GRAYTHWAITE
20 EDWARD ST, NORTH SYDNEY

Flora and Fauna Report

For:

SHORE - SYDNEY CHURCH OF ENGLAND GRAMMAR SCHOOL

September 2010

Final Report

Cumberland Ecology
PO Box 2474, Carlingford Court 2118

Report No. 9119RP1

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology

Approved by:	David Robertson
Position:	Project Director
Signed:	
Date:	*14 September, 2010*

Table Of Contents

Table Of Contents

Table Of Appendices

List of Tables

List of Figures

List of Photographs

Chapter 1

Introduction

1.1 Purpose and Background

Cumberland Ecology has been requested by Shore – Sydney Church of England Grammar School to undertake a flora and fauna assessment of the Graythwaite property at 20 Edward Street, North Sydney within the North Sydney LGA. The owners of the property are proposing the construction of new buildings within the property, as well as refurbishment of some of the existing buildings.

The property, hereon referred to as "the subject site" currently supports established gardens of both exotic and introduced trees and shrubs. There are several existing buildings within the subject site, some of which have heritage values. **Figure 1.1** shows the location of the subject site.

The objectives of this report are to:

- Describe the vegetation communities on the subject site;
- Describe the fauna habitat characteristics of the subject site;
- Identify any threatened species, populations or ecological communities existing on the subject site (as listed under the schedules of the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act));
- Assess the likelihood of occurrence of threatened species, populations or ecological communities on the subject site;
- Assess the potential impact of the proposed development on threatened flora and fauna, including the completion of Assessments of Significance under Section 5A of the NSW *Environmental Planning and Assessment Act 1979*; and
- Recommend mitigation measures to reduce the impacts of the proposed development on the flora and fauna values of the subject site if necessary.

1.2 Terminology

This report uses the following terminology:

- **Subject site** means the Graythwaite property at 20 Edward Street, North Sydney;
- **Locality** is the area within the North Sydney LGA which encompasses the subject site;
- **LGA** abbreviates Local Government Area;
- **EPBC Act** abbreviates the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;
- **TSC Act** abbreviates the NSW *Threatened Species Conservation Act 1995*; and
- **DECCW** abbreviates the NSW Department of Environment, Climate Change and Water.

Coordinate System: MGA Zone 56 (GDA 94)

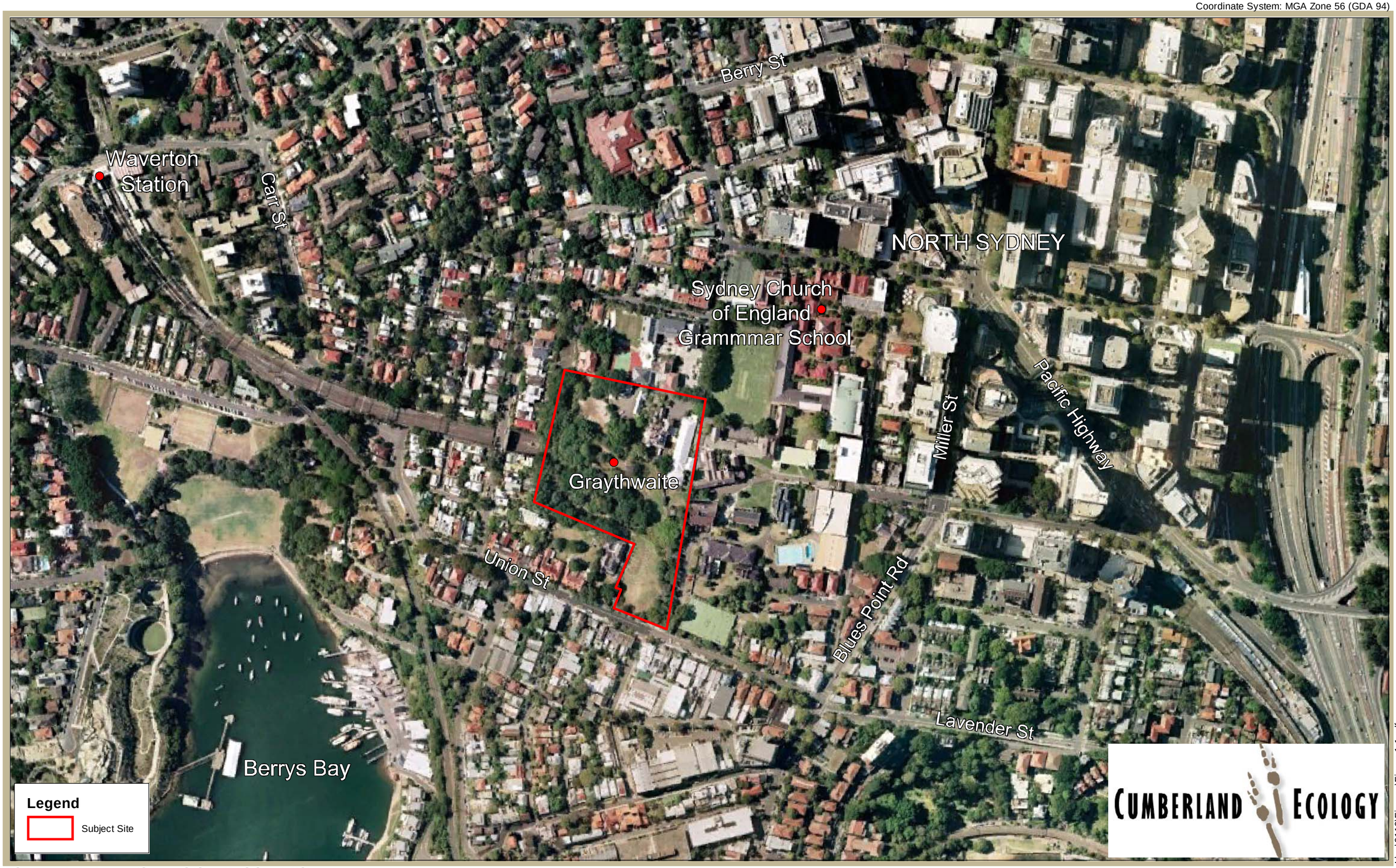


Figure 1.1. Location of the Subject Site

1000 0 1000 2000 3000 4000 m

Chapter 2

Methods

2.1 Database Searches and Literature Review

Prior to surveys, databases were reviewed to determine the likely occurrence of various flora and fauna species. Particular emphasis was given to determining the likely occurrence of any of the threatened flora and fauna known to occur in the wider locality. Searches were conducted for the North Sydney LGA from the following databases:

- Department of Environment, Climate Change and Water (DECCW) Atlas of NSW Wildlife; and
- Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) EPBC Protected Matters Search Tool.

In addition, relevant literature was reviewed to further ascertain the likelihood of occurrence of species, particularly threatened species, in the locality of the subject site.

2.2 Flora Survey

A flora survey was conducted on 2 July 2010. During the survey, five sites were examined in detail to determine the potential impacts of the proposed development on vegetation within the subject site. These sites were chosen based on the likely impact areas of the current concept plan for the development. The remaining vegetation of the subject site was surveyed using a random meander, during which all flora species present were recorded.

