126 GREVILLE STREET AND PART OF 25 MILLWOOD AVE, CHATSWOOD

Ecological Assessment of Land Proposed for Rezoning

For:

BARANA GROUP PTY LIMITED

July 2010

Final Report

Cumberland Ecology
PO Box 2474, Carlingford Court 2118

Report No. 10012RP1

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

Approved by:	Dr David Robertson
Position:	Project Director
Signed:	
Date:	*8 July, 2010*

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INTRODUCTION

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been engaged by Barana Group Pty Limited (the proponent) to undertake an ecological assessment to support a Planning Proposal for land in Lot 1 DP 532353, 126 Greville Street and Lot 1 DP 408490, part of 25 Millwood Ave, Chatswood. The purpose of this report is to assess the constraints to, and potential impacts of, development on the land located at the above mentioned address (referred to as the 'subject land' within this report). Following a rejected rezoning of the property by Willoughby Council Cumberland Ecology has reassessed the flora and fauna values of the subject land in an attempt to identify any future constraints to future development and reassess any potential impacts on threatened flora and fauna.

METHODOLOGY

Background literature and threatened species databases were consulted to gain a more detailed understanding of the types of threatened species and communities that had the potential to occur within the subject land.

Surveys of the subject site were carried out in June 2006, February 2007 and June 2010. These included flora quadrat surveys and observational fauna surveys and habitat assessments. Targeted searches were also conducted for threatened flora and fauna species considered to have potential to occur within the subject land.

RESULTS

The vegetation within the subject land is generally highly modified with the majority of the site forming a landscaped mix of native and exotic vegetation. This urbanised vegetation community consists of a largely exotic understory consisting of *Cynodon dactylon* (Couch Grass) under a planted shrub layer with a mix of remnant and planted canopy species.

The following two native vegetation communities exist within a small area of the subject land;

- Hornsby Enriched Sandstone Exposed Woodland; and
- Coastal-Shale Sandstone Forest.

Neither of these communities are considered to conform to Endangered Ecological Communities under State or Commonwealth legislation. The communities vary in condition from those that are actively managed as Asset Protection Zones (APZs) and highly disturbed, through vegetation that is weed invaded and impacted from edge effects, to some areas that are comparatively undisturbed with minor weed invasion.

One State and Commonwealth vulnerable flora species was recorded within the subject land along the western boundary (*Darwinia biflora*). The species currently exists within a very small area of the site that will be managed as an APZ. This species will not be directly impacted by the proposal and its current habitat will continue to be managed under bushfire protection legislation. Management of this species will be incorporated into a Vegetation Management Plan (VMP) to be prepared for the site. The VMP will ensure that the occurrence of this species is maintained in perpetuity as the site is developed.

A limited range of fauna habitats occur within the study area and typical urban fauna species of northern Sydney were detected. No threatened fauna species were identified during recent surveys, however the subject land contains potential, but limited, habitat for a range of other threatened species including Eastern Bent-wing Bat, Powerful Owl, Barking Owl, Varied Sittella, Little lorikeet and Grey-headed Flying Fox.

POTENTIAL IMPACTS

The proposal at this stage applies for a rezoning only and there will be no direct impacts as a result of project approval. However given the nature of the Planning Proposal it is envisaged that future impacts could potentially occur as the proposal is realised, as such this report assumes impacts of the project based upon the concept plan provided by the proponent. The results of seven part tests based on this concept plan indicate that no significant impacts on any threatened species or community is likely as a result of the Planning Proposal. While small amounts of habitat will be lost for some fauna species, the impact of this loss is likely to be neutral in the short-term. In the long term there will be a gain in habitat with the re-establishment of forest conforming to a local vegetation community along the riparian corridor and in the northern portion of the site under the current building footprint. Therefore there will be broad areas of similar or better flora habitat upon completion of the proposal through the provision native forest reestablishment along the creek, the planting of native landscaped gardens and by considering the extensive area of suitable habitat within Lane Cove National Park.

Darwinia biflora occurs within a very small area of the subject land. With appropriate management the occurrence of *Darwinia biflora* on the subject land is not likely to be significantly impacted by secondary processes and no individuals will be removed as part of the proposal. The occurrence of this species currently exists within a managed APZ and will continue to be managed within this area under the future development. This species is expected to survive in the long-term in this location under the management to be prescribed by the VMP.

CONCLUSION

The assessment of impacts based on the results of the Seven Part tests for the proposal indicate that no significant impacts will occur on any threatened flora or fauna species as a result of the Planning Proposal. The proposal however will require the clearing of a small area of native vegetation and is adjacent to Blue Gum Reserve and Lane Cove National Park. Also, *Darwinia biflora* has been detected on the site in the APZ along the site's western boundary. As such a number mitigation and management measures are recommended to assist in the minimisation of impacts on these important ecological features. The recommended measures include:

- Erosion, sediment and pollution control, particularly during construction;
- Management of water during construction;
- Retention of important habitat features;
- Management of *Darwinia biflora* under a site specific Vegetation Management Plan (VMP);
- Rehabilitation and management of vegetation under a site specific VMP.

Chapter 1

Introduction

1.1 Purpose

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been engaged by Barana Group Pty Limited (the proponent) to undertake an ecological assessment to support a Planning Proposal for land in Lot 1 DP 532353, 126 Greville Street and Lot 1 DP 408490, part of 25 Millwood Ave, Chatswood (hereafter referred to as the 'subject land') (**Figure 1.1**).

The purpose of the report is to describe the current biodiversity values of the subject land and to assess the potential impacts of future development of the subject land on flora and fauna, particularly threatened species, populations and communities that are listed under the schedules of the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The objectives of this ecological assessment are to:

- Describe and map vegetation communities within the subject land, identifying any listed threatened communities;
- Identify and map the location of threatened flora and fauna species;
- Assess the likelihood that threatened flora and fauna species could occur within the subject land;
- Describe the types and extent of potential impacts on threatened communities and species arising from development; and
- Provide mitigation and management advice regarding the potential impacts on flora and fauna for the scale of development proposed for the subject land.

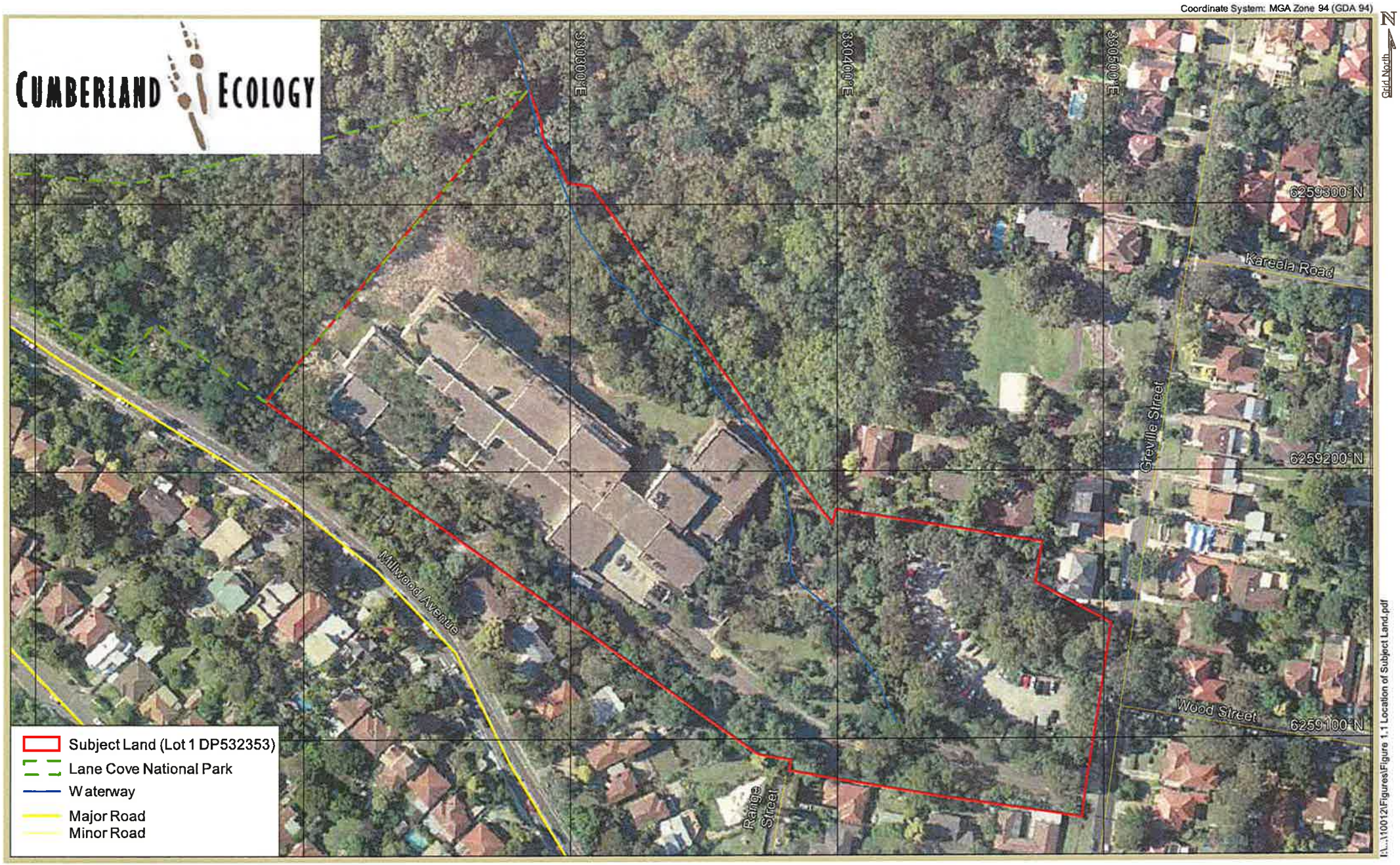

Figure 1.1 Location of Subject Land

1.2 Background

1.2.1 Location

The subject land comprises Lot 1 DP 532353, 126 Greville Street and Lot 1 DP 408490, part of 25 Millwood Ave, Chatswood and is approximately 3.5ha in size. The subject land falls within the Willoughby Local Government Area (LGA). It is situated to the north of existing residential development within Chatswood and is bounded to the east by Greville Street and to the west and north by Blue Gum Reserve (open space managed by Willoughby Council), which connects to Lane Cove National Park further to the west. The subject land is located approximately 800m to the east of Lane Cove River.

