Travers environmental

Flora & Fauna Assessment

OXFORD FALLS SENIORS LIVING RESORT

OCTOBER 2008
REF: 8054F

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FLORA & FAUNA ASSESSMENT

OXFORD FALLS ROAD AND BARNES ROAD, OXFORD FALLS

OCTOBER 2008

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EXECUTIVE SUMMARY

This Flora and Fauna Assessment Report has been prepared by *Travers environmental* to identify the flora and fauna characteristics of Lots 1110, 1111, 1113 & 1336 DP 752038, Lot 20 DP 842523 and Lot 80 DP 846099 Oxford Falls Road and Barnes Road, Oxford Falls.

Legislative Requirements

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

In respect of matters required to be considered in the *Environmental Planning & Assessment Act* (1979) and relating to the species / provisions of the *Threatened Species Conservation Act* (1995), one (1) threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*) was recorded within the subject site. No threatened flora species or endangered ecological communities were recorded within or in close proximity to the subject site.

In accordance with Section 5A of the EP&A Act, the 7 part test of significance concluded that the proposed development will not have a significant impact on any threatened species, populations or endangered ecological communities. Therefore, a Species Impact Statement should not be required for the proposed development.

In respect of matters required to be considered under the *Environment Protection and Biodiversity Conservation Act* (1999), one (1) threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*) was recorded. No threatened flora species, and no endangered ecological communities listed under this Act were recorded within or in close proximity the subject site. It is considered that the proposal is unlikely to have a significant impact on the recorded species and therefore a referral to Department of the Environment & Heritage is not required.

The proposed development was not considered to have a significant impact on matters of National Environmental Significance. As such a referral to Department of the Environment, Water, Heritage & the Arts should not be required.

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

Director Generals Requirements

The proposal has been declared as a major project under Part 3A and Director General Requirements (DGR's) have been issued.

This assessment has been prepared in accordance with the key ecological issues outlined within the Director Generals Requirements (DGR's), issued by the NSW Department of Planning (DoP) in August 2006. Those issues relevant to this report are identified in Table 1 below.

Table 1: Director General Requirements

Item	Director General Requirement	Relevant section of this report
General Requirements		
3	A draft statement of commitments, outlining environmental management, mitigation and monitoring measures	
Key Issues		
Threatened Species and Corridor values	Address impacts on threatened species having regard to the Draft Guidelines for Threatened Species Assessment and recommend offset measures to avoid or mitigate the impacts	These guidelines have been gazetted since the issuing of DGR's. The assessment is provided at Section 4.
	Provide a peer review of the threatened species component of the EA prior to submission.	Undertaken by Steven Ambrose (Ambrose Ecological Surveys Pty Ltd). His comments have been incorporated into this document and are included as Appendix 1 to this report. Appendix 2 provides a response to the peer review and outlines the specific areas of the report which were updated as a result of the peer review.
	Address corridor values or connective importance of any vegetation on the subject land; the possible loss of connectivity to bushland areas to the south, east and west, impacts on adjoining and nearby bushland areas.	Section 4.3
	Demonstrate adequate buffer and address long-term protection of threatened species.	An Environemental Corridor has been provided to the Middle Creek Tributary. The implementation and management of these features have been discussed in detail within the Waterway Impact Study (Travers environmental, 2008). The long term protection of threatened species is discussed in Sections 5
	Identify mitigation measures for long term protection of threatened species.	Section 5

A peer review of this assessment was undertaken by Stephen Ambrose of Ambrose Ecological Services dated 1 September 2005. The results of this peer review have been taken into consideration in this current assessment. As identified in Table 1 above, a response to the peer review and the specific areas of the report which were updated as a result is provided in Appendix 1 of this report.

DECC's Recommended EA Requirements

The proposal has been declared as a major project under Part 3A and Director General Requirements (DGR's) have been issued. Attachment 1 of the DGR's provides a list of the

DECC's recommended EA requirements. Item 1 – Impacts on threatened species and their habitats is pertinent to this flora and fauna assessment and has been addressed below. Each of the DGR's pertinent to this assessment has been provided in Table 1 within the Executive Summary.

a) *A field survey of the site should be conducted and documented in accordance with the gazetted draft Guideline for Threatened Species Assessment and any relevant environmental impact assessment guidelines where these have been prepared by the DECC. Surveys should include targeting the following threatened species and communities:*
   - *Acacia bynoeana*
   - *Grevillea caleyi*
   - *Syzygium paniculatum*
   - *Tetratheca glandulosa*
   - *Duffy's Forest Endangered Ecological Community*
   - *Giant Burrowing Frog*
   - *Grey-headed Flying-fox*
   - *Powerful Owl*
   - *Barking Owl*
   - *Koala*
   - *Spotted-tailed Quoll*
   - *Rosenberg's Goanna*

This assessment has been undertaken in Section 4 of this report. Potential habitat for a range of threatened species, including those identified above, is considered to be present on-site. Despite the presence of potential habitat, only the Grey-headed Flying-fox was recorded during survey undertaken on the site. The disturbed nature of the site currently provides minimal habitat outside of the riparian zone. In light of this, it is considered that the proposed revegetation and rehabilitation of drainage lines across the site will mean that this development will not result in a significant impact upon threatened species. It is considered that there will actually been an improvement in the quality, connectivity and diversity of habitat on this site as a result of the propsed development.

b) Describe the actions that will be taken to avoid or mitigate impacts or compensate for unavoidable impacts of the project on threatened species and their habitat. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

Table 1 below outlines each of the mitigation actions being taken as well as an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

Table 1: Mitigation Measures Proposed and Assessment of Effectiveness

Mitigation Action	Effectiveness and Reliability	Residual Impacts
Creation of an Environmental corridor	The waterway is currently unprotected with the majority of the creekline overgrown with weeds. The corridor wil provide a no development zone thus allowing the ability for not only ecological functioning but also open space use and scientific education opportunites on riparian and aquatic observation for local schools. This is a highly effective and reliable mitigation measure with proven benefits for water quality, habitat and vegetated connectivity.	Ongoing weed management required. This will be implemented as part of the ongoing site management requirements of the Waterway Impact Study.
Revegetation of drainage lines to provide habitat connectivity.	The provision of a permanent vegetated link within the corridor will enhance not only vegetated links but also ecological functioning in the form of aquatic, riparian and terrestrial habitat creation.	Ongoing weed management required and potential edge effects. The implementauion of a monitoring program (weeds, plant establishment and growth) will ensure these impacts are kept to a minimum.
In-stream works	The creation of in-stream sequence of riffles, pools and runs will assist sustainability of instream aquatic and benthic habitat. Creek stabilisation works will ensure long term protection of creek bank and minimise erosion. Water quality will be enhanced through aeration over riffle areas and detention in pools.	Initial water quality impact during construction. No long term impacts are perceived within the site. Poor water quality upstream has potential to create negative impact within site.
Development Design	The development has been designed to utilise the cleared portions of the site with minimal clearing of vegetation required. The development has been designed to increase the amount of native vegetation on the site and provide water quality treatment and increased habitat potential through the creation of development / creekline buffers and increased aquatic habitat.	Increased human use of the site. Residual impact upon native flora and fauna.
Stormwater and water quality Management	Stormwater and water quality management measures to be implemented include retention of drainage lines on-site, revegetation of Middle Creek Tributary, removal of stock grazing on site, bioretention systems, swales, rain gardens, porous paving, roof gardens, rainwater tanks, stormwater re-use tanks, onsite detention (OSD) tanks.	
Retention of Hollow Bearing Trees	The retention of hollow bearing trees is an effective means of preserving roosting and breeding habitat for a range of arboreal mammals as well as birds.	Twenty-one (21) hollow-bearing trees were observed within the subject site. Three (3) of these trees will be required to be removed. However, as 85% of the hollow-bearing trees are to be retained with the majority of them being protected within the environmental corridor a significant impact is not considered likely.

Conclusion

It is concluded that the proposed development of Lots 1110, 1111, 1113 & 1336 DP 752038, Lot 20 DP 842523 and Lot 80 DP 846099 Oxford Falls Road and Barnes Road, Oxford Falls, is unlikely to result in a significant impact on any threatened species, populations or endangered ecological communities or their habitats.

As such no further assessments are considered to be required under the *EP&A Act 1979, EPBC Act 1999, FM Act 1994 or WM Act 2000.*

Report prepared by:

John Travers B. App. Sc. / Ass. Dip. (Parks & Wildlife) – Director
Emma Coombs B. Sc (Mar. Sci. / Sust. Res. Mgt.) - Ecologist
Lindsay Holmes B. Sc. (Biology) – Botanist
Corey Mead B. App. Sc. (Coastal Mgt) – Fauna Ecologist

Licences –

Individual staff members are licensed under Clause 20 of the *National Parks and Wildlife (Land Management) Regulation 1995* and Section 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.

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

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1 INTRODUCTION

Travers environmental has been engaged by *Tiffany Developments* to undertake a Flora and Fauna Assessment within Lots 1110, 1111, 1113 & 1336 DP 752038, Lot 20 DP 842523 and Lot 80 DP 846099 Oxford Falls Road and Barnes Road, Oxford Falls within the Warringah LGA. The combined lots will hereafter be referred to as the subject site.

1.1 Aims of the Assessment

The aims of the flora & fauna assessment are to:

- Carry out a botanical survey to describe the vegetation communities and their condition
- 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
- Assess the conservation value of the site
- Prepare a flora and fauna impact assessment in accordance with the requirements of the *Environment Protection and Biodiversity Conservation Act 1999,* the *Threatened Species Conservation Act 1995,* the *Fisheries Management Act 1994* and the Guidelines for Threatened Species Assessment issued by the DECC.

1.2 Information Collation

A review of the relevant information pertinent to the subject site was undertaken prior to the initiation of field surveys as background to the study. Information sources reviewed include the following:

- Bushfire Protection Assessment, Oxford Falls Road and Barnes Road, Oxford Falls (Travers environmental, 2008)
- Tree Assessment Report, Oxford Falls Road, Oxford Falls (Travers environmental 2008)
- Stormwater Concept Plan for Revised Development Application (JMD Development Consultants 5 September 2008)
- Water Quality Management Concept, Oxford Falls Road, Barnes Road, Oxford Falls (SEEC Morse McVey 8 September 2008)

Standard Technical Resources

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (working draft) *(Department of Environment and Conservation 2004).*
- Aerial photographs (scale 1:25,000) and Topographical maps (scale 1:25,000)
- *Atlas of NSW Wildlife* (DECC, 2008) 1:100,000 scale map sheet
- The schedules of the *Threatened Species Conservation Act, 1995*
- The schedules of the *Fisheries Management Act, 1994*
- Lists of threatened species and communities in the *Environmental Protection and Biodiversity Act 1999*

- Rare or Threatened Australian Plants (ROTAP)

Other Documentation

- Warringah Council Creek Management Study (March 2004)
- Narrabeen Lagoon Estuary Management Plan (2002) and the
- Northern Beaches Stormwater Management Plan (1999).

1.3 Statutory Requirements

1.3.1 State

Threatened Species Conservation (TSC) Act (1995)
The specific requirements of the *Threatened Species Conservation (TSC) Act* (1995) must be addressed in the assessment of flora and fauna matters. This requires the consideration of potential impacts on threatened species, populations and ecological communities.

Environmental Planning & Assessment (EP&A) Act (1979)
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 & Assessment (EP&A) Act* (1979) and are based on a 7 part test of significance.

Section 5A

The factors to be taken into account in deciding whether there is a significant effect on threatened species are set out in Section 5A of the *Environmental Planning & Assessment (EP&A) Act* (1979) 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.

Part 3A

Part 3A of the *EP&A Act* (1979) relates to major infrastructure and other projects which require approval by the Minister. Section 75B of this Part outlines the types of projects to which this Part applies.

The proposed development to be assessed in this report has been declared a major project under Part 3A of the *EP&A Act* (1979) and SEPP Major Projects.