A targeted threatened flora search was also undertaken on 2 July 2010. This involved walking a random meander throughout the subject site looking for threatened species known to occur in the locality.

2.3 Fauna Survey

2.3.1 Fauna Habitat Assessment

A fauna habitat assessment was conducted on 2 July 2010. An assessment was made of various features that would provide suitable habitat for the types of fauna known to occur in the wider locality, with particular emphasis given to detecting suitable habitat for threatened fauna species.

Vegetation within the subject site was surveyed to determine the presence of suitable forage and shelter habitat for fauna. Features such as fruiting or blossoming trees and shrubs, hollow-bearing trees and dense understorey vegetation were noted.

The exteriors and interiors of the buildings were searched for cavities and areas where fauna may seek refuge. Any signs of fauna use were also noted, particularly the presence of scats. Buildings were inspected and comments were noted regarding the structure and potential habitat features. Photographs were also taken throughout the site of any respective habitat features.

2.3.2 Fauna Survey

i. Diurnal Fauna Survey

A diurnal fauna survey was conducted on 2 July 2010. During the diurnal survey, all fauna species heard or seen were recorded. In addition, all signs of the occurrence of fauna (e.g. scats and burrows) were recorded during the diurnal survey.

ii. Microchiropteran Bat Surveys

Microchiropteran bat surveys were conducted on 2, 3 and 4 July 2010. Surveys were conducted using three Anabat SD1 bat call detectors to record all microchiropteran bats actively foraging at the site. The anabat units were deployed adjacent to existing buildings within the subject site for three nights to determine the potential use of these buildings as roosting sites by microchiropteran bats.

2.4 Conditions and Limitations

Weather conditions prior to the survey were relatively cold, with a minimum temperature of 4.3^{o}C in the days leading up to the survey. The maximum temperature on the day of the survey was 12.1^{o}C. In the week prior to the survey, 18.8mm of rain occurred at the subject site.

Although relatively wet leading up to the survey, the low temperatures during this period were not suitable for detecting most of the common amphibians and reptiles known to occur in the locality. However, the Red-crowned Toadlet (*Pseudophryne australis*) is a winter breeding amphibian, and these conditions were optimal for detecting this species where present.

The survey was conducted over a three day period. As such the results of the survey show a "snapshot" of fauna that currently occurs within the subject site. It is assumed a greater diversity of fauna than was detected in such a short survey period would use the subject site from time to time.

Chapter 3

Results

3.1 Flora

3.1.1 Vegetation Communities

The subject site is currently comprised of two broad vegetation communities. Much of the site supports dense gardens of exotic and non-indigenous plants. The remaining areas of the subject site support cleared and mown grassy areas or areas where vegetation has been removed and replaced with hard surfaces such as buildings and concrete. **Figure 3.1** shows the areas of occurrence of these broad vegetation communities within the subject site. Photographs of vegetation within the subject site are provided in **Appendix A**.

The subject site does not support any of the native vegetation communities known to occur in the locality. The vegetation of the subject site would not meet the criteria for any of the EPBC Act or TSC Act listed Critically Endangered Ecological Communities (CEEC's) or Endangered Ecological Communities (EEC's).

3.1.2 Flora Species

Flora species occurring within the subject site are predominantly horticultural, with occasional seedling native species such as *Pittosporum undulatum* which have no doubt appeared as a result of flying foxes and frugivorous birds.

EPBC Act and TSC Act database searches for the North Sydney LGA indicated that the following threatened flora has the potential to occur in the wider locality of the subject site:

- *Acacia bynoeana* (Bynoe's Wattle) – listed as Vulnerable under the EPBC Act and Endangered under the TSC Act;
- *Acacia terminalis subs. terminalis* (Sunshine Wattle) – listed as Endangered under both the EPBC Act and the TSC Act;
- *Caladenia tessellata* (Thick-lipped Spider Orchid) – listed as Vulnerable under the EPBC Act and Endangered under the TSC Act;

- *Cryptostylis hunteriana* (Leafless Tongue-orchid) – listed as Vulnerable under both the EPBC Act and the TSC Act;
- *Eucalyptus camfieldii* (Camfield's Stringybark) – listed as Vulnerable under both the EPBC Act and the TSC Act;
- *Melaleuca biconvexa* (Biconvex Paperbark) – listed as Vulnerable under both the EPBC Act and the TSC Act; and,
- *Tetratheca glandulosa* (Glandular Pink-bell) – listed as Vulnerable under both the EPBC Act and the TSC Act.

During the survey, no threatened flora species were detected within the subject site. Habitat assessment and the absence of records indicated that the subject site does not support any of the threatened plants known to occur in the wider locality. It is therefore unlikely that the proposed development of the subject site would result in impacts on any of the threatened plants known to occur in the wider locality.

A complete list of flora species recorded within the subject site during the survey is provided in **Appendix B**. Flora surveys were undertaken in detail at five locations within the subject site. The results of surveys from these locations are discussed below.

i. Site 1

Site 1 was comprised of the area proposed under the concept plan for a group of buildings near Edward Street, between the eastern boundary of the subject site and the Coach House. The survey area included all vegetation within approximately 20 metres of the proposed buildings.

This area was totally cleared of natural vegetation that was replaced with buildings, hard surfaces and minor exotic gardens. There were no native flora species occurring within Site 1.

ii. Site 2

Site 2 was comprised of the area within 20 metres of proposed two-storey building between Coach House and Headmaster's House. This site had been totally cleared of natural vegetation and replanted with lawns and landscape trees. The upper slope section largely contained herbaceous weeds.

Minor patches of *Dichondra repens* and *Cotula australis* were the only naturally occurring species remaining in Site 2. Overall these species were estimated to represent less than 1% of the ground cover of this site.

iii. Site 3

Site 3 was comprised of the area within 20 m of proposed two storey building in north-western corner of the property. This site had been totally cleared of natural vegetation and replanted with exotic trees. All understorey within this site was comprised exotic small trees, shrubs and ground covers, and most of these were weed species. Weedy vines were common. The noxious *Parietaria judaica* was also common here. A small patch of *Microlaena stipoides* was recorded on the upper southern end of the slope above the proposed building envelope.

A row of planted mature *Ficus macrophylla* occurred along western boundary fence adjacent to Site 3.

iv. Site 4

Site 4 was comprised of the area each side of the existing driveway south from near the Dining Room to Union Street, including the car park surrounds east of driveway.

Natural vegetation had been removed from Site 4 and replaced with exotic plantings. The main species present were *Robinia pseudoacacia*, *Cinnamomum camphora* and *Lophostemon confertus*. More recent plantings of *Lomandra longifolia* and other sclerophyllous species were also present.

