



**35 WATER STREET, WAHROONGA**

**Species Impact Statement**

For:

**MURLAN CONSULTING**

March 2009

Final Report

**Cumberland Ecology**

PO Box 2474, Carlingford Court 2118

**Report No. 8104RP1**

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

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Approved by: David Robertson

Position: Project Director

Signed: 

Date: 10 March, 2009

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## CERTIFICATION

This is to certify that this Species Impact Statement has been prepared in accordance with the requirements of Sections 109, 110 and 111 of the *Threatened Species Conservation Act 1995* particularly the requirements notified by the Director General of the NSW Department of Environment and Conservation, and with regard to the matters identified by Section 5A of the *Environmental Planning and Assessment Act 1979*.

The curriculum vitae of the principal author and major contributors are provided within this document.

Principal Author /  
Director of the  
SIS:

David Robertson

Position: Director of Cumberland Ecology



Signed:

Date: 10 March, 2009

"I, Ben MacGibbon, of Murlan Consulting Pty Ltd, 26 Pirrama Road Pyrmont NSW 2009, being the applicant for the Major Project Application MP 07\_0151, 35 Water Street Wahroonga on Lot 1 DP 375262, have read and understood this Species Impact Statement. I understand the implications of the recommendations made in the statement and accept that they may be placed as conditions of consent or concurrence for the proposal".

Signed:



Date: 10 March, 2009

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# Executive Summary

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## BRIEF

Cumberland Ecology has been contracted to provide ecological advice in relation to a proposed hospital development located at the former John Williams Hospital at 35 Water St Wahroonga. The property is 2.13 hectares (ha) in size and is located at Lot 1 DP 375262.

The subject site is located within an urbanised area of the Sydney suburb of Wahroonga. A portion of the site contains the Critically Endangered Ecological Community (CEEC) Blue Gum High Forest (BGHF) in the Sydney Basin Bioregion.

This Species Impact Statement (SIS) has been prepared as a requirement as part of the Part 3A Project Application Director-General's Requirements (DGRs) for Major Project Application MP 07\_0151 issued by the Department of Planning (DOP) on 3 December 2008. Although a SIS is not usually required with a Part 3A application, as legally it is only triggered under Parts 4 and 5 of the *Environmental Planning and Assessment Act 1979*, DOP consultation with the Department of Environment and Climate Change (DECC) prior to issuance of the DGRs resulted in DECC requiring a SIS for the impacts on BGHF. The requirement has been incorporated into the DGRs issued by the DOP. This SIS also satisfies the DGR issued from DOP: *impact of the development on existing native flora and fauna and their habitats, including identified threatened species, having regard to the Threatened Species Assessment Guidelines*.

Waterbrook purchased the property at 35 Water Street, Wahroonga in 2005 and a development application for a 78 apartment SEPP Seniors Living Self Care Facility development was lodged with Council in 2006. This development application was refused and the refusal upheld in the Land and Environment Court predominantly on ecological grounds as it would have resulted in the loss of 19% of the BGHF. Between development application submission with Council and the appeal to the Land and Environment Court, the listing of BGHF was revised to Critically Endangered Ecological Community. This proposal was the subject of the judgement of Commissioner Watt and Acting Commissioner Taylor, in the Land and Environment Court proceedings No. 11194 of 2006, *Murlan Consulting Pty Limited v Ku-ring-gai Council LEC*.

It is noted from the judgement that the Court held that this development proposal, the subject of the appeal, would have a significant impact on threatened species, populations or endangered ecological communities and, accordingly would need to be assessed by a SIS according to the *Threatened Species Conservation Act 1995* (TSC Act).

In 2007, Cumberland Ecology was contracted to prepare a 7 Part Test in relation to a development proposal for a 61 apartment SEPP Seniors Living Self Care Facility. The findings of this 7 Part Test were that the proposal will not have a significant impact on the BGHF, that was identified on site by Dr Smith in April 2007. Accordingly, Cumberland Ecology was of the opinion that an SIS was not required for the previous proposal. However, notwithstanding this finding, Cumberland Ecology was instructed by the applicant to prepare a SIS on a precautionary basis to assist the consent authority evaluate impacts to BGHF. This document was submitted with the development application to Ku-ring-gai Council in December 2007. It was noted that this proposal had materially reduced the intrusions of built form into the areas of BGHF mapped by the Parties Single Expert in the Land and Environment Court proceedings, Dr Peter Smith, and that was the subject of the Court's determination.

In December 2007, Murlan Consulting applied to the DOP for assessment of a hospital scheme under Part 3A of the EP&A Act prior to the refusal from Ku-ring-gai Council being issued for the 61 apartment self-care facility. The hospital scheme, as assessed by this SIS, almost entirely retains the BGHF on the subject site (98.2%) and substantially increases the area of compensatory planting from 646m<sup>2</sup> with the 61 self-care retirement apartment scheme to 1770m<sup>2</sup> under the current proposal.

The main objectives of this SIS are to:

- Identify threatened species issues and provide appropriate amelioration strategies to minimise adverse impacts resulting from the proposal; and
- Assist consent or determining authorities in the assessment of the development application under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

## PROPOSED DEVELOPMENT

The subject site is currently home to "Rippon Grange", a heritage-listed house with associated stables, swimming pool, garden, garden structures and additional buildings. The original house was built in 1898, and in 1952 was donated to the government for use as a hospital. The total area of the property covers approximately 21,320m<sup>2</sup>. The land currently supports a range of buildings including the heritage-listed Rippon Grange.

A Hospital development is proposed for the subject site with three wings of a new building proposed for construction. The following wings are proposed:

- West Hospital Wing: this wing is located in the southwest portion of the subject site partly where a schoolhouse currently exists, and will extend southwards. It will be from four levels with one basement level to three levels with no basement;
- Main Hospital Wing: this wing is located south of Rippon Grange and north of the stables, and runs in an east-west direction. This wing is positioned in part where

the original garage and pool house currently exist. It will be six levels and a further basement level to three levels and with three basement levels; and

- East Hospital Wing: this wing is located in the south-eastern portion of the subject site. Construction of this wing will require the removal of a small area of BGHF. It will include 5 levels and 1 basement level.

## **SITE LOCATION**

The subject site is located in Wahroonga in the Ku-ring-gai LGA. It is zoned under the Ku-ring-gai Municipal Council's Planning Scheme Ordinance as Special Use 5(a) hospital. It is located within the Pittwater subregion of the Sydney Metro Catchment Management Authority and in the Sydney Basin Bioregion. Wahroonga is situated on the upper North Shore of Sydney, approximately 20km from the city centre. It is located on a plateau, approximately 200m above sea level.

## **SURVEY METHODS**

### ***Database Analysis and Literature Review***

Threatened species records held in databases of the Department of Environment and Climate Change (DECC) and Department of the Environment, Water, Heritage and the Arts (DEWHA) were obtained and reviewed for relevance to the habitats of the study area. The database analysis entailed examination of threatened flora species records from:

- The NSW Government BioNet database records of species within the LGA and the bioregion; and
- The DEWHA interactive map database within a polygon that incorporated the study area and surrounding landscapes (referred to as a Protected Matters Report).

The flora and vegetation of the subject site has been investigated by a range of ecological specialists over the last two years. A review of these reports was conducted.

### ***Flora Survey***

A botanical survey was conducted by Urban Bushland Management Consultants on 22<sup>nd</sup> February 2006. This survey included vegetation mapping and random meanders. Additional flora and vegetation surveys were conducted by P. Smith, the court-appointed expert in 2007 which this SIS takes into account.

Cumberland Ecology initially conducted further botanical surveys on 16<sup>th</sup> August 2007. These involved a random meander covering the entire site followed by quadrat analysis. A total of ten 10m x 10m quadrats were assessed within the boundaries of the Blue Gum High Forest as mapped by the Parties' Single Expert Dr Smith in proceedings no 11193 of 2006. Quadrats could not be located to avoid confounding edge effects because the occurrence of BGHF on the subject site is so narrow that it is entirely subject to edge effects.

An additional random meander survey for species not previously detected was conducted by Cumberland Ecology on 18<sup>th</sup> September 2008 and 10 additional 10m x 10m quadrats were surveyed on 19<sup>th</sup> September 2008. These surveys were undertaken after good weather conditions for plant growth to ensure a comprehensive native species list for the subject site. These quadrats were located in garden areas outside the area mapped by Dr Smith as BGHF and in some parts of the BGHF where quadrats had not previously been located.

The data and other general observations were used to define the plant community and determine the regeneration potential of the BGHF that is present on the site. The condition of the vegetation in each quadrat was assessed. This comprised estimation of the proportion of exotics in each of the canopy, small tree, shrub and ground cover strata, based on the percentage of total projective foliage cover in the relevant stratum that included introduced species.

### ***Fauna Survey***

The main fauna survey was conducted by Urban Bushland Management Consultants over three days in February and March 2006. Field surveys included habitat assessment, active searches for reptiles, frogs and birds, hair tubes, spotlighting; and echolocation call analysis. Two staff from Cumberland Ecology carried out additional owl call playback in August 2007.

## **RESULTS**

### ***Vegetation***

Part of the vegetation on the subject site corresponds to the NSW Scientific Committee's final determination for the Critically Endangered Ecological Community (CEEC) Blue Gum High Forest. In the preceding Court case, there has been some debate as to what portion of this community is present on the subject site. The Parties Single expert, Dr Smith, using the recently published CEEC listing considers that BGHF covers 6,350m<sup>2</sup> of the subject site, which is a conservative assessment of the community. Teresa James reviewed the previous SIS for the 61 self-care retirement apartment scheme and decided that the BGHF covered an additional 0.2ha to the area mapped by Dr Smith. Additional areas mapped by James included the croquet lawn, as well as lawns and gardens to the

north and south of the croquet lawn. James' mapping is based on the presence of common native ground cover species and not on characteristic BGHF species, following a brief site inspection and review of relevant reports. James has neglected to acknowledge that such areas such as the croquet lawn have a disturbed soil profile, so are not likely to contain a viable seed bank from the BGHF that existed there before clearance. Only two of the herbaceous native species recorded by James in the additional 0.2ha are characteristic of BGHF.

This report uses the mapping of the community done by Dr Smith to define the extent of BGHF on the subject site. Additional quadrat surveys confirmed that remaining vegetation on the subject site consists of landscaped gardens with a variety of exotic and native species. The BGHF does not extend beyond the area mapped by Smith because very few species characteristic of the community occur in surrounding gardens and lawns, and native species are limited to colonising ground cover species, not BGHF canopy, small tree and shrub species. Such species are commonly found in disturbed areas and are not an indication that an area will regenerate as BGHF or any other community. The lack of regeneration of key canopy, small tree and shrub species in these areas indicates that the BGHF is not expanding.

The area stated by Dr Smith as containing BGHF at 35 Water Street forms a reverse "L" shape along a boundary with adjacent residences on the southern side and adjoining Young Street on the eastern side. This zone (Blue Gum Zone) varies between approximately 20 and 35 metres in width and 135 metres long along Young Street, and 15 and 40 metres wide and 125 metres long near the southern boundary. The east-west length of the widest section near the southern boundary is approximately 50 metres.

The vegetation in the Blue Gum Zone is highly degraded, with a high level of weed invasion. It has a variable canopy, mainly of *Eucalyptus saligna* (Blue Gum), with large numbers of other species, native and exotic (Appendix B). Locally native species include: *Angophora floribunda* (Rough-barked Apple), *Eucalyptus pilularis* (Blackbutt) and *Eucalyptus paniculata* (Grey Ironbark). The understorey varies from dense with many species of small trees and/or shrubs, to exotic grassland with no or occasional scattered small trees or shrubs. The most common small trees (including juveniles) are *Ligustrum lucidum* (Large-leaved Privet) and *Pittosporum undulatum* (Sweet Pittosporum). The most common shrubs are *Genista monspessulana* (Montpellier Broom), *Ageratina megalophylla*, *Ligustrum sinense* (Small-leaved Privet) and *Ochna serrulata* (Mickey Mouse Plant). The ground covers also vary greatly. Grassy areas tend to be dominated by the introduced *Stenotaphrum succedanea* (Buffalo Grass). Open situations near the southern boundary are generally dominated by a wider range of exotics, including *Plantago lanceolata* (Lambs Tongue), *Anagallis arvensis* (Scarlet Pimpernel), *Ehrharta erecta* (Veldt Grass), *Euphorbia peplus* (Petty Spurge) and *Ipomoea indica* (Morning Glory). The indigenous *Geranium homeanum* (a Storksbill) and *Oplismenus aemulus* (Basket Grass) are locally common in some locations. More shady situations beneath tree canopy typically contain high proportions of *Asparagus densiflorus* (Fern Asparagus), *Asparagus scandens*, *Nephrolepis cordifolia* (Fishbone Fern) and *Freesia refracta* (Freesia).

Of the 32 tree species recorded during the Cumberland Ecology flora surveys, 9 are naturally occurring. Eighteen other species are NSW or Australian species that are not locally indigenous or occur in other habitat in the district. Six naturally occurring shrub species were recorded in the quadrats. Other shrub specimens are either planted and potentially native to the site, but grown from unknown provenance propagules, or occur in other habitats in the local district, or are not native to the district or Australia. Thirty-five ground cover species are natural to the site with 65 non-native species being present. Eight of the total of 22 vines are native to the site.

The condition of the vegetation is generally poor, with much weed infestation. A wide variety of weeds are present, many of which are noxious. Weeds range from groundcover to shrubs and trees. These include species such as Privet, African Olive, Broom, Camphor Laurel and many others. Many exotic species were purposefully planted as garden plants throughout the site. Some species have also been planted that, while native to Sydney, are not native to BGHF. Within each of the ten quadrats surveyed, estimates were made of the percentages of exotic species in each of the four vegetation strata (canopy tree, small tree, shrub and ground cover). While the canopy layer was generally dominated by native species, up to 100% of other layers were dominated by weeds. UBMEC has indicated that the BGHF has low to moderate resilience based on the level of disturbance to the soil and the level of weed invasion (UBMEC, 2009).

The remaining vegetation on the subject site consists of areas that have previously been maintained as gardens or lawns. Such areas do contain some native species; remnant canopy species, *Pittosporum undulatum* or colonising ground cover species that commonly occur in disturbed areas. However, these parts of the subject site are dominated by exotic species and have been cultivated and maintained as such for many decades. The croquet lawn is one such area adjacent to the mapped BGHF where some native species have been recorded but it has undergone substantial earthworks to create a level lawn and would have been maintained as such with topsoil dressing for several decades. Characteristic native canopy, small tree and shrub species of BGHF as described by the Scientific Committee are not regenerating in areas outside the mapped BGHF, with the exception of *Pittosporum undulatum*, which has the properties of an environmental weed (Rose and Fairweather, 1997) and rare *Eucalyptus saligna* seedlings.

### **Fauna Habitat Features**

Tree hollows of a variety of sizes are present in a number of Blue Gums and other trees on the site. The hollows provide nesting opportunities for Lorikeets (one pair was seen flying to and from a slit hollow in a Blue Gum), bats, possums, and possibly cockatoos. No large stags or hollows were noted that would provide nesting habitat for owls. Hollows were noted in 11 trees on the subject site.

A variety of habitat features such as shelter sites for ground-dwelling species are present on the subject site. These include a stone wall on the eastern side of the property where a croquet lawn was present. A collapsed gazebo is present to the north of this. A gutter runs along the southern boundary of the property, and entrances under the various

buildings are present. Dead trees and logs are present on the eastern side of the site. Damp soils are present in a number of areas, evidenced by the presence of Sphagnum Moss. This is particularly noticeable in the northeast corner and the southern area of the site. An ephemeral drainage line runs north-south along the western side of the driveway in the south-eastern part of the study area.

Many of the buildings have openings that would allow animals inside. For example, the old stables could provide roosting for a variety of birds and bats.

### **Threatened Species**

No threatened plant species occur naturally on the subject land. Two specimens of the small tree *Syzygium paniculatum* (Magenta Lilly Pilly) are present at the subject site but these are old trees and were probably planted on the site as this species generally occurs in rainforest habitats.

Two threatened fauna species were recorded: the Grey-headed Flying-fox and the Gang-gang Cockatoo. Grey-headed Flying-foxes were seen flying overhead and heard foraging off-site to the north and are likely to forage within the trees of the site on a regular basis. The Gang-gang Cockatoo was seen flying over the subject site. It has potential to forage on the site but is not considered likely to nest on the subject land.

## **IMPACTS OF THE PROPOSED DEVELOPMENT**

This assessment of the impact of the current proposal is based upon Dr Smith's mapping of BGHF on the subject site. According to mapping by Peter Smith (2007), the proposed development would involve clearing 116m<sup>2</sup> or 1.8% of BGHF. This includes only four trees, at least one of which is likely to have been planted. It is not considered that the removal of this vegetation will have a significant impact on the viability of the community on the subject site and within the locality, as the occurrence on the subject site, particularly the area to be cleared, is highly degraded.

The retained forest community will be restored by weeding and replanting according to a Vegetation Management Plan (VMP). Additional areas totalling 1770m<sup>2</sup> made up of small patches in the south east and south west portions of the subject site will also be revegetated as BGHF according to the VMP. This will increase the area of native vegetation on the subject site and improve the condition of the BGHF community through weed control works and additional plantings of locally native species typical of the community. An area of 583 m<sup>2</sup> of early works plantings in the south of the subject site will provide additional buffering to the BGHF.

Table 1.1 shows a summary of the impacts on BGHF and additional areas of BGHF to be re-vegetated as a result of the proposal.

**Table 1.1 TOTAL AREA OF BGHF AFFECTED (REMOVED) BY THE DEVELOPMENT AND ADDITIONAL AREAS OF BGHF TO BE RE-CONSTRUCTED**

| FOOTPRINT ELEMENT                                           | Area<br>m <sup>2</sup> | Cumulative<br>m <sup>2</sup> | Cumulative<br>impact on BGHF<br>% |
|-------------------------------------------------------------|------------------------|------------------------------|-----------------------------------|
| BGHF FOOTPRINT as mapped by Smith                           | 6,350                  |                              |                                   |
| A: FOOTPRINT OF EAST HOSPITAL WING IN BGHF                  | 42                     | 42                           | 0.7                               |
| B: ON GRADE DRIVEWAY IN BGHF                                | 74                     | 116                          | 1.8                               |
| C: ADDITIONAL AREAS OF LANDSCAPE TO BE RE-VEGETATED AS BGHF | -1770                  | -1654                        | 27.9                              |

**Note:** Additionally, there is potential for edge effects and hydrological changes that could further impact on this vegetation community and these are discussed within the SIS.

### ***Threatened Species***

No threatened species are considered likely to be significantly impacted by the proposed development. A range of threatened species are considered in this SIS to be potentially “affected species”. Most of these have not been recorded at the subject site, but are considered in the impact assessment as a precautionary measure. Species assessed include:

- *Syzygium paniculatum* (Magenta Lilly Pilly);
- *Tetratheca juncea*;
- Superb Fruit Dove;
- Parrots including Glossy Black-cockatoo and Gang-gang Cockatoo;
- Owls such as the Powerful and Masked Owls; and
- Bats including the Grey-headed Flying-fox and a range of microchiropteran bats known to occur in urban areas.

Due to the small area (1.8%) of BGHF that would be cleared as a result of the proposed development and the retention of 98.2% of BGHF, the reconstruction of 1770m<sup>2</sup> as BGHF, and extensive restoration work proposed within the BGHF, no significant impact is expected for any of these species.

### ***Blue Gum High Forest***

Blue Gum High Forest, a community listed as “critically endangered” under the TSC Act, is present on the subject site. The community on the subject site does not correspond to the EPBC listing as the understorey is too highly modified. This has been confirmed by the Department of the Environment, Water, Heritage and the Arts. Blue Gum High Forest covers 6,350m<sup>2</sup> of the subject site.

Under the proposal the forest will be conserved, weeded and replanted in the long term. The total area of BGHF affected (removed) by the development is approximately 116m<sup>2</sup>, representing about 1.8% of the BGHF vegetation on the subject site.

Additionally, there is potential for edge effects and hydrological changes that could further impact on this vegetation community. The proximity of the proposed buildings to the BGHF and increased human use of the subject site could increase impacts such as weed invasion but the BGHF is currently under threat from such edge effects due to the size, shape and history of the remnant. Existing impacts from weeds and any that have the potential to be exacerbated by the proposal will be mitigated through the implementation of the VMP. Construction of basement levels will not have a significant impact on groundwater available to the BGHF due to the nature of subsurface flows on the subject site and the construction design to minimise soil moisture loss. The proposed buildings will not have an over-shadowing effect on the BGHF because the canopy trees will not be over-shadowed at all, understorey trees are relatively shade-tolerant and the shadows from the buildings will move across and not permanently shade the BGHF.

#### *Recovery Capacity*

The community present on the subject site varies in condition from moderately to highly degraded and disturbed. Some areas will require assisted natural regeneration via weed control to regenerate whereas other areas will require plantings and ongoing weed control to resemble a native plant community (UBMEC, 2009). Owing to extreme changes to the natural vegetation and habitat over a prolonged period, it is concluded that the plant community has been subject to a very large reduction in ecosystem function, as indicated by:

- Changes in community structure;
- Changes in species composition;
- Existing disruption of ecological processes (including nutrient enrichment of habitat, changed hydrology, modification of natural soil profiles and restriction of natural genetic exchange and species importation to the site);
- Invasion and establishment of exotic species;
- Degradation of habitat, and
- Fragmentation and isolation of habitat.

It would be impossible for the remaining indigenous vegetation to naturally regenerate to any form of native bushland. Even with assisted natural regeneration it is unlikely the site

will provide suitable habitat for re-establishment of viable, representative BGHF community that would contribute significantly to conservation of the Critically Endangered Ecological Community. It is however possible that a simplified form of BGHF could be re-established in the eastern section of the site, near Young Street, where soils appear to be relatively intact. It should also be possible to re-establish native canopy, small tree, shrub and ground cover strata. Owing to the narrow width, large edge effect and surrounding development, this section of Blue Gum Zone will need permanent ongoing maintenance work, especially to the ground cover stratum.

#### *Impact of the Proposed Development*

The BGHF of the subject site is part of a band of this community that has been mapped by NPWS as running in a generally southwest to northeast direction. The vegetation within the subject site has limited connectivity to the south and west, however the vegetation within the subject site has connectivity to a larger patch of vegetation to the north-east which is known as Turiban Reserve. The current plans involve the removal of a small area of BGHF on the site. This will not affect the continuity of the community on the subject site or within the locality and the reduced footprint of the east wing compared with the previous two schemes improves connectivity within the BGHF on the subject site.

Based on the species in and adjacent to the study area and the time the community has been dominated by exotic species, it is probable that the soil seed bank from locally indigenous species now ranges from depleted, no longer viable, to absent, according to the variable soil disturbance and time since native seed was deposited in the soil seed bank in different parts of the site. Clearing of a small area of vegetation will therefore not have any material affect on the seed bank at the site.

The subject site for the development has been used as a hospital for many years and has experienced considerable disturbances over past decades, including vegetation clearance, construction of buildings and associated infrastructure such as paths and drains, planting a wide range of exotic flora species, colonisation of the site by weeds and feral animal and keeping of poultry. The resultant impacts on soils, and the modification of understorey and thinning of the tree cover has diminished the values of the area as a potential conservation reserve. Better quality vegetation with a more intact understorey exists in the locality. Such habitats are of greater value for long term conservation of the BGHF. Notwithstanding such past impacts, the proposal for the redevelopment of the site will entail conservation and enhancement of the majority of BGHF.

Threatened flora and fauna are an important consideration in the planning and environmental assessment process. However, when assessing the feasible alternatives to a proposed development, it is salient to recognise the presence of threatened flora and fauna should not automatically be assumed to be sufficient constraint to preclude development from a site. The clearance of threatened species habitat can – (and is frequently across Australia) - justified under some circumstances when ecological issues are carefully weighed against social and economic issues.

## ***Long-term Mitigation Measures***

A range of long-term mitigation measures are proposed for the site. These include assisted natural regeneration and supplementary planting (reconstruction) within the BGHF, and management of construction to avoid unnecessary impacts on the vegetation. There will be additional plantings (reconstruction) outside the current area of BGHF which will cover approximately 1770m<sup>2</sup>. Details of these are provided in the attached Vegetation Management Plan (VMP) prepared by Urban Bushland Management Consultants.

The layout of the proposed development has been designed to avoid direct impacts on BGHF habitat on the whole, and minimise impacts for the East Hospital Wing which is placed partly within the boundary of the community on the subject site. The VMP provides recommendations for the protection of the vegetation. These include measures such as:

- Definition of the construction zone for building works located near the edge of the BGHF;
- Erection of exclusion and sediment fencing to protect bushland adjacent to the construction zone; and
- Wooden tree shields and supplementary fencing around trees to be retained within the construction zone.

Blue Gum High Forest on the subject site will be rehabilitated and reconstructed in a broad arc stretching south from Water St along the eastern side of the property, through the centre of the property and extending along the southern boundary to the south-western corner. This will reduce fragmentation and enhance connectivity within the subject site as well as enhance connectivity to BGHF in Wahroonga Public School on the northern side of Water Street by increasing the width of BGHF on the northern boundary of the subject site. Areas identified for reconstruction as BGHF will fill in the irregular shape of the existing BGHF to reduce the edge to area ratio. The VMP provides a range of recommendations for the control and management of weeds. The main focus of weed control will be on species listed as noxious or primary target weeds.

The BGHF will be buffered along its edges from the proposed development via the additional reconstruction areas and by early works plantings. The area mapped as BGHF includes the extent of tree crowns, which allows a buffer of approximately 3m to the tree trunks at the edge of mapped BGHF.

## ***Ongoing Monitoring***

Owing to the level of difficulty in restoring the BGHF resulting from the degraded state of its habitat on the subject site, bush regeneration work would need to be implemented in a professional, strategic and consistent manner for over ten years. Ongoing maintenance will be required in perpetuity to prevent re-infestation of weeds and ensure rehabilitation objectives are being met. A professional bush regenerator will need to be employed to

carry out these activities. Annual reviews will be provided to the proprietors and Ku-ring-gai Council.

### ***Compensatory Measures***

Reconstruction within the subject site of 1770m<sup>2</sup> of BGHF in accordance with a Vegetation Management Plan (VMP; UMBEC 2008), outside of the mapped area of the community, will significantly help to ameliorate impacts on the community. The VMP also prescribes assisted natural regeneration for core areas of BGHF. The native vegetation of the site has already been highly modified from its original floristic and structural condition. Only 20 of the 53 species listed in the final determination are present at the subject site. Rehabilitation of the community will achieve a “no net loss” of vegetation on the subject site, and will in fact greatly improve the condition, floristics, structure and extent of the community (achieve “improve or maintain”). As such, no external compensatory measures are considered necessary.

## **CONCLUSION**

Blue Gum High Forest occurs on the subject site but is currently highly impacted by past clearing and weed invasion. According to mapping by Peter Smith (2007), the proposed development would involve clearing 116m<sup>2</sup> or 1.8% of BGHF. This includes 4 trees, one of which is likely to have been planted. The current area of the forest will essentially be conserved and would be weeded and managed in perpetuity. The current proposal also proposes to reconstruct 1770m<sup>2</sup> of BGHF increasing the area of occupancy of BGHF by 27.9% within the subject site. Restoration of the community by weed control and by replanting of native species will also be undertaken and will increase the viability of the community in the long-term. In this regard, it needs to be recognised that the critically endangered listing of BGHF includes highly degraded forms of the community as is found on the subject site, which in places is not recognisable as a native vegetation community. The proposal will change this situation by significantly increasing the native plant species that are currently absent or in low abundance, and removing exotic species and weeds (and uncharacteristic natives) which have currently overwhelmed the BGHF community.

No threatened species would be significantly impacted by the proposed development.

# Introduction

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## 1.1 Purpose

Cumberland Ecology has been contracted to prepare a Species Impact Statement (SIS) for a proposed hospital development located at the former John Williams Hospital at 35 Water St Wahroonga. Two different Development Applications have previously been lodged with Ku-ring-gai Council, in July 2006 and December 2007 respectively. This current Application takes into consideration the need to protect and minimise the area of impact on Blue Gum High Forest (BGHF) upon the subject site. The property is 2.13 hectares (ha) in size and is located at Lot 1 DP 375262. Collectively, the aforementioned lot comprises the “subject site”. A proportion of the subject site retains native vegetation which is consistent with the critically endangered ecological community (CEEC) BGHF, of which a small portion would be cleared. This vegetation also provides habitat for threatened fauna.

The purpose of this SIS is to formally evaluate the impacts of the proposal upon threatened flora and fauna and to provide recommendations to mitigate and manage flora and fauna impacts arising from the construction and operation of a hospital. Although the SIS has been prepared primarily to meet the requirements of the New South Wales *Threatened Species Conservation Act 1995* (TSC Act), it also assesses the impact to threatened flora and fauna listed by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Therefore, within this document threatened flora and fauna include populations, species and communities listed by the TSC Act and/or the EPBC Act.

The SIS has been prepared in accordance with Division 2 Part 6 of the TSC Act which includes the requirements of the Director General (DGRs) of the NSW Department of the Environment and Climate Change (DECC), which are provided in Appendix A. It has also been prepared to assess threatened flora and fauna listed by the EPBC Act, irrespective of whether such entities are listed by the TSC Act.

The main objectives of this SIS are to:

- Identify threatened species issues and provide appropriate amelioration strategies to minimise adverse impacts resulting from the proposal;

- Provide an appropriate level of background information and assessment to facilitate determinations and licensing processes;
- Assist consent or determining authorities in the assessment of the development application under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act);
- Assist the Director-General of the DECC in deciding whether or not concurrence should be granted for the purposes of Part 3A of the EP&A Act; and
- Assist the Director-General of the DECC or the Minister for the Environment when consulted for the purposes of Part 3A of the EP&A Act.

Throughout the SIS at the start of each major section the relevant parts of the DGRs are reproduced in italics in order to demonstrate how each SIS section complies with statutory requirements.

## 1.2 Need for a Species Impact Statement

The subject site is located within an urbanised area of the Sydney suburb of Wahroonga. A portion of the site contains the CEEC *Blue Gum High Forest in the Sydney Basin Bioregion*. Previous ecological assessments concluded that the impact on this vegetation community would not be significant. Ku-ring-gai Council however refused consent for Development Application (DA) 855/06 for reasons which included:

- The development will have a significant detrimental impact on both the natural and built heritage values of the site; and
- The development will have a significant impact on the Blue Gum High Forest EEC.

This decision was appealed in the Land and Environment Court (*Murlan Consulting Pty Limited v Ku-ring-gai Council* LEC (NSW) no 11193 of 2006). The appeal was rejected, partly based on the significant impacts that would be felt by the BGHF on the subject site. Under the EP&A Act, any development which may cause a significant impact on threatened species, populations or communities must be assessed by a SIS according to the TSC Act. No SIS was prepared for the first proposal. Following this, Cumberland Ecology was contracted to prepare a 7-part test, which found that the proposal would not have a significant impact on the critically endangered ecological community that was identified on the site by Dr Peter Smith in April 2007. Despite the finding that a SIS was not needed, one was prepared as a precautionary measure to accompany a second development application. This was also refused by Ku-ring-gai Council.

An application for consent under Part 3A of the EP&A Act was made to the Department of Planning in December 2007 to have the current hospital proposal assessed by the DOP. Consultation between DOP and DECC resulted in a SIS being required as part of the Part

3A Applications DGRs, even though a SIS would otherwise not legally be required under Part 3A.

### 1.3 Land and Environment Court Findings in Previous Proceedings

The CEEC BGHF occurs on the subject site. There had been argument as to how much of the vegetation conformed to the final determination for this community. According to the previous Vegetation Management Plan approximately 2,600m<sup>2</sup> corresponded to this community (UBMEC, 2007), however the court-appointed expert, using the recently published CEEC listing, considers that BGHF covers 6,350m<sup>2</sup> of the subject site (Smith, 2007b).

The following comments were made regarding the BGHF in the Court's decision (NSWLEC, 2007) and have been considered during the preparation of this SIS:

*82. The impact of the proposal on the remnant BGHF on the land was determined to amount to a loss of 17% of the stand of trees (Smith,2007) but in oral evidence Dr Smith stated that the loss of BGHF would actually be 19%, taking into account the driveway for Building F (and an addition of 67m<sup>2</sup>). Dr Smith also took the position in oral evidence that acceptable development impacts should not exceed 5% loss of the BGHF community on a site.*

*87. The Blue Gum High Forest needs to be afforded the maximum protection given its perilous remnant state and spatial coverage. For the reasons discussed below a range of steps need to be undertaken and considered to ensure the continued health and vigour of Blue Gum High Forest. These include:*

- *The development of buildings and related infrastructure outside of the footprint of the Blue Gum High Forest. Any future development would need to have a minimum buffer determined by the canopy spread or 3m from the trunk as per the council's tree preservation order, whichever is the greater.*
- *Future assessment has to take into account and establish properly the effects of shading, impacts on sub and surface hydrology, root zone disturbance and other edges effects that would ensue from any excavation, underground and above ground development that may occur.*
- *While adjoining patches of Blue Gum High Forest are significant for the maintenance of the ecological community as a whole, they cannot be considered in exchange for either offset or as component in any calculation for a development proposal that aims to remove or degrade the BGHF at 'Rippon Grange'. Any future applicant for development should only consider the vegetation that is within the boundaries of the land.*
- *Where species or communities have been listed as critically endangered, the preservation and protection of a few neighbouring isolated trees can contribute to*

*the long-term viability of a greater community and should be preserved. No community can regenerate if the seed banks or sources of those seeds have been removed.*

- *Where a community once existed there remains a distinct possibility that viable seed banks may be retained in the surrounding soils. Therefore, even where fire hazard reductions of the understorey have been undertaken it is quite possible that viable seed banks will remain in the soil such that natural regeneration has the potential to occur particularly, when assisted by sensitive planning and environmental management.*
- *With respect to the connectivity and fragmentation of endangered and critically endangered species, a few remaining trees may well provide a critical link to maintaining and contributing to the long-term viability of refugia. Indeed, the cross-pollination of fragmented individuals and stands of eucalypt trees (including Blue Gum High Forest) may occur over extended distances.*
- *While seed dispersal contributes to regeneration it is less significant and effective than the genetic transfer associated with pollination. Pollination occurs in eucalypts such as those characterising the Blue Gum High Forest via a variety of active, non-specific pollinating vectors such as generalist insects and animals.*
- *Insects regularly disperse pollen over 100m but they also have the capacity to disperse pollen over distances of at least 1.6km. Species of eucalypts (including Blue Gum High Forest) that are subject to pollen dispersal by larger animals such as birds (e.g. lorikeets) are likely to be subject to cross-pollination over significantly longer distances. Such distances may be as great as 6km from a pollen source for eucalypts. Consequently, even relatively distal and isolated species can contribute significantly to the long-term genetic viability of endangered and critically endangered communities.*
- *In terms of protecting ecological communities, buffer zones play a significant role in mitigating undesirable edge effects associated with urban development. Edge effects are more marked in narrow buffers. Thus it would be prudent where feasible to maintain as a large a buffer as possible. Even where exotic vegetation surrounds native bushland (including Blue Gum High Forest), the removal of such vegetation is likely to have a negative impact, especially when it is replaced by urban development. Due to the effects of light, runoff; litter etc.*
- *An applicant should avoid development that would truncate, fragment or disconnect a Blue Gum High Forest stand at 'Rippon Grange'.*

## 1.4 Definitions

The following definitions have been used throughout this SIS:

- *Development* means:
  - the use of land, and
  - the subdivision of land, and
  - the erection of a building, and
  - the carrying out of a work, and
  - the demolition of a building or work, and any other act, matter or thing referred to in section 26 that is controlled by an environmental planning instrument,

But does not include any development of a class or description prescribed by the regulations for the purposes of this definition.
- *Proposal*: is the development, activity or action proposed.
- *Threatened species, populations and ecological communities*: means species, populations and ecological communities specified in Schedules 1, 1A and 2 and threatened species, population or ecological community means a species, population or ecological community specified in any of those Schedules.
- *Subject site*: means the area directly affected by the proposal. The subject site is 35 Water St Wahroonga.
- *Study area*: is the subject site and any additional areas which that are likely to be affected by the proposal whether directly or indirectly.
- *Locality*: The area within a 5km radius of the subject site.
- *Subject species*: means those threatened species that are known or considered likely to occur in the study area.

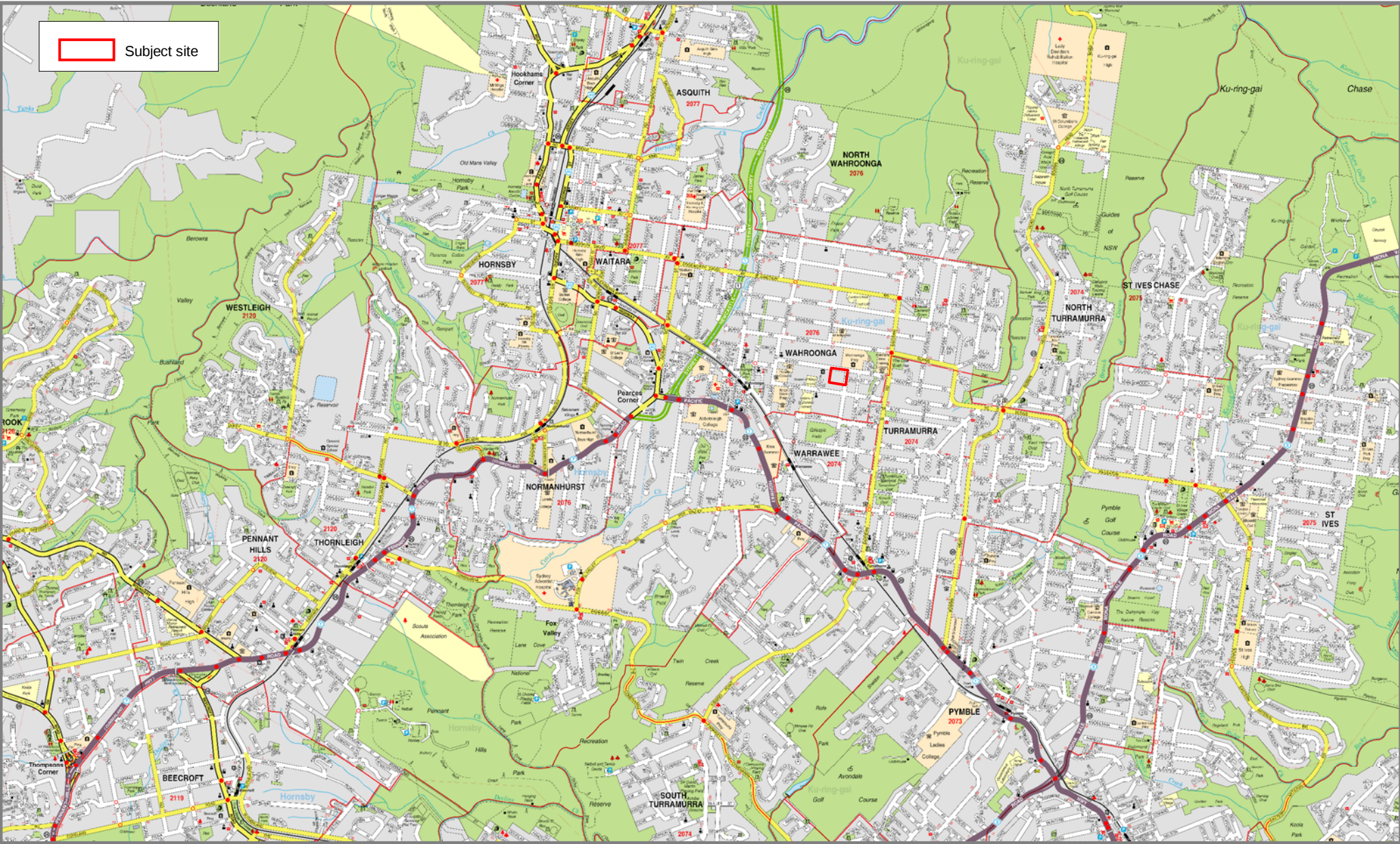


Figure 1.1 Location of the Subject Site

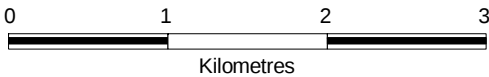


Figure 1.2 Aerial Photograph of the Locality

## Contextual Information

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### 2.1 Description of Proposal

*DGR 2.1 A species impact statement must include a full description of the action proposed, including its nature, extent, location, timing and layout (Section 110(1)).*

#### **2.1.1 Nature of the Proposal**

The subject site is currently home to “Rippon Grange”, a heritage-listed house with associated stables, swimming pool, glasshouse, garden, garden structures and additional buildings. The original house was built in 1898, and in 1952 was donated to the government for use as a hospital. The total area of the property covers approximately 21,320m<sup>2</sup>.

The land currently supports the following structures;

- Rippon Grange
- Swimming pool and pool shed;
- Former stable;
- Garage;
- Rustic shelter;
- Playroom/classroom;
- Classroom block;
- Covered way; and
- Killara Cottage.

The current extent of buildings and gardens are set back from the southern boundary of the property by between 25m (to the west) and 45m (to the east). This undeveloped area which is vegetated with native trees corresponds to the vegetation community BGHF. This vegetation extends along the eastern boundary of the property. The understorey is

predominantly introduced species and weeds. Isolated stands of trees exist throughout the property.

### **2.1.2 Layout, Extent and Location**

Two Development Applications have previously been lodged for the subject site with Kuring-gai Council. The first, lodged in July 2006, was based on a different development layout, a 78 apartment SEPP Seniors Living self-care facility. The second, lodged in December 2007, for a 61 apartment self-care facility, took into consideration the need to minimise impacts on BGHF. This current proposal, for a hospital, further reduces the clearance impacts on BGHF.

The currently proposed hospital development would involve clearing 116m<sup>2</sup> or 1.8% of BGHF as mapped by Peter Smith (2007). The current extent of the forest will essentially be conserved and would be weeded and managed in perpetuity. The current proposal would also entail reconstruction of 1770m<sup>2</sup> on the subject site as BGHF increasing the area of occupancy of BGHF by 27.9% within the site.

Additionally, edge effects and hydrological changes would further impact on this vegetation community.

Buildings and gardens already exist throughout the property, and the development is focussed on these areas. The following buildings are proposed or being retained:

- Rippon Grange: this building is located on the northern side of the property near the main entrance off Water St;
- Former stables, the main part of which is to be retained, with a smaller section to be demolished to assist the retention of the adjacent Brush Box trees, located south of Rippon Grange;
- West Hospital Wing: this wing is located in the southwest portion of the subject site partly where a schoolhouse currently exists, and will extend southwards;
- Main Hospital Wing: this wing is located south of Rippon Grange and north of the stables, and runs in an east-west direction. This wing is positioned in part where the original garage and pool house currently exist;
- East Hospital Wing: this wing is located in the south-eastern portion of the subject site. Construction of this wing will require the removal of a small area of BGHF; and
- Construction of in-ground services including sewerage and stormwater drainage pipelines..

### **2.1.3 *Timing***

Construction activities would commence within 4 to 6 months from project approval, approximately late 2009. The duration of construction would be approximately 18 months.



**35 Water St, Wahroonga  
BGHF area impact comparison**

|                                                                                     |                                                                         | Proposed Hospital Scheme |            |                         |                        |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------|------------|-------------------------|------------------------|
|                                                                                     |                                                                         | Sqm                      | Total Sqm  | % of BGHF area retained | % of BGHF area removed |
|  | Extent of Dr Smith 2007 mapped Blue Gum High Forest (BGHF) mapped area  |                          |            |                         |                        |
|  | Blue Gum High Forest (BGHF) Dr Smith mapped area                        |                          | 6350.0 sqm | 100.0%                  |                        |
|  | Total area of BGHF affected/ removed comprising of:-                    |                          |            |                         |                        |
|                                                                                     | A. Building footprint                                                   | -42.0 sqm                |            | 99.3%                   | 0.7%                   |
|                                                                                     | B. On grade driveway                                                    | -74.0 sqm                |            | 98.2%                   | 1.8%                   |
|                                                                                     |                                                                         | -116.0 sqm               | -116.0 sqm | 98.2%                   | 1.8%                   |
|                                                                                     | <b>Sub Total</b>                                                        |                          | 6234.0 sqm |                         |                        |
|  | Area of landscape to be revegetated as BGHF                             |                          | 1770.0 sqm |                         |                        |
|                                                                                     | <b>Total area of BGHF area following removal and revegetation works</b> |                          | 8004.0 sqm | 126.0%                  | -27.9%                 |
|  | Area of earlyworks planting (completed in 2006)                         |                          | 583.0 sqm  |                         |                        |
|  | Site Boundary                                                           |                          |            |                         |                        |

project:  
**PROPOSED PRIVATE HOSPITAL  
35 WATER STREET (LOT 1 DP 375262)**

client  
**WATERBROOK AT WAHROONGA**

scale: 1:1000@A4 drawing no: revision:  
date: 16.01.2009  
job no: 05-167S

**LV01 G**

**FIGURE 2.1: NATIVE VEGETATION BALANCE SHEET**

## 2.2 Location

The subject site is located at Lot 1, DP 375262 (No 35 Water Street), Wahroonga in the Ku-ring-gai LGA. This is located within the Pittwater subregion of the Sydney Metro Catchment Management Authority and the Sydney Basin Bioregion. Wahroonga is situated on the upper North Shore of Sydney, approximately 20km from the city centre. It is located on a plateau, approximately 200m above sea level. The total area of the site is approximately 2.1 ha.

## 2.3 Land Tenure Information

*DGR 2.2 Information must be provided about the land tenure across the study area.*

The lots which make up the subject site are variously zoned under the provisions of the Ku-ring-gai Planning Scheme Ordinance Council as follows:

- No 35 Water Street – 5(a) Special Uses (Hospital).

Surrounding properties are zoned 2(c) Residential except for Wahroonga Public School to the northeast, which is zoned 5(a) Special Uses (Schools). Wahroonga Public School is also known as “The Bush School”.

The subject site was owned by the NSW government prior to its sale in 2005 to the current owners (Waterbrook).

## 2.4 Soils and Geology

Soils in the area are mapped as Gn (Glenorie) (Chapman and Murphy, 1989). The landscape is undulating to rolling low hills and narrow ridges, hillcrests and valleys on Wiannamatta Group shales with a local relief of 50-80m and slopes of 5-20%. Soils are shallow to moderately deep *Red Podzolic Soils* on crests, moderately deep *Red* and *Brown Podzolic Soils* on upper slopes, and *Humic Gleys*, *Yellow Podzolic Soils* and *Gleyed Podzolic Soils* along drainage lines (Chapman and Murphy, 1989).

## 2.5 Vegetation

*DGR 2.3 Vegetation present within the locality must be mapped and described, including documentation of the aerial extent of each vegetation community. Include reference to the vegetation classification system used and to descriptions of threatened ecological communities as determined by the Scientific Committee. Classification must have regard to both structural and floristic elements.*

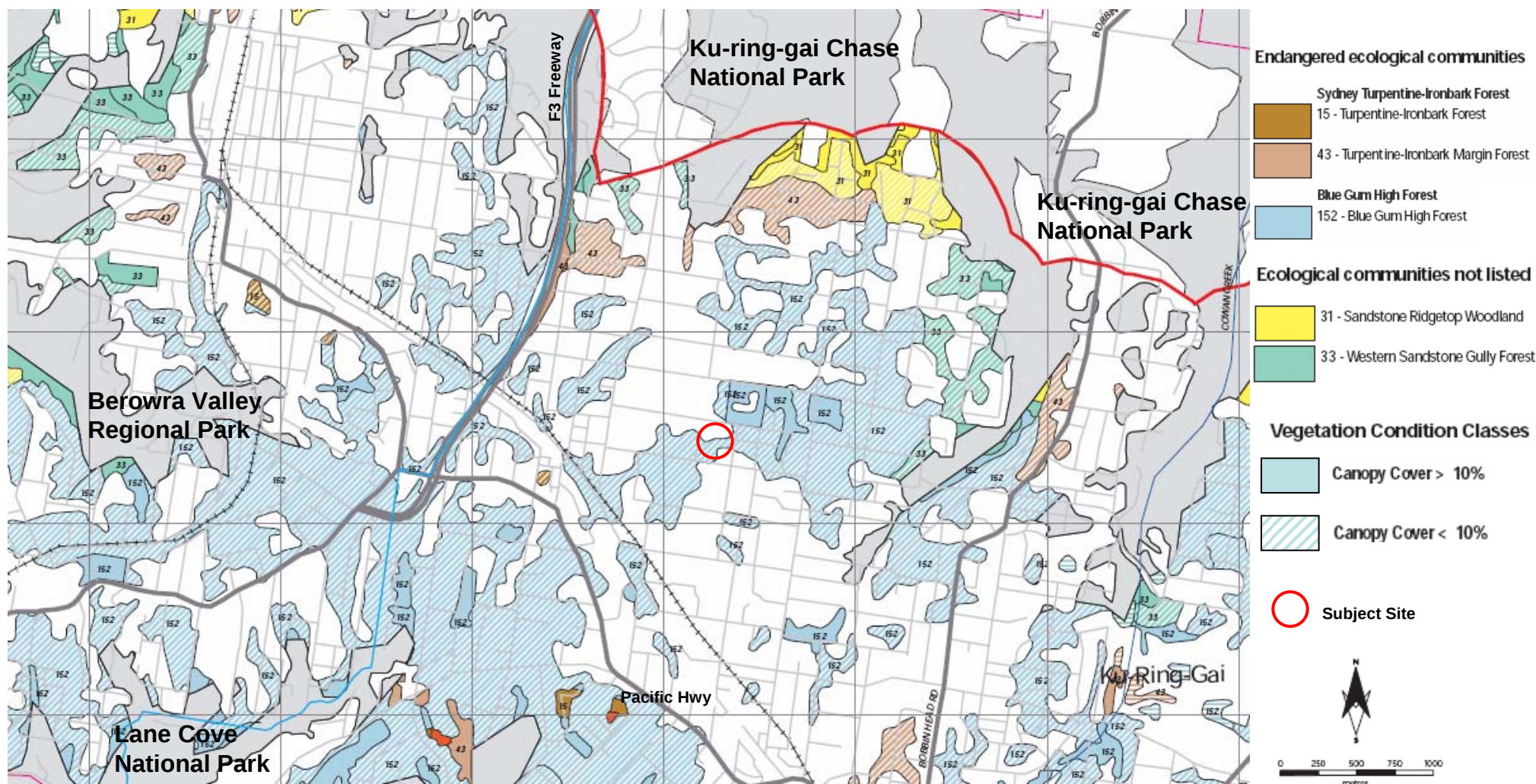
### 2.5.1 Introduction

A significant proportion of vegetation within the locality has been mapped as Blue Gum High Forest, with the majority of this as canopy cover of less than 10% (see Figure 2.2). This map unit includes trees that are scattered amongst an urban environment and includes the subject site. The NSW Scientific Committee's final determination of BGHF includes scattered remnant native trees and although much of the area shown in Figure 2.2 is urbanised, it demonstrates that scattered trees are important in contributing to the overall distribution of the community because the intact remnants of the community are very small and restricted in distribution.

Part of the vegetation on the subject site corresponds to the NSW Scientific Committee's final determination for the Critically Endangered Ecological Community (CEEC) BGHF. The portion of the subject site that contains this community has been subject to some debate, particularly regarding the degraded nature of the vegetation. The draft Vegetation Management Plan prepared in April 2007 used the previous EEC listing of the community and considered that approximately 2,600sq.m corresponded to this community (UBMEC, 2007). The court-appointed expert, Dr Peter Smith, using the recently published CEEC listing considers that Blue Gum High Forest covers 6,350m<sup>2</sup> of the subject site (Smith, 2007b, Smith, 2007a). A peer review of Cumberland Ecology's previous SIS by Teresa James identified an additional area approximately 30% the size of the Smith-mapped area as regenerating BGHF. Cumberland Ecology has surveyed additional quadrats within this area and disagrees that this area is consistent with the description for BGHF (NSW Scientific Committee, 2007). For the purpose of this SIS, the area considered to consist of the CEEC BGHF is the area mapped by Dr Smith (Smith, 2007b).

Blue Gum High Forest is also listed as a CEEC under the EPBC Act. An analysis of the vegetation of the subject site was conducted in order to determine whether clearing of this vegetation would constitute a controlled action under the EPBC Act.

Blue Gum High Forest as listed under the EPBC Act includes patches with an intact vegetation structure, a tree canopy cover greater than 10% and an area greater than 1ha. Patches with less than 10% tree canopy cover are also included if they are part of a native vegetation remnant that is greater than 5ha. Severely modified stands of trees characteristic of the canopy of BGHF, but without a native understorey are not included in the determination of the community, and do not form part of the listing, even though they are recognised as important biodiversity reservoirs (Rankin, 2007, Smith, 2006). The vegetation on the subject site does not conform to the final determination for the community as listed under the EPBC Act (Smith, 2006). This has been confirmed by the Department and clearing of vegetation is therefore not considered a controlled action under this Act (Rankin, 2007).



# Native Vegetation of the Cumberland Plain

Map 10 of 16



## 2.5.2 Blue Gum High Forest on the Subject Site

### i. Location

The area stated by Smith as containing BGHF at 35 Water Street forms a reverse “L” shape along a residential boundary on the southern side and adjoining Young Street on the eastern side. This zone (Blue Gum Zone) varies between approximately 20 and 35 metres in width and 135 metres long along Young Street, and 15 and 40 metres wide and 125 metres long near the southern boundary. The east-west length of the widest section near the southern boundary is approximately 50 metres.

### ii. Floristics

The vegetation in the Blue Gum Zone has a variable canopy, mainly of *Eucalyptus saligna* (Blue Gum), with large numbers of other species, native and exotic (Appendix B). Locally native species include: *Angophora floribunda* (Rough-barked Apple), *Eucalyptus pilularis* (Blackbutt) and *Eucalyptus paniculata* (Grey Ironbark). Some specimens occur just outside the property boundary but are considered in this report to be part of the subject plant community.

Numerous exotic tall tree species are present including some introduced eucalypts (e.g. *Eucalyptus grandis* (Flooded Gum), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Corymbia maculata* (Spotted Gum) and *Corymbia citriodora* (Lemon-scented Gum). Non-eucalypt species include: *Araucaria bidwillii* (Bunya Pine), *Araucaria cunninghamii* (Hoop Pine), *Jacaranda mimosifolia* (Jacaranda), *Liquidambar styraciflua* (Liquidambar) and *Cinnamomum camphora* (Camphor Laurel).