Under section 75U of Part 3A of the *EP&A Act* (1979), approvals that do not apply (relevant to this proposal) are:

- *Section 75U(e) an authorisation referred to in section 12 of the Native Vegetation Act (2003) or under any Act to be repealed by that Act to clear native vegetation.*
- *Section 75U(g) a bush fire safety authority under section 100B of the Rural Fires Act (1997)*

Native Vegetation Act 2003 and Regulations

Under Schedule 1 of the *Native Vegetation Act* (2003) lands that are excluded from application of the Act include;

- National Parks estate and other conservation areas;

- State Forest Land;
- Specific Local Government Areas (LGA's) listed below:

Ashfield, Auburn, Bankstown, Baulkham Hills, Blacktown, Botany Bay, Burwood, Camden, Campbelltown, Canterbury, Concord, Drummoyne, Fairfield, Hawkesbury, Holroyd, Hornsby, Hunters Hill, Hurstville, Kogarah, Ku-ring-gai, Lane Cove, Leichhardt, Liverpool, Manly, Marrickville, Mosman, Newcastle, North Sydney, Parramatta, Penrith, Pittwater, Randwick, Rockdale, Ryde, South Sydney, Strathfield, Sutherland Shire, Sydney City, Warringah, Waverley, Willoughby, Woollahra,

The proposed development within this report falls within the Warringah LGA, hence the proposal is exempt under Schedule 1, Part 3, Section 13 of the *Native Vegetation Act* (2003).

Fisheries Management Act (1994)
The *Fisheries Management Act* (1994) provides a list of threatened aquatic species, which 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, a Species Impact Statement (SIS) is required to be prepared and submitted to DECC for assessment under the *TSC Act* (1995).

1.3.2 National

The *Environment Protection and Biodiversity Conservation (EPBC) Act* (1999) requires that Commonwealth approval be obtained for certain actions. The Act provides an assessment and approvals system for actions that have a significant impact on matters of National Environmental Significance (NES). These may include:

- Wetlands protected by international treaty (the Ramsar Convention),
- Nationally listed threatened species and ecological communities,
- Nationally listed migratory species, and
- Nationally listed marine species.

Actions are projects, developments, undertakings, activities, 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 a matter of NES.

Where a proposed activity is located in an area identified to be a matter of NES, or such that it is likely to significantly affect nationally listed threatened species, ecological communities, migratory species or their habitats, the development proposal needs to be referred to the Department of the Environment, Water, Heritage and the Arts for assessment under the EPBC Act (1999).

1.4 Development Proposal

The Concept Plan proposes a seniors living resort development on six parcels of land located at Frenchs Forest, within the Warringah Local Government Area. The Seniors Living development is made up of several components including a nursing home facility, serviced apartments, self care dwellings, community and retail facilities and 24 hour, seven days a week access to medical attention through the provision of on site doctor.

- The Seniors Living Resort will provide three levels of care within a number of types of buildings with ancillary facilities that overall will comprise:
- A three storey nursing home facility containing 60 beds, with a high level of care
- 391 self care dwellings contained within a mixture of three and four storey apartment buildings and six two storey townhouse buildings on site.
- 100 Serviced apartments (low level care) within two four storey buildings
- Two access entry and exit points off Oxford Falls Road. No through site access to the western residential areas off Barnes Road is proposed, only emergency access and access for the two existing residential properties will be maintained.
- Amenities and facilities such as a swimming pool, gymnasium and communal areas are proposed within the basement and ground floor of the serviced apartment building.
- Two existing residences on the western portion of the site will be retained for residential purposes.
- The existing tennis academy building on the northern portion of the site will be retained for amenities, office facilities and short term accommodation.
- A bowling green will be located to the north of the site.
- Car parking spaces for residents, staff and visitors located within single level basement car parks with limited visitor parking at street level;
- A comprehensive landscaping scheme including water features to create an accessible, tranquil and natural environment setting;
- Realignment and rehabilitation of the eastern tributary and creation of a natural wetland;
- 24 hour, seven days a week provision of medical facilities.

The Concept Plan seeks approval for the proposed uses, building envelopes and yield to facilitate the proposed development. The detailed design, including resolved elevations and internal layout will be provided within the Project Application.

History of Site

On 26 October 2006 a Concept Plan and Environmental Assessment were lodged with the Department of Planning. This Concept Plan proposed a Seniors Living development comprising:

- A residential care facility with 94 beds, associated amenities, staff facilities and 25 car parking spaces
- 78 one bedroom serviced self care apartments with communal facilities and 25 car parking spaces
- 400 two bedroom and 200 one bedroom self contained dwelling apartments; and
- Ancillary support services including a resident doctor and nursing staff, amenities, pharmacy, office facilities, overnight accommodation, mini market, lounges, libraries, games room, swimming pools, tennis courts, gymnasium, bicycle and walking routes, caretakers and mini bus service.

Further information was requested on two separate occasions by the Department of Planning. Subsequently in May 2007, Urbis became involved with the project to review the scheme and provide advice. A new Concept Plan was developed and discussed with the

Department of Planning on 25 February 2008 and 15 April 2008, were it was agreed that the Concept Plan should be finalised and officially lodged.

Subject Site Legal Description

The subject site consists of six parcels of land, totalling an area of approximately 13.6 hectares. The site is legally described as follows:

- Lot 1110 in Deposited Plan 752088
- Lot 1111 in Deposited Plan 752038
- Lot 1113 in Deposited Plan 752038
- Lot 1336 in Deposited Plan 752038
- Lot 20 in Deposited Plan 842523
- Lot 80 in Deposited Plan 846099

Figure 1 shows surrounding vegetation connectivity whilst Figure 2 shows the proposed development.

1.5 Site Description

The planning and cadastral details of the subject site are provided in Table 1.1 while Table 1.2 summarises the geographical characteristics of the site.

Table 1.1 - Site Details

Location	Lots 1110, 1111, 1113 & 1336 DP 752038, Lot 20 DP 842523 and Lot 80 DP 846099 Oxford Falls Road and Barnes Road, Oxford Falls
Description of Location	Situated on the south-western side of Oxford Falls Road and is dissected by Barnes Road. The subject site has frontage to Oxford Falls Road of approximately 390 metres and to Barnes Road of approximately 370 metres.
Area	approximately 13.6 hectares
Topographic Map	Hornsby 1:25000
Grid Reference	337700E and 6264700N
Local Government Area	Warringah Council
Existing Land Use	Six residences and associated outbuildings, and a tennis academy / resort have been erected within the subject site;
Proposed Development	Seniors Living Development

Table 1.2 - Site Characteristics

Elevation	Approximately 78-114m AHD
Topography	Situated on flat to undulating land, Gradients are generally 0-15%, with steeper grades, up to approximately 90% in the west.
Earthworks	No major earthworks have been conducted within the subject site, although some earthworks have been undertaken in conjunction with erection of buildings and modification of the watercourse
Introduced Weeds	The cleared areas of the subject site are dominated by exotic species, while moderate to severe incursions of weeds have occurred within the bushland remnants
Evidence of Feral or Domestic fauna	European red fox, cat, dog and rabbit.

Legend

Subject Site Boundary

100 0 100 200 300 metres

Scale 1:8,000

N

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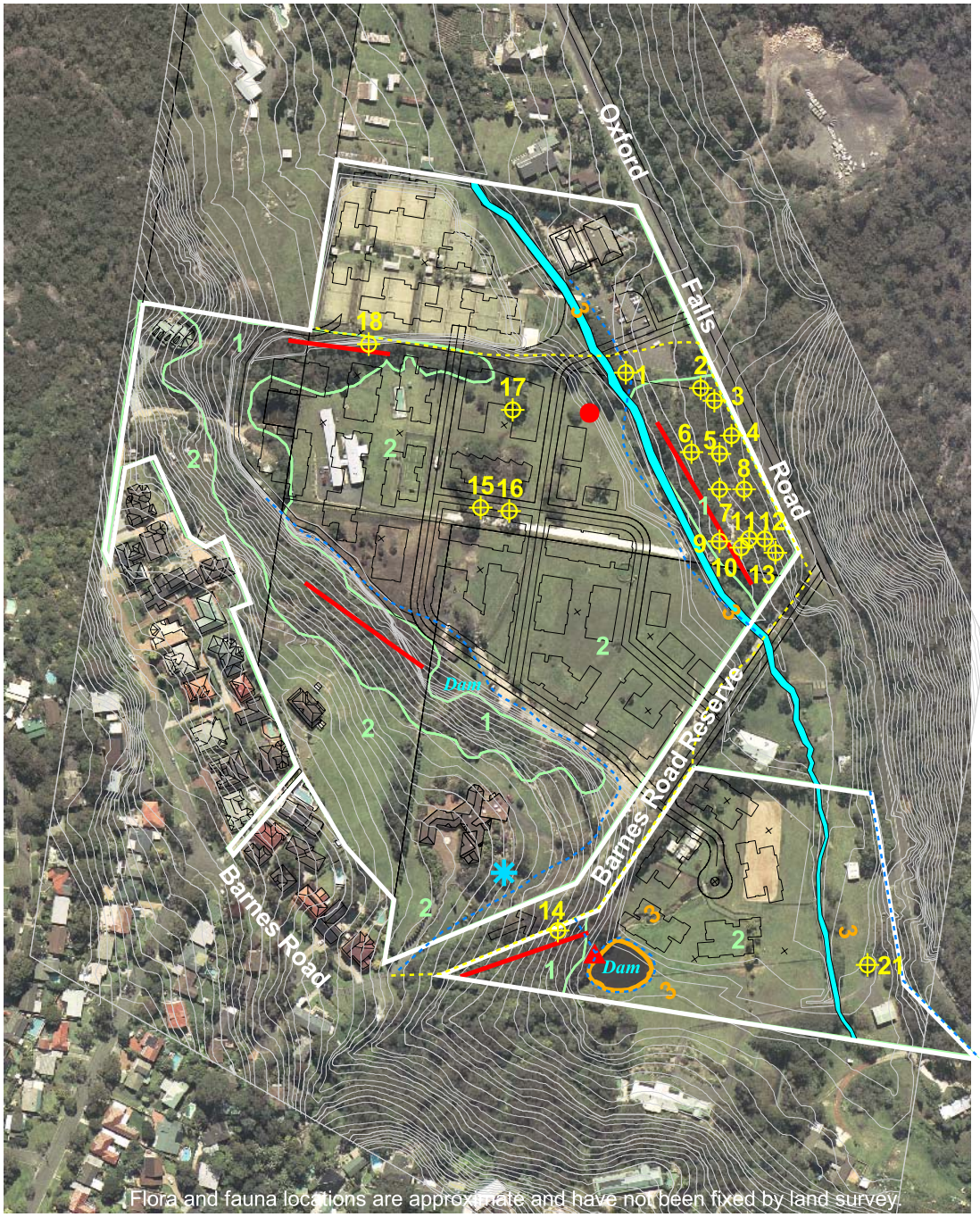
Figure 1 -
Study Site Location and Vegetation Connectivity
Oxford Falls

Fig. 1
10/09/08
Ref.No.5163/3166

Source: CAD by GA Architects International Pty. Ltd.



Legend

- *Subject Site Boundary
- Grey-headed Flying-fox
- Vegetation Community Boundary
- 1 Sandstone Woodland
- 2 Exotic Grassland with Scattered Trees
- 3 Aquatic Herbfield approx. 1metre wide
- Aquatic Herbfield
- 1 Habitat Tree
- Fauna Trapline
- Spotlight & Mobile Anabat Transect
- Anabat Station
- Nocturnal Call Playback Station

50 0 50 100 150 metres

N

Original plan produced in A4 colour

Scale 1:4,000

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Figure 2 -
Proposed Development, Vegetation Communities, Flora & Fauna Survey & Threatened Species Locations
Oxford Falls

Fig. 2
28/10/08
Ref.No.8054

Source: Orthophoto & CAD supplied by JMD Development Consultants

2 SURVEY TECHNIQUES

2.1 Background

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, has been used to overcome this survey limitation.