The naturally occurring species present within Site 4 were limited to a few young *Pittosporum undulatum* which were likely to be from seeds deposited by feeding Grey-headed Flying-foxes or frugivoruous birds, as well as *Dichondra repens*, *Geranium homeanum* and *Commelina cyanea* representing less than 1% of the ground cover in the site.

v. Site 5

Site 5 was comprised of the surrounds of the existing car park near Union Street entrance (indicated as a possible future development area in the concept plan) to approximately 10m from the car park. This site was cleared of natural vegetation with the exception of one small mature *Glochidion ferdinandi* and minor saplings of *Pittosporum undulatum*. The remainder of vegetation within Site 5 was comprised of exotic landscape species.

vi. Remaining Areas of the Subject Site

The only additional naturally occurring flora species recorded within the subject site during he survey were *Hypolepis muelleri*, *Cotula australis* and *Rumex brownii*. These occurred away from any areas proposed for development under the concept plan and would be unlikely to be affected by construction work associated with the development.

Some of the native flora species recorded adjacent to the areas proposed for development under the concept plan also occurred in other areas of the subject site. *Microlaena stipoides* was the most common native species, with localised occurrences at the margins of parts of the planted "bushland" zone. The one relatively large patch of *Hypolepis muelleri* also occurred in this zone.

Some species that may once have occurred naturally within the subject site prior to clearing had been planted as landscape species. These included: *Angophora costata*; *Ficus rubinginosa*; *Elaeocarpus reticulatus*; *Trema aspera*; *Melaleuca linariifolia*; *Acacia linifolia*; *Acacia longifolia*; *Banksia ericifolia*; *Grevillea linearis*; *Dodonaea triquetra*; *Hakea sericea; Hakea teretifolia; Lambertia Formosa; Pittosporum revolutum; Correa reflexa; Lomandra longifolia; Dianella caerulea var producta* and *Themeda australis*.

Coordinate System: MGA Zone 56 (GDA 94)

Grid North

1

2

3

Legend

Subject Site

Anabat No. and direction

Zone 1 - Dense planted trees and shrubs

Zone 2 - Predominantly cleared areas

CUMBERLAND ECOLOGY

I:\...\9119\Figures\Figure 3.1_v2.pdf

Figure 3.1. Vegetated Areas and Survey Locations

1000 0 1000 2000 3000 4000 m

3.2 Fauna

Habitat for fauna within the subject site consists of mature planted trees and shrubs surrounding a number of buildings. Some of these buildings have been disused for some time and now provide shelter habitat for a number of fauna groups. Photographs illustrating the various habitat values of the subject site are provided in **Appendix A**.

The subject site provides habitat for a range of common adaptable native fauna in addition to a number of introduced (feral) species. Individual fauna groups are discussed below.

3.2.1 Amphibians

With the exception of one small well, there are no water bodies within the subject site. The small well present was searched for adult frogs and tadpoles, however none were detected. The well is isolated from other water bodies, and does not provide suitable habitat for any threatened frog species. However, the well may provide suitable breeding habitat for any of the common amphibian species known to occur in the wider locality.

No amphibians were detected within the subject site during the survey, however it is likely that the site would support common, adaptable amphibian species such as the Eastern Sedge Frog (*Litoria fallax*) and the Striped Marshfrog (*Limnodynastes peronii*).

EPBC database searches indicate the potential occurrence of the threatened Green and Golden Bell Frog (*Litoria aurea*) and the threatened Giant Burrowing Frog (*Heleioporus australiacus*) within the locality of the subject site. Surveys and habitat assessment indicate that there is no suitable habitat for the Green and Golden Bell Frog or the Giant Burrowing Frog, and there are no DECCW records of either species within the North Sydney LGA. It is therefore unlikely that either of these species would occur within the subject site.

DECCW records indicate that the Red-crowned Toadlet is known to occur within the North Sydney LGA. Habitat assessment and searches indicated that the subject site does not provide any suitable habitat for this species, and the Red-crowned Toadlet has not been recorded from the immediate locality of the subject site. The occurrence of this species at the site is therefore unlikely.

3.2.2 Reptiles

The subject site provides suitable forage and shelter habitat for several of the common adaptable reptile species known to occur in the wider locality. During the survey, only the Garden Skink (*Lampropholis delicata*) was observed. However, it is likely that other small reptile species would also occur within the subject site.

Although there are no DECCW records of the threatened Broad-headed Snake (*Hoplocephalus bungaroides*) in the North Sydney LGA, EPBC database searches indicate the potential occurrence of (or suitable habitat for) this species within the locality of the subject site. Surveys and habitat assessment indicate that there is no suitable habitat for the Broad-headed Snake on the subject site, and it is therefore unlikely that this species would occur within the subject site.

3.2.3 Birds

The planted trees and shrubs within the subject site provide suitable forage, shelter and nesting habitat for a range of common and adaptable bird species. Birds present or likely to occur within the subject site can be broadly separated into four groups and are discussed below.

i. Frugivores

The subject site supports a number of specimen trees that provide forage for a range of common frugivorous birds. In addition to various *Ficus sp*., the site also supports Camphor Laurel (*Cinnamomum camphora*). These trees attract a range of birds including Figbird (*Sphecotheres viridis*) and Pied Currawong (*Strepera graculina*), both of which were recorded during the survey. Migrant frugivores such as Channel-billed Cuckoo (*Scythrops novaehollandiae*) and Common Koel (*Eudynamys scolopacea*) are also likely to occur within the subject site during the summer months.

The Australian King Parrot (*Alisterus scapularis*) was recorded within the subject site and is known to feed on fruits and berries of plants that occur here, as well as seeds and blossoms. In addition, the larger trees of the subject site may provide suitable nesting hollows for this species as well as the Rainbow Lorikeet (*Trichoglossus haematodus*). Both the Australian King Parrot and the Rainbow Lorikeet are common species, and neither is listed as threatened under either the TSC Act or the EPBC Act.

EPBC database searches did not indicate the occurrence of any threatened frugivorous birds within the locality of the subject site. However, DECCW database searches indicated that the Superb Fruit-dove (*Ptilinopus superbus*) is infrequently recorded from within the North Sydney LGA. Although the rare occurrence of this nomadic species cannot be completely discounted, it is unlikely that the subject site would provide significant habitat for this or any other threatened frugivorous birds.

ii. Nectarivores

The subject site and neighbouring properties supports several native tree specimens (*Angophora and Eucalyptus sp*.) that provide forage for common adaptable nectarivorous birds. Noisy Miner (*Manorina melanocephala*), Rainbow Lorikeet and Red Wattlebird (*Anthochaera carunculata*) were recorded during the survey and it is likely that a number of additional common nectarivorous birds would occur here during blossom periods.

EPBC database searches indicate the potential occurrence of the threatened Regent Honeyeater (*Anthochaera phrygia*) and Swift Parrot (*Lathamus discolor*) within the locality of the subject site. However, DECCW database records indicate that none of the threatened nectarivorous birds have been recorded within the locality of the subject site. Despite the absence of DECCW records, the results of bird surveys undertaken for North Sydney Council by P & J Smith Ecological Consultants (2008) indicate that there is a single record for the Swift Parrot at Crows Nest in 2002.

