. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	×	✓	×	×	low	✓
Macquarie Perch *Macquaria australasica* 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.*	×	×	-	-	×	×
Australian Greyling *Prototroctes maraena* 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 1000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (e.g. weirs, waterfalls).	×	×	-	-	×	×
OEH	-	Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife* database							

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 (✓)
					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	

EPBC	-	Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
V	-	Denotes vulnerable listed species under the relevant Act
E	-	Denotes endangered listed species under the relevant Act
NOTE:	1.	This field is not considered if no suitable habitat is present within the subject site
	2.	'records' refer to those provided by the *Atlas of NSW Wildlife*
	3.	'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle.

A detailed assessment in accordance with Section 5A of the *EP&A Act* will be completed for these species in Appendix 3 of this report.

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

Table A2.3 – Migratory fauna habitat assessment

Common name ***Scientific name***	**Preferred habitat** ***Migratory breeding***	**Suitable habitat present (✓)**	**Recorded on site (✓)**	**Comments**
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs. *Sedentary; dispersive.*	×	-	-
White-throated Needletail (*Hirundapus caudacutus*)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies forage often along favoured hilltops and timbered ranges. *Breeds Siberia, Himalayas, east to Japan. Summer migrant to eastern Australia.*	✓	×	-
Rainbow Bee-eater (*Merops ornatus*)	Open woodlands with sandy, loamy soil; sandridges, sandspits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses. *Breeding resident in northern Australia. Summer breeding migrant to south east & south west Australia.*	×	-	-
Black-faced Monarch (*Monarcha melanopsis*)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. *Summer breeding migrant to coastal south east Australia, otherwise uncommon.*	Sub-optimal	×	-
Satin Flycatcher (*Myiagra cyanoleuca*)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. *Breeds mostly south-east Australia & Tasmania over warmer months, winters in north east Qld.*	Sub-optimal	×	-
Rufous Fantail (*Rhipidura rufifrons*)	Undergrowth of rainforests / wetter eucalypt forests/gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. *Breeding migrant to south east Australia over warmer months. Altitudinal migrant in north east NSW in mountain forests during warmer months.*	✓	×	-
Great Egret (*Ardea alba*)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. *Dispersive; cosmopolitan.*	✓	×	-
Cattle Egret (*Ardea ibis*)	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains. *Breeds in summer in warmer parts of range including NSW.*	✓	×	-

Common name ***Scientific name***	Preferred habitat ***Migratory breeding***	Suitable habitat present (✓)	Recorded on site (✓)	Comments
Latham's Snipe (*Gallinago hardwickii*)	Soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks; seepage below dams; irrigated areas; scrub or open woodland from sea-level to alpine bogs over 2000m; samphire on saltmarshes; mangrove fringes. *Breeds Japan. Regular summer migrant to Australia. Some overwinter.*	Sub-optimal	×	-
Fork-tailed Swift (*Apus pacificus*)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. *Breeds Siberia, Himalayas, east to Japan south-east Asia. Summer migrant to east Australia. Mass movements associated with late summer low pressure systems into east Australia. Otherwise uncommon.*	✓	×	-

7 Part Test of Significance

A3

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

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

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

Detailed flora and fauna investigations of the subject site, together with habitat assessments, have resulted in the identification of potential habitat for a variety of threatened species. An assessment of these species is as follows:

Threatened flora

- *Acacia bynoeana*
- *Epacris purpurascens* var. *purpurascens*
- *Eucalyptus camfieldii*
- *Persoonia hirsuta*
- *Pimelea curviflora* var. *curviflora*
- *Tetratheca glandulosa*

Endangered ecological communities

- nil

Threatened fauna

- Red-crowned Toadlet ^
- Rosenberg's Goanna ^
- Barking Owl ^
- Little Eagle
- Powerful Owl *
- Masked Owl
- Little Lorikeet
- Glossy Black-Cockatoo *
- Gang-gang Cockatoo
- Scarlet Robin
- Varied Sittella
- Swift Parrot
- Regent Honeyeater
- Spotted-tailed Quoll ^
- Southern Brown Bandicoot ^
- Eastern Pygmy Possum
- Grey-headed Flying-fox *
- Yellow-bellied Sheathtail-bat
- East-coast Freetail Bat
- Little Bentwing-bat
- Large-footed Myotis
- Greater Broad-nosed Bat
- Eastern Bentwing-bat *
- Eastern Falsistrelle

Note:

* indicates species recorded within or in close proximity to the subject site during surveys.
^ indicates remaining species considered with potential to occur based on local records or requested by DGRs (DoP 2006) or DECC (2009) for detailed survey and assessment as part of more recent study area proposals.

Endangered populations

- None for fauna
- None for fauna

Despite the presence of potential habitat or the recording of presence during surveys, 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. The proposal will have limited impacts upon the remnant vegetation within the study area. The remnant vegetation has existed insitu with rural residential, horses and recreational pursuits for many decades, and there is currently no management of vegetation or drainage.