The understorey varies from dense with many species of small trees and/or shrubs, to exotic grassland with no or occasional scattered small trees or shrubs. The most common small trees (including juveniles) are *Ligustrum lucidum* (Large-leaved Privet) and *Pittosporum undulatum* (Sweet Pittosporum). The most common shrubs are the exotic species *Genista monspessulana* (Montpellier Broom), *Ageratina megalophylla*, *Ligustrum sinense* (Small-leaved Privet) and *Ochna serrulata* (Mickey Mouse Plant).

The ground covers also vary greatly. Grassy areas tend to be dominated by the introduced *Stenotaphrum succedanea* (Buffalo Grass). Open situations near the southern boundary are generally dominated by a wider range of exotics, including *Plantago lanceolata* (Lambs Tongue), *Anagallis arvensis* (Scarlet Pimpernel), *Ehrharta erecta* (Veldt Grass), *Euphorbia peplus* (Petty Spurge) and *Ipomoea indica* (Morning Glory). The indigenous *Geranium homeanum* (a Storksbill) and *Oplismenus aemulus* (Basket Grass) are locally common in some locations. More shady situations beneath tree canopy typically contain high proportions of *Asparagus densiflorus* (Fern Asparagus), *Asparagus scandens*, *Nephrolepis cordifolia* (Fishbone Fern) and *Freesia refracta* (Freesia).

**Table 2.1 STRUCTURE OF VEGETATION AND PROJECTIVE FOLIAGE COVER**

| Quadrat | Canopy (height (m), projective foliage cover) | Small Tree (height (m), projective foliage cover) | Shrub (height (m), projective foliage cover) | Groundcover (height (m), projective foliage cover) |
|---------|-----------------------------------------------|---------------------------------------------------|----------------------------------------------|----------------------------------------------------|
| 1       | 20-30; 30%                                    | 5-14; 30%                                         | 0.5-3; 50%                                   | 0-0.5; 50%                                         |
| 2       | 20-39; 10%                                    | 7-10; 10%                                         | 1-4; 60%                                     | 0-1; 70%                                           |
| 3       | 12-25; 40%                                    | 6-7; 5%                                           | 0.5-2; 60%                                   | 0-0.5; 40%                                         |
| 4       | 25; 50%                                       | 10-15; 20%                                        | 0.5-1.5; 5%                                  | 0-0.5; 25%                                         |
| 5       | 25; 50%                                       | 10; 10%                                           | 0.5-2.5; 30%                                 | 0-0.5; 60                                          |
| 6       | 30; 30%                                       | 12; 60%                                           | 1-1.5; 5%                                    | 0-0.5; 90%                                         |
| 7       | 20-25; 25%                                    | absent                                            | 0.5-2; 10%                                   | 0-0.5; 80%                                         |
| 8       | 25; 70%                                       | absent                                            | 0.5-1.5; 5%                                  | 0-0.5; 80%                                         |
| 9       | 15-25; 30%                                    | absent                                            | absent                                       | 0-0.5; 90%                                         |
| 10      | 15-25; 50%                                    | 6-8; 5%                                           | 1-2.5; 80%                                   | 0-0.8; 50%                                         |
| 11      | 40, 10%                                       | 10, 70%                                           | 1.5-2, 60%                                   | 0-1, 30%                                           |
| 12      | 10, 5%                                        | absent                                            | 2, 30%                                       | 0-0.3, 100%                                        |
| 13      | 20, 10%                                       | absent                                            | 2-3, 70%                                     | 0-1, 70%                                           |
| 14      | 20, 5%                                        | 6, 5%                                             | 1.5, 10%                                     | 0-0.3, 90%                                         |
| 15      | 15, 80%                                       | absent                                            | 2, 20%                                       | 0-1.2, 90%                                         |
| 16      | 8, 10%                                        | absent                                            | absent                                       | 0-0.4, 95%                                         |
| 17      | 40, 10%                                       | 5-15, 50%                                         | 1-2, 20%                                     | 0-0.5, 95%                                         |
| 18      | 40, 10%                                       | 4-8, 20%                                          | 2-3, 25%                                     | 0-0.4, 95%                                         |
| 19      | 35, 25%                                       | absent                                            | 1.5, 5%                                      | 0-1, 95%                                           |
| 20      | 30, 10%                                       | absent                                            | 1.5, 5%                                      | 0-0.5, 60%                                         |

A number of photographs of quadrats taken on 16<sup>th</sup> August 2007 are shown below to provide a comparison of BGHF vegetation throughout the subject site. Other quadrat photographs have been provided in Appendix B.



**Photograph 2.1**

**Quadrat 1**



**Photograph 2.2**

**Quadrat 2**



**Photograph 2.3**

**Quadrat 4**



**Photograph 2.4**

**Quadrat 6**

### iii. Identification of Plant Community in Blue Gum Zone

Based on the natural soil type, average annual rainfall and presence of indigenous remnant and regeneration species, it is concluded here that the original vegetation prior to clearing was Blue Gum-Blackbutt Open Forest. The original community would have conformed to the Final Determination for BGHF, now listed as a Critically Endangered Ecological Community under the TSC Act. The existing plant community conforms to the Final Determination on the basis that “highly modified relics of the community also persist as small clumps of trees without a native understorey” (Paragraph 9) (NSW Scientific Committee, 2004e).

At the time of this survey the original understorey vegetation had been almost totally removed and replaced by introduced species from other parts of Australia and overseas. Based on the extent of modification of the natural vegetation and its habitat, the community cannot now be considered representative of BGHF despite the existence of some species that are characteristic of the community.

An analysis of the vegetation at the subject site compared to the final determination for BGHF can be found in Chapter 6.

### iv. Condition of the Blue Gum High Forest on the Subject Site

Of the 24 tree species recorded in the ten quadrats, five are naturally occurring. Eighteen other species are NSW or Australian species that are not locally indigenous or occur in other habitat in the district. Some juvenile *Eucalyptus saligna* and *Syncarpia glomulifera* (Turpentine) were planted from unknown provenance seedlings. One large mature tree, previously considered to be *Eucalyptus saligna* is an introduced *Eucalyptus grandis* (Flooded Gum).

Only three naturally occurring shrubs (*Omalanthus populifolius* – Bleeding Heart, shrub-sized *Pittosporum undulatum* and *Trema tomentosa* – Poison Peach) were recorded in the quadrats. Four others (*Acacia floribunda*, *A. longifolia*, *A. elata* and *Pomaderris lanigera*) are observed near the southern end of the Young Street Blue Gum Zone. Other shrub sized specimens are either planted and potentially native to the site, but grown from unknown provenance propagules (*Elaeocarpus reticulatus* – Blueberry Ash), or occur in other habitats in the local district (*Callicoma serratifolia* and *Ceratopetalum gummiferum*), or are not native to the district or Australia. Some native species not indicated as introduced to the site (UBMC 2006) are considered here to not occur naturally. These include: *Acacia fimbriata*, *Callistemon salignus*, *Ceratopetalum apetalum*, *Melia azedarach* and *Syncarpia glomulifera*, and are considered to have been planted.

Nineteen ground cover species are natural to the site with 56 non-native species being present. The most common indigenous species, *Geranium homeanum* (a Storksbill) and *Oplismenus aemulus* (Basket Grass), are widespread indigenous pioneers that do not necessarily indicate that a succession from non-bushland to bushland will occur. Both

species are commonly found in lawns and domestic gardens in many parts of the Sydney district and beyond.

Eight of the total of 22 vines are native to the site.

The great majority of locally indigenous shrubs, ground covers and vines are represented by a few individuals or are extremely localised in distribution. The bulk of the biomass comprises exotic species of which many are known environmental weeds (UBMEC, 2007). The competitive ability of most of the latter is favoured by disturbed soil conditions and unnaturally elevated nutrient levels as appear to occur at the subject site. Environmental weeds are invasive species that are known to naturally replace locally indigenous species and/or prevent their regeneration or spread. This can occur through stronger competitive ability or their ability to produce dense shade that reduces the vigour and survival chances of lower-growing species.

### 2.5.3 Other Vegetation

Much of the subject site has been disturbed through many years of occupation. A wide range of introduced garden species and weeds are present throughout the site. These include plants such as Camellias, Rhododendrons, Broom, Privet, Banana Palms and so on. Remnant canopy trees are present within landscaped areas. Two Magenta Lilly Pillies (*Syzygium paniculatum*) are present. It is likely that these species were also planted and are not native to the site.

Six of the additional vegetation quadrats surveyed by Cumberland Ecology were in areas outside the Smith-mapped BGHF. Quadrats 11, 13 and 15 were in garden areas that contained or were overhung by remnant canopy trees. These contained a total of 5, 2 and 2 characteristic BGHF species (as per final determination), and in each quadrat, one of these species was the remnant canopy tree. Quadrats 12, 14 and 16 were in lawn areas and contained 4, 2 and 4 characteristic BGHF species each respectively. Quadrats 12 and 14 contained overhanging *Eucalyptus saligna* and Quadrat 16 contained overhanging *Pittosporum undulatum* and a planted *Elaeocarpus reticulatus*. These quadrats could not be considered as BGHF because of the dominance of exotic species and low number of species characteristic of BGHF. Quadrat 14 is located on the croquet lawn and contained a total of 10 native species, all of which, with the exception of the overhanging *E. saligna*, are common native, colonising, herbaceous ground covers and only *Pratia purpurascens* is listed in the final determination for BGHF. Quadrat 16 is located in the area where the East Wing is proposed and contained 9 native species of which 7 are common ground cover species with *Dianella caerulea* and *Oplismenus aemulus* listed in the final determination for BGHF. The native ground cover species that have been recorded in each of these quadrats are common to many native vegetation communities in the Sydney Basin Bioregion and beyond. They are not explicitly indicative of BGHF and many of these species also commonly occur in disturbed habitats such as lawns.

The lack of regeneration of key canopy, small tree and shrub species in these areas indicates that the BGHF is not expanding. Weed control could assist with natural

regeneration in areas where the soil profile remains relatively undisturbed but the length of time under cultivation, the absence of shade from canopy and other strata, and long-term presence of exotic species must also be taken into account. The croquet lawn is not likely to naturally regenerate with canopy and understorey species because the soil profile has been altered via cut and fill for the construction of the lawn and likely maintenance with topsoil dressing.



0 25 50  
Metres

Figure 2.3

Vegetation of the Subject Site

## 2.6 Description of Habitat Values

### DGR 5.3.1 Description of habitat values

*Specific habitat features must be described (eg frequency and location of stags, hollow bearing trees, culverts, rock shelters, rock outcrops, crevices, caves, drainage lines, soaks etc) and the density of understorey vegetation and groundcover.*

*The condition of the habitat within the study area must be discussed, including the prevalence of introduced species, species of weeds present and an estimate of the total weed cover as a percentage of each vegetation community, whether trampling or grazing is apparent, effects of erosion, prevalence of rubbish dumping, history of resource extraction or logging and proximity to roads.*

*Details of the subject site's fire history (eg frequency, time since last fire, intensity) and the source of fire history (eg observation, local records), must be provided.*

#### **2.6.1 Habitat Features**

Tree hollows of a variety of sizes are present in a number of Blue Gums and other trees on the site. The hollows provide nesting opportunities for Lorikeets (one pair was seen flying to and from a slit hollow in a Blue Gum), bats, possums, and possibly cockatoos. No large stags or hollows were noted that would provide nesting habitat for owls. Hollows were noted in 11 trees on the subject site (see table below and Figure 2.3), and in some of these trees more than one hollow was present. In NSW, terrestrial vertebrate species that are reliant on tree hollows for shelter and nests include at least 46 mammals, 85 birds, 32 reptiles and 16 frogs (Gibbons and Lindenmayer, 2002). Of these, 45 species are listed as threatened on Schedule 1 and Schedule 2 of the Threatened Species Conservation Act. As hollows are required for breeding for many of these species, the loss of hollow-bearing trees has the potential to limit or halt breeding of certain species, which can cause species to become locally extinct. Loss of hollow-bearing trees has been given a preliminary listing as a key threatening process by the Scientific Committee (NSW Scientific Committee, 2006).

**Table 2.2 TREES WITH HOLLOWES**

| Tree | Scientific name             | Common Name        | Mapped by |
|------|-----------------------------|--------------------|-----------|
| 92   | <i>Eucalyptus saligna</i>   | Blue Gum           | UMBC      |
| 93   | <i>Angophora floribunda</i> | Rough-barked Apple | UMBC      |
| 94   | <i>Eucalyptus saligna</i>   | Blue Gum           | UMBC      |
| 99   | <i>Eucalyptus saligna</i>   | Blue Gum           | CE        |
| 123  | <i>Eucalyptus saligna</i>   | Blue Gum           | TWM/UBMC  |

**Table 2.2 TREES WITH HOLLOWS**

| Tree | Scientific name                 | Common Name | Mapped by |
|------|---------------------------------|-------------|-----------|
| 166  | <i>*Liquidambar styraciflua</i> | Liquidambar | TWM/UBMC  |
| 193  | <i>Eucalyptus saligna</i>       | Blue Gum    | TWM/UBMC  |
| 314  | <i>Eucalyptus saligna</i>       | Blue Gum    | TWM/UBMC  |
| 323  | <i>Eucalyptus saligna</i>       | Blue Gum    | TWM/UBMC  |
| 328  | <i>*Erythrina x sykesii</i>     | Coral Tree  | TWM/UBMC  |
| 345  | <i>Eucalyptus saligna</i>       | Blue Gum    | TWM/UBMC  |

Notes \* exotic; CE: Cumberland Ecology, TWM: TreeWiseMen; UBMC: Urban Bushland Management Consultants, it has been recommended that 323 & 328 be removed by TreeWiseMen as these trees are considered to be structurally unsound and in poor condition . For more details see Appendix F.

A variety of habitat features for ground-dwelling species are present on the subject site. These include a stone wall on the eastern side of the property where a croquet lawn was present. A gutter runs along the southern boundary of the property, and entrances under the various buildings are present. Dead trees and logs are present on the eastern side of the site. Damp soils are present in a number of areas, evidenced by the presence of Sphagnum Moss. This is particularly noticeable in the northeast corner and the southern area of the site. An ephemeral drainage line runs north-south along the western side of the driveway in the south-eastern part of the study area.

Many of the building have openings which would allow animals inside. For example, the old stables could provide roosting for a variety of birds and bats.

The density of the vegetation varies greatly across the site. The structure includes the following:

- Lawns;
- Planted garden beds;
- Large trees with groundcover only; and
- Dense thickets with emergent trees.

## **2.6.2 Habitat Condition**

### *i. Introduction*

The subject site was previously used as for respite care. A number of buildings exist on the property, along with landscaped areas. Public roads form the northern and eastern boundaries of the site. A number of roads and pathways exist throughout the subject site. There is little erosion and no trampling or grazing. Rubbish is present in a number of

locations and includes a pile of rubble in the south west portion of the site below the current buildings and a collapsed gazebo near the croquet lawn. Rubbish is also present within the soil in some locations.

It is not known when the original clearing occurred in the local area. The residence was built in 1898 and other buildings constructed since then. Other parts of the property were used for gardens and a chicken run. It is assumed that the gardens were fertilised, including with horse and chicken manure, and dug over as was the practice of the time.

## *ii. Soils*

No soil surveys are known to have been done at the site to determine quantitatively the current soil condition. Despite this, it was apparent during fieldwork that most of the property was likely to have altered soil profiles compared to the natural soil. Based on ground contours and existing vegetation, the most undisturbed soil possibly occurred adjacent to Young Street. Dumped rubble was noted to occur in the soil profile in some locations in this area. The soil south of the stables, extending to the boundary, was most uneven and unnatural in contour, indicating it had been dug up and possibly other soil had been imported and deposited in the area. This area had also been used as a vegetable garden and chicken run. Both of these uses could be expected to result in significant changes to soil chemistry owing to fertilisers being produced and used. The vegetation in this zone was dominated by many species of herbaceous exotics. Experience with repair of BGHF on similar soils in other areas (e.g. parts of Ryde) has indicated that such conditions are extremely difficult to ameliorate and to convert to a viable native plant community. The construction of the croquet lawn adjacent the BGHF would have involved cut and fill of the existing landscape. Retaining walls are located above and below the relatively level croquet lawn, the lower retaining wall marking the extent of the BGHF on naturally occurring soils. The croquet lawn is also likely to have been maintained with additional fill and top soil from time to time.

## *iii. Hydrology*

The construction and use of buildings on the property for over 100 years is also likely to have had an impact on soils by providing nutrients via rainwater runoff that are in excess of naturally occurring levels and intolerant to indigenous species.. Whilst some nutrients are more readily dispersed through soil strata, phosphorus is largely retained and can be expected to favour growth of most exotics in preference to most native species.

Hydrological changes have occurred on and around the site owing to the development of the areas for houses, a school, roads and stormwater drainage. The significance of existing hydrological impact in the Blue Gum Zone has not been specifically determined or documented, however its impact on soil is possibly within the general limits of tolerance for BGHF habitat.

#### iv. Vegetation

The condition of the vegetation is generally poor, with much weed infestation (UBMEC, 2009). A wide variety of weeds are present, many of which are noxious. Weeds range from groundcover to shrubs and trees. These include species such as Privet, African Olive, Broom, Camphor Laurel and many others. Many exotic species were purposefully planted as garden plants throughout the site. Some species have also been planted that, while native to Sydney, are not native to BGHF. These include recent (2006) plantings along the southern boundary. Photograph 2.5 shows these recent plantings, with a groundcover including weeds and native geraniums. Effort was made to remove weeds, particularly Morning Glory, in this area prior to this planting (see Photograph 2.6). There are a small number of dead Eucalypts along the eastern boundary.

Within each of the ten quadrats surveyed, estimates were made of the percentages of exotic species in each of the four vegetation strata (canopy tree, small tree, shrub and ground cover) (Table 2.2). These indicated that throughout the Blue Gum Zone most understorey strata contained very high proportions of introduced species. The distribution of the canopy stratum varied greatly. The small tree stratum generally contained high proportions of exotic species. In quadrats where lower proportions were recorded, the stratum was largely absent, often being represented by a few specimens of *Pittosporum undulatum* (Sweet Pittosporum) only. The ground cover was represented by less than 70% exotics in one only quadrat (Quadrat 8), where one indigenous herb species (*Geranium homeanum*) was common. *Oplismenus aemulus* (Basket Grass) was relatively common in Quadrat 7.

**Table 2.3 PERCENTAGE OF EXOTIC SPECIES IN PROJECTIVE FOLIAGE COVER OF EACH STRATUM**

| Quadrat | Canopy | Small Tree | Shrub  | Groundcover |
|---------|--------|------------|--------|-------------|
| 1       | 40     | 40         | 100    | 95+         |
| 2       | 0      | 100        | 70     | 95+         |
| 3       | 0      | 70         | 95+    | 95+         |
| 4       | 0      | 50         | 80     | 80          |
| 5       | 0      | 5          | 100    | 90          |
| 6       | 0      | 90         | 70     | 95+         |
| 7       | 100    | absent     | 100    | 70          |
| 8       | 0      | absent     | 100    | 40          |
| 9       | 20     | absent     | absent | 90          |



**Photograph 2.5** Weeds, new plantings and native geraniums along southern boundary



**Photograph 2.6** Morning Glory cover prior to weeding 2006 (photo by Murlan)

A number of weed species are listed as noxious under the Noxious Weeds Act. The following control measures are relevant to weeds present on the site, as listed in Table 2.4:

- Class 3: The plant must be fully and continuously suppressed and destroyed.
- Class 4: The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed.
- Class 5: The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with. These requirements are:
  - Outbreaks of notifiable weeds must be reported to the local control authority (LCA) within 3 days of discovery;
  - The LCA (Ku-ring-gai Council) must then report the outbreak to the NSW Department of Primary Industries;
  - The LCA must ensure that any actions that are necessary to prevent further spread of the weed are immediately carried out.

**Table 2.4 NOXIOUS WEEDS PRESENT ON THE SUBJECT SITE**

| Name                 | Species                      | Class |
|----------------------|------------------------------|-------|
| Asparagus Fern       | <i>Asparagus aethiopicus</i> | 4     |
| Blackberry           | <i>Rubus fruticosus</i>      | 4     |
| Camphor Laurel       | <i>Cinnamomum camphora</i>   | 4     |
| Cape Broom           | <i>Genista monspessulana</i> | 3     |
| Climbing Asparagus   | <i>Asparagus plumosus</i>    | 4     |
| Madeira Vine         | <i>Anredera cordifolia</i>   | 4     |
| Morning Glory        | <i>Ipomea indica</i>         | 4     |
| Ochna                | <i>Ochna serrulata</i>       | 4     |
| Oxalis               | <i>Oxalis spp.</i>           | 5     |
| Broad-leaved Privet  | <i>Ligustrum lucidum</i>     | 4     |
| Narrow-leaved Privet | <i>Ligustrum sinense</i>     | 4     |
| Rhizomatous Bamboo   | <i>Phyllostachys sp.</i>     | 4     |

### 2.6.3 Fire History

There is no evidence of fire on the site. The subject site is in an urban, albeit well-vegetated, area where bushfires are unlikely.

## 2.7 Plans and Maps

***DGR 2.4** An aerial photograph (or reproduction of such a photograph) (preferably colour) of the locality must be provided, indicating scale, and clearly delineating the subject site.*

*A map or maps must be provided, showing:*

- in the locality,
  - land tenures and uses including parks and reserves, and areas of high human activity such as townships, regional centres and major roads.
  - any locally significant areas for threatened biodiversity.
  - the locations of any previously known threatened species or endangered populations.
  - the locations and types of vegetation and cleared areas (with reference to the description required in section 2.3).
- in the study area,
  - the location, size and dimensions of the study area.
  - the full extent of the proposed works as described in section 2.1 at a scale of not less than 1:1000.
  - topography of the site and immediate surrounds at a scale of not less than 1:3000.
  - the locations and types of vegetation and cleared areas (with reference to the description required in section 2.3).
  - the current activities/usage of this land.

*All maps must indicate scale and have an explanatory legend of any symbols used.*

A number of maps are provided throughout this SIS to comply with the above list, as well as other maps mentioned in the DGRS.

## Initial Assessment

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### DGR 3. Initial Assessment

Address the following:

- a general description of the threatened species or populations known or likely to be present in the area that is the subject of the action and in any area that is likely to be affected by the action.
- a general description of the ecological community present in the area that is the subject of the action and in any area that is likely to be affected by the action

### 3.1 Identifying subject threatened species, population and ecological communities

#### DGR 3.1.1 Assessment of available information

*In determining the subject threatened species, populations and ecological communities likely to be present (the subject species), consideration must be given to the habitat types present within the study area, and to recent records and the known distribution of threatened species, populations and ecological communities in the locality.*

*Flora and fauna databases such as the DECC Atlas of NSW Wildlife, and those held by local government, the Australian Museum, the CSIRO, Forests NSW and the Botanic Gardens Trust Sydney **must** be consulted to assist in compiling the list. Note that the DECC Atlas only holds records for which the DECC is the custodian and does not include records held in other databases, and the conditions of data licences or data exchange agreements prevent the DECC from distributing such information. In many cases, the DECC Atlas may only contain a small subset of the available data. Hence, other databases must also be consulted to assist in making an adequate determination of subject species.*

*In determining the subject species, the Priorities Action Statement and any available recovery plans and draft recovery plans and vegetation assessment and mapping by State or local government agencies must be consulted.*

Database analyses and a review of the current literature for records of threatened species occurring within the locality were examined for the likelihood of threatened species to

occur in the habitats present in the study area. The NSW Government's BioNet database (NSW Government, 2007) was used to identify threatened species that have been recorded within the locality in the last 10 years. This database accesses collections and data from the Australian Museum, the Department of Environment and Climate Change (DECC - National Parks and Wildlife Service and the Royal Botanical Gardens), and the Department of Primary Industries (NSW State Forests and NSW Fisheries). Threatened species data was separately requested from the DECC in order to map records. Consideration was also given to those threatened species listed in the DGRs but not listed by the atlas as occurring within the study area. Existing literature for the subject site was also consulted for records of threatened species using the subject site (Smith, 2007a, Smith, 2007b, UBMC, 2006). Maps of threatened species known in the locality are provided in Figures 3.1 and 3.2.

All of the threatened species known to occur in the study area or considered likely to occur in the study area were treated as subject species. The following tables provide analyses of species that have been included within the list of "subject species". These tables also include an indication of the likelihood that species will be impacted by the project and also whether or not they should be included as affected species (ie within the list of species that are likely to be impacted by the project). The SIS approach to the list of affected species is precautionary, so that species that are considered to have some chance of occurrence within the study area are not discarded from consideration, but are considered as being affected species and are covered in the species profiles within Chapter 5.

## 3.2 Endangered Ecological Communities

Blue Gum High Forest is known to occur on the subject site. This community is listed as critically endangered under both the TSC Act and the EPBC Act. No other EECs occur on the subject site.

## 3.3 Endangered Populations

One endangered population is listed for the area: the Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai LGA. The population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area (DEC (NSW), 2005c).

## 3.4 Threatened Species

The following tables provide information on threatened species recorded in the LGA in the last 10 years, together with an analysis of the likelihood of occurrence based on conservation status, number of records, and habitat requirements.

**Table 3.1 THREATENED FLORA RECORDS FOR THE LAST 10 YEARS**

| Scientific Name              | Common Name             | TSC Status | EPBC Status | LGA Count | Sydney Basin Bioregion | Habitat                                                                                                                                                                                                    | Likelihood of occurrence | Subject Species (DGRs) | Affected Species |
|------------------------------|-------------------------|------------|-------------|-----------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------|------------------|
| <i>Acacia bynoeana</i>       | Bynoe's Wattle          | E          | V           | 3         | 205                    | Mainly occurs in heath and dry sclerophyll forest on infertile, well-drained sand and sandy clay substrates; open, slightly disturbed sites preferred.                                                     | Low                      |                        | No               |
| <i>Darwinia biflora</i>      |                         | V          | V           | 30        | 290                    | Occurs in woodland, open-forest or scrub-heath vegetation, on the zone of integration between weathered shale-capped ridges and Hawkesbury Sandstone; fire is important in the life cycle of this species. | Low                      |                        | No               |
| <i>Eucalyptus camfieldii</i> | Camfield's Stringybark  | V          | V           | 5         | 57                     | Shallow, sandy soils on Hawkesbury Sandstone; occurs near the boundary of tall coastal heaths and low open woodland.                                                                                       | Low                      |                        | No               |
| <i>Grammitis stenophylla</i> | Narrow-leaf Finger-fern | E          |             | 1         | 10                     | Rainforest and moist eucalypt forest, near                                                                                                                                                                 | Low                      |                        | No               |

**Table 3.1 THREATENED FLORA RECORDS FOR THE LAST 10 YEARS**

| Scientific Name                | Common Name         | TSC Status | EPBC Status | LGA Count | Sydney Basin Bioregion | Habitat                                                                                                                                                                                        | Likelihood of occurrence | Subject Species (DGRs) | Affected Species |
|--------------------------------|---------------------|------------|-------------|-----------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------|------------------|
| <i>Haloragodendron lucasii</i> |                     | E          | E           | 8         | 14                     | streams and in moist places on rocks and trees. Confined to a very narrow distribution on the north shore of Sydney. Grows in moist locations in dry sclerophyll forest.                       | Low                      |                        | No               |
| <i>Melaleuca deanei</i>        | Deane's Paperbark   | V          |             | 4         | 73                     | Heath on sandstone.                                                                                                                                                                            | Low                      |                        | No               |
| <i>Syzygium paniculatum</i>    | Magenta Lilly Pilly | V          | V           | 1         | 49                     | Mainly restricted to Riparian and Littoral Rainforest                                                                                                                                          | Present                  | Y                      | Yes              |
| <i>Tetratheca glandulosa</i>   |                     | V          | V           | 9         | 296                    | Shale-sandstone transition habitat on ridgetops and upper slopes of sandstone benches with shallow loam soils; vegetation structure varies from heaths and scrub to woodlands and open forest. | Low                      |                        | Yes              |

**Table 3.2 THREATENED FAUNA RECORDS FOR THE LAST 10 YEARS**

| Scientific Name               | Common Name                | TSC Status | EPBC Status | LGA Count | Sydney Basin Bioregion | Habitat                                                                                                                                                                                                                                                                                       | Likelihood of occurrence | Subject Species (DGRs) | Affected Species |
|-------------------------------|----------------------------|------------|-------------|-----------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------|------------------|
| <i>Litoria aurea</i>          | Green and Golden Bell Frog | E          | V           | 1         | 1150                   | Marshes, dams or stream sides containing vegetation such as bullrushes or spikerushes.                                                                                                                                                                                                        | Low                      |                        | No               |
| <i>Pseudophryne australis</i> | Red-crowned Toadlet        | V          |             | 31        | 711                    | Only on Triassic sandstones of the Sydney basin in steep escarpment areas with permanently moist soaks or dense ground vegetation/litter near ephemeral headwater stream beds. They are usually restricted to the upper parts of ridges and to areas with open woodland and heath vegetation. | Low                      |                        | No               |
| <i>Varanus rosenbergi</i>     | Heath Monitor              | V          |             | 2         |                        | Heath and woodland on sandstone. Requires termite mounds for nesting.                                                                                                                                                                                                                         | Low                      |                        | No               |
| <i>Botaurus poiciloptilus</i> | Australasian Bittern       | V          |             | 1         | 41                     | Australasian Bitterns are                                                                                                                                                                                                                                                                     | Low                      |                        | No               |

**Table 3.2 THREATENED FAUNA RECORDS FOR THE LAST 10 YEARS**

| Scientific Name                 | Common Name           | TSC<br>Status | EPBC<br>Status | LGA<br>Count | Sydney<br>Basin<br>Bioregion | Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Likelihood<br>of<br>occurrence | Subject<br>Species<br>(DGRs) | Affected<br>Species |
|---------------------------------|-----------------------|---------------|----------------|--------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------|---------------------|
| <i>Callocephalon fimbriatum</i> | Gang-gang Cockatoo    | V             |                | 8            | 409                          | <p>widespread but uncommon over south-eastern Australia. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.).</p> <p>The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. It occurs in densely timbered wet sclerophyll forest with old growth attributes for nesting and roosting; open woodlands and urban fringe areas may be used for foraging.</p> | Intermediate                   | Y                            | Yes                 |
| <i>Calyptorhynchus lathamii</i> | Glossy Black-Cockatoo | V             | E              | 5            | 899                          | <p>The species is uncommon although widespread</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Low                            | Y                            | Yes                 |

**Table 3.2 THREATENED FAUNA RECORDS FOR THE LAST 10 YEARS**

| Scientific Name        | Common Name  | TSC<br>Status | EPBC<br>Status | LGA<br>Count | Sydney<br>Basin<br>Bioregion | Habitat                                                                                                                                                                                                                                                                    | Likelihood<br>of<br>occurrence | Subject<br>Species<br>(DGRs) | Affected<br>Species |
|------------------------|--------------|---------------|----------------|--------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------|---------------------|
| <i>Ninox connivens</i> | Barking Owl  | V             |                | 2            | 49                           | throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria. This species requires dry forests of Allocasuarina spp. with low soil nutrient status; and nests in tree hollows in temperate rainforest and woodlands. | Intermediate                   | Y                            | Yes                 |
| <i>Ninox strenua</i>   | Powerful Owl | V             |                | 26           | 478                          | The Powerful Owl is endemic to eastern and                                                                                                                                                                                                                                 | High                           | Y                            | Yes                 |

**Table 3.2 THREATENED FAUNA RECORDS FOR THE LAST 10 YEARS**

| Scientific Name             | Common Name       | TSC Status | EPBC Status | LGA Count | Sydney Basin Bioregion | Habitat                                                                                                                                                                                                                                                                                                  | Likelihood of occurrence | Subject Species (DGRs) | Affected Species |
|-----------------------------|-------------------|------------|-------------|-----------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------|------------------|
| <i>Polytelis swainsonii</i> | Superb Parrot     | V          | V           | 0         | 0                      | south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria<br><br>The Superb Parrot is found throughout Inland Eastern NSW. Including the south-west slopes. Inhabits Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. | Low                      | Y                      | No               |
| <i>Ptilinopus superbus</i>  | Superb Fruit Dove | V          |             | 0         | 0                      | The Superb Fruit-dove occurs principally from north-eastern Queensland to north-eastern NSW. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It                                                       | Low                      | Y                      | Yes              |

**Table 3.2 THREATENED FAUNA RECORDS FOR THE LAST 10 YEARS**

| Scientific Name             | Common Name       | TSC Status | EPBC Status | LGA Count | Sydney Basin Bioregion | Habitat                                                                                                                                                                                                                                                                                                                              | Likelihood of occurrence | Subject Species (DGRs) | Affected Species |
|-----------------------------|-------------------|------------|-------------|-----------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------|------------------|
| <i>Tyto novaehollandiae</i> | Masked Owl        | V          |             | 0         | 112                    | may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. | High                     | Y                      | Yes              |
| <i>Xanthomyza phrygia</i>   | Regent Honeyeater | E1         | E           | No Record | 214                    | Regent Honeyeaters occur mainly in dry box ironbark open-forest and woodland areas inland of the Great Dividing Range. Occasionally found in coastal areas in Swamp Mahogany and Spotted Gum Forests.                                                                                                                                | Low                      | Y                      | No               |

**Table 3.2 THREATENED FAUNA RECORDS FOR THE LAST 10 YEARS**

| Scientific Name            | Common Name          | TSC Status | EPBC Status | LGA Count | Sydney Basin Bioregion | Habitat                                                                                                                                                                                                                                                                                                                                               | Likelihood of occurrence | Subject Species (DGRs) | Affected Species |
|----------------------------|----------------------|------------|-------------|-----------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------|------------------|
| <i>Cercartetus nanus</i>   | Eastern Pygmy Possum | V          |             | 2         | 150                    | Heath, woodland, sclerophyll forest and rainforest habitats are used; woodland and heath habitat preferred in southern NSW; diet includes nectar and pollen from banksias, eucalypts and bottlebrushes; tree hollows, rotten stumps, holes in the ground, abandoned bird-nests and Ringtail Possum dreys and thickets of vegetation used for shelter. | Low                      | No                     | No               |
| <i>Chalinolobus dwyeri</i> | Large-eared Pied Bat | V          | V           | 0         | 144                    | Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW.                                                                                                                                                   | Low                      | Y                      | Yes              |

**Table 3.2 THREATENED FAUNA RECORDS FOR THE LAST 10 YEARS**

| Scientific Name                            | Common Name              | TSC Status | EPBC Status | LGA Count | Sydney Basin Bioregion | Habitat                                                                                                                                                                                                                                                                                      | Likelihood of occurrence | Subject Species (DGRs) | Affected Species |
|--------------------------------------------|--------------------------|------------|-------------|-----------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------|------------------|
| <i>Dasyurus maculatus</i>                  | Spotted-tailed Quoll     | V          | E           | 1         | 394                    | Rainforest, open forest, woodland, coastal heath and inland riparian forest habitats; den sites occur in tree hollows, logs, small caves, rock crevices and rocky-cliff faces.                                                                                                               | Low                      |                        | No               |
| <i>Isodon obesulus</i>                     | Southern Brown Bandicoot | E1         | E           | 10        | 40                     | Found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River. Known to occur in heathland, shrubland, and dry sclerophyll forest; spatial mosaics of vegetation of different ages, such as those produced by fire and habitat disturbance, may be important. | Intermediate             | Y                      | No               |
| <i>Miniopterus schreibersii oceanensis</i> | Eastern Bent wing Bat    | V          |             | 1         | 2                      | Eastern Bent-wing Bats occur along the east and                                                                                                                                                                                                                                              | Intermediate             | Y                      | Yes              |

**Table 3.2 THREATENED FAUNA RECORDS FOR THE LAST 10 YEARS**

| Scientific Name                 | Common Name                     | TSC Status | EPBC Status | LGA Count | Sydney Basin Bioregion | Habitat                                                                                                                                                                                                                                                  | Likelihood of occurrence | Subject Species (DGRs) | Affected Species |
|---------------------------------|---------------------------------|------------|-------------|-----------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------|------------------|
| <i>Mormopterus norfolkensis</i> | Eastern Freetail Bat            | V          |             | 1         | 195                    | north-west coasts of Australia. Primarily roost in caves; and hunt above canopy in forested areas. Found along the east coast from south Queensland to southern NSW. Occurs in dry sclerophyll forest and woodland; roost in tree hollows or under bark. | Low                      | Y                      | Yes              |
| <i>Pteropus poliocephalus</i>   | Grey-headed Flying-fox          | V          | V           | 17        | 382                    | Found within 200Km of the Eastern coast. Forages on fruits and flowering eucalypts. A camp exists in the Gordon area.                                                                                                                                    | High                     | Y                      | Yes              |
| <i>Saccolaimus flaviventris</i> | Yellow-bellied Sheathtailed Bat | V          |             | 0         | 17                     | The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia.                                                                                                                                                 | Low                      | Y                      | Yes              |

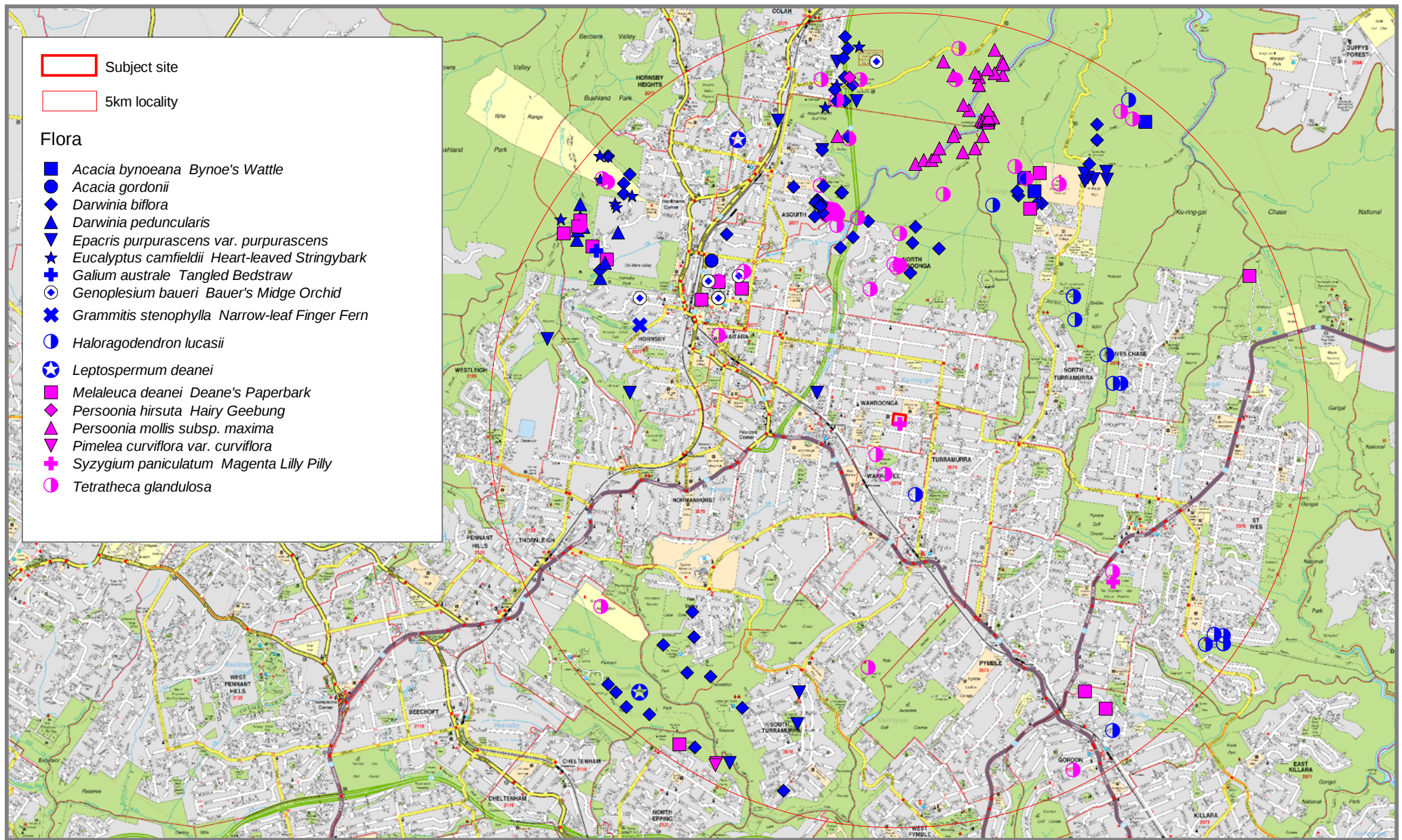


Figure 3.1 Threatened Flora of the Locality

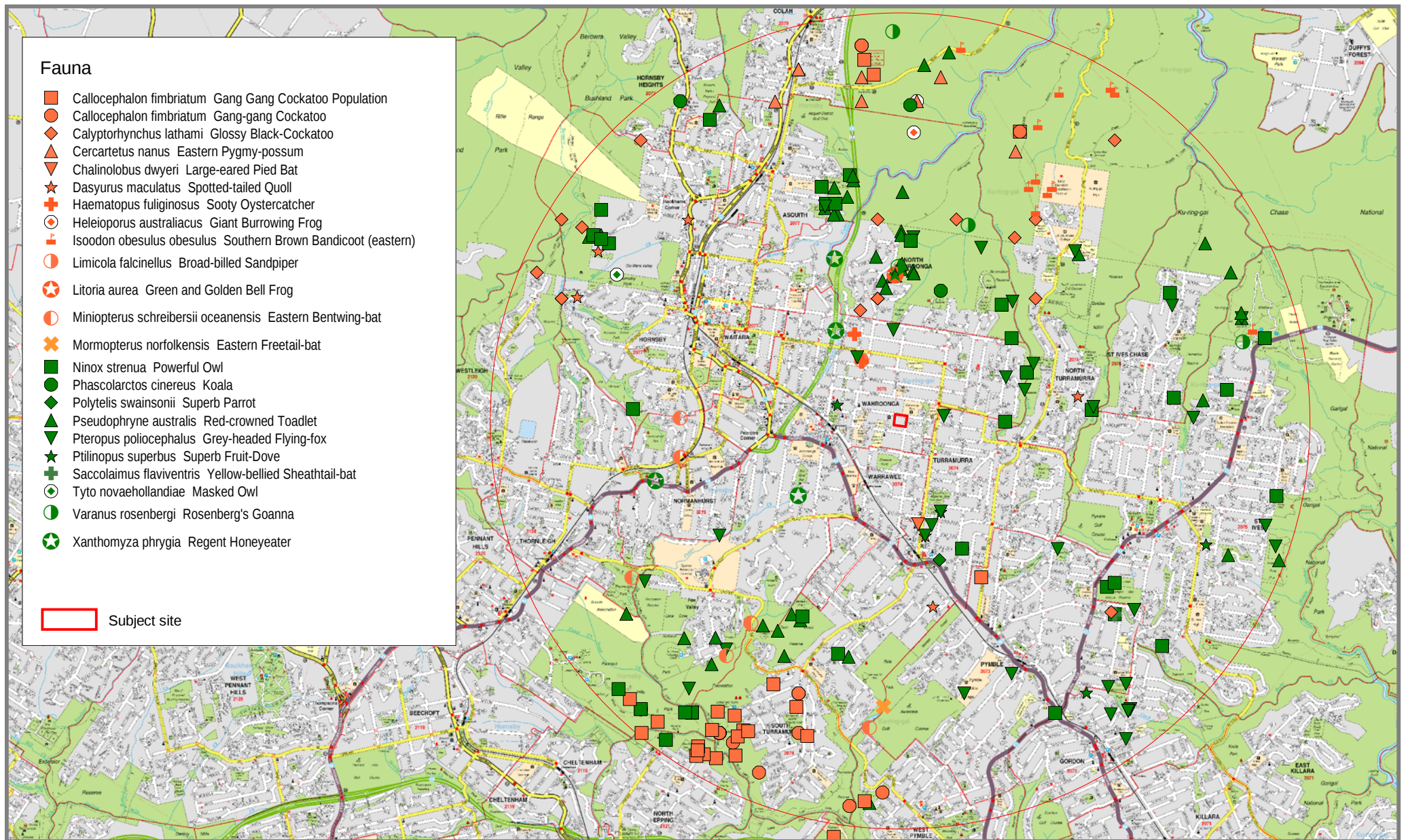


Figure 3.2 Threatened Fauna of the Locality

## Survey and Habitat Mapping

### 4.1 Survey Methods

#### DGR 4.1 Requirement to survey

*A fauna and flora survey is to be conducted in the study area. Targeted surveys must be conducted for all subject threatened species, populations and ecological communities determined in accordance with section 3 and for species, populations and ecological communities identified in section 4.3.*

*The techniques and timing of these surveys should be commensurate with the biology/ecology of these species and ecological communities in order to maximise the likelihood and accuracy of detection. Guidance on appropriate methodologies and level and timing of survey efforts for some other species can be obtained from environmental impact assessment guidelines (see section 9.4), draft or approved recovery plans, scientific or environmental management journals, biodiversity surveys and other sources. The information required to identify the type of impacts and assess their significance on threatened species is the key determinant for the level of survey effort required. Appropriate justification for reducing otherwise recommended levels of survey effort is required to show that impacts are not likely to be significant. Previous surveys and assessments may contribute to addressing this requirement if they have been conducted and documented in accordance with the following provisions.*

*Species of taxonomic uncertainty must have their identification confirmed by a recognised authority such as the Australian Museum or National Herbarium at the Royal Botanic Gardens, Sydney.*

*DGR 4.2.1 Survey Techniques must be described and, where possible, a reference supporting the survey technique is to be provided.*

*DGR 4.2.2 The time invested each time a survey technique is applied must be summarised in the sis, based on the completed proformas. E.g.- number of person hours/transect, duration of call playback, number of nights traps set. **It is not sufficient to aggregate all time spent on all survey techniques. Effort must be expressed each time a survey technique is applied***

#### **4.1.1 Database Analysis**

Threatened species records held in databases of the DECC and DEWHA were obtained and reviewed for relevance to the habitats of the study area. The database analysis entailed examination of threatened flora species records from:

The NSW Government BioNet database records of species within the LGA and the bioregion; and

The DEWHA interactive map database within a polygon that incorporated the study area and surrounding landscapes (referred to as a Protected Matters Report).

The NSW Government's BioNet database (NSW Government, 2007) was used to identify threatened species that could occur within the locality. Likelihood of occurrence was determined by confirming the recorded sightings of the threatened species in the database in combination with an estimate of habitat suitability on the subject site for each species. The NSW Government BioNet database includes threatened species records from the Australian Museum, the Royal Botanical Gardens, State Forests and the National Parks and Wildlife Service. The DECC NPWS Wildlife Atlas (DECC (NSW), 2007a) records come from historical reports, DECC staff, survey data from major projects, consultants and the general public.

While the data is extensive, it is by definition patchy. It does not provide the full distribution of a species. Except in areas where comprehensive survey information has been incorporated into the database, the search results for a particular area are based on a mix of reported sightings. Sightings often follow patterns of human movement, such as along roads. Similarly, a common species in an area may not be recorded because of its perceived value. The number of recorded sightings for a species does not necessarily correspond in any way to the actual abundance of that species in NSW. Contributors often focus their efforts on recording threatened and endangered species, with the result that rare species may have more recorded sightings in the Atlas than common species.

The EPBC Protected Matters search tool is also limited in that much of the information is indicative only of what may occur in an area. It brings together information from a range of sources including government, research and community organisations. Maps have been collated from a range of sources, at various resolutions. The information on threatened species varies in resolution according to current scientific knowledge; some species are well known, while other species have yet to be fully investigated. For endangered ecological communities where the distribution is well-known maps have been derived from reliable sources. Where they are not well-known, maps are derived from indicative data.

#### **4.1.2 Literature Review**

The flora and vegetation of the subject site has been investigated by a range of ecological specialists over the last three years. In particular, the following assessments have been prepared for the site:

- Flora and Fauna Assessment – Opportunities and Constraints Study by Urban Bushland Management Consultants Pty Ltd (UBMC, 2005);
- Flora and Fauna Assessment by Urban Bushland Management Consultants Pty Ltd (UBMC, 2006); and
- Various reports prepared by the court-appointed expert, Dr Peter Smith (Smith, 2006, Smith, 2007b, Smith, 2007a).

### **4.1.3 Flora**

#### *i. Urban Bushland Management Consultants and Court-appointed Expert*

A botanical survey was conducted by Urban Bushland Management Consultants on 22<sup>nd</sup> February 2006. This survey included vegetation mapping and random meanders. Plant identifications were made according to Harden (Harden, 1990, Harden, 1991, Harden, 1992, Harden, 1993) and structure classified according to Specht (Specht, 1970).

Additional flora and vegetation surveys were conducted by P. Smith, the court-appointed expert in 2007.

#### *ii. Cumberland Ecology*

Cumberland Ecology conducted further botanical surveys on 16<sup>th</sup> August 2007. These involved a random meander (Cropper, 1993) covering the entire site followed by quadrat analysis. A total of 10 10m x 10m quadrats were assessed within the boundaries of the BGHF as mapped by the court-appointed expert P. Smith. Quadrats could not be located to avoid the confounding of edge effects because the occurrence of BGHF on the subject site is so narrow that it is entirely affected by edge effects. An additional random meander survey for species not previously detected was conducted by Cumberland Ecology on 18<sup>th</sup> September 2008 and 10 additional 10m x 10m quadrats were surveyed on 19<sup>th</sup> September 2008. The additional quadrats were located around the outside of the Smith-mapped BGHF in garden or lawn areas, or in areas of the BGHF not covered by the quadrats surveyed in 2007. These surveys were undertaken after good rainfall conditions for plant growth to ensure a comprehensive native species list for the subject site. A cover abundance rating was given to each species recorded in each quadrat according to the modified Braun-Blanquet method (Mueller-Dombois and Ellenberg, 1974).

The data and other general observations were used to define the plant community and determine its potential for regeneration to a viable condition that would be representative of BGHF, as described in the Final Determination for the community. Brief comments are given (see Chapters 6 and 7) on the methods of rehabilitation that are likely to be required to restore simplified BGHF in the subject site in accordance with the Land and Environment Court's requirements.

The condition of the vegetation in each quadrat was assessed. This comprised estimation of the proportion of exotics in each of the canopy, small tree, shrub and ground cover strata, based on the percentage of total projective foliage cover in the relevant stratum that comprised introduced species.

Plant community structure is defined according to Specht (Specht, 1970). Plant species nomenclature conforms to Harden (Harden, 1990, Harden, 1991, Harden, 1992, Harden, 1993) except for the revision of *Eucalyptus maculata* to *Corymbia maculata* and *Eucalyptus citriodora* to *Corymbia citriodora*.

#### **4.1.4 Fauna**

The fauna results for the subject site mainly rely upon the surveys conducted by UBMC in 2006. Survey methods and effort according to the DECC Guidelines for Threatened Species Assessment (NSW NPWS and SMEC Australia, 2001) were not considered warranted due to the small size, disturbed nature and separation of the subject site from areas of intact habitat by established urban areas.

##### *i. Urban Bushland Management Consultants*

Fauna survey was conducted by two people on three occasions: 23<sup>rd</sup> February, 1<sup>st</sup> March and 7<sup>th</sup> March 2006. Field surveys included the following:

- Habitat assessment;
- Active searches;
- Hair tubes;
- Spotlighting; and
- Echolocation call analysis.

Efforts were made to document the diversity, structure and value of fauna habitats present within the subject site. This included the identification of habitat features such as:

- Feed trees;
- Mature trees with hollows;
- Connectivity of fauna corridors; and
- Aquatic environments (UBMC, 2006).

Active diurnal searches were conducted using the random meander method. This method involved walking randomly across all parts of the site, sampling all habitats, until no new species had been recorded for 30 minutes. During these searches rocks, logs, urban

refuse and other suitable ground material was turned in order to identify any sheltering frogs or reptiles (UBMC, 2006).

Hair tube trapping was undertaken between February 23 and March 7 2006. Ten hair tubes were scattered throughout the subject site. Tubes were placed on the ground and baited with a mixture of oats, peanut butter and honey (5 tubes) or anchovies (5 tubes). A total of 120 hair tube nights were conducted. Hair samples were sent to hair expert Barbara Triggs for identification (UBMC, 2006).

Spotlighting was conducted throughout the site on two nights: March 1 and March 7 2006. Spotlighting followed paths, tracks and roads, as well as any other accessible areas. Spotlighting was focussed on areas away from disturbance to increase the potential to detect species. Spotlighting commenced at dusk and lasted for approximately 1hr on each night (UBMC, 2006).

Anabat II detectors were used to identify echolocation calls of microchiropteran bats on two nights: March 1 and March 6 2006. Detectors were placed at six locations throughout the subject site. These were turned on 15 minutes prior to dusk and left in place for up to 2 hrs. A total of 9hrs recording was accumulated. Calls were analysed using Anabat 6.3 software (UBMC, 2006).

## ii. Cumberland Ecology

Two people from Cumberland Ecology carried out Call Playback on 16<sup>th</sup> August 2007. Calls played included Barking Owl, Masked Owl and Powerful Owl. Calls were broadcast through a loudspeaker after 15 minutes of quiet listening after dark. Each owl's call was played intermittently for five minutes, followed by 15 minutes of listening. A total of 2 person hours was accumulated.

### 4.1.5 Weather

Weather conditions were generally favourable during the 2006 fauna surveys. Strong winds on March 1 may have inhibited bat recordings. Weather conditions during the Cumberland Ecology survey on August 16<sup>th</sup> 2007 were variable. It had rained earlier in the day, however cleared up in the afternoon. Temperatures were cool. A light wind blew in the evening. Conditions for both surveys are shown in Table 4.1 below.

**Table 4.1 WEATHER CONDITIONS**

| Date           | Cloud             | Moon               | Temp. | Wind                 |
|----------------|-------------------|--------------------|-------|----------------------|
| 23 Feb 2006    | 7/8 cover         | ½ (set at 3.58pm)  | 26    | 1-2 – light-moderate |
| 1 March 2006   | 8/8 cover         | 0 (set at 8.21pm)  | 22    | 3 – strong           |
| 7 March 2006   | 0/8 cover (clear) | ½ (rose at 2.34pm) | 23    | 0 – calm             |
| 16 August 2007 | 6/8 cover         | ¼ (set at 8.35pm)  | 17    | 1 - light            |

#### **4.1.6 Limitations**

The diversity of the species recorded during surveys by Urban Bushland Management Consultants was considered to be indicative of the true diversity present. Diversity can be influenced by seasonal factors, with some species inconspicuous or absent at certain times of the year. Some species are difficult to identify outside their flowering season. Urban Bushland Management Consultants considered that sufficient time and effort was allowed to provide an adequate floristic description of the subject site.

Cumberland Ecology carried out limited survey as much survey has already been done at the subject site.