2.2 Survey Techniques

To determine the likely and actual occurrence of flora species, fauna species and plant communities on the subject site a variety of assessments were undertaken to supplement previous surveys of the area and literature reviews. The methods utilised included:

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

- ***Data Search*** - A search of the Atlas of NSW Wildlife (DECC, 2008) was undertaken to identify records of threatened flora & fauna species located within a 10km radius of the site. Those species were then assessed for potential habitat within the subject site.

- ***Aerial Photograph Interpretation*** - Aerial photographs at 1:25,000 scale were utilised to identify the extent of vegetation with respect to the site and surrounding areas.

- ***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 are sent to Barbara Triggs for identification. Invertebrates are sent to Michael Shea of the Malacology Section at the Australian Museum.

2.3 Fauna Survey Methodology

2.3.1 Diurnal Birds

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

Opportunistic bird counts are also made while undertaking other survey work and during spotlight surveys of the site.

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 is recorded and identified using reference libraries.

Approximately thirteen (13) hours of opportunistic survey was conducted for diurnal bird census (Table 2.1).

2.3.2 Nocturnal Birds

Nocturnal birds were surveyed using the formal census methodology outlined in the Flora and Fauna survey guidelines: Lower Hunter Central Coast Region (Murray *et al* 2002). Nocturnal surveys were conducted on the nights of the 12 and 15 January 2004.

Masked Owls (*Tyto novaehollandiae*), Powerful Owls (*Ninox strenua*), Sooty Owls (*Tyto tenebricosa*) and Barking Owls (*Ninox connivens*) were targeted by broadcasting taped calls through a 15 watt Toa 'Faunatech' amplifier.

Each of the four species calls were broadcast for three (3) minute periods with three (3) minute intervals between each for approximately thirty (30) minutes. Each interval consisted of quiet listening and stationary spotlighting. This was followed by 20 minutes of quiet listening and roving spotlighting.

Survey effort and weather conditions are outlined in detail in Table 2.1.

2.3.3 Arboreal and Terrestrial Mammals

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 10-20 metre 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 2-3 m above the ground at an incline of 10 degrees to facilitate drainage during inclement weather. A mixture of honey and water was then sprayed onto the trunk 3-5 metres above the trap and around the platform as a lure.

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

Five (5) trap-lines were set on the nights of January 12th, 13th, 14th and 15th, 2004. The location of the trap-lines is shown in Figure 2. Each trap-line consisted of 5 type A arboreal traps, 3 type B terrestrial traps and 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 standard cage traps used are 18cm x 18cm by 45cm long.

Ten (10) cage traps were set on the nights of January 12th, 13th, 14th and 15th, 2004. Cage trapping consisted of a total of 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.

Assessment was made of 'found' scats, markings, diggings, runways and scratches during visits to the site. Habitat was also assessed to determine the likelihood of threatened native species of fauna occurring within the subject site.

Spotlighting for nocturnal mammalian fauna was carried out using a hand held lamp of 750,000 candlelight power (100W halogen globe). This technique involved walking amongst the woodland areas of the subject site so that a maximum number of trees could be observed.

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

i. A search of the Atlas of NSW Wildlife (DEC 2006) database.

ii. The site was surveyed on foot, with Koala food trees being inspected for signs of Koala usage. Trees were inspected and identified for the presence of Koalas, 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 were calculated. Additionally the location and density of droppings if found were documented.

iii. Koalas were also targeted during spotlight surveys.

iv. Identification and an assessment of the density of tree species listed as Koala feed trees in State Environmental Planning Policy No. 44 - Koala Habitat Protection was undertaken across the site. An estimate of the percentage density of each tree species across the site was determined by averaging the percentage of stems counted.

Survey effort and weather conditions are outlined in detail in Table 2.1.

2.3.4 Bats

Micro-chiropteran bats were surveyed by echolocation using an Anabat Mk 2 detector in both roving and stationary positions throughout the entire subject site.

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

The location of Anabat survey is depicted in Figure 2.

2.3.5 Amphibians

Amphibians were surveyed by vocal call identification, by using a tape recorder to record male calls in suitable places and then comparing these to known calls. Amphibians specifically targeted included: Giant Burrowing Frogs, Green & Golden Bell Frogs and Red-Crowned toadlets.

Amphibians were also surveyed by habitat searches.

Any amphibians found are visually identified and when required to be examined are handled with Latex gloves and kept moist until release.

2.3.6 Reptiles

Searches for reptiles in likely localities such as under logs, rubbish debris, and in deep leaf litter were carried out during diurnal visits to the site.

Spotlighting of terrestrial habitats suitable for reptiles occurred during nocturnal surveys.

Field Survey Method

Flora: flora survey methodology was adopted from the Flora and Fauna survey guidelines: Lower Hunter Central Coast Region (Murray *et al* 2002) and was undertaken by one (1) botanist on the 8 January 2004.

Each of the identified vegetation communities were assessed using 20 x 20 metre quadrats and 10 x 40 metre 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 subject site.

The flora survey targeted all vegetation communities present within the subject site. The location of the vegetation communities is presented in Figure 2.

Fauna: fauna survey dates, times, weather conditions and methods employed are shown in Table 2.1. The location of fauna survey is presented in Figure 2.

Table 2.1 – Fauna Survey Methodology and Dates

Fauna Group	Date	Weather Conditions	Survey Method	Survey Effort / Time (24hr)
Diurnal Birds	12/01/04	8/8 cloud, no wind, temp 26°C, no rain	Diurnal Opportunistic	3hr 45 mins 12.45-16.30
	13/01/04	2/8 cloud, no wind, temp 21°C	Diurnal Opportunistic	4 hr 50 mins 07.30-12.20
	14/01/04	5/8 cloud, no wind, temp 22°C	Diurnal Opportunistic	1 hr 30 mins 07.30-09.00
	15/01/04	8/8 cloud, no wind, temp 20°C, no rain	Diurnal Opportunistic	1 hr 30 mins 07.30-09.00
	16/01/04	8/8 cloud, no wind, temp 18°C, light rain	Diurnal Opportunistic	1 hr 50 mins 07.40-09.30
Nocturnal Birds	12/01/04	5/8 cloud, no wind, temp 22°C	Owl call playback	50 mins 20.45 – 21.35
	15/01/04	1/8 cloud, no wind, temp 19°C	Owl call playback	50 mins 20.40 – 21.30
Arboreal Mammals	12/01/04	5/8 cloud, no wind, temp 22°C	Spotlighting	55 mins 20.45 – 21.40
	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	1 hr 08.40 - 09.40
	15/01/04	8/8 cloud, no wind, temp 18°C,	Elliott trapping	25 trap nights
Terrestrial Mammals	12/01/04	5/8 cloud, no wind, temp 22°C	Spotlighting	55 mins 20.45 – 21.40
	12/01/04	2/8 cloud, no wind, temp 21°C	Elliott / cage trapping	25 Elliott, 10 cage trap nights
	13/01/04	5/8 cloud, no wind, temp 22°C, scattered showers	Elliott / cage trapping	25 Elliott, 10 cage trap nights
	14/01/04	8/8 cloud, no wind, temp 20°C, scattered showers	Elliott / cage trapping	25 Elliott, 10 cage trap nights
	15/01/04	1/8 cloud, no wind, temp 19°C	Spotlighting	1 hr 08.40 - 09.40
	15/01/04	8/8 cloud, no wind, temp 18°C,	Elliott / cage trapping	25 Elliott, 10 cage trap nights
Bats	12/01/04	5/8 cloud, no wind, temp 22°C	Anabat II	1 hr 25 mins 20.15 - 21.40
	15/01/04	1/8 cloud, no wind, temp 19°C	Anabat II	1 hr 20 mins 20.20 - 21.40
Reptiles	12/01/04	5/8 cloud, no wind, temp 22°C	Spotlighting	55 mins 20.45 – 21.40
	13/01/04	2/8 cloud, light SE wind, temp 26°C	Habitat search	3 hrs 20 mins 09.00 – 12.20
	15/01/04	1/8 cloud, no wind, temp 19°C	Spotlighting	1 hr 08.40 - 09.40
Amphibians	12/01/04	5/8 cloud, no wind, temp 22°C	Spotlighting + call detection	55 mins 20.45 – 21.40
	13/01/04	2/8 cloud, light SE wind, temp 26°C	Habitat search + passive Red Crowned Toadlet Survey	3 hrs 20 mins 09.00 – 12.20
	15/01/04	1/8 cloud, no wind, temp 19°C	Spotlighting + call detection	1 hr 08.40 - 09.40

3 SURVEY RESULTS

3.1 Flora Results

Three (3) vegetation communities were identified within the subject site through aerial photographic interpretations and extensive ground truthing. The location of the vegetation communities is presented in Figure 2.

- Sandstone Woodland
- Exotic grassland with Scattered Trees
- Aquatic Herbfield

Vegetation Community 1 –Sandstone Woodland:

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

Structure - Woodland with a canopy cover of approximately 15-30% and height of approximately 10-20 metres. The understorey consists of a variable, but generally moderate shrublayer to 4 metres high and sparse to moderate groundcover of herbs, ferns and grasses.

Disturbances - This vegetation community has been disturbed by the construction of access roads and moderate to severe incursions of weeds.

Common Species

Trees: *Eucalyptus piperita* (Sydney Peppermint), *Angophora costata* (Sydney Red Gum) 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* (Yellow Tea Tree), *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), *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) and *Plantago lanceolata* (Ribwort).

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 Sandstone Woodland.

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* (Sydney Red Gum), *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 albida* (Tall Fleabane), *Euphorbia peplus*, *Gamochaeta americana* (Cudweed), *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).

Vegetation Community 3 – Aquatic Herbfield:

Occurrence - This vegetation community occurs along the tributary of Middle Creek and on the edge of the farm dam in Lot 1336.

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

Disturbances - This community has been disturbed by modification of sections of the watercourse 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), *Colocasia esculenta* (Taro), *Cyperus eragrostis* (Umbrella Sedge), *Hydrocotyle bonariensis* (Pennywort), *Ludwigia peruviana*, *Ranunculus repens* (Creeping Buttercup), *Salix sp.* (Willow) and *Tradescantia fluminensis* (Wandering Jew).