Summary of threatened fauna species recorded

Powerful Owl *(Ninox strenua)*

Behavioural background - The Powerful Owl inhabits mature rainforest and wet and dry eucalypt forest. Optimal habitat includes a tall shrub layer and abundant hollows supporting high densities of arboreal mammals. Roosting is generally within dense foliage of mid-canopy trees in sheltered gullies. Large trees with hollows at least 45cm in diameter and 100cm deep are required for nesting. Mated pairs of Powerful Owl roost together or separately, maintaining several roost sites throughout their territory, which are used in rotation *(Lindsey 1992),* shifting with the availability of prey. A pair is generally faithful to a traditional nesting hollow. Powerful Owls form pairs for life, and are strongly territorial. Estimates of the home range of this species vary greatly, but territories are thought to range from 800 to 1500ha *(Kavanagh 1997).*

Recordings - A Powerful Owl was recorded responding to call-playback on 7 April 2010. An individual was spotlighted approximately half an hour after the Powerful Owl call was broadcast on this occasion. The individual was perched in a tree less than 15m from the call-playback station. When observed by spotlight, this individual flew east and perched within the neighbouring lands on the other side of Oxford Falls Road. It then flew in approximately the same distance south where it perched and called for an extended period (see Figure 2 for locations and flight direction). It was heard at times from around this same location whilst undertaking spotlighting activities within the study area.

Owl whitewash was also observed during survey at three locations within the Peppermint-Angophora Woodland / Open Forest. One location was observed within the eastern portions next to Oxford Falls Road. Two other locations were observed in the narrow vegetated strip adjacent to the large dam in the southern portions of the subject site (see Figure 1 for approximate locations).

The whitewash observed was considered consistent with *Ninox* owl species as two were located below dense foliage perches. Owl whitewash, as described by owl expert John Young, is typically scattered droppings of thicker and whiter lime content located below suitable roosting perches depending on the species. The whitewash is considered most likely to belong to Powerful Owl.

Site Specific Habitat - It is considered that the subject site provides suitable roosting and foraging and habitat for the Powerful Owl. There are no suitable nesting hollows within the subject site. Suitable nesting hollows located within the study area were targeted during the 2010 breeding season with no use of these hollows recorded.

Roosting habitat is best represented within areas of Peppermint-Angophora Woodland / Open Forest community particularly the larger eastern portions located along Oxford Falls Road. Suitable roosting habitat is typified by dense areas of mid-storey foliage where individuals may perch out of open view during diurnal periods.

Foraging habitat is evident within the subject site by an obvious large presence of prey species and their habitat, particularly the favoured Common Ringtail Possum (*Pseudocheirus peregrinus*) and Grey-headed Flying-fox (*Pteropus poliocephalus*).

The removal of habitat for APZ will impact on suitable roosting and prey species habitat. This is particularly given that two roosting locations were recorded within this area. Both roosting and prey species habitat will be reduced or eliminated within the APZ area. The provision to revegetate a cross site corridor will not provide any short or medium term replacement habitat.

Due to the species tendency to have numerous roosting sites within seasonal foraging home ranges, the removal of such roosts within the narrow southern strip is not considered to be significant. As no nesting locations will be impacted or are nearby and prey species habitat is otherwise well represented in the locality it is unlikely that the proposal will result in a significant impact on a local population of this species. Furthermore, higher quality roosting habitat is represented elsewhere in the local surrounds; the recorded roosting locations may also have been the result of response to call-playback.

The *Recovery Plan for the Large Forest Owls* (DEC 2006) states that forest clearing and fragmentation is recognised as the greatest ongoing threat to the three (3) large forest owls in NSW. The recovery plan also states that the Powerful Owl, in particular, displays considerable resilience to low level habitat disturbance through its continuing and successful occupancy of bushland among the outer suburbs of major Australian cities.

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

Behavioural background - The Grey-headed Flying-fox 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 et. al., 2008*). Camps can be found in riparian rainforest patches, Melaleuca stands, mangroves, riparian woodland or modified vegetation in urban areas.

Grey-headed Flying-foxes are canopy-feeding frugivores and nectarivores, inhabiting a wide range of habitats including rainforests, open forests, woodlands, Melaleuca swamps, Banksia woodlands and cultivated areas during night foraging forays. Foraging is generally within 20km of camps.

Site Specific - The subject site provides suitable foraging habitat for the Grey-headed Flying-fox.

On the night of 12 January 2004 at 20:35, four (4) Grey-headed Flying-foxes were spotlighted foraging within trees in Vegetation Community 2 - Exotic Grassland with Scattered Trees located next to the existing house within the subject site. One (1) individual of this species was again recorded foraging within this community during surveys undertaken on 29 March 2010. This individual was foraging on a bottlebrush tree located

within the landscaped gardens surrounding the house near to the previous observations (see Figure 2 for locations). On this same night two (2) other individuals were observed in flight over the subject site generally heading in a north easterly direction.

It is considered that flowering trees throughout the Peppermint-Angophora Woodland / Open Forest and Grassland with Scattered Trees vegetation communities provide suitable foraging habitat for this species. Given the extent of suitable foraging habitat within the proposed conservation areas and throughout the local area, it is considered that the removal of suitable foraging trees within the development area will not significantly impact on this species. Future landscaping and restoration of habitat within the subject site will sufficiently supplement the short-term loss of habitat.