1.2.2 Site Characteristics

i. Land use and zoning

The majority of subject land is zoned 5(a) Species Uses 'A' (Acoustic Laboratory) under the *Willoughby Local Environmental Plan (LEP) 1995.* Under the planning proposal, the site would be in Zone R3 Medium Density Residential with a triangular section in the north western portion to be in Zone E2 Environmental Conservation. The building on the subject land is currently occupied by National Acoustic Laboratories. The existing development is situated principally on the western side of the subject land, with a car park area in the north-eastern portion.

ii. Aspect

The subject land slopes to the north west towards Blue Gum Creek (see **Figure 1.1**). The highest area of the subject land occurs along the eastern boundary at approximately 50m AHD. The lowest area of the subject land occurs in the north western corner at approximately 20m AHD.

iii. Soils

The subject land has been mapped as comprising the Lucas Heights and Gymea Soil Landscapes (Chapman and Murphy, 1989). The Lucas Heights Soil Landscape occurs through the central portion of the subject land, with the Gymea Soil Landscape occurring in the north western and south eastern portions. The Lucas Heights soil landscape occurs on gently undulating crests and ridges on plateau surfaces of the Mittagong Formation. The Gymea soil landscape occurs on undulating to rolling rises and low hills on Hawkesbury Sandstone.

iv. Hydrology

A minor tributary to Blue Gum Creek, which drains to Lane Cove River, flows through the subject land in a north-westerly direction. The tributary extends from a stormwater pipe near the centre of the eastern portion of the subject land to the western portion along the north western boundary. The tributary enters into the subject land through a large stormwater culvert and prior to entering into the subject land it carries only urban run-off. As such, vegetation adjacent to the tributary has been impacted by a significant degree of weed invasion.

The proponent consulted with DNR (now Office of Water) in 2006 regarding the riparian zone requirements of the watercourse flowing through the property. The watercourse has been categorised into an "upper" and a "lower" reach for the purposes of site assessment (PSB 2006).

The upper reach flows from storm water pipes from catchment above near the entrance to the property at Greville St, through the main area of landscaping on the site, and around the existing building at its north eastern-most point. This upper reach includes two waterfalls. The lower reach of the watercourse begins from a third, larger waterfall (referred to by PSB, 2006, as 'Waterfall 03'), which is situated immediately north-west of the eastern-most protrusion of the existing building. The lower reach flows through to the northern-most point of the subject land.

Based on the Office of Water's Guidelines for controlled Activities in Riparian Corridors (2008) and the Strahler System, the current system for stream order classification, the watercourse has been designated as a First Order Watercourse, requiring an average 10m core riparian zone from the from the top of the bank on either side of the watercourse.

v. Vegetation

The vegetation on the subject land comprises a mix of remnant forest patches and mixed native and exotic landscape plantings. Some of the original vegetation communities within the subject land have been partially or entirely cleared and remaining vegetation is impacted by current or adjacent land uses. Approximately 0.697ha of remnant vegetation remains on the subject land with an additional 0.08ha of native regrowth within the current Asset Protection Zone (APZ). The condition of the vegetation communities varies across the subject land depending upon location, with a general increase in vegetation quality downstream from the development.

1.2.3 Project Background

The proponent purchased the subject land in 2003. The proponent began the process of seeking approval for rezoning of the subject land for the purposes of future development in 2006. The rezoning application included provisions for the rezoning of the subject land for medium density residential development. Willoughby Council refused the application on a number of grounds, including ecological constraints. This report provides updated

information regarding the ecological values of the subject land and accompanies a new Planning Proposal.

1.2.4 Proposed Project

Approval is being sought for rezoning the subject land for future residential use and the construction of a medium density residential development. The layout of the residential master plan concept is shown in **Figure 2.1**. The proposed project includes the following:

- 220 apartments, ranging from 4-6 storeys in height;
- Basement car parks;
- Access via Greville Street;
- Emergency access via Range Road;
- Asset Protection Zone (APZ) surrounding the core riparian area; and
- Extensive revegetation of the riparian corridor.

The Category 3 portion of the watercourse will be subject to some desilting works and the addition of one landscaped waterfall and some deepening and widening of the areas immediately below waterfall 02. This will create a pool and riffle system. Riparian vegetation will be restored and fully restructured in the central portion of the property, where the watercourse is designated as Category 3 (upstream of Waterfall 03), for an average 10m on either side of the top of the bank. The APZ in this region will be located outside this corridor of vegetation.

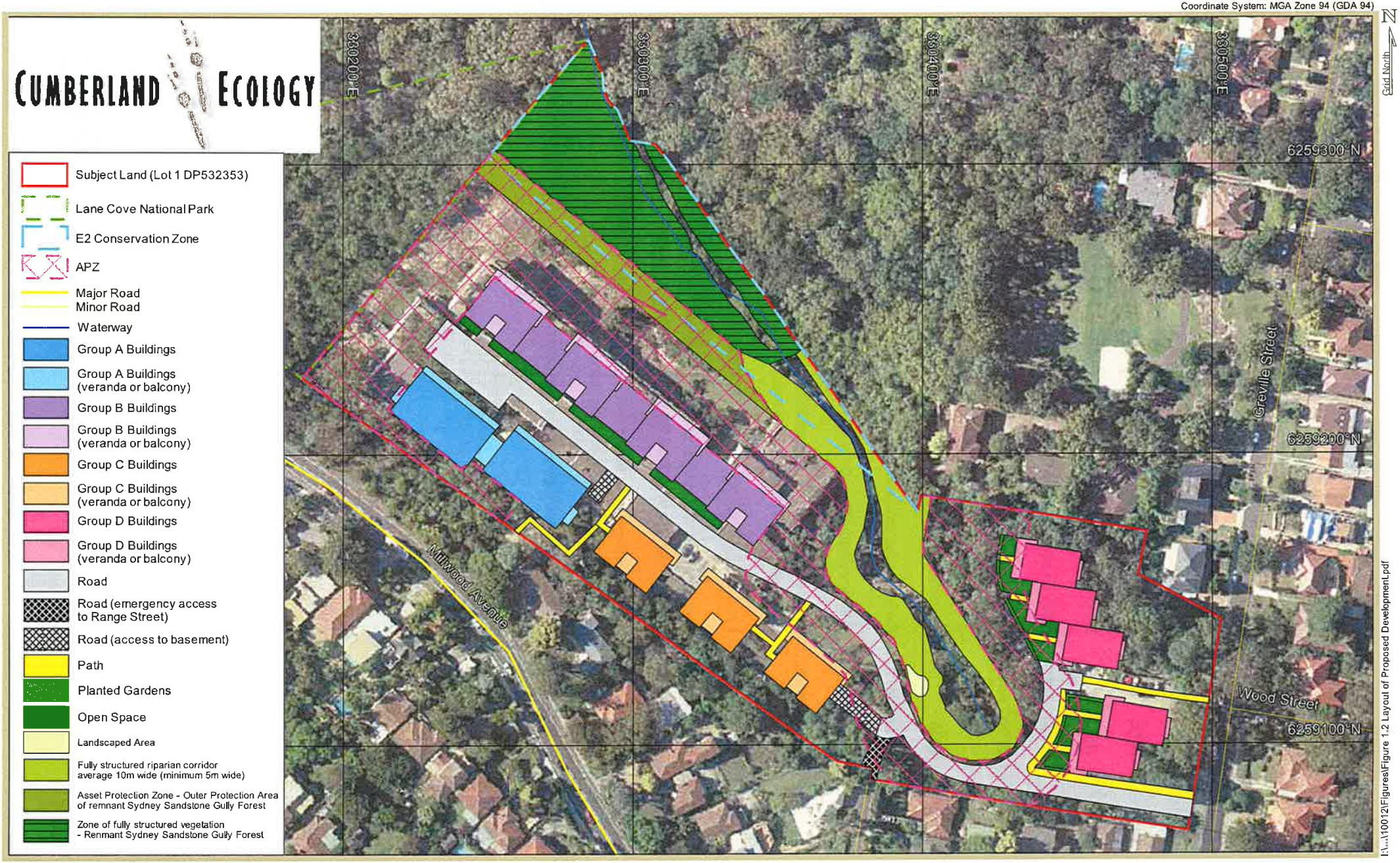

Figure 1.2 Layout of Proposed Development

1.3 Terms and Abbreviations

APZ: Asset Protection Zone;

DECCW: NSW Department of Environment, Climate Change and Water;

EP&A Act: NSW *Environmental Planning and Assessment Act 1979*;

EPBC Act: Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;

LGA: Local Government Area;

Locality: Refers to the land within a 10km radius of the subject land;

Proposal: The development, activity or action proposed;

Study area: The subject site and any additional areas that are likely to be affected by the proposal, either directly or indirectly;

Subject land: Lot 1 DP 532353, 126 Greville St, Chatswood;

Subject site: The area on the property at 126 Greville Street which will be directly impacted by the proposed rezoning and redevelopment;

Threatened species: Refers to flora and fauna species listed as vulnerable, endangered or critically endangered under the TSC Act or EPBC Act; and

TSC Act: NSW *Threatened Species Conservation Act 1995*.

Chapter 2

Methodology

2.1 Literature Review

The following documents have been reviewed for the preparation of this report:

- HLA Envirosciences (2003) Ecological Investigation: National Acoustic Laboratory Facility, Chatswood West, NSW; and
- DEC (NSW) (2004) Systematic Survey of Vertebrate Fauna in Lane Cove National Park
- Letter prepared by Nick Skelton regarding the Review of Ecological Assessment of Rezoning Application for the acoustics Laboratory at 126 Greville Street Chatswood (February 2009);
- Response to Skelton review of Cumberland Ecology Flora and Fauna Report for Rezoning 126 Greville St, Chatswood;.
- NPWS (2003) Draft Recovery Plan for the Barking Owl;
- DEC (2006) Recovery Plan for the Large Forest Owls;
- DECCW letter regarding the rezoning of Land 126 Greville St, Chatswood (February 2010);
- Letter Prepared by Nick Skelton regarding the Two Letters from the Applicant Responding to a request for Further Ecological Information for a Rezoning Application for the Acoustics Laboratory at 126 Greville Street, Chatswood, (June 2010).