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

Table 3.1 - Flora Observations for the Subject Site

Scientific Name	Common Name	Family	Community
Trees			
Allocasuarina torulosa	Forest Oak	Casuarinaceae	2
Angophora costata	Sydney Red Gum	Myrtaceae	1c 2
Casuarina cunninghamiana	Swamp Oak	Casuarinaceae	2
Casuarina glauca	Swamp Oak	Casuarinaceae	2
Corymbia gummifera	Red Bloodwood	Myrtaceae	1
Corymbia maculata	Spotted Gum	Myrtaceae	2
Eucalyptus deanei	Round-leaved Gum	Myrtaceae	1 2
Eucalyptus haemastoma	Scribbly Gum	Myrtaceae	1
Eucalyptus paniculata	Grey Ironbark	Myrtaceae	2
Eucalyptus piperita	Sydney Peppermint	Myrtaceae	1c 2
Eucalyptus punctata	Grey Gum	Myrtaceae	1
Eucalyptus sieberi	Silvertop Ash	Myrtaceae	1
Shrubs			
Acacia decurrens	Black Wattle	Mimosoideae	1
Acacia floribunda	Sally Wattle	Mimosoideae	2
Acacia linifolia	Flax Wattle	Mimosoideae	1
Acacia longifolia	Sydney Golden Wattle	Mimosoideae	1 2
Acacia parramattensis	Sydney Green Wattle	Mimosoideae	1 2
Acacia stricta	-	Mimosoideae	1
Acacia suaveolens	Sweet Scented Wattle	Mimosoideae	1
Acacia terminalis	Sunshine Wattle	Mimosoideae	1
Allocasuarina littoralis	Black She-oak	Casuarinaceae	1
Banksia ericifolia	Heath-leaved Banksia	Proteaceae	1
Banksia integrifolia	Honeysuckle	Proteaceae	1
Banksia oblongifolia	-	Proteaceae	1
Banksia serrata	Old Man Banksia	Proteaceae	1 2
Banksia spinulosa	Hairpin Banksia	Proteaceae	1
Bossiaea heterophylla	-	Faboideae	1
Bossiaea scolopendria	-	Faboideae	1
Callicoma serratifolia	Black Wattle	Cunoniaceae	1
Callistemon citrinus	Crimson Bottlebrush	Myrtaceae	2
Calochilus gracillimus	Beared Orchid	Orchidaceae	1
Ceratopetalum gummiferum	Christmas Bush	Cunoniaceae	1 2
Dillwynia retorta	Eggs and Bacon	Faboideae	1
Dodonaea triquetra	Hop Bush	Sapindaceae	1
Elaeocarpus reticulatus	Blueberry Ash	Elaeocarpaceae	1c
Epacris crassifolia	-	Epacridaceae	1
Epacris microphylla	Coral Heath	Epacridaceae	1
Eriostemon australasius	Pink Wax Plant	Rutaceae	1
Grevillea buxifolia	Grey Spider Flower	Proteaceae	1
Grevillea speciosa	Red Spider Flower	Proteaceae	1 2
Hakea sericea	Silky Hakea	Proteaceae	1
Hibbertia aspera	-	Dilleniaceae	1
Hibbertia bracteata	-	Dilleniaceae	1
Hibbertia empetrifolia	-	Dilleniaceae	1
Kunzea ambigua	Tick Bush	Myrtaceae	1 2
Lambertia formosa	Mountain Devil	Proteaceae	1
Lasiopetalum ferrugineum	Rusty Velvet-bush	Sterculiaceae	1
Leptospermum polygalifolium	Yellow Tea Tree	Myrtaceae	1
Melaleuca quinquenervia	Broad-leaved Tea Tree	Myrtaceae	2
Melaleuca styphelioides	Prickly-leaved Tea Tree	Myrtaceae	1 2
Micrantheum ericoides		Euphorbiaceae	1

Table 3.1 - Flora Observations for the Subject Site

Omalanthus populifolius	Bleeding Heart	Euphorbiaceae	1 2
Ozothamnus diosmifolius	Ball Everlasting	Asteraceae	1
Persoonia lanceolata	Lance-leaved Geebung	Proteaceae	1
Persoonia levis	Broad-leaved Geebung	Proteaceae	1
Persoonia pinifolia	Pine-leaved Geebung	Proteaceae	1
Phyllanthus hirtellus	Thyme Spurge	Euphorbiaceae	1
Pittosporum undulatum	Sweet Pittosporum	Pittosporaceae	1 2
Platylobium formosum	Handsome Flat-pea	Faboideae	1c
Platysace linearifolia	Narrow-leafed Platysace	Apiaceae	1
Pultenaea retusa	-	Faboideae	1
Pultenaea stipularis	-	Faboideae	1
Viminaria juncea	Native Broom	Faboideae	2
Woollsia pungens	Woolsia	Epacridaceae	1
Zieria laevigata	-	Rutaceae	1
Vines			
Billardiera scandens	Apple Dumplings	Pittosporaceae	1
Cassytha pubescens	Devil's Twine	Lauraceae	1
Smilax glyciphylla	Sarsparilla	Smilacaceae	1c
Herbs			
Actinotus helianthi	Flannel Flower	Apiaceae	1
Austrodanthonia sp.	Wallaby Grass	Poaceae	1
Austrostipa pubescens	Tall Spear Grass	Poaceae	1
Caustis flexuosa	Curly Sedge	Cyperaceae	1
Centella asiatica	Swamp Pennywort	Apiaceae	1 2
Commelina cyanea	Scurvy Weed	Commelinaceae	2
Cryptostylis erecta	Bonnet Orchid	Orchidaceae	1c
Cyathochaeta diandra	-	Cyperaceae	1
Cynodon dactylon	Common Couch	Poaceae	2
Dianella caerulea	Flax Lily	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
Entolasia marginata	Bordered Panic	Poaceae	1 2
Entolasia stricta	Wiry Panic	Poaceae	1
Eragrostis brownii	Brown's Lovegrass	Poaceae	1
Gahnia clarkei	Saw Sedge	Cyperaceae	1
Gonocarpus micranthus	Creeping Raspwort	Haloragaceae	2
Gonocarpus teucroides	Raspwort	Haloragaceae	1 2
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
Lepidosperma laterale	Variable Sword-sedge	Cyperaceae	1
Lepyrodia scariosa	-	Restionaceae	1
Lomandra longifolia	Spiky-headed Mat-rush	Lomandraceae	1
Lomatia silaifolia	Crinkle Bush	Proteaceae	1

Table 3.1 - Flora Observations for the Subject Site

Lythrum hyssopifolia	Hyssop's Loosestrife	Lythraceae	2 3
Microlaena stipoides	Weeping Grass	Poaceae	2
Mitrasacme polymorpha	Mitrewort	Loganiaceae	2
Panicum bisulcatum	Blackseed Panic	Poaceae	3
Patersonia sericea	Wild Iris	Iridaceae	1
Persicaria hydropiper	Water Pepper	Polygonaceae	3
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
Xanthosia pilosa	-	Apiaceae	1c
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
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	1c 2
Selaginella uliginosa	Swamp Selaginella	Selaginellaceae	1
Sticherus urceolatus	-	Gleicheniaceae	1
Todea barbara	King Fern	Osmundaceae	1
-	Exotic Palm	Arecaceae	2
Acacia excelsa	Ironwood	Mimosoideae	1
Acacia saligna	Golden Wreath Wattle	Mimosoideae	1 2
Acetosa sagittata	Turkey Rhubarb	Polygonaceae	1 2
Agapanthus praecox	Agapanthus	Amaryllidaceae	2
Ageratina adenophora	Crofton Weed	Asteraceae	1 2 3
Ageratum houstonianum	Mist Flower	Asteraceae	1 2
Amaranthus spinosus	Needle Burr	Amaranthaceae	1
Anagalis arvensis	Pimpernel	Primunlaceae	1 2
Andropogon virginicus	Whisky Grass	Poaceae	1 2
Araucaria heterophylla	Norfolk Island Pine	Araucariaceae	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
Centaurium erythraea	Pink Stars	Gentianaceae	1 2
Centaurium tenuiflorum	-	Gentianaceae	2
Cestrum parqui	Chilean Cestrum	Solanaceae	2
Cinnamomum camphora	Camphor Laurel	Lauraceae	1 2
Cirsium vulgare	Spear Thistle	Asteraceae	1 2

Table 3.1 - Flora Observations for the Subject Site

Citrus limonia	Bush Lemon	Rutaceae	2
Colocasia esculenta	Taro	Araceae	3
Conyza albida	Tall Fleabane	Asteraceae	1 2
Coreopsis lanceolata	Coreopsis	Asteraceae	1 2
Cortaderia selloana	Pampas Grass	Poaceae	1 2
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	Faboideae	2 3
Erythrina X sykesii	Coral Tree	Faboideae	2
Eucalyptus microcorys#	Tallowwood	Myrtaceae	2
Eucalyptus scoparia	Willow Gum	Myrtaceae	2
Euphorbia peplus	-	Euphorbiaceae	1 2
Ficus pumila	Creeping Fig	Moraceae	1
Fumaria muralis	Wall Fumitory	Fumariaceae	2
Gamochaeta americana	Cudweed	Asteraceae	1 2
Gamochaeta spicata	Cudweed	Asteraceae	1 2
Harpephyllum caffrum	Kaffir Plum	-	2
Hedychium gardnerianum	Ginger Lily	Anthericaceae	1 2
Hydrocotyle bonariensis	Pennywort	Apiaceae	2 3
Hypochaeris radicata	Flatweed	Asteraceae	1 2
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
Lilium formosanum	-	Liliaceae	1
Lonicera japonica	Honeysuckle	Caprifoliaceae	1 2
Lotus suaveolens	Hairy Birds-foot Trefoil	Faboideae	2
Ludwigia peruviana	-	Onagraceae	3
Melaleuca armillaris		Myrtaceae	1 2
Modiola caroliniana	Red-flowered Mallow	Malvaceae	2
Monstera deliciosa	-	Araceae	2
Musa acuminata	Banana	-	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
Populus alba	White Poplar	Salicaceae	2
Populus nigra	Lombardy Poplar	Salicaceae	1 2
Protasparagus aetheopicus	Asparagus Fern	Asparagaceae	1 2

Table 3.1 - Flora Observations for the Subject Site

Ranunculus repens	Creeping Buttercup	Ranunculaceae	1 2 3
Ricinis communis	Castor Oil Plant	Euphorbiaceae	1 2
Robinia pseudoacacia	Black Locust	Faboideae	2
Rubus ulmifolius	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	-	1 2
Senecio madagascariensis	Fireweed	Asteraceae	1 2 3
Senna pendula	Cassia	Caesalpinioideae	1 2 3
Setaria gracilis	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
Tibouchina sp.	-	Melastomataceae	2
Toxicodendron succedanium	Rhus Tree	Anacardiaceae	1
Tradescantia fluminensis	Wandering Jew	Commelinaceae	2 3
Trifolium dubium	Yellow Suckling Clover	Faboideae	1 2
Trifolium fragiferum	Strawberry Clover	Faboideae	2
Trifolium repens	White Clover	Faboideae	1 2
Verbascum virgatum	Twiggy mullein	Scrophulariaceae	2
Verbena bonariensis	Purple Top	Verbenaceae	1 2 3
Verbena brasiliensis	Flaxleaf Fleabane	Verbenaceae	1 2
Zantedeschia aethiopica	Arum Lily	Araceae	2
# denotes species native to Australia but exotic within the locality.			

3.1.1 Endangered Ecological Communities

The following endangered ecological communities have been observed within the general locality of the subject site: Duffys Forest Ecological Community, Eastern Suburbs Banksia Scrub, Pittwater Spotted Gum Forest, Sydney Coastal Estuary Swamp Forest Complex and Sydney Freshwater Wetlands.

Duffys Forest Ecological Community is confined to specific areas of the Ku-ring-gai Plateau, with lateritic soils. Lateritic soils were not observed within the subject site.

Eastern Suburbs Banksia Scrub, Sydney Coastal Estuary Swamp Forest Complex and Sydney Freshwater Wetlands are confined to various types of Quaternary alluvium, which do not occur within the subject site.

Pittwater Spotted Gum Forest is confined to the Narrabeen shales which do not occur within the subject site.