The timeframe and budget were considered to be adequate to allow all necessary flora and fauna surveys to be conducted. This SIS uses surveys that have been conducted over several years, allowing adequate time for surveys and for surveys to be conducted during the appropriate season.

This SIS has relied on a number of other studies and background documentation. All relevant information has been provided to Cumberland Ecology for the preparation of the SIS.

It is not considered that any disturbances that have occurred on the subject site prior to surveys such that the flora and/or fauna have been altered or unable to be surveyed. Some weed control and native species planting had been undertaken prior to the flora surveys in 2007 but this is more likely to have stimulated more growth of native species in the southern section of the BGHF.

All areas of the subject site were accessible for the field surveys and it is considered that all areas were adequately surveyed. However, some statements about BGHF connectivity in the study area refer to external sites which were not accessed during the SIS surveys. Existing information was relied upon for these external sites.

All seasonal or vagrant species have been taken into account during the assessment of this SIS. Flora surveys were conducted during the flowering season of *Tetradlea glandulosa*, therefore it is considered to be adequately surveyed. A precautionary approach has been taken for the majority of threatened species as it cannot be confirmed whether or not they actually use the subject site. The reason being that surveys are limited to a finite time and the subject site covers a very small area of a large range for many of the affected species. Therefore fauna may not have been using this part of the range at the time of survey.

The surveys for the SIS were undertaken by qualified personnel. Details of qualifications and experience have been provided in Appendix D.

The survey effort for vegetation is considered to be more than adequate, particularly compared with the DECC draft threatened species survey guidelines (DEC (NSW),

2005h). The fauna survey is considered adequate as the site is very small and not likely to support a large faunal diversity.

In terms of cryptic or difficult to survey species, many of the more mobile fauna were not present at the time of surveys and so a precautionary approach has been taken when assessing these species. *Tetratheca glandulosa* is a cryptic plant that is often not apparent when not in flower. Flora surveys were conducted during the flowering period of this species and therefore it is considered to be adequately surveyed.

The precautionary principle has been considered for all threatened species and the majority of potential habitat for these species is being retained. It has also been considered for the BGHF with the outcome that the development will improve the community, rather than leaving it degrade without management.



Figure 4.1

Survey sites

## 4.2 Survey Results

### DGR 4.2.2 Documenting survey effort and results

*Attachment 1 contains survey proformas for a range of standard fauna survey techniques. Digital copies of these proformas are available by electronic mail and should be obtained from the nominated contact officer. These proformas should be used by field staff when undertaking fauna surveys and completed data sheets are to be included as an appendix to the SIS.*

*Name(s) and contact phone number(s) of surveyor(s) and other personnel must be recorded. Other persons who identified records (e.g., by analysis of Anabat recordings, hair tubes, scats) should also be named.*

*The date and time and environmental conditions experienced during each survey must be documented.*

*The time invested each time a survey technique is applied must be summarised in the SIS, based on completed proformas. e.g. - number of person hours/transect, duration of call playback, number of nights traps set. **It is not sufficient to aggregate all time spent on all survey techniques. Effort must be expressed each time a survey technique is applied.***

*Any limitations (e.g. denied access to private land) to sampling across the study area are to be documented.*

### DGR 4.2.3 Description and mapping of results of vegetation, flora and fauna surveys

*The locations of any newly recorded threatened species or endangered populations resulting from additional surveys must be mapped and described. The mapping of vegetation required under section 2.3 must be reflect any new information resulting from additional surveys.*

#### **4.2.1 Survey Effort**

A full description of survey effort can be found in proformas in Appendix C.

#### **4.2.2 Vegetation**

A full description of the vegetation of the subject site can be found in Chapter 2. A map of the vegetation is provided in Chapter 2.

### 4.2.3 Flora

#### i. Threatened Species

One threatened species was identified: *Syzygium paniculatum* (Magenta Lilly Pilly). This species was recorded in two locations: at the front of the property on the northern boundary, and in a garden bed in the central eastern portion of the site. While the individuals are large and old, it is likely that the specimens were planted and are not native to the site. *Syzygium paniculatum* requires flowing water for germination (Payne, 1997) and so it is unlikely that seedlings would germinate on the subject site from these specimens.

Flora surveys were conducted during the flowering period of *Tetradlea glandulosa* and so should have detected the species if it occurred on the subject site. Despite failing to detect the species and the subject site only providing marginal potential habitat for the species, it has still been assessed as affected by the proposal.

#### ii. Native species

A range of indigenous and planted native species are present within the subject site. Only a small portion of the native species are listed in the final determination for BGHF. **Table 4.2 below** lists native flora indigenous to the locality. Not all of these species are representative of BGHF. **Table 4.3 below** lists flora native to Australia that are planted within the subject site. These species are not usually found within BGHF but may also provide important resources for bird and bat species. A full list of flora species recorded for the site can be found in Appendix B.

**Table 4.2 INDIGENOUS PLANT SPECIES RECORDED ON THE SUBJECT SITE**

| Family         | Scientific Name                     | Common Name        | BGHF |
|----------------|-------------------------------------|--------------------|------|
| <b>Trees</b>   |                                     |                    |      |
| Casuarinaceae  | <i>Allocasuarina torulosa</i>       | Forest Oak         | Y    |
| Myrtaceae      | <i>Angophora floribunda</i>         | Rough-barked Apple | Y    |
|                | <i>Eucalyptus pilularis</i>         | Blackbutt          | Y    |
|                | <i>Eucalyptus saligna</i>           | Blue Gum           | Y    |
|                | <i>Syncarpia glomulifera - pl</i>   | Turpentine         |      |
| Pittosporaceae | <i>Pittosporum undulatum</i>        | Sweet Pittosporum  | Y    |
| <b>Shrubs</b>  |                                     |                    |      |
| Elaeocarpaceae | <i>Elaeocarpus reticulatus - pl</i> | Blueberry Ash      | Y    |
| Euphorbiaceae  | <i>Omalanthus populifolius</i>      | Bleeding Heart     |      |
| Fabaceae       | <i>Acacia floribunda</i>            | Sally Wattle       |      |
| Myrtaceae      | <i>Eucalyptus saligna - pl</i>      | Blue Gum sapling   | Y    |

**Table 4.2 INDIGENOUS PLANT SPECIES RECORDED ON THE SUBJECT SITE**

| Family                  | Scientific Name                         | Common Name                 | BGHF |
|-------------------------|-----------------------------------------|-----------------------------|------|
| Pittosporaceae          | <i>Pittosporum undulatum</i>            | Sweet Pittosporum saplings  | Y    |
| <b>Herbs - Dicots</b>   |                                         |                             |      |
| Acanthaceae             | <i>unidentified sp</i>                  |                             |      |
|                         | <i>Pseuderanthemum variabile</i>        | Pastel Flower               | Y    |
| Convolvulaceae          | <i>Dichondra repens</i>                 | Kidney Plant                |      |
| Geraniaceae             | <i>Geranium homeanum</i>                | Trailing Storksbill         |      |
| Lobeliaceae             | <i>Pratia purpurascens</i>              | Whiteroot                   | Y    |
|                         |                                         | Rough-barked Apple seedling | Y    |
| Myrtaceae               | <i>Angophora floribunda</i>             |                             |      |
| Oxalidaceae             | <i>Oxalis ?exilis</i>                   |                             |      |
| Plantaginaceae          | <i>Plantago debile</i>                  |                             |      |
| Polygonaceae            | <i>Rumex brownii</i>                    |                             |      |
| <b>Herbs - Monocots</b> |                                         |                             |      |
| Cyperaceae              | <i>Cyperus gracilis</i>                 |                             |      |
|                         | <i>Cyperus imbecillis</i>               |                             |      |
| Lomandraceae            | <i>Lomandra longifolia</i>              | Spiny-headed Mat-rush       | Y    |
| Phormiaceae             | <i>Dianella caerulea var producta</i>   | Rough Flax Lily             | Y    |
|                         | <i>Danthonia ?racemosa var racemosa</i> | a Wallaby Grass             |      |
| Poaceae                 | <i>Echinopogon caespitosus</i>          | a Hedgehog Grass            |      |
|                         | <i>Echinopogon ovatus</i>               | a Hedgehog Grass            |      |
|                         | <i>Entolasia marginata</i>              | Margined Panic              | Y    |
|                         | <i>Microlaena stipoides</i>             | Weeping Meadow-grass        |      |
|                         | <i>Oplismenus aemulus</i>               | Basket Grass                | Y    |
|                         | <i>Oplismenus imbecillis</i>            |                             | Y    |
| <b>Vines</b>            |                                         |                             |      |
| Apocynaceae             | <i>Parsonsia straminea</i>              | Common Silkpod              |      |
| Fabaceae                | <i>Glycine tabacina</i>                 |                             |      |
|                         | <i>Hardenbergia violacea</i>            | Purple Coral Pea            |      |
|                         | <i>Kennedia rubicunda</i>               | Dusky Coral Pea             |      |
| Ranunculaceae           | <i>Clematis glycinoides</i>             | Travellers Joy              |      |
| Luzuriagaceae           | <i>Eustrephus latifolius</i>            | Wombat Berry                | Y    |

Notes: BGHF: species listed in the final determination for Blue Gum High Forest.

**Table 4.3 PLANTED NATIVE (NON-INDIGENOUS) SPECIES**

| Family         | Scientific Name                 | Common Name                     |
|----------------|---------------------------------|---------------------------------|
| <b>Trees</b>   |                                 |                                 |
| Arecaceae      | <i>Livistona australis</i>      | Cabbage Palm                    |
| Cunoniaceae    | <i>Ceratopetalum apetalum</i>   | Coachwood                       |
| Cupressaceae   | <i>Callitris rhomboidea</i>     | Port Jackson Pine               |
| Moraceae       | <i>Ficus rubiginosa</i>         | Rusty Fig                       |
| Myrtaceae      | <i>Callistemon salignus</i>     | Willow Bottlebrush              |
| Myrtaceae      | <i>Corymbia citriodora</i>      | Lemon-scented Gum               |
| Myrtaceae      | <i>Corymbia maculata</i>        | Spotted Gum                     |
| Myrtaceae      | <i>Eucalyptus grandis</i>       | Flooded Gum                     |
| Myrtaceae      | <i>Eucalyptus crebra</i>        | Narrow-leaved Ironbark          |
| Podocarpaceae  | <i>Podocarpus elatus</i>        | Plum Pine                       |
| Proteaceae     | <i>Grevillea robusta</i>        | Silky Oak                       |
| Proteaceae     | <i>Stenocarpus sinuatus</i>     | Wheel-of-fire Tree              |
| Sapindaceae    | <i>Cupaniopsis parvifolia</i>   | Small-leaved Tuckeroo           |
| <b>Shrubs</b>  |                                 |                                 |
| Araliaceae     | <i>Polyscias elegans</i>        | Celerywood sapling              |
| Araucariaceae  | <i>Araucaria cunninghamii</i>   | Hoop Pine sapling               |
| Araucariaceae  | <i>Araucaria bidwillii</i>      | Bunya Pine sapling              |
| Cunoniaceae    | <i>Callicoma serratifolia</i>   | Callicoma sapling               |
| Cunoniaceae    | <i>Ceratopetalum gummiferum</i> | Christmas Bush                  |
| Cyatheaceae    | <i>Cyathea australis</i>        | Rough Tree Fern                 |
| Fabaceae       | <i>Acacia decurrens</i>         | Green Wattle                    |
| Myrtaceae      | <i>Acmena smithii var minor</i> | Lilly Pilly (small-leaved race) |
| Myrtaceae      | <i>Backhousia myrtifolia</i>    | Grey Myrtle                     |
| Myrtaceae      | <i>Melaleuca armillaris</i>     | Bracelet Honey-myrtle           |
| Pittosporaceae | <i>Pittosporum tobira</i>       | Japanese Cheesewood             |

### iii. Weeds and Exotic species

At least 113 species of weeds and other exotic plants are present within the BGHF vegetation. These are shown in Appendix B. Some of these species are listed as noxious in Ku-ring-gai Council.

#### **4.2.4 Fauna**

A small number of native species were detected on the site by Urban Bushland Management Consultants. These included four mammals (two possums and two bats), 15 birds, and two reptiles (UBMC, 2006). The full list can be found in Appendix B.

Two threatened species were recorded: the Grey-headed Flying-fox and the Gang-gang Cockatoo. Grey-headed Flying-foxes were seen flying overhead and heard foraging off-site to the north. The subject site provides some foraging resources for this species. When the various eucalypts are in flower, this site is likely to be used as marginal habitat by this species. Similarly, the Gang-gang Cockatoo was seen traversing over the subject site. This species may forage on the subject from time-to-time, and the species is not likely to be reliant on any of the resources of the subject site as these are present elsewhere and in greater numbers in the area.

Urban Bushland Management Consultants recorded the decaying carcass of a Brush-tailed Possum on the subject site (UBMC, 2006). Cumberland Ecology recorded the decaying, decapitated carcass of a Ringtail Possum on the subject site. Powerful Owls are known to decapitate their prey, however it is unlikely they would discard the carcass.

## Assessment of Likely Impacts on Threatened Species and Populations

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### 5.1 Assessment of species likely to be affected

#### DGR 5.1 – Assessment of Species Likely to be Affected.

The following are further requirements related to your obligation under Section 110 (2)(b) to address the following:

- An assessment of which threatened species or population known or likely to be present in the area are likely to be affected by the action.

*This requirement requires you to refine the list of subject threatened species and populations (given the outcome of survey and analysis of likely impacts) in order to identify which threatened species or endangered populations may be affected directly or indirectly (including cumulatively), by the proposal. This is to be done taking account of the requirements outlined previously in section 4 of these requirements and information in any relevant Scientific Committee determinations, recovery plans and draft recovery plans, and vegetation assessment and mapping. Detailed rationale should be provided to demonstrate how the list was derived. If adequate surveys/studies have been undertaken to categorically demonstrate the species does not occur in the study area, or if not resident, will not utilise habitats on site on occasion, or if off-site, be influenced by off-site impacts of the activity, that species does not have to be considered further. Otherwise all species/populations likely to occur in the study area (based on general species distribution information), and known to utilise those habitat types, should be assessed as if present.*

*The requirements in the remainder of this section need only be addressed for those species that are likely to be affected by the proposal. Subsequently this information should be used in an Assessment of Significance (as required in section 8) for each of those species or populations.*

The following list of threatened species and endangered populations includes those that may be affected by the proposal and are therefore assessed in subsequent sections of this chapter:

- *Syzygium paniculatum*;
- *Tetratheca glandulosa*;
- Superb Fruit-dove;
- Glossy Black Cockatoo;
- Gang-gang Cockatoo;
- Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai LGAs
- Masked Owl;
- Powerful Owl;
- Barking Owl;
- Large-eared Pied Bat;
- Eastern Bentwing Bat;
- Yellow-bellied Sheath-tail Bat;
- Eastern Free-tail Bat; and
- Grey-headed Flying-fox.

This list of species has been refined from the list of subject species (see Chapter 3) based on their known occurrence on the subject land or their likelihood of occurrence. The remaining subject species listed in Chapter 3 are not analysed further here as they are not considered likely to occur in the study area (based on general species distribution information) and/or are not known to utilise the habitat types of the subject land.

*Syzygium paniculatum* classifies as an “affected species” because it has been recorded on the subject land. *Tetratheca glandulosa* and the bird and bat species listed above have been included as “affected species” because suitable habitat is present on the subject land for these species. The Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai LGAs is also included in the list above because the subject land is within the population range boundary described in the Final Determination for the population (NSW Scientific Committee, 2001).

A number of species listed as subject species are not being assessed as affected species. It is considered for those species not being assessed that the subject site does not provide suitable habitat (see Table 3.2)

## 5.2 Analysis of Affected Species

### DGR 5.2 Discussion of local and regional abundance and distribution

The following are further requirements related to your obligation under Section 110(2)(d) to address the following:

- An estimate for the local and regional abundance of those species or populations

#### DGR 5.2.1 Discussion of other known local populations

A discussion of other known populations in the locality must be provided. An estimate of the numbers of individuals of each threatened species or population utilising the area and the relative significance of the population(s) in the study area to the populations in the locality must be included.

### DGR 5.3 Assessment of habitat

The following are further requirements related to your obligation under Section 110(2)(f) to address the following:

- a full description of the type, location, size and condition of the habitat (including critical habitat) of those species and populations and details of the distribution and condition of similar habitats in the region (Section 110 (2)(f)).

#### DGR 5.3.1 Description of habitat values

Specific habitat features must be described (eg frequency and location of stags, hollow bearing trees, culverts, rock shelters, rock outcrops, crevices, caves, drainage lines, soaks etc) and the density of understorey vegetation and groundcover.

The condition of the habitat within the study area must be discussed, including the prevalence of introduced species, species of weeds present and an estimate of the total weed cover as a percentage of each vegetation community, whether trampling or grazing is apparent, effects of erosion, prevalence of rubbish dumping, history of resource extraction or logging and proximity to roads.

Details of the subject site's fire history (eg frequency, time since last fire, intensity) and the source of fire history (eg observation, local records), must be provided.

#### 5.3.2 Discussion of habitat utilisation

A discussion of how individuals use the area (eg residents, transients, adults, juveniles, nesting, foraging) and discussion of the significance of the habitat of the study area to the viability of the threatened species or endangered population in the locality must be included.

#### 5.4 Discussion of conservation status

The following are further requirements related to your obligation under Section 110(2)(c) to address the following:

- for each species or population likely to be affected, details of its local, regional and State-wide conservation status, the key threatening processes generally affecting it, its habitat requirements and any recovery plan or threat abatement plan applying to it

and to your obligation under Section 110(2)(e) to address the following:

- an assessment of whether those species or populations are adequately represented in conservation reserves (or other similar protected areas) in the region

and to your obligation under Section 110(2)(e1) to address the following:

- an assessment of whether any of those species or populations is at the limit of its known distribution

The relative significance of the subject site for threatened species or endangered populations in the locality must be discussed. In particular, discussion of other known populations must be provided. Such an assessment must consider and compare the differences in the type, condition, and tenure and long-term security of other areas of known habitats in the locality with those in the study area.

The SIS must also include reference to the threatening processes that are generally accepted by the scientific community as affecting the species or population and are likely to be caused, promoted or exacerbated by the proposal. Consideration must also be given to measures outlined in the Priorities Action Statement and to any approved or draft recovery plans or threat abatement plans which may be relevant to the proposal.

Known occurrences in the locality and region of the extinction or degradation of local populations of each affected threatened species or population and of fragmentation, decrease in extent or degradation of its habitat should be documented.

#### DGR 5.5 Discussion of the likely effect of the proposal at local and regional scales

The following are further requirements related to your obligation under Section 110(2)(g) to address the following:

- a full assessment of the likely effect of the action on those species and populations, including, if possible, the quantitative effect of local populations in the cumulative effect in the region

#### DGR 5.5.1      *Significance within a local context*

*Provision of information to allow adequate determination of the significance of the effects of the proposal in accordance with Section 5A of the EP&A Act is required. The significance of impacts in the study area for conservation of affected threatened species or endangered populations in the locality must be discussed. An assessment of the significance of such impacts must compare and take into account the differences in the type, condition, and the tenure and long-term security, of other areas of known habitats in the locality with those in the study area.*

#### DGR 5.5.2      *Discussion of connectivity*

*The potential of the proposal to increase fragmentation of the habitat or decrease the ability for movement of individuals and/or gene flow between habitats or populations of a threatened species or population must be appraised.*

#### DGR 5.5.3      *Consideration of threatening processes*

*Assessment of effects must not be limited only to threats that are recognised as key threatening processes, but must include other threatening processes that are generally accepted by the scientific community as affecting the species or population and are likely to be caused or exacerbated by the proposal. Assessment should also include consideration of information in the Priorities Action Statement and any approved or draft recovery plans or threat abatement plans which may be relevant to the proposal.*

The information requested above is provided below for each of the affected species. General information requested in DGR 5.3.1 (Description of habitat values) has been provided in Chapter 2.

## **5.3      Magenta Lilly Pilly (*Syzygium paniculatum*)**

### **5.3.1      *Description***

*Syzygium paniculatum* (Myrtaceae) is a rainforest tree that grows to 8 m in height. It has flaky bark, leaves up to 10 cm long, produces white inflorescences from November to February at the end of each branch, and fruits mature in May (NSW NPWS, 2001b).

### **5.3.2      *Abundance and Distribution***

#### *i.      Local and regional abundance and distribution*

*Syzygium paniculatum* is endemic to NSW and exists in the north coast, central coast and south coast botanical divisions, from Bulahdelah to Conjola State Forest (DECC (NSW), 2007b).

Populations of this species are known to occur within the Sydney Metro Catchment Management Authority (CMA), in the Pittwater CMA sub-region (DECC (NSW), 2007b). In the last 10 years there has been one confirmed report of *Syzygium paniculatum* in the local government area of Ku-ring-gai and there have been 49 occurrences of the species in the Sydney bioregion (NSW Government, 2007).

#### ii. *Other Local Populations*

Aside from two individuals identified on the subject land (which have been planted there), only one other occurrence of this species has been recorded in the locality (Figure 3.1).

The proposal will not impact the individuals that occur on the subject land. The local occurrence of the species will not be affected by the proposal as all known populations (aside from the two occurrences in Ku-ring-gai LGA) occur outside the locality and are not dependent on the area of the subject land for their long-term survival.

### 5.3.3 *Habitat*

#### i. *Assessment of habitat*

This species occurs in riparian gallery rainforests, littoral rainforest in the north coast region and in the south coast region it is restricted to remnant stands of littoral rainforest. These habitats are generally rare due to development along the NSW coast. This species is generally found on Quaternary gravels, sands, silts and clays that do not exist on the subject site (Payne, 1997).

#### ii. *Habitat utilisation*

Two specimens are present on the subject land. These are old trees, but were probably planted rather than being native to the site. These trees will be retained on the site. No seedlings have been recorded from the subject site. No suitable habitat for this species occurs in the study area and thus the subject land is not important to the viability of the species.

### 5.3.4 *Conservation Status*

*Syzygium paniculatum* is listed as vulnerable under the TSC Act and vulnerable under the EPBC Act. It is not considered as locally or regionally significant in the Ku-ring-gai LGA because of its state listing.

There is no critical habitat registered for the species and the vegetation communities it occurs in are not listed as endangered ecological communities. The two individuals of this species on the subject land have been planted and the proposal will not result in their

removal, therefore, the following threatening processes for this species will not be exacerbated by the proposal:

- Invasion of native plant communities by bitou bush and boneseed (key threatening process);
- Ecological consequences of high frequency fires (key threatening process) as frequent fires can destroy individuals before a large enough seed set can be stored in soil;
- Habitat loss from clearing for development;
- Grazing and trampling of habitat by grazing stock; and
- Weed invasion commonly by local weed species and particularly by *Lantana camara* (proposed key threatening process) as weeds may over-shade individuals.

The species is generally found on the central coast around Bulahdelah and on the southern coast at Jervis Bay. There have been no records of the species between Towra Point Nature Reserve to Jervis Bay on the south coast (Mills, 1996). The species is not at its distributional limit on the subject land. Any impacts of the proposal on this individual will not affect the distribution of the species within the region.

No recovery plans have been drafted or finalised for this species.

### **5.3.5 Discussion of Likely Impacts**

#### *i. Significance within a local and regional context*

Aside from the planting of two individuals of this species on the subject land and one other occurrence to the south east of the subject land, the species is not found in the locality and rarely in a regional context. The proposal will not impact on this species on a local or regional scale as no individuals will be removed.

#### *ii. Discussion of connectivity*

Only two occurrences of this species have been recorded in the locality (including that on the subject land). No seedlings have been recorded on the subject site and research has indicated that a proximity to streams is required to facilitate germination and is required for dispersal in this species (Payne, 1997). Thus the subject land is not important to this species for dispersal between existing populations because there are no streams present and no overland water flow to areas of potential habitat for the species outside the subject site. The subject land and study area do not provide a direct habitat link between existing populations in the locality as only one occurrence of the species has been recorded

outside the subject land and also, the subject land is surrounded by residential development.

*iii. Consideration of threatening processes*

The two individuals of this species on the subject land have been planted and the proposal will not result in their removal, therefore, the following threatening processes for this species will not be exacerbated by the proposal:

- Invasion of native plant communities by bitou bush and boneseed (key threatening process);
- Ecological consequences of high frequency fires (key threatening process) as frequent fires can destroy individuals before a large enough seed set can be stored in soil;
- Habitat loss from clearing for development;
- Grazing and trampling of habitat by grazing stock; and
- Weed invasion commonly by local weed species and particularly by *Lantana camara* (proposed key threatening process) as weeds may over-shade individuals.

No recovery plans have been drafted or finalised for this species.

## **5.4 *Tetratheca glandulosa***

### **5.4.1 *Description***

*Tetratheca glandulosa* is a small, spreading shrub that grows to a height of 20 – 50 cm and generally flowers from July to November (NSW NPWS, 2000b). It is associated with shale-sandstone transition habitat and occurs on ridgetops, upper slopes and, to a lesser extent, on mid-slope sandstone benches (Chapman and Murphy, 1989).

### **5.4.2 *Abundance and Distribution***

*i. Local and regional abundance*

The species is limited to the Sydney Basin Bioregion, with its known distribution extending from Sampson's Pass (Yengo National Park), to West Pymble (Lane Cove National Park), Ingleside (Pittwater LGA) and East Kurrajong (Wollemi National Park). Within this range, there are approximately 150 known populations of which three populations south of the

Hawkesbury River contain over 200 individuals and three populations north of the Hawkesbury River contain over 200 individuals (NSW NPWS, 2000b).

*Tetratheca glandulosa* occurs locally (see Figure 3.1), with many of the records being from Ku-ring-gai Chase National Park. In the last 10 years there have been 9 confirmed records of this species from within the Ku-ring-gai LGA (NSW Government, 2007).

#### ii. *Other local populations*

One of the largest populations of *T. glandulosa* occurs in Berowra Valley Regional Park, which mostly falls outside the locality. Other populations within the locality and surrounds occur in Ku-ring-gai Chase National Park or within bushland on the interface between residential or other developed areas and Berowra Valley Regional Park or Ku-ring-gai Chase National Park, as seen in Figure 3.1. These include populations at:

- Hornsby Rifle Range;
- Heights Place, Hornsby Heights;
- Excelsior Road, Mt Colah;
- Oxley Drive, Mt Colah;
- Kuringai Chase Road, Mt Colah;
- End of Fox Valley Rd, Wahroonga;
- Gillespie Playing Fields, Warrawee;
- North Wahroonga; and
- North Turramurra.

### 5.4.3 *Habitat*

#### i. *Assessment of habitat*

*Tetratheca glandulosa* utilises shale-sandstone transition habitats and is usually associated with shale cappings on sandstone. It occurs on ridgetops and upper slopes and occasionally mid-slope sandstone benches (NSW NPWS, 2000b). It occurs in heaths and scrubs to woodland/open woodland in communities that broadly fall into the category of Sydney Sandstone Ridgetop Woodland (Benson and Howell, 1994).

Most of the known and potential habitat in the locality is located within Ku-ring-gai Chase National Park which is maintained by the DECC. Populations located south of Ku-ring-gai

Chase National Park (Figure 3.1) are less secure because they occur on private property, close to development.

#### ii. *Habitat utilisation*

The species has not been found to occur on the subject land but potentially suitable habitat is present in the more open areas, for example, near Quadrat 4. This habitat is not considered to be significant to the viability of the species in the locality as the species has not been found within the habitat in the study area.

The proposal will not affect the viability of populations of this species within the locality as they are not likely to depend on the potential habitat on the subject land.

### 5.4.4 *Conservation Status*

*Tetratheca glandulosa* is listed as vulnerable under the TSC Act and vulnerable under the EPBC Act. It is not considered as locally or regionally significant in the Ku-ring-gai LGA because of its state listing. It is considered to be adequately reserved north of the Hawkesbury River and as far south of the Hawkesbury as the locality but not in the far south of its distribution (NSW NPWS, 2000a).

The habitat requirements for this species are not specifically conserved. There is no critical habitat registered for the species and the vegetation communities it occurs in are not listed as endangered ecological communities.

*Tetratheca glandulosa* has not been found to occur in the study area and therefore, the following threatening processes for this species will not be exacerbated by the proposal:

- Bushrock removal (key threatening process) as this increases soil disturbance and increases erosion which may decrease the seed bank by washing away soil in which it is contained;
- Clearing of native vegetation (key threatening process) as this destroys populations of the species and their habitats;
- Exclusion of fire (NSW NPWS, 2000a) as the species may need fire for large germination events. Exclusion of fire also affects the species as overstorey species such as *Banksia* spp grow over the plants reducing their access to sunlight;
- Construction of fire access tracks and mechanical fire fuel reduction (NSW NPWS, 2000b) as this has the potential to clear or damage individual plants;
- Habitat fragmentation (NSW NPWS, 2000b) has the potential to decrease genetic exchange between patches of plants and thus decrease the success of individuals;

- Invasion and establishment of exotic vines (key threatening process) as these species may over-shade individuals;
- *Lantana camara* (key threatening process) as this species may over-shade individuals;
- Competition and grazing by the feral European rabbit (key threatening process) as this may damage and destroy individuals;
- Ecological consequences of high frequency fires (key threatening process) as frequent fires can destroy individuals before a large enough seed set can be stored in soil;
- Infection of native plants by *Phytophthora cinnamomi* (key threatening process);
- Invasion of native plant communities by bitou bush and boneseed (key threatening process); and
- Invasion of native plant communities by exotic perennial grasses (key threatening process) as these species may over-shade individuals.

Most of the known and potential habitat in the locality is located within Ku-ring-gai Chase National Park which is maintained by the DECC. Populations located south of Ku-ring-gai Chase National Park (Figure 3.1) are less secure because they occur on private property, close to development.

No recovery plans have been drafted or finalised for this species.

#### **5.4.5 Discussion of Likely Impacts**

##### *i. Significance within a local and regional context*

The proposal will not impact on this species on a local or regional scale as no individuals were found to occur in the study area.

##### *ii. Discussion of connectivity*

Occurrences of populations of this species in the locality are discussed in Section 5.4.2 above. These populations are broadly connected to continuous native vegetation that forms part of Berowra Valley Regional Park or Ku-ring-gai Chase National Park, with the exception of the populations at Fox Valley Rd, Warrawee, north of the centre of Hornsby, and those around Thornleigh, Pymble and Gordon. There is not likely to be dispersal between the two conservation areas due to the development occurring on the plateau between them. It is possible that the populations on either side of the plateau were once connected across the top of the plateau that has now been cleared for development.

No individuals of this species are known to occur in the study area. Thus the subject land is not important to this species for dispersal between existing populations. The subject land and study area do not provide a direct habitat link between existing populations in the locality as the subject land is surrounded by residential development.

iii. *Consideration of threatening processes*

*Tetratheca glandulosa* has not been found to occur in the study area and therefore, the following threatening processes for this species will not be exacerbated by the proposal:

- Bushrock removal (key threatening process) as this increases soil disturbance and increases erosion which may decrease the seed bank by washing away soil in which it is contained;
- Clearing of native vegetation (key threatening process) as this destroys populations of the species and their habitats;
- Exclusion of fire (NSW NPWS, 2000a) as the species may need fire for large germination events. Exclusion of fire also affects the species as overstorey species such as *Banksia* spp grow over the plants reducing their access to sunlight;
- Construction of fire access tracks and mechanical fire fuel reduction (NSW NPWS, 2000b) as this has the potential to clear or damage individual plants;
- Habitat fragmentation (NSW NPWS, 2000b) has the potential to decrease genetic exchange between patches of plants and thus decrease the success of individuals;
- Invasion and establishment of exotic vines (key threatening process) as these species may over-shade individuals;
- *Lantana camara* (key threatening process) as this species may over-shade individuals;
- Competition and grazing by the feral European rabbit (key threatening process) as this may damage and destroy individuals;
- Ecological consequences of high frequency fires (key threatening process) as frequent fires can destroy individuals before a large enough seed set can be stored in soil;
- Infection of native plants by *Phytophthora cinnamomi* (key threatening process);
- Invasion of native plant communities by bitou bush and boneseed (key threatening process); and
- Invasion of native plant communities by exotic perennial grasses (key threatening process) as these species may over-shade individuals.

No recovery plans have been drafted or finalised for this species.

## 5.5 Superb Fruit-dove (*Ptilinopus superbus*)

### 5.5.1 Description

The male Superb Fruit-dove is brightly coloured, with golden-green upperparts, a brilliant orange-vermilion neck, and a rich purple crown. The female is light green on the back, has a small purple spot on the crown, and no dark breast band (DEC (NSW), 2005g).

This species inhabits rainforest or closed forest and forages high in the canopy for fruit. Part of the population is migratory or nomadic and young birds move through Sydney in autumn (DEC (NSW), 2005g).

### 5.5.2 Abundance and Distribution

#### *i. Local and regional abundance*

This species occurs from north-eastern Queensland to north-eastern NSW, and less commonly further south as far as Moruya. There are also records of vagrants in eastern Victoria and Tasmania (DEC (NSW), 2005g).

Populations of this species are not known or expected to occur in the Sydney Metro CMA (DEC (NSW), 2005g).

There have been no records of this species in the Sydney Basin Bioregion or the Ku-ring-gai LGA in the last 10 years.

#### *ii. Other local populations*

The species has not been recorded in the study area. No known populations exist in the locality or the LGA.

### 5.5.3 Habitat

#### *i. Assessment of habitat*

The Superb fruit-dove occurs in rainforest or similar closed forest with a canopy in which the species can forage for fruits. There is a general preference for fig and palm type plants. The species may also forage in eucalypt forest or acacia woodland where fruit bearing trees are present.

ii. *Habitat utilisation*

This species has not been recorded on the subject land and there have been no records in the locality in the last ten years. The subject land provides only a limited area of potential foraging habitat for this species and is not considered to be significant to the viability of the species.

#### **5.5.4 Conservation Status**

The Superb Fruit-dove is listed as vulnerable in NSW under the TSC Act. A recognised threat to this species is the clearing and degradation of rainforest remnants. No recovery plans have been drafted or finalised for this species.

#### **5.5.5 Discussion of Likely Impacts**

i. *Significance within a local and regional context*

The proposal will not impact on this species on a local or regional scale as no individuals were found to occur in the study area and very limited potential foraging habitat occurs on the subject land.

ii. *Discussion of connectivity*

The canopy cover will remain intact for most of the site and will not create impedance to the movement of the species. The BGHF would provide some foraging opportunities in the canopy. The reduction of canopy cover is not expected to impact the life cycle of the species.

iii. *Consideration of threatening processes*

The essential threat to the Superb Fruit-dove is the clearing and degrading of rainforest remnants. The remnant BGHF on the site does not comprise remnant rainforest and as such, clearing a small proportion of the forested area will not constitute a threat to the species.

## **5.6 Glossy Black-cockatoo (*Calyptorhynchus lathamii*)**

### **5.6.1 Description**

The Glossy Black-cockatoo is a brownish black bird around 46–50 cm long with a small crest. Males differ from females in that they have narrower tails with bright red panels.

Females have tails that are red to reddish-yellow barred with black and they may have yellow markings around the head area (DEC(NSW), 2005e). The species is a highly specialised feeder which only feeds on the wooden cones of casuarinas (she-oaks). Adults breed during autumn and winter and one young bird is raised per season (Crome and Shields, 1992).

### **5.6.2 Abundance and Distribution**

#### *i. Local and regional abundance*

Glossy Black-cockatoo is locally abundant with many records occurring in the locality. In the last 10 years there have been 5 records from within the Ku-ring-gai LGA and 899 records from the Sydney Basin Bioregion. Many of the records from within the locality occur in Ku-ring-gai Chase National Park. Glossy Black-cockatoos are distributed inland to the southern tablelands and central western plains of NSW (DEC(NSW), 2005e).

#### *ii. Other local populations*

Birds can occur as pairs, small groups or parties of up to 25 individuals from several families. Groups are likely to move according to food availability (Schodde and Tidemann, 1986).

It is unknown how many populations occur in the locality due to the distribution of records, which are scattered mainly throughout Ku-ring-gai Chase National Park and Berowra Valley Regional Park. It is likely however, that individuals from more than one population interbreed and disperse through the locality.

No individuals have been recorded in the study area, therefore the subject land is not considered significant for populations in the locality.

### **5.6.3 Habitat**

#### *i. Assessment of habitat*

The Glossy Black Cockatoo characteristically inhabits forests on sites with low soil-nutrients, reflecting the distribution of key *Allocasuarina* spp, predominantly Forest Oak (*Allocasuarina torulosa*) and Black She-oak (*Allocasuarina littoralis*) in eastern populations. The species requires large tree hollows for nesting (NSW NPWS, 1999).

*ii. Habitat utilisation*

Trees with hollows known to occur on the subject land will be retained, thereby retaining any potential nesting habitat for the species. Limited foraging habitat opportunities exist on the subject land where several casuarinas occur. These feed trees will not be removed.

No individuals of the species have been recorded on the subject land and it is unknown whether any individuals may utilise habitat on the subject land. The subject land is not considered to be significant to the viability of the species.

#### **5.6.4 Conservation Status**

The Glossy Black-cockatoo is listed as vulnerable in NSW under the TSC Act and endangered nationally under the EPBC Act. The species is at threat from the following:

- Reduction of suitable habitat through clearing for agriculture or development;
- Loss of tree hollows;
- Too-frequent fire which reduces the abundance and recovery of she-oaks; and
- Illegal bird smuggling and egg collecting.

None of these threats will be exacerbated by the proposal on the subject land as the majority of potential feeding and nesting habitat will be retained. One hollow-bearing *Eucalyptus saligna* will be removed as a result of the development but nine hollow-bearing trees will be retained.

There have been a number of records of this species within the locality. Many of the records occur within the boundaries of the Ku-ring-gai Chase National Park. Also, many sightings of the species have been in Lane Cove National Park and the Berowra Valley.

Many of the records from within the locality occur in Ku-ring-gai Chase National Park. Glossy Black-cockatoos are distributed inland to the southern tablelands and central western plains of NSW (DEC(NSW), 2005e). The species is not at the limit of its known distribution in the locality of the subject land.

#### **5.6.5 Discussion of Likely Impacts**

*i. Significance within a local and regional context*

The proposal will not impact on this species on a local or regional scale as no individuals were found to occur in the study area and very limited potential foraging habitat occurs on the subject land.

*ii. Discussion of connectivity*

There have been a number of records of this species within the locality. Most of the records occur within the boundaries of the Ku-ring-gai Chase National Park and the Berowra Valley Regional Park. The species has been recorded in areas where there is significant development as well and as such, development on this site will not impede the movement of the species.

Due to the Glossy Black-cockatoo being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Ku-ring-gai Chase National Park and Berowra Valley Regional Park and across the region. Vegetation on the subject land makes up a tiny area of potential habitat but is not considered to have corridor functions due to the fact that the subject land is surrounded by urban development. The proposal will not sever any corridors.

*iii. Consideration of threatening processes*

The Glossy Black-cockatoo is at threat from the following:

- Reduction of suitable habitat through clearing for agriculture or development;
- Loss of tree hollows;
- Too-frequent fire which reduces the abundance and recovery of she-oaks; and
- Illegal bird smuggling and egg collecting.

Recovery Management guidelines suggested by DECC include:

- Reduce the impact of burning to retain diverse understorey species and in particular to permit the regeneration of she-oaks;
- Protect existing and future hollow-bearing trees for nest sites;
- Retain and protect areas of native forest and woodland containing she-oaks;
- Establish forested corridors linking remnant areas of habitat; include local she-oak species in bush revegetation works; and
- Report suspected illegal bird trapping and egg-collecting to the DECC.

## 5.7 Gang-gang Cockatoo (*Callocephalon fimbriatum*) - including the Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai LGAs

### 5.7.1 Description

The Gang-gang Cockatoo is a relatively small dark-grey cockatoo which generally, reaches about 32-37 cm in length and has a wing span of 62-76cm. Feathers are distinctively square on the ends, with a lighter coloured margin producing a scalloped appearance. Males have a bright red head and crest. Females have a grey head and crest and the scalloped margins of females breast feathers are reddish pink (DEC (NSW), 2005c).

### 5.7.2 Abundance and Distribution

#### i. Local and regional abundance

There are 8 records of the Gang-gang Cockatoo in the Ku-ring-gai LGA and 409 records in the Sydney Bioregion.

The local population of Gang-gang Cockatoos is listed as Endangered under schedule one part two of the TSC Act. The population is estimated to encompass about 18 to 40 breeding pairs. The population previously occurred over the Baulkham Hills, Cherrybrook and Dural areas, however, due to heavy development in these areas the species is now restricted to the Ku-ring-gai and Hornsby LGAs. The species is regionally important being the only breeding population in the Sydney metropolitan area.

#### ii. Other local populations

A locally Endangered Population exists in the Hornsby & Ku-ring-gai Local Government areas. This group is significant because it is the only known Gang-gang Cockatoo breeding population in the Sydney metropolitan area.

No individuals have been recorded in the study area, therefore the subject land is not considered significant for the population in the locality.

### 5.7.3 Habitat

#### i. Assessment of habitat

Gang-gang Cockatoos have a preference in the winter months for lower altitude habitats, including dry coastal eucalypt forest and Box - Iron-bark assemblages. The species is commonly found in urban environments. During summer the species is known to feed on

*Eucalyptus pauciflora* (snow gum) in the sub-alpine woolland environment. The species has declined by 44% in its NSW range (NSW Scientific Committee, 2001) between 1981 and 2001. The reasons for the decreasing population are not fully known, although the removal of habitat and the late breeding period in the life cycle are thought to be key factors (NSW Scientific Committee, 2001). The Gang-gang Cockatoo will usually breed in tall sclerophyll forests with hollows or large limbed trees present to nest.

## ii. *Habitat utilisation*

On the subject land there are few opportunities for a species the size of a cockatoo to nest. One hollow-bearing *Eucalyptus saligna* will be removed as a result of the development but nine hollow-bearing trees including potential nesting habitat will be retained. Limited foraging habitat is provided within the vegetation on the subject land, the majority of which will be retained.

The use of hollow-bearing trees on the subject land for nesting by this species is considered unlikely due to the fact that individual pairs of Gang-gang Cockatoos show high fidelity to selected nesting trees (choosing nesting hollows of particular shape, position and structure) (DEC (NSW), 2005d) and the fact that no individuals of the species were found to occur on the subject land. The subject land is not considered to be significant to the viability of the species.

### 5.7.4 *Conservation Status*

The Gang-gang Cockatoo is listed as a vulnerable species in NSW under the TSC Act. The Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai LGAs is listed under the TSC Act as an endangered population in NSW.

Threats to the species and population include:

- Clearing of vegetation and degradation of habitat which may reduce the abundance of optimal foraging and roosting habitat;
- Individual pairs show high fidelity to selected nesting trees (choosing nesting hollows of particular shape, position and structure), with clearing and frequent fire posing a threat to continued successful breeding;
- Climate change may alter the extent and nature of its preferred habitat (cool temperate vegetation);
- Susceptible to *Psittacine cirovirus* disease (PCD) which is spread through contaminated nest chambers. PCD is known to have increased near Bowral in the southern highlands of New South Wales over the past decade and constitutes a further threat to the species;

- Urban development resulting in clearing of forest and woodland habitat and the loss of connectivity to other populations of the species;
- Ongoing disturbance by humans and human activities to nesting and roosting areas;
- Competition for nesting hollows with other native and introduced species;
- Low population size could result in inbreeding depression over time; and
- Predation by cats and collision with vehicles, as the species ventures into urbanised areas to feed on seasonally available resources and flies between fragmented habitat areas.

The population is highly restricted to Beecroft – Cheltenham in the west, Epping – North Epping in the south, Turramurra – South Turramurra in the east, and Thornleigh – Wahroonga to the north. The population encompasses, but is not restricted to, Pennant Hills Park and parts of Lane Cove National Park.

The population is well represented within the parks and reserves of the area including Lane Cove National Park and Pennant Hills Park. The subject land is not at the limit of the distribution of the species or population.

### **5.7.5 Discussion of Likely Impacts**

#### *i. Significance within a local and regional context*

The proposal will not impact on this species on a local or regional scale as no individuals were found to occur in the study area and very limited potential foraging habitat occurs on the subject land.

#### *ii. Discussion of connectivity*

There have been a number of records of this species within the locality, particularly south of the subject land.

Due to the Gang-gang Cockatoo being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Vegetation on the subject land makes up a tiny area of potential habitat but is not considered to have corridor functions due to the fact that the subject land is surrounded by urban development. The proposal will not sever any corridors.

#### *iii. Consideration of threatening processes*

Threats to the species and population include:

- Clearing of vegetation and degradation of habitat which may reduce the abundance of optimal foraging and roosting habitat;
- Individual pairs show high fidelity to selected nesting trees (choosing nesting hollows of particular shape, position and structure), with clearing and frequent fire posing a threat to continued successful breeding;
- Climate change may alter the extent and nature of its preferred habitat (cool temperate vegetation);
- Susceptible to *Psittacine cirovirus* disease (PCD) which is spread through contaminated nest chambers. PCD is known to have increased near Bowral in the southern highlands of New South Wales over the past decade and constitutes a further threat to the species;
- Urban development resulting in clearing of forest and woodland habitat and the loss of connectivity to other populations of the species;
- Ongoing disturbance by humans and human activities to nesting and roosting areas;
- Competition for nesting hollows with other native and introduced species;
- Low population size could result in inbreeding depression over time; and
- Predation by cats and collision with vehicles, as the species ventures into urbanised areas to feed on seasonally available resources and flies between fragmented habitat areas.

No recovery plans have been drafted or finalised for this species.

## 5.8 Masked Owl (*Tyto novaehollandiae*)

### 5.8.1 Description

The Masked Owl is a large forest owl but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. It forages close to the ground in open habitats (Blakers et al., 1984) mostly in grasslands and open forests and woodlands with a grassy understorey.

Masked Owls roost and nest in large tree hollows. Pairs maintain and hunt throughout a home range that may be up to 1000 ha. Pairs are commonly breeding between the months of March and July, however, earlier records do occur (February) as do later events (September). The male prepares the nest cavity in a tree hollow after which the female incubates 2-3 eggs usually hatching within 35 days and the young fledge at 75-80 days (Schodde and Mason, 1999).

## **5.8.2 Abundance and Distribution**

### *i. Local and regional abundance*

There are over 112 records of the species in the Sydney Bioregion in the last 10 years (NSW Government, 2007). However, there have been no confirmed sightings in the Ku-ring-gai LGA in the last 10 years.

### *ii. Other known local populations*

Within the locality there has been one recorded sighting at Hornsby Park. There are no recognised local populations of Masked Owl in the locality but as the species has a large range it is possible that individuals would enter and leave the locality at will. Given the large home range of this species and the fact that no individuals have been recorded in the study area, the subject land does not form significant habitat for the Masked Owl.

## **5.8.3 Habitat**

### *i. Assessment of habitat*

The Masked Owl lives in eucalypt forest/woodland, densely vegetated gullies and tall old growth trees or caves from sea level to 1100m. Masked Owls are often found in open forest with a sparse understorey, as well as fragmented forest/pastoral landscapes (Kavanagh, 1996). Masked Owls require large tree hollows for nesting.

The distribution of the species includes 90% of NSW and only excludes the Arid North Western Corner. The species is most common along the eastern coast but extends to the western plains. There is no seasonal change in the distribution of the species.

### *ii. Habitat utilisation*

One hollow-bearing *Eucalyptus saligna* will be removed as a result of the development but nine hollow-bearing trees including potential nesting habitat will be retained. Potential foraging habitat for the species occurs in the study area.

There is one record of a Masked Owl in the locality. No individuals of the species have been recorded on the subject land and it is unknown whether any individuals may utilise habitat on the subject land. The subject land is not considered to be significant to the viability of the species.

## **5.8.4 Conservation Status**

The Masked Owl is not listed under the EPBC Act. It is listed as Vulnerable on Schedule 2 of the TSC Act (NSW Scientific Committee, 2004d). The species was listed because:

- Its distribution has been reduced;
- Its population is suspected to be reduced;
- It faces moderate threatening processes;
- It is an ecological specialist (it depends on particular types of diet or habitat); and
- It has poor recovery potential.

The Masked Owl is at threat from the following:

- Loss of mature hollow-bearing trees and changes to the structure of forests and woodland that lead to fewer such trees in the future;
- Clearing of habitat for grazing agriculture, forestry or other developments;
- Reduction in the number of prey through pesticide use; and
- Being hit by vehicles.

## **5.8.5 Discussion of Likely Impacts**

### *i. Significance within a local and regional context*

Masked Owls have a large home range, up to 1000ha in size, the species often hunts along the edges of woodlands and forests including road sides. The species requires open areas to hunt. The species main diet is ground dwelling mammals especially rats.

There will be little impact on the Masked Owl as a result of this development. The species will still be able to utilise habitat on the property.

### *ii. Discussion of connectivity*

Masked owls have such a large range that they can move from remnant to remnant to forage. The problem with the fragmentation of habitat is whether it can sustain a population of prey species for the masked owl to feed.

### *iii. Consideration of threatening processes*

The Masked Owl is at threat from the following:

- Loss of mature hollow-bearing trees and changes to the structure of forests and woodland that lead to fewer such trees in the future;
- Clearing of habitat for grazing agriculture, forestry or other developments;

- Reduction in the number of prey through pesticide use; and
- Being hit by vehicles.

A recovery plan for the Large Forest Owls has been prepared (DEC (NSW), 2006) and is relevant to the Masked Owl. The overall objective of this plan is “to ensure that the three species persist in the wild in NSW in each region where they presently occur.” Specific objectives relevant to the proposal include:

Objective 1: To minimise further loss and fragmentation of habitat outside conservation reserves and State Forests by protection and management of significant owl habitat (including individual nests).

Although the proposal will affect some potential foraging habitat for the species, potential nesting habitat will not be impacted. Areas of potential nesting habitat for this species occur within Ku-ring-gai Chase National Park, Berowra Valley Regional Park and Lane Cove River National Park and are thus protected.

Objective 2: To minimise the impacts of development activities on large forest owls and their habitats outside conservation reserves and State Forests.

Development of the subject land will be confined to areas that provided minimal potential foraging habitat for the species. The size of the area to be cleared or managed for fire protection is very small.

The threat abatement plan for predation by the red fox is relevant to this species. The proposal is not inconsistent with these objectives, which focus on fox control programs.

## 5.9 Powerful Owl (*Ninox strenua*)

### 5.9.1 Description

The Powerful Owl is the largest of Australia’s owls. It feeds on larger arboreal marsupials, megachiropterans, and other fauna captured in trees. It forages mostly in open forests and typically roosts in tall trees in moist gullies.

Breeding begins in April when a nest site is chosen, usually in a large tree cavity, high in an old growth eucalypt. The male of the species prepares the hollow with dead leaves and wood debris for the female to lay two eggs four days apart in late May or early June. Pairs maintain and hunt throughout a home range that may be up to 1000 ha.

## **5.9.2 Abundance and Distribution**

### *i. Local and regional abundance*

Powerful Owl is locally abundant with many records occurring in the locality (see Figure 3.2) and over 26 records from within the Ku-ring-gai LGA in the last ten years.

The species is widely distributed in NSW, occurring throughout the eastern forests from the coast inland to the tablelands with some scattered records from the western slopes, although these are mostly historic. The estimated minimum population size for this species in the State is 2000 pairs. It is known that the Powerful Owl is widely distributed throughout its range in NSW and occurs mostly within conservation reserves and state forests (DEC (NSW), 2005f).

### *ii. Other local known populations*

Breeding adult Powerful Owls are resident in the region but make local seasonal movements within their large home range. Depending on habitat availability, pairs are ideally separated by two to six kilometres, with home ranges of 800-1000 hectares per pair (NSW NPWS, 2004c). Powerful Owl records occur throughout the locality, however, it is not known for sure if these are from the same population, or the same pair within their large range, although it can be assumed that one pair occurs in the locality.

Given the large home range of this species and the fact that no individuals have been recorded in the study area, the subject land does not form significant habitat for the Powerful Owl.

## **5.9.3 Habitat Assessment**

### *i. Assessment of habitat*

Habitat for this species is widespread and primarily tall, moist productive eucalypt forests of the eastern tableland edge and the mosaic of wet and dry sclerophyll forests occurring on undulating, gentle terrain nearer the coast (NSW NPWS, 2004c). Densely forested gullies with adjacent more open forest containing old growth trees with hollows are the preferred habitats.

### *ii. Description of habitat utilisation*

No individuals of this species have been recorded on the subject land, however, due to the large home range and behaviour of this species, it can be assumed that one to two individuals utilise habitat on the subject land, at least from time to time. It is not likely that this owl nests on the subject land as suitably large tree hollows are not common and those that do occur were observed to be occupied by other bird species. One hollow-bearing

*Eucalyptus saligna* will be removed as a result of the development but nine hollow-bearing trees including potential nesting habitat will be retained.

The Powerful Owl may use the edge of the BGHF on occasion to hunt rodents and birds. There will be little impact on the Powerful Owl as a result of this development and the species will still be able to utilise habitat on the property. The subject land is not considered to be significant to the viability of the species.

#### **5.9.4 Conservation Status**

The Powerful Owl is listed as vulnerable under the TSC Act due to the apparently small population size of this species, their supposed vulnerability to vegetation clearing and intensive logging and the small number of existing records prior to 1988 (DEC (NSW), 2006). It is not considered as locally or regionally significant in the Ku-ring-gai LGA because of its state listing.

Powerful Owls are potentially threatened by clearing of native vegetation (key threatening process) for agricultural or urban developments, and intensive harvesting practices for wood production in native forests.

The proposal will result in the removal of a relatively small amount of native vegetation, however this is not in a known roosting/nesting site for the Powerful Owl.

The overall objective of the NSW Large Forest Owl Recovery Plan is to ensure that the three species (Powerful Owl, Masked Owl and Sooty Owl) persist in the wild in NSW in each region where they presently occur (DEC (NSW), 2006). The proposal will not conflict with these objectives, and will help maintain suitable nesting habitat in the locality through the retention and protection of large hollow-bearing trees.

Powerful Owl is threatened by or the proposal will further impact the species through the following processes:

- Clearing of native vegetation as this will clear potential foraging habitat. However, potential nesting and further potential foraging habitat will be retained on the subject land;
- Competition from feral honeybees as they can form hives in tree hollows that also form potential nesting habitat for the Powerful Owl. The proposal is not likely to exacerbate this process;
- Ecological consequences of high frequency fires as fire can destroy tree hollows that form potential nesting habitat. It is likely that fire management around the proposal will only involve low intensity fire which will not affect tree hollows;
- Predation by the European red fox as fledglings can become prey items for foxes. Foxes already exist on the subject land and are not likely to be increased in number by the proposal; and

- The removal of dead wood and dead trees, as dead trees are often hollow and contain potential nesting habitat. No trees with hollows suitable for this species were detected on the subject site and no dead trees will be removed outside the subject site.