It is recommended that bottlebrush trees surrounding the existing house within the subject site are retained where possible or otherwise replaced as part of future landscaping.

Eastern Bentwing-bat (*Miniopterus orianae oceanensis*)

Behavioural background - 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*). Caves are an important resource for this species, particularly for breeding, where maternity caves must have suitable temperature, humidity and physical dimensions to permit breeding (*Dwyer 1995*). Roost sites in tree hollows have not been reported within the literature reviewed.

Site Specific - The subject site provides suitable foraging habitat for the Eastern Bentwing-bat. Roosting habitat is not likely but should not be ruled out based on the presence of old buildings. No suitable caves, bridges or culverts were observed during survey. The subject site does not offer any breeding habitat.

The Eastern Bentwing-bat was recorded during each of the three 2010 nocturnal surveys undertaken on 23 March and 6 and 7 April. Recordings were made from all four (4) *Anabat* station locations (see Figure 2 for locations). This suggests that the study area is utilised for foraging throughout, however it should be noted that all *Anabat* stations were placed on the fringes of forest, tall landscaped vegetation or next to waterbodies where foraging is more likely concentrated by this particular species.

As no breeding or roosting habitats will be impacted by the proposal, and foraging habitat will remain consistent in the locality, there will be no likely significant impact on the local population of this species.

Glossy Black-Cockatoo (*Calyptorhynchus lathami*)

Behavioural background - The Glossy Black-Cockatoo inhabits mountain forests, coastal woodland, open forest and trees bordering watercourses where there are substantial stands of Allocasuarina. They choose trees with larger cone crops but show no sign of selecting trees on the basis of cone size, concentrating foraging in trees with a high ratio of total seed weight to cone weight (*Clout 1989*). They breed in hollow trees or stumps, usually in eucalypts.

Site specific - It is considered that the subject site provides suitable foraging and roosting habitat for the Glossy Black-Cockatoo. There is no suitable nesting habitat present within the subject site or outer APZ areas.

A trio of Glossy Black-Cockatoos was heard and then observed late in the day on 30 March 2010, landing to perch in trees located up the slope of neighbouring native vegetation, approximately 60m to the east of the subject site (see Figure 2 for location). It appeared that this trio had flown from the south and likely over the subject site.

Target searches were undertaken below mature and seeding *Allocasuarina* trees found within the study area during 2010 surveys with no evidence of foraging found. In general *Allocasuarina* trees occur in low densities within the study area with high densities of mature seeding specimens occurring almost immediately on the other side of Oxford Falls Road and extending into natural bushlands to the east.

Given that the subject site has not recorded any foraging activity and nesting habitat is not present it is considered that the proposed development will not impose any significant impacts on this species.

Summary of other threatened species requiring target survey by the DGR's (DoP 2006) and / or DECC (2009)

Giant Burrowing Frog (*Heleioporus australiacus*)

Behavioural background - This species is most common on the Hawkesbury Sandstone in the Sydney region. It occurs south to Victoria (*Barker .et. al. 1995*). Males call from beside smaller semi-permanent to permanent streams or dams or from burrows within the bank of streams or dams. (*Anstis M.*, *2002*). They call mainly in spring and late autumn, but also after rain in late summer. Foamy egg mass is laid in a burrow such as an old crayfish hole in a stream bank, or concealed under dense vegetation. (*Anstis M., 2002*).

Site specific - It is considered that the subject site does not provide suitable habitat for this species.

Barking Owl (*Ninox connivens*)

Behavioural background - The Barking Owl utilises dry sclerophyll forests and woodlands of tropical, temperate and semi-arid zones, often dominated by eucalyptus, and containing many large trees suitable for roosting or breeding. This species is both carnivorous and insectivorous, taking mainly insects outside breeding season and more birds and mammals when breeding (*Higgins, P.J. 1999*). The Barking Owl utilises eucalypt forests and woodlands and adjacent cleared areas for foraging and large hollows for nesting and breeding (*Schodde & Tidemann 1986*).

Site specific - Targeted surveys for this species were undertaken during surveys. Call playback stations and hollow bearing tree locations are shown on Figure 2.

Given the hollow characteristic utilised as described by the Barking Owl Recovery Plan (NPWS 2003), it is considered that hollow bearing trees HT9, HT11, HT14 HT19, HT31 and HT32 provide suitable nesting habitat within the study area. None of these trees are located within the subject site itself.

Due to this species tendency to have numerous roosting sites within seasonal foraging home ranges, the removal of potential roosting habitat within the subject site is not considered to be significant. As no nesting locations will be impacted and prey species habitat is otherwise well represented in the locality it is unlikely that the proposal will result in a significant impact on a local population of this species.