3.2 Fauna Results

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		
Australasian Grebe	*Tachybaptus novaehollandiae*	O
Australian Magpie	*Gymnorhina tibicen*	O C
Australian Magpie-Lark	*Grallina cyanoleuca*	O C
Australian Raven	*Corvus coronoides*	O C
Australian Wood Duck	*Chenonetta jubata*	O C
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	O C
Common Koel	*Eudynamys scolopacea*	O C
Common Myna *	*Acridotheres tristis*	O
Common Starling *	*Sturnus vulgaris*	O C
Crested Pigeon	*Ocyphaps lophotes*	O C
Dollarbird	*Eurystomus orientalis*	O
Dusky Moorhen	*Gallinula tenebrosa*	O
Eastern Rosella	*Platycercus eximius*	O C
Eastern Spinebill	*Acanthorhynchus tenuirostris*	O
Eastern Whipbird	*Psophodes olivaceus*	C
Fan Tailed Cuckoo	*Cuculus flabelliformis*	C
Galah	*Cacatua roseicapilla*	O C
Grey Butcherbird	*Cracticus torquatus*	O C
Laughing Kookaburra	*Dacelo novaeguineae*	O C
Little Pied Cormorant	*Phalacrocorax melanoleucos*	O
Masked Lapwing	*Vanellus miles*	O C
New Holland Honeyeater	*Phylidonyris novaehollandiae*	O
Noisy Miner	*Manorina melanocephala*	O C
Pacific Black Duck	*Anas supercilliosa*	O
Pied Currawong	*Strepera graculina*	O C
Rainbow Lorikeet	*Trichoglossus haematodus*	O C
Red Wattle Bird	*Anthochaera carunculata*	O C
Red-whiskered Bulbul*	*Pycnocotus jucosus*	O C
Sacred Kingfisher	*Todiramphus sanctums*	O C
Silvereye	*Zosterops lateralis*	O C
Spotted Turtle-dove *	*Streptopelia chinensis*	O
Sulphur Crested Cockatoo	*Cacatua galerita*	O C
Superb Fairy-wren	*Malurus cyaneus*	O C
Welcome Swallow	*Hirundo neoxena*	O
Willie Wagtail	*Rhipidura leucophrys*	O C
Yellow-tailed Black-cockatoo	*Calyptorhynchus funereus*	C
Mammals		
Brown Antechinus	*Antechinus stuartii*	E
Common Ringtail Possum	*Pseudocheirus peregrinus*	Sp
Grey-Headed Flying-fox [v]	*Pteropus poliocephalus*	Sp
Common Brushtail Possum	*Trichosurus vulpecula*	E Sp
Long-nosed Bandicoot	*Parameles nasuta*	E Ca
Gould's Wattled Bat	*Chalinolobus gouldii*	A
Little Forest Bat	*Vespadelus vulturnus*	A
House Mouse *	*Mus musculus*	E
Rabbit *	*Oryctolagus cuniculus*	O Sc
Black Rat *	*Rattus rattus*	E
Dog *	*Canis familiaris*	**O**
Horse *	*Equus caballus*	**O Sc**
Reptiles		
Eastern Water Skink	*Eulamprus quoyii*	E O
Garden Skink	*Lampropholis guichenoti*	E O

Table 3.2 Fauna Observations for the Study Area

Eastern Water Dragon	*Physignathus lesueurii*	Ca O
Eastern Blue Tongue	*Tiliqua scincoides*	Ca O
Amphibians		
Striped Marsh Frog	*Limnodynastes peronii*	C
Perons Tree Frog	*Litoria peronii*	C

Note: * indicates introduced species
v indicates vulnerable species

A	-	Anabat II	C	-	Call Identification
O	-	Observation	P	-	Call Playback Response
E	-	Elliott Trap	S	-	Habitat Search
Sp	-	Spotlight	Sc	-	Scat, Track or Sign Identification
Ca	-	Cage trap			

3.3 Vegetation Connectivity

'Address corridor values or connective importance of any vegetation on the subject land; the possible loss of connectivity to bushland areas to the south, east and west, impacts on adjoining and nearby bushland areas'.

The subject site is bound to the north-west and north by rural residential land, to the east and north-east by natural vegetation and to the south by residential land. Natural vegetation adjoining the subject site to the north-east includes recreation reserves which extend to the north along Wakehurst Parkway which eventually joins to the Garigal National Park.

Natural vegetation adjoining the subject site to the west forms a vegetation corridor along Wakehurst Parkway to the south-west. This corridor extends to the south across Frenchs Forest Road and Warringah Road into an extensive area of natural vegetation including Manly Dam Reserve and Garigal National Park. Figure 1 shows surrounding vegetation connectivity.

The subject site contains two vegetation corridors. The main corridor trends north-west, south-east through the subject site adjacent to the Middle Creek Tributary. This vegetation is to be maintained and enhanced in accordance with the requirements of the Waterway Impact Study (Travers environmental 2008). This will ensure the vegetative connectivity importance of this vegetation is maintained.

The vegetation corridor along the southern side of the tennis court consists of an exotic and native planted landscape mix with mown grass groundcover. As this corridor is in an artificial state it is not currently considered to form a significant vegetation corridor for the movement of fauna species. However, the revegetation of this corridor in accordance with the Waterway Impact Study (Travers environmental 2008) will maintain and further enhance the connective importance of this corridor to surrounding vegetation.

With the implementation of corridor protection and enhancement in accordance with the requirements of the Waterway Impact Study (Travers environmental 2008), there will be no loss of connectivity to bushland areas to the south, east and west. The connectivity will in fact be enhanced.

The retained and enhanced connectivity will mitigate any potential impacts on adjoining and nearby bushland areas.

3.4 Habitat

The three (3) vegetation communities present within the subject site provide a variety of habitats. The habitat attributes of each vegetation community are described below.

3.4.1 Habitat Types

A range of fauna habitats is present throughout the subject site and includes:

- Vegetated areas of Woodland;
- Dense shrublayer;
- Dense ground cover of herbs and grasses;
- Areas ground cover dominated by Lantana and other exotic species;
- Nectar producing plants, principally *Banksia* and *Acacia;*
- Sap flows, particularly on Sydney Red Gum and Red Bloodwood trees;
- Small (<10cm) to medium (10-30cm) sized tree hollows;
- Fallen timber and hollow logs;
- Loose soil suitable for burrowing;
- Rock ledges and caves;
- Cliff lines;
- Sparse to moderate litter layer;
- Aquatic Habitats characterised by farm dams and ephemeral drainage lines; and
- Occasional rubbish debris (corrugated iron sheets, building refuse);

Vegetation Community 1 - Sandstone Woodland occurs in a number of sections of the subject site, being areas that do not contain arable soil. This community is dominated by the November to December flowering *Eucalyptus piperita* (Sydney peppermint) and *Angophora costata* (Sydney Red Gum), and the January to April flowering *Corymbia gummifera* (Red Bloodwood). This provides foraging habitat for birds, bats and arboreal mammals. Fourteen (14) hollow bearing trees/habitat trees (Figure 2), were observed within this vegetation community. These contained small (<10cm) to medium (10 - 30cm) sized hollows, which provide potential roosting and nesting habitat for small birds, micro-chiropteran bats, small arboreal mammals and some arboreal reptile 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.

Vegetation community 2 - Exotic Grassland with Scattered Trees, occurs in the sections of the subject site with arable soil. This community is dominated by a variety of flowering trees in which provide foraging habitat for birds, bats and arboreal mammals. Seven (7) hollow bearing trees/habitat trees (Figure 2), were observed within this vegetation community. These contained small (<10cm) to medium (10 - 30cm) sized hollows, which provide potential roosting and nesting habitat for small birds, micro-chiropteran bats, small arboreal mammals and some arboreal reptile species. Scattered areas of sparse shrublayer provides limited protective and foraging habitat for birds, arboreal mammals and terrestrial mammal species. A dense groundcover of herbs and grasses as well as tree litter provides limited habitat for small terrestrial mammals, reptiles and amphibians.

Vegetation community 3 - Aquatic Herbfield occurs along the tributary of Middle Creek and on the edge of the farm dam in Lot 1336. This community is characterised by a moderate to dense herbfield to a height of 1-2 metres 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. Small bodies of water within this vegetation community provide suitable breeding habitat for amphibian species.

3.4.2 SEPP 44 Koala Habitat Protection

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

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.

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 1 hectare, hence Part 2 – Development Control of Koala Habitats, of the Policy applies.

Step 1 – Is the land PKH*?*

Two Koala food tree species (*Eucalyptus punctata* and *Eucalyptus haemastoma*) listed on Schedule 2 of State Environmental Planning Policy No. 44 - Koala Habitat Protection, were observed within the subject site. These two species made up approximately 5% of trees within vegetation community 1 – Sandstone Woodland. This is less than the 15% indicated by SEPP 44, therefore the subject site is not considered to be PKH.

Step 2 – Is the land CKH*?*

No Koalas were directly observed at the time of fauna survey, which included diurnal searches of trees and spotlighting. In addition, there was no secondary evidence of Koala habitation in the area. Searches for secondary indications of Koalas included, observations for scratchings on trees and scats beneath trees.

A search of the Atlas of NSW Wildlife (DEC 2006) database found eight (8) records of Koala habitation within a 10 km radius of the subject site. The record closest to the subject site was approximately 1.4 km to the south-west in 1994. The most recent record within 5 km was in 1997, 2.2 km to the north-west. It is therefore considered that the subject site does not comprise CKH and as such no further matters relevant to this Policy apply.

4 7-PART TEST OF SIGNIFICANCE

The Department is required to consider the impact upon threatened species, populations and or endangered ecological communities from any development or activity via the process of a 7 part test of significance under section 5 of the EP7A Act (1979). The significance of the assessment is then used to determine the need for a more detailed Species Impact Statement (SIS).

The following 7 part test of significance relies on the ecological assessment provided in Sections 3 & 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**
- *Caladenia tessellata*
- *Epacris purpurascens var, purpurascens*
- *Eucalyptus camfieldii*
- *Grevillea caleyi**
- *Melaleuca deanei*
- *Pimelea curviflora var, curviflora*
- *Syzygium paniculatum**
- *Tetratheca glandulosa**

Endangered Ecological Communities

Duffy's Forest Endangered Ecological Community*

Threatened Fauna

- Giant Burrowing Frog*
- Green and Golden Bell Frog
- Red-crowned Toadlet
- Broad-headed Snake
- Rosenberg's Goanna*
- Australasian Bittern
- Black Bittern
- Superb Fruit-dove
- Glossy Black-cockatoo
- Gang-Gang Cockatoo
- Swift Parrot
- Barking Owl*
- Koala*
- Spotted-tailed Quoll*
- Southern Brown Bandicoot
- Long-nosed Potoroo
- Eastern Pygmy Possum
- Grey-headed Flying-fox*
- Yellow-bellied Sheathtail-bat
- Large-footed Myotis
- Eastern Bentwing-bat
- Greater Broad-nosed Bat

- Regent Honeyeater
- Powerful Owl*
- Masked Owl
- Eastern Freetail-bat
- Eastern False Pipistrelle

* Indicates those species identified in the DGR's as recommended by DECC to be addressed in the EA .

Of these species, the Grey-headed Flying-fox was recorded within the subject site during surveys. Despite the presence of potential habitat, the remaining listed species were not recorded. 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. This consideration is based on the limited habitat removed for these species and the continuum of extensive areas of similar quality adjacent habitat.

Summary of Threatened Species Recorded

Grey-headed Flying-fox (*Pteropus poliocephalus*)
The Grey-headed Flying-fox is a canopy feeding frugivore and nectarivore species inhabiting rainforests, open forests, woodlands, *Melaleuca* swamps and *Banksia* woodlands. This species provides a means of seed dispersal and pollination for many native plants. Grey-headed Flying-foxes congregate in large numbers at roosting sites (camps) that may be found in rainforest patches, *Melaleuca* stands, mangroves, riparian woodland or modified vegetation in urban areas (NPWS, 2000).

On the night of January 12th, 2004 at 20:35, four (4) Grey-headed Flying-fox were spotlighted foraging within trees in vegetation community 2 - Exotic Grassland with Scattered Trees. It is considered that flowering trees throughout the subject site provide suitable foraging habitat for this species. Given the extent of suitable foraging habitat throughout the local area, it is considered that the proposal is unlikely to disrupt the life cycle of the Grey-headed Flying-fox such that a viable local population is likely to be placed at risk of extinction.

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

At the time of compilation of this report there were no endangered populations listed under Part 2 of Schedule 1 of *TSC Act* (1995) identified within the subject site.

One endangered population of Long-nosed Bandicoots occurs approximately 10km south of the subject site at North Head. Given the considerable distance from the subject site this population is not considered to require further assessment.

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

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 endangered ecological communities were recorded within or adjacent to the subject site. It is therefore considered that the proposed development is unlikely to have an adverse effect on the extent of any ecological community such that its local occurrence is likely to be placed at risk of extinction.