2.2 Database Analysis

Database analysis was conducted for the locality using both the DECCW Atlas of NSW Wildlife Database (DECCW, 2010a) and DEWHA Protected Matters Search Tool (DEWHA, 2010. The Wildlife Atlas search was used to generate records of threatened flora and fauna species listed under the TSC Act within a 10km radius of the subject land.

The Protected Matters Search Tool generated a list of potentially occurring flora, fauna and ecological communities listed under the EPBC Act within a 10km radius of the subject land. The lists generated from these databases were reviewed against available knowledge of the site to ascertain the likelihood of occurrence of threatened species.

2.3 Flora Survey

2.3.1 2006-2007 Surveys

A field inspection was conducted on the subject land on 22 June 2006 to evaluate the condition of native vegetation and to ascertain the value of the site for native flora and fauna. Work conducted during the site inspection included:

- A preliminary survey using random meander transect methods; and
- Observations of species present, general floristics, structure and condition of plant communities.

The area surveyed comprised all the vegetated sections of the property that may be impacted by potential redevelopment. These include:

- The small area of bushland garden between the entry to the site and the car park area (Zone 1);
- The larger bushland garden, including natural bushland elements, east of the car park (Zone 2);
- The relatively extensive landscaped zone in the central section of the property (Zone 3);
- The small lawn and fire break on the north-eastern end of the property, adjacent to the existing building (Zone 4);
- Bushland in the lower gully below the western-most waterfall on the property (Zone 5); and
- The midslope bushland below Zone 4, between the waterfall at Zone 5 and the north western boundary of the property (Zone 6).

The locations of 2006-2007 surveys are shown in **Figure 2.1**.

Notes were taken regarding the nature and condition of the vegetation in each zone. Plant communities were described based on the dominant canopy species and community structure, according to Specht (Specht 1970). Plant species nomenclature conforms to Harden (Harden, 1990-1993), except for the change of *Tradescantia albiflora* to *T. fluminensis*.

Consideration was given to the likely viability of native flora present and the potential impact of redevelopment at the site on native flora. The potential conservation significance of communities and species was based on the TSC Act Schedules, EPBC Act, Briggs & Leigh (Briggs and Leigh 1995) and Benson & Howell (Benson and Howell 1994). The likely contributions to conservation of the community and species were considered with respect to factors such as condition, likely viability and existing threats.

A search for threatened species was made concurrently with the survey. The threatened plant species *Darwinia biflora* has been identified on the adjacent Lane Cove National Park property in the HLA (2003) study. Additional targeted surveys for this species were undertaken by Cumberland Ecology on 9 February 2007.

2.3.2 2010 Surveys

Additional flora surveys were undertaken on 9 June and 1 July 2010. These surveys were conducted in accordance with the (then) DEC Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (Working Draft) (DEC (NSW), 2004). These surveys involved the following:

- Random meander surveys to detect flora species across the subject land;
- Vegetation sampling within quadrats (20m x 20m) to obtain information on floristic composition and community structure;
- Targeted searches for threatened flora known or considered likely to occur within the subject land; and
- Targeted searches for endangered ecological communities (EECs) known or considered likely to occur within the subject land.

Vegetation within a total of 3 quadrats was sampled according to DEC survey guidelines. The relative abundance and cover of each species within these quadrats was approximated using a modified Braun-Blanquet scoring system (Braun-Blanquet, 1927). The locations of the quadrats are shown in **Figure 2.1**.

Within each quadrat, all vascular flora species present were identified to species level where possible, and recorded. All vascular plants recorded or collected were identified using keys and nomenclature provided in Harden (Harden, 1990-1993). Where known, taxonomic and nomenclatural changes have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust, 2010).

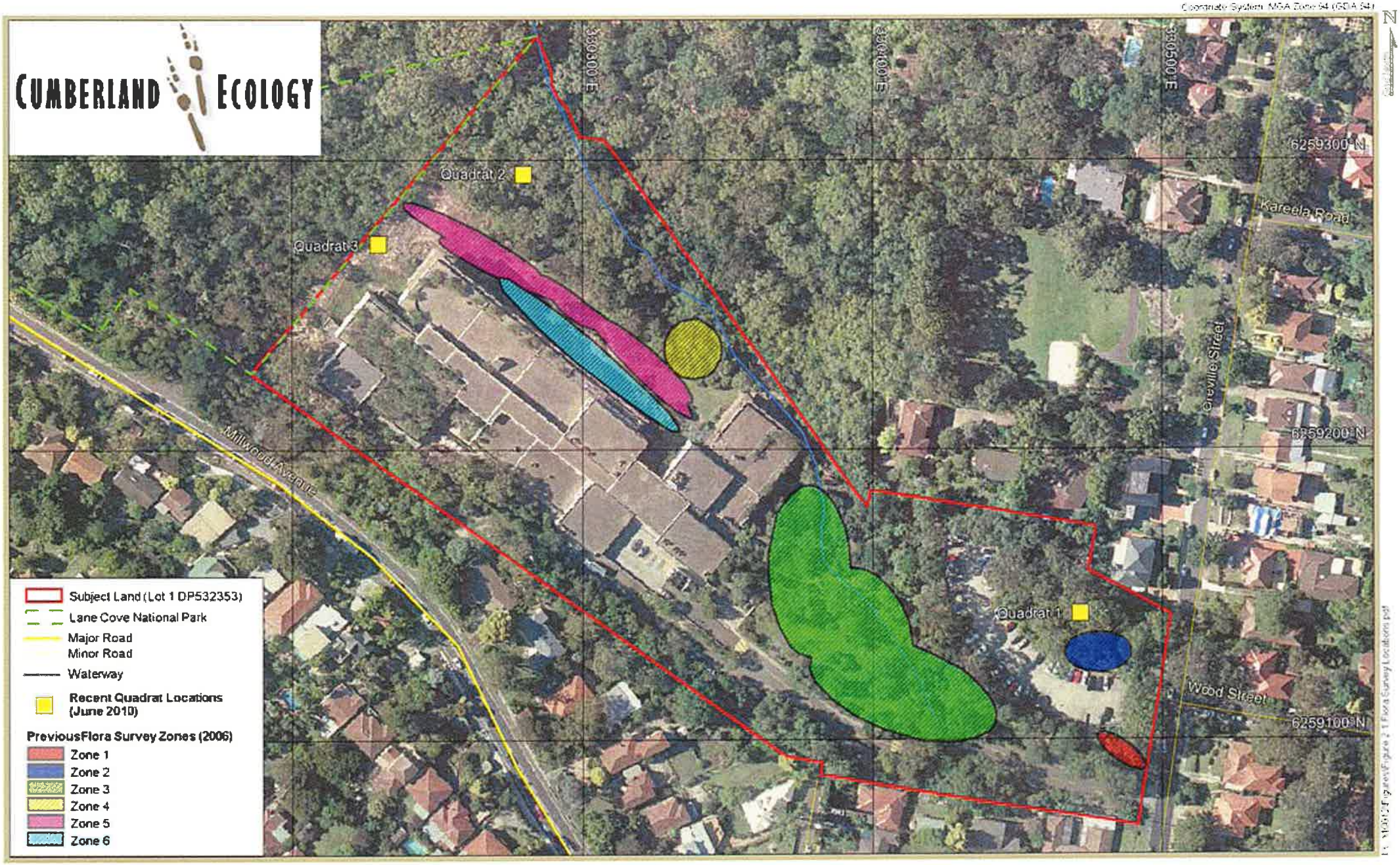

Figure 2.1 Flora Survey Locations

2.4 Fungus Survey

Species of fungus were observed to be fruiting during the time of a site visit, on 26 June 2006. The basidiomes (above-ground fruiting structures) of these fungi were photographed and later identified by Dr Ray Kearney of Sydney Fungal Studies Group Inc. from the photographs.

2.5 Fauna Survey

2.5.1 Fauna Species

Fauna trapping were considered unnecessary for the subject land because the subject land is directly adjacent to Lane Cove National Park, which has been extensively surveyed. Comprehensive species lists can be viewed within *Systematic Survey of Vertebrate Fauna in Lane Cove National Park* (DEC(NSW), 2004b) or accessed via the DECCW Atlas of NSW Wildlife Database (DECCW, 2010a). It is not considered likely that different fauna species occur on the subject land. All species observed during the 9 June 2010 survey were recorded to give an understanding of the type of fauna that use the site.

Searches for the Red-crowned Toadlet were conducted on 9 June 2010. Weather conditions prior to the survey had been favourable for detection of this species. Searches were conducted along the waterways and involved call-playback of the species call, listening for call responses as well as searches amongst leaf litter within areas considered likely to contain the species.

2.5.2 Habitat Assessment

Fauna habitat assessments were undertaken in conjunction with flora surveys during both 2006-2007 surveys and 2010 surveys. Fauna habitat assessments included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks and soaks. An assessment of the structural complexity of vegetation, the age structure of the forest and the nature and extent of human disturbance throughout the subject land was also undertaken and considered. Structural features considered included the nature and extent of the understorey and ground stratum, extent of canopy and flowering characteristics.

Hollows were used as a general indication of habitat quality for arboreal fauna, and hollow dwelling birds and bats. Hollows observed during surveys were noted and the location recorded using GPS and the general vegetation condition and tree maturity was used to predict whether trees on site were likely to contain hollows.

Indirect indicators of fauna use of the site such as droppings, diggings, footprints, scratches, nests, burrows, paths and runways were recorded. The 2010 surveys included targeted searches for owl pellets in likely roosting habitats.

2.6 Limitations

2.6.1 Flora

The flora surveys were conducted during a number of site inspections in June 2006, February 2007 and June 2010. Therefore surveys have been conducted across three years and two seasons (winter and summer) providing an opportunity to consider temporal variability of the vegetation. Where flowering features were not able to be identified other features were utilised to enable identification of the species.