Koala (*Phascolarctos cinereus*)

Behavioural background - Koalas are recognised to occupy both forest and woodland communities, provided that the suitable eucalypt tree species are present. Koalas inhabit both wet and dry eucalypt forest that contains a canopy cover of between 10% and 70% as well as suitable feed trees (*Reed et. al. 1990*). The home range of Koalas varies according to the quality of habitat and number of available food trees, more so than food tree density. Studies in Port Stephens have recorded home range sizes between 0.2-500ha, with an average of 80-90ha, considering also that males tend to occupy larger areas.

Site specific - Targeted surveys for this species were undertaken during surveys. Call playback stations are shown on Figure 2. A habitat assessment for this species according to the definitions of *SEPP 44 - Koala Habitat Protection* is provided within this section of the document. Under SEPP 44 the subject site is not considered to provide PKH.

Further to this one (1) primary food tree species (*Eucalyptus robusta*) and one (1) secondary food tree species (*Eucalyptus punctata*), as listed in Appendix 1 of the Recovery Plan for the Koala (*Phascolarctos cinereus*), were recorded within the study area. Koalas show a higher level of use for primary tree species. If these are absent, secondary tree species may support Koala habitat at a lower carrying capacity. *E. robusta* occurs as a single recorded specimen and *E. punctata* occurs in low densities.

Therefore the subject site does not likely offer suitable habitat that may be utilised as part of existing home ranges. The study area also has low potential to offer transient habitat to individuals in dispersal based on nearby records and surrounding habitats and roads. Therefore the proposal is not likely to significantly impact on a local population of Koalas. .

Spotted-tailed Quoll (*Dasyurus maculatus*)

Behavioural background - The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry open forests and rainforests containing rock caves, hollow logs or trees for shelter / breeding. It appears to prefer moist forest types and riparian habitat. It has been recorded from dry sclerophyll forest, open woodland and coastal heathland, and despite its occurrence in inland riparian areas, it also ranges over dry ridges (NPWS 1999).

Female home ranges are generally non-overlapping and 88-1,515ha in size. Male home ranges are much larger, from 359-5,512ha in size, and overlap and encompass multiple female home ranges. The species is capable of covering large distances in a short period of time, with animals recorded at moving at least 8km in a day and 19km in a *week (Long & Nelson 2010).* Habitat that is critical to the survival of the Spotted-tailed Quoll includes large patches of forest with adequate denning resources and relatively high densities of medium sized mammalian prey.

Site specific - This species was not recorded during surveys incorporation targeted hair tubes.

The areas of forest removed or modified as part of the proposal are not considered highly suitable for the species due to the narrow or disturbed nature of these portions. This is considered also due to an absence of shelter in the form of hollows or caves within this portion. Use of the western corridor is considered unlikely in respect of this species being known to require large areas of relatively intact vegetation in which to forage (*NPWS, 1999*). The site is also surrounded by local roads. Whilst there is some potential for the species to utilise the habitat present, this habitat is not likely central to local activity, particularly given the social organisation between individuals. Therefore, the proposal is not likely to significantly impact on a local population of this species.

Rosenberg's Goanna (*Varanus rosenbergi*)

Behavioural background - On the east coast of NSW the Rosenberg's Goanna (also known as Heath Monitor) is a Hawkesbury / Narrabeen sandstone outcrop specialist (*State Forests of NSW, 1995*). The Rosenberg's Goanna is largely restricted to heath (*NPWS 1997*); inhabiting humid woodlands, dry hardwood forests and heathland where it shelters in self-dug burrows, hollow logs, rock crevices and sandstone outcrops (*Cogger 1992*), usually with a sandy substrate (*State Forests of NSW, 1997*). The Rosenberg's Goanna shelters in self-dug burrows, hollow logs, rock crevices and sandstone outcrops (*Cogger 1992*). Eggs are laid within a terrestrial termite mound.

Site specific - Targeted surveys for this species were undertaken during 2010 surveys. Locations of funnel trap transects are shown on Figure 2. This species was not conclusively recorded during survey; however a large dark lizard was very briefly observed scurrying away when disturbed at the location of the far southern cage trap. A clear observation was not possible, however it was considered more likely of monitor lizard rather than dragon lizard size.

It is considered that the subject site provides suitable foraging and burrowing habitat for the Rosenberg's Goanna, particularly along the rocky outcroppings contained along the western remnants. Suitability is not ideal due to the narrow linear remnants and fragmented connectivity to those that do exist, however the species has potential to occur based on the incidence of local records and anecdotal evidence of local activity.

The *Atlas of NSW Wildlife* also provides records of this species within the nearby locality, predominantly on the other side of Oxford Falls Road in habitats extending north. An aerial assessment of the locality also shows that high quality areas of heath and neighbouring forest habitats occur to the east within and surrounding Red Hill Park reserve and extensive areas extending north into and beyond Cromer Heights. Approximately 18ha of heath and heath associated habitat exists to the immediate north of the subject site. This area extends for a smaller distance as connective forest as well as extended habitat on the other side of Wakehurst Parkway.

A local population of Rosenberg's Goanna, although more likely centred on nearby higher quality habitat, may actively utilise the eastern or western vegetated fringes of the subject site on occasion or in dispersal.