Although there is the potential for any of the threatened nectarivorous birds to infrequently occur within the wider locality, the subject site provides only limited habitat for this group. It is therefore unlikely that any threatened nectarivorous bird species would be dependent on the subject site for forage.

iii. Nocturnal Birds

The garden vegetation and lighting of the subject site would provide an abundance of prey for nocturnal insectivorous birds, although none were recorded here during the surveys. The subject site could potentially provide suitable forage habitat for common nocturnal birds such as the Tawny Frogmouth (*Podargus strigoides*) and Southern Boobook (*Ninox novaeseelandiae*) despite the urban surrounds.

DECCW database records indicate that both the threatened Powerful Owl (*Ninox strenua*) and Barking Owl (*Ninox connivens*) have been recorded within the locality of the subject area. Although not recorded during surveys, the subject site provides suitable habitat for an abundance of prey for both the Powerful Owl and, to a lesser extent, the Barking Owl. It is possible that the subject site may therefore form a component of a much wider home range for these species. However the site does not provide suitable roosting or nesting habitat for either of these owls.

iv. Introduced and Generalist Species

As with most urban environments, the subject site provides suitable habitat for a number of common introduced species. House Sparrow (*Passer domesticus*), Common Starling (*Sturnus vulgaris),* Common Myna (*Acridotheres tristis*), Spotted Turtle-dove (*Streptopelia chinensis*) and Feral Pigeon (*Columba livia*) were all recorded within the subject site.

In addition to introduced birds the subject site was dominated by generalist species of native birds. The Noisy Miner, Pied Currawong and Rainbow Lorikeet are highly adaptable species that thrive in urban environments and actively exclude many smaller, less aggressive species.

Despite the impacts of aggressive species such as the Noisy Miner, the subject site provides some limited shelter, forage and breeding habitat for common small passerines, including the White-browed Scrubwren (*Sericornis frontalis*) which was observed during surveys.

3.2.4 Mammals

Mammals occurring within the subject site are grouped into two broad categories: Non-flying mammals and bats. These are discussed below.

i. Non-flying Mammals

Dense garden vegetation and artificial structures such as disused buildings provide suitable shelter habitat for a number of common non-flying mammal species within the subject site. All species recorded during the survey are highly adaptable species that commonly occur in heavily urbanised environments. Scats found during the survey indicated that both The Common Brushtail Possum (*Trichosurus vulpecula*) and the Common Ringtail Possum (*Pseudocheirus peregrinus*) occur within the subject site. An absence of suitable habitat (particularly hollow-bearing trees) combined with the surrounding urban environment indicate that other native non-flying mammal species are unlikely to occur within the subject site.

As with many urban areas, the subject site supports a range of introduced mammals. Signs (scats and burrows) recorded during the survey indicate that the Black Rat (*Rattus rattus*) and House Mouse (*Mus musculus*) are present within the disused buildings of subject site. Signs of the House Cat (*Felis catus*) were also detected within the subject site, although it is difficult to determine whether these are of domestic pets belonging to adjacent residents.

Although there are no DECCW database records for any threatened non-flying mammals within the North Sydney LGA, EPBC database searches indicate that two of these species have the potential to occur in the locality of the subject site. These are the Spotted-tail Quoll (*Dasyurus maculatus*) and the Long-nosed Potoroo (*Potorous tridactylus*). No signs of these species were recorded during the survey, and habitat assessment indicates that the subject site does not provide suitable habitat for either the Spotted-tailed Quoll or the Long-nosed Potoroo.

ii. Bats

The subject site provides suitable forage habitat for a range of microchiropteran (microbats) and megachiropteran (flying-foxes) bats. In addition, small tree hollows, dense garden vegetation and artificial structures such as buildings provide suitable roosting habitat for a number of microbat species.

Anabat devices used during surveys detected calls from two microbat species within the subject site. These were Eastern Bentwing-bat (*Miniopterus shreibersii oceanensis*) and Gould's Wattled Bat (*Chalinolobus gouldii*). The locations and directions of anabat units deployed during the survey are shown in **Figure 3.1**.

The Eastern Bentwing-bat is listed as Vulnerable under the TSC Act. It is not listed as threatened under the EPBC Act. This is typically a cave-dependant species, however it will also shelter in artificial structures such as culverts and old buildings. During the winter months, the Eastern Bentwing-bat typically occupies winter roost sites some distance from breeding habitat. During the warmer months, Eastern Bentwing-bats congregate in large numbers in breeding caves with specific climatic conditions. The subject site does not provide suitable breeding habitat for the Eastern Bentwing-bat.

Gould's Wattled Bat is a common, adaptable species that typically roosts in tree hollows but may also take shelter in artificial structures such as the roofs of old buildings. Gould's Wattled Bat is not listed as threatened under either the EPBC Act or the TSC Act.

The calls of both Gould's Wattled Bats and Eastern Bentwing-bats were recorded adjacent to the existing buildings of the subject site. The concentration of these calls during the dusk period indicated both species may be roosting within the roof cavities of these buildings.

In addition to those microbat species recorded during the survey it is likely that the subject site would provide suitable forage for a range of common microbat species. The disused buildings within the subject site are also likely to provide suitable roost habitat for a number of these species.

The EPBC database searches indicate the potential for the threatened Large-eared Pied Bat (*Chalinolobus dwyeri*) to occur in the locality of the subject site. Surveys and habitat assessment indicate that the subject site does not provide suitable habitat for this cave-roosting species, and the occurrence of the Large-eared Pied Bat here is therefore unlikely.

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as Vulnerable under both the EPBC Act and the TSC Act. Signs detected during the survey indicated that this species forages within the subject site. Roosting and breeding camps of the Grey-headed Flying-fox are known to occur within the Royal Botanic Gardens approximately 2km from the site. The subject site provides forage for the Grey-headed Flying-fox in the form of fruiting figs and Camphor Laurel, and blossoming *Angophora* and *Eucalyptus*. However, the subject site does not provide suitable roosting or breeding habitat for this species.

Seven part tests of significance for the Eastern Bentwing-bat and the Grey-headed Flying-fox are provided in **Appendix C**.

Chapter 4

Discussion and Recommendations

4.1 Threatened Fauna

Two threatened fauna species were found to occur within the subject site. These were the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) (listed as vulnerable under the TSC Act) and the Grey-headed Flying-fox (*Pteropus poliocephalus*), (listed as vulnerable under both the EPBC Act and the TSC Act).

4.1.1 The Eastern Bentwing-bat

The Eastern Bentwing-bat has been recorded within the subject site, and the timing of calls recorded during the survey indicated that individuals of this species occupy the roofs of existing buildings within the subject site. Given the relatively low number of calls recorded, and the timing of the survey during the winter months, it is likely that only a small number of individual Eastern Bentwing-bats utilise the roofs of the buildings within the subject site as winter roost habitat.

The proposed refurbishment of some existing buildings within the subject site has the potential to impact on winter roosting habitat for a small number of Eastern Bentwing-bats. It is therefore recommended that fauna protocols should be developed and employed prior to and during demolition and construction operations under the proposed development. Some mitigation measures are provided in Section 4.2.

4.1.2 The Grey-headed Flying-fox

The Grey-headed Flying-fox is known to roost at Royal Botanic Gardens approximately 2km to the south-east of the subject site, and individuals from this camp forage extensively throughout Sydney. It is likely that Grey-headed Flying-foxes recorded foraging within the subject site are from this camp. The subject site does not provide any roosting or breeding habitat for the Grey-headed Flying-fox.