It is likely that the majority of flora species have now been recorded and that issues including conservation significance of the flora, condition and viability of bushland and likely impact on native vegetation have been satisfactorily assessed.

Some threatened flora species occurring within the locality are cryptic and may occur on the subject land but were not detected during the survey. An assessment of the likelihood of occurrence of all threatened flora species recorded in the locality was undertaken to supplement the flora survey.

2.6.2 Fauna

Fauna surveys largely relied on literature review, database analysis and fauna habitat assessment. The literature review, database analysis and fauna habitat assessment gave an indication of the species that could occur on the subject land. An assessment of the likelihood of occurrence of all threatened fauna species recorded in the locality was undertaken to supplement the fauna habitat assessment.

Chapter 3

Results

3.1 Introduction

This chapter presents the findings of flora and fauna surveys across the subject land during the current and previous surveys. A variety of woodland and open forest flora and fauna are known to occur in the locality surrounding the subject land and a considerable diversity of species has been identified in the adjacent Lane Cove National Park. Flora quadrat data is provided in **Appendix A** while a composite flora species list from all surveys can be found in **Appendix B.** Fauna survey results from the 2010 survey are provided in **Appendix C.**

3.2 Vegetation Communities

3.2.1 Introduction

i. General features of the vegetation

The subject land has been extensively cleared and modified during the construction of the existing and previous infrastructure. As a result, a large portion of the subject land has been cleared of the original native vegetation and exists as developed, hardstand and exotic grassland areas. However, some remnants of the original bushland of the locality remain in patches on the subject land.

The following vegetation communities were recorded on the subject land. Vegetation community names have been based on the Sydney Metro Catchment Management Authority Vegetation Mapping (DECCW 2009):

- Mixed native and exotic landscape plantings;
- Hornsby Enriched Sandstone Exposed Woodland; and
- Coastal Shale-Sandstone Forest..

A description of each of the communities recorded is provided below and their distribution on the subject land is shown in **Figure 3.1**. The area of each vegetation community is provided in **Table 3.1**.

Table 3.1 VEGETATION COMMUNITIES WITHIN THE SUBJECT LAND

Vegetation Community	Current Area of Vegetation (ha)	Currently Managed/APZ (ha)
Hornsby Enriched Sandstone Exposed Woodland	0.080	0.073
Coastal Shale-Sandstone Forest	0.697	0.033
Urban Native / Exotic Vegetation	1.205	0.890
Total	**1.982**	**0.996**

3.2.2 Mixed Native and Exotic Landscape Plantings

This community covers most of the open area on the subject land, to the west of the Greville Street entry. It largely comprises plantings of locally indigenous and exotic species in each vegetation stratum (canopy, small tree, shrub and ground cover).

The most common and widespread species is *Cynodon dactylon* (Couch Grass), which has been planted in the central area of the property and adjacent to the large building on its northern face. *C. dactylon* is absent from this community where tree cover is dense or the landscape tends to a more naturalistic approach. The area adjacent to the northern and western face of main building is managed as an asset protection zone (APZ) and is clear of significant vegetation.

Numerous trees and shrubs have been planted, especially Australian native species, many of which also occur naturally in the local area such as *Eucalyptus microcorys* (Tallowwood), *Eucalyptus robusta* (Swamp Mahogany) and *Syncarpia glomulifera* (Turpentine). There are also remnant or re-growth species of native plant communities that occur locally (e.g. *Syncarpia glomulifera* (Turpentine); *Pittosporum undulatum* (Sweet Pittosporum); *Glochidion ferdinandi* (Cheese Tree) and *Oplismenus aemulus* (Basket Grass)). These occur in small proportions and do not represent a native vegetation community from the Sydney region. Introduced exotic species are uncommon due to the ongoing vegetation management of the subject land but dominate in adjacent properties. Examples of these include: *Ligustrum* spp (Privets), *Lantana camara* (Lantana); *Ehrharta erecta* (Panic Veldt Grass); and *Tradescantia fluminensis* (Wandering Jew).

Photograph 3.1 Mixed Native and Exotic Landscape Plantings

3.2.3 Hornsby Enriched Sandstone Exposed Woodland

This community does not conform to any EECs under the TSC or EPBC Acts and the majority of this community has been highly modified through the ongoing management as an APZ within the western portion (**Figure 3.1**) of the subject land. The same community extends further west off the subject land (**Figure 3.1**). Due to the ongoing APZ management of this community no trees are present and shrubs are maintained at a very low height. Dominant shrub species include *Kunzea ambigua* (Tick Bush), *Polyscias sambucifolia* (Elderberry Panax), *Micrantheum ericoides, Leucopogon ericoides* and *Darwinia biflora*. The common ground cover species include *Pavonia hastata, Dianella caerulea* var *producta* and the exotic grass *Melinus repens* (Red Natal Grass). The vegetation mapped within and adjacent to this subject land is consistent with this community however there is no sign of clay enrichment of the community in this location as is suggested by the Sydney Metro Catchment Management Authority Vegetation Mapping profile for this community (DECCW 2009).

3.2.4 Coastal-Shale Sandstone Forest

This community is not listed as an EEC under State or Commonwealth legislation and occurs in two discrete pockets of the subject land located in the north west corner of the subject land along the riparian corridor and north east corner of the subject land between

the property boundary and the site car park (**Figure 3.1**). This community is seen in two subtly different but distinct forms within the subject land due to the ongoing nature of disturbance within the northeast corner.

i. Northwest portion of Subject Land

The vegetation within the north west corner of the project area and is relatively good condition. Edge effects are visible from the APZ that is managed to the south of the vegetation and weed invasion is quite high in the riparian strip, but much of the remnant vegetation between these zones seems relatively undisturbed. The soil within and adjacent to the area is sandy with no obvious clay enrichment.

Within this northwest portion of the subject land *Eucalyptus pilularis* (Blackbutt) and *Eucalyptus piperita* (Sydney Peppermint) are the dominant canopy species with *Eleocarpus reticularis* (Blueberry Ash) being a common mid-story species. The dominant shrub species is *Kunzea ambigua* (Tick Bush), with *Woolsia pungens*, *Polyscias sambucifolia* (Elderberry panax), *Logania albiflora*, *Grevillea linearifolia*, *Pomaderris elliptica* and the exotic *Ochna serrulata* (Mickey Mouse Plant), all common. Dominant ground covers included *Lomandra longifolia* (Spiny-headed Matt-rush) and *Entolasia stricta* (Wiry Panic).

Photograph 3.2 **Coastal-Shale Sandstone Forest in the north west potion of Subject Land**

ii. Northeast portion of Subject Land

This community in the north east corner of the car park is mapped as the State listed Endangered Ecological Community (EEC) Sydney Turpentine - Ironbark Forest (STIF) within the recent vegetation mapping document, Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area (DECCW, 2009). Field inspection of this area and subsequent analysis of quadrat data indicated that this area of vegetation contains species indicative of three different communities in the Sydney Metro CMA mapping (Coastal Shale-Sandstone Forest, Coastal Enriched Sandstone Sheltered Forest and Sydney Turpentine-Ironbark Forest). The tree communities occur on soils that are shale influenced and so have at least some plant species that require the more fertile shale-derived soils. However, the former two communities occur on substrates with a lower shale influence.

The community in the northeast portion of the subject land was determined to be Coastal Shale-Sandstone Forest rather than STIF for the following reasons:

- *Eucalyptus piperita* (Sydney Peppermint), which is not a STIF species dominates the canopy;
- *Corymbia gummifera* (Red Bloodwood), which is typical of Coastal Shale-Sandstone Forest is present on site; and
- Key species indicative of STIF are absent, including species such as *Eucalyptus paniculata* (Grey Ironbark.

There is also at most a weak influence of shale and shale derived soils, consistent with Coastal Shale-Sandstone Forest. Thorough inspection of the soil types within the subject land and along Greville Street indicated that sandstone was by far the dominant influence on the soil landscape with most areas containing light sandy-loam soil substrates; a very minor clay influence was present in some locations through the formation of ironstone. Very minor evidence of inter-bedded shales were the identified during inspections of sandstone rock walls which were at considerable depth below the soil surface.

The dominant canopy species within this north east area are *Eucalyptus piperita* (Sydney Peppermint), *Angophora costata* (Smooth-bark Apple) and *Syncarpia glomulifera* (Turpentine) with a dense midstorey of *Pittosporum undulatum* (Sweet Pittosporum). The shrub layer is dominated by the exotic *Ochna serrulata* (Mickey Mouse Plant), *Ligustrum sinense* (Small-leaved Privet), *Cinnamomum camphora* (Camphor Laurel), as well as the native *Glochidion ferdinandi* (Cheese Tree). The ground cover is dominated by the exotic *Asparagus densiflorus (Fern Asparagus),, Lonicera japonica* (Japanese Honeysuckle), *Ehrharta erecta* (Panic Veldt Grass) and the native *Microlaena stipoides* (Weeping Meadow-grass) and *Smilax glyciphylla* (Sarsaparilla).

One sapling that occurs in this area looks superficially like *Eucalyptus saligna* (Sydney Blue Gum), which if present would indicate a stronger shale influence to the soil. However

the street tree adjacent to the subject land and the sapling on its eastern boundary are actually *Eucalyptus grandis* (Flooded Gum), and are not native to the study area.