No terrestrial termite mounds, which are considered the most suitable for nesting habitat, were observed within the study area. Terrestrial termite mounds were observed beyond the study area boundary towards the end of the hair tube transect which extended into neighbouring lands to the north west.

Funnel trapping survey targeted the presence of this species within what was considered the most suitable areas of habitat for the species within the subject site. No Rosenberg's Goannas were captured or observed opportunistically during survey meanders within all vegetated areas present.

Given the suitability of habitat present, the higher quality habitat in the local area surrounds where records are know, it is considered that the proposal will not likely significantly impact on the local population of this species.

Southern Brown Bandicoot (*Isoodon obesulus*)

Behavioural background - The Southern Brown Bandicoot has been detected in a range of habitats, including open forest, woodland, heaths, agricultural land and urban areas, preferring areas with thick ground cover which provide protection from predators *(Braithwaite, 1988). Environment Australia* (2000) recorded this species from a range of habitat types, though it was more typically found in heathland environments on sandy friable soils. When located in forests and woodlands, there is generally a heathy or shrubby understorey characterised by *Acacia*, *Banksia*, *Daviesia, Epacris, Hakea*, *Leptospermum*, *Melaleuca* and *Platylobium* species.

Distribution is patchy along the NSW coast and foothills with current information suggesting only two population strongholds, one in the far south-eastern corner and the other within the Northern Sydney Metropolitan Area. Research undertaken by *Macquarie University* indicates that the sub-populations within Ku-ring-gai and Garigal National Parks may have been genetically different (DEC 2006). Additionally, this species is found to display a preference for newly regenerating natural heathland habitat following fire or clearing (*Menkhorst & Seebeck 1990; Braithwaite and Gullan 1978; Stoddart and Braithwaite 1979; Opie 1980*).

Site specific - Cage trapping for this species was undertaken for four (4) nights in January 2004, ten (10) nights in April 2010, as well as supplementary hair tube survey for seven (7) nights between March and April 2010. The 2010 surveys also used truffle oil as an additional attractant known for its increased success rate at recording this species. Despite the presence of suitable habitat this species has not been detected following these extensive targeted surveys within the subject site and nearby. Targeted surveys for this species are described in Section 2.3.6 and Table 2.1. Locations of target method funnel trap transects are shown on Figure 1.

It is considered that suitable habitat for this species is present in select locations within the western vegetated potions of the study area. Suitability is not considered ideal due to a lack of extensive heath and dense native scrub type habitats and the fragmented connectivity between those areas that do exist. Bandicoot activity was observed during survey, however the more common Long-nosed Bandicoot (*Perameles nasuta*), more noted for its presence near disturbed areas and the urban interface, was recorded in these locations.

Based on the species absence during targeted survey it is considered that the proposal is not likely to significantly impact on a local population of this species. The proposed east-west corridor along the northern site boundary will restore potential for this and other terrestrial species to disperse in the locality as east-west connectivity is currently highly fragmented within the study area.

Red-crowned Toadlet (*Pseudophryne australis*)

Behavioural background - Red-crowned Toadlets use small ephemeral drainage lines, which feed water from the top of ridges to perennial creeks below. This species is totally confined to the Hawkesbury sandstone formation and is not usually found in the vicinity of permanent water (*Ehmann, 1997*). Breeding habitat is small puddles or depressions where rock or leaf litter holds back water temporarily (*Ehmann, 1997*; *State Forests Threatened Species Protocol, 1997*). Breeding congregations can occur deep in grass and debris beside such non-perennial creeks, gutters etc. They have also been noted to be very partial to damp shelves and cracks in sandstone where they have been observed emerging at dusk (NPWS 1997). At other times, individuals disperse and are found under rocks, logs etc. on sandstone ridges (*Cogger, H.G. 2000*).

Site specific - Target searches were undertaken for this species within the study area as part of the 2004 as well as 2010 surveys. Search areas of 2010 surveys are provided in Figure 2, with methods described in Section 2.3.5 and effort summarised in Table 2.1. Searches were undertaken during good conditions following or during rainfall.

The 2010 searches were undertaken along portions of all drainages within the study area considered to provide habitat. This totalled two drainages within the subject site as well as other drainages to the north and south. The surveyed drainages within the study area are depicted in Figure 2 and described below:

- Drainage 1: Occurs outside of the study area to the north and was considered the most ideal habitat providing small ephemeral pools fed by trickling clear water out of a small naturally vegetated catchment above.

- Drainage 2: Provides larger pools, higher flows and modifications with weed incursions. Water quality relatively high.

- Drainage 3 (within the subject site): Is a solid sandstone slope that is fed from seepage through managed grasslands above. Flow is not too high however there were no observed suitable ponding locations for tadpole development and shelter was limited along the immediate drainage line. This flowed as a waterfall into a dam below.

- Drainage 4 (within the subject site): Is a constructed roadside drain containing leaf litter and low flow, however was located in a highly managed setting untypical for the species. Searches were undertaken here due to calls heard which were later identified as the partial call of *Crinia signifera*.