The Powerful Owl has been detected in a number of conservation reserves throughout the Sydney Metropolitan Region, including Lane Cove National Park and Ku-ring-gai National Park.

### **5.9.5 Discussion of Likely Impacts**

#### *i. Significance within a local and regional context*

The proposal will not impact on this species on a local or regional scale as no individuals were found to occur in the study area and very limited potential foraging habitat occurs on the subject land.

#### *ii. Discussion of connectivity*

Due to the Powerful Owl being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Ku-ring-gai Chase National Park, Berowra Valley Regional Park and Lane Cove National Park and various local reserves and parks across the region. Vegetation on the subject land makes up a tiny area of potential habitat between these National Parks in the locality and is unlikely to be a significant corridor for this species. The proposal will not sever any corridors.

#### *iii. Consideration of threatening processes*

The Powerful Owl is at threat from the following:

- Destruction of suitable forest and woodland habitat;
- Forest management practices that reduce availability of food or that result in the loss of old trees and large tree-hollows;
- High-frequency burning; and
- Disturbances during the breeding period, such as clearing, logging or burning.

A recovery plan has been written for large forest owls which includes the Powerful Owl (DEC (NSW), 2006). Objectives include:

- Protecting habitat off-reserves and in State Forests;

- Minimising impacts of development activities;
- Modelling and mapping owl habitat;
- Monitoring trends in owl populations;
- Assessing management of forestry activities;
- Increasing knowledge of biology and ecology; and
- Increasing community awareness.

Management actions suggested by the DECC include protecting nest sites, retaining riparian areas, and preserving hollow-bearing trees.

Although the proposal will affect some potential foraging habitat for the species, potential nesting habitat will not be impacted. Areas of potential nesting habitat for this species occur within the adjacent Lane Cove River National Park and are thus protected.

Development of the subject land will be confined to areas that only afford potential foraging habitat for the Powerful Owl. The size of the area to be cleared or managed for fire protection is very small.

The threat abatement plan for predation by the red fox is relevant to this species. The proposal is not inconsistent with these objectives, which focus on fox control programs.

## 5.10 Barking Owl (*Ninox connivens*)

### 5.10.1 Description

The Barking Owl is distributed unevenly and in isolated patches along coastal districts around most of Australia. The species is widespread and quite common in parts of northern Australia but is considered generally uncommon in southern Australia. It is distributed sparsely throughout NSW although it is rarely recorded in the far west. The Barking Owl needs large trees and is therefore absent from much of central Australia, the Nullabor Plain and also from Tasmania and large offshore islands. Barking Owls are also found in New Guinea and the Moluccas. They occupy eucalypt woodland, open forest, swamp woodlands and timbered watercourses

Barking Owls are agile and aggressive hunters and therefore take a wide range of prey. Their diet includes rabbits, many types of birds, gliders, small possums, bats, rodents and insects. Most prey appears to be taken on the ground or when perched. Territories range from 30 to 200 hectares and pairs of birds remain in the same area all year.

Breeding occurs during late winter and early spring. The male appears to choose the nest site but rarely visits after laying. The nest is a large hollow in the trunk or large limb of a

tree. They will occasionally nest in deep forks of trees, rock crevices and rabbit burrows. The same site is often used for many years.

### **5.10.2 Abundance and Distribution**

#### *i. Local and regional abundance*

There have been 2 records of Barking Owl in the Ku-ring-gai LGA, along with another 49 records in the Sydney Bioregion in the last 10 years.

#### *ii. Other local populations*

There are no recognised populations in the locality. Given the large home range of this species and the fact that no individuals have been recorded in the study area, the subject land does not form significant habitat for the Barking Owl.

### **5.10.3 Habitat**

#### *i. Assessment of habitat*

Ideal habitat for the Barking Owl includes open country with a choice of large trees for roosting and nesting. In southern districts, Barking Owls choose creeks and rivers, particularly with River Red Gums, isolated stands of trees and open woodland. In northern Australia they favour paperbark swamps as well as previous habitats. Typically, the species favours big timber and open country and avoids dense closed forests. Although Barking Owls are generally wary at their nest, they may become very accustomed to humans; nesting close to farm buildings and even streets in towns. Occasionally the Barking Owl roosts in more dense habitats but hunts over more open country. Nests are in hollows of large, old eucalypt trees. Roosts are typically in tall, densely-foliaged understorey trees, such as wattles and She-oaks, or the dense clumps of canopy leaves in large eucalypts (DEC (NSW), 2005a).

#### *ii. Habitat utilisation*

This species may forage across the subject land. If this is the case, the subject land provides a very small area of foraging habitat for the species given the home range of up to 1000 ha. No individuals of the species were observed on the subject land and it is not expected that any nest there. In any case, one hollow-bearing *Eucalyptus saligna* will be removed as a result of the development but nine hollow-bearing trees will be retained. The subject land is not considered to be significant to the viability of the species.

#### **5.10.4 Conservation Status**

The Barking Owl is listed as Vulnerable on Schedule 2 of the TSC Act (NSW Scientific Committee, 2004a). It was listed due to:

- A decline in numbers;
- Habitat reduction;
- Low rate of reproduction; and
- Its position at the top of the food chain.

The Barking Owl is at threat from the following:

- Clearing of woodland and dry open forest vegetation, particularly large hollow-bearing trees, for agriculture, forestry and firewood harvesting; and
- Frequent fire that leads to degradation of understorey vegetation which is critical as habitat for its prey.

#### **5.10.5 Discussion of Likely Impacts**

##### *i. Significance within a local and regional context*

The Barking Owl has only been sighted twice in the last 10 years within the Ku-ring-gai LGA. It is thus considered unlikely that the proposal will affect the species locally.

##### *ii. Discussion of connectivity*

Due to the Barking Owl being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Ku-ring-gai Chase National Park, Berowra Valley Regional Park and Lane Cove National Park and various local reserves and parks across the region. Vegetation on the subject land makes up a tiny area of potential habitat between these National Parks in the locality and is unlikely to be a significant corridor for this species. The proposal will not sever any corridors.

##### *iii. Consideration of threatening processes*

The Barking Owl is at threat from the following:

- Clearing of woodland and dry open forest vegetation, particularly large hollow-bearing trees, for agriculture, forestry and firewood harvesting; and

- Frequent fire that leads to degradation of understorey vegetation which is critical as habitat for its prey.

A draft recovery plan has been written for this species (NSW NPWS, 2003). Objectives include

- Assessing the size and viability of populations;
- Establishing monitoring programs;
- Investigating management strategies; and
- Supporting genetic studies.

Management actions suggested by the DECC include retaining buffers around known nesting sites, protecting woodland and forest which contains hollow-bearing trees, protecting riparian areas, and applying mosaic pattern hazard reduction techniques to minimise habitat loss (NSW NPWS, 2003).

## 5.11 Large-eared Pied Bat (*Chalinolobus dwyeri*) and Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)

### 5.11.1 Description

The Large-eared Pied Bat is a microchiropteran with large ears and curly wattles; it has uniform glossy black fur on the back; the belly is washed with brown, usually with a band of bright white fur along the sides of the body. A combination of relatively short broad wings and low weight ratio is indicative of manoeuvrable flight and an ability to forage for insects below the canopy (Strahan, 1995).

Little information is known of the reproductive biology of this species with the current knowledge based on intermittent observation on the Copeton Mine tunnels which has since been flooded (Strahan, 1995). The Copeton colony assembled deep in the tunnel in early spring with births taking place in late November and early December. Most females gave birth to two young which are suckled until late January. The colony was seen to disperse during autumn and winter. Females are known to give birth at twelve months of age however it is uncertain whether mating occurs in winter or spring (Strahan, 1995).

Eastern Bent-wing Bats are found in eastern Australia, from north Queensland to far southeast South Australia. In NSW they are found from the coast to the western slopes, including high elevations of the Great Divide (DEC (NSW), 2005b).

In early spring, females of a population form a nursing colony and travel from numerous widely scattered roost sites to specific nursery caves that provide the high temperature and humidity requirements for raising their young. These nursery caves are highly

significant (DEC (NSW), 2005b). This species has the unique ability during hibernation for delayed implantation of a fertilised egg. The capacity for delayed implantation enables mating over a long period whilst the timing of the birth is relatively fixed, usually in December (Strahan, 1995).

### **5.11.2 Abundance and Distribution**

#### *i. Local and regional abundance*

The Large-eared Pied Bat has not been recorded in the last 10 years within the Ku-ring-gai LGA. There are 144 records of the species in the Sydney Bioregion (NSW Government, 2007).

The Eastern Bent-wing Bat has only been recorded in the Ku-ring-gai LGA once in the last 10 years, while being recorded 436 times in the Sydney Bioregion (NSW Government, 2007).

#### *ii. Discussion of other known local populations.*

Within the locality there are six records of Eastern Bent-wing Bats, all to the south-east of the subject land and one record of the Large-eared Pied Bat (Figure 3.2). No individuals of these species have been recorded in the study area therefore the subject land does not form significant habitat for them and the proposal will not impact on the occurrences of the species in the locality.

### **5.11.3 Habitat**

#### *i. Assessment of habitat*

The habitats utilised by the Large-eared Pied Bat are diverse; ranging from tropical to cool-temperate wet and dry sclerophyll forest to open habitats and woodland. Roosting occurs in caves or tunnels with highly specific environmental requirements for nursing young (Strahan, 1995). They live in colonies and roost in caves, old mines, stormwater channels and occasionally buildings. Regional movements can be as great as several hundred kilometres.

The Eastern Bent-wing Bat is insectivorous and is typically found hunting for small insects above the canopy in well timbered valleys (Strahan, 1995). This species roosts in caves or tunnels and will disperse on occasion up to 300km from the maternity cave which is used for the birth and rearing of young. These caves have specific climate regimes.

Both species are loyal to their caves and will return to the caves for many years. Breeding colonies for these species may number from 100 to 150,000 individuals so care must be

taken to leave roosting sites and surrounds undisturbed. Both species hunt in the forest for insects such as moths.

*ii. Habitat utilisation*

Vegetation on the subject land provides potential foraging habitat for these species but no roosting habitat exists. The subject land is not considered to be significant to the viability of the species.

The Large-eared Pied Bat is known to roost in caves, old mine shafts, as well as the former nests of the Fairy Martin. The Eastern Bentwing Bat also roosts in caves and mines as well as other man-made structures. There are many national parks within the Sydney Basin Bioregion that are likely to contain suitable habitat for these species and the Large-eared Pied Bat and Eastern Bentwing Bat are known to occur in several of these.

#### **5.11.4 Conservation Status**

The Large-eared Pied Bat is listed as vulnerable under the TSC Act and vulnerable under the Commonwealth EPBC Act. There are no populations that are known to occur in conservation reserves within the locality.

The Eastern Bentwing Bat is listed as vulnerable under the TSC Act. It is unknown as to whether the species is adequately represented in conservation reserves. There are no populations that are known to occur in conservation reserves within the locality.

The habitat requirements for these species are not specifically conserved, although there may be habitat within local national parks. There is no critical habitat registered for the species and the vegetation communities they occur in are not listed as endangered ecological communities.

The Large-eared Pied Bat is at threat from the following:

- Clearing and isolation of forest and woodland habitats near cliffs, caves and old mine workings for agriculture or development.
- Loss of foraging habitat close to cliffs, caves and old mine workings from forestry activities and too-frequent burning, usually associated with grazing.
- Damage to roosting and maternity sites from mining operations, and recreational caving activities.
- Use of pesticides.

The Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) is listed as VULNERABLE on Schedule 2 of the TSC Act (NSW Scientific Committee, 2004b). The species was listed because:

- Its population has been reduced to a critical level, but is suspected to be stable;
- It faces severe threatening processes;
- It is an ecological specialist (it depends on particular types of diet or habitat); and
- It concentrates (individuals within populations of the species congregate or aggregate at specific locations).

Eastern Bent-wing Bats are at threat from the following:

- Disturbance of colonies, especially in nursery or hibernating caves, may be catastrophic;
- Destruction or modification of caves that are seasonal or potential roosting sites;
- Rehabilitation of derelict mines;
- Changes to forest habitat, especially surrounding maternity caves; and
- Insecticide use.

The species is not listed under the EPBC Act.

Large areas of potential habitat exist in the Lane Cove and Ku-ring-gai Chase National Parks, and in the Berowra Valley Regional Park. Each of these parks provides a fairly secure range of habitats for each species.

#### **5.11.5 Discussion of Likely Impacts**

##### *i. Significance within a local and regional context*

The Large-eared Pied Bat has only been recorded once in the last 27 years within the Ku-ring-gai LGA. It is thus considered unlikely that the proposal will affect the species locally.

The Eastern Bentwing-bat has only been recorded seven times in the last 27 years within the Ku-ring-gai LGA. It is thus considered unlikely that the proposal will affect the species locally.

*ii. Discussion of connectivity*

Due to the Large-eared Pied Bat and Eastern Bentwing-bat being both highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Ku-ring-gai Chase National Park, Berowra Valley Regional Park and Lane Cove National Park and various local reserves and parks across the region. Vegetation on the subject land makes up a tiny area of potential habitat between these National Parks in the locality and is unlikely to be a significant corridor for this species. The proposal will not sever any corridors.

*iii. Consideration of threatening processes*

The Large-eared Pied Bat and Eastern Bentwing-bat at threat from the following:

- Clearing of woodland and dry open forest vegetation, particularly large hollow-bearing trees, for agriculture, forestry and firewood harvesting; and
- Clearing of vegetation and degradation of habitat which may reduce the abundance of optimal foraging habitat;
- Disturbance of colonies, especially in nursery or hibernating caves, may be catastrophic;
- Destruction or modification of caves that are seasonal or potential roosting sites;
- Changes to forest habitat, especially surrounding maternity caves; and
- Insecticide use.
- Clearing and isolation of forest and woodland habitats near cliffs, caves and old mine workings for agriculture or development.
- Loss of foraging habitat close to cliffs, caves and old mine workings from forestry activities and too-frequent burning, usually associated with grazing.
- Damage to roosting and maternity sites from mining operations, and recreational caving activities.

The removal of canopy is a threatening process for both species, the action will incur minimal canopy removal. The disturbance of roosting sites is a threat, the site has not observed/recorded either of these species using the site as a roost as such these species are not likely to be affected by this action.

No recovery plans have been drafted or finalised for either of these species.

## 5.12 Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)

### 5.12.1 Description

The Yellow-bellied Sheathtail Bat has shiny black fur on its back and white or yellow fur on the underside. It is a wide ranging species, found across much of northern and eastern Australia.

The Yellow-bellied Sheathtail Bat roosts mainly in tree hollows, but has also been found in cracks in dry clay and under rock slabs. It occurs in a wide variety of habitats, ranging from wet sclerophyll forest to grasslands and desert. The species forages above the tree canopy for insects. Young are born between December - March (DEC (NSW), 2005i).

### 5.12.2 Abundance and Distribution

#### i. Local and regional abundance

There are no records of the species in the Ku-ring-gai LGA within the last 10 years and there are 17 records of the species in the last 10 years with in the Sydney Bioregion

#### ii. Other known local populations

There are no recognised local populations of the species. There have also been few records of the species in the LGA and it is unlikely that there would be a viable population in the local vicinity.

#### iii. Assessment of habitat

The Yellow-bellied Sheathtail Bat utilises tropical to cool temperate rainforest to woodland and open country. It usually forages high above the forest canopy but in mallee or open areas it feeds lower to the ground. This species has been found to roost in tree hollows and has been recorded in the abandoned nests of Sugar Gliders (DEC (NSW), 2005i).

#### iv. Habitat utilisation

The subject land provides potential roosting and foraging habitat for this species. No individuals of the species were recorded in the study area and it is not expected that the species roosts there because this species appears to defend an aerial range which may coincide with breeding sites (DEC (NSW), 2005i). In any case, one hollow-bearing *Eucalyptus saligna* will be removed as a result of the development but nine hollow-bearing trees will be retained. The subject land is not considered to be significant to the viability of the species.

### 5.12.3 Conservation Status

The Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) is listed as vulnerable on Schedule 2 of the Threatened Species Conservation Act 1995 (DEC (NSW), 2005i). The species was listed because:

- Its population is suspected to have been reduced; and
- It is an ecological specialist (it depends on particular types of diet or habitat).

The Yellow-bellied Sheathtail Bat is at threat from the following:

- Clearing and fragmentation of forest and woodland habitat;
- Loss of mature hollow-bearing trees and changes to the structure of forests and woodlands that would lead to fewer such trees in the future; and
- Use of pesticides.

There is currently no recovery plan for this species.

### 5.12.4 Discussion of Likely Impacts

#### *i. Significance within a local and regional context*

The Yellow-bellied Sheathtail Bat has only been sighted once in the last 27 years within the Ku-ring-gai LGA. It is thus considered unlikely that the proposal will affect the species locally.

#### *ii. Discussion of connectivity*

Due to the Yellow-bellied Sheathtail Bat being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Ku-ring-gai Chase National Park, Berowra Valley Regional Park and Lane Cove National Park and various local reserves and parks across the region. Vegetation on the subject land makes up a tiny area of potential habitat between these National Parks in the locality and is unlikely to be a significant corridor for this species. The proposal will not sever any corridors.

#### *iii. Consideration of threatening processes*

- Disturbance to roosting and summer breeding sites.
- Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions.

- Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat.
- Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores.

The removal of canopy is a threatening process for the Yellow-bellied Sheath-tail, the action will incur minimal canopy removal. The disturbance of roosting sites is a threat, the site has not observed/recorded any Yellow-bellied Sheath-tail using the site as a roost as such the species is not affected by this action.

### 5.13 Eastern Free-tail bat (*Mormopterus norfolkensis*)

#### 5.13.1 Description

This is a microchiropteran bat with dark brown to reddish brown fur on the back; slightly lighter fur on the belly, with pale bases and hairs (Churchill, 1998). Most records for the Eastern Free-tail-bat originate from dry eucalypt forest and woodland east of the Great Dividing Range, mainly from southern New South Wales to south east Queensland (Strahan, 1995). However some confusion exists with this species and other little freetail-bats as no adequate taxonomic description has been carried out (Australian Museum Business Services, 1995). Virtually nothing is known of the biology of this distinctive species; therefore very few records have been authenticated and some records may be from other species whose distribution overlaps. Current confusion about the identification of this species has caused uncertainty regarding its habitat and distribution (NSW NPWS, 2002).

No information is available on the diet and foraging of this species except that it hunts insects above the forest canopy or in clearings at the edge of the forest (Strahan, 1995).

Little is known of its reproductive cycle but suggestion is made that sexes separate at certain times of the year, perhaps for birth and raising of young (Strahan, 1995). A single young is born in summer.

#### 5.13.2 Abundance and Distribution

##### *i. Local and Regional abundance*

There has been one record of the species in the last 10 years in the Ku-ring-gai LGA. 195 records exist in the last 10 years of the species in the Sydney Bioregion.

ii. *Other known local populations*

There are no recognised local populations of the Eastern Freetail bat. There have also been few records of the species in the LGA and it is unlikely that there would be a viable population in the local vicinity.

### 5.13.3 Habitat

i. *Habitat assessment*

The Eastern Freetail Bat is likely to utilise habitats ranging from warm temperate to subtropical sclerophyll forest and woodlands. The roost information from the few recorded are from small colonies found in tree hollows and under loose bark.

ii. *Habitat utilisation*

The subject land provides potential roosting and foraging habitat for this species. No individuals of the species were recorded in the study area. In any case, one hollow-bearing *Eucalyptus saligna* will be removed as a result of the development but nine hollow-bearing trees will be retained. The subject land is not considered to be significant to the viability of the species.

### 5.13.4 Conservation Status

The Eastern Freetail Bat (*Mormopterus norfolkensis*) is listed as VULNERABLE on Schedule 2 of the Threatened Species Conservation Act (NSW Scientific Committee, 2004c). The species was listed because:

- Its population and distribution are suspected to be reduced;
- It faces moderate threatening processes ; and
- It is an ecological specialist (it depends on particular types of diet or habitat).

The Eastern Freetail-bat would likely be at threat from the following:

- Loss of mature hollow-bearing trees and changes to the structure of forests and woodlands that would lead to fewer such trees in the future.
- Clearing of forest and woodland habitat for agricultural, residential and infrastructure development; and
- Use of pesticides.

The species is not listed under the EPBC Act.

### **5.13.5 Discussion of Likely Impacts**

#### *i. Significance within a local and regional context*

The Eastern Free-tail bat has only been sighted once in the last 27 years within the Ku-ring-gai LGA. It is thus considered unlikely that the proposal will affect the species locally.

#### *ii. Discussion of connectivity*

Due to the Eastern Free-tail Bat being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Ku-ring-gai Chase National Park, Berowra Valley Regional Park and Lane Cove National Park and various local reserves and parks across the region. Vegetation on the subject land makes up a tiny area of potential habitat between these National Parks in the locality and is unlikely to be a significant corridor for this species. The proposal will not sever any corridors.

#### *iii. Consideration of threatening processes*

- Loss of hollow-bearing trees.
- Loss of foraging habitat.
- Application of pesticides in or adjacent to foraging areas.

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

### **5.14.1 Description**

The Grey-headed Flying-fox is about 23-28cm from head to tail and is about 0.6 to 1kg in weight. The species has dark grey fur on the body and lighter grey fur on the head. A russet collar encircles the head (NSW NPWS, 2001a).

### **5.14.2 Abundance and Distribution**

#### *i. Local and regional abundance*

The Grey-headed Flying-fox is locally abundant with many records occurring in the locality (see Figure 3.2). The subject land is within 10 km of the Grey-headed Flying-fox camp site at the Ku-ring-gai Flying Fox Reserve in Gordon, where numbers have ranged from 350 to 69,000 individuals in the period 1998 to 2006 (KBCS 2006 – Ku-ring-gai Bat Conservation Society Inc. web site, <http://www.sydneymbats.org.au/cms/>). The Ku-ring-gai Grey-headed Flying-fox reserve is about 14ha in size and is protected under a voluntary

conservation agreement between the New South Wales Government and the Ku-ring-gai local council. Other colony sites in the region include the Royal Botanical Garden, Sydney and Cabramatta in Sydney's west.

Local and regional abundance of this species follows a seasonal pattern and is dependent on the availability of food resources.

*ii. Other local populations*

The Grey-headed Flying-foxes recorded in the locality of the subject land are likely to have been using the camp site at Gordon for roosting. Local populations do not exist as such due to the migration of individuals over large distances within their range in response to food availability. Flying-fox numbers vary greatly at camp sites throughout the year because the species is nomadic (Churchill, 1998).

The subject site is not a significant area of habitat for the species as it only contains a very small area of foraging habitat in proportion to the range of the species. Foraging habitat will remain secure within large areas including Ku-ring-gai Chase National Park, Lane Cove National Park and Berowra Valley Regional Park.

The proposal will not impact on any individuals or camp site of the species within the locality.

### **5.14.3 Habitat**

*i. Assessment of habitat*

Grey-headed flying-fox occurs in Subtropical and temperate rainforests, tall sclerophyll forests and woodland, heaths and swamps. Urban gardens and fruit crops also provide habitat for the grey-headed flying-fox. Native feed species include any in the *Eucalyptus*, *Melaleuca* and *Banksia* genera. The Grey-headed Flying-fox is an important pollinator and seed dispersal mechanism for native species (NSW NPWS, 2001a).

This pattern is likely to occur throughout the locality and region. However, there are many national parks within the Sydney Basin Bioregion that are likely to contain habitat in good condition and the Grey-headed Flying-fox is known to occur in several of these including Ku-ring-gai Chase National Park, Garigal National Park, Berowra Valley Regional Park and Lane Cove National Park.

*ii. Habitat utilisation*

The subject land contains foraging habitat for the species only. As the species is wide-ranging and covers large areas in any one night, the subject land only represents a very small percentage of the total foraging habitat for the species within the locality. Despite the

subject land only comprising a small area of habitat for the species, a large proportion of the vegetation on the subject land will be retained as potential habitat for the species. The subject land is not considered to be significant to the viability of the species.

#### **5.14.4 Conservation Status**

The Grey-headed Flying-fox is listed as vulnerable under the TSC Act and vulnerable under the EPBC Act. It is not considered as locally or regionally significant in the Ku-ring-gai LGA because of its state listing (Hornsby Shire Council, 2004). There are several camp sites that are known to occur in the Sydney region, including Ku-ring-gai Flying Fox Reserve, Cabramatta Creek Flying-fox Reserve and the Royal Botanic Gardens.

The habitat requirements for this species are not specifically conserved. There is no critical habitat registered for the species and the vegetation communities it occurs in are not listed as endangered ecological communities.

Grey-headed Flying-fox is threatened by clearing of native vegetation (key threatening process). Clearing on the subject land will remove potential foraging habitat for this species but this will be a very limited area and will not result in a significant impact to the species.

The subject land is within 10 km of the Grey-headed Flying-fox camp site at the Ku-ring-gai Flying Fox Reserve in Gordon, where numbers have ranged from 350 to 69 000 individuals in the period 1998 to 2006 (KBCS 2006 – Ku-ring-gai Bat Conservation Society Inc. web site, <http://www.sydneymbats.org.au/cms/>). The Ku-ring-gai Grey-headed Flying-fox reserve is about 14ha in size and is protected under a voluntary conservation agreement between the New South Wales Government and the Ku-ring-gai local council.

No recovery plans have been drafted or finalised for this species.

#### **5.14.5 Discussion of Likely Impacts**

##### *i. Significance within a local and regional context*

The Grey-headed Flying-fox has been recorded 38 times in the last 27 years within the Ku-ring-gai LGA.

##### *ii. Discussion of connectivity*

Due to the Grey-headed Flying-fox being highly mobile, it is not considered that continuous vegetation is required for dispersal between habitat areas. Broad corridors occur in the locality through Ku-ring-gai Chase National Park, Berowra Valley Regional Park and Lane Cove National Park and various local reserves and parks across the region. Vegetation on the subject land makes up a tiny area of potential habitat between

these National Parks in the locality and is unlikely to be a significant corridor for this species. The proposal will not sever any corridors.

*iii. Consideration of threatening processes*

- Loss of foraging habitat.
- Disturbance of roosting sites.
- Unregulated shooting.
- Electrocution on powerlines.

The removal of canopy is a threatening process for the Grey-headed Flying-fox, the action will incur minimal canopy removal. The disturbance of roosting sites is a threat, the site is not recognised as a roosting site as such the species is not affected by this action. Unregulated shooting and Electrocution of powerlines are not relevant to this site.

## 5.15 Description of Feasible Alternatives

### 6.5 Description of feasible alternatives

*The following are further requirements related to your obligation under Section 110 (3)(e) to address the following:*

- *A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed having regard to the biophysical , economic and social considerations and the principals of ecologically sustainable development*

#### **5.15.1 Introduction**

Under the development proposal, the majority of BGHF and the habitat that it currently affords to threatened fauna is to be conserved and improved by weeding and replanting of native plant species. The forest will be managed in perpetuity via the implementation of a VMP. There is only a small impact predicted to the forest on site and a limited number of ways that the proposed development can be modified to further reduce the impact. Nevertheless, a range of alternatives to the proposed development have been considered, including having no development, a smaller foot print, or a different type of development upon another portion of the subject site. The situation of the footprint assessed by this SIS and the construction design is considered to be the most acceptable option in terms of minimising impacts on BGHF and providing appropriate access to the proposed hospital buildings. The East Wing has been moved further away from the BGHF compared to the equivalent building in previous proposals so that it now only impacts on 0.7% of the BGHF, which equates to two trees – an *Elaeocarpus reticulatus* and a *Pittosporum undulatum*. This proposal also provides a suitable economic outcome for the proposal that will allow

for the ongoing management of the BGHF for conservation rather than let the forest continue to degrade.

The subject site for the development was used as a hospital for many years and has experienced considerable disturbances over past decades, including vegetation clearance, construction of buildings and associated infrastructure such as paths and drains, planting a wide range of exotic flora species, colonisation of the site by weeds and feral animal and keeping of poultry. The resultant impacts on soils, and the modification of understorey and thinning of the tree cover has diminished the values of the area as a potential conservation reserve. Better quality vegetation with a more intact understorey exists in the locality. Such habitats are of greater value for long term conservation of the BGHF. Notwithstanding such past impacts, the proposal for the redevelopment of the site will entail conservation and enhancement of the majority of BGHF on the subject site.

Threatened flora and fauna are an important consideration in the planning and environmental assessment process. However, when assessing the feasible alternatives to a proposed development, it is salient to recognise that the presence of threatened flora and fauna should not automatically be assumed to be sufficient constraint to preclude development from a site. The clearance of threatened species habitat can – (and is frequently across Australia) - justified under some circumstances when ecological issues are carefully weighed against social and economic issues.

Further, potential clearing needs to be considered in the context of the likely outcome of implementing a project. In the context of a project's outcome, the balance between limited clearing and compensatory measures may justify a conclusion that the project achieves, in ecological terms, a positive outcome. In this instance, although some limited clearing of highly degraded BGHF community is to occur, the overall ecological outcome will be a significant improvement on the current state of the BGHF community.

No threatened species will be significantly impacted by the proposed development, and none of the subject species that are considered possible to occur on the subject site are endemic to the locality or restricted to the subject site, subject land or study area. All have a much wider distribution. The two principle threatened fauna species Grey-headed Flying-fox and Gang Gang Cockatoo that were observed flying over head and the two planted threatened flora species *Syzygium paniculatum* are unlikely to be impacted upon as a result of the proposed development.

The subject land is rectangular in shape and the site slopes gradually down to the South. The North portion of the property is dominated by locally significant heritage buildings and landscape elements, while the South and East of the site is where the Sydney BGHF community is located.

To a large extent, the impact of a new development will not be specifically dependent on the use (whether it is used as a hospital, a seniors living development, or general residential development) but will instead depend on the location of, and size of, the new buildings. (i.e the sensitivity of the design approach).

The subdivision of the land into residential lots was considered however it would potentially have a more significant impact on the BGHF mapped areas. The reinstatement of the property back to a single grand dwelling and expansive bushland garden was considered however this scheme appeared unlikely to generate sufficient funding to initially restore the BGHF and heritage elements and gave no support for the availability of necessary ongoing funding in subsequent years for bushland regeneration.

#### **5.15.2 “Do Nothing” Approach**

Doing nothing is not a viable option for the owner or for the small remnant of BGHF on the subject site. The BGHF is irreversibly altered and is dominated by weeds in the understorey so it is unlikely to regenerate to a viable, fully functioning native vegetation community (UBMEC, 2009). The option of doing nothing will not provide for the regeneration of native flora within the BGHF on the site and the vegetation will continue in a degraded state because of the establishment of weed populations. The BGHF is currently over-run with a wide range of weed species and these will continue to increase at the expense of native flora if there is no active management strategy put in place. Through the provision of conditions of consent, the management of the community and its viability can be ensured. The “do nothing” option is not sustainable.

#### **5.15.3 Alternate design**

Any negative impacts which may be anticipated are unlikely to be significant to the BGHF community on the subject site. Further, steps are proposed to rehabilitate the BGHF by active management of weeds and re-planting local native plant species will produce a very significant improvement in the condition of the BGHF community.

The proposed development has been designed over the past year with the primary aim of balancing the various requirements and constraints evident, with the conservation of heritage and BGHF elements being the primary drivers in obtaining the appropriate footprint and density for the development of the property.

In the recent Land and Environment Court proceedings in relation to DA No. 855/06, the Court appointed expert on ecology, Dr Peter Smith, expressed the opinion that a level of impact on BGHF of 5% of the existing area was an acceptable level of impact. The project has a level of impact significantly less than this with an impact assessed as being 1.8%.

#### **5.15.4 Alternative Use of the Subject Site**

Cumberland Ecology has been instructed that alternatives to the current proposal have been considered by the proponent based on what is permissible under current zoning and the intensity of impacts that each alternative would have on the subject. The zoning of the vast majority of the subject site under the Ku-ring-gai Council Planning Ordinance is Special use 5(a) “Hospital” with the following permissible uses:-

- Utility installations (other than generating works or gas holders)
- special events
- hospital

The property has been used as a convalescent hospital for the past 50 years. The existing hospital facilities on the site are run down and would not comply with, and need upgrading to modern hospital compliance standards. In addition the existing number of rooms is very limited and therefore additional development would be required to provide an ongoing modern hospital development. Apart from a hospital (and special events and utility installations) the only other permitted use under the zoning is seniors housing.

A Seniors Living self-care facility has been considered for the subject site in two previous development applications. The first development application was for a 78 apartment facility that included a building in the north eastern corner of the site that would have involved clearing a larger area of BGHF. The second development application, for a 61 apartment facility had a building footprint similar to the current proposal but the eastern building was slightly larger and would have required the clearing of a larger area of BGHF.

#### **5.15.5 Economic and Social Considerations**

It is understood that the availability of professional health care facilities within the New South Wales Sydney metropolitan area has been a key socio-economic issue at both Federal and State Government levels. With the advent of urban consolidation strategies being implemented, Sydney's North Shore population is growing. This increased population will place greater pressure on the demand for health care facilities.

The subject site is appropriately zoned for a private hospital and the site's use for this purpose would contribute to the provision of improved hospital services in the Upper North Shore.

Development of a private hospital as proposed will enable protection and improvement of the BGHF on the subject site in perpetuity (or for as long as the facility remains on the site). In this regard, the proponent has included a commitment in the draft Statement of Commitments to implement the Vegetation Management Plan appended to the EA.

The NSW Government sold the subject site in an open tender in June 2005. The property was surplus to the Department of Community Services requirements. After 50 years of use as a children's convalescent facility the Government handed over the property in a very dilapidated condition. It is understood buildings regarded as having local heritage significance have been infested with termites and roofs left to leak by the former owners. For many years and right up to June 2005 the Government also actively mowed under the BGHF resulting in the current highly disturbed and weed infested nature of much of the BGHF on the subject site.

It is considered that it is impossible for the remaining BGHF vegetation to naturally regenerate to any form of native bushland on the site without assisted natural regeneration. It is important that an appropriate level of development to the site is agreed as soon as possible to facilitate the appropriate funding for this bush regeneration.

The proposal is for a major project providing an orderly and efficient use of the subject site in a manner that respects the heritage significance and ecological significance of the site. The private hospital will assist in reducing the burden on public hospitals and more acute private hospitals in the area.

#### **5.15.6 Justification for the Design**

Ongoing reconstruction and protection of the BGHF on the site is expected to take at least 10 years with maintenance in perpetuity. It has been acknowledged that it is impossible for the remaining vegetation to naturally regenerate to any form of native bushland. It should be noted that the BGHF reconstruction has increased significantly since listing in 2007 of BGHF as a critically endangered ecologically community under the TSC Act, because since the current owners acquired the site the total area of defined BGHF has doubled and the area that has been added to this definition is in very poor condition (UBMEC, 2009).

The ongoing process of the assisted natural regeneration of the BGHF can be undertaken in conjunction with the operation of the private hospital facility as proposed in the draft Statement of Commitments accompanying the EA on commencement of hospital related activities. Funds for BGHF maintenance will be allocated in the operations and facility management budget prior to the proposed facility opening. The proposed use of the site as a commercially viable private hospital facility therefore provides long-term surety in the funding, maintenance and protection of the BGHF endangered ecological community present on the subject site.

It was clearly acknowledged by the owner and design team that the constraints of the BGHF and Heritage elements on the site limit the realistic footprint of any such development and as such any design must recognise the importance of the BGHF. The philosophy of the proposed design for the hospital is therefore formed around a footprint which reduces impact on BGHF.

To achieve a sustainable project that enables the ongoing regeneration and maintenance of the BGHF and heritage elements to the property an efficient private hospital operation is required.

The proposed buildings are located mostly away from the mapped BGHF. The only exception is the footprint of the East Hospital Wing which encroaches to a minor extent on the mapped BGHF. This building's footprint has been minimised and shaped in an irregular style from standard configurations to minimise its impact on the BGHF. The East Wing has been located to maintain a connection between the main two stands of BGHF on the property. It has also been located to avoid the loss of individually high significance rated trees, particularly Sydney Blue Gums. Detailed review of construction methodology

for the East Wing basement has been considered by the design team to minimise impact on the BGHF stand during construction period, as verified in the VMP, the hydrogeology report by DF Dickson (November 2008) and arborist report by Castor (June 2008).

The proposed development will have a minor incursion by the East Hospital Wing into the BGHF. This is more than offset by the cessation of past human intervention to the BGHF understorey on the site, such as vegetable gardens, chicken runs and lawn mowing that has occurred in past years and also by the regeneration of the BGHF on the subject site.

Other alternatives such as increasing the height of buildings on other parts of the property and reducing the East Wing's footprint were considered however heritage and streetscape constraints have limited this as a viable alternative.

If the proposed development takes place, there will be a relatively small impact to the distribution and abundance of the affected species in question but it is highly unlikely to threaten the viability of either the BGHF or the threatened fauna that occasionally make use of it for foraging. Therefore, after due consideration within this SIS, the authors of the SIS believe that minor clearance of the area of habitat as proposed is justifiable.

#### **5.15.7 Conclusion**

Under the development proposal, the BGHF and the habitat that it currently affords to threatened fauna is to be conserved and improved by weeding and replanting of native plant species. The forest will be managed in perpetuity via the implementation of a VMP. Although a small number of trees will be removed, and although there is some limited potential for indirect impacts through changes to storm water runoff and the hydrogeological regime, these impacts have been assessed as manageable or negligible and are not considered likely to threaten the viability of the vegetation in the long term. Due to the extent of conservation and restoration proposed by the current proposal, there is only limited scope to further reduce impacts. Such modifications to design are not warranted when weighed against other factors including the social and economic issues faced by the project.

## Assessment of Likely Impacts on Endangered Ecological Communities

### 6.1 Assessment of Endangered Ecological Communities Likely to be Affected

#### DGR 6.1 Assessment of EECs likely to be affected

*The following are further requirements related to your obligation under Section 110 (3)(a) to address the following:*

*A general description of the ecological community present in the area that is the subject of the action and in any area that is likely to be affected by the action.*

Blue Gum High Forest, a community listed as “critically endangered” under the TSC Act, is present on the subject site. The community on the subject site does not correspond to the EPBC listing as the understorey is too highly modified (DEH, 2005). This has been confirmed by the Department of Environment and Water Resources, now DEWHA (Rankin, 2007).

Some of the vegetation on the subject site consists of a range of trees including *Eucalyptus saligna* (Sydney Blue Gum), *E. pilularis* (Blackbutt), *E. paniculata* (Grey ironbark), *Angophora floribunda* (Rough-barked Apple), and *Acmena smithii* (Lilly Pilly) which are either diagnostic or characteristic of BGHF. Numerous exotic tall tree species are also present. The understorey varies from dense with many species of small trees and/or shrubs, to exotic grassland with no or occasional scattered small trees or shrubs. The understorey and groundcover are highly disturbed and weed infested, however a number of native species of this community are present. Thirty-four ground cover species that were recorded in quadrats are natural to the site with 70 non native species being present in quadrats.

The area stated by Smith (Smith, 2007b) as containing BGHF forms an “L” shape along a residential boundary on the southern side and adjoining Young Street on the eastern side. This zone varies between approximately 20 and 35 metres in width and 135 metres long along Young Street, and 15 and 40 metres wide and 125 metres long near the southern boundary. The east-west length of the widest section near the southern boundary is approximately 50 metres.

More information regarding the floristics and structure of this community on the subject site can be found in Chapter 2.

## 6.2 Description of Habitat

### 6.2.1 Introduction

#### DGR 6.2 Description of habitat

*The following are further requirements related to your obligation under Section 110(3)(c) to address the following:*

- *a full description of the type, location, size and condition of the habitat of the ecological community and details of the distribution and condition of similar habitats in the region.*

Blue Gum High Forest has been estimated to cover approximately 6350m<sup>2</sup> which is approximately 28% of the subject site. The community is found in a narrow band down the eastern side of the site and in a broader zone along the southern boundary. These are generally in the lower portions of the site.

Historical land uses of the BGHF area on the subject site as a garden, vegetable patch, chicken run and compost area have degraded the habitat for the community. Many planted species have become invasive weeds throughout the BGHF and nutrient enrichment from these activities is likely to have encouraged other noxious and environmental weeds. Weeds range from groundcover to shrubs and trees. These include trees and shrubs such as Privet, African Olive, Broom, and Camphor Laurel, and vines such as Morning Glory and Asparagus Fern. Many exotic species were purposefully planted as garden plants throughout the site. Some species have also been planted that, while native to Sydney, are not native to BGHF. These include recent (2006) plantings along the southern boundary. There are a small number of dead native trees (Blue Gums and Angophoras) along the eastern boundary.

The great majority of locally indigenous shrubs, ground covers and vines are represented by a few individuals or are extremely localised in distribution. The bulk of the biomass comprises exotic species of which many are known environmental weeds (UBMEC, 2007). The competitive ability of most of the latter is favoured by disturbed soil conditions and unnaturally elevated nutrient levels as appear to occur at the subject site. As such, it will be extremely difficult for the BGHF to recover and even with intense management as proposed in the VMP, only a simplified version of the native community will be achieved.

The majority of the vegetation surrounding the subject site is restricted to roadside corridor vegetation. The vegetation within the subject site has limited connectivity to the south and west, however the vegetation within the subject site has connectivity to a larger patch of vegetation to the north-east which is known as Turiban Reserve. .Fragments of various

sizes are scattered throughout the Ku-ring-gai and Hornsby LGAs. The largest fragments in the area can be found on the western side of the Pacific Highway. Only approximately 200ha of this community is left in the region.

## 6.2.2 *Habitat in the Study Area*

### DGR 6.2.1 Study area

*An assessment of habitat the study area is required and must include:*

- *a description of each threatened ecological community, including:*
  - o *a description those areas where the community may only be represented by soil stored seed with no or few above-ground components, and*
  - o *description of disturbance history and recovery capacity. If the site shows signs of disturbance, details should be provided of the site's disturbance history. An assessment should be made of the ability of the ecological community to recover to a state representative of its pre-disturbance condition. This assessment will include consideration of the site's in-situ and migratory resilience and will be accompanied by a map of the recovery capacity of the ecological community across the site. Consideration should be given to the results (preliminary or otherwise) of restoration projects being undertaken at other sites that contain the ecological community when assessing its recovery capacity.*
  - o *comparison of the affected community with the endangered ecological community as determined by the NSW Scientific Committee.*
  - o *reference to any relevant available recovery plans and draft recovery plans and vegetation assessment and mapping.*
  - o *maps, consistent with the descriptions provided, showing the extent and condition of the community.*

#### *i. Introduction*

The wider study area contains BGHF and small pockets of isolated stands of trees which are not considered to conform to this CEEC. The community present on the subject site is in a highly degraded and disturbed condition but does conform to the CEEC as described in Paragraph 9 of the final determination for the community. More details regarding the floristics, structure and disturbance history can be found in Chapter 2 of this report.

*ii. Comparison with the Final Determination*

The following table provides a comparison between the vegetation community on the subject site and the final determination for BGHF (TSC Act).

**Table 6.1 COMPARISON WITH FINAL DETERMINATION**

| Paragraph | Final Determination                                                                                                                                                                              | Discussion of the Community on the Subject Site       |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| 1         | BGHF in the Sydney Basin Bioregion is the name given to the ecological community characterised by the species assemblage listed in paragraph 2. All sites are within the Sydney Basin Bioregion. | The subject site is within the Sydney Basin Bioregion |
| 2         | BGHF in the Sydney Basin Bioregion is characterised by the following assemblage of species:                                                                                                      |                                                       |
|           | <i>Acmena smithii</i>                                                                                                                                                                            | Present                                               |
|           | <i>Adiantum aethiopicum</i>                                                                                                                                                                      | Present                                               |
|           | <i>Allocasuarina torulosa</i>                                                                                                                                                                    | Present                                               |
|           | <i>Alphitonia excelsa</i>                                                                                                                                                                        |                                                       |
|           | <i>Angophora costata</i>                                                                                                                                                                         | Present                                               |
|           | <i>Angophora floribunda</i>                                                                                                                                                                      | Present                                               |
|           | <i>Asplenium flabellifolium</i>                                                                                                                                                                  |                                                       |
|           | <i>Backhousia myrtifolia</i>                                                                                                                                                                     | Planted                                               |
|           | <i>Blechnum cartilagineum</i>                                                                                                                                                                    |                                                       |
|           | <i>Breynia oblongifolia</i>                                                                                                                                                                      |                                                       |
|           | <i>Calochlaena dubia</i>                                                                                                                                                                         |                                                       |
|           | <i>Carex maculata</i>                                                                                                                                                                            |                                                       |
|           | <i>Cissus hypoglauca</i>                                                                                                                                                                         |                                                       |
|           | <i>Clematis aristata</i>                                                                                                                                                                         |                                                       |
|           | <i>Clerodendrum tomentosum</i>                                                                                                                                                                   |                                                       |

**Table 6.1 COMPARISON WITH FINAL DETERMINATION**

| Paragraph | Final Determination                                 | Discussion of the Community on the Subject Site |
|-----------|-----------------------------------------------------|-------------------------------------------------|
|           | <i>Dianella caerulea</i>                            | Present                                         |
|           | <i>Doodia aspera</i>                                |                                                 |
|           | <i>Elaeocarpus reticulatus</i>                      | Planted                                         |
|           | <i>Entolasia marginata</i>                          | Present                                         |
|           | <i>Entolasia stricta</i>                            |                                                 |
|           | <i>Eucalyptus globoidea</i>                         |                                                 |
|           | <i>Eucalyptus paniculata</i>                        | Present                                         |
|           | <i>Eucalyptus pilularis</i>                         | Present                                         |
|           | <i>Eucalyptus saligna</i>                           | Present                                         |
|           | <i>Eustrephus latifolius</i>                        | Present                                         |
|           | <i>Ficus coronata</i>                               |                                                 |
|           | <i>Glochidion ferdinandi</i> var. <i>ferdinandi</i> |                                                 |
|           | <i>Glycine clandestina</i>                          | Present                                         |
|           | <i>Hydrocotyle laxiflora</i>                        |                                                 |
|           | <i>Leucopogon juniperinus</i>                       |                                                 |
|           | <i>Lomandra longifolia</i>                          | Present                                         |
|           | <i>Marsdenia rostrata</i>                           |                                                 |
|           | <i>Maytenus silvestris</i>                          |                                                 |
|           | <i>Morinda jasminoides</i>                          |                                                 |
|           | <i>Notelaea longifolia</i> forma <i>longifolia</i>  |                                                 |
|           | <i>Oplismenus aemulus</i>                           | Present                                         |

**Table 6.1 COMPARISON WITH FINAL DETERMINATION**

| Paragraph | Final Determination                                                                                                                                                                                                                                                                                                                                              | Discussion of the Community on the Subject Site                                                                                                         |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | <i>Oplismenus imbecillis</i>                                                                                                                                                                                                                                                                                                                                     | Present                                                                                                                                                 |
|           | <i>Oxalis perennans</i>                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                         |
|           | <i>Pandorea pandorana</i>                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                         |
|           | <i>Persoonia linearis</i>                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                         |
|           | <i>Pittosporum revolutum</i>                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                         |
|           | <i>Pittosporum undulatum</i>                                                                                                                                                                                                                                                                                                                                     | Present                                                                                                                                                 |
|           | <i>Platylobium formosum</i>                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                         |
|           | <i>Poa affinis</i>                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                         |
|           | <i>Polyscias sambucifolia subsp. A</i>                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                         |
|           | <i>Pratia purpurascens</i>                                                                                                                                                                                                                                                                                                                                       | Present                                                                                                                                                 |
|           | <i>Pseuderanthemum variabile</i>                                                                                                                                                                                                                                                                                                                                 | Present                                                                                                                                                 |
|           | <i>Pteridium esculentum</i>                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                         |
|           | <i>Rapanea variabilis</i>                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                         |
|           | <i>Smilax australis</i>                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                         |
|           | <i>Smilax glycyphylla</i>                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                         |
|           | <i>Tylophora barbata</i>                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                         |
|           | <i>Viola hederacea</i>                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                         |
| 3         | The total species list of the community is considerably larger than that given above, with many species present in only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought condition and by its disturbance (including fire) history. The number of species, and the | Twenty of the 53 species listed for the community are present at the subject site. The community has a long history of disturbance at the subject site. |

**Table 6.1 COMPARISON WITH FINAL DETERMINATION**

| Paragraph | Final Determination                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Discussion of the Community on the Subject Site                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | above ground relative abundance of species will change with time since fire, and may also change in response to changes in fire regime (including changes in fire frequency). At any one time, above ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species; the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 4         | <p>BGHF is dominated by a tall canopy of eucalypts that may exceed 30 m in height. Its understorey is typically multi-layered with a midstorey of mesophyllous shrubs and small trees and a diverse ground layer of herbs, ferns and some grasses.</p> <p>Most stands of the community are in a state of regrowth after past clearing or logging activities, and consequently trees may be shorter, less dense or more dense than less disturbed stands.</p> <p>BGHF is dominated by either <i>Eucalyptus pilularis</i> (Blackbutt) or <i>E. saligna</i> (Sydney Blue Gum). <i>Angophora costata</i> (Smooth-barked Apple) is frequently observed in remnants close to the shale/sandstone boundary, but also occurs infrequently on deep shale soils, as does <i>A. floribunda</i> (Rough-barked Apple). <i>Eucalyptus paniculata</i> (Grey Ironbark) is typically found on upper slopes.</p> <p>A relatively diverse stratum of small trees is usually present, and includes <i>Pittosporum undulatum</i> (Sweet Pittosporum), <i>Elaeocarpus reticulatus</i> (Blueberry Ash) and <i>Allocasuarina torulosa</i> (Forest Oak).</p> <p>Shrub species are typically mesophyllous, such as <i>Breynia oblongifolia</i> (Coffee Bush),</p> | <p>The canopy at the subject site is generally around 30m high. The understorey varies from dense with many species of small trees and/or shrubs, to exotic grassland with no or occasional scattered small trees or shrubs.</p> <p>The subject site was originally developed in the late 1800's with buildings and landscaped areas. Areas of BGHF on the subject site are highly disturbed with many exotic species present.</p> <p>Blue Gum, Blackbutt, Grey Ironbark, Smooth-barked Apple, and Rough-barked Apple are present at the subject site.</p> <p>Sweet Pittosporum and Forest Oak are present at the subject site. Blueberry Ash is present as a planted shrub</p> <p>None of these shrub species are present at the subject site.</p> |

**Table 6.1 COMPARISON WITH FINAL DETERMINATION**

| Paragraph | Final Determination                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Discussion of the Community on the Subject Site                                                                                                                                                                                                                                                                                                                                                                                                |
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|           | <p><i>Pittosporum revolutum</i>, (Yellow Pittosporum), <i>Clerodendrum tomentosum</i>, <i>Notelaea longifolia</i> forma <i>longifolia</i> (Large Mock-olive), <i>Maytenus sylvestris</i> (Narrow-leaved Orange Bark), <i>Polyscias sambucifolia</i> subsp. A (Elderberry Panax) and <i>Rapanea variabilis</i> (Muttonwood). Mesophyllous species are generally more common in gullies associated with both shale and volcanic soils than slopes and ridgetops. Sclerophyllous species such as <i>Persoonia linearis</i> (Narrow-leaved Geebung) and <i>Leucopogon juniperinum</i> (Prickly Bearded-heath) occur more frequently closer to the shale/sandstone boundary.</p> <p>The ground stratum is often dense and contains a mixture of herb, grass and fern species including <i>Adiantum aethiopicum</i>, <i>Entolasia marginata</i> (Bordered Panic), <i>Lomandra longifolia</i> (Spiny-headed Matrush), <i>Calochlaena dubia</i> (Common Groundfern), <i>Dianella caerulea</i> (Blue Flax Lily), <i>Pseuderanthemum variabile</i> (Pastel Flower) and <i>Oplismenus imbecillis</i>.</p> <p>Vine species are also frequently present, in particular <i>Tylophora barbata</i> (Bearded Tylophora), <i>Eustrephus latifolia</i>, (Wombat Berry), <i>Clematis aristata</i> (Old Man's Beard) and <i>Pandorea pandorana</i> (Wonga Wonga Vine).</p> | <p>Bordered Panic, Spiny-headed Matrush, Blue Flax Lily, Pastel Flower and <i>Oplismenus imbecillis</i> are present at the subject site.</p> <p>A small number of native vines are present, although only Wombat Berry of the species listed here is present. Other native species present at the subject site include <i>Parsonsia straminea</i>, <i>Glycine tabacina</i>, <i>Hardenbergia violacea</i>, and <i>Clematis glycinoides</i>.</p> |
| 5         | <p>While no systematic fauna surveys have been carried out across the range of BGHF a number of mammal and bird species listed as threatened in NSW have been recorded as resident or transient in the community. These include the Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>), Yellow-bellied Sheath-tail-bat (<i>Saccolaimus flaviventris</i>), Glossy Black cockatoo (<i>Calyptorhynchus lathami</i>) and the Powerful Owl (<i>Ninox strenua</i>).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>A range of common urban birds utilise the subject site. Grey-headed Flying-foxes have been seen flying over the site and are likely to use it on occasion for foraging, as are other threatened fauna.</p>                                                                                                                                                                                                                                  |
| 6         | <p>BGHF is typically associated with soils derived from Wianamatta Shale (Tozer 2003), though may occur in adjacent areas underlain by Hawkesbury Sandstone. The community</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>Originally the soil would have been derived from Wianamatta Group shales. Most of the property is now likely to have altered</p>                                                                                                                                                                                                                                                                                                            |

**Table 6.1 COMPARISON WITH FINAL DETERMINATION**

| Paragraph | Final Determination                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Discussion of the Community on the Subject Site                                                                                                                                                                                                                                                                                                                                                                                                             |
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|           | also occurs on soils associated with localised volcanic intrusions, 'diatremes' (Benson and Howell 1994).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | soil profiles compared to the natural soil. The soil south of the stables, extending to the boundary, is most uneven and unnatural in contour, indicating it had been dug up and possibly other soil had been imported and deposited in the area. This area had also been used as a vegetable garden and chicken run. Both of these uses could be expected to result in significant changes to soil chemistry owing to fertilisers being produced and used. |
|           | Typically, BGHF occurs more than 100m above sea level, where rainfall exceeds 1050 mm per annum, although it may be present in sheltered locations with lower rainfall (Tozer 2003).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The subject site is located in Wahroonga, high on the Hornsby Plateau where rainfall is higher than many other parts of Sydney.                                                                                                                                                                                                                                                                                                                             |
|           | In drier areas and approaching the shale/sandstone boundary, it intergrades with Sydney Turpentine Ironbark Forest, which is currently listed as an Endangered Ecological Community under the TSC Act. Stands that exhibit intermediate characteristics are collectively covered by the Determinations of these communities and may be diagnosed by detailed consideration of the assemblage of species present at the site.                                                                                                                                                                                                                                                                                                           | There is no Sydney Turpentine Ironbark Forest in the vicinity.                                                                                                                                                                                                                                                                                                                                                                                              |
| 7         | Vegetation surveys carried out across the range of BGHF include those of Benson and Howell (1990, 1994) and Tozer (2003). All of these studies describe and map this community as 'BGHF', including map unit 6b 'Tall open-forest: <i>Eucalyptus pilularis</i> – <i>Eucalyptus saligna</i> ' of Benson and Howell (1994) and map unit 153 of Tozer (2003). In addition, Benson and Howell (1994) map separately that part of this community which occurs on soils associated with diatremes as 'Glen Forest, map unit 6c, i. Tall open-forest: <i>Eucalyptus saligna</i> ', noting that this vegetation was 'very similar to the BGHF of the north shore [i. e. map unit 6b]'. BGHF belongs to the North Coast Wet Sclerophyll Forests | The area has been mapped as BGHF by NPWS 2002.                                                                                                                                                                                                                                                                                                                                                                                                              |

**Table 6.1 COMPARISON WITH FINAL DETERMINATION**

| Paragraph | Final Determination                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Discussion of the Community on the Subject Site                                                                                                                                                             |
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|           | vegetation class of Keith (2004).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                             |
| 8         | BGHF is found on the north shore and northern suburbs of Sydney and has been recorded from the local government areas of Lane Cove, Willoughby, Ku-ring-gai, Hornsby, Baulkham Hills, Ryde and Parramatta within the Sydney Basin Bioregion and may occur elsewhere in the Bioregion.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | The subject site is located in Ku-ring-gai Council.                                                                                                                                                         |
| 9         | BGHF has a very highly restricted geographic distribution, and is currently estimated to cover an extant area of less than 200 ha (Tozer 2003). The distribution comprises a series of small remnant patches, the largest of which is less than 20ha.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | BGHF on the subject site is part of a small remnant together with the community present at Wahroonga Public School.                                                                                         |
|           | Highly modified relics of the community also persist as small clumps of trees without a native understorey. All remnants of the community are now surrounded by urban development. Consequently, the distribution of BGHF is severely fragmented. Fragmentation of habitat contributes to a very large reduction in the ecological function of the community.                                                                                                                                                                                                                                                                                                                                                                                                                                                | The community on the subject site is highly modified, and in many places consists of canopy trees without a native understorey.                                                                             |
| 10        | Prior to European settlement, about 200 years ago, BGHF is estimated to have covered an area of approximately 3700 ha (Tozer 2003). Its current extent amounts to less than 5% of this original distribution. The dominant eucalypts of the community live for several hundred years. BGHF has therefore undergone a very large reduction in its geographic distribution within a time span appropriate to the life cycle and habitat characteristics of its component species. Small-scale clearing associated with residential subdivision, road upgrading, extension and maintenance of service easements, etc. pose a threat of ongoing decline in the extent of the community. Clearing of native vegetation is listed as a Key Threatening Process under the Threatened Species Conservation Act 1995. | BGHF on the subject site is a remnant of a larger patch that has been cleared for residential subdivision, roads and schools. A small amount of additional clearing is proposed as part of the development. |
| 11        | Changes in structure of BGHF have occurred as a consequence of the extensive removal of large old trees. A number of stands of Blue Gum Forests have highly modified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | BGHF on the subject site has a highly modified structure due to past clearing, planting of exotic species, and invasion by                                                                                  |

**Table 6.1 COMPARISON WITH FINAL DETERMINATION**

| Paragraph | Final Determination                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Discussion of the Community on the Subject Site                                                                                                                                                                                                                                                                                     |
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|           | understories, in which the native woody component has been largely replaced by woody exotic species or by increased abundance of native and exotic grasses. Continued underscrubbing, frequent burning and mowing may maintain the understorey in an artificially open state and prevent recruitment of species with the community. The loss of large trees removes essential habitat for a range of tree-dependent fauna (Gibbons and Lindenmeyer 1996). The reduction of understorey complexity, through the reduction of native shrub cover, degrades habitat for a range of bird and mammal species (Catling 1991). These processes contribute to a very large reduction in the ecological function of the community.                                                         | weeds. Nutrient flow in stormwater and higher nutrient levels from previous gardening practices has encouraged the spread of exotics and weeds within the community.                                                                                                                                                                |
| 12        | <p>The influx of stormwater, which brings excessive moisture, pollutants and nutrients to the remnant forests from surrounding urban areas, is a significant ongoing threat to the ecological integrity of BGHF. This, together with the legacy of past disturbances and the abundance and dispersal of weed propagules from nearby urban areas, results in the invasion, establishment and spread of weeds (Thomson and Leishman 2005).</p> <p>Problematic weed species in BGHF include the following:</p> <p><i>Asparagus asparagoides</i></p> <p><i>Cinnamomum camphora</i></p> <p><i>Lantana camara</i></p> <p><i>Ligustrum lucidum</i></p> <p><i>Ligustrum sinense</i></p> <p><i>Ochna serrulata</i></p> <p><i>Passiflora edulis</i></p> <p><i>Passiflora subpeltata</i></p> | <p>The buildings and roads present on the subject site provide stormwater which introduces excessive moisture, pollutants and nutrients to the community. The presence of numerous abundant weeds is evidence of this.</p> <p>Present</p> <p>Present</p> <p>Present</p> <p>Present</p> <p>Present</p> <p>Present</p> <p>Present</p> |

**Table 6.1 COMPARISON WITH FINAL DETERMINATION**

| Paragraph | Final Determination                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Discussion of the Community on the Subject Site                                                                                                                                                                                                                     |
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|           | <i>Pennisetum clandestinum</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Present                                                                                                                                                                                                                                                             |
|           | <i>Rubus ulmifolius</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                     |
|           | <i>Senna colutioides</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                     |
|           | <i>Tradescantia fluminensis</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Present                                                                                                                                                                                                                                                             |
|           | 'Invasion and establishment of exotic vines and scramblers', 'Invasion of native plant communities by exotic perennial grasses' and 'Invasion, establishment and spread of Lantana ( <i>Lantana camara</i> L. sens. lat)' are listed as Key Threatening Processes under the Threatened Species Conservation Act. The influx of stormwater, pollutants and nutrients, and the invasion of weeds contribute to a very large reduction in the ecological function of the community. | Weeds (including exotic vines and scramblers, exotic perennial grasses and lantana) often make up between 50-100% of the projective foliage cover of parts of the community on the subject site. This is particularly the case in the shrub and groundcover layers. |
| 13        | BGHF in the Sydney Basin Bioregion is eligible to be listed as a critically endangered ecological community as, in the opinion of the Scientific Committee, it is facing an extremely high risk of extinction in New South Wales in the immediate future, as determined in accordance with criteria as prescribed by the Threatened Species Conservation Regulation 2002.                                                                                                        |                                                                                                                                                                                                                                                                     |

Notes Information from final determination (NSW Scientific Committee, 2004e)

### iii. Seed bank

Based on the species in and adjacent to the study area and the time the community has been dominated by exotic species, it is probable that the soil seed bank for locally indigenous species now ranges from depleted, no longer viable, to absent, according to the variable soil disturbance and time since native seed was deposited in the soil seed bank in different parts of the subject site.