Photograph 3.3 **Coastal-Shale Sandstone Forest in the north east potion of Subject Land**

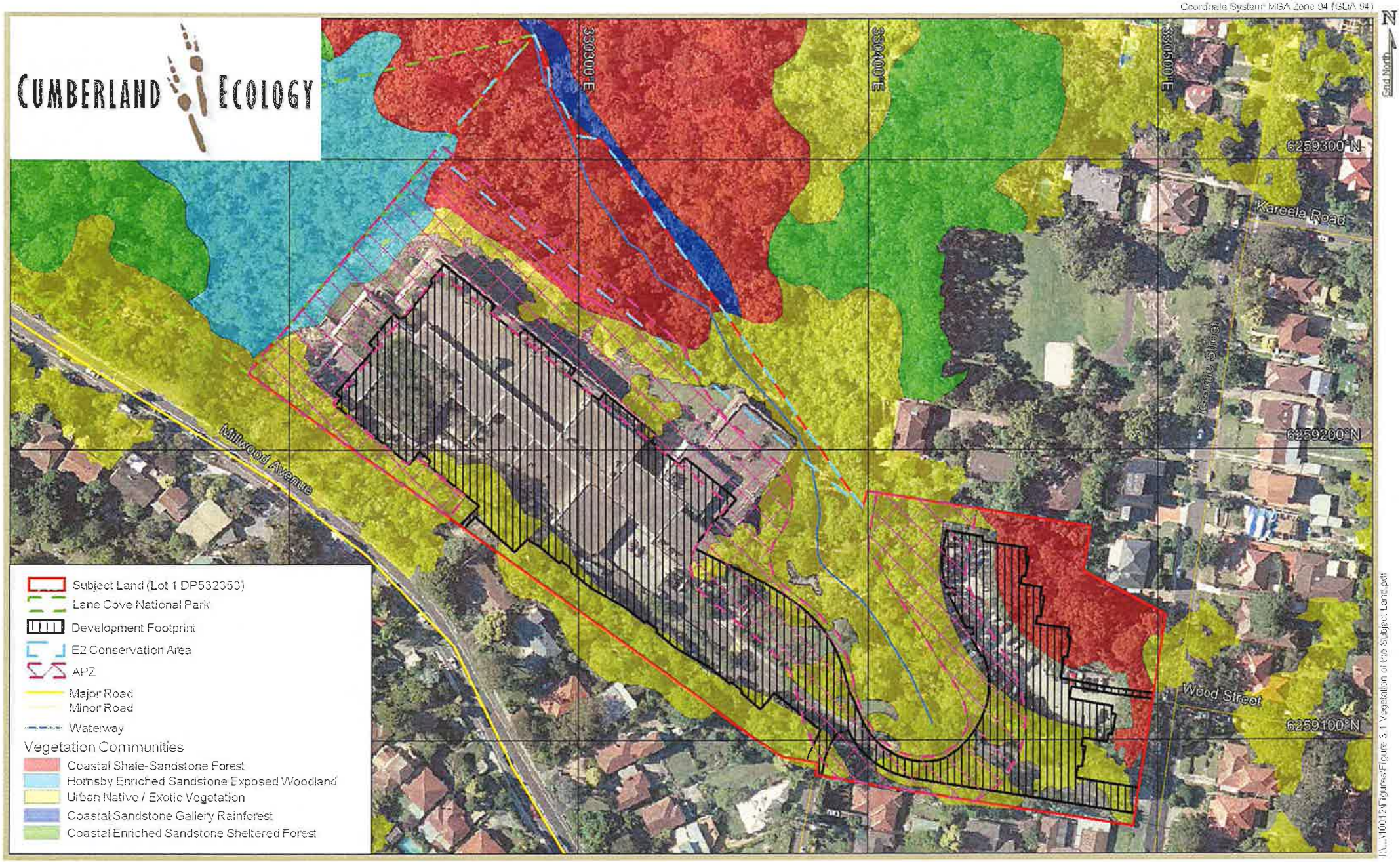

Figure 3.1 Vegetation of the Subject Land

3.3 Flora

A number of flora surveys have been conducted within the subject land over several years and most recently by Cumberland Ecology in 2010. A total flora species list from previous and current surveys is provided in **Appendix A**. Quadrat data from Cumberland Ecology quadrats undertaken using the (then) DEC Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (Working Draft) (DEC (NSW), 2004) is provided in **Appendix B**. Over 250 flora species have been recorded on the subject land, with approximately 145 of the species being native, highlighting the extensive exotic influence on the vegetation of the subject land. The flora species that occur within the forest communities are relatively consistent between the current survey and the earlier surveys.

3.3.1 Threatened Flora

One threatened flora species, *Darwinia biflora*, has been recorded on the subject land. This species is listed as vulnerable under both the TSC Act and EPBC Act. *Darwinia biflora* occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone and ridge top heath and woodland vegetation.

Darwinia biflora is well represented in Sydney's sandstone National Parks with 32 records from within Lane Cove National Park and 48 records from within the bounds of Ku-ring-gai Council. The species is often abundant in disturbed areas such as the existing APZ on site and occurs in populations of thousands of individuals in some locations.

A total of 41 individuals were recorded during 2010 surveys. These specimens occur in only a small portion of the subject lands. Locations of these specimens are shown in **Figure 3.2**. The rezoning of the subject land is unlikely to cause a significant impact on this species based on the results of the assessment of significance prepared for the species provided appropriate management of the sub-population is undertaken. An assessment of Significance for *Darwinia biflora* is provided in **Appendix D**.

With respect to the *Darwinia biflora* it is not considered necessary to complete an EPBC Act Referral for the rezoning of the subject land. The individuals of this species form a small sub-population of a population that exists across the southern end of the species known range. The species is unlikely to be impacted by the proposed rezoning and the species and its habitat will be managed appropriately under a VMP to be prepared for the site to ensure its survival within the subject land.

A number of other threatened flora species listed under the TSC Act and EPBC Act are known to occur within the locality. **Table 3.1** analyses the likelihood of occurrence of each threatened flora species recorded within the locality on the subject land.

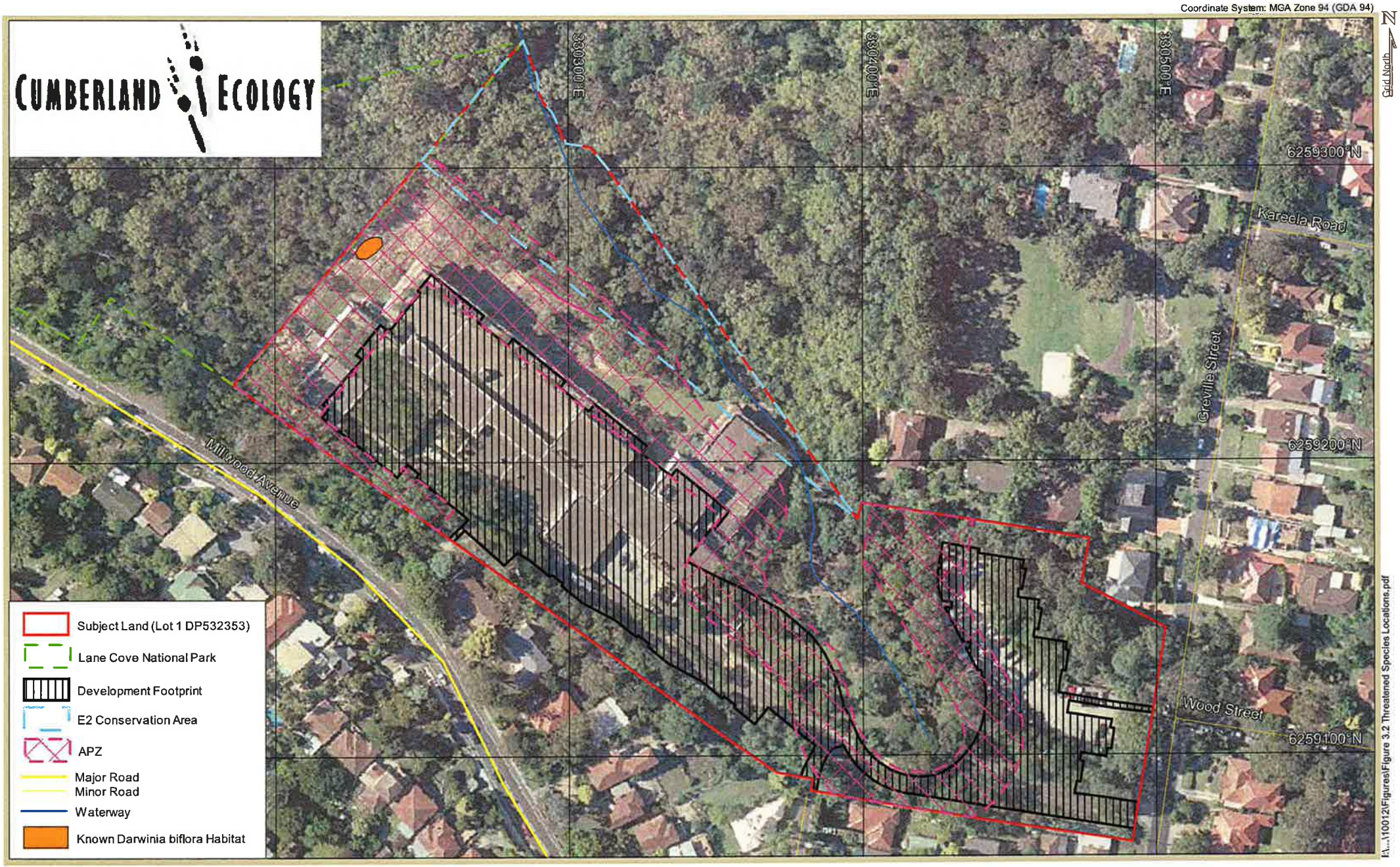

Figure 3.2 Threatened Species Locations

Table 3.2 LIKELIHOOD OF OCCURRENCE OF THREATENED FLORA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count*	Lane Cove National Park Count*	Habitat Requirements	Likelihood of Occurrence
Elaeocarpaceae	*Tetratheca glandulosa*		V	V	11	19	Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest.	Potential. Not recorded during current surveys. Small area of potential habitat within the proposed E2 zone within the subject land.
Ericaceae	*Epacris purpurascens var. purpurascens*		V		9	6	Found in a range of habitat types, most of which have a strong shale soil influence.	Potential. Not recorded during current surveys. Small area of potential habitat within the proposed E2 zone within the subject land.
Fabaceae (Mimosoideae)	*Acacia bynoeana*	Bynoe's Wattle	E1	V	4		Occurs in heath or dry sclerophyll forest on sandy soils.	Unlikely. No suitable habitat.
	Acacia terminalis subsp. terminalis	Sunshine Wattle	E1	E	1		Occurs in coastal scrub and dry sclerophyll woodland on sandy soils.	Unlikely. No suitable habitat.