- Drainage 5: Is a high flow perennial gully (outside of the subject site) that is fed by stormwater flows from the local urban landscape. Some side portions of low flow and pooling exist with ideal shelter opportunities but on the whole is less typical due to high volume flows. Two search locations were undertaken along this drainage line.

It is considered that the proposal is not likely to significantly impact on a local population of this species based on the species absence during targeted surveys.

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 flora or fauna populations within the Warringah LGA.

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

No EECs were recorded within the study area.

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

No EECs were recorded within the study area.

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 *Acacia bynoeana, Epacris purpurascens, Eucalyptus camfieldii, Persoonia hirsuta, Pimelea curviflora* var. *curviflora, Tetratheca glandulosa,* Red-crowned Toadlet, Rosenberg's Goanna, Barking Owl, Little Eagle, Powerful Owl, Masked Owl, Little Lorikeet, Glossy Black-Cockatoo, Gang-gang Cockatoo, Scarlet Robin, Varied Sittella, Swift Parrot, Regent Honeyeater, Spotted-tailed Quoll, Southern Brown Bandicoot, Eastern Pygmy Possum, Grey-headed Flying-fox, Yellow-bellied Sheathtail-bat, East-coast Freetail Bat, Little Bentwing-bat, Large-footed Myotis, Greater Broad-nosed Bat, Eastern Bentwing-bat and Eastern Falsistrelle.

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

The subject site inclusive of surrounding proposed APZs comprises approximately 3.36ha of natural open forest / woodland vegetation with some moderate and highly disturbed portions. The proposed development is likely to remove or modify approximately 0.142ha of such habitat for the aforementioned species for APZ purposes.

ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The subject site is covered by a mixture of natural and disturbed bushland and cleared areas. The areas of natural vegetation are narrow or patch remnants surrounded by urban or rural residential landscapes and bound by the busy Wakehurst Parkway to the west and Oxford Falls Road to the east. These remnant patches are subsequently already fragmented within the local natural landscape with no direct connectivity to expansive areas of similar forest/woodland habitat in the locality. The proposal will not further fragment the patches from contiguous surrounding habitat but will further fragment the patches from each other internally. For this reason, a ~24m cross site corridor is proposed along the northern site boundary. The proposed development utilises the existing structure and is centred within the existing cleared areas of the site. The resultant clearing of habitat is for APZ purposes.

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

The proposal will not impact on any recorded EECs or threatened flora. The proposal is not of significant importance to recorded threatened species and not likely central to the habitat requirements of species with potential to occur. The remnant vegetation along Oxford Falls Road will be conserved as a biodiversity corridor as part of the proposal.

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

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

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

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

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

- Barking Owl (*Ninox connivens*) (NPWS 2003)

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

- Large Forest Owls ((Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*)) (DEC 2006)
- Southern Brown Bandicoot (*Isoodon obesulus*) (DEC 2006)

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
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			✓
Anthropogenic Climate Change			✓
Bushrock removal		✓	
Clearing of native vegetation	✓		
Competition and habitat degradation by feral goats			✓
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)			✓
Competition from feral honeybees			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments			✓
Forest Eucalypt dieback associated with over-abundant psyllids and bell miners			✓
High frequency fire resulting in the disruption of life-cycle processes in plants and animals and loss of vegetation structure and composition			✓
Herbivory and environmental degradation caused by feral deer			✓
Importation of red imported fire ants into NSW			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Infection of native plants by *Phytophthora cinnamomi*		✓	
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers		✓	
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of *Lantana camara*		✓	
Invasion of native plant communities by bitou bush & boneseed *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses			✓
Invasion of native plant communities by African Olive (*Olea europaea* subsp. *cuspidata*)			✓
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*)			✓
Loss of hollow bearing trees			✓

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
	Likely	Possible	Unlikely
Loss and / or degradation of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)			✓
Predation by the European Red Fox (*Vulpes vulpes*)			✓
Predation by the Feral Cat (*Felis catus*)			✓
Predation by Plague Minnow or Mosquito Fish (*Gambusia holbrooki)*			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition & disease transmission from Feral pigs (*Sus scofa*)			✓
Removal of dead wood and dead trees		✓	

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

Bushrock removal

The proposal may remove naturally occurring sandstone bushrock but it is more likely that this rock will be retained as part of on-site landscaping. There will be reduced potential for threatened species to use this bushrock given the management of surrounding vegetation required for APZs and landscaping. For threatened species considered, the Rosenberg's Goanna and to a lesser extent the Red-crowned Toadlet may utilise this rock type habitat and therefore it is recommended to provide some degree of native vegetation landscaping along the rocky habitats to the north of the house. This may permit ongoing north-south passage of goannas.

It is also recommended that any bush rocks requiring removal should be relocated into the proposed corridor. This corridor should contain large sandstone rocks placed together.

Clearing of native vegetation

The proposal is of a class of development recognised as a threatening process. The proposal may require the removal or maintenance of some native vegetation for asset protection purposes. 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. As such, a 24m wide corridor is proposed along the northern boundary which shall link the narrow sandstone and heath area to the riparian vegetation adjacent to Oxford Falls Road.