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

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

It is considered that the habitat attributes of the subject site provide known or potential habitat for the following species; *Acacia bynoeana*, *Caladenia tessellata*, *Epacris purpurascens var, purourascens*, *Eucalyptus camfieldii*, *Grevillea caleyi*, *Melaleuca deanei*, *Pimelea curviflora var, curviflora*, *Syzygium paniculatum*, *Tetratheca glandulosa*, Duffy's Forest Endangered Ecological Community, Giant Burrowing Frog, Barking Owl, Green and Golden Bell Frog, Koala, Red-crowned Toadlet, Spotted-tailed Quoll, Broad-headed Snake, Southern Brown Bandicoot, Rosenberg's Goanna, Long-nosed Potoroo, Australasian Bittern, Eastern Pygmy Possum, Black Bittern, Grey-headed Flying-fox, Superb Fruit-dove, Yellow-bellied Sheathtail-bat, Glossy Black-cockatoo, Large-footed Myotis, Gang-Gang Cockatoo, Eastern Bentwing-bat, Swift Parrot, Greater Broad-nosed Bat, Regent Honeyeater, Eastern Freetail-bat, Powerful Owl, Eastern False Pipistrelle, Masked Owl.

The subject site has an area of approximately 13.6 hectares. The proposed development is likely to remove only a small proportion of potential habitat for the aforementioned species. In contrast, the proposed development will retain areas of remnant vegetation with greater habitat importance. In particular, vegetation to be retained along the western and southern sides of the subject site provide corridors to extensive vegetation further offsite.

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

Vegetation extending from the western boundary, towards the central and southern ends of the subject site will be retained within the proposed development. This vegetation currently forms a corridor with an extensive area of vegetation offsite. This vegetation extends to the north west forming Garigal National Park. Vegetation at the southern end on the subject site will also be retained as part of the development proposal and will continue to form a corridor with an extensive area of vegetation towards the south.

In addition, vegetation along the eastern boundary of the subject site within the Environmental Corridor will be retained and enhanced. This vegetation is currently divided from extensive vegetation further east by Oxford Falls Road.

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

It is proposed to remove approximately 0.30ha (17.2%) of the existing vegetation for the purpose of the development. The revegetation and protection of vegetation within the Environmental Corridor and western boundary of the subject site will result in the retention and rehabilitation of 4.45ha of vegetation on the subject site, resulting in an increase of 3.01ha of natural vegetation.

The habitat to be removed or modified by the proposed development consists predominantly of cleared grasslands, much of which has been invaded by a variety of weeds and is considered to be of low importance as habitat. Vegetation to be retained by the proposed

development to the west, south and east is considered to be of greater importance due to its connectivity to extensive areas of habitat offsite. In addition, the Environmental Corridor along the Middle Creek Tributary and drainage lines will be rehabilitated and will enhance habitat within the subject site. A full assessment of the vegetation to be removed has been provided within the Waterway Impact Study (Travers Environmental, 2008).

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 (1995). 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 recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Barking Owl *(Ninox connivens).* (DECC 2003)

Approved 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*) (DECC 2006)
- Southern Brown Bandicoot (*Isoodon obesulus*) (DECC 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. It is considered that the small amount of vegetation removed as part of the proposal should not be considered as an opposing objective to any of the aforementioned 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 (1995) 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 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			✓

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**
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			✓
Ecological consequences of high frequency fires			✓
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments			✓
Herbivory and environmental degradation caused by feral deer			✓
Human-caused Climate Change			✓
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 fungus causing the disease chytridiomycosis			✓
Infection of native plants by *Phytophthora cinnamomi*			✓
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion and establishment of exotic vines and scamblers			✓
Invasion of native plant communities by bitou bush & boneseed *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses			✓
Invasion, establishment and spread of *Lantana camara*			
Loss and/or degradation of sites used for hill-topping by butterflies			✓
Loss of Hollow-bearing Trees	✓		
Predation by the Feral Cat (*Felis catus*)			✓
Predation by the European Red Fox (*Vulpes vulpes*)			✓
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 from Feral pigs (*Sus scofa*)			✓
Removal of dead wood and dead trees		✓	

"Clearing of native vegetation" is a Key Threatening Process and as such the proposal is of a class of development recognised as a threatening process. The removal of native vegetation on the subject site is not likely to significantly affect the biodiversity of the local

area due to the extent of better quality natural vegetation within the site being enhanced and the small area of vegetation to be removed.

The “Loss of Hollow-bearing Trees” is a Key Threatening Process. Twenty-one (21) hollow-bearing trees were observed within the subject site. Three (3) of these trees, numbers 15, 16 and 17 will be required to be removed. The removal of this tree would constitute the proposal as being a class of development recognised as a threatening process. However, as 85% of the hollow-bearing trees are to be retained with the majority of them being protected within the Environmental Corridor (except tree #14 – see Figure 2), a significant impact is not considered likely.

Note: evidence of rabbit was recorded within the subject site during surveys. It is not considered that the proposal will have any contributing effect to the local occurrence of these threatening processes.

5 CONCLUSIONS & STATEMENT OF COMMITMENTS

5.1 Conclusions

The document forms the basis of assessment required under Section 5A of the *Environmental Planning and Assessment Act* (1979). This assessment determines if future development of the site is likely to have a significant effect on threatened species, populations and/or endangered ecological communities.

Environmental Planning & Assessment Act 1979 & Threatened Species Conservation Act 1995

In respect of matters required to be considered under the *Environmental Planning & Assessment Act* (1979) and relating to the species / provisions of the *Threatened Species Conservation Act* (1995);

- One (1) threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*) was recorded within the subject site;
- No threatened flora species were recorded within or in close proximity to the subject site; and
- No endangered populations or endangered ecological communities listed under this Act were recorded within or in close proximity the subject site.

The 7 part test of significance (Section 4 of this report) has concluded that the proposed development will not have a significant impact on any threatened species, populations or endangered ecological communities. Therefore, a Species Impact Statement should not be required for the proposed development.

Environment Protection and Biodiversity Conservation Act 1999

In respect of matters required to be considered under the *Environment Protection and Biodiversity Conservation Act* (1999);

- One (1) threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*) was recorded within the subject site;
- No threatened flora species were recorded within the subject site; and
- No endangered ecological communities listed under this Act were recorded within or in close proximity the subject site.

Therefore, the proposed development was not considered to have a significant impact on matters of National Environmental Significance. As such a referral to Department of the Environment, Water, Heritage & the Arts should not be required.

Fisheries Management Act 1994

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

DECC's Recommended EA Requirements specific to the Flora and Fauna Assessment
The proposal has been declared as a major project under Part 3A and Director General Requirements (DGR's) have been issed. Attachment 1 of the DGR's provides a list of the DECC's recommended EA requirements. Item 1 – Impacts on threatened species and their habitats is pertinent to this flora and fauna assessment and has been addressed below. Each of the DGR's pertinent to this assessment has been provided in Table 1 within the Executive Summary.

b) *A field survey of the site should be conducted and documented in accordance with the gazetted draft Guideline for Threatened Species Assessment and any relevant environmental impact assessment guidelines where these have been prepared by the DECC. Surveys should include targeting the following threatened species and communities:*
   - *Acacia bynoeana*
   - *Grevillea caleyi*
   - *Syzygium paniculatum*
   - *Tetratheca glandulosa*
   - *Duffy's Forest Endangered Ecological Community*
   - *Giant Burrowing Frog*
   - *Grey-headed Flying-fox*
   - *Powerful Owl*
   - *Barking Owl*
   - *Koala*
   - *Spotted-tailed Quoll*
   - *Rosenberg's Goanna*

This assessment has been undertaken in Section 4 of this report. Potential habitat for a range of threatened species, including those identified above, is considered to be present on-site. Despite the presence of potential habitat, only the Grey-headed Flying-fox was recorded during survey undertaken on the site. Due to the disturbed nature of the site providing minimal habiatat outside of the riparian zone, as well as the proposed revegetation and rehabitlitation of drainage liens across the site, it is considered that there will not be a significant impact upon threatened species as a result of this development. It is considered that there will actually been an improvement in the quality, connectivity and diversity of habitat on this site as a result of the propsed development.

b) Describe the actions that will be taken to avoid or mitigate impacts or compensate for unavoidable impacts of the project on threatened species and their habitat. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

Table 5.1 below outlines each of the mitigation actions being taken as well as an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

Table 5.1: Mitigation Measures Proposed and Assessment of Effectiveness

Mitigation Action	Effectiveness and Reliability	Residual Impacts
Creation of an environmental corridor	The waterway is currently unprotected with the majority of the creekline overgrown with weeds. The corridor wil provide a no development zone thus allowing the ability for not only ecological functioning but also open space use and scientific education opportunites on riparian and aquatic observation for local schools. This is a highly effective and reliable mitigation measure with proven benefits for water quality, habitat and vegetated connectivity.	Ongoing weed management required. This will be implemented as part of the ongoing site management requirements of the Waterway Impact Study.
Revegetation of drainage lines to provide habitat connectivity.	The provision of a permanent vegetated link within the corridor will enhance not only vegetated links but also ecological functioning in the form of aquatic, riparian and terrestrial habitat creation.	Ongoing weed management required and potential edge effects. The implementauion of a monitoring program (weeds, plant establishment and growth) will ensure these impacts are kept to a minimum.
In-stream works	The creation of in-stream sequence of riffles, pools and runs will assist sustainability of instream aquatic and benthic habitat. Creek stabilisation works will ensure long term protection of creek bank and minimise erosion. Water quality will be enhanced through aeration over riffle areas and detention in pools.	Initial water quality impact during construction. No long term impacts are perceived within the site. Poor water quality upstream has potential to create negative impact within site.
Development Design	The development has been designed to utilise the cleared portions of the site with minimal clearing of vegetation required. Effective means of minimising ecological impacts. The development has been designed to increase the amount of native vegetation on the site and provide water quality treatment and increased habitat potential through the creation of development / creekline buffers and increased aquatic habitat.	Increased human use of the site. Residual impact upon native flora and fauna.
Stormwater and water quality Management	Stormwater and water quality management measures to be implemented include retention of drainage lines on-site, revegetation of Middle Creek Tributary, removal of stock grazing on site, bioretention systems, swales, rain gardens, porous paving, roof gardens, rainwater tanks, stormwater re-use tanks, onsite detention (OSD) tanks.	
Retention of Hollow Bearing Trees	The retention of hollow bearing trees is an effective means of preserving roosting and breeding habitat for a range of arboreal mammals as well as birds.	Twenty-one (21) hollow-bearing trees were observed within the subject site. Three (3) of these trees will be required to be removed. However, as 85% of the hollow-bearing trees are to be retained with the majority of them being protected within the environmental corridor a significant impact is not considered likely.

Potential Ecological Impact

The potential ecological impact on this site relates to the impact not only from the construction of the development but also the long term environmental impacts that can result from any development undertaken within vegetated landscapes. The potential ecological impacts on this site relate to stormwater management, impact upon the riparian zones and drainage lines, construction and implementation of asset protection zones and loss of vegetation.

Each of these issues has been taken into consideration during the design of this development to ensure that there are no short or long term ecological impacts to this site. The management of this corridor has been discussed in detail within the *Waterway Impact Study* (*Travers environmental*, 2008)

There is potential on this site to achieve a better environmental outcome than the current situation. The subject site is currently an unmanaged landscape with uncontrolled weed growth adjacent the Middle Creek Tributary and also throughout the site. The site is owned by mulitiple parties with an inconsistent approach to its management. Upon implementation of the recommendations from each of the reports prepared for this proposal, there will be a consistent management approach across the entire lands with retained and managed vegetation areas providing protection to the watercourse.

Vegetative connectivity will be enhanced and maintained in perpetuity to ensure the link between higher quality habitat is maintained. Water quality will be enhanced through the implementation of WSUD objectives which meet the required targets for water quality. Aquatic habitat will be enhanced within the creekline through the creation of a more natural stream sequence of riffle, pools and runs. This will not only improve the aesthetic qualities of the site, but provide an enhanced aquatic habitat for native flora and fauna utlising the site.

Building locations, asset protection zones and retained vegetation areas have been designed for the proposal to ensure that the bulk of the development has been contained within the already cleared portions of the site.

The Middle Creek Tributary is to be protected within the environmental corridor. This corridor is designed to increase the distance between development and the watercourse and reduce possible edge effects. The retention and protection of these items will require the implementation of the *Waterway Impact Study* (including Riparian Plan of Management).