Table 3.2 LIKELIHOOD OF OCCURRENCE OF THREATENED FLORA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count*	Lane Cove National Park Count*	Habitat Requirements	Likelihood of Occurrence
Haloragaceae	*Haloragodendron lucasii*		E1	E	6		Associated with dry sclerophyll forest. Reported to grow in moist sandy loam soils in sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland.	Potential. Area of potentially suitable habitat occurs near watercourse and will be protected within Core Riparian Zone.
Hygrophoraceae	*Camarophyllopsis kearneyi*		E1		1		Occurrence appears to be limited to the Lane Cove Bushland Park.	Potential. Area of potentially suitable habitat occurs near watercourse and will be protected within Core Riparian Zone.
	Hygrocybe anomala var. ianthinomarginata		V		1		Occurs in gallery warm temperate forests. Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. Known from Lane Cove Bushland Park and Royal and Blue Mountains NPs	Potential. Area of potentially suitable habitat occurs near watercourse and will be protected within Core Riparian Zone.
	Hygrocybe		V		1		Occurs in gallery warm temperate	Potential. Area of

Table 3.2 LIKELIHOOD OF OCCURRENCE OF THREATENED FLORA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count*	Lane Cove National Park Count*	Habitat Requirements	Likelihood of Occurrence
	aurantipes						forests. Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. Known from Lane Cove Bushland Park and Royal and Blue Mountains NPs.	potentially suitable habitat occurs near watercourse and will be protected within Core Riparian Zone.
	Hygrocybe austropratensis		E1		1		Occurs in gallery warm temperate forests. Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. Occurrence appears to be limited to the Lane Cove Bushland Park.	Potential. Area of potentially suitable habitat occurs near watercourse and will be protected within Core Riparian Zone.
	Hygrocybe collucera		E1		1		Occurs in gallery warm temperate forests. Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. Occurrence appears to be limited to the Lane Cove Bushland Park.	Potential. Area of potentially suitable habitat occurs near watercourse and will be protected within Core Riparian Zone.

Table 3.2 LIKELIHOOD OF OCCURRENCE OF THREATENED FLORA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count*	Lane Cove National Park Count*	Habitat Requirements	Likelihood of Occurrence
	Hygrocybe griseoramosa		E1		1		Occurs in gallery warm temperate forests. Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. Occurrence appears to be limited to the Lane Cove Bushland Park.	Potential. Potential. Area of potentially suitable habitat occurs near watercourse and will be protected within Core Riparian Zone.
	Hygrocybe lanecovensis		E1		1		Occurs in gallery warm temperate forests. Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. Occurrence appears to be limited to the Lane Cove Bushland Park.	Potential. Area of potentially suitable habitat occurs near watercourse and will be protected within Core Riparian Zone.
	Hygrocybe reesiae		V		1		Occurs in gallery warm temperate forests. Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. Known from Lane Cove Bushland Park, Blue Mountains	Potential. Area of potentially suitable habitat occurs near watercourse and will be protected within Core Riparian Zone.

Table 3.2 LIKELIHOOD OF OCCURRENCE OF THREATENED FLORA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count*	Lane Cove National Park Count*	Habitat Requirements	Likelihood of Occurrence
							National Park and Tasmania.	
	Hygrocybe rubronivea		V		1		Occurs in gallery warm temperate forests. Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. Known from Lane Cove Bushland Park, Blue Mountains National Park and south east Queensland.	Potential. Area of potentially suitable habitat occurs near watercourse and will be protected within Core Riparian Zone.
Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V		5	2	Grows in dry sclerophyll forest on the coast and adjacent ranges.	Unlikely. No suitable habitat.
	Darwinia biflora		V	V	42	34	Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone.	Present. A population of 41 individuals occurs within a small area on the western boundary of the subject land.
	Eucalyptus camfieldii	Heart-leaved Stringybark	V	V	20		Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone.	Unlikely. No suitable habitat.

Table 3.2 LIKELIHOOD OF OCCURRENCE OF THREATENED FLORA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count*	Lane Cove National Park Count*	Habitat Requirements	Likelihood of Occurrence
							Coastal heath mostly on exposed sandy ridges.	
	Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	4		Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite.	Unlikely. Not of conservation significance in the Sydney region.
	Leptospermum deanei		V	V	2	10	Woodland on lower hill slopes or near creeks. Sandy alluvial soil or sand over sandstone.	Potential. Not recorded during current surveys. Small area of potential habitat within the proposed E2 zone within the subject land.
	Melaleuca deanei	Deane's Paperbark	V	V	15	6	The species grows in heath on sandstone.	
	Syzygium paniculatum	Magenta Lilly Pilly	E1	V	4		On the south coast , it occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast, it	Unlikely. No suitable habitat.

Table 3.2 LIKELIHOOD OF OCCURRENCE OF THREATENED FLORA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count*	Lane Cove National Park Count*	Habitat Requirements	Likelihood of Occurrence
							occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	
Orchidaceae	*Caladenia tessellata*	Thick Lip Spider Orchid	E1	V	2		Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	Potential. Not recorded during current surveys. Small area of potential habitat within the proposed E2 zone within the subject land.
	Genoplesium baueri	Bauer's Midge Orchid	V		10	1	Grows in sparse sclerophyll forest and moss gardens over sandstone.	Potential. Not recorded during current surveys. Small area of potential habitat within the proposed E2 zone within the subject land.

Table 3.2 LIKELIHOOD OF OCCURRENCE OF THREATENED FLORA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count*	Lane Cove National Park Count*	Habitat Requirements	Likelihood of Occurrence
Poaceae	*Deyeuxia appressa*		E1	E	3		Given that Deyeuxia appressa hasn't been seen in over 60 years, almost nothing is known of the species' habitat and ecology. This species is mesophytic (grows in moist conditions).	Unlikely. No suitable habitat.
Proteaceae	*Persoonia hirsuta*	Hairy Geebung	E1	E	4		Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	Unlikely. No suitable habitat.
Sterculiaceae	*Lasiopetalum joyceae*		V	V	1		Grows in heath on sandstone.	Unlikely. No suitable habitat.
Thymelaeaceae	*Pimelea curviflora var. curviflora*		V	V	4	2	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridge tops and upper slopes amongst woodlands.	Unlikely. No suitable habitat.

* Records obtained from the DECCW Atlas of NSW Wildlife

3.4 Fungi

The following taxa of fungi were recorded within the subject land during the 2006/2007 surveys:

- *Laccaria sp.*;
- *Mycena sp.*;
- *Lactarius eucalypti*;
- *?Lepiota sp.*; and
- *Collybia sp.*

Nine threatened species of fungi and one endangered ecological community (EEC) of fungi are known from the locality of the subject land. These were not found to occur in the subject land.

3.5 Fauna

3.5.1 Fauna Habitat

Vegetation within the subject land provides potential habitat for a range of native vertebrate fauna species, including amphibians, birds, terrestrial and arboreal mammals, bats and reptiles. Vegetated areas with a greater complexity in structure are likely to support a wider range of species than the communities with simple structure.

Key habitat features recorded during the current surveys included;

- Riparian environments which provide habitat for wetland birds, frogs and reptiles;
- Ground cover, leaf litter and fallen timber suitable as shelter for small terrestrial fauna species;
- Tree hollows suitable as shelter and nesting habitat for hollow dependant fauna; and
- Blossom-producing trees suitable for foraging for a range of nectivorous species.

The water course on the subject land emanates from a storm-water drain on the southern side of the property and carries only urban storm water. It then flows across a landscaped area and down three small sandstone water falls before entering the bushland in the northern corner of the property. The watercourse then terminates in Blue Gum Creek. For

most of its length on the property, from the lowermost water fall upstream to the pipe, it provides little in the way of freshwater habitat for native stream fauna and water quality is likely to be low as a result of contaminants and nutrients derived from the upstream urban catchment. However, more of a natural stream habitat exists below the third waterfall and this is likely to afford more substantial habitat for freshwater macroinvertebrates and possibly fish, however no fish of conservation significance are expected to occur within this area. It is expected that below the third waterfall, the water course would provide habitat for frogs, reptiles as well as birds and bats that forage along stream corridors. This potential aquatic habitat occurs outside the future development footprint and will be protected within the Core Riparian Zone of the water course.

Features such as understorey vegetation, leaf litter and fallen logs, which provide shelter for many of the small to medium sized terrestrial fauna species known from the locality, were generally limited to areas not previously cleared. Vegetation structure within the northern patch of bushland varies, with the lower gully area (within 20m of the watercourse) having a greater availability of shrub/mid storey vegetation and cover for ground-dwelling fauna compared to the higher slopes.

No hollows suitable for nocturnal owl species (DEC 2006, NPWS 2003) or arboreal marsupials to nest in were detected on the subject land and it is considered unlikely that these animals nest in this area due to the poor quality habitat and its location on the fringe of urban development.

The majority of the forest vegetation on the subject land, as well as the vegetation within the general locality provides suitable foraging habitat for a range of nectivorous species during blossom periods, with the best quality habitat within Lane Cove National Park. Review of the blossom periods for these canopy species indicates that there is suitable foraging habitat for these species throughout most of the year. The blossoms of the dominant tree species recorded on the subject land are known to provide a food source for a number of threatened species including the Grey-headed Flying-fox (*Pteropus poliocephalus*).

3.5.2 Fauna Species

A suite of fauna species have been recorded in the vicinity of the subject land during previous surveys. A total fauna species list from the current surveys is provided in **Appendix C**. The fauna species recorded during the current survey are common in the locality.

A number of threatened fauna species listed under the TSC Act and EPBC Act are known to occur within the locality of the subject land. **Table 3.2** analyses the likelihood of occurrence of each threatened flora species recorded within the locality on the subject land.

Table 3.3 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count	Lane Cove National Park Count	Habitat Requirements	Likelihood of Occurrence
Amphibians								
Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E1	V	2		Inhabits marshes, dams and stream-sides, particularly those containing bulrushes (Typha spp.) or Spikerushes (Eleocharis spp.).	Unlikely. No suitable habitat within the subject land.
Myobatrachidae	*Pseudophryne australis*	Red-crowned Toadlet	V		37	11	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	Possible. Not recorded during 2010 surveys. Recorded within Lane Cove National Park. Quality of habitat poor due to being downstream of large residential area. Potential habitat restricted to downstream portion of watercourse
Aves								
Accipitridae	*Pandion haliaetus*	Osprey	V		1		Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.	Unlikely. No suitable habitat within the subject land.