The proposed development will not require the removal of any large figs or blossom-producing trees that currently provide suitable forage for the Grey-headed Flying-fox. It is therefore likely that the subject site will continue to provide foraging habitat for the Grey-headed Flying-fox during and after the proposed development. Development of the subject

site is not considered to have an impact on this species because it will not result in the removal of foraging, roosting or breeding habitat for the species.

4.2 Mitigation Measures

Any proposed development within the subject site will result in a minor loss of habitat for common native and introduced fauna. In addition, development will remove potential roost habitat for two microbat species, including one species that is listed as Vulnerable under the TSC Act. The following measures are recommended to minimise the impact of the proposal on these species.

4.2.1 Demolition Protocol

i. Pre-demolition removal of roofs

It is recommended that steps be taken to allow potentially occurring microbats and other fauna to vacate the buildings if demolition or major reconstruction is required under the proposed development. This would include careful removal of the roof of the buildings to allow the species to escape during the following night. Removing the roofs of the buildings would reduce the suitability of these buildings as habitat for nocturnal species that use them as shelter during the day, and would discourage these animals from returning.

4.2.2 Manual Fauna Removal

Immediately prior to the commencement of development work it is recommended that a fauna trapping program should be implemented to remove fauna that currently occupies the buildings destined for demolition or reconstruction. Trapping should continue for a one week period, with all trapped fauna being removed from the subject site. Native fauna should be relocated to a nominated site, and introduced species should be disposed of ethically.

In addition to pre-demolition work, a trained ecologist/fauna handler should be on call during demolition to aid in the safe removal of any additional fauna still present within the building or to handle injured wildlife.

If any animals are spotted trying to exit the buildings by demolition contractors, work should temporarily stop to allow the animal to reach a safe position.

4.2.3 Understorey Vegetation

As recommended by P & J Smith Ecological Consultants (2008) it is important to retain dense vegetation within the landscape to provide shelter and breeding habitat for small birds. This habitat within the subject site is currently in the form of dense weedy

vegetation. Under the proposed development of the subject site it is recommended that any removal of dense weedy growth should be replaced with similar dense native understorey species to retain shelter and breeding habitat for small birds at the site.

Chapter 5

Conclusions

The subject site supports established gardens of exotic and non-indigenous plants only. None of the vegetation present is representative of any native vegetation communities. None of the vegetation present within the subject site would meet the criteria for any of the EPBC Act or TSC Act listed CEEC's or EEC's known to occur in the wider locality.

Anabat survey results indicated that low numbers of Eastern Bentwing-bats are likely to roost within the roofs of existing buildings within the subject site. The refurbishment or demolition of these buildings under the proposed development has the potential to impact on these individuals. It is recommended that fauna protocols should be established and impacts on microbats and other fauna should be managed prior to and during construction or demolition operations.

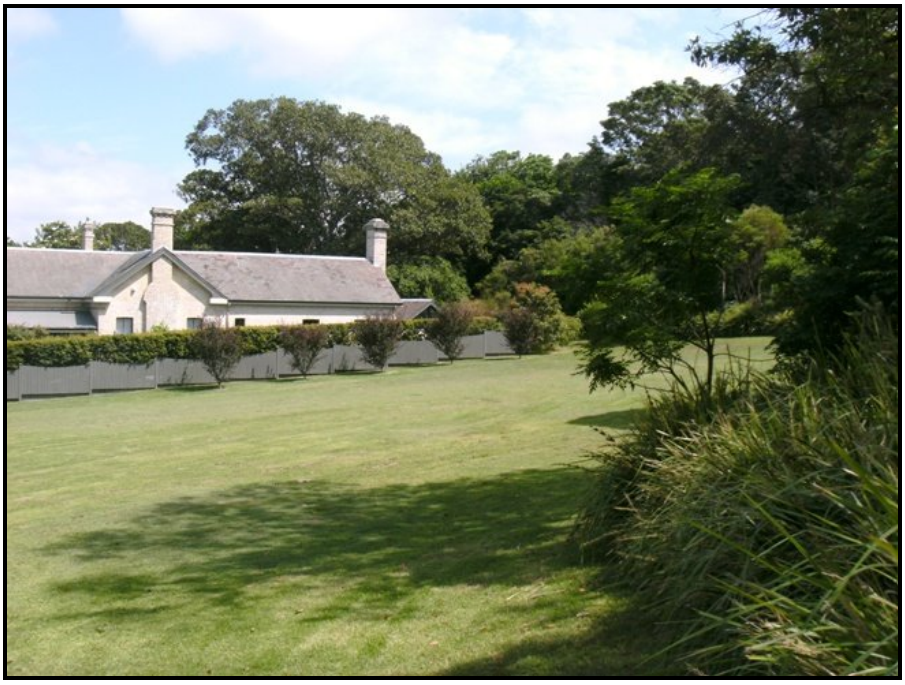
The Grey-headed Flying-fox is known to forage on fruit and blossom-producing trees within the subject site. The proposed development will not result in the removal of any of these trees. Further, the subject site does not provide suitable roosting or breeding habitat for the Grey-headed Flying-fox. Suitable forage habitat for this species occurs throughout the locality of the subject site, and it is highly unlikely that the proposed development will result in any significant impacts on the Grey-headed Flying-fox.

Appendix A

Site Photographs

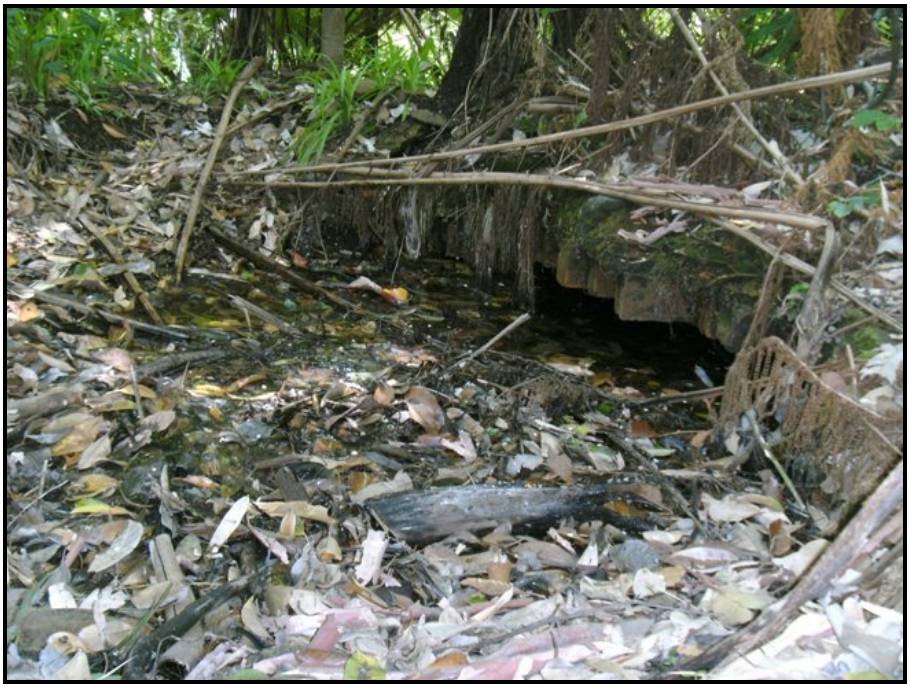
Photograph A.1 **Dense planted garden vegetation within the subject site**