Implementation of bushfire defendable space

An assessment of the bushfire protection requirements needed for the development to guard against the potential impact of bushfires has been prepared (*Travers environmental*, August 2008). This assessment provides recommendations in respect of fuel management, construction standards / building protection, access, bushfire education and land ownership responsibility in line with the RFS *Planning for Buishfire Protection 2006*.

5.2 Statement of Commitments

The following recommendations are made in accordance with the principles of Ecologically Sustainable Development and are made to mitigate any potential impacts upon threatened species:

- Where possible, habitat trees (Figure 2) are to be retained. If a habitat tree is to be removed it must be inspected by a suitably qualified person for fauna occupation and if it is occupied by breeding native fauna, the removal of the tree is to be postponed until the young have matured.

- A Riparian Plan of Management (RPoM) is to be developed to direct the rehabilitation and revegetation of remnant vegetation throughout the subject site.
- Best practice mitigation measures are to be implemented to prevent sediment and stormwater runoff into the creek and associated riparian zone. Such measures may include; installation of sediment fences during construction, rapid revegetation of bare ground, sediment basins, installation of bioswales, filter strips, polishing ponds and aerating riffle zones.
- Habitat relevant to the regionally significant Brown Antechinus (*Antechinus stuartii*) and Long-nosed Bandicoot (*Perameles nasuta)* (NPWS 1997) is to be retained and rehabilitated within the corridor vegetation.
- Vegetation connectivity is to be retained within the Environmental Corridor and associated drainage line rehabilitation.

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APPENDIX 1

Response to Peer Review

Our Ref: 5163:JAC/sr

15 September 2008

Tiffany Developments Pty Ltd
11C Grandview Apartments
MILSONS POINT NSW 2061

Attention: Mr Sid Londish

Dear Sid

Re: Dr Stephen Ambrose, peer review of Flora and Fauna and Tree Assessment reports, Oxford Falls Road and Barnes Road, French's Forest

Conacher Travers has reviewed the comments made by Dr Stephen Ambrose, Director of Ambrose Ecological Services Pty Ltd, dated the 1 September 2005, for the Flora and Fauna Assessment and Tree Assessment reports prepared for Oxford Falls Road and Barnes Road, French's Forest.

From the outset Dr Ambrose was not presented with the totality of documents that have been prepared for the development project. The following is a list of documents prepared by *Conacher Travers* for the site.

- Flora and Fauna Assessment (*Conacher Travers Pty Ltd* 2004)
- Tree Assessment Report (*Conacher Travers Pty Ltd* 2004)
- Conservation Land Use Management Plan (*Conacher Travers Pty Ltd* 2005)
- Waterway Impact Study (*Conacher Travers Pty Ltd* 2006)
- Bushfire Protection Assessment (*Conacher Travers Pty Ltd* 2004)
- Bushfire Emergency Response Plan (*Conacher Travers Pty Ltd* 2004)

The majority of these reports have since been updated in accordance with the latest proposal.

Dr Ambrose has taken the initial view that the report was inadequate. This is rejected by *Conacher Travers*. Indeed the Ambrose review was wanting in several areas I suspect due to his less than comprehensive ecological assessment of the site.

It would have guided our client a little more had he looked at the site more thoroughly and realised that the site is already developed and little ecological value remains insitu; and that there was significant retention of native vegetation and proposals to provide a significant environmental / riparian corridor.

It is fair to say that parts of the report were not clear to an in-experienced reader and to that fact I have responded with comments below.

The following commentary is provided (*italics*) in response to each of the points (**bold**) raised by Dr Ambrose.

- ***Flora Field Survey***

Section 2.1 states that "a flora survey using a stratified sampling regime within each of the identified vegetation communities was undertaken on January 8th 2004."

The "stratified sampling regime" is not described or defined. Therefore, it is not possible to determine if adequate flora survey techniques or efforts have been employed.

This comment is not appropriate given that the site is mainly cleared and that the report provided a vegetation map of communities that were derived from extensive fieldwork.

Notwithstanding this Section 2.1 of the flora and fauna report has been updated with the following information to further explain the methodology undertaken for flora survey.

Flora survey methodology was adopted from the Flora and Fauna survey guidelines: Lower Hunter Central Coast Region (Murray et al 2002) and was undertaken by one (1) botanist on the 8 January 2004.

Each of the identified vegetation communities were assessed using 20 x 20 metre quadrats and 10 x 40 metre 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 subject site.

The flora survey targeted all vegetation communities present within the subject site. The location of the mapped vegetation communities is presented in Figure 2.

- ***Fauna Database Searches***

Section 2.2 (Fauna Survey Techniques) lists the Atlas of NSW Wildlife as the only source of threatened fauna records that have been accessed. While this is the most comprehensive of fauna databases for NSW, there are several bird databases for the Sydney region that should have also been accessed. These include:

(a) Cumberland Bird Observers' Club bird Atlas;
(b) NSW Bird Atlassers database; and
(c) Birds Australia Bird Atlas.

Information from these databases have been provided to the NSW Department of Environment & Conservation (DEC) for inclusion into the Atlas of NSW Wildlife. However, there is a contractual arrangement between DEC and providers of this information (Birds Australia, NSW Bird Atlassers Inc., and the Cumberland Bird Observers Club) not to make that information available to third parties for commercial purposes. Third parties have to acquire this additional information directly from the information providers for a small commercial fee.

The accepted standard for flora and fauna assessments is the Department of Environment and Conservation (DEC) NSW Wildlife Atlas, which lists NSW, threatened species records from the Threatened Species Conservation Act (1995) and the Department of Environment

And Heritage (DEH) Protected Matters Search Tool, which lists threatened species under the Commonwealth Environment Protection and Biodiversity Conservation Act (1999).

Conacher Travers would only access the additional databases outlined as item (c) by Dr Ambrose for a Species Impact Statement (SIS). There is no reason to require data to be derived from the items listed as (a) & (b) by Dr Ambrose and DEC does not require their use.

As Dr Ambrose would know the sites ecological environment does not induce the need for additional data sets to be complied. It is incorrect and misleading to suggest that Conacher Travers should have used the three as suggested.

- ***Diurnal Bird Surveys***

Section 2.2.1 states that birds were recorded through visual observation. Many bird species are often detected by their calls rather than by sight because of the cryptic or timid behaviour of species. Therefore, it is unlikely that a complete list of bird species on the site was compiled if only visual observation was used.

Where diurnal birds recorded from opportunistic sightings, or were specific bird survey methods employed? It would have been appropriate to have selected at least four 2 ha areas on site and Area Search Surveys (30 minutes per area) and recording bird species heard or seen during the surveys. The results of these surveys should then be supplemented with the results of opportunistic bird sightings.

The report may have given the impression that only visual observations were made but only a deaf person could have been restricted in undertaking a visual assessment only. I can assure Dr Ambrose that my ecological field staff have not yet succumbed to deafness.

Notwithstanding that, section 2.2.1 of the flora and fauna report has been updated with the following information to further explain the methodology undertaken for diurnal bird survey:

Opportunistic, visual observation and call identification of birds was carried out during visits to the site. Approximately thirteen (13) hours of opportunistic survey was conducted for diurnal bird census (Appendix 2). Table A1.4 describes the species identified within the subject site and the method of identification used for each. Survey effort and weather conditions are outlined in detail in Appendix 2.

- ***Nocturnal Bird Surveys***

The report states that the calls of four threatened owl species were played for 3-minute periods at 3-minute intervals for 30 minutes, followed by 20 minutes of listening & spotlighting.

It is not clear from the report if call broadcasts for all four species were broadcast over a single 30-minute period, or that four separate 30-minute broadcast periods, one for each species, were surveyed. It is also not stated if the nocturnal bird surveys were conducted on a single night or over several nights.

A 30-minute survey period would only allow 15 minutes of broadcast of owl calls. This is an insufficient amount of survey effort in a single night, either for a single species or for four species. A single night's owl survey should be at least 3 hours in duration using the following methodology:

(a) In a single 60-minute period, there should be 40 minutes of broadcasting (10 minutes per species) and 20 minutes of spotlighting & listening.

(b) This procedure should be repeated at least twice in a single night (that is, a total of 3 hrs of survey effort/night).
(c) Nocturnal bird surveys should be conducted over at least three successive nights because some of the owl species (e.g. Powerful Owls) have large home ranges and may not be close to the broadcast point some nights.

No nocturnal birds were recorded during the field surveys. This may have been because the site is not used by threatened owl species or may be a result of insufficient survey effort. Given that the subject site is only 3 km from Garigal National Park, where threatened owl species have been recorded, and typical prey items occur on the subject site, it is possible that the site is used occasionally by owl species.

Section 2.2.2 of the flora and fauna report has been updated with the following information to further explain the methodology undertaken for nocturnal bird survey:

Nocturnal birds were surveyed using the formal census methodology outlined in the Flora and Fauna survey guidelines: Lower Hunter Central Coast Region (Murray et al 2002). Nocturnal surveys were conducted on the nights of the 12 and 15 January 2004 (Appendix 2).

Masked Owls (Tyto novaehollandiae), Powerful Owls (Ninox strenua), Sooty Owls (Tyto tenebricosa) and Barking Owls (Ninox connivens) were targeted by broadcasting taped calls through a 15 watt Toa 'Faunatech' amplifier.

Each of the four species calls were broadcast for three (3) minute periods with three (3) minute intervals between each for approximately thirty (30) minutes. Each interval consisted of quiet listening and stationary spotlighting. This was followed by 20 minutes of quiet listening and roving spotlighting.

Survey effort and weather conditions are outlined in detail in Appendix 2.

- ***Arboreal and Terrestrial Mammals***

The types of traps used and the densities of trapping appear adequate.

The report states that cage traps, used for surveying Brown Bandicoots and Spotted Quolls, were baited with a mix of honey, oats and peanut butter. While this is a suitable bait for bandicoots, quolls are carnivores and are not usually attracted to this type of bait; sardines and/or uncooked chicken meat is more appropriate for attracting quolls.

It is standard practice by Conacher Travers fauna technicians to use uncooked chicken meat or the like for carnivorous animals such as the Spotted-tail quoll. The omission of the description of the type of bait used for this animal appears to be an oversight and as such Section 2.2.3 of the flora and fauna report has been updated with the following information to further explain the bait used for the Brown Bandicoot and Spotted Quoll.

"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."

Four trapping nights is only just a sufficient survey period. Long-nosed Bandicoots, a species caught in cage traps in the present study, is usually easy to trap. However, Southern Brown Bandicoots are trap shy and it is my experience that it takes at least 4 or 5 successive trap nights. Both bandicoot species can sometimes co-exist in the same area.

Four trapping nights is the minimum outlined in the Flora and Fauna survey guidelines: Lower Hunter Central Coast Region (Murray et al 2002). As four nights have been undertaken then it is commensurate with the 4-5 nights as suggested by Dr Ambrose. Not withstanding this, it would be wise for Dr Ambrose to review the sites habitat conditions or maybe visit the site in the first place and he would find that the site is not habitat for the southern brown bandicoot. There is habitat to the south west but not within the site.

- ***Bats***

Appropriate bat survey techniques and efforts were employed. Section 2.2.4 states that both mobile and fixed Anabat detectors were used in the surveys, but Appendix 2 (Fauna Survey Details) only acknowledges the use of a mobile detector. Where fixed detectors used and, if so, where were they located, how many were used, and how many nights were they out there?

Section 2.2.4 of the flora and fauna report has been updated with the following information to further explain the methodology undertaken for arboreal and terrestrial mammals:

Micro-chiropteran bats were surveyed by echolocation using an Anabat Mk 2 detector in both roving and stationary positions throughout the entire subject site. Mega-chiropteran bat species, such as Grey-headed Flying-fox (Pteropus poliocephalus), were surveyed by targeting flowering / fruiting trees during spotlighting activities.