Table 3.3 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count	Lane Cove National Park Count	Habitat Requirements	Likelihood of Occurrence
Anatidae	*Nettapus coromandelianus*	Cotton Pygmy-Goose	E1		4	4	Freshwater lakes, lagoons, swamps and dams, particularly those vegetated with waterlilies and other floating and submerged aquatic vegetation. It uses standing trees with hollows close to water for roosting and breeding.	Unlikely. No suitable habitat within the subject land.
Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	V		1	1	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bulrushes (Typha spp.) and Spikerushes (Eleocharis spp.).Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails.	Unlikely. No suitable habitat within the subject land.
	Ixobrychus flavicollis	Black Bittern	V		4		Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland,	Unlikely. No suitable habitat within the subject land.

Table 3.3 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count	Lane Cove National Park Count	Habitat Requirements	Likelihood of Occurrence
							rainforest and mangroves.	
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E1		1		Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber.	Unlikely. No suitable habitat within the subject land.
Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V		2	6	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Move to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting.	Likely. Not recorded in recent surveys but suitable feed species exist within the subject land. Small numbers of records exist within Lane Cove National Park. Small area of potential habitat within the proposed E2 zone within the subject land. Any potential breeding habitat unlikely to be impacted.
	Callocephalon fimbriatum	Gang-gang Cockatoo	E2		2	6	Significant as it is the last known breeding population in the Sydney	Possible. Not recorded in recent surveys but suitable

Table 3.3 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count	Lane Cove National Park Count	Habitat Requirements	Likelihood of Occurrence
		population in the Hornsby and Ku-ring-gai Local Government Areas					Metropolitan area. Has a small population size, estimated to be between 18 - 40 pairs. Also utilises less heavily timbered woodlands and urban fringe areas to forage, but appears to favour well timbered country through which it habitually flies as it moves about.Occurs within a variety of forest and woodland types. Usually frequents forested areas with old growth attributes required for nesting and roosting purposes.	feed species exist within the subject land. Small numbers of records exist within Lane Cove National Park. Small area of potential habitat within the subject land.
	Calyptorhynchus lathami	Glossy Black-Cockatoo	V		1		Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur.	Possible. Not recorded in recent surveys but suitable feed species exist within the subject land. Small numbers of records exist within Lane Cove National Park. Small area of potential habitat restricted to vegetation with

Table 3.3 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count	Lane Cove National Park Count	Habitat Requirements	Likelihood of Occurrence
								Allocasuarina sp.
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1		1		Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.	Unlikely. No suitable habitat within the subject land.
Columbidae	*Ptilinopus superbus*	Superb Fruit-Dove	V		9		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 may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	Unlikely. No suitable habitat within the subject land.
Laridae	*Sterna albifrons*	Little Tern	E1		1		Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with	Unlikely. No suitable habitat within the subject land.

Table 3.3 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count	Lane Cove National Park Count	Habitat Requirements	Likelihood of Occurrence
							occasional offshore islands or coral cay records).	
Meliphagidae	*Xanthomyza phrygia*	Regent Honeyeater	E1	E	5		Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak.	Possible. Suitable flowering feed trees within the subject land. Site may be used as an occasional and opportunistic forage location during wide scale migratory movements. Small area of potential habitat within the proposed E2 zone within the subject land.
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V		1		It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Likely. Suitable habitat within the subject land. Small area of potential habitat within the proposed E2 zone within the subject land.
Psittacidae	*Glossopsitta*	Little Lorikeet	V		1		Little Lorikeets mostly occur in dry,	Likely. Suitable habitat

Table 3.3 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count	Lane Cove National Park Count	Habitat Requirements	Likelihood of Occurrence
	pusilla						open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range.	within the subject land and species recorded during surveys of Lane Cove National Park.
	Lathamus discolor	Swift Parrot	E1	E	4		Occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations.	Possible. Suitable winter flowering feed trees within the subject land. Site may be used as an occasional forage location during Winter migration.
Strigidae	*Ninox connivens*	Barking Owl	V		4		Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting.	Likely. Forage and roost habitat within the subject land. Known to roost in the adjacent Blue Gum Reserve
	Ninox strenua	Powerful Owl	V		84	15	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	Likely. Forage and roost habitat within the subject land. Recorded during surveys of Lane Cove National Park

Table 3.3 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count	Lane Cove National Park Count	Habitat Requirements	Likelihood of Occurrence
Mammalia								
Burramyidae	*Cercartetus nanus*	Eastern Pygmy-possum	V		2		Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest.	Unlikely. Level of disturbance of habitat considered unlikely to this species which is sensitive to the impacts of edge effects.
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	5		Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	Unlikely. Species is considered unlikely to forage this close to residential developments.
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V		1		Occur in dry sclerophyll forest and woodland east of the Great Dividing	Possible. Potential forage habitat for this species

Table 3.3 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count	Lane Cove National Park Count	Habitat Requirements	Likelihood of Occurrence
							Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	within the subject land. Small area of potential habitat within the proposed E2 zone within the subject land.
Petauridae	*Petaurus australis*	Yellow-bellied Glider	V		1		Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	Unlikely. No suitable habitat within the subject land.
Phascolarctidae	*Phascolarctos cinereus*	Koala	V		1		Inhabit eucalypt woodlands and forests.	Unlikely. No suitable habitat within the subject land.
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	906	7	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Site	Likely. Suitable feed trees for the species within the subject land and species has been recorded during surveys of Lane Cove National Park.

Table 3.3 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count	Lane Cove National Park Count	Habitat Requirements	Likelihood of Occurrence
							fidelity to camps is high with some camps being used for over a century. Travel up to 50 km to forage.	
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V		18	5	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 km range of maternity caves. Hunt in forested areas, catching moths and other flying insects above the tree tops.	Likely. Suitable feed trees for the species within the subject land and species has been recorded during surveys of Lane Cove National Park. Small area of potential habitat within the proposed E2 zone within the subject land.
Reptilia								
Varanidae	*Varanus rosenbergi*	Rosenberg's Goanna	V		2		Found in heath, open forest and woodland. Associated with termites, the mounds of which this species	Unlikely. Species relies on large foraging areas. No termite mounds for foraging

Table 3.3 LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES KNOWN FROM THE LOCALITY

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Locality Count	Lane Cove National Park Count	Habitat Requirements	Likelihood of Occurrence
							nests in; termite mounds are a critical habitat component. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens. Individuals require large areas of habitat.	or breeding within the subject land.

3.6 Threatened Species Considered Likely to Occur

While no threatened fauna species were recorded within the subject land during recent surveys, seven species listed as vulnerable under the TSC Act are considered likely to occur. It is considered that if the Varied Sittella, Powerful Owl, Barking Owl, Gang-gang Cockatoo and Eastern Bent-wing Bat did occur they would be restricted to habitats within the E2 Conservation Zone as other habitats are not appropriate. There is however potential for the Grey-headed Flying-fox and the Little Lorikeet to forage on the majority of native canopy species within the subject land. These species are considered in more detail below. Assessments of Significance for these species are provided in **Appendix D**.

3.6.1 Varied Sittella

The Varied Sittella (*Daphoenositta chrysoptera*) was recently listed as vulnerable under the TSC Act and is known to inhabit wet and dry woodlands and forests including the vegetation communities found within and around the subject land. While not previously recorded on the subject land the species has been previously recorded within Lane Cove National Park (DEC(NSW), 2004b). The available habitat for this species within the subject land is limited to areas within the E2 Conservation Lands.

3.6.2 Little Lorikeet

The Little Lorikeet (*Glossopsitta pusilla*) was also recently listed as vulnerable under the TSC Act and is considered likely to forage within the subject land opportunistically during locally prolific blossom periods or when other nectar sources are scarce. While not previously recorded on the subject land the species has been previously recorded within Lane Cove National Park (DEC(NSW), 2004b). Suitable foraging habitat for the Little Lorikeet is present within all areas of the subject land and potential nesting habitat is present within undisturbed vegetation such as the E2 Conservation Lands, particularly within areas containing smooth-barked trees.

3.6.3 Gang-gang Cockatoo

The Gang-gang Cockatoo (*Callocephalon fimbriatum*) is listed as vulnerable under the TSC Act and an Endangered population of the species is known to occur within the Hornsby and Ku-ring-gai Local Government Areas. The species undertakes a seasonal, altitudinal migration and during summer is typically found in tall mountain forests and woodlands. During winter the species has bee known to occur at lower altitudes in drier and is often found in urban and coastal areas. The species is known to occur within the Lane Cove National Park (DECCW, 2010) and is considered likely to is considered likely to forage within the subject land opportunistically. Suitable foraging habitat for the Gang-gang Cockatoo is mainly restricted to the E2 Conservation Lands and it is not considered

that suitable nesting habitat occurs for this species due to the lack of trees bearing large hollows suitable for this species.

3.6.4 Powerful Owl and Barking Owl

The subject site provides suitable foraging and roost habitat for the Powerful Owl (*Ninox strenua*) and the Barking Owl (*Ninox connivens*). The Powerful Owl has numerous records from within the locality (DECC (NSW), 2009) and has been recorded within Lane Cove National Park (DEC(NSW), 2004b). Anecdotal records, supported by Cumberland Ecology staff observations in 2007, indicate that the Barking Owl is known to roost within Blue Gum Reserve, adjacent to the subject site. These species are listed as vulnerable under the TSC Act. The subject land contains a riparian corridor; which are known to constitute preferred habitat for Powerful and Barking Owls, and the subject site is considered to provide suitable habitat for some of the owl's preferred prey species, including the Common Ring-tail Possum (*Pseudocheirus peregrinus*) although no signs of whitewash or owl pellets were recorded during the 2010 survey. The revegetation of the riparian corridor will be beneficial to these species and prey.