With the possible exception of *Pomaderris lanigera* and *Leucopogon juniperina* (Prickly Beard-heath), all recorded indigenous species at the site could be expected to have survived in exotic gardens without additional propagules being imported from other bushland.

It is likely that other indigenous species that might have survived the initial clearing for the residence and gardens in the early 1900's would no longer have a viable soil seed bank unless they survived vegetatively until much more recently.

No additional areas outside the mapped area of BGHF on the subject site are likely to contain a seed bank for the BGHF community because of soil disturbance. Such areas include landscaped gardens, the croquet lawn and tennis court, driveways and paths. The croquet lawn and tennis courts would have been subject to cut and fill, as evidenced by the presence of retaining walls, in order to provide a level playing surface. These areas are also likely to have been dressed with topsoil to maintain playing surfaces. The gardens would have been under horticultural cultivation for many decades with topsoil disturbance and the addition of fertilisers. Weeding of gardens may have removed native species as the seed bank germinated in favour of cultivated plants. The current density and vigour of exotic ground covers is also likely to suppress any native seedlings that may germinate.

The limitations on the area in which a seed bank for BGHF could exist does not prohibit areas adjacent to the BGHF from being colonised by native ground covers from surrounding areas. In the recent September 2008 flora surveys, several native ground covers were observed, including *Wahlenbergia gracilis*, *Geranium homeanum*, *Poranthera microphylla*, *Centella asiatica*, *Dichondra repens*, *Pratia purpurascens* and *Glycine microphylla*. However, all of these species are small ground covers that are colonising species. They are commonly found in many different communities and are also found in disturbed areas. The presence of these common colonisers does not indicate that the BGHF community is regenerating in adjacent areas.

### iv. Recovery Capacity

Owing to extreme changes to the natural vegetation and habitat over a prolonged period, it is concluded that the plant community has been subject to a very large reduction in ecosystem function, as indicated by the:

- Changes in community structure;

- Changes in species composition;
- Existing disruption of ecological processes (including nutrient enrichment of habitat, changed hydrology, modification of natural soil profiles and restriction of natural genetic exchange and species importation to the site);
- Invasion and establishment of exotic species;
- Degradation of habitat, and
- Fragmentation and isolation of habitat.

It would be impossible for the remaining indigenous vegetation to naturally regenerate to any form of native bushland based on:

- general principles of small reserve design (Fox, 1992), with regard to the small area of vegetation to be retained and rehabilitated, and the large edge effect;
- the reduction in ecosystem function in and adjacent to the Blue Gum Zone at the subject site;
- the presence of large populations of environmental weeds in vegetative and soil seedbank forms; and
- probable low resilience of much of the Blue Gum Zone for natural regeneration.

Lembit's (Lembit, 2007) comment that the native vegetation is entering a "recovery phase" is optimistic and appears to be based on the regeneration of a few canopy tree saplings and small amounts of pioneer ground cover species. The site certainly does not possess a high degree of "ecological integrity and high recovery potential".

Even with assisted natural regeneration it is unlikely the site will provide suitable habitat for re-establishment of viable, representative BGHF community that would contribute significantly to conservation of the Critically Endangered Ecological Community.

The resilience of the Blue Gum Zone for return to natural community was assessed as:

- Moderate to low in the section parallel to Young Street, and
- Low to absent in the southern sections (near the old stables).

It is possible that vegetation similar to a simplified form of BGHF could be re-established in the eastern section of the site, near Young Street, where soils appear to be relatively intact. It should be possible to re-establish native canopy, small tree, shrub and ground cover strata. Owing to the narrow width, large edge effect and surrounding development this section of Blue Gum Zone will need permanent ongoing maintenance work, especially to the ground cover stratum.

The methods to achieve the desired results would include: assisted natural regeneration and supplementary planting (reconstruction). It is recommended that weed control and only minor planting be done initially, in order to enable natural regeneration levels to be

determined. If adequate natural regeneration does not occur in all strata, appropriate planting should occur in the relevant strata.

Owing to the level of difficulty of the site, bush regeneration work would need to be implemented in a professional, strategic and consistent manner for over ten years with maintenance management required in perpetuity.

It is possible that vegetation similar to a very simplified form of BGHF could be established near the southern boundary, including south of the old stables, where soils are most heavily modified. It should be possible to re-establish canopy, small tree and shrub strata mainly by planting suitable species (reconstruction). Re-establishment of the ground cover is likely to be problematic although some native species could survive amongst the weeds. It might be necessary to maintain mulch over the ground surface in order to control most herbaceous weeds. As with the Young Street area, this will need permanent ongoing maintenance to ensure survival of community and indigenous species.

#### v. *Limiting factors*

Although it should be possible to establish a simplified form of BGHF in the Former John William Hospital, it cannot be expected to be a fully naturally functioning ecosystem. Most of the issues that have led to the current condition of the community will largely continue despite minor amelioration of the existing impacts. These include:

- Ongoing weed impacts;
- Fragmentation and limitation of size of final community;
- Isolation from other viable areas of similar bushland – resulting in limited natural genetic exchange and importation of additional naturally occurring species;
- Large edge effect, even if buffer zones are included in the development;
- Stormwater impacts, despite attempts to reduce these by relevant modification of site drainage;
- Lack of natural fire regime; and
- Necessary inclusion of some exotic, culturally significant plants in the community.

Despite the limitations, it should be possible to restore, reconstruct and fabricate a largely native plant community similar to BGHF. Most of the technical issues required for this work have been addressed in the Vegetation Management Plan (VMP) (UBMEC, 2009). It is, however, recommended that some additional information be provided in the VMP or at the restoration implementation plan stage to more clearly describe the final patterns of vegetation strata and concentrations of individual species. This is aimed at ensuring a more natural arrangement of vegetation, and distribution of species is obtained, than could occur if the implementing organisation was not sufficiently familiar with bushland, especially BGHF.

## 6.2.3 Occurrences in the Locality

### DGR 6.2.2 Locality

*A discussion of other occurrences of each threatened ecological community populations in the locality must be provided. This must include:*

- *a comparison of other known occurrences and their habitats with those of the study area in terms of remnant sizes, connectivity, species diversity and abundances, quality and condition (including levels of disturbances, weed diversity and abundances).*
- *the tenure and long-term security of other occurrences and its habitat.*
- *the relative significance of the subject site for each threatened ecological community in the locality and region.*

The BGHF of the subject site is part of a band of this community that has been mapped by NPWS as running in a generally southwest to northeast direction. The vegetation within the subject site has limited connectivity to the south and west, the vegetation to the south and west of the site consists of scattered trees within a highly fragmented urban landscape. The vegetation within the subject site has connectivity to a patch across Water Street at Wahroonga Public School, adjoining a larger patch of vegetation to the north-east of the subject site known as Turiban Reserve. This is connected via street trees to The Clive Evatt Reserve. Most of the vegetation in the area is mapped as having a canopy cover of less than 10%, except for the patches located within Wahroonga Public School, Turiban Reserve and Clive Evatt Reserve, which have a cover of greater than 10%. While still in a degraded condition, the vegetation at Wahroonga Public School is better than that at the subject site (Smith, 2006). Turiban and Clive Evatt Reserves are council reserves and are thus afforded some protection in the long-term. Maintenance of the condition of the vegetation within these reserves is dependent on council funding. Wahroonga Public School is owned by the Department of Education and is therefore not protected in the long term, however its continued use as a school is likely. Maintenance of the vegetation on this site is dependent on funding from the Department of Education, and the School itself. Other vegetation mapped in the area is on private property and is likely to be in generally poor condition, and is not protected in the long-term.

Other small patches are located throughout the Ku-ring-gai area, with much larger fragments found to the west of the Pacific Highway. Very little of the community is mapped as having a canopy cover of greater than 10%. Very little of the community has long-term protection as the majority of the community occurs on private land.

Given the critically endangered status of the community, any remaining patch has some significance for long-term viability of the community as a whole. The vegetation on the subject site is in degraded and weed-infested condition (UBMEC, 2009), however some native understorey and groundcover vegetation does occur. Vegetation on the subject site forms a narrow link between two larger patches, and together this fragment forms a

stepping stone link between vegetation on the western side of the Pacific Highway and vegetation on the north-eastern parts of the plateau. As such, the vegetation of the subject site is important for the viability of the community as a whole as it facilitates genetic exchange between individual fragments. The proposal will not affect the connectivity of the community as the fragment currently on the subject site will remain intact.

## 6.3 Discussion of Conservation Status

### DGR 6.3 Discussion of conservation status

*The following are further requirements related to your obligation under Section 110 (3)(b) to address the following:*

*For each ecological community present, details of its local, regional and State-wide conservation status, the key threatening processes generally affecting it, its habitat requirements and any recovery plan or threat abatement plan applying to it.*

*The following are further requirements related to your obligation under Section 110 (3) (b1) to address the following:*

*An assessment of whether those ecological communities are adequately represented in conservation reserves (or other similar protected areas) in the region.*

*The following are further requirements related to your obligation under Section 110 (3) (b2) to address the following:*

*An assessment of whether any of those ecological communities is at the limit of its known distribution.*

*The relative significance of the subject site for each threatened ecological community in the locality must be discussed. In particular, discussion of other known occurrences of each affected threatened ecological community must be provided. Such an assessment must consider and compare the differences in remnant sizes, connectivity, species diversity and abundances, quality and condition (including levels of disturbances, weed diversity and abundances), tenure and long-term security of other known occurrences and habitats in the locality with those in the study area.*

*The SIS must also include reference to the threatening processes that are generally accepted by the scientific community as affecting each ecological community and are likely to be caused, promoted or exacerbated by the proposal and to the Priorities Action Statement and any approved or draft recovery plans or threat abatement plans which may be relevant to the proposal.*

*Known occurrences in the locality and region of fragmentation, decrease in extent or degradation of each ecological community or its habitat should be documented.*

### **6.3.1 Conservation Status**

Blue Gum High Forest is listed as critically endangered community under both the TSC Act and the EPBC Act, although the community on the subject site has been determined as corresponding to only the TSC Act's definition due to the lack of native understorey. BGHF has a very highly restricted geographic distribution on the north shore of Sydney,

and is currently estimated to cover an extant area of less than 200 ha. Prior to European settlement, about 200 years ago, BGHF is estimated to have covered an area of approximately 3700 ha. Its current extent therefore amounts to less than 5% of this original distribution (Tozer, 2003, NSW Scientific Committee, 2004e).

Due to the restricted distribution of the community, the site at Wahroonga would be considered to be near the limit of its range, although the subject site is located towards the centre of this distribution.

Blue Gum High Forest is conserved within the following reserves: Dalrymple-Hay Nature Reserve, Lane Cove National Park and Ku-ring-gai Chase National Park.

### 6.3.2 Threats

The distribution of BGHF comprises a series of small remnant patches, the largest of which is less than 20ha. Highly modified relics of the community also persist as small clumps of trees without a native understorey. All remnants of the community are now surrounded by urban development. Consequently, the distribution of BGHF is severely fragmented. Fragmentation of habitat contributes to a very large reduction in the ecological function of the community.

Blue Gum High Forest is threatened by the following key threatening processes:

- Clearing of native vegetation:
  - This includes further clearing for urban development and subsequent impacts from fragmentation as well as mowing, which stops regrowth;
- Weed invasion:
  - Invasion by a variety of weeds have been listed as key threatening processes. These include invasion by exotic vines and creepers, exotic perennial grasses, and Scotch Broom (preliminary listing). Scotch Broom and creepers such as Morning Glory and Asparagus Vine are present throughout the community at the subject site.

Other threatening processes that have relevance to the fauna associated with BGHF include:

- Removal of dead wood and dead trees;
- Loss of hollow-bearing trees.

Other threats to the community include:

- Urban run-off, which leads to increased nutrients and sedimentation; and

- Inappropriate fire regimes, which have altered the appropriate floristic and structural diversity of the community (e.g. dominance of *Pittosporum undulatum*).

### 6.3.3 Recovery

DECC has recommended 22 priority actions to assist with the recovery of this community. Relevant actions include:

- Notify land owners/managers of presence of BGHF and discuss implications for use and management;
- Liaise and support landholders to secure protection and active management of priority BGHF sites;
- Liaise with landholders to prepare site specific Plans of Management;
- Undertake priority weed control works;
- Undertake priority stormwater and erosion control works;
- Investigate planning and incentives programs to promote and encourage protection and management of BGHF, particularly on private land.

The recovery of this ecological community is being addressed as part of the Cumberland Plain Endangered Ecological Communities Recovery Plan, which is currently being prepared (and was meant to be finalized in July 2007).

Conservation mechanisms proposed in the Recovery Plan include:

- Identification and reservation of high conservation value remnants;
- Environmental protection zoning;
- Development control processes;
- Plans of management; and
- Voluntary conservation agreements.

Management options for BGHF can include:

- Formation of vegetation corridors;
- Development and implementation of bush regeneration strategies;
- Regeneration of canopy trees as many original trees are ageing;
- Weeding of the edges of remnants to enable natural regeneration to occur; and

- Use of fire to control some weed species and stimulate natural regeneration.

## 6.4 Discussion of the Likely Effect of the Proposal at Local and Regional Scales

### DGR 6.4 Discussion of the likely effect of the proposal at local and regional scales

*The following are further requirements related to your obligation under Section 110 (2)(g) to address the following:*

*A full assessment of the likely effect of the action on those species and populations, including, if possible, the quantitative effect of local populations in the cumulative effect in the region.*

#### **6.4.1 Introduction**

Blue Gum High Forest is associated with soils derived from Wianamatta Shale, though may occur in adjacent areas that are underlain by Hawkesbury Sandstone. The community also occurs on soils associated with localised volcanic intrusions. Generally the BGHF occurs more than 100m above sea level, in places where rainfall is greater than 1050mm per annum. It may also be present in sheltered locations with lower rainfall. In drier areas approaching the shale-sandstone transition it may intergrade with the Sydney Turpentine Ironbark Forest which is also an Endangered Ecological Community (NSW Scientific Committee, 2007).

According to DECC the impacts to endangered ecological communities from the proposed development are likely to arise from:

- fragmentation and isolation of habitat and an incremental decline in its quality and extent;
- loss of locally significant vegetation;
- loss of foraging habitat for threatened fauna and a reduction in their local abundance and distribution.
- changes in the hydrological regime resulting from altered surface flows and groundwater levels;
- deterioration in water quality;
- changes in vegetation structure, floristics and microhabitat due to shading;
- increased susceptibility to competition, disease, predation, insect attack and other disturbances due to increased access and a reduction in vegetative cover;

- indirect effects of urbanisation eg tree removal, rubbish dumping, soil compaction, erosion, weed invasion as well as altered drainage patterns and nutrient levels resulting from increased runoff;
- clearing, modification and long term degradation of habitat associated with the provision of asset protection zones; and
- indirect impacts to adjacent and downstream areas as a result of the clearing/loss of vegetative cover including greater susceptibility to weeds, pests, competition, disease, predation, insect attack and other disturbances associated with increased edge effects and human access.

## **6.4.2 Significance within a local context**

### **6.4.1 Significance within a local context**

*Provision of information to allow adequate determination of the significance of the effects of the proposal in accordance with Section 5A of the EP&A Act (see section 8 of these requirements below) is required. The significance of impacts in the study area for conservation of affected ecological communities in the locality must be discussed. An assessment of the significance of such impacts must compare and take into account the differences in remnant sizes, connectivity, species diversity and abundances, quality and condition (including levels of disturbances, weed diversity and abundances), tenure and long-term security of other known occurrences and habitats in the locality with those in the study area.*

Blue Gum High Forest has a very highly restricted geographic distribution, and is currently estimated to cover an extant area of less than 200 ha (Tozer, 2003). Formerly BGHF would have covered 25% of Ku-ring-gai LGA, however today only about 1.4% (23.4ha) exists within areas of council control. Another 50 ha of fragmented BGHF exists within the control of the adjacent Hornsby Council.

Blue Gum High Forest on the subject site covers an area of less than 1ha. The vegetation has been mapped by NPWS as being part of a larger remnant, however much of this vegetation is isolated trees within gardens, and is not likely to all be comparable to BGHF. Blue Gum High Forest is highly fragmented throughout its extent, with the largest fragments being approximately 20ha in size.

Nearby fragments are located in Wahroonga Public School "The Bush School", Turiban Reserve and Clive Evatt Reserve. While still in a degraded condition, the vegetation at Wahroonga Public School is better than that at the subject site (Smith, 2006). Turiban and Clive Evatt Reserve are council reserves and are thus afforded some protection in the long-term. Maintenance of the condition of the vegetation within these reserves is dependent on council funding. Wahroonga Public School is owned by the Department of Education and is therefore not protected in the long term, however its continued use as a school is likely. Maintenance of the vegetation on this site is dependent on funding from

the Department of Education, and the School itself. Other vegetation mapped in the area is on private property and is likely to be in generally poor condition, and is not protected in the long-term.

Twenty of the 53 species listed in the final determination are present at the subject site. Of the 24 tree species recorded in the ten quadrats, five are naturally occurring. Eighteen other species are NSW or Australian species that are not locally indigenous or occur in other habitat in the district. Only one naturally occurring shrub is recorded in the quadrats. Two others are observed near the southern end of the Young Street Blue Gum Zone. Other shrub sized specimens are either planted and potentially native to the site, but grown from unknown provenance propagules, or occur in other habitats in the local district, or are not native to the district or Australia. Nineteen ground cover species are natural to the site with 56 non-native species being present. Six of the total of 18 vines are native to the site.

The condition of the vegetation is generally poor, with much weed infestation (UBMEC, 2009). The community has a long history of disturbance at the subject site. A wide variety of weeds are present, many of which are noxious. Weeds range from groundcover to shrubs and trees. These include species such as Privet, African Olive, Broom, Camphor Laurel and many others. Many exotic species were purposefully planted as garden plants throughout the site. Within each of the ten quadrats surveyed, estimates were made of the percentages of exotic species in each of the four vegetation strata (canopy tree, small tree, shrub and ground cover). These indicated that throughout the community most understorey strata contained very high proportions of introduced species (up to 100% cover in many places). The distribution of the canopy stratum varied greatly. The small tree stratum generally contained high proportions of exotic species.

The area of BGHF to be removed from the subject site represents approximately 1.8% of the total area of BGHF represented on the subject site. However, this area to be removed represents approximately 0.2% of the total area of BGHF in the study area and beyond when considering the fragment of the community contained within Wahroonga Public School, Turiban Reserve North and Turiban Reserve South. This larger fragment contains much higher quality BGHF, as it has been included within the DEWHA determination for BGHF which does not consider remnant trees with a non-native understorey to be included as the critically endangered ecological community. Therefore it is not considered significant within the local context of the community that 18 trees with no native understorey is cleared.

### **6.4.3 Extent of habitat removal or modification**

#### **6.4.2 Extent of habitat removal or modification**

*The location, nature and extent of habitat removal or modification which may result from the proposed action including the cumulative loss of habitat from the study area (including all proposed DAs and those areas in the subject area already with development consent or*

identified for development) and the impacts of this on the viability of the endangered ecological community in the locality.

*This must include an assessment of the proportion of the endangered ecological community to be affected by the proposal, in relation to the total extent of the endangered ecological community, and the impact of this on the viability of the endangered ecological community at the local level.*

- o The development of buildings and related infrastructure outside of the footprint of the BGHF. Any future development would need to have a minimum buffer determined by the canopy spread or 3m from the trunk as per the council's tree preservation order, whichever is the greater.*
- o Future assessment has to take into account and establish properly the effects of shading, impacts on sub and surface hydrology, root zone disturbance and other edges effects that would ensue from any excavation, underground and above ground development that may occur*
- o In terms of protecting ecological communities, buffer zones play a significant role in mitigating undesirable edge effects associated with urban development. Edge effects are more marked in narrow buffers. Thus it would be prudent where feasible to maintain as a large a buffer as possible.*

#### *i. Habitat removal*

A number of buildings currently exist within the subject site. These generally occur on the western portion of the subject site. Blue Gum High Forest occurs along the eastern and southern parts of the site, where no buildings currently exist. Some buildings within the subject site will be redeveloped (i.e. Former John Williams Hospital and the stables). The redevelopment of these areas will have little impact on the BGHF of the subject site as buildings, roads, paths and gardens have existed in these areas for many years.

New buildings include the East Hospital Wing which is located in the southeast quadrant between the two portions of BGHF and is the only building not located over pre-existing structures. This building is to be five levels with one basement level. This building will encroach on the edge of the BGHF. This area of BGHF is highly degraded, on the edge of the existing patch and does not contain a native understorey. The remaining vegetation outside the BGHF that will be cleared for the East Wing comprises garden and lawn, dominated by buffalo grass. These areas would require intensive ongoing management if they were to be restored as some form of BGHF. Although regenerating this area as BGHF would allow for a more practical shape for the conservation area, regenerating 1770m<sup>2</sup> of other areas of the subject site as BGHF outside of the Smith-mapped area is considered to be a suitable substitution for the area of lawn on which the East Wing will be located.

According to mapping by Peter Smith (2007), the proposed development would involve clearing 116m<sup>2</sup> or 1.8% of BGHF. Additionally, edge effects and hydrological changes have the potential to further impact on this vegetation community.

Of the 126 trees within the BGHF, 111 will be retained, including all trees with Significance Ratings of 1, 2 and 3 (see Arboricultural Impact Assessment (Tree Wise Men, 2009)). Of the 15 trees to be removed, 6 are target weed species (UBMEC, 2009) and 5 are structurally unsound (Tree Wise Men, 2009). Only two trees will be removed from the BGHF for the construction of the East Wing and two will be removed for the driveway. Three of these trees to be cleared for the development are species belonging to the BGHF community (*E. saligna*, *Pittosporum undulatum*, *Elaeocarpus reticulatus*) and the other is likely to have been a planted specimen (*Callistemon salignus*). A summary is provided in Table 6.2 and details within Table 6.3.

**Table 6.2 SUMMARY OF TREE REMOVAL**

|                                                            | Number | %    |
|------------------------------------------------------------|--------|------|
| Trees retained within BGHF                                 | 111    | 88%  |
| Trees removed as weeds or dead and dangerous               | 11     | 9%   |
| Trees removed for driveway, building or other construction | 4      | 3%   |
| Total trees within BGHF mapped areas                       | 126    | 100% |

ii. *Construction impacts*

It is recognised that there will be disturbance within the BGHF around the edge of the East Hospital Wing during construction. According to the VMP, fence barriers will be placed 3m from the edge of the building to prohibit construction activities encroaching into the BGHF further than necessary (UBMEC, 2009). The footprint of the East Hospital Wing has been designed to minimise encroachment of the 3m construction zone on the BGHF. The 3m construction zone is needed to provide construction access outside of the building's footprint. Scaffolding will be narrowed where possible to reduce the need for tree pruning and a layer of woodchip or boarding will be laid in the construction zone to protect tree roots (Tree Wise Men, 2009). Drilling for pilings can be done from within the footprint of each building and machinery does not need to encroach on areas within the BGHF that are to be retained.

The majority of retained trees are buffered to construction impacts of 3m or the extent of canopy spread, as per Council's tree protection order. Four trees occur outside the edge of the 3m wide construction zone and have a crown greater than 3m radius that overhangs the construction zone (Trees 110, 126, 127 and 321). Tree 374 occurs at the edge of the construction zone and has a crown of less than 3m radius but is within 3m of the edge of the building. See the Site Strategy Plan drawing no. LS.DA.05 Revision H by Taylor Brammer for locations of trees and extent of tree crowns in relation to the building and

construction zone. Measures will be taken to protect these trees as per the Arboricultural Impact Assessment, such as narrowing scaffolding around these trees.

*iii. Overshadowing impacts*

There is potential for the proposed hospital buildings to overshadow the BGHF, from the west and north, at certain times of the day and particular times of year. The main overshadowing impacts will be in the southern portion of the subject site whereas the BGHF in the north eastern section will remain unaffected beyond the impacts of the existing buildings, because this section is further north than the proposed buildings. The canopy trees are 25 to 40m high and even though downslope of the proposed buildings, will still overtop the roof line. Therefore the canopy trees will not be affected by shading. The understorey is currently subject to shading from the existing canopy and over-shadowing is not likely to have a significant impact on these plants due to BGHF being relatively shade-tolerant and the variation in over-shadowing that will occur with the proposed buildings during different times of the year and on cloudy days (Tree Wise Men, 2009).

Consider that the buildings will be constructed around existing edges of the BGHF. These edges have been subject to increased sunlight levels since the surrounding forest was cleared and display negative impacts such as weed invasion. Originally, the forest would have contained canopy trees over 40m tall (Tozer, 2003). Remaining patches of BGHF are open forests with a small tree layer and an often dense shrub layer. The majority of plants would only receive partial sunlight for most of the day because of the combined shade effect of the vegetation strata (Benson and Howell, 1994). The BGHF on the subject site has had this shade effect removed via the removal of the surrounding forest, now more light-tolerant species grow around the edges and throughout the remnant because it is so narrow that sunlight easily gets through. The construction of buildings to the north and west of the BGHF will have a shading impact on the BGHF but this is predicted to have a beneficial impact of shading out some of the weeds. Some edges of the BGHF will also be shaded by plantings in the reconstruction areas but this is also considered to be beneficial.

*iv. Hydrological impacts*

There is potential for the basements of the Main Hospital Wing and East Wing to impact on the hydrology of the BGHF but the impact is not expected to extend beyond the 3m construction zone (Tree Wise Men, 2009). Piesometers installed in three bore holes on the subject site have indicated that there is no significant water movement through the underlying shale. It is more likely that soil moisture in the top 1m of the soil horizon is more important for the survival of trees in the BGHF as the bulk of the root mass is between 0.6 and 1m below the surface (Tree Wise Men, 2009). Soil water impacts that may arise from the basement excavation will be minimised through the use of vertical piling and shotcreting (or insertion of pre-cast panels), reducing the exposure of the excavation to the elements and avoiding benching or over-excavation towards the trees (Dickson, 2009). Agricultural soil moisture probes will be used to measure the soil moisture in the top 1m of the soil horizon. These are recommended for use at 20-30m spacings throughout the

BGHF at a distance of 10 and 30m from the construction zone. Water from hard surfaces will be collected and are proposed for reuse on the subject site in landscaping. It can be used to irrigate the BGHF if necessary based on results from the soil moisture probes (Dickson, 2009).

It is possible to provide a hydraulic filter to the basement to match the existing hydraulic properties of the subject site in order to minimise disturbance to the existing groundwater flows and levels. Given the slow rate of horizontal movement of water through the clays and underlying Ashfield shale of the study area, it is the opinion of Dickson that the cutting of groundwater flow to the BGHF could not eventuate (Dickson, 2009). It is acknowledged by Tree Wise Men that roots of forest trees are generally contained within the upper 1m of soil and that moisture is not only gained from the water table but also rainfall, overland flows and lateral soil water movement.

The surface collection drainage system in the surrounding area will totally control runoff up to the 20 year ARI so that no pollution will overflow into the habitat, in accordance with the Drainage Concept Plan prepared by the LHO Group.

v. *Root zone disturbance*

A Drainage Concept Plan has been prepared by The LHO Group which states the BGHF Habitat will remain intact. It is proposed to install a drainage pipe in two locations within the BGHF habitat where the spacing between the pipelines and the trees is adequate to avoid damage to the tree roots during construction. Excavation will be by hand and proper erosion control measures will be used to minimise any disturbance to the existing natural ground. Immediately after completion of the drainage, restoration of the disturbed ground will be undertaken including bush regeneration and revegetation.

vi. *Edge effects and buffers*

Edge effects are an existing problem for BGHF on the subject site, given that the BGHF is surrounded by areas that are either landscaped or contain buildings or paths. Increased sunlight, water and nutrient runoff has lead to significant weed invasion and establishment throughout the BGHF on the subject site. Large edge effects will continue to occur at the site, and the development will not significantly increase these existing impacts as they will be managed in the future by the implementation of the VMP which will lead to an increase in the area of BGHF and an improvement in its condition and viability (UBMEC, 2009). Edge effects will be reduced at the site by the rehabilitation of existing BGHF and reconstruction of additional areas of BGHF vegetation and will be buffered through existing landscaping including garden beds and the croquet lawn, and early works plantings along the southern boundary.

*vii. Operational impacts*

During operation as a private hospital facility, there is potential for increased human use of the site to increase damaging impacts to the BGHF. Urbanisation of the fringe of bushland usually leads to degradation of the surrounding bushland through increased human use, for example, the creation of informal bushwalking tracks and dumping of rubbish and garden waste. The development of the subject site as a hospital, however, is not likely to promote such uses. The external boundaries of the BGHF will be fenced from the public and recreational use of the BGHF will be encouraged to be confined to an accessible pathway. Rubbish and garden waste will be disposed of in an appropriate manner so as to not impact on the BGHF and this can be managed by the operator of the facility.

*viii. Impacts from Asset Protection Zones*

The subject site is not on bush fire prone land and as such, does not need to provide asset protection zones. Therefore, none of the BGHF will be modified for the provision of asset protection zones.

*ix. Modifications to Blue Gum High Forest habitat*

The remainder of the BGHF will be modified via bush regeneration to remove exotic species and replant indigenous species. Additional areas totalling 1770m<sup>2</sup> will be reconstructed as BGHF. The areas chosen for reconstruction have been chosen for their proximity to existing BGHF, more natural soil profiles and avoidance of other site constraints such as the heritage-listed curtilage to Rippon Grange. The reconstruction area in the north-east of the subject site will improve BGHF connectivity to Wahroonga Public School.

**Table 6.3 TREES TO BE REMOVED FROM WITHIN THE BGHF**

| Tree No | Trees species                  | Common Name        | Native or Exotic | SULE Rating | Significance Rating | Reason for removal                                  |
|---------|--------------------------------|--------------------|------------------|-------------|---------------------|-----------------------------------------------------|
| 105     | <i>Eucalyptus saligna</i>      | Sydney Blue Gum    | Native           | S           | 5                   | Structurally unsound                                |
| 113     | <i>Jacaranda mimosifolia</i>   | Jacaranda          | Exotic           | M           | 4                   | Proposed Driveway/Weed species per VMP (UBMEC 2008) |
| 115     | <i>Callistemon salignus</i>    | Willow Bottlebrush | Native           | M           | 4                   | Proposed Driveway                                   |
| 116     | <i>Eucalyptus saligna</i>      | Sydney Blue Gum    | Native           | L           | 4                   | Proposed Driveway                                   |
| 130     | <i>Pittosporum undulatum</i>   | Native Daphne      | Native           | L           | 4                   | Proposed East Wing                                  |
| 151     | <i>Jacaranda mimosifolia</i>   | Jacaranda          | Exotic           | S           | 4                   | Weed species per VMP (UBMEC 2008)                   |
| 152     | <i>Jacaranda mimosifolia</i>   | Jacaranda          | Exotic           | S           | 4                   | Weed species per VMP (UBMEC 2008)                   |
| 153     | <i>Jacaranda mimosifolia</i>   | Jacaranda          | Exotic           | S           | 4                   | Weed species per VMP (UBMEC 2008)                   |
| 154     | <i>Jacaranda mimosifolia</i>   | Jacaranda          | Exotic           | S           | 4                   | Weed species per VMP (UBMEC 2008)                   |
| 176     | <i>Dead Stag</i>               | Dead Stag          | Native           | R           | 5                   | Structurally unsound                                |
| 194     | <i>Jacaranda mimosifolia</i>   | Jacaranda          | Exotic           | M           | 4                   | Weed species per VMP (UBMEC 2008)                   |
| 203     | <i>Elaeocarpus reticulatus</i> | Blueberry Ash      | Native           | L           | 4                   | Proposed East Wing                                  |
| 323     | <i>Eucalyptus saligna</i>      | Sydney Blue Gum    | Native           | R           | 5                   | Structurally unsound                                |
| 328     | <i>Erythrina saligna</i>       | Coral Tree         | Exotic           | R           | 5                   | Structurally unsound/weed species                   |
| 371     | <i>Eucalyptus saligna</i>      | Sydney Blue Gum    | Native           | L           | 5                   | Structurally unsound                                |

#### **6.4.4 Discussion of connectivity**

##### 6.4.3 Discussion of connectivity

*The potential of the proposal to increase fragmentation of each threatened ecological community, its relation to adjoining vegetation and to exacerbate edge effects or to decrease the ability for movement of individuals and/or gene flow between habitats must be discussed. The impact on habitats in the proximate reserved lands, particularly Turiban Reserve, Mona St Reserve and Clive Evatt Reserve, must be discussed.*

*If connectivity between adjacent remnants of endangered ecological communities is likely to be affected, the impact of the proposal on connectivity must also be discussed.*

Blue Gum High Forest is restricted to the northern side of Sydney. Due to development over the last century this community has become highly fragmented. The current plans involve the removal of a small area of BGHF on the subject site. This will not affect the continuity of the community on the site, however the narrow connection will be further constricted. This will mainly impact the groundcover and shrub layer. The groundcover and shrub layer at the subject site are dominated by exotic species, with small numbers of natives. The canopy layer will remain largely intact. As such, the development will not impact on ability for movement of individuals.

Based on Smith's (Smith, 2006) map of the extent of community, the community ranges in width from approximately 20 to 35 metres and is 135 metres in length along Young Street. The occurrence along the southern side of the western section of the property ranges from approximately 15 to 40 metres wide, and is 125 metres in length. Both sections are fragmented from each other and are further internally fragmented by paths and meandering margins, presenting a high perimeter to area ratio (edge effect). There is little potential for significantly reducing the edge effect.

Apart from the highly modified BGHF in Wahroonga Public School, there is no BGHF adjoining the subject site, although there are indigenous canopy trees in adjacent properties. There is therefore little opportunity for natural vectors to re-introduce indigenous species that are currently absent. It can be generally expected that the frequency of re-introduction of locally indigenous species is inversely proportional to the distance from other suitable bushland in the district. Whilst this does not exclude the probability of new species being imported to the subject site, it is likely to result in the rate of importation being low.

Other nearby bushland occurs in:

- Wahroonga Public School (approximately 10m north of The Blue Gum Zone on the subject site);
- Turiban Reserve (approximately 250m north-east); and
- Clive Evatt Reserve( approximately 425m northeast).

The nearest large bushland reserve is 1km east – Lovers Jump Creek. The extensive bushland over 1km north of the subject site (in Ku-ring-gai Chase National Park) is dominated by sandstone plant communities.

Good examples of BGHF occur in Dalrymple-Hay Nature Reserve (approximately 3km southeast), and part of Sheldon Forest (two kilometres south).

Based on the poor condition of proximate BGHF and relatively long distance to more intact occurrences, the BGHF on the subject site adds value to local occurrences of the community. Transfer of genetic material between patches of BGHF can occur through the dispersal of pollen and seeds via bat and bird species.

### **6.4.5 Consideration of threatening processes**

#### **6.4.4 Consideration of threatening processes**

*Assessment of effects must not be limited to threats that are recognised as key threatening processes, but must include threatening processes that are generally accepted by the scientific community as affecting the species or population and are likely to be caused or exacerbated by the proposal. Assessment should also include consideration of information in the Priorities Action Statement and any approved or draft recovery plans or threat abatement plans which may be relevant to the proposal.*

4.5% of the original BGHF still exists (Tozer, 2003) and most exist in small remnants that are highly susceptible to further fragmentation. Threats include development and increased nutrition rates, mowing and clearing. The absence of fire has resulted in the dominance within the community of *Pittosporum undulatum*, within the understorey which has led to the loss of other understorey species. Development and increased nutrients, along with clearing and mowing has lead to losses in the understorey species diversity (NSW NPWS, 2004a).

Blue Gum High Forest is threatened by the following key threatening processes:

➤ **Clearing of native vegetation:**

This includes further clearing for urban development and subsequent impacts form fragmentation as well as mowing, which stops regrowth. A minimal amount of BGHF will be cleared as part of the development proposal. The majority of the subject site has already been cleared, with a number of buildings, paths, roads, gardens and lawns already in existence.

➤ **Weed invasion:**

Invasion by a variety of weeds have been listed as key threatening processes. These include invasion by exotic vines and creepers, exotic perennial grasses, and Scotch Broom (preliminary listing). Montpellier Broom and creepers such as Morning Glory and Asparagus Vine are present throughout the community at the

subject site. Much of the groundcover, shrub and small tree layers within the community have been highly infested by weeds. In some areas within the subject site (particularly the southwestern portion) the community is represented by canopy trees and the occasional native groundcover.

A range of priority actions have been recommended by DECC that are relevant to the subject site. These include:

- Liaise and support landholders to secure protection and active management of priority BGHF sites – the development has been situated in such a way that most of the areas to be developed are located outside the BGHF mapped area. Most of the BGHF on the subject site is to be retained.
- Liaise with landholders to prepare site specific Plans of Management – a Vegetation Management Plan has been prepared for the subject site and is referenced within this SIS;
- Undertake priority weed control works – weed control will be carried out in order to comply with the Vegetation Management Plan for the subject site.
- Undertake priority stormwater and erosion control works – construction for the development will follow best practice for stormwater and erosion to ensure that the BGHF on the subject site is not impacted during or after construction activities.
- Investigate planning and incentives programs to promote and encourage protection and management of BGHF, particularly on private land – no planning or incentive programs have been discussed regarding the BGHF on the subject site.

The recovery of this ecological community is being addressed as part of the Cumberland Plain Endangered Ecological Communities Recovery Plan, which is currently being prepared. Conservation mechanisms proposed in the Recovery Plan that are relevant to the subject site include

- Development control processes;
- Plans of management; and
- Voluntary conservation agreements.

This SIS has been prepared in order to assess the impacts of the development on the BGHF that occurs on the subject site and in surrounding areas. A VMP has been prepared concurrently which provides for the rehabilitation of the community on the subject site. This VMP focuses on removing weeds from the community and planting relevant native species.

## 6.5 Consideration of Land and Environment Court Judgement

The Land and Environment Court recommended that:

*The BGHF needs to be afforded the maximum protection given its perilous remnant state and spatial coverage. For the reasons discussed below a range of steps need to be undertaken and considered to ensure the continued health and vigour of BGHF.*

The judgement also indicated that a detailed assessment was required under Section 5a of the EP&A Act and the *Threatened Species Conservation Act*, ie by a Species Impact Statement. This SIS has been prepared after the findings of the Court case and provides a fresh assessment of the impacts of the project. For this reason, the conclusions of the SIS should not necessarily be bound to the conclusions of the Court case. Notwithstanding that, the following table provides the list of steps the Land and Environment Court recommended combined with an opinion by the authors of the SIS about how these orders have been complied with by the Development Application.

**Table 6.4 PROPOSAL COMPLIANCE WITH COURT FINDINGS**

| Court Findings                                                                                                                                                                                                                                                                                                                                                                                                                                                        | SIS Compliance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 82. The impact of the proposal on the remnant BGHF on the land was determined to amount to a loss of 17% of the stand of trees (Smith,2007) but in oral evidence Dr Smith stated that the loss of BGHF would actually be 19%, taking into account the driveway for Building F (and an addition of 67m <sup>2</sup> ). Dr Smith also took the position in oral evidence that acceptable development impacts should not exceed 5% loss of the BGHF community on a site. | <p>According to mapping by Peter Smith (2007), the proposed development would involve clearing 116m<sup>2</sup> or 1.8% of BGHF.</p> <p>The retained forest community will be restored by weeding and replanting according to a VMP increasing the area of native vegetation on the subject site and improving the condition of the BGHF community through weed control works and additional plantings of locally native species typical of the community.</p> <p>The driveway to the East Wing will be on grade, not excavated through the BGHF. It is proposed to have a porous surface to reduce hydrological impacts on the BGHF.</p> |
| 87. The BGHF needs to be afforded the maximum protection given its perilous remnant state and spatial coverage. For the reasons discussed below a range of steps need to be undertaken and considered to ensure the continued health and vigor of BGHF. These include:                                                                                                                                                                                                | <p>The development has been re-designed to enable protection of the vast majority (98.2%) of BGHF on the site. Additional plantings of native flora are planned to add to the occurrence on site by 1770m<sup>2</sup> and to restore the understorey of the existing forest. The development will also provide for ongoing management of BGHF on the subject site to reduce the impacts of currents threats to</p>                                                                                                                                                                                                                        |

**Table 6.4 PROPOSAL COMPLIANCE WITH COURT FINDINGS**

| Court Findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | SIS Compliance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| <ul style="list-style-type: none"> <li>➤ The development of buildings and related infrastructure outside of the footprint of the BGHF. Any future development would need to have a minimum buffer determined by the canopy spread or 3m from the trunk as per the council's tree preservation order, whichever is the greater.</li> <li>➤ Future assessment has to take into account and establish properly the effects of shading, impacts on sub and surface hydrology, root zone disturbance and other edges effects that would ensue from any excavation, underground and above ground development that may occur.</li> <li>➤ While adjoining patches of BGHF are significant for the maintenance of the ecological community as a whole, they cannot be considered in exchange for either offset or as component in any calculation for a development proposal that aims to remove or degrade the BGHF at 'Former John Williams Hospital'. Any future applicant for development should only consider the vegetation that is within the boundaries of the land.</li> <li>➤ Where species or communities have been listed as critically endangered, the preservation and protection of a few neighbouring isolated trees can contribute to the long-term viability of a greater community and should be preserved. No community can regenerate if the seed banks or sources of those seeds have been removed.</li> <li>➤ Where a community once existed there</li> </ul> | <p>the community, predominantly weed invasion.</p> <p>A large proportion of the development will not impact on BGHF at the subject site. The East Hospital Wing will require the removal of 42m<sup>2</sup> of the community, including only 2 trees. In general, existing landscaped areas and BGHF reconstruction zones will act as a buffer between the community and the development.</p> <p>The impact of the development on the trees has been assessed in detail in the Arboricultural Impact Assessment appended to the EA. Impacts on trees have been assessed in accordance with accepted practice having regard to the age and condition of the individual trees concerned.</p> <p>Assessment of these impacts is included in the SIS (Chapter 6).</p> <p>Impacts on the vegetation are assessed within the subject site, and amelioration measures proposed are wholly contained within the subject site. Analysis of wider impacts are also discussed in order to satisfy requirements from DECC</p> <p>Isolated Blue Gums within the subject site are also being retained.</p> <p>Based on the species in and adjacent to the study</p> |

**Table 6.4 PROPOSAL COMPLIANCE WITH COURT FINDINGS**

| Court Findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | SIS Compliance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <p>remains a distinct possibility that viable seed banks may be retained in the surrounding soils. Therefore, even where fire hazard reductions of the understorey have been undertaken it is quite possible that viable seed banks will remain in the soil such that natural regeneration has the potential to occur particularly, when assisted by sensitive planning and environmental management.</p> <ul style="list-style-type: none"> <li>➤ With respect to the connectivity and fragmentation of endangered and critically endangered species, a few remaining trees may well provide a critical link to maintaining and contributing to the long-term viability of refugia. Indeed, the cross-pollination of fragmented individuals and stands of eucalypt trees (including BGHF) may occur over extended distances.</li> <li>➤ While seed dispersal contributes to regeneration it is less significant and effective than the genetic transfer associated with pollination. Pollination occurs in eucalypts such as those characterising the BGHF via a variety of active, non-specific pollinating vectors such as generalist insects and animals.</li> <li>➤ Insects regularly disperse pollen over 100m but they also have the capacity to disperse pollen over distances of at least 1.6km. Species of eucalypts (including BGHF) that are subject to pollen dispersal by larger animals such as birds (e.g. lorikeets) are likely to be subject to cross-pollination over significantly longer distances. Such distances may be as great as 6km from a pollen source for eucalypts. Consequently, even relatively distal and isolated species can contribute significantly to the long-term genetic viability of endangered and critically endangered communities.</li> <li>➤ In terms of protecting ecological</li> </ul> | <p>area and the time the community has been dominated by exotic species, it is probable that the soil seed bank for locally indigenous species now ranges from depleted, no longer viable, to absent, according to the variable soil disturbance and time since native seed was deposited in the soil seed bank in different parts of the site. Potential seed banks will be retained throughout the retained area of BGHF on the subject site.</p> <p>Connectivity within BGHF will be retained both within the subject site and with adjoining areas where this community exists. As such, the subject site will continue to provide a source of pollen for surrounding areas, and therefore contribute to the long-term viability of the community in the locality.</p> <p>Retention of the majority of this community on the subject site will allow for the continued use of the site by a variety of fauna species, including possums, birds and insects which will contribute to pollination of the plants.</p> <p>A range of fauna species are known to occur on the site. These include wide-ranging species such as lorikeets which are known dispersers of pollen. Continued use of the site by such species will contribute to the long-term viability of BGHF in the locality.</p> <p>Edge effects are an existing problem at the</p> |

**Table 6.4 PROPOSAL COMPLIANCE WITH COURT FINDINGS**

| Court Findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | SIS Compliance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>communities, buffer zones play a significant role in mitigating undesirable edge effects associated with urban development. Edge effects are more marked in narrow buffers. Thus it would be prudent where feasible to maintain as a large a buffer as possible. Even where exotic vegetation surrounds native bushland (including BGHF), the removal of such vegetation is likely to have a negative impact, especially when it is replaced by urban development. Due to the effects of light, runoff; litter etc.</p> <p>➤ An applicant should avoid development that would truncate, fragment or disconnect a BGHF stand at 'Former John Williams Hospital'.</p> | <p>subject site, given that areas that are not BGHF are either landscaped or contain buildings or paths. Large edge effects will be managed in the future by the implementation of the VMP which will lead to an increase in the area of BGHF and an improvement in its condition and viability. Edge effects will be reduced at the site by the reconstruction of additional areas of BGHF vegetation and will be buffered through existing landscaping including garden beds and the croquet lawn, and early works plantings along the southern boundary. Use of mowing buffers will help prevent further incursions into the community by exotic species.</p> <p>The BGHF at the subject site is currently fragmented by the presence of a range of landscaped areas, roads and paths. The East Hospital Wing will impinge slightly on the extent of the community, however the restoration of the community and weed control that will be undertaken will in fact increase the viability of the community in the long-term and will reduce fragmentation within the site.</p> |

## 6.6 Description of Feasible Alternatives

### 6.5 Description of feasible alternatives

*The following are further requirements related to your obligation under Section 110 (3)(e) to address the following:*

*A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed having regard to the biophysical , economic and social considerations and the principals of ecologically sustainable development*

Feasible alternatives have been discussed in detail for BGHF and for flora/fauna habitat generally under section 5.15 in the preceding chapter. In any event, it is noted that the conclusion is that the proposed development will have an overall significantly positive impact on the BGHF community on the subject property.

## Ameliorative Measures

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### DGR 7.1 Description of ameliorative measures

*The following are further requirements related to your obligation under Sections 110(2)(i) and 110 (3)(f) to address the following:*

- *A full description and justification of the measures proposed to mitigate any adverse effect of the action on the species and populations [section 110(2) (i)] [or] ecological community [section 110(3) (f)] including a compilation (in a single section of the statement) of those measures.*

## 7.1 Long term management strategies

### DGR 7.1.1 Long term management strategies

*Consideration must be given to developing long term management strategies to protect areas within the study area which are of particular importance for the threatened species or endangered populations likely to be affected. This may include proposals to restore or improve habitat on site where possible.*

#### **7.1.1 Introduction**

Chapter 6 contains a full discussion of the recovery potential of the BGHF that is present on the subject site. As mentioned, it would be impossible for the remaining indigenous vegetation to naturally regenerate to any form of native bushland. The resilience of the Blue Gum Zone for return to natural community was assessed as:

- Moderate to low in the section parallel to Young Street, and
- Low to absent in the southern sections (near the old stables).