Photograph A.2 **Planted vegetation along the southern driveway of the subject site**

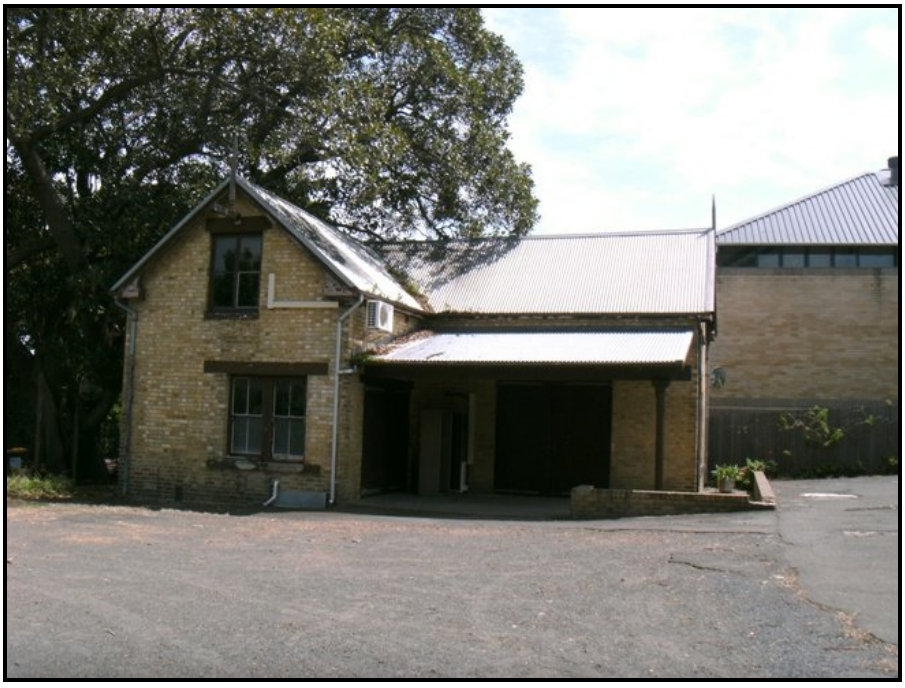


Photograph A.3 Open grassy areas of the subject site

Photograph A.4 Dense weedy undergrowth providing habitat for small birds



Photograph A.5 **Small spring located in the centre of the subject site**



Photograph A.6 **Existing buildings providing suitable roost habitat for microbats**

Appendix B

Flora Species List

Table B.1 FLORA SPECIES LIST

			Site				
Trees			**1**	**2**	**3**	**4**	**5**
Araucariaceae	**Araucaria columnaris*	Cooks Pine	r				
Cupressaceae	**Cupressus spp.*		r				r
Pinaceae	**Pinus radiata*	Monterey Pine	r				
Aceraceae	**Acer negundo*	Hard Alder	r	r		r	
Anacardiaceae	**Mangifera indica*	Mango	r				
Araceae	**Schefflera actinophylla*	Umbrella Tree	r				
Bignoniaceae	**Jacaranda mimosifolia*	Jacaranda					r
Casuarinaceae	**Allocasuarina torulosa*	Forest Oak				r	
	**Casuarina cunninghamiana*	River Oak				r	
	**C. glauca*	Swamp Oak				r	
Euphorbiaceae	*Glochidion ferdinandi var ferdinandi*	Cheese Tree					r
Fabaceae	**?Kigelia pinnata*	Sausage Tree		r			
	**Erythrina sykesii*	Coral Tree			r		
	**Robinia pseudoacacia*	Black Locust				c	
Fagaceae	**Quercus palustris*	Pin Oak				r	
Lauraceae	**Cinnamomum camphora*	Camphor Laurel	r			c	
	**Cryptocarya obovata*	Pepperberry				r	
Magnoliaceae	**Magnolia grandiflora*					r	

Table B.1 FLORA SPECIES LIST

			Site					
Moraceae	**Ficus macrophylla*	Morton Bay Fig	r			v		
	# F. rubiginosa	Rusty Fig	r			r		
	**Morus alba*	Mulberry		r		r		
Myrtaceae	*# Angophora costata*	Smooth-barked Apple					r	
	**Decaspermum humile*	Silky Myrtle	r					
	**Eucalyptus saligna/grandis*	Blue Gum/Flooded Gum				r		
	**E. sp.*						r	
	**Lophostemon confertus*	Brush Box					o	
	**Rhodomyrtus psidioides*	Native Guava						
	**Syzygium luemannii*	Small-leaved Lilly Pilly	r					
	**S. paniculatum*	Magenta Cherry	r				r	
Oleaceae	**Ligustrum lucidum*	Large-leaved Privet				o		r
	**Olea europaea ssp cuspidata*	African Olive	r			r		
Platanaceae	**Platanus ?orientalis*	Oriental Plane Tree					r	
Proteaceae	**Grevillea robusta*	Silky Oak						
	**Stenocarpus sinuatus*	Firewheel Tree					r	
Rutaceae	**Melicope micrococca*	Hairy Doughwood	r				r	
Salicaceae	**Populus alba*	White Poplar				r		
	**P. nigra*	Lombardi Poplar					r	
	**P. ?simonii*	Chinese Poplar						r
	**Salix babylonica*	Weeping Willow					r	

Table B.1 FLORA SPECIES LIST

			Site			
Sapindaceae	**Alectryon subdentatus*	Hairy Birds-eye	o	c		r
	**Cupaniopsis anacardioides*	Tuckeroo	r			
Sterculiaceae	**Brachychiton acerifolius*	Flame tree			r	
Ulmaceae	**Celtis sinensis*	Hackberry		o		
	**Trema aspera*	Poison Peach			o	
	**Ulmus parvifolia*	Small-leaved Elm				r
Arecaceae	**Archontophoenix cunninghamiana*	Bangalow Palm			r	
	**Howea fosterana*	Thatch Palm				r
	**Livistona australis*	Cabbage Palm	r			
	**Trachycarpus fortunei*	Windmill Palm	r			
	**Washingtonia sp.*	Cotton Palm	r			
Shrubs						
Callitraceae	**Callitris sp.*	a Cypress Pine			r	
Aceraceae	**Acer palmatum*	Japanese Maple		r		
Amygdalaceae	**Prunus sp.*	Cherry	r			
Apocynaceae	**Plumeria indica*	Frangipani	r			
	**Oleander neriifolia*	Oleander	r			
Berberidaceae	**Nandina domestica*	Sacred Bamboo	r			r
Caprifoliaceae	**Abelia grandiflora*	Abelia	r			r
Elaeocarpaceae	*# Elaeocarpus reticulatus*	Blueberry Ash		r	o	