Figure 2 of the Flora and Fauna report depicts the location of Anabat stations and mobile Anabat transects. Appendix 2 of the flora and fauna report describes fauna survey effort and states that Anabat Stations were put out on the 12 and 15 January 2004 for a total of 2 hours and 45 minutes. Mobile Anabat survey was also undertaken on the 12 and 15 January 2004 during spotlighting for a total of 1 hour and 55 minutes.

- ***Reptile and Amphibian Surveys***

Appropriate survey techniques and efforts were employed. Section 2.2.5 needs to identify what amphibian species calls were broadcast, just as in the same manner as Section 2.2.2 identified what owl species were broadcast.

Section 2.2.5 of the flora and fauna report has been updated with the following information to further explain the methodology undertaken for amphibian surveys:

Amphibians were surveyed by vocal call identification, by using a tape recorder to record male calls in suitable places and then comparing these to known calls. Amphibians specifically targeted included: Giant Burrowing Frogs, Green & Golden Bell Frogs and Red-Crowned toadlets. Amphibians were also surveyed by habitat searches.

- ***Flora Species List***

There are discrepancies in the native species lists of the Flora and Fauna Report (Table A1.1) and the Tree Assessment Report (Schedule 1).

The Tree Assessment Report records 17 Tallowwoods (*Eucalyptus microcorys*), three Swamp Mahoganies (*Eucalyptus robusta*) and one Cabbage Tree Palm (*Livistona australis*) on the subject site. None of these species occur in Table A1.1 of the Flora and Fauna Assessment Report.

Conversely, the Flora and Fauna Report lists the Red Bloodwood (*Corymbia gummifera*) as occurring on the subject site, but this is not listed in Schedule 1 of the Tree Assessment Report.

Although I have visited the subject site, I have not conducted a comprehensive flora survey. Therefore, I do not know if all plant species present on the site have been recorded in either the Flora and Fauna Report or Tree Assessment Report. However, the richness and diversity of plant species recorded by Conacher Travers, including the level of invasion by weed and other exotic plant species would approximate what I would expect for a site of this type.

The Tree Assessment Report was restricted to trees likely to be removed within the development area. Eucalyptus gummifera (Red Bloodwood) was located outside of this area and as a result was not recorded within Schedule 1 of this report.

Eucalyptus microcorys (Tallowwood) was recorded within Schedule 1 of the Tree Assessment report and Table A1.2 of the Flora and Fauna report. The recording within the Flora and Fauna report was listed within the exotic species list as this species is not native to the locality and is considered to be a planted specimen as explained in Section 3.1 Flora survey results.

Eucalyptus robusta (Swamp Mahogany) and Livistona australis (Cabbage Palm) were identified within the Tree Assessment report as they were located within the proposed development footprint. These species were not identified within the Flora and Fauna report as flora survey was restricted to naturally occurring native vegetation only and these species were planted as landscape species, as explained in section 3.1 Flora survey results, of the Flora and Fauna report, which states;

"It should be noted that a number of trees and shrubs, although native to the locality, appear to have been planted."

- ***Vegetation Communities***

The Flora and Fauna Report correctly identifies and describes the vegetation communities that are present on the subject site. Figure 1 is missing from my copy of the Flora and Fauna Report, so I do not know if the vegetation communities have been adequately mapped.

Vegetation communities have been adequately described within the Flora and Fauna report and mapped accurately within Figure 1.

- ***Threatened Flora and Endangered Ecological Communities***

Threatened flora species and endangered ecological communities that occur within the locality have been accurately identified. No endangered ecological communities occur on the subject site. I did not find any threatened plant species on the subject site, which would support the conclusions made in the Flora & Fauna Assessment Report but, as I mentioned earlier, I did not complete a comprehensive flora survey for the purposes of reviewing the reports.

No comment on, or review of threatened flora and endangered ecological communities was required.

- ***Fauna Species***

I agree with the conclusion that all fauna species that were recorded on the subject site are common within the greater Sydney area. The Red-whiskered Bulbul has been identified in Table A1.4 as a native species, but is actually an exotic (introduced) species.

The Red-whiskered Bulbul has now been given an asterix to denote that it is an exotic species in Table A1.4 of the Flora and Fauna report.

- ***Fauna Habitat***

The Flora and Fauna Report identifies 14 hollow-bearing trees in the Sydney Sandstone Woodland Community and seven hollow-bearing trees in the Exotic Grassland with Scattered Trees Community. The locations of these trees should be mapped within this report.

No change to the report required, all habitat trees have been depicted in Figure 2 of the Flora and Fauna report.

Where any of the hollow-dependent fauna recorded on the subject site (e.g. microbats, possums, marsupial mice, wood ducks) observed emerging from any of these tree hollows. If so, these trees should be identified.

Section 2.2.3 of the Flora and Fauna report states that:

"Habitat was also assessed to determine the likelihood of threatened native species of fauna occurring within the subject site."

During habitat assessments no hollow-dependent fauna were observed emerging from identified tree hollows.

The Tree Assessment Report only specifically identifies one tree (Tree No. 9) as containing hollows, but comments imply that hollows also occur in other trees. All hollow-bearing trees should be specifically identified in the final column of the Schedule 1 table.

The tree assessment report was undertaken within the proposed development footprint only and as such only one (1) hollow bearing tree was identified within this location.

The Flora and Fauna Assessment Report indicates that there are sap flows from trunks of some trees (especially Sydney Red Gums and Red Bloodwoods). These trees need to be identified and mapped in the Flora and Fauna Report. How prevalent are these sap flows?

Sap trees are not typically mapped as these ecological resources are natural occurrences for certain native trees.

- ***Threatened Fauna Species***

The Flora and Fauna Report correctly identifies threatened fauna species that occur within the locality and the availability of habitat for these species on the subject site.

In the Eight-part tests, the Flora and Fauna Report mentions that the nectar Northern Grey Ironbark (*Eucalyptus siderophloia*) and Forest Red Gum (*E. tereticornis*) would

provide a potential food source for the Regent Honeyeater (p.18). Neither of these tree species were recorded in the flora species list (Table A1.1). Potential nectar sources on the subject site for the Regent Honeyeater, especially over the autumn and winter periods, would be from the Swamp Mahogany (*E. robusta*) and the various Banksia species. The River Oak (*Casuarina cunninghamiana*) and Swamp Oak (*C. glauca*) along the creek would also act as a favoured corridor habitat for the Regent Honeyeater.

Eucalyptus siderophloia (Northern Grey Ironbark) and Eucalyptus tereticornis (Forest Red Gum) do not occur within the subject site and as such part (a), Section 5.0 of the flora and fauna report has been amended to state:

It is considered that the subject site provides potential foraging habitat for this species particularly within the trees which may flower throughout part of winter, Eucalyptus robusta (Swamp Mahogany) and various Banksia species.

- ***Eight Part Test***

Despite the inadequacies of some parts of the survey methodology, I agree with the conclusions of the 8-part tests that the proposed development of the subject site is unlikely to significantly impact on the status of threatened species or their habitats. Therefore, a Species Impact Statement is probably not required in relation to the proposed development.

Survey methodology is not considered to be inadequate however; it has been explained in greater detail within the report as a result of Dr Ambrose comments.

- ***SEPP 44 assessment***

Section 4.11.1 of the Flora and Fauna Report contains an accurate SEPP 44 assessment that the site is not Core Koala Habitat. I recommend that the assessment can be improved by:

- **defining Core and Potential Koala Habitats, as defined in SEPP 44;**
- **identifying what signs of Koala activity were searched for during the fauna survey.**

There is no assessment of whether the subject site is Potential Koala Habitat under SEPP 44. Given that Koalas have been recorded close to the site (1.4 km to the south-west in 1994 and 2.2 km to the north-west in 1997) and the presence of two food species on the site, Koalas may potentially use the site.

Section 4.11.1 of the flora and fauna report has been updated with the following information to further explain the methodology and results of the koala habitat assessment within the site.

SEPP 44 Koala Habitat Protection

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

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.

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 1 hectare, hence Part 2 – Development Control of Koala Habitats, of the Policy applies.

Step 1 – Is the land PKH?

Two Koala food tree species (Eucalyptus punctata and Eucalyptus haemastoma) listed on Schedule 2 of State Environmental Planning Policy No. 44 - Koala Habitat Protection, were observed within the subject site. These two species made up approximately 5% of trees within vegetation community 1 – Sandstone Woodland. This is less than the 15% indicated by SEPP 44, therefore the subject site is not considered to be PKH.

Step 2 – Is the land CKH?

No Koalas were directly observed at the time of fauna survey, which included diurnal searches of trees and spotlighting. In addition, there was no secondary evidence of Koala habitation in the area. Searches for secondary indications of Koalas included, observations for scratchings on trees and scats beneath trees. A search of the Atlas of NSW Wildlife (DEC 2006) database found eight (8) records of Koala habitation within a 10 km radius of the subject site. The record closest to the subject site was approximately 1.4 km to the south-west in 1994. The most recent record within 5 km was in 1997, 2.2 km to the north-west. It is therefore considered that the subject site does not comprise CKH and as such no further matters relevant to this Policy apply.

In addition, Section 2.2.3 of the report has been amened to explain in further detail the methodology undertaken to assess for Koala habitat.

- ***Recommendations in report***

Section 4.3 (Vegetation Connectivity) of the Flora and Fauna Report (p.9) recommends that the main vegetation (wildlife) corridor runs north-west to south-east through the subject site and it would be retained. However, this is not included in the list of recommendations (Section 6.2, pp. 25-26).

Connectivity is discussed in Section 4.3 of the current report. The recommendation referred to above has now been listed in Section 5.2 Statement of Commitments, of the current Flora and Fauna report.

The first recommendation of the report (p.25) states that, where possible, habitat trees should be retained. However, the report does not identify those trees on the site that are significant habitat trees. Important habitat trees should be mapped in the report and justified as to why they are important, so that the developers can, where possible, avoid removing them.

All habitat trees have been mapped in Figure 2 of the Flora and Fauna report. All habitat trees are considered to be of significance and should be retained where possible.

The final recommendation of the report (p.26) states that the western side of the drainage line in the eastern part of the subject site should be revegetated as a riparian zone while being maintained as an Asset Protection Zone (APZ). I am not sure how this can be achieved. This recommendation needs to be supported with a Vegetation Management Plan (VMP) that details what plant species can be planted, in what numbers and densities, how weeds and other exotic plants would be controlled, whose responsibility it would be to manage and implement the VMP, a timetable for each action, and how it would conform with the requirements of an APZ.

This should occur as a condition of consent. Notwithstanding this, the detail of providing an APZ and a modified vegetated corridor is acceptable environmental practice for our company and a design will occur at the appropriate time. The concept is quite acceptable particularly when the site will be managed by a community association.

There should also be additional recommendations for preventing the runoff of sediments and excessive water runoff into the creek and its associated riparian zone.

Dr Ambrose has not been provided with a copy of the Waterway Impact Study prepared by Conacher Travers and if he had read that document he would find that this issue was covered in great detail in the most appropriate document.

The following recommendation has now been listed in Section 6.2 Recommendations, of the Flora and Fauna report.

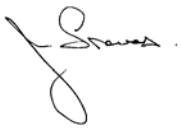
"Conacher Travers Pty Ltd recommends best practice mitigation measures to prevent sediment and stormwater runoff into the creek and associated riparian zone. Such measures may include; sediment fences during construction, rapid revegetation of bare ground, sediment basins, installation of bioswales, filter strips, polishing ponds and aerating riffle zones."

Conclusions

The majority of the comments made by Dr Ambrose were in relation to the survey methodology. All comments have been considered and incorporated into the reports. It should be noted that Dr Ambrose agreed with the conclusions of the *Environmental Planing & Assessment Act* (1979), Section 5A test of significance in that the proposed development within the site was unlikely to significantly impact any threatened species or their habitats and as such a Species Impact Statement was unlikely to be required.

Should you have any further questions in relation to the peer review undertaken by Dr Stephen Ambrose and the amended Flora and Fauna and Tree Assessment reports please do not hesitate to contact me.

Yours faithfully



John Travers
Director
CONACHER TRAVERS PTY LTD