It is possible that vegetation similar to a simplified form of BGHF could be re-established in the eastern section of the site, near Young Street, where soils appear to be relatively intact. Near the southern boundary where soils are most heavily modified a very simplified form of BGHF could be established. Owing to the narrow width, large edge effect and surrounding development this section of Blue Gum Zone will need permanent ongoing maintenance work, especially to the ground cover stratum. Owing to the level of difficulty

of the site, bush regeneration work would need to be implemented in a professional, strategic and consistent manner for over ten years with maintenance in perpetuity.

The methods to achieve the desired results would include:

- Assisted natural regeneration and supplementary planting (reconstruction) in the Young St area. It is recommended that weed control and only minor planting be done initially, in order to enable natural regeneration levels to be determined. If adequate natural regeneration does not occur in all strata, appropriate planting should occur in the relevant strata.
- It should be possible to re-establish canopy, small tree and shrub strata in the southern section and adjacent to the northern section mainly by planting suitable species (reconstruction). Re-establishment of the ground cover is likely to be problematic although some native species could survive amongst the weeds. It might be necessary to maintain mulch over the ground surface in order to control most herbaceous weeds. As with the Young Street area, this will need permanent ongoing maintenance to ensure survival of community and indigenous species.

Reconstruction within the BGHF will be managed according to the Vegetation Management Plan (VMP) developed for the site. The VMP covers the following issues:

- Managing the potential impacts of development;
- Managing weed invasion;
- Managing rehabilitation and reconstruction of BGHF on the subject site;
- Managing edge sites and interface zones; and
- Managing fauna habitat.

### **7.1.2 Managing the Potential Impacts of Development**

#### *i. Introduction*

The layout of the proposed development has been designed to avoid direct impacts on BGHF on the whole, except for the East Hospital Wing which is placed partly over the edge of the community on the subject site.

Blue Gum High Forest can be impacted in a variety of ways as a result of the development. These include the effects of shading, impacts on sub and surface hydrology, root zone disturbance and other edges effects that would ensue from any excavation, underground and above ground development that would occur.

As mentioned above, most of the development is located away from the delineation of the BGHF, and buildings and hard surfaces already exist throughout the property that

currently cause some degree of shading and obstruction to water flow. The vegetation community is located downslope of most of the existing and proposed buildings.

## *ii. Construction Impacts*

Construction of buildings and pathways has the potential to impact on BGHF on the subject site. Ameliorative measures will be required prior to, during, and after construction works. The VMP provides recommendations for the protection of the vegetation. These include measures such as:

- Definition of the construction zone for building works located near the edge of the BGHF;
- Erection of exclusion and sediment fencing to protect bushland adjacent to the construction zone; and
- Wooden tree shields and supplementary fencing around trees to be retained within the construction zone.

A Construction Management Plan has been prepared to mitigate any runoff and soil erosion effects on the BGHF as a result of construction.

## *iii. Hydrology*

The construction and use of buildings on the property for over 100 years is likely to have had an impact on soils by providing nutrients via rainwater runoff that are in excess and are unnatural for indigenous species. Whilst some nutrients are more readily dispersed through soil strata, phosphorus is largely retained and can be expected to favour growth of most exotics in preference to most native species. Hydrological changes have occurred on and around the site in the past owing to the development of the areas for houses, a school, roads and stormwater drainage. The significance of existing hydrological impact in the Blue Gum Zone has not been specifically determined or documented, however its impact on soil is possibly within the general limits of tolerance for BGHF.

As the existing development occurs and the proposed development will occur upslope of both sections of the Blue Gum Zone, the latter will continue to receive elevated nutrients in overland rainwater and subsurface flows along approximately half its perimeter, irrespective of attempted hydrologic controls or possible buffer zones. If all flows were diverted, moisture received by the vegetation would be altered significantly and result in habitat modification.

A *Hydraulic Services Report* (HSR) and *Concept Drainage Plan* (CDP) have been prepared for the proposed development. The CDP details requirements for on-site retention, detention of stormwater, roof, surface drainage and basement drainage, subsoil drainage and stormwater quality control (in accordance with Ku-ring-gai Council's requirements).

These measures, together with the sediment fencing during construction, will prevent excess water reaching the BGHF. The existing drainage patterns between landscaped areas and the vegetation community will remain essentially unchanged.

There will be a small reduction in the amount of water reaching the BGHF as some of the hard surfaces which currently flow to the vegetation will be developed, and the stormwater will be managed. Additionally, construction of basement carparking has the potential to reduce sub-soil flow. Despite this, landscaped areas and the vegetation community itself will continue to collect sufficient water, both from runoff and sub-soil flow. The on-grade driveway through the BGHF will be constructed from a porous material to reduce hydrological impacts on the BGHF. Irrigation of BGHF can be used to mitigate soil drying during excavation of the basement to the East Wing.

#### iv. *Impact on Root Zones*

The proposed buildings have been sited to avoid critical root zones in accordance with Arboricultural Impact Assessment for further details see (Appendix F).

Trees within construction footprints are recommended for removal. Where construction was proposed within critical root zone offsets, those trees have also been recommended for removal unless the works are of a minor nature (e.g footpaths), in which case design modifications have been recommended. Fully elevated, pier and beam type construction is possible within critical root zones however this will involve specific construction and monitoring for those trees within critical root zones. Where construction was proposed outside the primary root zone for those trees to be retained no specific design or tree protection monitoring is required.

#### v. *Tree Removal*

Of the 126 trees within the BGHF, 111 will be retained, including all trees with Significance Ratings of 1, 2 and 3 (see Arboricultural Impact Assessment (Tree Wise Men, 2009)). Of the 15 trees to be removed, 6 are target weed species (UBMEC, 2009) and 5 are structurally unsound (Tree Wise Men, 2009). Only two trees will be removed from the BGHF for the construction of the East Wing and two will be removed for the driveway. A summary is provided in Table 7.1 and details within Table 7.2.

**Table 7.1 SUMMARY OF TREE REMOVAL**

|                                                            | Number | %    |
|------------------------------------------------------------|--------|------|
| Trees retained within BGHF                                 | 111    | 88%  |
| Trees removed as weeds or dead and dangerous               | 11     | 9%   |
| Trees removed for driveway, building or other construction | 4      | 3%   |
| Total trees within BGHF mapped areas                       | 126    | 100% |

**Table 7.2 TREES TO BE REMOVED FROM WITHIN THE BLUE GUM HIGH FOREST**

| Tree No       | Trees species                  | Common Name        | SULE Rating | Significance Rating | Reason for removal                                  |
|---------------|--------------------------------|--------------------|-------------|---------------------|-----------------------------------------------------|
| <b>Exotic</b> |                                |                    |             |                     |                                                     |
| 113           | <i>Jacaranda mimosifolia</i>   | Jacaranda          | M           | 4                   | Proposed Driveway/Weed species per VMP (UBMEC 2008) |
| 151           | <i>Jacaranda mimosifolia</i>   | Jacaranda          | S           | 4                   | Weed species per VMP (UBMEC 2008)                   |
| 152           | <i>Jacaranda mimosifolia</i>   | Jacaranda          | S           | 4                   | Weed species per VMP (UBMEC 2008)                   |
| 153           | <i>Jacaranda mimosifolia</i>   | Jacaranda          | S           | 4                   | Weed species per VMP (UBMEC 2008)                   |
| 154           | <i>Jacaranda mimosifolia</i>   | Jacaranda          | S           | 4                   | Weed species per VMP (UBMEC 2008)                   |
| 194           | <i>Jacaranda mimosifolia</i>   | Jacaranda          | M           | 4                   | Weed species per VMP (UBMEC 2008)                   |
| 328           | <i>Erythrina saligna</i>       | Coral Tree         | R           | 5                   | Structurally unsound/weed species                   |
| <b>Native</b> |                                |                    |             |                     |                                                     |
| 105           | <i>Eucalyptus saligna</i>      | Sydney Blue Gum    | S           | 5                   | Structurally unsound                                |
| 115           | <i>Callistemon salignus</i>    | Willow Bottlebrush | M           | 4                   | Proposed Driveway                                   |
| 116           | <i>Eucalyptus saligna</i>      | Sydney Blue Gum    | L           | 4                   | Proposed Driveway                                   |
| 130           | <i>Pittosporum undulatum</i>   | Native Daphne      | L           | 4                   | Proposed East Hospital Wing                         |
| 176           | <i>Dead Stag</i>               | Dead Stag          | R           | 5                   | Structurally unsound                                |
| 203           | <i>Elaeocarpus reticulatus</i> | Blueberry Ash      | L           | 4                   | East Hospital Wing/stormwater incursion             |
| 323           | <i>Eucalyptus saligna</i>      | Sydney Blue Gum    | R           | 5                   | Structurally unsound                                |
| 371           | <i>Eucalyptus saligna</i>      | Sydney Blue Gum    | L           | 5                   | Structurally unsound                                |

Note: for further details on significant ratings and SULE ratings see attached Appendix F.

### **7.1.3 Managing Weed Invasion**

Eighty-three percent of the 229 identified flora species at the subject site are introduced (horticultural) species or weeds (UBMC, 2006). These include trees and shrubs, vines or scramblers, and groundcover (include turf grasses). A number of weeds present on the subject site are noxious, and some are listed as key threatening processes (Scotch Broom, Lantana, vines and creepers, and perennial grasses). These are discussed in more detail in Chapter 6. Some of the plantings in the landscaped areas and within the BGHF are classified as “significant” plantings and will need to be retained.

The VMP provides a range of recommendations for the control and management of weeds. The main focus of weed control will be on species listed as noxious or primary target weeds (UBMEC, 2009). More detail can be found in the attached VMP.

### **7.1.4 Managing Regeneration and Reconstruction of Blue Gum High Forest on the Subject Site**

#### *i. Introduction*

Blue Gum High Forest on the subject site will be rehabilitated and reconstructed in a broad arc stretching south from Water St along the eastern side of the property, through the centre of the property and extending along the southern boundary to the south-western corner. This will reduce fragmentation and enhance connectivity within the subject site.

Lembit's (Lembit, 2007) comment that the native vegetation is entering a “recovery phase” is optimistic and appears to be based on the regeneration of a few canopy tree saplings and small amounts of pioneer ground cover species. The site certainly does not possess a high degree of “ecological integrity” and “high recovery potential”.

One of the important aspects of the regeneration of the vegetation will be the removal and control of weeds. This is covered above and in more detail in the VMP.

Under the VMP, the site has been divided into five management zones. These are:

- Management Zone 1: existing BGHF Habitat, Young/Water Streets – East and South-eastern Areas;
- Management Zone 2: BGHF trees with some native understorey, with introduced plantings – Central Area;
- Management Zone 3: Canopy trees over lawns and garden beds – South-western Area;
- Management Zone 4: includes the existing buffer zone planting on the south-western property boundary; and

- Management Zone 5: incorporates the 5 areas designated as “compensatory offsets” between the BGHF Habitat (as mapped in the VMP) and adjacent land uses (eg private gardens, lawns or development).

## ii. *Protection of Threatened Flora and Culturally Significant Trees*

Two individuals of *Syzygium paniculatum* (Magenta Lilly Pilly) are present on the subject site in landscaped areas. These species are not part of the BGHF vegetation, but will be protected during construction to avoid damage. No other threatened species are to be planted within the site.

A number of culturally significant trees have been identified on the site, some of which are located within the bounds of the BGHF Vegetation. These trees will be retained. Trees identified as culturally significant are shown and discussed in the VMP.

## iii. *Enrichment Planting*

It should be possible to re-establish native canopy, small tree, shrub and ground cover strata. Owing to the narrow width, large edge effect and surrounding development the community will need permanent ongoing maintenance work, especially to the ground cover stratum. It is recommended that weed control and only minor planting be done initially, in order to enable assisted natural regeneration levels to be determined. If adequate natural regeneration does not occur in all strata, appropriate planting should occur in the relevant strata.

Species characteristic of BGHF must be the only species planted (i.e. native plants that are not characteristic of this community must be avoided). Seed collection from local stands of BGHF should occur immediately in order to propagate tubestock for planting. This will retain the integrity of the local gene pool.

Owing to the level of difficulty of the site, bush regeneration work would need to be implemented in a professional, strategic and consistent manner for over ten years with maintenance in perpetuity.

The VMP needs to clearly describe the final patterns of vegetation strata and concentrations of individual species. This is aimed at ensuring a more natural arrangement of vegetation, and distribution of species is obtained, than could occur if the implementing organisation was not sufficiently familiar with bushland, especially BGHF.

### **7.1.5 Managing Edge Sites and Interface Zones**

The interface (or buffer zone) between the BGHF community and the development (including garden beds and lawns) is the most vulnerable to edge effects. Based on Smith's delineation of the extent of community, the community ranges in width from approximately 20 to 35 metres and is 135 metres in length along Young Street. The

occurrence along the southern side of the western section of the property ranges from approximately 15 to 40 metres wide, and is 125 metres in length. Both sections are fragmented from each other and are further internally fragmented by paths and meandering margins, presenting a high perimeter to area ratio (edge effect). There is little potential for significantly reducing the edge effect.

Although it should be possible to establish a simplified form of BGHF in the Former John Williams Hospital site, it cannot be expected to be a fully naturally functioning ecosystem. Most of the issues that have lead to the current condition of the community will largely continue despite minor amelioration of the existing impacts. These include:

- Ongoing weed impacts;
- Fragmentation and limitation of size of final community;
- Isolation from other viable areas of similar bushland – resulting in limited natural genetic exchange and importation of additional naturally occurring species;
- Large edge effect, even if buffer zones are included in the development;
- Soil profile alteration, especially below the old stables;
- Stormwater impacts, despite attempts to reduce these by relevant modification of site drainage;
- Lack of natural fire regime; and
- Necessary inclusion of some exotic, culturally significant plants in the community.

A high level of maintenance will be required to manage the buffer zones. Recommendations within the VMP include:

- Unwanted garden debris and rubbish must be removed immediately;
- Mowing/slashing along the interface must be carried out more frequently than in other landscaped areas;
- The first 2-3m of the interface should be heavily planted with a dense cover of native shrubs and grasses; and
- Barriers (e.g. logs/bollards) are to be placed along the interface to provide a mowing edge.

### **7.1.6 Managing Fauna Habitat**

The final determination for BGHF notes that the fauna is also an important part of the endangered ecological community. The development will not have a significant impact on any threatened species, however management of the vegetation should be carried out such that fauna is benefited.

Clearing of a dense understorey (even if dominated by exotic species) is generally detrimental to small birds, and can lead to the loss of these species from urban gardens and bushland reserves (UBMEC, 2009). Clearing of weeds should be staged so that there are some areas of dense understorey at all times. Revegetation should be planned in such a way that structural diversity of vegetation is achieved.

Eleven trees on the subject site have been identified as hollow-bearing and hence provide important potential habitat for native hollow-dependent fauna. Of these, two trees will be removed as they are considered structurally unstable and one such tree is also an environmental weed. Five other trees are located around the proposed path and hollow limbs may be pruned to reduce the hazard to people walking below. Tree hollows that are lost from the subject site should be replaced by nest boxes or the installation of hollow limbs on remaining trees at a ratio of 2:1.

## 7.2 Compensatory Measures

### DGR 7.1.2 Compensatory strategies

*Where significant modification of the proposal to minimise impacts on threatened species or endangered communities is not possible then compensatory strategies should be considered. These may include other offsite or local area proposals that contribute to long term conservation of the threatened species, population or endangered ecological community.*

*Where such proposals involve other lands, or where the involvement of community groups is envisaged in such proposals, such groups are to be consulted and proposals should contain evidence of support from these stakeholders and relevant land managers.*

*Compensatory benefits likely to result from such measures proposed for alternative sites are to be discussed and evaluated along with a discussion of mechanisms of how they might best occur.*

*If your proposal is to include compensatory strategies, these should be provided in a detailed offsetting package. Such a package should be prepared in accordance with the attached guidelines "Principles for the Use of Biodiversity Offsets" (Attachment 3).*

Reconstruction of BGHF within the subject site is considered sufficient to ameliorate impacts on the community. There will be an area 1770m<sup>2</sup> in size to replanted with BGHF species. The native vegetation of the site has already been highly modified from its original floristic and structural condition. Only 20 of the 53 species listed in the final determination are present at the subject site. Rehabilitation of the community will achieve a "no net loss" of vegetation on the subject site, and will in fact improve the condition, floristics, structure and extent of the community (achieve "improve or maintain"). As such, no external compensatory measures are considered necessary.

## 7.3 Ongoing Monitoring

### DGR 7.1.3 Ongoing monitoring

*Any proposed pre-construction monitoring plans or on-going monitoring of the effectiveness of the mitigation measures must be outlined in detail, including the objectives of the monitoring program, method of monitoring, reporting framework, duration and frequency. Generally, ameliorative strategies which have not been proved effective should be undertaken under experimental design conditions and appropriately monitored.*

Owing to the level of difficulty of restoring BGHF on the subject site, bush regeneration work would need to be implemented in a professional, strategic and consistent manner for over 10 years with maintenance management to be undertaken in perpetuity to control weeds after stochastic events such as drought, fire and canopy gap creation. A professional bush regenerator will need to be employed to carry out these activities. Activities and objectives set out in the VMP have been limited to a 5 year period. During this time an annual review of activities must be undertaken to assess effectiveness of weed control and survival of plantings. Annual reviews will be provided to the owners of Waterbrook and Ku-ring-gai Council. After 5 years a full review of reassessment of the VMP and works undertaken to that time must be carried out. This review will enable production of an updated VMP which will cover the following 5 years. The 5 year review and updated VMP must be provided to and approved by Ku-ring-gai Council.

Ongoing maintenance will be required in perpetuity to prevent re-infestation of weeds and ensure rehabilitation objectives are being met. The maintenance will be financed via the annual operational budget of the private hospital facility that the operator will endorse on commencement of hospital related activities. After 10 years reporting requirements and continuing rehabilitation and maintenance will be negotiated with Ku-ring-gai Council based on performance to date.

## 7.4 Translocation

### DGR 7.1.4 Translocation

*The DECC does not consider that translocation of threatened species, populations and ecological communities is an appropriate ameliorative strategy for the purposes of considering impacts of a particular development/activity. The DECC strongly supports the view that development proposals which may impact on a significant local population of threatened species, populations or ecological communities as determined by the SIS should aim to:*

- *minimise the impacts by considering all possible alternatives to the development, such that a significant impact is not likely; and*
- *manage the remaining habitat (if any) to ensure that the local population continues to exist in the long term.*

*The translocation of threatened species, populations and ecological communities is only supported by the DECC in specific conservation programs (eg. recovery planning) but only as a last resort, and only when in-situ conservation options have been exhausted. Such programs should only be reconsidered following extensive investigation of a demonstrated long term financial commitment on behalf of the applicant.*

Translocation is not being proposed as an ameliorative measure for this development.

## Assessment of Significance of Likely Effect of Proposed Action

### DGR 8 Assessment of Significance of Likely Effect of Proposed Action

*An assessment of significance (in accordance with section 5A EP&A Act) is to be provided for each of the affected threatened species, population or ecological community identified in the SIS, and must incorporate relevant information required in sections 5.1 to 7. On the basis of the assessment a conclusion is to be provided concerning whether, based on more detailed assessment through the SIS process and consideration of alternatives and/or ameliorative measures proposed in the SIS, the proposal is still considered likely to have a significant effect on threatened species, population or ecological community or its habitat.*

### 8.1 Blue Gum High Forest

- 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,*

Not applicable

- 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.*

Blue Gum High Forest has been estimated to cover approximately 6350m<sup>2</sup> which is approximately 28% of the subject site. The community is found in a narrow band down the eastern side of the site and in a broader zone along the southern boundary. These are generally in the lower portions of the site. A few trees and some understorey plants will be cleared as a result of the proposed development.

Based on the species in and adjacent to the study area and the time the community has been dominated by exotic species, it is probable that the soil seed bank for locally indigenous species now ranges from depleted, no longer viable, to absent, according to the variable soil disturbance and time since native seed was deposited in the soil seed bank in different parts of the site. The community on the subject site is currently over-run with weeds, and has a reduced number of indigenous species that are generally typical of this community. Clearing of a few trees will not significantly alter the composition of the community on the subject site.

- 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.*

According to mapping by Peter Smith (2007), the proposed development would involve clearing 116m<sup>2</sup> or 1.8% of BGHF.

Based on Smith's (Smith, 2006) map of the extent of community, the community ranges in width from approximately 20 to 35 metres and is 135 metres in length along Young Street. The occurrence along the southern side of the western section of the property ranges from approximately 15 to 40 metres wide, and is 125 metres in length. Both sections are fragmented from each other and are further internally fragmented by paths and meandering margins, presenting a high perimeter to area ratio (edge effect). The BGHF of the subject site is part of a band of this community that has been mapped by NPWS as running in a generally southwest to northeast direction. The vegetation within the subject site has limited connectivity to the south and west, however the vegetation within the subject site has connectivity to a larger patch of vegetation to the north-east which is known as Turiban Reserve.

The current plans involve the removal of a small area of BGHF on the site. This will not affect the continuity of the community on the site, however the narrow connection will be further constricted. This will mainly impact the groundcover and shrub layer. The canopy layer will remain largely intact.

Fragments of various sizes of BGHF are scattered throughout the Ku-ring-gai and Hornsby LGAs. The largest fragments in the area can be found on the western side of the Pacific Highway. Only approximately 200ha of this community is left in the region. The condition of the vegetation on the subject site is generally poor, with much weed infestation (UBMEC, 2009). A wide variety of weeds are present, many of which are noxious. Weeds range from groundcover to shrubs and trees. Many exotic species were purposefully planted as garden plants throughout the site. Some species have also been planted that, while native to Sydney, are not native to BGHF. Given the disturbed nature of the vegetation on the subject site, the removal of a very small area will not impact on the long-term viability of the community in the area. Restoration of the community and weed control that will be undertaken will in fact increase the viability of the community in the long-term.

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

No critical habitat for this community has currently been listed in the critical habitat registry 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 plans,*

A range of priority actions have been recommended by DECC that are relevant to the subject site. These include:

- Liaise and support landholders to secure protection and active management of priority BGHF sites – the development has been situated in such a way that most of the areas to be developed contain existing buildings. Most of the Blue Gum High Forest on the subject site is to be retained.
- Liaise with landholders to prepare site specific Plans of Management – a Vegetation Management Plan has been prepared for the subject site and is referenced within this SIS;
- Undertake priority weed control works – weed control will be carried out in order to comply with the Vegetation Management Plan for the subject site.
- Undertake priority stormwater and erosion control works – construction for the development will follow best practice for stormwater and erosion to ensure that the BGHF on the subject site is not impacted during or after construction activities.
- Investigate planning and incentives programs to promote and encourage protection and management of BGHF, particularly on private land – no planning or incentive programs have been discussed regarding the BGHF on the subject site.

The recovery of this ecological community is being addressed as part of the Cumberland Plain Endangered Ecological Communities Recovery Plan, which is currently being

prepared (and was meant to be finalized in July 2007). Conservation mechanisms proposed in the Recovery Plan that are relevant to the subject site include

- Development control processes;
  - Plans of management; and
  - Voluntary conservation agreements.
- 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.*

4.5% of the original BGHF still exists and most exist in small remnants that are highly susceptible to further fragmentation. Threats include development and increased nutrition rates, mowing and clearing. The absence of fire has resulted in the dominance within the community of *Pittosporum undulatum*, within the understorey which has led to the loss of other understorey species. Development and increased nutrients, along with clearing and mowing has lead to losses in the understorey species diversity (NSW NPWS, 2004a).

Blue Gum High Forest is threatened by the following key threatening processes:

- Clearing of native vegetation:
  - This includes further clearing for urban development and subsequent impacts form fragmentation as well as mowing, which stops regrowth. A minimal amount of BGHF will be cleared as part of the development proposal. The majority of the subject site has already been cleared, with a number of buildings, paths, roads, gardens and lawns already in existence.
- Weed invasion:
  - Invasion by a variety of weeds have been listed as key threatening processes. These include invasion by exotic vines and creepers, exotic perennial grasses, and Scotch Broom (preliminary listing). Montpellier Broom and creepers such as Morning Glory and Asparagus Vine are present throughout the community at the subject site. Much of the groundcover, shrub and small tree layers within the community have been highly infested by weeds. In some areas within the subject site (particularly the south-western portion) the community is represented by canopy trees and the occasional native groundcover.

## Conclusion

According to mapping by Peter Smith (2007), the proposed development would involve clearing 116m<sup>2</sup> or 1.8% of BGHF. It is not considered that the removal of this vegetation will have a significant impact on the viability of the community on the subject site and

within the locality, particularly in light of the highly degraded nature of the vegetation present and the limited clearing that will occur. Restoration of the community and weed control that will be undertaken will increase the viability of the community in the long-term.

## 8.2 Magenta Lilly Pilly (*Syzygium paniculatum*)

- 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,*

This species exists on the subject site, and was probably planted as it is not normally present in BGHF. The two individual trees will be retained on the site, and as such the local population is not 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,*

No endangered populations are listed in Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

- c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
- (iii) *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*
  - (iv) *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:*
- (iv) *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
  - (v) *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*

- (vi) *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.*

A small area of BGHF will be cleared from the subject site. The two specimens present on the subject site will not be affected by clearing.

Vegetation on the subject site will continue to be connected to adjacent stands of vegetation. The proposed development will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat.

Habitat on the subject land is not important for *Syzygium paniculatum* in the locality. The specimens on the subject site are not part of a native population, and their genetic origin is unknown.

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

No critical habitat for this vulnerable species has currently been listed in the critical habitat registry 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 plans,*

No recovery plan has been prepared for this species. No threat abatement plans are relevant to this species. DECC has developed 1 priority action to help recover this species (prepare a recovery plan).

- 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.*

*Syzygium paniculatum* is generally threatened by (or the proposal could further impact the species through) the following processes:

- Bushrock removal: This is not an issue at the subject site; and
- Clearing of native vegetation as this could destroy a small area of potential habitat.

The proposal may also exacerbate the following processes, further impacting on the species (if present):

- Invasion and establishment of exotic vines (key threatening process) as these species may over-shade individuals.
- *Lantana camara* may over-shade individuals; and

- Infection of native plants by *Phytophthora cinnamomi*.

### Conclusion

The proposal will not have a significant impact on the viability of the species in the locality.

## 8.3 *Tetratheca glandulosa* (*Tetratheca glandulosa*)

- 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,*

This species has not been detected on the subject site. Other populations are known to occur in the area, particularly in Ku-ring-gai Chase National Park. The proposed development will not place a viable local population 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,*

This is a vulnerable species; no endangered populations are listed in Schedule 1 Part 2 of the *Threatened Species Conservation Act 1995*.

- c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
- (v) *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*
  - (vi) *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:*
- (vii) *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
  - (viii) *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*

- (ix) *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.*

A small area of BGHF will be cleared from the subject site. No known habitat will be cleared.

Vegetation on the subject site will continue to be connected to adjacent stands of vegetation. The proposed development will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat.

Habitat on the subject land is not important for other populations of *T. glandulosa* in the locality. Therefore the species will persist within the locality and other populations are not likely to be affected by the possible extinction of the population on the subject land so as to affect their viability.

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

No critical habitat for this vulnerable species has currently been listed in the critical habitat registry 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 plans,*

No recovery plan has been prepared for this species. No threat abatement plans are relevant to this species. DECC has developed 14 priority actions to help recover this species. Actions with some relevance to the subject site include:

- Encourage community awareness and involvement in threat management works; and
- Undertake works to maintain or improve habitat connectivity between and between populations.

- 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.*

*Tetratheca glandulosa* is threatened by or the proposal could further impact the species through the following processes:

- Bushrock removal: This is not an issue at the subject site; and
- Clearing of native vegetation as this could destroy a small area of potential habitat.

The proposal may also exacerbate the following processes, further impacting on the species (if present):

- Invasion and establishment of exotic vines (key threatening process) as these species may over-shade individuals.
- *Lantana camara* may over-shade individuals;
- Infection of native plants by *Phytophthora cinnamomi*; and
- Invasion of native plant communities by exotic perennial grasses as these species may over-shade individuals.

#### Conclusion

The proposal will not have a significant impact on the viability of the species in the locality.

## 8.4 Superb Fruit-dove (*Ptilinopus superb*)

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

The Superb fruit-dove occurs in rainforest or similar closed forest with a canopy in which the species can forage for fruits. This species has not been recorded on the subject land and there have been no records in the locality in the last ten years. The subject land provides only a limited area of potential foraging habitat for this species and is not considered to be significant to the viability of the species.

- 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,*

No endangered populations of this species have been listed in Schedule 1 Part 2 of the TSC Act 1995 within the region.

- 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.*

A small amount of foraging occurs on the subject site. Some trees which provide foraging habitat for this species may be removed.

The proposal is not likely to fragment or isolate any areas of habitat for this species as it is highly mobile. The species is capable of flying over developed areas.

The subject site affords a small area of foraging habitat for the species. As the Superb Fruit-dove is highly mobile and moves around according to the availability of foraging habitat, it is likely to use a much broader area of habitat, including large areas of Ku-ring-gai Chase National Park. Therefore the land affected by the proposal is not important habitat for the species.

- 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 currently been listed in the critical habitat registry 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 plans,*

No recovery plan for this species has been prepared by DECC to date. DECC has recommended 16 priority actions to assist with the recovery of this species. Actions relevant to the subject site include:

- o Liaise with relevant landholders and managers to protect, rehabilitate, enlarge and reconnect habitat. Raise awareness of weed threats and need for compensatory plantings; and

- o Ensure that Camphor Laurel removal is compensated for by replacement with winter-fruiting native laurels, figs and Elaeocarpaceae to avoid significant reduction of existing food resources.

The threat abatement plan for predation by the red fox is relevant to this species. The proposal is not inconsistent with these objectives, which focus on fox control programs.

- 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.*

Superb Fruit-dove is threatened by or the proposal will further impact the species through the following processes:

- Clearing of native vegetation as this will clear foraging habitat. However, potential foraging habitat will be retained on the subject land;
- Ecological consequences of high frequency fires as fire can destroy rainforest habitat that is important to this species. Fire will not be part of the management of the subject site; and
- Predation by the European red fox as fledglings can become prey items for foxes. Foxes may exist on the subject site but are not likely to be increased in number by the proposal.

### *Conclusion*

The proposal is not likely to have a significant impact on a viable local population of the species.

## **8.5 Glossy Black-cockatoo (*Calyptorhynchus lathamī*)**

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

The proposed development is unlikely to impact on the foraging resources for the Glossy Black Cockatoo that occur in the subject site. Casuarina trees will be retained on the subject site. Trees with nesting hollows will also be retained. Therefore, the proposal is unlikely to disrupt the life cycle of the species such that a local viable population would be placed at risk of extinction.

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

No endangered populations of this species have been listed in Schedule 1 Part 2 of the TSC Act within the region.

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

- (iii) *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*
- (iv) *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:*

- (iv) *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- (v) *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*
- (vi) *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.*

A small amount of foraging and nesting habitat occurs on the subject site. Although a small proportion of foraging habitat will be removed from the site, all potential nesting habitat for the species will be retained.

The proposal is not likely to fragment or isolate any areas of habitat for this species as it is highly mobile. The species is capable of flying over developed areas.

The subject site affords foraging habitat and possibly nesting habitat for the species. As the Glossy Black Cockatoo is highly mobile and moves around according to the availability of foraging habitat, it is likely to use a much broader area of habitat, including large areas of Ku-ring-gai Chase National Park. Therefore the land affected by the proposal is not important habitat for the species.

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 currently been listed in the critical habitat registry 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 plans,*

No recovery plan for this species has been prepared by the NSW National Parks and Wildlife Service to date. DECC has recommended 9 priority actions to assist with the recovery of this species. Actions relevant to the subject site include:

- o Increase landholder and public awareness and interest in Glossy Black Cockatoo conservation and habitat management; and
- o Encourage the restoration of foraging habitat that has been cleared or degraded by previous impacts.

The threat abatement plan for predation by the red fox is relevant to this species. The proposal is not inconsistent with these objectives, which focus on fox control programs.

- 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.*

Glossy Black Cockatoo is threatened by or the proposal will further impact the species through the following processes:

- Clearing of native vegetation as this will clear foraging habitat. However, potential nesting and further potential foraging habitat will be retained on the subject land;
- Competition from feral honeybees as they can form hives in tree hollows that also form potential nesting habitat for the Glossy Black Cockatoo. The proposal is not likely to exacerbate this process;
- Ecological consequences of high frequency fires as fire can destroy tree hollows that form potential nesting habitat. Fire will not be part of the management of the subject site;
- Infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations as it can leave Glossy Black Cockatoos prone to other infections. However, the proposal will not exacerbate the likelihood of this disease infecting a local population;
- Predation by the European red fox as fledglings can become prey items for foxes. Foxes may exist on the subject site but are not likely to be increased in number by the proposal; and
- The removal of dead wood and dead trees because dead trees are often hollow and contain potential nesting habitat. Some dead trees may be removed but all trees with hollows will be retained on the subject land.

## Conclusion

The proposal is not likely to have a significant impact on a viable local population of the species.

## 8.6 Gang-gang Cockatoo (*Callocephalon fimbriatum*)

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

The proposed development is unlikely to impact on the foraging resources for the Gang-gang Cockatoo as only a small area will be cleared. Trees with nesting hollows will also be retained. Therefore, the proposal is unlikely to disrupt the life cycle of the species such that a local viable population would be placed at risk of extinction.

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

The endangered population is found in the Ku-ring-gai and Hornsby local government areas. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area, where most nesting is likely to take place. As such, the proposal is unlikely to disrupt the life cycle of the species such that the endangered population would be placed at risk of extinction.

- 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.*

Although a small proportion of foraging habitat will be removed from the subject land, all potential nesting habitat for the species will be retained.

The proposal is not likely to fragment or isolate any areas of habitat for this species as it is highly mobile. The species is capable of flying over developed areas.

The subject site affords foraging habitat and possibly nesting habitat for the species. As the Gang-gang Cockatoo is highly mobile and moves around according to the availability of foraging habitat, it is likely to use a much broader area of habitat, including large areas of Lane Cove National Park and Ku-ring-gai Chase National Park. Therefore the land affected by the proposal is not important habitat for the species.

- 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 currently been listed in the critical habitat registry 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 plans,*

No recovery plan for this species has been prepared by the NSW National Parks and Wildlife Service to date. DECC has recommended 8 priority actions to assist with the recovery of this species. Actions relevant to the subject site include:

- o Develop a strategy that includes street tree or other planting, browse plant species within reserves and private residences.

The threat abatement plan for predation by the red fox is relevant to this species. The proposal is not inconsistent with these objectives, which focus on fox control programs.

- 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.*

Gang-gang Cockatoo is threatened by or the proposal will further impact the species through the following processes:

- Clearing of native vegetation as this will clear foraging habitat. However, potential nesting and further potential foraging habitat will be retained on the subject land;

- Competition from feral honeybees as they can form hives in tree hollows that also form potential nesting habitat for the Gang-gang Cockatoo. The proposal is not likely to exacerbate this process;
- Ecological consequences of high frequency fires as fire can destroy tree hollows that form potential nesting habitat. Fire will not be part of the management of the subject site;
- Infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations as it can leave Gang-gang Cockatoos prone to other infections. However, the proposal will not exacerbate the likelihood of this disease infecting a local population;
- Predation by the European red fox as fledglings can become prey items for foxes. Foxes may exist on the subject site but are not likely to be increased in number by the proposal; and
- The removal of dead wood and dead trees as dead trees are often hollow and contain potential nesting habitat. Some dead trees may be removed but all trees with hollows will be retained on the subject land.

### Conclusion

The proposal is not likely to have a significant impact on a viable local population of the species.

## 8.7 Powerful Owl (*Ninox strenua*)

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

The Powerful Owl has not been recorded from the subject site but has been recorded in the locality. Given the large home range of the species (pairs maintain and hunt throughout a home range that may be up to 1000 ha), the presence of suitable adjacent habitat and its ability to adapt to disturbance within its home range it is unlikely that the viability of the local population will be adversely affected by the proposed development.

- (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,*

The area's Powerful Owl population is not listed as an endangered population 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.*

Due to the small area of the subject site, and the large home range of the species, the proposed development is unlikely to modify or remove a significant area of Powerful Owl habitat.

The project will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat.

The majority of hollow-bearing trees are being preserved on the site which may provide nesting sites for the species (although few large hollows are present). The area to be cleared is a small portion of their potential home range. As such, the project will not affect the long-term viability of the species.

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

There are no areas of critical habitat for Powerful Owl listed under the TSC Act.

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

A draft recovery plan for the Large Forest Owls has been prepared and is relevant to the Powerful Owl. The overall objective of this plan is “to ensure that the three species persist in the wild in NSW in each region where they presently occur.” Specific objectives relevant to the proposal include:

*Objective 1: To minimise further loss and fragmentation of habitat outside conservation reserves and State Forests by protection and management of significant owl habitat (including individual nests).*

*Objective 2: To minimise the impacts of development activities on large forest owls and their habitats outside conservation reserves and State Forests.*

Although the project would remove some potential foraging habitat for the species, potential foraging and nesting habitat would be retained on the Project Site. The Project Site is on the outskirts of a large tract of native vegetation, and as such large areas of habitat will remain in the locality.

The threat abatement plan for predation by the red fox is relevant to this species. The proposal is not inconsistent with these objectives, which focus on fox control programs.

DECC has identified 21 priority actions to assist with the recovery of this species in New South Wales. These include:

- Encourage private landholders to undertake management options to conserve and/or actively manage forest owl habitat;
  - Use records of concurrence and licence conditions to develop a set of prescriptive guidelines that may be used to mitigate the impacts of developments on the Powerful Owl outside conservation reserves and State forests; and
  - Develop a sampling methodology stratified across different land tenures and disturbance histories, as well as a set of standardised regional monitoring protocols.
- 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 project will involve land clearance and soil disturbance. As such it will involve several Key Threatening Processes under the TSC Act:

- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands;
- Bushrock removal;
- Clearing of native vegetation;
- The removal of dead trees, dead wood and logs;
- Predation by feral red fox;

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned above have been prepared by DECC to date.

## Conclusion

The Powerful Owl is not likely to be impacted by the proposed development.

## 8.8 Masked Owl (*Tyto novaehollandiae*)

- (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,*

Potential nesting habitat for the Masked Owl exists at the subject site, although few large hollows are present. There is one record for the locality for this species (adjacent to Berowra Valley Regional Park). This species was not detected in surveys at the site. The proposed development is unlikely to result in a viable local population of this species become extinct.

- (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,*

The area's Masked Owl population is not listed as an endangered population 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.*

Due to the small area of the subject site, and the large home range of the species, the proposed development is unlikely to modify or remove a significant area of Masked Owl habitat.

The project will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat.

The majority of hollow-bearing trees are being preserved on the site which may provide nesting sites for the species (although few large hollows are present). The area to be cleared is a small portion of their potential home range. As such, the project will not affect the long-term viability of the species.

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

There are no areas of critical habitat for Masked Owl listed under the TSC Act.

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

A draft recovery plan for the Large Forest Owls has been prepared and is relevant to the Powerful Owl. The overall objective of this plan is *“to ensure that the three species persist in the wild in NSW in each region where they presently occur.”* Specific objectives relevant to the proposal include:

*Objective 1: To minimise further loss and fragmentation of habitat outside conservation reserves and State Forests by protection and management of significant owl habitat (including individual nests).*

*Objective 2: To minimise the impacts of development activities on large forest owls and their habitats outside conservation reserves and State Forests.*

Although the project would remove some potential foraging habitat for the species, potential foraging and nesting habitat would be retained on the Project Site. The Project Site is on the outskirts of a large tract of native vegetation, and as such large areas of habitat will remain in the locality.

The DECC has identified 21 priority actions to help recover the Masked Owl in New South Wales. Actions relevant to the subject site include:

- Encourage private landholders to undertake management options to conserve and/or actively manage forest owl habitat; and
- Prepare guidelines addressing issues associated with habitat protection and management and survey and assessment on private lands.

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned in part (g) below have been prepared by the NSW National Parks and Wildlife Service to date.

- 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 project will involve land clearance and soil disturbance. As such it will involve several Key Threatening Processes under the TSC Act:

- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands;
- Clearing of native vegetation;
- The removal of dead trees, dead wood and logs; and
- Predation by feral red fox.

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned above have been prepared by DECC to date.

### Conclusion

This species is unlikely to be negatively impacted by the proposed development.

## 8.9 Barking Owl (*Ninox connivens*)

- 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,*

Given the large home-range of this species (territories range from 30 to over 1000 hectares and pairs of birds remain in the same area all year), broad prey base and ability to nest in open country, it is unlikely that the proposal will affect the viability of the Barking Owl. No disruption to the lifecycle of the Barking Owl is therefore expected.

- 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,*

The area's Barking Owl population is not listed as an endangered population 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.*

No Barking Owls were recorded from the subject site, nor has this species been recorded in the locality. Due to the small area of the subject site, and the large home range of the species, the proposed development is unlikely to modify or remove a significant area of Barking Owl habitat.

The project will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat.

The majority of hollow-bearing trees are being preserved on the site which may provide nesting sites for the species (although few large hollows are present). The area to be cleared is a small portion of their potential home range. As such, the project will not affect the long-term viability of the species.

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

There are no areas of critical habitat for Barking Owl listed under the TSC Act.

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

A draft recovery plan has been prepared by the DECC for this species. Some of the clearing for the project components may reduce potential nesting sites for Barking Owls in the locality. The proposed action is therefore not consistent with the recovery plan's

objective of protecting Barking Owl habitat from disturbance due to developments and activities.

The DECC has identified 17 priority actions to help recover the Barking Owl in New South Wales. Actions relevant to the subject site include:

- Negotiate with individual land managers to achieve appropriate measures to protect all known Barking Owl nest sites in NSW. Protection will need to address threats such as human disturbance, collision with wires, secondary poisoning from chemicals;
- Incorporate the consideration of Barking Owl habitat and potential habitat as a high priority in the assessment of property for reserve establishment;
- Establish formal conservation arrangements for properties with Barking Owls, which can be used to protect wildlife habitat.

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned in part (g) below have been prepared by the NSW National Parks and Wildlife Service to date.

*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 project will involve land clearance and soil disturbance. As such it will involve several Key Threatening Processes under the TSC Act:

- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands;
- Clearing of native vegetation;
- The removal of dead trees, dead wood and logs; and
- Predation by feral red fox.

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned above have been prepared by DECC to date.

### *Conclusion*

The Barking Owl is not likely to be significantly impacted by the proposed development.

## 8.10 Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)

- 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,*

No known roosts are present in the locality. This species is likely to roost in sandstone caves in Ku-ring-gai Chase National Park. The proposed development will not affect maternity or general roost sites. Foraging habitat occurs on the subject site, of which a very small area will be cleared. A viable local population is unlikely to be placed at risk of extinction as a result of the proposed development.

- 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,*

The Eastern Bentwing Bat is not listed as an endangered population 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.*

An insignificant proportion of forest will be cleared on the subject site, but remaining forest will provide corridors and habitat for foraging. A significant area of known habitat will not be affected by the proposed development.

This is a highly mobile species and the impacts of the project are not expected to have a deleterious impact upon habitat corridors or habitat connectivity for dispersal of the species. The extent of clearing will not cause any isolation of potential foraging habitat for this species. The project will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat.

Removal of trees will reduce foraging areas for this species, however large areas of habitat remain in the locality. The project will not affect the long-term viability of this species.

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 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 plan for this species has been prepared by the NSW National Parks and Wildlife Service to date. The DECC has identified 25 priority actions to help recover the Eastern Bentwing Bat in New South Wales. Actions relevant to the subject site include:

- Control foxes and feral cats around roosting sites, particularly maternity caves and hibernation sites;
- Provide map of significant roosts to Rural Fire Service and seek inclusion of mitigative measures (below) on Bush Fire Risk Management Plan(s), risk register and/or operation map(s). Exclude fire, where practical, 100m from cave/roosts entrance; and
- Ensure protection of known roosts and forest within 10 km of roosts in PVP assessments (offsets should include nearby remnants in high productivity) and other environmental planning instruments.

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned in part (g) below have been prepared by the NSW National Parks and Wildlife Service to date.

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 project will involve land clearance and soil disturbance. As such it will involve several Key Threatening Processes under the TSC Act:

- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands;

- Bushrock removal;
- Clearing of native vegetation;
- The removal of dead trees, dead wood and logs;
- Predation by feral red fox;

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned above have been prepared by DECC to date.

### Conclusion

This species occurs in the study area and a small area of foraging habitat will be cleared but no cave roosts will be impacted. It is not expected to be significantly affected by the total project. No significant impact is likely.

## 8.11 Large-eared Pied Bat (*Chalinolobus dwyeri*)

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

The Large-eared Pied Bat is known to utilise daytime roosts including caves, mine tunnels, crevices in cliffs and abandoned bottle-shaped mud nests of Fairy Martins (Strahan, 1995, NSW NPWS, 2004b). Roosting is likely in Ku-ring-gai Chase National Park, but not on the subject site. The proposed development will not affect maternity or general roost sites. Foraging habitat exists on the subject site, of which a small portion will be cleared. A viable local population is unlikely to be placed at risk of extinction as a result of the proposed development.

- (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,*

The Large-eared Pied Bat is not listed as an endangered population 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.*

An insignificant proportion of forest will be cleared on the subject site, but remaining forest will provide corridors and habitat for foraging. A significant area of known habitat will not be affected by the proposed development.

This is a highly mobile species and the impacts of the project are not expected to have a deleterious impact upon habitat corridors or habitat connectivity for dispersal of the species. The extent of clearing will not cause any isolation of potential foraging habitat for this species. The project will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat.

Removal of trees will reduce foraging areas for this species, however large areas of habitat remain in the locality. The project will not affect the long-term viability of this species.

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 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 plan for this species has been prepared by the NSW National Parks and Wildlife Service to date. The DECC has identified 17 priority actions to help recover the Large-eared Pied Bat in New South Wales. Actions relevant to the subject site include:

- Prepare EIA guidelines which address the retention of hollow bearing trees maintaining diversity of age groups, species diversity, structural diversity. Give priority to largest hollow bearing trees; and
- Identify important foraging range and key habitat components for this species.

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned in part (g) below have been prepared by the NSW National Parks and Wildlife Service to date.

- 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 project will involve land clearance and soil disturbance. As such it will involve several Key Threatening Processes under the TSC Act:

- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands;
- Bushrock removal;
- Clearing of native vegetation;
- The removal of dead trees, dead wood and logs;
- Predation by feral red fox;

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned above have been prepared by the NSW National Parks and Wildlife Service to date.

### *Conclusion*

The proposed development is unlikely to have a significant impact upon this species.

## **8.12 Yellow-bellied Sheathtail Bat**

- (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,*

This species roosts in tree hollows and also buildings. Foraging habitat occurs on the subject site, of which a very small area will be cleared. This species has not been recorded in the LGA in the last ten years and was not recorded on site during recent surveys. A viable local population is unlikely to be placed at risk of extinction as a result of the proposed development.

- (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,*

The Yellow-bellied Sheathtail Bat is not listed as an endangered population 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.*

An insignificant proportion of forest will be cleared on the subject site, but remaining forest will provide corridors and habitat for foraging. A significant area of known habitat will not be affected by the proposed development.

This is a highly mobile species and the impacts of the project are not expected to have a deleterious impact upon habitat corridors or habitat connectivity for dispersal of the species. The extent of clearing will not cause any isolation of potential foraging habitat for this species. The project will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat.

Removal of trees will reduce foraging areas for this species, however large areas of habitat remain in the locality. The project will not affect the long-term viability of this species.

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 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 plan for this species has been prepared by the NSW National Parks and Wildlife Service to date. The DECC has identified 25 priority actions to help recover the Eastern Bentwing Bat in New South Wales. Actions relevant to the subject site include:

- Control foxes and feral cats around roosting sites, particularly maternity caves and hibernation sites;
- Provide map of significant roosts to Rural Fire Service and seek inclusion of mitigative measures (below) on Bush Fire Risk Management Plan(s), risk register and/or operation map(s). Exclude fire, where practical, 100m from cave/roosts entrance; and
- Ensure protection of known roosts and forest within 10 km of roosts in PVP assessments (offsets should include nearby remnants in high productivity) and other environmental planning instruments.

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned in part (g) below have been prepared by the NSW National Parks and Wildlife Service to date.

- 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 project will involve land clearance and soil disturbance. As such it will involve several Key Threatening Processes under the TSC Act:

- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands;
- Bushrock removal;
- Clearing of native vegetation;
- The removal of dead trees, dead wood and logs;
- Predation by feral red fox;

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned above have been prepared by DECC to date.

### *Conclusion*

This species occurs in the study area and a small area of foraging habitat will be cleared but no cave roosts will be impacted. It is not expected to be significantly affected by the total project. No significant impact is likely.

## 8.13 Grey-headed Flying Fox

- (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,*

Grey-headed Flying-foxes have been recorded flying over the subject site and feeding in the locality. Flying-foxes roost in camps of thousands of animals at specific sites. No known Flying-fox camp occurs on the subject site. A small area of foraging habitat for the species occurs at the subject site. However, due to the broad range and distribution of this species, it is unlikely that the proposed development would place a viable local population of the species 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,*

No endangered populations of this species are currently listed in the study area on Schedule 1 of 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.*

Habitat to be cleared on the subject site provides foraging habitat for this species, however no roost sites occur on the site. Other larger areas of habitat for this species occur within

the locality and throughout the region, including conservation reserves. The proposed development is not likely to modify or remove a significant area of habitat

Bats are highly mobile species and regularly fly over cleared areas. The proposed development is unlikely to significantly impact upon habitat connectivity, and areas of known habitat are not likely to become isolated from currently interconnecting or proximate areas of habitat.

Foraging habitat to be removed from the subject site is minimal compared to available habitat in the locality. It will not affect the long-term viability of the species.

*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 currently been listed in the critical habitat registry 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 plan for this species has been prepared by the NSW National Parks and Wildlife Service to date. The DECC has identified 31 priority actions to help recover the Grey-headed Flying-fox in New South Wales. Actions relevant to the subject site include:

- Protect and enhance priority foraging habitat for Grey-headed Flying-foxes, for example through management plans, local environmental plans and development assessments, and through volunteer conservation programs for privately owned land;
- Increase the extent and viability of foraging habitat for Grey-headed Flying-foxes that is productive during winter and spring (generally times of food shortage), including habitat restoration/rehabilitation works; and
- Set priorities for protecting foraging habitat critical to the survival of Grey-headed Flying-foxes and generate maps of priority foraging habitat.

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned in part (g) below have been prepared by the NSW National Parks and Wildlife Service to date.

*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 project will involve land clearance and soil disturbance. As such it will involve several Key Threatening Processes under the TSC Act:

- Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands;

- Bushrock removal;
- Clearing of native vegetation;
- The removal of dead trees, dead wood and logs; and
- Predation by feral red fox.

With the exception of the fox threat abatement plan, no threat abatement plans relevant to the threatening processes mentioned above have been prepared by the NSW National Parks and Wildlife Service to date.

### *Conclusion*

The development will have minimal impact on foraging habitat for the Grey-headed Flying-fox. The local populations of this species are not likely to be significantly impacted by the proposed development.

## Additional Information

### 9.1 Qualifications and Experience

#### DGR 9.1 Qualifications and experience

The following is your obligation under Sections 110(4) to address the following:

- A species impact statement must include details of the qualifications and experience in threatened species conservation of the person preparing the statement and of any other person who conducted research or investigations relied on in preparing the statement

The SIS project team included key personnel listed in Table 9.1. Experience and qualifications of each team member are provided in the *curricula vitae* found in Appendix D.

**Table 9.1 MEMBERS OF THE PROJECT TEAM**

| Team Member        | Company            | Role                           | Contact details    |
|--------------------|--------------------|--------------------------------|--------------------|
| Dr David Robertson | Cumberland Ecology | Project Director and Ecologist | Ph: (02) 98681933  |
| Joanne Brownett    | Cumberland Ecology | Project Manager/ Ecologist     | Ph: (02) 98681933  |
| James Schlunke     | Cumberland Ecology | Ecologist                      | Ph: (02) 98681933  |
| Dr Kirsten Crosby* | Cumberland Ecology | Senior Ecologist               | Ph: (02) 98681933  |
| Mina Bassarova*    | Cumberland Ecology | Ecologist                      | Ph: (02) 98681933  |
| David Thomas       | Thomas Surveys     | Botanist                       | Ph: (02) 9874 6581 |
| Gabor Vasarhelyi   | Focus GIS          | GIS Consultant                 | Ph: (02) 9614 7034 |

\*No longer employed at Cumberland Ecology

### 9.2 Other Approvals Required for the Development or Activity.

#### DGR 9.2 Other approvals required for the development or activity

The following are further requirements related to your obligations under sections 110(2) (j) and 110 (3) (g) to address the following:

- A list of any approvals that must be obtained under any other Act or law before the action may be lawfully carried out, including details of the conditions of any existing approvals that are relevant to the species or population or ecological community.

*Other approvals under NSW law*

*In providing a list of other approvals the following must be included:*

*Where a consent is required under Part 4 of the Environmental Planning and Assessment Act 1979, the name of the consent authority and the timing of the development application should be included; or*

*Where an approval(s) is required under Part 5 of the Environmental Planning and Assessment Act 1979, the name of the determining authority(ies), the basis for the approval and when these approvals are proposed to be obtained should be included.*

*Approval under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

*An action will require referral to, and may require the approval of, the Federal Minister for the Environment and Water Resources (in addition to any local or state government consent or approval) if that action will have, or is likely to have, a significant impact on the environment or on a matter of national environmental significance. Threatened species and communities listed in the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) are considered to be matters of national environmental significance, as are migratory species and a number of other matters. Information regarding matters of national environmental significance may be obtained from [www.environment.gov.au/epbc/matters/index.html](http://www.environment.gov.au/epbc/matters/index.html), on the website of the Commonwealth Department of The Environment and Water Resources (DEW) (formerly the Department of the Environment and Heritage) or by contacting DEW on 1800 803 772. Further information regarding the operation of the EPBC Act in NSW can be found on the NSW Dept of Planning's website at EPBC Act Guide to Implementation in NSW (available at <http://www.planning.nsw.gov.au/assessingdev/environmentalassessment.asp>) and on the DEW website at [www.environment.gov.au/epbc/about/index.html](http://www.environment.gov.au/epbc/about/index.html).*

This SIS accompanies a Part 3A Development Application to the Department of Planning.

The BGHF present on the subject site does not correspond to the community listed under the EPBC Act. The EPBC final determination states that BGHF occurs on deep soils derived from Wianamatta Shale. The soils within the subject site are highly disturbed from

past gardening and composting. The soil composition within the subject lands is unlikely to be in original form, as there have been many earthworks associated with the existing buildings and gardens beds.