Weed control of existing remnant native vegetation will also improve the longevity of those remnants.

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.

Invasion and establishment of exotic vines and scramblers

Morning Glory occurs patchily within remnants of vegetation. Additional disturbance may increase the rate of spread, therefore a weed control program is recommended to ensure there is adequate eradication, and control of invasive vines species.

Invasion, establishment and spread of Lantana camara

Lantana occurs patchily within remnants of vegetation. Additional disturbance may increase the rate of spread, therefore a weed control program is recommended to ensure there is adequate eradication, and control of Lantana within retained bushland.

Removal of dead wood and dead trees

The proposal will require the removal of deadwood on living trees to be removed and in this case is of a class of development recognised as a threatening process. Threatened fauna species with potential habitat within the subject site and likely dependent on dead wood or dead trees include the Scarlet Robin and Varied Sittella. These species have not been recorded to date within the subject site. Given the low amount of deadwood to be removed within the APZ areas, the removal of dead wood is not considered likely to impact on threatened species or the biodiversity of the local area.

National - Significant Impact Criteria

A4

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

CRITICALLY ENDANGERED AND ENDANGERED SPECIES

Significant impact criteria

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

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

>> What is a population of a species?

A 'population of a species' is defined under the *EPBC Act* as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:
- a geographically distinct regional population, or collection of local populations; or
- a population, or collection of local populations, that occurs within a particular bioregion.

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

'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary:
- For activities such as foraging, breeding, roosting, or dispersal;
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators);
- To maintain genetic diversity and long term evolutionary development; or
- For the reintroduction of populations or recovery of the species or ecological community.

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

VULNERABLE SPECIES

Significant impact criteria

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

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

>> What is an important population of a species?

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

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

CRITICALLY ENDANGERED AND ENDANGERED ECOLOGICAL COMMUNITIES

Significant impact criteria

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

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

MIGRATORY SPECIES

Significant impact criteria

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

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

>> What is important habitat for a migratory species?

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

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

>> What is an ecologically significant proportion?

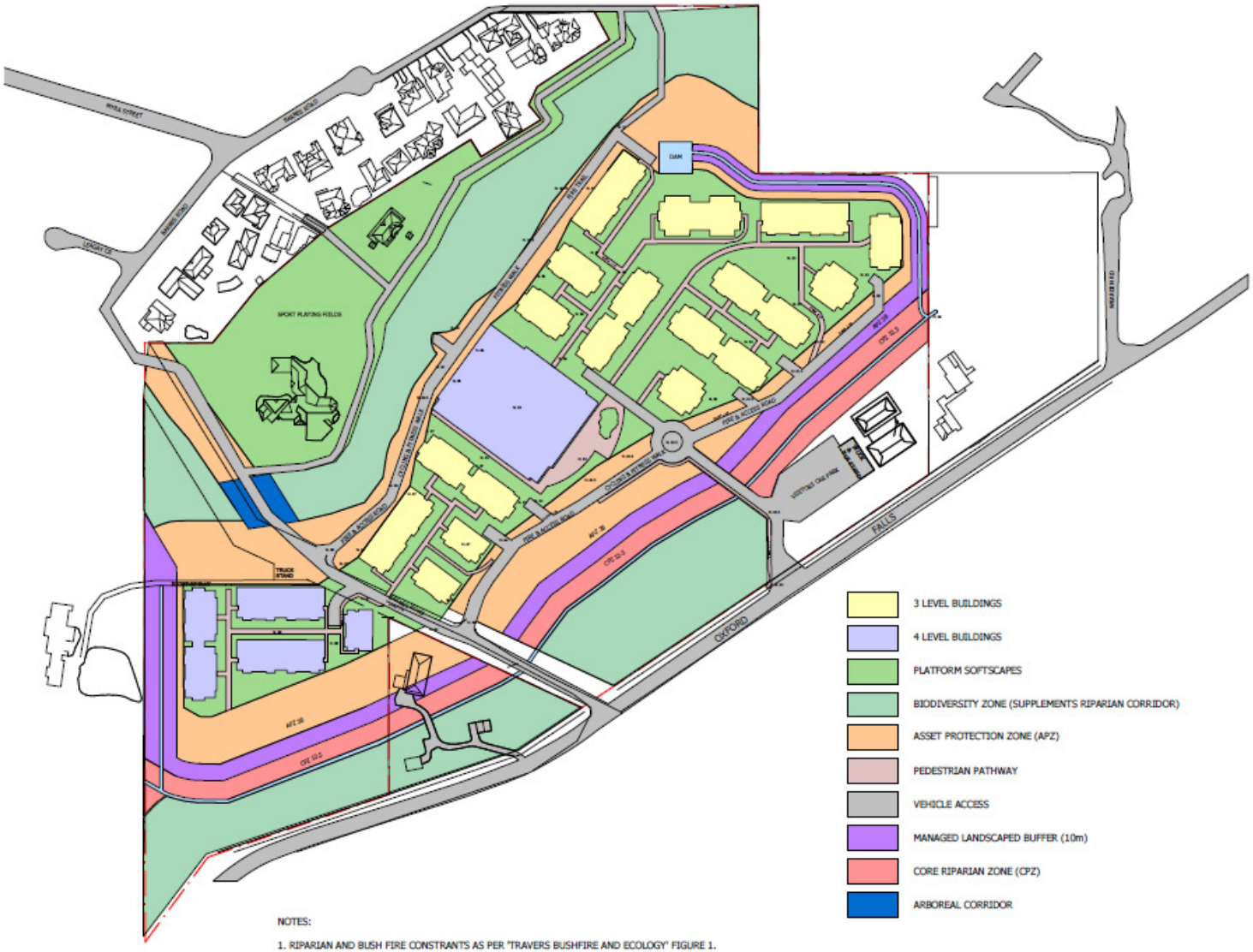
Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include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