Table B.1 FLORA SPECIES LIST

			Site				
Ericaceae	**Rhododendron sp. cv.*	Azalea	o				o
Euphorbiaceae	*Glochidion ferdinandi var ferdinandi*	saplings				r	
Fabaceae	**Acacia baileyana*	Cootamundra Wattle				r	
	# A. linifolia	Flax Wattle				r	
	# A. longifolia	Sydney Golden Wattle				r	
	**Senna pendula var glabrata*	Cassia			o		
Lamiaceae	**Lavandula sp. cv.*	Lavender	r				
Lauraceae	**Cinnamomum camphora*	saplings	o				r
	**Cryptocarya obovata*	saplings			o	o	
Magnoliaceae	**Magnolia soulangiana*	Magnolia	r				
Malaceae	**Cotoneaster glauca*	Cotoneaster					r
Malvaceae	**Abutilon sp.*	Chinese Lantern			v		
Meliaceae	**Melia azedarach*	White Cedar sapling	r				
Myrtaceae	*# Angophora hispida*	Dwarf Apple				r	
	**Callistemon linearis*	a Bottlebrush	r	r		r	
	**C. viminalis "Capt. Cook"*	a Bottlebrush				r	
	**C. viminalis "Kings Park"*	a Bottlebrush					r
	# Kunzea ambigua	Tick Bush				o	
	**Leptospermum laevigatum*	Coast Tea Tree				r	
	**L. squarrosum*	a Tea Tree				r	
	**L. sp.*	a Tea Tree		r		r	

Table B.1 FLORA SPECIES LIST

			Site				
	**Melaleuca hypericifolia*					r	
	# M. linariifolia	Snow-in-summer				r	
	**Tristaniopsis laurina*	Water Gum				r	
Ochnaceae	**Ochna serrulata*	Mickey Mouse Plant	r		r		r
Oleaceae	**Ligustrum lucidum*	saplings	o				
	**L. sinense*	saplings			o		
	**Olea europaea ssp cuspidata*	saplings	o		o		r
Pittosporaceae	*# Pittosporum revolutum*	Yellow Pittosporum				o	
	P. undulatum	saplings				o	r
Plumbaginaceae	**Plumbago sp.*	Plumbago	o				
Proteaceae	*# Banksia ericifolia*	Heath Banksia				r	
	**B. integrifolia*	Coast Banksia				o	r
	# Grevillea linearis					r	
	**G. cv. "Robyn Gordon"*						r
	**Hakea salicifolia*	Willow Hakea				r	
	# H. sericea	Silky Hakea		o		o	
	# H. teretifolia	Dagger Hakea				r	
	# Lambertia formosa	Mountain Devil				r	
	**Macadamia integrifolia*	Macadamia					r
	# Persoonia pinifolia	Pine-leaved Geebung				r	
	**Stenocarpus sinuatus*	Fire-wheel Tree				r	

Table B.1 FLORA SPECIES LIST

			Site				
Rosaceae	**Photinia sp.*					r	o
	**Rosa sp.*		r			r	
	**Spiraea sp.*	Maybush	r				
Rutaceae	**Citrus spp.*		o				
	# Correa reflexa					r	
	**Diosma vulgaris*	Diosma	r				
	**Murraya paniculata*	Murraya	r				
Sapindaceae	**Alectryon tomentosus*	saplings				o	
	**Cupaniopsis anacardioides*	saplings			r		
	# Dodonaea triquetra	Common Hop Bush				r	
Saxifragaceae	**Hydrangea sp.*		o				
Solanceae	**Cestrum parqui*	Green Cestrum		r	o		
	**Datura sp.*	Angels Trumpets	r				
Theaceae	**Camellia japonica cv.*	Camellia	r				
Ulmaceae	**Celtis sinensis*		o				
Verbenaceae	**Lantana camara*	Lantana		o	v		
Araceae	**Howea belmoreana*						r
	**Phoenix canariensis*	saplings			r		
Herbs - Ferns							
Davalliaceae	**Nephrolepis cordifolia*	Fishbone Fern	r				r

Table B.1 FLORA SPECIES LIST

			Site				
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern					
Pteridaceae	**Pteris umbrosa*	Jungle Brake	r				
Herbs - Dicots							
Apiaceae	**Ciclosperma leptophylla*	Slender Celery			r		
Asteraceae	**Ageratina adenophora*	Crofton Weed	r				
	**Bidens pilosa*	Farmers Friends	r	c	c		
	**Conyza bonariensis*	a Fleabane		o	r		r
	Cotula australis			o			
	**Erigeron karvinskianus*	Seaside Daisy	r				
	**Galinsoga parviflora*				o		
	**Hypochaeris radicata*	Flatweed	o	v			
	**Solvia sp.*	Bindii	r				
	**Sonchus oleraceus*	Sow Thistle	r	r	r	r	r
	**Taraxacum officinale*	Dandelion		c	o		
Brassicaceae	**Cardamine hirsuta*	Flickweed	o	o			
Caryophyllaceae	**Cerastium glomeratum*	Mouse-eared Chickweed		c			
	**Polycarpon tetraphyllum*	Four-leaf-all-seed	o	o			
	**Stellaria media*	Chickweed	o			o	
Convolvulaceae	*Dichondra repens*	Kidney Plant		o		r	

Table B.1 FLORA SPECIES LIST

			Site				
Crassulaceae	**Crassula sp.*		r				
Euphorbiaceae	**Euphorbia peplus*	Petty Spurge	r		c		
Fabaceae	**Trifolium repens*	White Clover		o			
Geraniaceae	*Geranium homeanum*	a Storksbill				r	
Lamiaceae	**Stackys arvensis*	Stagger Weed		o			
Malvaceae	**Sida rhombifolia*	Paddys Lucerne			o	r	
Meliaceae	**?Toona australis*	Red Cedar seedling					r
Oxalidaceae	**Oxalis pes-caprae*		o	r		r	
	**O. spp.*		r	o		r	r
Plantaginaceae	**Plantago lanceolata*	Lambs Tongue	r	o			
Polygonaceae	**Acetosa sagitatta*	Turkey Rhubarb			o	r	
	Rumex brownii		r				
Scrophulariaceae	**Acanthus spinosus*	Oyster Plant	r				
Urticaceae	**Parietaria judaica*	Asthma Weed	o	c	v	o	o
Verbenaceae	**Verbena officinalis*	Small-flowered Purpletop			r		
Violaceae	**Viola odorata*	Violet			r		
Herbs - Monocots							
Agavaceae	**Agave americana*	Century Plant	r				
Alliaceae	**Nothoscordum borbonicum*	Onion Weed	r			r	
Amaryllidaceae	**Agapanthus sp.*	Agapanthus	o		r	o	o