“The listed ecological community includes patches with an intact vegetation structure, a tree canopy greater than 10%, and an area greater than one hectare” (DEH, 2005). As the vegetation occupying the subject site is less than one hectare, the vegetation is considered not to be the listed EPBC critically endangered BGHF. The vegetation structure is also not considered to comply with the EPBC determination as the vegetation deemed BGHF does not have intact vegetation structure. The vegetation structure comprises of a native tree canopy with an almost exotic shrub and ground cover assemblage.

Two threatened species listed under the EPBC Act were recorded from the subject site: *Syzygium paniculatum* (Magenta Lilly Pilly) and *Pteropus poliocephalus* (Grey-headed Flying-fox). The proposed development will not have a significant impact on these species or any other matters of national environmental significance. As such, no referral is required for this proposal.

### 9.3 Licensing Matters Relating to Conducting Surveys

#### DGR 9.3 *Licensing matters relating to conducting surveys*

*Persons conducting flora and fauna surveys must have appropriate licences or approvals under relevant legislation. The relevant legislation and associated licences and approvals that may be required are listed below:*

##### *National Parks and Wildlife Act 1974:*

- *General Licence (Section 120) to harm or obtain protected fauna (this may include threatened fauna).*
- *Licence to pick protected native plants (Section 131).*
- *Scientific Licence (Section 132C) to authorise the carrying out of actions for scientific, educational or conservation purposes.*

##### *Threatened Species Conservation Act 1995:*

- *Licence to harm threatened animal species, and/or pick threatened plants and/or damage the habitat of a threatened species (Section 91).*

##### *Animal Research Act 1985:*

- *Animal Research Authority to undertake fauna surveys.*

Flora and fauna survey carried out by Cumberland Ecology was covered by:

- National Parks and Wildlife Service (Department of Environment and Conservation)
  - Scientific Licence S11164,
  - Expiry 31/03/2009
- Animal Research Authority (Department of Primary Industries)
  - Authority Number: 04/0935
  - Expiry: 11/10/2009

## 9.4 Section 110 (5) Reports

### DGR 9.4 Section 110 (5) reports

*Section 110(5) of the Threatened Species Conservation Act 1995 has the effect of requiring DECC to provide that information regarding the State-wide conservation status of the subject species as it has available, in order to satisfy ss.110(2) & (3) of the Act. To this end, a number of publications have been produced:*

- *DECC has produced a set of profiles for a number of threatened species, populations and ecological communities and are available on DECC website ([www.threatenedspecies.environment.nsw.gov.au](http://www.threatenedspecies.environment.nsw.gov.au)). Some of these may be relevant to the subject species for this development.*
- *The Metropolitan Branch Biodiversity Conservation Section has produced a number of profiles and environmental impact assessment guidelines for species, populations and ecological communities (refer to Attachment 2). Check Attachment 2 to see whether there is a later version of a required profile or guideline than that available via the DECC Threatened Species website and, if required, seek it from the contact officer.*

*Proponents and consultants should note that DECC has no further published information available to satisfy s.110(5) of the Act and that purchase or receipt and use of the above profiles can be taken to have satisfied the requirements of ss.110(2) & (3) in relation to the State-wide conservation status of the listed species, populations and ecological communities.*

The DECC website ([www.threatenedspecies.environment.nsw.gov.au](http://www.threatenedspecies.environment.nsw.gov.au)) was regularly used during the preparation of this SIS in order to access threatened species profiles, and information on key threatening processes and priority actions for threatened species.

## Conclusion

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The subject site contains a highly modified form of BGHF as part of an estate that has been used as a private residential dwelling since 1898 then a hospital since 1952. Remnant trees and other BGHF species occur in an approximate 'L' shape along the southern and eastern boundaries of the subject site, covering an area of 6350m<sup>2</sup> mapped by Peter Smith (2007). The BGHF is extremely degraded due to the historical land uses within the remnant including gardens, a chicken run, a vegetable patch and a compost heap. Currently, it is overgrown with weeds, with the majority of species recorded being introduced and dominating the ground, shrub and small tree strata.

The proposal involves the renovation of the heritage-listed house "Rippon Grange" and construction of a new building with three wings for use as a private hospital facility. This will involve clearing of approximately 116m<sup>2</sup> or 1.8% of BGHF.

Of the 126 trees within the BGHF, 111 will be retained, including all trees with Significance Ratings of 1, 2 and 3. Of the 15 trees to be removed, 6 are target weed species and 5 are structurally unsound. Only two trees will be removed from the BGHF for the construction of the East Wing and two will be removed for the driveway.

Of all the trees to be removed for the construction of the hospital facility, only one native hollow-bearing tree will be removed from the BGHF area and one introduced hollow-bearing tree will be removed from the remainder of the subject site, out of a total of 11 hollow-bearing trees. This will ensure habitat for native fauna species is retained, including potential habitat for threatened fauna species.

The BGHF on the subject site is linked to larger patches in Turiban and Clive Evatt Reserves via the remnant in Wahroonga Public School across the road, and street trees. This connectivity will remain intact as the majority of the BGHF will be retained. The section to be cleared only represents a small portion (1.8%) of the total BGHF on site and is located at the edge of the remnant.

Potential habitat is provided on the subject site for some threatened species, including *Tetratheca glandulosa*, Superb Fruit-dove, Glossy Black Cockatoo, Gang-gang Cockatoo, Masked Owl, Powerful Owl, Barking Owl, Large-eared Pied Bat, Eastern Bentwing Bat, Yellow-bellied Sheath-tail Bat, Eastern Freetail Bat and Grey-headed Flying-fox. Two planted specimens of *Syzygium paniculatum* also occur and will be retained on the subject site. Although the Grey-headed Flying-fox and Gang-gang Cockatoo have been observed flying over the site, it is not likely that the site provides exclusive habitat for any threatened fauna species. It is more likely to provide foraging habitat as part of a much larger range,

due to its small size and degraded habitat quality. The small area of habitat to be removed and construction of the hospital are not considered to have a significant impact on threatened flora or fauna species.

Besides impacts of vegetation removal, there is potential for the BGHF to be affected by changes to the hydrological regime, increased edge effects and construction impacts. Studies into the hydrogeology of the subject site have demonstrated that the excavation of basement levels will not have a significant impact on water table levels available to the BGHF.

The BGHF is a small remnant and already subject to edge effects throughout because of its narrow shape. The implementation of the VMP (UBMEC, 2009) will reduce the existing edge effects and mitigate any potential for exacerbation of edge effects by the proposal. The VMP also specifies ameliorative measures for construction impacts on the BGHF through the erection of exclusion fences and sediment fences to prevent construction activities encroaching on the BGHF, trampling, stockpiling and sediment deposits.

The VMP will be implemented for 10 years from project approval. This will cover the assisted natural regeneration and reconstruction where necessary of existing BGHF, as well as the reconstruction of an additional 1770m<sup>2</sup> as a simplified form of BGHF. It is anticipated that the BGHF will never recover to a true representation of the native vegetation community because of its existing degraded condition and low to moderate resilience (UBMEC, 2009). This means that the BGHF will always exist as a simplified version of the community. On conclusion of the VMP, the BGHF and reconstruction areas will enter a maintenance phase where the operational budget of the private hospital facility will provide funding for the BGHF in perpetuity.

The proposed private hospital facility is not considered to have a significant impact on any threatened species or community. Approximately 98.2% of the BGHF will be retained and the overall area increased by 1770m<sup>2</sup>. The implementation of the VMP will improve the quality of vegetation in the remnant but without ongoing active management, the BGHF will be continually overgrown by weeds. The economic viability of the proposed private hospital facility will ensure ongoing funding for the implementation of the VMP and the maintenance of the BGHF in perpetuity.

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*Appendix A*

# Director-General's Requirements

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**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                              | TSC Act Section | Requirements                                                                                                                                                                                                                                                                                                                                                                                  | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                          | SIS Section                        |
|----------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| 1. Form of the Species Impact Statement                  |                 |                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                    |
| 1.1                                                      | Section 109 (1) | <i>A Species Impact Statement must be in writing</i>                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                    |
|                                                          |                 | <i>A Species Impact Statement must be signed by the principal author of the statement and by: (a) the applicant for the licence, or (b) if the species impact statement is prepared for the purposes of the Environmental planning and Assessment Act 1979, the applicant for the development consent or the proponent of the activity proposed to be carried out (as the case requires).</i> |                                                                                                                                                                                                                                                                                                                                                                                                                                                 | See inside page of the report      |
| 1.2                                                      | Section 109 (2) |                                                                                                                                                                                                                                                                                                                                                                                               | A full description of the full nature, extent, and timing of the proposal and all associated actions, including but not restricted to construction, provision or ongoing maintenance of approved or proposed. Buildings or other structures; Utilities such as for sewage, electricity, gas or water; routes for access and egress; drainage infrastructure and changes made to surface water flows; bushfire hazard reduction; and landscaping |                                    |
| 2.1 Description of proposal, subject site and study area | Section 110 (1) | <i>A Species Impact Statement must include a full description of the action proposed, including its nature, extent, location, timing, and layout</i>                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                 | SIS section 2.1<br>SIS section 2.6 |
| 2.2 Land tenure                                          | Section 110 (1) |                                                                                                                                                                                                                                                                                                                                                                                               | Information must be provided about the land tenure                                                                                                                                                                                                                                                                                                                                                                                              | SIS section 2.3                    |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section        | TSC Act Section | Requirements | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                 | SIS Section                                                                                 |
|--------------------|-----------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| information        |                 |              | across the study site                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                             |
|                    |                 |              | Vegetation within the locality must be mapped and described, including documentation of the areal extent of each vegetation community. Include reference to the vegetation classification system used and to descriptions of threatened ecological communities as determined by the scientific committee. Classification must have regard to both structural and floristic elements.                                                                                   | SIS section 2.5<br>SIS section 6.1<br>SIS section 6.2<br>SIS section 6.3<br>SIS section 6.4 |
| 2.3 Vegetation     | Section 110 (1) |              | An Aerial photograph (or reproduction of such a photograph) (preferably colour) of the locality must be provided, indicating scale, and clearly delineating the subject site.                                                                                                                                                                                                                                                                                          | Figure 1.2                                                                                  |
| 2.4 Plans and Maps | Section 110 (1) |              | A Map or Maps must be provided, showing: in the locality: land tenures and uses including parks and reserves, and areas of high human activity such as townships, regional centres and major roads. Any locally significant areas for threatened biodiversity, the locations of any previously known threatened species or endangered populations, the locations and types of vegetation and cleared areas (with reference to the description required in section 2.3) | Figure 1.1<br>Figure 2.2<br>Figure 3.1<br>Figure 3.2                                        |
|                    |                 |              | In the study area, the location size and dimensions of                                                                                                                                                                                                                                                                                                                                                                                                                 | Figure 2.1                                                                                  |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                                                        | TSC Act Section    | Requirements                                                                                                                                                                                                   | Additional Information                                                                                                                                                                                                                                                              | SIS Section            |
|------------------------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
|                                                                                    |                    |                                                                                                                                                                                                                | the study area, the full extent of the proposed works as described in section 2.1 at a scale of not less than 1:3000. The locations and types of vegetation and cleared areas (with reference to the description required in section 2.3) the current activities/usage of the land. | Figure 2.3             |
|                                                                                    |                    |                                                                                                                                                                                                                | All maps must indicate scale and have an explanatory legend of any symbols used                                                                                                                                                                                                     |                        |
| 3 Initial Assessment                                                               | Section 110 (2)(a) | <i>A general description of the threatened species or populations known or likely to be present in the area that is the subject of the action and in the area that is likely to be affected by the action.</i> |                                                                                                                                                                                                                                                                                     | SIS Chapter 3          |
|                                                                                    | Section 110 (3)(a) | <i>A general description of the ecological community present in the area that is the subject of the action and in any area that is likely to be affected by the action.</i>                                    |                                                                                                                                                                                                                                                                                     |                        |
| 3.1 Identifying subject threatened species, populations and ecological communities |                    |                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                     |                        |
| 3.1.1 Assessment of available information                                          |                    |                                                                                                                                                                                                                | In determining the subject threatened species, populations and ecological communities likely to be present (the subject species), consideration must be                                                                                                                             | Table 3.1<br>Table 3.2 |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section | TSC Act Section | Requirements | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | SIS Section                       |
|-------------|-----------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
|             |                 |              | <p>given to the habitat types present within the study area, and to recent records and the known distribution of threatened species, populations and ecological communities in the locality.</p> <p>Flora and fauna databases such as the DECC Atlas of NSW Wildlife and those held by local government, the Australian Museum, the CSIRO, Forests NSW and the Botanic Gardens Trust Sydney <b>must</b> be consulted to assist in compiling the list. Note that the DECC Atlas only holds records for which the DECC is the custodian and does not include records held in other data bases, and the conditions of data licences or data exchange agreements prevent the DECC from distributing such information. In many cases, the DECC atlas may only contain a small subset of the available data. Hence, other databases must also be consulted to assist in making an adequate determination of the subject species.</p> <p>In determining the subject species, the Priorities Action Statement and any available recovery plans and draft recovery plans and vegetation assessment and mapping by state or local government agencies must be consulted</p> | <p>Table 3.1</p> <p>Table 3.2</p> |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section            | TSC Act Section | Requirements | Additional Information                                                                | SIS Section |
|------------------------|-----------------|--------------|---------------------------------------------------------------------------------------|-------------|
|                        |                 |              | The following species must be considered for inclusion in the list of subject species |             |
|                        |                 |              | Scientific Name    Common Name                                                        | Table 3.1   |
|                        |                 |              | <i>Syzygium paniculatum</i> Magenta Lilly Pilly                                       | Table 3.2   |
|                        |                 |              | <i>Ptilinopus superbus</i> Superb Fruit Dove                                          | Table 3.2   |
|                        |                 |              | <i>Polytelis swainsonii</i> Superb Parrot                                             | Table 3.2   |
|                        |                 |              | <i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo                                  | Table 3.2   |
|                        |                 |              | <i>Xanthomyza phrygia</i> Regent Honeyeater                                           | Table 3.2   |
|                        |                 |              | <i>Callocephalon fimbriatum</i> Gang-gang Cockatoo                                    | Table 3.2   |
|                        |                 |              | <i>Pteropus poliocephalus</i> Grey-headed Flying-fox                                  | Table 3.2   |
|                        |                 |              | <i>Tyto novaehollandiae</i> Masked Owl                                                | Table 3.2   |
|                        |                 |              | <i>Ninox strenua</i> Powerful Owl                                                     | Table 3.2   |
|                        |                 |              | <i>Ninox connivens</i> Barking Owl                                                    | Table 3.2   |
|                        |                 |              | <i>Miniopterus schreibersii</i> Eastern Bent wing Bat                                 | Table 3.2   |
|                        |                 |              | <i>Chalinolobus dwyeri</i> Large-eared Pied Bat                                       | Table 3.2   |
|                        |                 |              | <i>Sacclaimus flaviventris</i> Yellow-bellied Sheathtailed Bat                        | Table 3.2   |
|                        |                 |              | <i>Mormopterus norfolcensis</i> Eastern Freetail Bat                                  | Table 3.2   |
|                        |                 |              | <i>Isoodon obesulus</i> Southern Brown Bandicoot                                      | Table 3.2   |
| Endangered Populations |                 |              | Gang-gang Cockatoo population in the Hornsby and                                      | Table 3.2   |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                       | TSC Act Section | Requirements | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                     | SIS Section       |
|-----------------------------------|-----------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Endangered ecological communities |                 |              | Ku-ring-gai local government areas                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |
|                                   |                 |              | Blue Gum High Forest (EPBC Listed)                                                                                                                                                                                                                                                                                                                                                                                                                         | SIS section 3.1.3 |
|                                   |                 |              | This list is not exhaustive. One of the roles of an SIS is to determine which species may be utilising a development site given the limitations of existing databases                                                                                                                                                                                                                                                                                      |                   |
| 4. Survey                         |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                            | SIS Chapter 4     |
| 4.1 Requirement to Survey         |                 |              | A fauna and flora survey is to be conducted in the study area. Targeted surveys must be conducted for all subject threatened species, populations and ecological communities determined in accordance with section 3 and for other species, populations and ecological communities identified in section 4.3                                                                                                                                               | SIS section 4.1   |
|                                   |                 |              | The Techniques and timing of these surveys should be commensurate with the biology/ecology of these species and ecological communities in order to maximise the likelihood and accuracy of detection. Guidance on appropriate methodologies and level and timing of survey efforts for some other species can be obtained from environmental impact assessment guidelines (see section 9.4), draft or approved recovery plans, scientific or environmental | SIS section 4.1   |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                                 | TSC Act Section | Requirements | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SIS Section     |
|-------------------------------------------------------------|-----------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|                                                             |                 |              | <p>management journals, biodiversity surveys and other sources. The information required to identify the type of impacts and assess their significance on threatened species is the key determinant for the levels of survey effort required. Appropriate justification for reducing otherwise recommended levels of survey effort is required to show that impacts are not likely to be significant. previous surveys and assessments may contribute to addressing this requirement if they have been conducted and documented in accordance with the following provisions</p> <p>Species of taxonomic uncertainty must have their identification confirmed by a recognised authority such as the Australian Museum or the National Herbarium at the Royal Botanic Gardens Sydney.</p> |                 |
| 4.2 Documentation                                           |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |
| 4.2.1 Description of survey techniques and survey locations |                 |              | <p>Survey techniques must be described and where possible a reference supporting the survey technique employed is to be provided</p> <p>The size, orientation and dimensions of quadrats or length of transects should be clearly documented for each type of survey technique undertaken. Full AMG</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | SIS section 4.1 |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                 | TSC Act Section | Requirements | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                               | SIS Section                                                 |
|---------------------------------------------|-----------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| 4.2.2 Documenting Survey Effort and Results |                 |              | grid references for the survey sites should be noted. Survey sites should be shown on maps, at a scale of not less the 1:300 which indicate scale and have an explanatory legend of any information showing symbols used.                                                                                                                                                                                                            |                                                             |
|                                             |                 |              | The Proformas in attachment 1 should be used for fauna survey. Data sheets are to be added as an appendix to the SIS                                                                                                                                                                                                                                                                                                                 | SIS Appendix C                                              |
|                                             |                 |              | Names and contact phone numbers of surveyors and other personnel must be recorded. Other persons who identified records (e.g. Anabat records, hair tubes scats) should also be named                                                                                                                                                                                                                                                 | SIS Appendix D                                              |
| 4.2.3 description and mapping of results of |                 |              | The date time and environmental conditions experienced during each survey must be documented. The time invested each time a survey technique is applied must be summarised in the SIS, based on the completed proformas. E.g. - number of person hours/transect, duration of call playback, number of nights traps set. Any limitations (e.g. denied access to private land) to sampling across the study area are to be documented. | SIS section 4.1.5<br>SIS section 4.2.1<br>SIS section 4.1.6 |
|                                             |                 |              | The locations of any newly recorded threatened species or endangered populations resulting from                                                                                                                                                                                                                                                                                                                                      | Figure 2.3                                                  |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                                           | TSC Act Section | Requirements | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | SIS Section   |
|-----------------------------------------------------------------------|-----------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| vegetation, flora and fauna surveys                                   |                 |              | <p>additional surveys must be mapped and described.</p> <p>The mapping of vegetation required under section 2.3 must reflect any new information resulting from additional surveys</p> <p>Assessment of impacts must consider the nature extent and timing of the proposal and all associated actions, including but not restricted to construction, provision and ongoing maintenance of approved or proposed: Buildings or other structures; utilities such as for sewage, electricity, gas and water; routes for access and egress; dams and associated infrastructure and changes made to surface water flows; bush fire hazard reduction and; landscaping.</p> <p>Assessment must include the direct and indirect impacts of these activities which may occur both on and off the subject land</p> <p>The impacts on threatened species and populations from the from the proposed development are likely to arise from: fragmentation and isolation of habitat and an incremental decline in its quality and extent; loss of locally significant vegetation; loss of foraging habitat for threatened fauna and a reduction in their local abundance and distribution; changes in the</p> |               |
| 5. Assessment of likely impacts on threatened species and populations |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SIS Chapter 5 |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                     | TSC Act Section   | Requirements                                                                                                                                     | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | SIS Section     |
|-------------------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|                                                 |                   |                                                                                                                                                  | hydrological regime resulting from altered surface flows and groundwater levels; deterioration in water quality; changes in vegetation structure, floristics and microhabitat due to shading; increased susceptibility to competition, disease predation, insect attack and other disturbances due to increased access and a reduction in vegetative cover; indirect effects of urbanisation eg tree removal, rubbish dumping, soil compaction, erosion, weed invasion as well as altered drainage patterns and nutrient levels resulting from increased runoff; clearing, modification and long-term degradation of habitat associated with the provision of asset protection zones; and indirect impacts to adjacent and downstream areas as a result of the clearing loss of vegetative cover including greater susceptibility to weeds, pests, competition, disease, predation, insect attack and other disturbances associated with increased edge effects and human access. |                 |
| 5.1 Assessment of species likely to be affected | Section 110(2)(b) | <i>An assessment of which threatened species or population known or likely to be present in the area are likely to be affected by the action</i> | This Requirement requires you to refine the list of subject threatened species and populations in order to identify which threatened species or endangered populations may be affected directly or indirectly (including cumulatively), by the proposal. This is to                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SIS section 5.1 |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                        | TSC Act Section   | Requirements                                                                            | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | SIS Section   |
|----------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
|                                                    |                   |                                                                                         | <p>be done taking account of the requirements outlined previously in section 4 of these requirements and information in any relevant scientific committee determinations, recovery plans and draft recovery plans, and vegetation assessment and mapping. Detailed rational should be provided to demonstrate how the list was derived. if adequate surveys/studies have been undertaken to categorically demonstrate the species does not occur in the study area, or if not resident, will not utilise habitats on site on occasion, or if off-site be influenced by off-site impacts of the activity, that species does not have to be considered further. Otherwise all species/populations likely to occur in the study area (based on general species distribution data) and known to utilise those habitat types, should be assessed as if present.</p> <p>The requirements in the remainder of this section need only be addressed for those species that are likely to be affected by the proposal. Subsequently this information should be used in an Assessment of Significance (as required in section 8) for each of those species or populations.</p> |               |
| 5.2 Discussion of local and regional abundance and | Section 110(2)(d) | <i>an estimate for the local and regional abundance of those species or populations</i> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SIS Chapter 5 |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                       | TSC Act Section    | Requirements                                                                                                                                                                                                                                                                  | Additional Information                                                                                                                                                                                                                                                                                                                                                                                           | SIS Section   |
|---------------------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| distribution                                      |                    |                                                                                                                                                                                                                                                                               | A discussion of other known populations in the locality must be provided. An estimate of the numbers of individuals of each threatened species or population utilising the area and the relative significance of the population/s in the study area to the populations in the locality must be included                                                                                                          | SIS Chapter 5 |
| 5.2.1 Discussion of other known local populations |                    |                                                                                                                                                                                                                                                                               | The relative significance of the subject site for threatened species or endangered populations in the locality must be discussed. In particular, discussion of other known populations must be provided. Such an assessment must consider and compare the differences in type, condition, and tenure and long-term security of other areas of known habitat in the locality with those in the study area.        | SIS Chapter 5 |
| 5.3 Discussion of conservation status             | Section 110(2)c    | <i>for each species or population likely to be affected, details of its local, regional and state-wide conservation status, the key threatening processes generally affecting it, its habitat requirements and any recovery plan or threat abatement plan applying to it.</i> | The SIS must also include reference to the threatening processes that are generally accepted by the scientific community as affecting the species or population and are likely to be caused, promoted, or exacerbated by the proposal. Consideration must also be given to measures outlined in the Priority 4s Action Statement and to any approved or draft recovery plans or threat abatement plans which may | SIS Chapter 5 |
|                                                   | Section 110 (2)(e) | <i>An assessment of whether those species or populations are adequately represented in conservation reserves (or other similar protected areas) in the region.</i>                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                  |               |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                                                      | TSC Act Section   | Requirements                                                                                                                                                                                               | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SIS Section                    |
|----------------------------------------------------------------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
|                                                                                  |                   |                                                                                                                                                                                                            | be relevant to the proposal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                |
|                                                                                  |                   |                                                                                                                                                                                                            | Known occurrences in the locality and region of the extinction or degradation of local populations of each affected threatened species or population and of fragmentation, decrease in extent or degradation of its habitat should be documented.                                                                                                                                                                                                                                                                                                                                     | SIS Chapter 5                  |
| 5.5 Discussion of the likely effect of the proposal at local and regional scales | Section 110(2) e1 | <i>an assessment of whether any of those species or populations is at the limit of its known distribution</i>                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                |
|                                                                                  |                   | <i>A full assessment of the likely effect of the action on those species and populations, including, if possible, the quantitative effect of local populations in the cumulative effect in the region.</i> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | SIS Chapter 5                  |
|                                                                                  | Section 110(2) h  |                                                                                                                                                                                                            | Provision of information to allow adequate determination of the significance of the effects of the proposal in accordance with section 5A of the EP&A Act is required. The significance of impacts in the study area for conservation of affected threatened species or endangered populations in the locality must be discussed. An assessment of the significance of such impacts must compare and take in to account the differences in the type, condition, and the tenure and long-term security, of other areas of known habitats in the locality with those in the study area. | SIS Chapter 5<br>SIS Chapter 8 |
| 5.5.1 Significance within a local context                                        |                   |                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                |
| 5.5.2 Discussion of                                                              |                   |                                                                                                                                                                                                            | The potential of the proposal to increase                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SIS Chapter 5                  |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                  | TSC Act Section   | Requirements                                                                                                                                                                                                                                                                                                              | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | SIS Section      |
|----------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| connectivity                                 |                   |                                                                                                                                                                                                                                                                                                                           | fragmentation of the habitat or decrease the ability for movement of individuals and or gene flow between habitats or populations of a threatened species or population must be appraised.<br><br>Assessment of effects must not be limited only to threats that are recognised as key threatening processes, but must include other threatening processes that are generally accepted by the scientific community as affecting the species or population and are likely to be caused or exacerbated by the proposal. Assessment should also include consideration of information in the Priorities Action Statement and any approved or draft recovery plans. |                  |
| 5.5.3 Consideration of threatening processes |                   |                                                                                                                                                                                                                                                                                                                           | Where a Statement of Environmental Effects, Environmental Impact Statement or Review of Environmental Factors deals with these matters, the SIS may refer to the relevant section of the SEE, EIS or REF as long as the document referred to is provided with the SIS. The SIS must include details of the condition and use of other parts of the subject area and why these can or cannot be considered as feasible alternatives.                                                                                                                                                                                                                            | SIS Chapter 5    |
| 5.6 Description of Feasible alternatives     | Section 110(2)(h) | <i>a description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed, having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development.</i> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SIS section 5.15 |
| 6. Assessment of Likely                      |                   |                                                                                                                                                                                                                                                                                                                           | Assessment of impacts must consider the nature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                                               | TSC Act Section   | Requirements                                                                                                                                                                                                                                                                                                                                                                     | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | SIS Section     |
|---------------------------------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Impacts on Endangered Ecological Communities                              |                   |                                                                                                                                                                                                                                                                                                                                                                                  | <p>extent and timing of the proposal and all associated actions, including but not restricted to construction, provision and ongoing maintenance of approved or proposed actions.</p> <p>This Requirement requires you to refine the list of subject threatened species and populations in order to identify which threatened species or endangered populations may be affected directly or indirectly (including cumulatively), by the proposal. This must include reference to the ecological community as described by the NSW scientific committee, and to the requirements outlined previously in section 4 of these requirements and take in to account any relevant recovery plans and draft recovery plans and vegetation assessment and mapping.</p> |                 |
| 6.1 Assessment of endangered ecological communities likely to be affected | Section 110(3)(a) | <p><i>A general description of the ecological community present in the area that is the subject of the action and in any area that is likely to be affected by the action.</i></p> <p><i>A full description of the type, size, and condition of the habitat of the ecological community and details of the distribution and condition of similar habitats in the region.</i></p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SIS Section 6.1 |
| 6.2 Description of Habitat                                                | Section 110(3)©   |                                                                                                                                                                                                                                                                                                                                                                                  | <p>An assessment of habitat that study area is required and must include: a description of each threatened ecological community, including: a description those areas where the community may only be represented</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | SIS section 6.2 |
| 6.2.1 Study Area                                                          |                   |                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SIS section 6.2 |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                           | TSC Act Section   | Requirements                                                                                                                                                                                                                    | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | SIS Section                                   |
|---------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
|                                       |                   |                                                                                                                                                                                                                                 | <p>by soil stored seed with no or few above ground elements, and description of disturbance history and recovery capacity, comparison of the affected community with the endangered ecological community as determined by the NSW Scientific Committee; reference to any relevant available recovery plans and draft recovery plans and vegetation assessment and mapping; maps, consistent with the descriptions provided, showing the extent and condition of the community.</p> <p>A discussion of each threatened ecological community populations in the locality must be provided, including comparisons with other known occurrences and their habitats with those in the study area in terms of remnant sizes, connectivity, species diversity and abundances, quality and condition; the tenure and long-term security of other occurrences and its habitat; the relative significance of the subject site for each threatened ecological community in the locality and the region.</p> |                                               |
| 6.2.2 Locality                        |                   |                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>SIS section 6.3</p> <p>SIS section 6.4</p> |
| 6.3 Discussion of conservation status | Section 110(3)(b) | <p><i>For each ecological community present, details of its local, regional and state-wide conservation status, the key threatening processes generally affecting it, its habitat requirements and any recovery plan or</i></p> | <p>The relative significance of the subject site for threatened ecological community in the locality must be discussed. In particular, discussion of other known populations must be provided. Such an assessment</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | SIS section 6.3                               |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                                                      | TSC Act Section    | Requirements                                                                                                                                                                                              | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SIS Section                        |
|----------------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
|                                                                                  |                    | <i>any threat abatement plan applying to it.</i>                                                                                                                                                          | must consider and compare the differences in remnant sizes, connectivity, species diversity and abundances, quality and condition, tenure and long-term security of other known occurrences and habitats in the locality with those in the study area.<br><br>The SIS must also include reference to the threatening processes that are generally accepted by the scientific community as affecting each ecological community and are likely to be caused, promoted, or exacerbated by the proposal and to the Priorities action statement and any approved or draft recovery plans or threat abatement plans which may be relevant to the proposal, |                                    |
|                                                                                  | Section 110(3)(b1) | <i>Assessment of whether those ecological communities are adequately represented in conservation reserves (or other similar protected areas within the region.</i>                                        | Known occurrences in the locality and region of the fragmentation, decrease in extent or degradation of each ecological community or its habitat should be documented.                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SIS section 6.3                    |
|                                                                                  | Section 110(3)(b2) | <i>an assessment of whether any of those ecological communities is at the limit of its know distribution</i>                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SIS section 6.3<br>SIS section 6.4 |
| 6.4 Discussion of the likely effect of the proposal at local and regional scales | Section 110(2)(g)  | <i>A full assessment of the likely affect of the action on those species and populations, including, if possible the quantitative effect of local populations in the cumulative effect in the region.</i> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SIS section 6.4                    |
| 6.4.1 Significance within a local context                                        |                    |                                                                                                                                                                                                           | The significance of impacts in the study area for conservation of affected ecological communities in                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | SIS section 6.4                    |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                      | TSC Act Section | Requirements | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | SIS Section     |
|----------------------------------|-----------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 6.4.2 Extent of habitat removal  |                 |              | <p>the locality must be discussed. An assessment of the significance of such impacts must compare and take into account the differences in remnant, sizes, connectivity, species diversity and abundances, quality and condition, tenure and long-term security of other known occurrences and habitats in the locality with those in the study area.</p> <p>The location, nature and extent of habitat removal or modification which may result from the proposed action including cumulative loss of habitat from the study area and the impacts of this on the viability of the EEC in the locality. This must include an assessment of the proportion of EEC to be affected by the proposal, in relation to the total extent of the EEC at the local level</p> <p>the potential of the proposal to increase fragmentation of each threatened ecological community, its relation to adjoining vegetation and to exacerbate edge effects or to decrease the ability for movement of individuals and/or gene flow between habitats in the proximate reserved lands, particularly Turiban Reserve, Mona St reserve, and Clive Evatt reserve, must be discussed. If connectivity between adjacent remnants of endangered ecological</p> | SIS section 6.4 |
| 6.4.3 Discussion of connectivity |                 |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | SIS section 6.4 |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                  | TSC Act Section   | Requirements                                                                                                                                                                                                                                                                                                              | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SIS Section     |
|----------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 6.4.4 Consideration of threatening processes |                   |                                                                                                                                                                                                                                                                                                                           | communities is likely to be affected, the impact of the proposal on connectivity must also be discussed<br><br>Assessment of effects must not be limited only to threats that are recognised as key threatening processes, but must include other threatening processes that are generally accepted by the scientific community as affecting the species or population and are likely to be caused or exacerbated by the proposal. Assessment should also include consideration of information in the Priorities action Statement and any approved or draft recovery plans or threat abatement plans which may be relevant to the proposal. | SIS section 6.4 |
| 6.5 Description of feasible alternatives     | Section 110(3)(e) | <i>a description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed, having regard to the biophysical, economic and social considerations and the principals of ecologically sustainable development.</i> | Where a Statement of Environmental Effects, Environmental Impact Statement or Review of Environmental Factors deals with these matters, the SIS may refer to the relevant section of the SEE, EIS or REF. the SIS must include details of the condition and use of other parts of the subject area and why these can or cannot be considered as feasible alternatives.                                                                                                                                                                                                                                                                      | SIS section 6.5 |
| 7 Ameliorative Measures                      |                   |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SIS Chapter 7   |
| 7.1 Description of                           | Sections          | <i>A full description of and justification of the measures</i>                                                                                                                                                                                                                                                            | Ameliorative or compensatory measures proposed to                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | SIS section 7.1 |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                           | TSC Act Section                    | Requirements                                                                                                                                                                                     | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | SIS Section     |
|---------------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| ameliorative measures                 | 110(2)(i);<br>Section<br>110(3)(f) | <i>proposed to mitigate any adverse effect of the action on the species and populations [s.110 (2) (i)] [or] ecological community [s.110 (3) (f)] including a compilation of those measures.</i> | reduce or offset the level of impact should only be considered where it can be shown that they have been successful applied elsewhere. The likely efficiency of such measures with respect to the current proposal should be assessed in detail.<br><br>Consideration must be given to developing long term management strategies to protect areas within the study area which are of particular importance for the threatened species or endangered populations likely to be affected. This may include proposals to restore or improve habitat onsite where possible | SIS section 7.2 |
| 7.1.1 Long Term management Strategies |                                    |                                                                                                                                                                                                  | Compensatory benefits likely to result from such measures proposed for alternative sites are to be discussed and evaluated along with a discussion of mechanisms of how they might best occur                                                                                                                                                                                                                                                                                                                                                                          | SIS section 7.1 |
| 7.1.2 Compensatory strategies         |                                    |                                                                                                                                                                                                  | Any proposed pre-construction monitoring plans or on-going monitoring of the effectiveness of the mitigation measures must be outlined in detail, including objectives of the monitoring program, method of monitoring, reporting framework, duration and frequency. Generally, ameliorative strategies which have not been proved effective should be undertaken under experimental design conditions and                                                                                                                                                             | SIS section 7.2 |
| 7.1.3 Ongoing monitoring              |                                    |                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | SIS section 7.3 |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                                      | TSC Act Section | Requirements                                                                                                                                               | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | SIS Section     |
|------------------------------------------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 7.1.4 Translocation                                              |                 |                                                                                                                                                            | <p>appropriately monitored</p> <p>The DECC does not consider that translocation of threatened species, populations and ecological communities is an appropriate ameliorative strategy for the purposes of considering impacts of a particular development/activity.</p> <p>An assessment of significance (in accordance with section 5A EP&amp;A act) is to be provided for each of the affected threatened species, population or ecological identified in the SIS and must incorporate relevant information require in sections 5.1 to 7. On the basis of the assessment a conclusion is to be provided concerning whether, based upon more detailed assessment through SIS process and consideration of alternatives and/or ameliorative measures proposed in the SIS, the proposal is still considered likely to have a significant impact on the threatened species, population or ecological community or its habitat.</p> | SIS section 7.4 |
| 8 Assessment of significance of likely Effect of proposed action |                 |                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SIS Chapter 8   |
| 9 Additional Information                                         |                 |                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |
| 9.1 Qualifications and experience                                | Section 110(4)  | <i>A species impact statement must include details of the qualifications and experience in threatened species conservation of the person preparing the</i> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SIS Appendix D  |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                                                  | TSC Act Section   | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                       | Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | SIS Section     |
|--------------------------------------------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|                                                              |                   | <i>statement and of any other person who has conducted research or investigations relied on in preparing the statement.</i>                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |
| 9.2 Other approvals required for the development or activity | Section 110(3)(g) | <i>a list of any approvals that must be obtained under any other act or law before the action may be lawfully carried out, including details of the conditions of any existing approvals that are relevant to the species or population or ecological community</i> <ul style="list-style-type: none"> <li>➤ <i>General Licence (section 120) to harm or obtain protected fauna (this may include threatened fauna;</i></li> </ul> | Other approvals under NSW law: Where a consent is required under part 4 of the EP&A Act 1979, the name of the consent authority and the timing of the development application should be included; or where an approval(s) is required under part 5 of the EP&A Act 1979, the name of the determining authority(ies), the basis for the approval and when these approvals are proposed to be obtained should be included. Approval Under the EPBC Act 1999 and action will require referral to, and may require the approval of the federal minister for the Environment and Water Resources, if that action will have, or is likely to have, significant impact on the environment or on a matter of national significance. | SIS section 9.2 |
| 9.3 Licensing matters relating to conducting surveys         | NPW Act 1974      | <ul style="list-style-type: none"> <li>➤ <i>Licence to pick protected flora (section 131;</i></li> </ul>                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SIS section 9.3 |

**Table A.1 COMPLIANCE WITH DIRECTOR GENERAL'S REQUIREMENTS**

| DGR Section                 | TSC Act Section                                                | Requirements                                                                                                                                                                                                                                                                                                                                                          | Additional Information                                                                                                                                                                                                                                | SIS Section     |
|-----------------------------|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|                             |                                                                | <p>➤ <i>Scientific Licence (section 132C) to authorise the carrying out of actions for scientific, educational or conservation purposes.</i></p> <p><i>Licence to harm threatened animal species, and/or pick threatened plants and/or damage the habitat of threatened species(section91)</i></p> <p><i>Animal research Authority to undertake fauna surveys</i></p> |                                                                                                                                                                                                                                                       |                 |
| 9.4 Section 110 (5) reports | TSC Act 1995<br>Animal<br>Research Act 1985<br>Section 110 (5) |                                                                                                                                                                                                                                                                                                                                                                       | <p>Section 110 (5) of the TSC act 1995 has the effect of requiring DECC to provide that information regarding the State-wide conservation Status of the subject species as it ahs available, in order to satisfy ss.110 (2) &amp; (3) of the act.</p> | SIS section 9.4 |

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*Appendix B*

Species Lists and Quadrat Photographs

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## B.1 Flora

Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE

| Gardens       |                         |                      |   |      |      |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Croquet |      |
|---------------|-------------------------|----------------------|---|------|------|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|
| Family        | Scientific Name         | Common Name          | 1 | 2    | 3    | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Lawn    | BGHP |
| Trees         |                         |                      |   |      |      |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Aceraceae     | *Liquidambar            |                      |   |      |      |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
|               | styraciflua             | Liquidambar          |   |      |      |   |   |   |   |   | 1 |    |    |    |    |    |    | 1  |    |    |    |    |         |         |      |
| Arecaceae     | *Livistona australis    | Cabbage Palm         |   |      | 1    |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Bignoniaceae  | *Jacaranda mimosifolia  | Jacaranda            | 1 |      |      |   |   | 1 |   |   |   |    | 2  | 1  |    |    |    | 1  |    |    |    |    |         |         |      |
| Casuarinaceae | Allocasuarina torrulosa | Forest Oak           |   |      | 1    |   |   |   |   |   |   |    |    |    |    |    |    |    | 1  |    |    |    |         |         |      |
| Cunoniaceae   | *Ceratopetalum          |                      |   |      |      |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
|               | apetalum - pl           | Coachwood            |   |      | 1    |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Cupressaceae  | *Callitris rhomboidea   | Port Jackson Pine    |   |      |      |   |   |   |   |   |   | 5  | 1  |    |    |    |    |    |    |    |    |    |         |         |      |
| Cupressaceae  | *Cupressus sp           | Cypress              |   |      |      |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Ericaceae     | *Rhododendron sp cv     | Rhododendron         | 5 |      |      |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Lauraceae     | *Cinnamomum             |                      |   |      |      |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
|               | camphora                | Camphor Laurel       |   |      |      |   |   |   |   |   |   |    |    |    | 1  |    | 1  |    |    |    |    |    |         |         |      |
| Malvaceae     | Brachychiton            |                      |   |      |      |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
|               | acerifolius             | Illawarra flame-tree |   |      |      |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         | x    |
| Moraceae      | *Ficus rubiginosa - pl  | Rusty Fig            |   |      |      |   |   |   |   |   |   | 1  | 5  |    |    |    |    |    |    |    |    |    | x       |         |      |
| Myrtaceae     | Angophora floribunda    | Rough-barked         | 5 | dead | dead |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    | 5  |    |         |         |      |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family    | Scientific Name                | Common Name        | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13        | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Croquet |      |
|-----------|--------------------------------|--------------------|---|---|---|---|---|---|---|---|---|----|----|----|-----------|----|----|----|----|----|----|----|---------|---------|------|
|           |                                |                    |   |   |   |   |   |   |   |   |   |    |    |    |           |    |    |    |    |    |    |    |         | Lawn    | BGHF |
|           |                                | Apple              |   |   |   |   |   |   |   |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         |      |
|           |                                | Smooth-barked      |   |   |   |   |   |   |   |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         |      |
| Myrtaceae | <i>Angophora costata</i>       | Apple              |   |   |   |   |   |   |   |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         | x    |
|           | <i>*Callistemon salignus</i> - |                    |   |   |   |   |   |   |   |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         |      |
| Myrtaceae | pl                             | Willow Bottlebrush |   |   |   |   |   | 6 |   |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         |      |
|           |                                | Lemon-scented      |   |   |   |   |   |   |   |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         |      |
| Myrtaceae | <i>*Corymbia citriodora</i>    | Gum                |   |   |   |   |   |   | 1 |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         |      |
| Myrtaceae | <i>*Corymbia maculata</i>      | Spotted Gum        |   |   |   |   |   |   |   |   |   | 5  |    |    |           |    |    |    |    |    |    |    |         |         |      |
|           |                                | Narrow-leaved      |   |   |   |   |   |   |   |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         |      |
| Myrtaceae | <i>*Eucalyptus crebra</i>      | Ironbark           |   |   |   |   |   |   |   |   |   | 1  |    |    |           |    |    |    |    |    |    |    |         |         |      |
| Myrtaceae | <i>*E. grandis</i>             | Flooded Gum        |   |   |   |   |   |   | 5 |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         |      |
| Myrtaceae | <i>E. pilularis</i>            | Blackbutt          |   |   | 5 |   |   |   |   |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         |      |
| Myrtaceae | <i>E. saligna</i>              | Blue Gum           | 5 | 1 | 6 | 6 | 6 | 5 |   | 7 | 5 | 6  |    | 1  | 5         | 5  |    |    | 5  | 5  | 5  |    |         |         | x    |
| Myrtaceae | <i>E. paniculata</i>           | Grey Gum           |   |   |   |   |   |   |   |   |   |    | 5  |    |           |    |    |    |    |    |    |    |         |         |      |
|           |                                |                    |   |   |   |   |   |   |   |   |   |    |    |    | 5         |    |    |    |    |    |    |    |         |         |      |
|           |                                |                    |   |   |   |   |   |   |   |   |   |    |    |    | (planted) |    |    |    |    |    |    |    |         |         |      |
| Myrtaceae | <i>Syzygium paniculatum</i>    | Magenta Lillypilly |   |   |   |   |   |   |   |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         |      |
|           | <i>Syncarpia glomulifera</i> - |                    |   |   |   |   |   |   |   |   |   |    |    |    |           |    |    |    |    |    |    |    |         |         |      |
| Myrtaceae | pl                             | Turpentine         |   |   | 1 | 1 |   |   |   |   |   |    |    |    |           |    |    |    | 1  |    |    |    |         |         | x    |
| Myrtaceae | <i>Acmena smithii</i>          | Lilly Pilly        |   |   |   |   |   |   |   |   |   |    |    |    |           |    |    |    |    |    |    | 1  |         |         |      |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

|                |                                 |                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Croquet |      |  |
|----------------|---------------------------------|--------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|--|
| Family         | Scientific Name                 | Common Name        | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Lawn    | BGHP |  |
|                | <i>Olea europaea</i> spp.       |                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Oleaceae       | <i>cuspidata</i>                | African olive      |   |   |   |   |   |   |   |   |   |    | 1  |    |    |    | 2  |    |    | 1  |    |    |         |         |      |  |
| Pinaceae       | * <i>Pinus radiata</i>          | Monterey Pine      |   |   |   |   | 1 |   |   |   |   |    |    |    |    |    |    |    | 2  | 2  |    |    |         |         | x    |  |
| Pittosporaceae | <i>Pittosporum undulatum</i>    | Sweet Pittosporum  | 5 |   |   |   | 5 |   |   |   |   | 5  |    |    |    |    | 6  | 5  | 5  | 2  |    |    |         |         | x    |  |
| Podocarpaceae  | * <i>Podocarpus elatus</i>      | Plum Pine          |   |   |   |   |   | 1 |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Proteaceae     | * <i>Grevillea robusta</i>      | Silky Oak          |   | 1 |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Proteaceae     | * <i>Stenocarpus sinuatus</i>   | Wheel-of-fire Tree |   | 1 |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         | x    |  |
|                |                                 | Small-leaved       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Sapindaceae    | * <i>Cupaniopsis parvifolia</i> | Tuckeroo           |   |   |   | 5 |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Shrubs         |                                 |                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
|                |                                 |                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Amygdalaceae   | * <i>Prunus</i> sp cv           | Flowering Cherry   | 1 | 1 |   |   | 1 |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Araucariaceae  | * <i>Araucaria bidwillii</i>    | Bunya Pine sapling |   |   |   |   |   |   |   |   |   | 1  |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Araucariaceae  | * <i>A. cunninghamii</i>        | Hoop Pine sapling  |   |   |   |   | 1 |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Araliaceae     | * <i>Polyscias elegans</i>      | Celerywood sapling |   |   |   | 1 |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
|                | * <i>Ageratina</i>              |                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Asteraceae     | <i>megalophylla</i>             |                    | 6 |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Berberidaceae  | * <i>Nandina domestica</i>      | Sacred Bamboo      | 1 |   |   |   |   |   |   |   |   |    |    |    |    |    | 2  |    | 1  |    |    |    |         |         |      |  |
| Bignoniaceae   | * <i>Jacaranda mimosifolia</i>  | Jacaranda sapling  | 1 |   |   | 1 |   |   |   |   |   |    |    |    | 1  |    |    |    |    |    |    |    |         |         |      |  |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family         | Scientific Name                  | Common Name       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Croquet |      |
|----------------|----------------------------------|-------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|
|                |                                  |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Lawn    | BGHF |
| Caesalpinaceae | <i>*Senna pendula</i>            |                   |   |   |   |   |   |   |   |   |   |    | 2  |    |    |    |    |    |    |    |    |    |         |         | x    |
|                | <i>*Callicoma serratifolia</i> - |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Cunoniaceae    | pl                               | Callicoma sapling |   |   |   |   |   |   | 2 | 1 |   |    |    |    |    |    |    |    |    |    |    | 2  |         |         |      |
|                | <i>*Ceratopetalum</i>            |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Cunoniaceae    | <i>gummiferum</i> - pl           | Christmas Bush    |   |   |   |   |   |   | 2 |   |   |    |    |    |    |    |    |    |    |    |    | 2  |         |         |      |
|                |                                  |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Cyatheaceae    | <i>*Cyathea australis</i>        | Rough Tree Fern   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Cyatheaceae    | <i>Cyathea</i> sp.               |                   |   |   |   |   |   |   |   |   |   |    | 5  |    |    |    |    |    |    |    |    |    |         |         |      |
|                | <i>Elaeocarpus</i>               |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Elaeocarpaceae | <i>reticulatus</i> - pl          | Blueberry Ash     |   |   | 1 |   |   |   | 2 |   |   |    |    |    |    |    |    | 1  |    |    |    | 1  |         |         | x    |
|                |                                  | Rhododendron      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Ericaceae      | <i>*Rhododendron</i> sp cv       | juvenile          | 1 |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Ericaceae      | <i>*Tsutsusi</i> sp.             | Azalea            |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Escalloniaceae | <i>*Escallonia</i> sp            |                   |   |   |   |   |   |   |   |   |   | 1  |    |    |    |    |    |    |    |    |    |    |         |         |      |
|                | <i>Omalanthus</i>                |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Euphorbiaceae  | <i>populifolius</i>              | Bleeding Heart    |   |   |   |   |   |   |   | 3 |   |    |    |    |    |    |    |    |    |    |    | 1  | x       |         |      |
|                | <i>*Genista</i>                  |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Fabaceae       | <i>monspessulana</i>             | Montpellier Broom |   |   | 7 | 2 |   |   |   |   | 2 | 5  | 5  | 5  | 7  |    |    |    |    | 5  |    |    |         |         |      |
|                |                                  | Green Wattle      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Fabaceae       | <i>*Acacia decurrens</i>         | saplings          |   |   | 1 | 2 |   |   |   |   |   |    |    |    |    | 1  |    |    |    |    |    |    |         |         |      |
| Fabaceae       | <i>A. floribunda</i>             | Sally Wattle      |   |   |   |   |   |   | 2 |   |   |    |    |    |    |    |    |    | 1  |    |    |    |         |         |      |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family    | Scientific Name                           | Common Name                     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20  | Gardens | Croquet |      |
|-----------|-------------------------------------------|---------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|-----|---------|---------|------|
|           |                                           |                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |     |         | Lawn    | BGHF |
| Fabaceae  | <i>A. baileyana</i>                       | Cootumundra wattle              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |     |         | x       |      |
| Fabaceae  | <i>A. longifolia</i>                      |                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |     |         |         | x    |
| Fabaceae  | <i>A. elata</i>                           |                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |     |         |         |      |
| Fabaceae  | <i>Paraserianthes lophantha</i>           | Cape Leeuwin wattle             |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    | adj |         |         |      |
| Fabaceae  | <i>Pultenaea</i> sp.                      |                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |     |         | x       |      |
| Fabaceae  | <i>*Senna pendula</i> var <i>glabrata</i> | Cassia                          |   |   |   |   | 1 |   |   |   |   |    |    |    |    |    |    |    |    |    |    |     |         |         |      |
| Fabaceae  | <i>*Cinnamomum camphora</i>               | Camphor Laurel saplings         |   | 2 |   |   | 3 |   |   |   |   | 3  |    |    |    |    |    |    |    |    |    |     |         |         |      |
| Lauraceae | <i>*Rhaphiolepis indica</i>               | Indian Hawthorn                 |   |   |   |   |   |   |   |   |   | 1  |    |    |    |    |    |    |    |    |    |     |         |         |      |
| Malvaceae | <i>Sida rhombifolia</i>                   |                                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    | 5  | 2   |         |         |      |
| Meliaceae | <i>*Melia azedarach</i>                   | White Cedar                     |   |   |   |   |   |   |   | 1 |   |    |    |    |    |    |    |    | 1  |    |    |     |         |         |      |
| Meliaceae | <i>*Acmena smithii</i> var <i>minor</i>   | Lilly Pilly (small-leaved race) |   |   |   |   |   |   | 2 |   |   |    |    |    |    |    |    |    |    |    |    |     |         |         |      |
| Myrtaceae | <i>*Backhousia myrtifolia</i>             | Grey Myrtle                     |   |   |   |   |   |   | 2 | 2 |   |    |    |    |    |    |    |    |    |    |    |     |         |         |      |
| Myrtaceae | <i>Eucalyptus saligna</i> - pl            | Blue Gum sapling                |   |   |   |   |   |   | 1 | 1 |   |    |    |    |    |    |    |    |    |    |    |     |         |         |      |
| Myrtaceae | <i>*Melaleuca armillaris</i>              | Bracelet Honey-myrtle           |   |   |   |   |   |   |   |   |   | 1  |    |    |    |    |    |    |    |    |    |     |         |         |      |
| Ochnaceae | <i>*Ochna serrulata</i>                   | Mickey Mouse Plant              | 2 | 2 |   |   | 2 |   |   |   |   |    | 2  |    |    |    |    |    | 3  |    |    |     |         |         |      |
| Oleaceae  | <i>*Ligustrum lucidum</i>                 | Large-leaved Privet             | 3 | 6 | 2 | 2 | 5 | 2 |   |   |   | 7  | 5  |    |    |    | 5  | 5  |    | 5  |    |     |         |         | x    |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family         | Scientific Name                   | Common Name                   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Croquet |      |
|----------------|-----------------------------------|-------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|
|                |                                   |                               |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Lawn    | BGHF |
|                |                                   | saplings                      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Oleaceae       | <i>*L. sinense</i>                | Small-leaved Privet           | 1 |   |   |   | 1 |   |   |   |   | 2  | 3  |    |    |    |    |    |    |    |    |    |         |         |      |
| Oleaceae       | <i>*Olea europea ssp africana</i> | African Olive saplings        |   | 1 |   |   |   | 1 |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | x       |      |
| Pittosporaceae | <i>*Pittosporum tobira</i>        | Japanese Cheesewood           |   |   | 1 |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Pittosporaceae | <i>P. undulatum</i>               | Sweet Pittosporum             | 2 | 2 |   |   | 1 | 1 |   | 1 | 2 | 5  |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Rhamnaceae     | <i>Pomaderris lanigera</i>        | Woolly Pomaderris             |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         | x    |
| Rosaceae       | <i>*Cotoneaster glaucophylla</i>  | Cotoneaster                   |   |   | 1 |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Rosaceae       | <i>*Cotoneaster franchetti</i>    | Grey Cotoneaster              |   |   |   |   |   |   |   |   |   | 1  |    | 1  |    | 1  |    |    |    |    |    |    |         |         |      |
| Sapindaceae    | <i>*Alectryon tomentosus</i>      |                               | 1 | 1 |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Sapindaceae    | <i>*Cupaniopsis parvifolia</i>    | Small-leaved Tuckeroo sapling |   |   |   | 1 |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Sapindaceae    | <i>*Brachychiton acerifolius</i>  | Flame Tree saplings           | 1 |   |   |   | 1 |   |   |   |   | 1  | 1  |    |    |    |    |    |    |    |    |    |         |         |      |
| Strelitziaceae | <i>Strelitzia reginae</i>         | Bird of paradise              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | 2  | 2  |    |    |         |         | x    |
| Theaceae       | <i>Camellia</i> sp.               |                               |   |   |   |   |   |   |   |   |   | 5  |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Ulmaceae       | <i>*Celtis occidentalis</i>       | Hackberry saplings            | 1 |   |   | 1 |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Ulmaceae       | <i>Trema tomentosa</i>            | Poison Peach                  |   |   |   |   |   |   |   |   |   |    |    | 1  |    | 1  |    |    |    | 1  |    |    |         |         |      |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family         | Scientific Name              | Common Name        | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Croquet |      |  |
|----------------|------------------------------|--------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|--|
|                |                              |                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Lawn    | BGHP |  |
| Herbs - Dicots |                              |                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Aspleniaceae   | <i>Asplenium nidus</i>       | Birds Nest Fern    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    | x       |         |      |  |
| Acanthaceae    | <i>*Acanthus mollis</i>      | Oyster Plant       |   |   |   |   |   |   |   | 2 |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Acanthaceae    | <i>Pseuderanthemum</i>       |                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
|                | <i>variable</i>              | Pastel Flower      |   |   | 3 | 2 |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
|                | <i>*Ciclosperma</i>          |                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Apiaceae       | <i>leptophylla</i>           | Slender Celery     |   |   |   |   |   |   | 2 | 2 | 2 |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Apiaceae       | <i>Centella asiatica</i>     |                    |   |   |   |   |   |   |   |   |   |    |    |    | 2  | 3  |    |    |    |    |    |    |         | x       |      |  |
| Araliaceae     | <i>Hydrocotyle</i> sp.       |                    |   |   |   |   |   |   |   |   |   |    |    |    |    | 1  |    |    |    |    |    |    |         |         |      |  |
| Asteraceae     | <i>*Ageratina adenophora</i> | Crofton Weed       |   |   |   |   |   |   |   | 1 |   |    |    |    | 3  | 2  |    | 1  | 2  |    |    |    |         |         |      |  |
| Asteraceae     | <i>*Ageratina riparia</i>    |                    |   |   |   |   |   |   |   |   |   |    |    |    | 2  |    | 2  |    |    |    |    |    |         |         | x    |  |
| Asteraceae     | <i>*Bidens pilosa</i>        | Farmers Friends    |   |   |   |   |   |   | 1 | 1 | 3 |    |    |    | 1  |    |    |    |    | 2  |    |    |         | x       |      |  |
| Asteraceae     | <i>*Cirsium vulgare</i>      | Spear Thistle      |   |   |   |   |   |   | 2 | 2 |   |    |    |    | 1  |    |    |    |    |    | 3  | 2  |         |         |      |  |
| Asteraceae     | <i>*Conyza albida</i>        | Tall Fleabane      | 1 |   |   |   |   | 2 | 2 | 3 | 3 |    |    | 1  |    | 2  |    |    |    |    |    |    |         |         |      |  |
| Asteraceae     | <i>Conyza</i> sp.            |                    |   |   |   |   |   |   |   |   |   |    |    |    | 4  |    |    | 2  |    |    |    | 2  |         | x       |      |  |
|                | <i>*Crassocephalum</i>       |                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Asteraceae     | <i>crepidioides</i>          | Thickhead          |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    | 1  |    |         | x       |      |  |
|                | <i>*Erechtites</i>           |                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Asteraceae     | <i>valerianifolia</i>        | Brazilian Fireweed |   |   |   |   |   |   |   | 3 |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family          | Scientific Name                | Common Name                  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Croquet |      |
|-----------------|--------------------------------|------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|
|                 |                                |                              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Lawn    | BGHF |
| Asteraceae      | <i>Euchiton sphaericum</i>     |                              |   |   |   |   |   |   |   |   |   |    |    | 2  |    |    |    |    |    |    |    |    |         |         | x    |
| Asteraceae      | <i>Euchiton</i> sp.            |                              |   |   |   |   |   |   |   |   |   |    |    |    | 4  |    |    |    |    |    |    |    |         |         |      |
| Asteraceae      | <i>*Hypochaeris radicata</i>   | Flatweed                     |   |   |   | 1 |   | 1 |   | 3 |   |    |    |    | 3  | 4  |    |    |    |    |    | 3  |         |         | x    |
| Asteraceae      | <i>Hypochaeris</i> sp1         |                              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    | 3  |    |    |    |    |         |         |      |
| Asteraceae      | <i>Hypochaeris</i> sp. 2       |                              |   |   |   |   |   |   |   |   |   |    |    |    | 1  |    |    | 1  |    |    |    |    |         |         |      |
|                 | <i>*Senecio</i>                |                              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Asteraceae      | <i>madagascariensis</i>        | Fireweed                     |   |   |   |   |   | 2 |   | 2 |   |    |    | 1  |    | 5  |    | 2  | 1  |    | 1  | 1  |         |         | x    |
| Asteraceae      | <i>Senecio vagus</i>           |                              |   |   |   |   |   |   |   |   |   |    |    |    |    | 2  |    |    |    |    |    |    |         |         |      |
| Asteraceae      | <i>*Sonchus oleraceus</i>      | Sow Thistle                  |   |   |   |   |   |   | 1 |   | 2 |    |    |    |    |    |    | 1  |    |    | 1  |    |         |         |      |
| Asteraceae      | <i>*Taraxacum officinale</i>   | Dandelion                    |   |   |   |   |   |   |   | 1 |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Brassicaceae    | <i>*Cardamine hirsuta</i>      | Flickweed                    |   |   |   |   |   |   |   |   | 3 |    |    |    |    | 2  |    |    |    |    |    |    |         |         |      |
| Campanulaceae   | <i>Wahlenbergia gracilis</i>   |                              |   |   |   |   |   |   |   |   |   |    |    |    |    | 1  |    |    |    |    |    |    |         |         | x    |
|                 | <i>*Cerastium</i>              | Sticky Mouse-eared           |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Caryophyllaceae | <i>glomeratum</i>              | Chickweed                    |   |   |   |   |   |   | 1 |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         | x    |
|                 |                                | Common Mouse-eared Chickweed |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Caryophyllaceae | <i>Cerastium fontanum</i>      |                              |   |   |   |   |   |   |   |   |   |    |    |    | 3  | 2  |    |    |    |    |    |    |         |         |      |
| Chenopodiaceae  | <i>Einadia hastata</i>         |                              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    | 1  |    |         |         |      |
| Convolvulaceae  | <i>Dichondra repens</i>        | Kidney Plant                 | 1 |   |   | 3 | 1 | 2 |   | 2 |   |    |    |    |    | 2  |    | 1  |    | 1  | 2  |    | x       |         |      |
| Davaliaceae     | <i>*Nephrolepis cordifolia</i> | Fishbone Fern                |   | 7 | 5 |   |   |   |   |   |   |    |    |    | 6  | 5  | 5  |    |    |    |    |    | x       |         |      |
| Euphorbiaceae   | <i>*Euphorbia peplus</i>       | Petty Spurge                 |   |   |   |   |   |   | 3 | 3 | 3 |    |    |    |    |    |    |    |    |    |    |    |         |         |      |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family         | Scientific Name               | Common Name         | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Croquet |      |
|----------------|-------------------------------|---------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|
|                |                               |                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Lawn    | BGHF |
| Euphorbiaceae  | <i>Poranthera microphylla</i> |                     |   |   |   |   |   |   |   |   |   |    |    | 2  |    |    |    |    |    |    |    |    |         | x       |      |
|                | <i>*Genista</i>               |                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Fabaceae       | <i>monspessulana</i>          |                     |   |   | 2 |   |   |   |   |   |   |    |    |    |    | 5  |    | 2  |    | 2  |    |    |         |         |      |
| Fabaceae       | <i>*Medicago polymorpha</i>   | Medic               |   |   |   |   |   |   | 1 |   |   |    |    |    |    |    |    |    |    |    |    | 1  |         |         |      |
| Fabaceae       | <i>*Trifolium repens</i>      | White Clover        |   |   |   |   |   |   | 2 |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Fumariaceae    | <i>*Fumaria</i> sp            | Fumaria             |   |   |   |   |   |   | 2 |   | 1 |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Geraniaceae    | <i>Geranium homeanum</i>      | Trailing Storksbill |   |   |   | 1 |   | 2 | 2 | 6 | 2 |    |    |    |    | 3  |    |    |    |    | 4  | 3  |         |         |      |
|                | <i>*Cinnamomum</i>            | Camphor Laurel      |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Lauraceae      | <i>camphora</i>               | seedlings           | 1 |   |   | 1 |   |   |   |   |   |    |    |    |    |    |    |    |    | 1  |    |    |         |         |      |
| Lobeliaceae    | <i>Pratia purpurascens</i>    | Whiteroot           |   |   |   |   |   | 2 |   |   |   |    |    | 4  | 1  | 1  |    |    |    |    |    |    |         |         |      |
| Malvaceae      | <i>*Modiola caroliniana</i>   |                     |   |   |   |   |   |   |   | 2 | 2 |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Malvaceae      | <i>*Sida rhombifolia</i>      | Paddys Lucerne      |   |   |   |   |   |   | 1 | 2 | 1 |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Oxalidaceae    | <i>*Oxalis pes-caprae</i>     | Sour Sob            |   |   |   |   | 1 | 1 | 2 | 2 |   |    |    | 1  |    |    | 1  |    |    |    |    | 2  | x       |         |      |
|                |                               | Rough-barked        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Myrtaceae      | <i>Angophora floribunda</i>   | Apple seedling      |   | 1 |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
|                | <i>*Olea europea</i> ssp      | African Olive       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Oleaceae       | <i>africana</i>               | seedlings           |   |   | 1 |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         | x    |
|                |                               | Mickey Mouse Plant  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Ochnaceae      | <i>*Ochna serrulata</i>       | seedlings           |   |   | 1 | 1 |   |   |   |   |   |    |    |    |    |    | 3  |    |    | 3  |    |    |         |         | x    |
| Phytolaccaceae | <i>*Phytolacca octandra</i>   | Inkweed             |   |   |   |   |   |   |   | 1 |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Plantaginaceae | <i>Plantago debile</i>        |                     | 1 |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |

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|                  |                       |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Croquet |      |  |
|------------------|-----------------------|-------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|--|
| Family           | Scientific Name       | Common Name       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Lawn    | BGHP |  |
| Plantaginaceae   | *P. lanceolata        | Lambs Tongue      |   |   |   |   | 2 | 5 | 2 | 4 |   |    |    |    | 3  | 4  |    | 3  |    |    | 4  | 6  | x       | x       | x    |  |
| Polygonaceae     | Rumex brownii         |                   |   |   |   |   |   |   |   |   | 1 |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Primulaceae      | *Anagallis arvensis   | Scarlet Pimpernel |   |   |   |   |   |   | 4 | 2 |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Primulaceae      | *Primula sp cv        | Primula           |   |   |   |   |   |   |   | 2 |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Ranunculaceae    | *Ranuncula repens     | Buttercup         |   |   |   |   |   |   |   | 1 |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
|                  |                       | Blackberry        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Solanaceae       | *Solanum nigrum       | Nightshade        |   |   |   |   |   |   | 1 | 1 |   |    |    |    |    |    |    |    |    |    | 1  | 1  |         |         |      |  |
| Tropaeolaceae    | *Tropaelum majus      | Nasturtium        |   |   |   |   |   |   |   | 3 |   |    |    |    |    |    |    |    |    |    | 1  |    |         |         |      |  |
| Verbenaceae      | *Verbena bonariensis  | Purpletop         |   |   |   |   | 1 |   | 1 | 1 | 1 |    |    |    |    |    |    |    |    |    |    |    | x       |         |      |  |
| Herbs - Monocots |                       |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
|                  |                       | a Broad-leaved    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Agavaceae        | *Cordyline fruticosa  | Palm Lily         |   |   |   | 1 |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Amaryllidaceae   | *Agapanthus sp.       | Agapanthus        |   |   |   |   | 2 |   |   |   |   | 2  |    |    |    |    |    | 2  |    |    |    | 1  |         |         |      |  |
| Amaryllidaceae   | *Crinum pedunculatum  | Swamp Lily        |   | 1 |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Amaryllidaceae   | *Crinum moorei        | Natal Lily        |   |   |   |   |   |   |   |   |   |    |    |    |    |    | 1  |    |    |    |    |    |         |         |      |  |
|                  | *Chlorophytum         |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |  |
| Anthericaceae    | comosum               | Spider plant      |   |   |   |   |   |   |   |   |   |    | 5  |    |    |    |    |    |    |    |    | 3  |         |         |      |  |
| Asparagaceae     | *Asparagus densiflora | Fern Asparagus    | 4 | 4 | 5 | 4 | 5 | 5 | 3 |   | 2 | 6  |    |    |    |    |    |    |    |    |    |    |         |         |      |  |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family        | Scientific Name                   | Common Name     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Croquet |      |
|---------------|-----------------------------------|-----------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|
|               |                                   |                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Lawn    | BGHF |
| Asparagaceae  | <i>*Asparagus aethiopicus</i>     |                 |   |   |   |   |   |   |   |   |   | 7  | 2  | 2  |    | 3  | 1  | 6  | 4  | 1  |    |    |         | x       |      |
| Asparagaceae  | <i>Asparagus scandens</i>         |                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Bambusaceae   | <i>*Phyllostachys aurea</i>       | Fishpole Bamboo |   | 2 | 1 |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Commelinaceae | <i>*Tradescantia fluminensis</i>  | Wandering Jew   |   |   |   |   |   |   |   | 2 |   |    |    |    |    |    |    |    |    | 3  |    |    |         |         |      |
| Clusiaceae    | <i>Hypericum gramineum</i>        |                 |   |   |   |   |   |   |   |   |   |    | 2  |    |    |    | 1  |    |    |    |    |    |         |         |      |
| Cyperaceae    | <i>Carex</i> sp.                  |                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | x       |      |
| Cyperaceae    | <i>*Cyperus eragrostis</i>        |                 |   |   |   |   |   |   |   | 1 |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Cyperaceae    | <i>C. gracilis</i>                |                 |   |   |   | 2 | 2 |   |   | 2 |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Cyperaceae    | <i>C. imbecillis</i>              |                 |   |   | 1 |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Cyperaceae    | <i>Cyperus</i> sp. 1              |                 |   |   |   |   |   |   |   |   |   |    | 2  |    |    |    |    |    |    |    |    |    |         |         |      |
| Cyperaceae    | <i>Cyperus</i> sp. 2              |                 |   |   |   |   |   |   |   |   |   |    | 1  |    | 2  |    | 3  |    |    |    |    |    |         |         |      |
| Iridaceae     | <i>*Freesia refracta</i>          | Freesia         |   | 4 | 3 | 2 |   | 2 |   |   |   |    |    |    | 1  |    |    |    |    |    |    |    |         |         |      |
| Iridaceae     | <i>*Dietes vegeta</i>             |                 |   |   |   |   | 2 |   |   |   | 5 |    | 1  |    |    | 3  |    | 5  | 3  |    |    |    |         |         |      |
| Iridaceae     | <i>*Crocasmia x crocosmiflora</i> | Montbrecia      | 2 |   |   |   |   |   |   |   |   |    | 2  | 1  |    |    | 2  |    |    | 2  | 2  |    |         |         | x    |
| Iridaceae     | <i>Romulea rosea</i>              |                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    | x       |         |      |
| Liliaceae     | <i>*Lilium formosanum</i>         | Formosan Lily   |   |   |   | 2 |   |   |   |   |   |    |    |    |    |    |    | 1  | 3  |    |    | x  |         |         |      |
| Musaceae      | <i>*Musa</i> sp cv                | Banana          | 1 | 1 |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family      | Scientific Name              | Common Name      | 1 | 2 | 3 | 4 | 5 | 6 | 7    | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Croquet |      |
|-------------|------------------------------|------------------|---|---|---|---|---|---|------|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|
|             |                              |                  |   |   |   |   |   |   |      |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Lawn    | BGHF |
| Musaceae    | <i>*Strelitzia reginae</i>   | Strelitzia       | 2 | 1 |   |   | 1 |   |      |   |   | 1  |    |    |    |    |    |    |    |    |    |    |         |         |      |
|             | <i>Dianella caerulea</i> var |                  |   |   |   |   |   |   | 2    |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Phormiaceae | <i>producta</i>              | Rough Flax Lily  | 1 | 1 |   | 1 | 2 | 2 | (pl) | 1 | 1 | 2  | 2  |    |    |    |    |    | 2  |    |    |    | 3       | x       |      |
|             | <i>Dianella caerulea</i> var |                  |   |   |   |   |   |   |      |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Phormiaceae | <i>caerulea</i>              |                  |   |   |   |   |   |   |      |   |   |    |    |    |    |    |    | 1  |    |    |    |    |         |         |      |
| Poaceae     | <i>*Axonopus affinis</i>     | Carpet Grass     | 1 |   |   |   |   |   |      |   |   |    |    | 7  | 3  | 7  |    | 8  |    | 6  |    |    |         | x       |      |
|             | <i>*Anthoxanthum</i>         |                  |   |   |   |   |   |   |      |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Poaceae     | <i>odoratum</i>              |                  |   |   |   |   |   |   |      |   |   |    |    |    |    | 1  |    | 2  |    |    |    |    |         | x       |      |
| Poaceae     | <i>*Bromus catharticus</i>   | Prairie Grass    |   |   |   |   |   | 2 |      | 2 | 2 |    |    | 1  |    |    |    |    |    |    | 2  | 3  |         |         |      |
| Poaceae     | <i>*Cynodon dactylon</i>     | Couch Grass      |   |   |   |   |   |   |      |   | 1 |    |    |    |    | 5  |    | 3  |    |    |    |    |         |         |      |
|             | <i>Danthonia racemosa</i>    |                  |   |   |   |   |   |   |      |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Poaceae     | var <i>racemosa</i>          | a Wallaby Grass  |   |   |   |   |   | 3 |      |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
|             | <i>Echinopogon</i>           |                  |   |   |   |   |   |   |      |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Poaceae     | <i>caespitosus</i>           | a Hedgehog Grass |   |   |   |   |   |   |      |   | 1 |    |    | 2  |    |    |    |    |    |    |    |    |         | x       |      |
| Poaceae     | <i>E. ovatus</i>             | a Hedgehog Grass |   |   |   |   |   | 1 |      |   |   |    |    |    |    | 2  |    | 2  |    |    |    |    |         | x       |      |
| Poaceae     | <i>*Ehrharta erecta</i>      | Veldt Grass      | 1 |   |   |   |   |   | 3    | 3 |   | 1  |    |    | 2  |    | 2  | 2  |    |    | 2  |    |         | x       |      |
| Poaceae     | <i>Entolasia marginata</i>   | Margined Panic   |   | 1 |   | 2 |   |   |      |   |   |    |    |    |    |    |    |    |    | 2  |    |    |         |         | x    |
|             | <i>Eragrostis</i>            | Australian       |   |   |   |   |   |   |      |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Poaceae     | <i>leptostachya</i>          | Lovegrass        |   |   |   |   |   |   |      |   |   |    |    |    |    |    |    |    |    |    |    |    |         | x       |      |
|             |                              | Weeping Meadow-  |   |   |   |   |   |   |      |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Poaceae     | <i>Microlaena stipoides</i>  | grass            | 2 |   |   |   | 2 |   |      |   | 1 |    |    |    |    |    |    |    |    |    | 5  |    |         |         |      |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family        | Scientific Name               | Common Name       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Croquet |      |
|---------------|-------------------------------|-------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|
|               |                               |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Lawn    | BGHP |
| Poaceae       | <i>Oplismenus aemulus</i>     | Basket Grass      | 2 |   | 2 |   |   |   | 3 | 1 | 2 |    | 1  | 3  |    |    |    | 1  | 2  | 2  | 5  | 3  | x       |         | x    |
| Poaceae       | <i>O. imbecillis</i>          |                   | 1 |   |   |   |   |   |   |   |   |    |    |    |    |    | 3  |    | 2  |    |    |    |         |         |      |
| Poaceae       | <i>*Paspalum dilatatum</i>    | Paspalum          |   |   |   |   |   |   | 1 | 2 | 3 |    |    | 2  | 1  | 1  |    | 1  |    |    |    |    |         |         |      |
|               | <i>*Pennisetum</i>            |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Poaceae       | <i>clandestinum</i>           | Kikuyu            |   |   |   |   |   |   |   |   | 1 |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
|               | <i>*Sporobolus indica</i> var |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Poaceae       | <i>capensis</i>               | Parramatta Grass  |   |   |   |   |   |   |   |   | 1 |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
|               | <i>*Stenotaphrum</i>          |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Poaceae       | <i>secundatum</i>             | Buffalo Grass     | 2 |   |   |   | 5 | 6 |   |   | 6 |    |    |    |    |    |    | 2  |    |    |    |    |         | x       |      |
| Poaceae       | <i>*Poa annua</i>             |                   |   |   |   |   |   |   |   |   |   |    |    |    | 1  |    |    |    |    |    |    |    |         |         |      |
| Poaceae       | <i>*Briza minor</i>           |                   |   |   |   |   |   |   |   |   |   |    |    |    | 2  | 2  |    |    |    |    |    | x  |         |         |      |
| Poaceae       | <i>Phyllostachys aurea</i>    | Golden Bamboo     |   |   |   |   |   |   |   |   |   |    |    |    |    |    | 1  |    |    |    |    |    |         |         |      |
| Poaceae       | <i>*Avena barbata</i>         | Slender Oat       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    | 1  |    |         |         |      |
| Rosaceae      | <i>Fragaria</i> sp.           | Strawberry        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
|               |                               | Spiny-headed Mat- |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Xanthoreaceae | <i>Lomandra longifolia</i>    | rush              |   |   |   |   | 1 |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
|               | <i>*Hedychium</i>             |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Zingiberaceae | <i>gardnerianum</i>           | Indian Ginger     | 1 |   |   |   |   | 1 |   |   |   | 1  | 1  |    |    |    | 6  |    |    |    |    |    |         |         |      |
| Vines         |                               |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family         | Scientific Name              | Common Name         | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Croquet |      |
|----------------|------------------------------|---------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|
|                |                              |                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Lawn    | BGHF |
| Acanthaceae    | <i>*Thunbergia alata</i>     | Black-eyed Susan    | 2 |   |   |   |   |   | 2 |   |   |    | 3  |    | 3  |    |    |    |    |    | 2  |    |         | x       |      |
| Amaryllidaceae | <i>Clivia miniata</i>        | Clivia              |   |   |   |   |   |   |   |   |   |    |    |    |    |    | 5  |    |    |    |    |    |         |         |      |
| Apocynaceae    | <i>Parsonsia straminea</i>   | Common Silkpod      |   |   |   | 3 | 2 |   |   |   |   |    |    |    |    |    |    |    |    | 1  |    |    |         |         | x    |
| Araliaceae     | <i>*Hedera helix</i>         | English Ivy         | 2 |   |   |   |   | 1 |   |   |   |    | 6  | 3  |    |    | 5  |    |    |    |    |    | x       |         |      |
| Asclepiadaceae | <i>*Araujia sericifera</i>   | Moth Vine           |   |   |   |   |   |   | 1 | 1 |   |    | 1  |    |    |    |    |    |    |    | 1  |    |         |         |      |
|                | <i>*Asparagus</i>            |                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Asparagaceae   | <i>asparagoides</i>          | Bridal Veil Creeper |   | 1 |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    | 1  |    |         |         | x    |
| Asparagaceae   | <i>*A. scandens</i>          |                     | 3 |   |   |   | 2 |   |   |   |   | 1  |    |    |    |    |    |    | 1  |    |    |    |         |         |      |
| Basellaceae    | <i>*Anredera cordifolia</i>  | Madeira Vine        |   |   |   |   |   |   |   | 1 |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
|                |                              | Japanese            |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Caprifoliaceae | <i>*Lonicera japonica</i>    | Honeysuckle         | 4 | 3 |   |   | 3 | 2 |   |   |   |    | 1  | 2  | 2  | 2  |    |    | 3  | 3  |    |    |         | x       | x    |
| Convolvulaceae | <i>*Ipomoea indica</i>       | Purple Glory        |   |   |   |   |   |   |   |   | 2 | 5  |    |    |    |    |    |    |    |    | 5  | 1  |         |         |      |
| Fabaceae       | <i>*Dipogon lignosus</i>     | Dolikos Pea         |   |   |   |   |   |   | 2 |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Fabaceae       | <i>Glycine tabacina</i>      |                     |   |   |   | 2 | 2 | 3 |   |   |   |    |    |    |    |    | 2  |    |    |    |    |    | x       |         |      |
| Fabaceae       | <i>Glycine microphylla</i>   |                     |   |   |   |   |   |   |   |   |   |    |    |    |    | 2  |    | 1  |    |    |    |    |         |         | x    |
| Fabaceae       | <i>Glycine clandestina</i>   |                     |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | 2  | 2  |    |    |         |         | x    |
| Fabaceae       | <i>Hardenbergia violacea</i> | Purple Coral Pea    |   |   |   | 1 |   |   |   |   |   |    |    |    |    |    |    |    |    | 1  |    |    |         |         |      |
| Fabaceae       | <i>Kennedia rubicunda</i>    | Dusky Coral Pea     |   |   | 1 | 1 |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    | 5  |         |         |      |
| Fabaceae       | <i>*Vicia sativa</i>         | Vetch               |   |   |   |   |   |   | 3 |   | 2 |    |    | 3  |    |    | 2  |    |    |    | 1  |    | x       |         |      |
| Faboideae      | <i>*Wisteria sp.</i>         |                     |   |   |   |   |   |   |   |   |   |    | 4  |    |    |    |    |    |    |    |    |    | x       |         |      |

**Table B.1 FLORA SPECIES RECORDED BY CUMBERLAND ECOLOGY ON THE SUBJECT SITE**

| Family         | Scientific Name              | Common Name       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Gardens | Croquet |      |
|----------------|------------------------------|-------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|---------|---------|------|
|                |                              |                   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | Lawn    | BGHF |
| Luzuriagaceae  | <i>Eustrephus latifolius</i> | Wombat Berry      | 2 | 1 |   |   | 1 |   |   |   |   |    | 1  |    |    |    |    |    | 1  | 1  |    |    |         |         |      |
| Oleaceae       | * <i>Jasminum</i> sp cv      | Jasmine           |   |   |   |   |   |   |   | 2 |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Passifloraceae | * <i>Passiflora edulis</i>   | Passionfruit Vine |   | 1 |   | 1 |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |
| Ranunculaceae  | <i>Clematis glycinoides</i>  | Travellers Joy    |   | 1 |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         | x       |      |
| Rosaceae       | <i>Rubus ulmifolius</i>      | Blackberry        |   |   |   |   |   |   |   |   |   |    |    |    | 1  |    |    |    |    | 1  |    |    |         |         |      |
| Sphagnaceae    | <i>Sphagnum</i> sp.          | Sphagnum Moss     | 2 |   |   |   |   | 2 |   |   |   |    |    |    |    |    |    |    |    |    |    |    |         |         |      |

\* = Introduced species

x = present in community but not in Quadrat

- |                                   |                                    |
|-----------------------------------|------------------------------------|
| 1: Rare                           | 6: 25-50% projective foliage cover |
| 2: Occasional                     | 7: 50-75% projective foliage cover |
| 3: Common                         |                                    |
| 4: Very common but less than 5%   |                                    |
| 5: 5-25% projective foliage cover |                                    |

## B.2 Quadrat Photographs



**Photograph B.1**      **Quadrat 1**



**Photograph B.2**      **Quadrat 2**



**Photograph B.3**      **Quadrat 3**



**Photograph B.4**      **Quadrat 4**



**Photograph B.5**      **Quadrat 5**



**Photograph B.6**      **Quadrat 6**



**Photograph B.7**      **Quadrat 7**



**Photograph B.8**      **Quadrat 8**



**Photograph B.9**      **Quadrat 9**



**Photograph B.10**      **Quadrat 10**



**Photograph B.11**      **Quadrat 11**



**Photograph B.12**      **Quadrat 12**



**Photograph B.13      Quadrat 13**



**Photograph B.14      Quadrat 14**



**Photograph B.15      Quadrat 15**



**Photograph B.16      Quadrat 16**



**Photograph B.17**      **Quadrat 17**



**Photograph B.18**      **Quadrat 18**



**Photograph B.19**      **Quadrat 19**



**Photograph B.20**      **Quadrat 20**

## B.3 Fauna

**Table B.2 FAUNA DETECTED BY UBMC AT THE SUBJECT SITE**

| Group    | Scientific Name                 | Common Name               | TSC/    |          |
|----------|---------------------------------|---------------------------|---------|----------|
|          |                                 |                           | EPBC    | Obs Type |
| MAMMALS  | <i>Chalinolobus gouldii</i>     | Gould's Wattle Bat        |         | W        |
|          | <i>Pseudocheirus peregrinus</i> | Common Ringtail Possum    |         | O        |
|          | <i>Pteropus poliocephalus</i>   | Grey-headed Flying-fox    | V/V     | O        |
|          | <i>Rattus rattus</i>            | Black Rat                 |         | H        |
|          | <i>Trichosurus vulpecula</i>    | Common Brushtail Possum   |         | O        |
| BIRDS    | <i>*Acridotheres tristis</i>    | Common Myna               |         | O        |
|          | <i>Alisterus scapularis</i>     | Australian King Parrot    |         | O        |
|          | <i>Cacatua galerita</i>         | Sulphur-crested Cockatoo  |         | O        |
|          | <i>Callocephalon fimbriatum</i> | Gang-gang Cockatoo        | V, EP/- | O        |
|          | <i>Coracina novaehollandiae</i> | Black-faced Cuckoo-shrike |         | O        |
|          | <i>Corvus coronoides</i>        | Australian Raven          |         | O        |
|          | <i>Cracticus torquatus</i>      | Grey Butcherbird          |         | O        |
|          | <i>Dacelo novaeguineae</i>      | Laughing Kookaburra       |         | O        |
|          | <i>Gymnorhina tibicen</i>       | Australian Magpie         |         | O        |
|          | <i>Hirundo neoxena</i>          | Welcome Swallow           |         | O        |
|          | <i>Manorina melanocephala</i>   | Noisy Miner               |         | O        |
|          | <i>Pardalotus punctatus</i>     | Spotted Pardalote         |         | O        |
|          | <i>Platycercus eximius</i>      | Eastern Rosella           |         | O        |
|          | <i>Podargus strigoides</i>      | Tawny Frogmouth           |         | O        |
|          | <i>Strepera graculina</i>       | Pied Currawong            |         | O        |
|          | <i>Trichoglossus haemotodus</i> | Rainbow Lorikeet          |         | O        |
| REPTILES | <i>Lampropholis delicata</i>    | Grass Skink               |         | O        |
|          | <i>Saproscincus mustelinus</i>  | Weasel Skink              |         | O        |

Notes V: Vulnerable under the TSC Act and/or EPBC Act, EP: endangered population under TSC Act

O: observed, H: hair; W: call

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*Appendix C*

Survey Proformas

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## C.1 Herpetofauna

**Table C.1 DIURNAL HERPETOFAUNA / NOCTURNAL STREAMSIDE CENSUS SURVEY PROFORMA**

| <b>Survey Details</b>                          |                                             |                                                                                     |                   |
|------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------|-------------------|
| Date of Survey                                 | 23 Feb 2006<br>1 March 2006<br>7 March 2006 |                                                                                     |                   |
| Name of surveyor                               | Deryk Engel<br>Stephen Bloomfield           | Contact number                                                                      | 9894 2255         |
| Name of person analysing calls                 |                                             | Contact number                                                                      |                   |
| Total effort expressed in person hours         | Not listed                                  |                                                                                     |                   |
| <b>Location Details</b>                        |                                             |                                                                                     |                   |
| Location (including basic habitat) description | 35 Water St<br>Wahroonga                    | Mixture of Blue Gum High Forest, landscaped gardens, buildings and other structures |                   |
| Map number                                     | 9130-4S                                     | Map name                                                                            | Hornsby           |
| Type of survey, eg. transect or quadrat        | Random meander                              | AMG Zone                                                                            | 56                |
| Active or passive search                       | Active and passive                          | Size of survey area (ha)                                                            | 2.5ha             |
| Survey area                                    | 2.5ha                                       |                                                                                     |                   |
| Eastings (6 digits)                            | 326400                                      | Northings (7 digits)                                                                | 6267630           |
| Eastings (6 digits)                            |                                             | Northings (7 digit)                                                                 |                   |
| Start time (24hr)                              |                                             | End time (24 hr)                                                                    |                   |
| <b>Weather Details</b>                         |                                             |                                                                                     |                   |
| At start of survey, record:                    |                                             | Cloud cover*                                                                        | 7/8<br>8/8<br>0/8 |
| Wind direction and speed*                      | 1 – light<br>3 – strong<br>0 -calm          | Rain*                                                                               | 0<br>0<br>0       |
| Temperature (°C)                               | 26<br>22<br>23                              | Moon*                                                                               | ½<br>0<br>½       |
| <b>Comments</b>                                |                                             |                                                                                     |                   |

## C.2 Diurnal Birds

**Table C.2 DIURNAL BIRD CENSUS FORM**

| Survey Details                                    |                                             |                                                                                     |                   |
|---------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------|-------------------|
| Date of Survey                                    | 23 Feb 2006<br>1 March 2006<br>7 March 2006 |                                                                                     |                   |
| Name of surveyor                                  | Deryk Engel<br>Stephen Bloomfield           | Contact number                                                                      | 9894 2255         |
| Number of surveyors                               | 2                                           | Date of survey                                                                      | 23 Feb 2006       |
| Total effort expressed in person hours            |                                             | Number of hectares covered or transect or point dimensions                          | 2.5ha             |
| Location Details                                  |                                             |                                                                                     |                   |
| Location (including basic habitat) description    | 35 Water St<br>Wahroonga                    | Mixture of Blue Gum High Forest, landscaped gardens, buildings and other structures |                   |
| Map number                                        | 9130-4S                                     | Map name                                                                            | Hornsby           |
| Full AMG reference(s) for survey site or transect | WGS84 UTM                                   | AMG Zone                                                                            | 56                |
| Start details                                     |                                             | Finish details                                                                      |                   |
| Easting (6 digits)                                | 326400                                      | Easting (6 digits)                                                                  | 6267630           |
| Northing (7 digits)                               |                                             | Northing (7 digits)                                                                 |                   |
| Start time (24hr)                                 |                                             | End time (24 hr)                                                                    |                   |
| Weather Details                                   |                                             |                                                                                     |                   |
| At start of survey, record:                       |                                             | Cloud cover*                                                                        | 7/8<br>8/8<br>0/8 |
| Wind direction and speed*                         | 1 – light<br>3 – strong<br>0 -calm          | Rain*                                                                               | 0<br>0<br>0       |
| Temperature (°C)                                  | 26<br>22<br>23                              | Moon*                                                                               | ½<br>0<br>½       |
| Comments                                          |                                             |                                                                                     |                   |

## C.3 Nocturnal Call Playback

**Table C.3 NOCTURNAL CALL PLAYBACK PROFORMA**

| Survey Details                                       |                                     |                                                                                              |                                |
|------------------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------|--------------------------------|
| Name of surveyor                                     | Kirsten Crosby,<br>Joanne Brownnett | Contact number                                                                               | 9868 1933                      |
| Date of survey                                       |                                     | Type of amplification<br>(loudhailer, tape deck only)                                        | Loudhailer with<br>CD          |
| Duration of call playback<br>(minutes)               | 5 minutes for each<br>species       | Duration of listening<br>(minutes)                                                           | 15 minutes for<br>each species |
| Location Details                                     |                                     |                                                                                              |                                |
| Location (including basic<br>habitat) description    | 35 Water St<br>Wahroonga            | Mixture of Blue Gum High<br>Forest, landscaped gardens,<br>buildings and other<br>structures |                                |
| Map number                                           | 9130-4S                             | Map name                                                                                     | Hornsby                        |
| Full AMG reference(s) for<br>survey site or transect | WGS84 UTM                           | AMG Zone                                                                                     | 56                             |
| Easting (6 digits)                                   | 326400                              | Easting (6 digits)                                                                           | 6267630                        |
| Start time (24 hr)                                   | 1820                                | End time (24 hr)                                                                             | 1920                           |
| Weather Details                                      |                                     |                                                                                              |                                |
| At start of survey, record                           |                                     | Temperature (°C)                                                                             | 17                             |
| Cloud cover*                                         | 6/8                                 | Moon*                                                                                        | ¼                              |
| Wind direction and speed*                            | 1 – light, SE                       | Rain*                                                                                        | 0                              |
| Comments                                             | Had rained<br>earlier in the day    |                                                                                              |                                |

## C.4 Ultrasonic Call Survey

**Table C.4 ULTRASONIC CALL SURVEY DETAILS**

| <b>Survey Details</b>                              |                       |                                                                                     |              |
|----------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------|--------------|
| Name of principle surveyor                         | Deryk Engel           | Contact number                                                                      | 9894 2255    |
| Name of person analysing calls                     | As above              | Contact number                                                                      |              |
| Date of survey                                     | 1 March               | GMA handheld or set and left                                                        | Set and left |
|                                                    | 7 March               |                                                                                     |              |
| <b>Location Details</b>                            |                       |                                                                                     |              |
| Location (including basic habitat description)     | 35 Water St Wahroonga | Mixture of Blue Gum High Forest, landscaped gardens, buildings and other structures |              |
| Time delay used - yes/no                           | No                    |                                                                                     |              |
| Start details or point location                    |                       | Finish details                                                                      |              |
| Map name                                           | Hornsby               | Map number                                                                          | 9130-4S      |
| Full AMG reference(s) for survey site or transects | WGS84 UTM             | AMG Zone                                                                            | 56           |
| Easting (6 digits)                                 | 326355                | Northing (7 digits)                                                                 | 6267419      |
|                                                    | 326286                |                                                                                     | 6267401      |
|                                                    | 326363                |                                                                                     | 6267652      |
|                                                    | 326350                |                                                                                     | 6267701      |
|                                                    | 326353                |                                                                                     | 6267613      |
|                                                    | 326457                |                                                                                     | 6267669      |
| Start time (24 hr)                                 | 1900                  | Finish time (24hr)                                                                  | 2130         |
| <b>Weather Details</b>                             |                       |                                                                                     |              |
| At start of survey, record:                        |                       | Cloud cover*                                                                        | 8/8          |
|                                                    |                       |                                                                                     | 0/8          |
| Wind direction and speed*                          | 3 – strong            | Rain*                                                                               | 0            |
|                                                    | 0 -calm               |                                                                                     | 0            |
| Temperature (°C)                                   | 22                    | Moon*                                                                               | 0            |
|                                                    | 23                    |                                                                                     | ½            |
| <b>Comments</b>                                    |                       |                                                                                     |              |

## C.5 Spotlighting Survey

**Table C.5 SPOTLIGHTING SURVEY PROFORMA**

| <b>Survey Details</b>                              |                              |                                                                                     |                |
|----------------------------------------------------|------------------------------|-------------------------------------------------------------------------------------|----------------|
| Name of surveyor                                   | Deryk Engel                  | Contact number                                                                      | 9894 2255      |
| Date of survey                                     | 1 March 2006<br>7 March 2006 | On foot or in vehicle                                                               | foot           |
| Number of surveyors                                | 2                            | Total effort expressed in person hours                                              | 8 person hours |
| Length of transect or grid dimensions              |                              | Number of lights                                                                    | 1              |
| Wattage of spotlight                               | 100                          |                                                                                     |                |
| <b><u>Location Details</u></b>                     |                              |                                                                                     |                |
| Location (including basic habitat) description     | 35 Water St<br>Wahroonga     | Mixture of Blue Gum High Forest, landscaped gardens, buildings and other structures |                |
| Map name                                           | Hornsby                      | Map number                                                                          | 9130-4S        |
| Full AMG reference(s) for survey site or transects | WGS84 UTM                    | AMG Zone                                                                            | 56             |
| Start details                                      |                              | Finish details                                                                      |                |
| Survey area                                        | 2.5ha                        |                                                                                     |                |
| Eastings (6 digits)                                | 326400                       | Northings (7 digits)                                                                | 6267630        |
| <b><u>Weather Details</u></b>                      |                              |                                                                                     | 8/8            |
| At start of survey, record:                        |                              | Cloud cover*                                                                        | 0/8            |
| Wind direction and speed*                          | 3 – strong                   | Rain*                                                                               | 0              |
|                                                    | 0 -calm                      |                                                                                     | 0              |
| Temperature (°C)                                   | 22                           | Moon*                                                                               | 0              |
|                                                    | 23                           |                                                                                     | ½              |
| Comments                                           |                              |                                                                                     |                |

## C.6 Hair Tube Survey

**Table C.6 HAIR TUBE SURVEY PROFORMA**

| Survey Details                                 |                                   |                                                                                     |                                                  |
|------------------------------------------------|-----------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------|
| Name of surveyor                               | Deryk Engel<br>Stephen Bloomfield | Contact number                                                                      | 9894 2255                                        |
| Name of person analysing hairs                 | Barbara Triggs                    | Contact number                                                                      |                                                  |
| Date traps set                                 | 23 February 2006                  | Date traps collected                                                                | 7 March 2006                                     |
| Size of tube (diameter and length)             | Faunatech funnels                 | Number of tubes                                                                     | 10                                               |
| Spacing between tubes                          | Randomly placed throughout site   | Bait used (e.g. meat type, peanut butter & oats)                                    | 5 – oats, peanut butter & honey<br>5 – anchovies |
| Length of transect or grid dimensions          | N/A                               |                                                                                     |                                                  |
| Location Details                               |                                   |                                                                                     |                                                  |
| Location (including basic habitat) description | 35 Water St<br>Wahroonga          | Mixture of Blue Gum High Forest, landscaped gardens, buildings and other structures |                                                  |
| AMG Zone                                       | 56                                |                                                                                     |                                                  |
| Map name                                       | Hornsby                           | Map number                                                                          | 9130-4S                                          |
| Easting (6 digits)                             | 326338                            | Eastings (6 digits)                                                                 | 6267640                                          |
|                                                | 326328                            |                                                                                     | 6267612                                          |
|                                                | 326330                            |                                                                                     | 6267683                                          |
|                                                | 326399                            |                                                                                     | 6267660                                          |
|                                                | 326419                            |                                                                                     | 6267629                                          |
|                                                | 326432                            |                                                                                     | 6267645                                          |
|                                                | 326437                            |                                                                                     | 6267686                                          |
|                                                | 326455                            |                                                                                     | 6267673                                          |
|                                                | 326391                            |                                                                                     | 6267594                                          |
|                                                | 326443                            |                                                                                     | 6267587                                          |
| Comments                                       |                                   |                                                                                     |                                                  |

## C.7 Standard reporting codes

Cloud cover. Record cloud cover in eights of sky.

Moon. Record using the following codes: 0=None, 1=1/4 moon, 2=1/2 moon, 3=3/4 moon, 4=full moon.

Wind direction and speed. Record wind direction to nearest cardinal point. Record wind speed using the following codes. 0=calm 1= Light, leaves rustle 2= Moderate, branches move 3=Strong, tops of trees move

Rain. Record using the following codes. 0=none, 1=drizzle - light, 2=drizzle - heavy 3=heavy rain

**Table C.7 OBSERVATION AND MICROHABITAT CODES**

| Code | Observation type     | Code | Microhabitat Type    | Code | Microhabitat Type |
|------|----------------------|------|----------------------|------|-------------------|
| A    | Stranded/beached     | AC   | Flying above canopy  | IS   | In soil           |
| C    | Cat kill             | BR   | In/on bridge         | IT   | In live tree      |
| D    | Dog kill             | BU   | In building          | IW   | In water          |
| E    | Nest or roost        | CK   | Crevice in rock      | LC   | Lower canopy      |
| F    | Tracks, scratching   | CL   | Crevice in log       | LS   | Low shrub         |
| H    | Hair or feathers     | DA   | Farm/fire dam        | MC   | Mid canopy        |
| I    | Fossil/sub-fossil    | DT   | In dead tree (stag)  | OB   | On beach sand     |
| M    | Miscellaneous        | EW   | Edge of water        | OL   | On log            |
| N    | Not located          | FC   | In/on post or stump  | OR   | On rock           |
| O    | Observed (sighted)   | FL   | Flying within canopy | OW   | Over water        |
| R    | Road kill            | GR   | On ground            | RD   | On road           |
| S    | Shot                 | HS   | High shrub           | TK   | On trunk          |
| T    | Trapped or netted    | IB   | In burrow            | UB   | Under bark        |
| V    | Fox kill             | IC   | In cave              | UC   | Upper canopy      |
| W    | Heard call           | IG   | In grass             | UG   | Undergrowth       |
| X    | In scat              | IH   | In tree hollow       | UL   | Under log         |
| Y    | Bones or teeth       | IL   | In litter            | UR   | Under rock        |
| Z    | In raptor/owl pellet | IR   | In reeds             | WH   | Waterhole         |

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*Appendix D*

Curricula Vitae of SIS Team

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## D.1 David Robertson

Dr David Robertson is a senior ecologist with more than 20 years experience in ecological survey and research. David is currently the director of Cumberland Ecology. He has a bachelor of science with majors in botany and zoology and a PhD in ecology.

Recent consultancy work has included:

- management of high level flora and fauna investigations for Environmental Impact Assessments;
- threatened species investigations;
- development of ecological management plans;
- habitat reconstruction;
- development of packages for compensatory habitats;
- management of negotiations about the level of mitigation measures required for flora and fauna impacts;
- bushfire assessments;
- biological monitoring of rivers, streams and lakes; and
- ecological risk assessment.

David is also very experienced at public speaking and has regularly provided expert testimony in court about ecological issues.

In previous work David was employed as the senior ecologist in charge of the Ecological Services Practice for ERM Australia. He also lectured in ecology and aquatic biology at Charles Sturt University, and was also employed as a senior ecologist with the Australian Museum. Currently, David lectures part time in ecology and environmental impact assessment at the Australian Catholic University.

David has skills that allow him to work in both aquatic and terrestrial flora and fauna inventory, management of threatened species, ecological risk assessment, wetland rehabilitation and management, and ecological research for environmental impact assessment.

### ***Fields of Competence***

### *Threatened species assessments*

David has directed or managed numerous threatened species assessments in Australia and in recent years has increasingly become involved in international work on threatened species.

Across Australia, he has completed numerous projects on threatened species in response to state and commonwealth threatened species legislation. Such legislation includes the NSW Threatened Species Conservation Act 1995, Queensland Nature Conservation Act, 1994 and the Victorian Flora and Fauna Conservation Guarantee 1998 and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. International threatened species assessments have been completed in Hong Kong, China and Sri Lanka.

Work on threatened species has included preliminary survey and impact assessment, detailed impact assessment and mitigation, monitoring and plans of management.

### *Provision of Strategic Ecological Advice*

Strategic ecological advice has been provided to aid the selection of potential development sites in Australia, Hong Kong, Sri Lanka and China. Examples include: a model to help minimise problems with threatened species issues developed for use by Landcom. Strategic advice about habitat reconstruction and monitoring in the Kam Tin Valley, Hong Kong.

### **Qualifications**

- Doctor of Philosophy, Ecology, University of Melbourne, 1986.
- Bachelor of Science (Honours), Ecology, University of Melbourne, 1980.

## **D.2 Joanne Brownnett**

Joanne Brownnett has been involved in flora and fauna surveys, impact assessment and monitoring in terrestrial environments. Currently, she is working on several projects including flora and fauna surveys with related Section 5A assessments, and is involved with weed and pest animal management projects and kangaroo management projects.

Recent consultancy work has included:

- Investigations for flora and fauna impact assessments;
- Development of bushland management plans with focuses on threatened species habitat management, weed control and bush regeneration;
- Monitoring of impacts from approved activities on ecological issues; and

- Investigations for green trade offsets and other compensatory measures.

#### ***Fields of Competence***

- Environment Protection and Biodiversity Conservation Act 1999
- Environmental Impact and Assessment Act (1979) NSW
- Threatened Species Conservation Act (1995) NSW
- Native Vegetation Conservation Act (1997) NSW
- Biodiversity issues, flora and fauna field surveys, biological monitoring and environmental impact assessment.

#### ***Qualifications***

Bachelor of Science (Environmental) Honours. The University of Sydney, 2003.

### **D.3 James Schlunke**

James Schlunke is a botanist/ecologist at Cumberland Ecology, based in Sydney. He has a Bachelor of Science degree with a double major in biology and First Class Honours in ecology from the University of Sydney.

He has been involved in flora and fauna surveys and has extensive experience in bushland restoration, through working as a bush regenerator. He is currently involved in flora work on several projects, including kangaroo impact monitoring and management. He also has experience with the identification of terrestrial and aquatic invertebrates, and their use in habitat monitoring.

Recent consultancy work has included:

- Flora and fauna surveys for impact assessment;
- Assessments of Significance under the TSC Act 1995 NSW, and
- Monitoring of impacts from macrofauna grazing on ecological issues

#### ***Fields of Competence***

- Environment Protection and Biodiversity Conservation Act 1999
- Threatened Species Conservation Act 1995 NSW
- Environmental Planning and Assessment Act 1979 NSW
- Native Vegetation Act 2003 NSW

- Biodiversity issues, flora and fauna field surveys, biological monitoring and environmental impact assessment.

### **Qualifications**

Bachelor of Science (Honours). The University of Sydney, 2008.

## **D.4 David Thomas**

David Has worked as a consulting ecologist for over twenty years. Prior to that he worked as an environmental officer for Sydney Water. David has had much involvement with local bushcare groups, and provides advice on construction site management & restoration. He is an expert on the flora of the greater Sydney region, and has carried out botanical surveys in the Illawarra and the Hunter Valley.

### **Fields of Competence**

- vegetation survey, assessment & mapping
- preparation of management plans for natural areas
- bushland reconstruction, rehabilitation & regeneration planning

## **D.5 Gabor Vasarhelyi**

Gabor has a degree in Environmental Science and has seven years experience in the application of GIS to environmental projects. His experience includes training, application development, spatial analysis, satellite image processing and interpretation, technical support and data collection. Application areas of GIS include environmental assessment and asset management. Gabor has particular experience with the software packages MapInfo, ERMMapper, ArcView, and Geomedia.

### **Fields of Competence**

- Use of Geographic Information Systems for environmental impact assessment
- Management of large GIS projects
- GIS data acquisition, manipulation and presentation
- Database design and management
- Remote sensing
- 3-D Visualisations

## **Education**

Bachelor of Science (Honours) Environmental Science, University of New South Wales.

## **D.6 Dr Kirsten Crosby**

Kirsten has extensive experience in ecological survey and research, gained both academically and professionally. Prior to joining Cumberland Ecology, Kirsten worked as a technical officer at the University Of New South Wales. In this position she managed student field trips around New South Wales, and taught field survey methods for mammals, birds, and aquatic and terrestrial invertebrates. She lectures in a guest capacity for subjects in vertebrate zoology, invertebrate zoology and palaeontology and evolution. As a project manager at Cumberland Ecology Kirsten managed fauna assessment and related report writing for a range of projects. Kirsten is now employed at Biosis Research.

Recent consultancy work included:

- (2005) Fauna surveys and ecological assessment for Central Hills (Camden) NSW. Client CITTA Properties
- (2005) Review and editing of reply to comments on Species Impact Statement, Referral and Management Plans for Clarence Valley Coffs Harbour Regional Water Supply Project. Client Department of Commerce.
- (2005) Fauna surveys and report writing for Awaba-Newstan mine extension NSW. Client Centennial Coal.

## **Fields of Competence**

- Knowledge of Commonwealth and State Environmental Legislation, including EPBC Act 1999, EP&A Act 1979, TSC Act 1995, FM Act 1994 etc.
- Knowledge of threatened fauna of NSW and fauna surveying methods including the use of arboreal and terrestrial Elliot traps, cage traps, pit traps, hair tubes, owl broadcasters, Anabat system.
- Ability to write complex documents that involve a high level of research, critical analysis and presentation.
- Ability to liaise with numerous government departments, clients and the community during preparation of documents and plans.

## **Qualifications**

- Doctor of Philosophy, Marsupial Evolution, University of New South Wales, 2003
- Graduate Certificate in Ecologically Sustainable Development, TAFE, 2005

- Bachelor of Science (Hons), Zoology, University of New South Wales, 1998.

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*Appendix E*

**Vegetation Management Plan**

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*Appendix F*

Arboricultural Impact Assessment

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*Appendix G*

Hydrogeology Report

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*Appendix H*

Statement of Commitments

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The following statements include legal obligations of the landowner that are established in the SIS and maybe included in the Statement of Commitments.

The Vegetation Management Plan (VMP) prepared by UBM Ecological Consultants Pty Ltd (UBMEC, 2009) will be implemented for a period of 10 years following project approval. The following statements are specific to the implementation of the VMP:

- The 6350m<sup>2</sup> area of Blue Gum High Forest (BGHF) present on the site will be retained in perpetuity and managed according to the VMP (UBMEC, 2009). Assisted natural regeneration will be undertaken in the BGHF according to the VMP.
- An additional area of 1770m<sup>2</sup> to the existing 6350m<sup>2</sup> BGHF will be reconstructed as a simplified version of BGHF as per the VMP (UBMEC, 2009) and be maintained in perpetuity.
- All works in the designated BGHF area are to be carried out according to the methodology described in the VMP.
- The retained BGHF vegetation and additional reconstruction areas will be protected from construction as per the VMP (UBMEC, 2009) via defining the construction zone around the edge of BGHF and reconstruction zones, erection of exclusion and sediment fencing, and providing shielding and fencing for trees to be retained within the construction zone (individual trees that are retained outside the BGHF and reconstruction zones).
- Culturally significant trees occurring within the BGHF will be retained as per the VMP (UBMEC, 2009).
- The two planted specimens of Magenta Lilly Pilly (*Syzygium paniculatum*) will be retained.
- The VMP will be implemented for 10 years. The VMP will be fully reviewed and updated after the first 5 years with the updated version to be provided to and approved by Ku-ring-gai Council.

Following the conclusion of the VMP, the BGHF and reconstructed zones will be maintained in perpetuity. These areas will require ongoing maintenance that will be funded in the operations and facilities management budget endorsed by the operator of the private hospital facility. The reporting requirements for the maintenance period on conclusion of the VMP will be negotiated with Ku-ring-gai Council.

Tree hollows lost from the subject site through tree clearance are to be replaced by nest boxes or installation of hollow limbs or remaining trees as a ratio of two replacement nest boxes or hollows for every hollow tree cleared.

Excess water will be prevented from draining into the BGHF via operation of the Concept Drainage Plan.

Minor works located in the critical root zones of any trees will be of a modified design where possible to ensure survival of the trees. For example, footpaths could be of a fully elevated pier and beam type construction.