>> What is the population of a migratory species?

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

Site Proposal 2010

A5



NOTES:

1. RIPARIAN AND BUSH FIRE CONSTRANTS AS PER 'TRAVERS BUSHFIRE AND ECOLOGY' FIGURE 1.

TIFFANY DEVELOPMENTS

Project: OXFORD FALLS

Sheet Title: SITE PLAN

0 75 150m

Date Plotted

NORTH

A001

1 : 1500

SULE Determinations and Terminology

A6

SULE (an acronym for **Safe Useful Life Expectancy**). Particular consideration is given to the following points when making the final SULE assessment for each tree;

- Obvious past influences (suppression)
- Present health and condition and future potential in current position
- Estimated age at assessment in relation to the life expectancy for the species
- Observed and potential structural defects which may influence potential life expectancy
- Potential remedial work which may allow retention in the existing location.

An outline of the four relevant SULE categories and their subgroups used in this report is as follows:

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1 Long **SULE** (Trees that appear to be retainable at the time of assessment for more than 40 years with an acceptable level of risk)

A A structurally sound tree, located where potential future growth can be accommodated

B A damaged or defective tree that could be made suitable in the long term (40+ years) where remedial care is given

C A tree of particular significance (historical / commemorative merit or rarity) that warrants extensive efforts in securing long term retention.

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2 Medium **SULE** (Trees that appear to be retainable at the time of assessment for 15 to 40 years with an acceptable level of risk)

A A tree predicted to only live between 15 and 40 more years

B A tree that may live for more than 40 years but should be removed to prevent safety or nuisance problems.

C A tree that may live for more than 40 years but should be removed to prevent competition with more suitable individuals or to provide space for new planting

D A damaged of defective tree that could be made suitable in the medium term (15-40 years) where remedial care is given.

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3 Short **SULE** (Trees that appear to be retainable at the time of assessment for 5 to 15 years with an acceptable level of risk)

A A tree predicted to only live between 5 and 15 more years

B A tree that may live for more than 15 years but should be removed to prevent safety or nuisance problems

C A tree that may live for more than 15 years but should be removed to prevent competition with more suitable individuals or to provide space for new planting

D A damaged of defective tree that could be only made suitable in the short term (5-15 years) and would require significant remedial work.

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4 Removals (Trees with a high level of risk and should be removed within the next 5 years)

A A dead, dying, suppressed or declining tree

B A dangerous tree through instability or recent loss of neighbouring trees

C A dangerous tree through structural defects (cavities, decay, included bark, wounds or poor form)

D A damaged tree that is clearly not safe to retain

E A tree that is damaging or may cause damage to existing structures within 5 years

F A tree that will become dangerous after removal of neighbouring trees for the reasons given in A) to E).

SULE ratings given to any tree in this report assumes that appropriate maintenance (if required) will be provided by a qualified arborist. Incorrect tree work practices can significantly accelerate tree suppression and increase hazard potential

EXPLANATION OF TERMINOLOGY USED

DBH - An acronym for Bole **diameter** at **breast height** (1.4 m from ground level).

Health - An indication of the vigour of a tree and is determined by the observed crown colour, density and insect attack, the percentage of dead or dying branches and the amount epicormic growth. The health of the canopy and that of the root system is interdependent and significant loss of tree vigour can result through both root and canopy (pruning, suppression) damage.

Suppressed, unhealthy trees have reduced ability to initiate internal defence systems (by the process of compartmentalisation) thus predisposing them to attack by insects and pathogenic decay organisms which increase the potential to drop dangerous branches.

Condition - An evaluation of the structural integrity of a tree, including defects that may affect the useful life of an otherwise healthy individual. Such influencing factors include cavities and decay, weak unions between branches or trunks and faults of form or habit.

Kino - A dark reddish exudate, rich in polyphenols (tannins), developed in the cambial region of eucalypts often as a result of injury; incorrectly called gum *(Boland et. al., 1992).*

Deadwood - The mature crown of a eucalypt maintains itself by the continual production of new crown units, which die in turn. Thus there will always be some dead branches in a healthy mature crown *(Florence, 1996).* Minor deadwood refers to dead branchlets, Major deadwood refers to main branches from the trunk.