Table B.1 FLORA SPECIES LIST

			Site				
	**Clivea miniata*	Clivea	r		r		
	**Crinum pedunculata*	Swamp Lily	r		r		r
	**Leucojum sp.*	Snowflakes	r				
Arecaceae	**Arecastrum romanzoffianum*	Cocos Palm seedling		r			
Arthropodiaceae	**Chloris comosum*	Spider Lily	r		r		
Asparagaceae	**Asparagus densiflora*	Fern Asparagus	r		r		r
Cannaceae	**Canna indica*	Canna Lily			r	r	
Commelinaceae	*Commelina cyanea*	Blue Wandering Jew				r	
	**Tradescantia albiflora*	Wandering Jew			v		
Cyperaceae	*Cyperus gracilis*		o				
Iridaceae	**Dietes grandiflora*		r				o
Liliaceae	**Aspidistra elatior*	Cast Iron Plant					r
Lomandraceae	*# Lomandra longifolia*	Spiny-headed Mat-rush				v	
Musaceae	**Musa sp. cv.*	Banana					r
Phormiaceae	*# Dianella caerulea*	Rough Flax Lily		r		r	
Poaceae	**Bromus catharticus*	Prairie Grass	r	c	o		
	**Ehrharta erecta*	Veldt Grass	o	c	o	o	o
	**Cynodon dactylon*	Couch Grass	o	v	o	c	
	Microlaena stipoides	Weeping Meadow-grass			r		
	Oplismenus aemulus	Basket Grass				adj	
	**Pennisetum clandestinum*	Kikuyu	r	c		o	

Table B.1 FLORA SPECIES LIST

			Site				
	**Setaria palmifolia*	Palm Grass			r		
	**Stenotaphrum secundatum*	Buffalo Grass	c	v			c
	# Themeda australis	Kangaroo Grass		r			
Strelitziaceae	**Strelitzia reginae*	Bird-of-Paradise	r				
Vines							
Apocynaceae	**Trachelospermum jasminoides*	Star Jasmine	r			r	o
Araceae	**Monstera deliciosa*	Fruit Salad Plant			o		
	**Philodendron sp.*				r		
Araliaceae	**Hedera helix*	English Ivy	c	o		o	c
Asclepiadaceae	**Araujia sericifera*	Moth Vine		r			
Basellaceae	**Anredera cordifolia*	Madeira Vine		c	v	o	
Convolvulaceae	**Ipomoea purpurea*	Morning Glory		o	c		
Moraceae	**Ficus pumila*	Creeping Fig	o				
Nyctaginaceae	**Bouganvillea sp. cv.*	Bouganvillea sp. cv.					r
Vitaceae	**Cissus antarctica*	Kangaroo Vine	r				
	**Vitis sp.*	Grape	r				
Asparagaceae	**Asparagus plumosa*	Bridal Veil Creeper	r		o		r

Table B.1 FLORA SPECIES LIST

	Site
KEY	
Indicative frequency of occurrence	
v = very common	
c = common	
o = occasional	
r = rare	
* indicates introduced species	
# = indicates planted species that could be local to the local area	
adj indicates species adjacent to survey patch in property	
Locations	
1 - Five proposed buidlings near Edward St.	
2 - Two proposed buildings between Coach House and Headmaster's House	
3 - Proposed building in north-west corner of property	
4 - Each side of road from Dining Room to Union St	
5 - Surrounds of existing car park near Union St entrance	

Appendix C

Seven Part Tests of Significance

C.1 Seven-part Test of Significance for the Eastern Bentwing-bat

The Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) occurs along the east and north-west coasts of Australia. It roosts in caves, derelict mines, stormwater tunnels, buildings and other man made structures. It forages above the canopy in forested areas. The Eastern Bentwing-bat forms maternity colonies in caves and populations usually centre on such caves. The Eastern Bentwing-bat is listed as Vulnerable on Schedule 2 of the TSC Act.

a) *In the case of a threatened species, whether the lifecycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.*

Individual Eastern Bentwing-bats are likely to roost in the roofs of existing buildings within the subject site. The roofs are likely to provide only winter non-breeding roost habitat for small numbers of this species. It is therefore not likely that the proposed development will affect the life cycle of the Eastern Bentwing-bat such that a viable local population is placed at risk of extinction.

b) *In the case of an endangered population, whether the lifecycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,*

There are no populations of the Eastern Bentwing-bat listed as endangered under the TSC Act.

c) *In the case of an endangered ecological community or critically 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 of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

d) *In relation to the habitat of a threatened species, population or ecological community:*

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

(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

(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.

Any of the existing buildings within the subject site may provide suitable roosting habitat for the Eastern Bentwing-bat. It is therefore possible that all potential roosting habitat for this species within the subject site may be removed or modified under the proposed development.

The proposed development of the subject site is unlikely to result in the fragmentation or isolation of suitable habitat for the Eastern Bentwing-bat. The habitat to be removed, modified or isolated as a result of the proposed development is not important to the long-term survival of these species within the locality. This species is highly mobile, and similar artificial roost habitat occurs throughout the wider locality.

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

No critical habitat for these species has currently been identified by the Director-General of the DECC.

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

No recovery plans have been prepared for these species. No threat abatement plans are relevant to these species.

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.

The proposed development will not result in the exacerbation of any key threatening process that will affect the Eastern Bentwing-bat.

Conclusion

The proposed development is not likely to have a significant impact on the Eastern Bentwing-bat. No Species Impact Statement is required for this species.

C.2 Seven-part Test of Significance for the Grey-headed Flying-fox

At this stage only a concept plan for the proposed development of the subject site has been provided, therefore a precise assessment of impacts of the development is unable to be prepared. However, an assessment of significance based upon the assumption that no mature trees will be removed under the proposed development has been prepared to proceed with the preparation of this report:

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,*

In the case of Grey-headed Flying-fox (*Pteropus poliocephalus*) the site is only small in size and does not contain roost habitat. No forage, roosting or breeding will be removed under the proposed development, and it will not therefore have an adverse effect on the life cycle of the species such that local populations are 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,*

Not applicable.

c) *In the case of an endangered ecological community or critically 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 of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable.

d) *In relation to the habitat of a threatened species, population or ecological community:*

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

The subject site does not provide suitable roosting or breeding habitat for the Grey-headed Flying-fox. No forage habitat will be removed or modified under the proposed development.

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

The subject site does not provide suitable roosting or breeding habitat for the Grey-headed Flying-fox. No forage habitat will become fragmented or isolated from other areas of habitat as a result of the proposed development.

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

The subject site does not provide suitable roosting or breeding habitat for the Grey-headed Flying-fox. No forage habitat will be removed or modified under the proposed development. Given the large areas of suitable habitat available for this species in the wider locality, it is unlikely that the forage habitat present within the subject site is important to the long-term survival of the Grey-headed Flying-fox in the locality.

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

No critical habitat for this species has been listed by the Director-General of DECCW.

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

No recovery plan exists for the Grey-headed Flying-fox. No threat abatement plans are relevant to this species.

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.

The proposed development of the subject site does not constitute a key threatening process, and is unlikely to result in an increase of any key threatening processes. No mature trees will be removed under the proposed development. As the vegetation on the subject site is not considered to form part of a native vegetation community, and is mainly comprised of plants trees and garden species, removal of vegetation from the subject site would not be considered to constitute the key threatening process *Clearing of native vegetation.*

Conclusion

Any proposed development on the subject site is not likely to have a significant impact on this species. No Species Impact Statement is required.