3.6.5 Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus)* is listed as vulnerable under the TSC Act and EPBC Act. The species inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests as well as cultivated and urban areas. The subject land supports a number of species which are suitable feed trees for the Grey-headed Flying-fox. These include trees from the Fabaceae, Myrtaceae and Pittosporaceae families. Whilst the subject site provides suitable foraging habitat for this species no camps were observed or are known to occur on it.

The Grey-headed Flying-fox roosts in colonies known as "camps". Bats have high site fidelity for camps and disperse between camps depending on the availability of food. In the Sydney area, there are three major Grey-headed Flying-fox camps at Ku-ring-gai Flying-fox Reserve at Gordon adjacent to Garigal National Park, the Royal Botanic Gardens, and Cabramatta Creek Flying-fox Reserve at Cabramatta (Ku-ring-gai Council, 1999). The Gordon camp is within close proximity to the subject land and there have been many sightings of the Grey-headed Flying-fox throughout the locality (DECCW, 2010a) including within Lane Cove National Park (DEC(NSW), 2004b).

3.6.6 Eastern Bentwing-bat

The site provides suitable foraging habitat, within the E2 Conservation Lands, for the threatened Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) which has been recorded within Lane Cove National Park (DEC(NSW), 2004b) and the wider locality. Some limited roost habitat is most likely provided by the larger trees, however, no obvious large tree hollows were identified during habitat tree assessments. This species forages in

and around the canopy of trees. Any habitat lost for this species will be re-established with the revegetation of the riparian corridor.

3.7 Amphibian Survey

Two common frog species, Common Eastern Froglet (*Crinia signifera*) and Striped Marsh Frog (*Limnodynastes peronii*), were recorded in recent surveys of the riparian corridor on the subject land. The habitat is highly disturbed and the water quality is predicated to be low due to the proximity to residential development. This postulation is supported by regular observations of algal masses that indicate an increased nutrient load within the creek.

Habitat assessments were conducted in riparian habitats and targeted threatened species searches were conducted for the amphibian species Red-crowned Toadlet. The gully within the subject land can be divided into two sections; the easterly section forms a highly altered waterway with mainly exotic canopy trees and little to no shrub layer. The westerly section is also disturbed being highly invaded with *Ligustrum sinense* (Small-leaved Privet) but the shrub layer and canopy species are mostly exotic. Neither section forms suitable habitat for the Red-crowned Toadlet which prefers habitat containing creeks and soaks on sandstone with out dense midstorey or shrub cover. This species requires rocks, logs and leaf litter for the deposit of eggs and the occurrence of nearby ephemeral creeks or streams for tadpoles to be washed into (Thumm and Mahony 1999). These ephemeral streams are limited within the subject land and not considered suitable for the species. The eastern section is too open and too highly disturbed to be considered habitat for this species (Robinson 2000, NSW NPWS 2001b) while the vegetation within the western section is too dense to be considered suitable for this species. Additionally the water quality is likely to be too poor to maintain the survival of this species due to its proximity to major roads and residential development.

An Assessment of Significance was undertaken for the Red-crowned Toadlet in the 2007 ecological assessment prepared by Cumberland Ecology. Since this time, further surveys for this species have been conducted as described above. These surveys have led to a better understanding of habitats within the subject land and as a result it is no longer considered necessary to prepare a seven-part test for this species as it is considered to have a relatively low potential to occur.

Chapter 4

Impact Assessment

4.1 Introduction

Impacts of the Planning Proposal on vegetation communities, flora species, and fauna habitat and species are not likely to be significant. The subject land has been historically cleared and remains highly altered as a landscaped garden with a few small pockets of native vegetation. These areas of native vegetation within the subject land will largely remain unaffected as part of the concept plan for the rezoning. The subject land will still support these areas of native vegetation, one of which will be rezoned E2 Environmental Conservation and the watercourse through the subject land will be revegetated to an ecologically functioning community. With appropriate management the long-term impacts of the proposed development are expected to be minimal with a positive outcome expected in the long-term.

Potential impacts to the ecological values of the subject land can be categorised as direct and indirect impacts. Potential direct impacts from future development include vegetation clearing and loss of habitat. Potential indirect impacts are the secondary processes that may occur as a result of development, such as increased edge effects and alteration to hydrological regimes.

4.2 Vegetation Communities

4.2.1 Direct Impacts

The primary direct impact resulting from future development will be the management of a very small area of native vegetation within the development area. The development area is defined as the area in which physical works are proposed. **Table 4.1** provides a summary of the current situation of native vegetation within the subject land while **Table 4.2** explains the situation of native vegetation at the conclusion of the development.

The total impact area across the subject land is approximately 1.3ha, of which less than 0.05ha comprises native vegetation communities. An additional 0.086ha will be managed as APZs that were not previously APZs. The large majority of the development footprint is comprised of 0.358ha of exotic communities and 1.0ha of cleared or developed land.

Table 4.1 CURRENT STAATUS OF NATIVE VEGETATION

Vegetation Community	Current Area of Vegetation (ha)	Area Currently Managed as APZ (ha)
Hornsby Enriched Sandstone Exposed Woodland	0.080	0.073
Coastal Shale-Sandstone Forest	0.697	0.033
Total	**0.777**	**0.106**

Table 4.2 NATIVE VEGETATION CLEARED, CONSERVED, MANAGED AND RE-ESTABLISHED UNDER THE PROPOSAL

Vegetation Community	Vegetation Cleared (ha)	Vegetation Retained (ha)	Additional APZ (ha)	E2 Conservation Zone (ha)	APZ in E2 Conservation Zone (ha)	Vegetation to be Re-established (ha)
Hornsby Enriched Sandstone Exposed Woodland	-	0.080	0.003	0.004	0.002	-
Coastal Shale-Sandstone Forest	0.047	0.650	0.083	0.391	0.036	-
Re-established vegetation	-	-	-	0.183	-	0.285
Total	**0.047**	**0.730**	**0.086**	**0.578**	**0.038**	**0.285**

4.2.2 Indirect Impacts

i. Introduction

The direct impact of vegetation clearance within the development is minimal and has limited potential to result in indirect impacts to adjacent vegetation such as increased edge effects, alteration to abiotic factors and increased sedimentation and erosion. The site is highly fragmented at present and the impacts of edge effects are obvious with extensive weed invasion throughout the subject lands as well as other forms of disturbance within fringes of vegetation.

Ambient light from the proposed structures is not expected to exceed the levels of ambient light currently occurring on the subject land. Existing light conditions were examined during a visit to the site on 11 February 2007 at 8 pm. Fluorescent lights are used in the existing development to light up roads throughout the site, all levels of the car park are illuminated by fluorescent lighting and fluorescent lighting is emitted from the Acoustics Laboratory windows towards the surrounding bushland areas. Due to the current levels of light on the site, it is not expected that Powerful and Barking Owls, known from the area, or their prey species will be affected by ambient light from the proposed structures.

The impact of development in the landscaped zone upstream of Waterfall 03 (central and eastern regions of the subject land) would have no direct or indirect negative impact on native vegetation. The removal of vegetation in this region will be restricted to the existing landscape plantings. Habitat values in the landscaped area are limited due to lack of canopy connectivity and lack of understorey vegetation. As noted by HLA (2003), the Noisy Miner is the most commonly encountered species on the site. The species dominates the avifauna in the area and its territorial behaviour results in low species richness. Removal of the existing landscape vegetation is not expected to significantly affect any native fauna species. DNR's requirement for a fully restructured 10m (on average) vegetation buffer around the watercourse in this region will actually be a valuable addition in terms of flora for the subject land and will result in enhanced habitat opportunities for fauna. A detailed revegetation plan is yet to be prepared for the site, however, taking into account the trees that will be retained in the north western part of the subject land and the proposed re-plantings along the waterway in the central part of the site, there is likely to be a net increase in the number of native tree species on the site as a result of the Proposal.

Modification of existing vegetation in the 10 m strip of vegetation to be managed for fire protection in the north-western section of the subject land, below Waterfall 03, would probably involve some level of clearing of largely native vegetation. Although this would not affect any endangered ecological community or threatened species of flora, it would reduce the buffer in the riparian zone between the developed zone and Lane Cove National Park.

The lower slopes of the small creek that drains through the subject land were, at the time of this survey, heavily infested with exotic species known to threaten bushland because of their invasive nature and ability to replace many indigenous species. The mid slope near the existing clearing contained much less weed, however invasive species were spreading from the lower slope and could be expected to eventually replace most of the existing indigenous understorey.

The main impact of urban development in the general area (including the subject site) is centred on the creek zone owing to the high nutrient levels in runoff water. This currently passes through the national park, and would not change if the development proposal proceeded. As discussed above, the present condition of the lower creek zone is severely degraded and is worsening. An effective weed control strategy would be of benefit to conservation of native flora in the area.

Although there is no proposal to affect the bushland at the eastern boundary with the national park, it is likely that any development, including demolition of the existing large building in the eastern section of the property, would have potential to cause soil erosion and storm water impacts, which may increase potential for weed invasion in the national park. Notwithstanding this, these issues can be managed by implementing appropriate controls during construction and demolition..

4.3 Flora

4.3.1 General Species

The future development on flora species will result in the clearing of a small area of native vegetation and therefore a minor loss of flora habitat. The retained vegetation adjacent to the development area could potentially be indirectly impacted due to:

- Increased edge effects;
- Alteration to hydrology;
- Alteration to fire regime;
- Increased sedimentation and erosion; and
- Physical damage.

Each of these indirect impacts is discussed in relation to vegetation communities and subsequently to flora species in **Section 4.2.2** above.

4.3.2 Threatened Species

One threatened flora species, *Darwinia biflora* has been recorded on the subject land. The species is listed as vulnerable under the EPBC and TSC Acts. A population of 41 individuals of this species was recorded from a small area at the western end of the subject land in an area currently managed as an APZ. This area is currently barricaded and signed as an ecologically sensitive area and the area will remain as part of the APZ under the proposed project. This APZ management will benefit the species by preventing regrowth of taller plants causing overshadowing and eventually death of the species. The species is known to occur within, and may prefer, disturbed sites such as APZs.

The proposal is not expected to impact upon any suitable habitat for *Darwinia biflora* as any of the potential habitat has been highly modified by previous developments. The implementation of appropriate management techniques for this population will ensure that the proposal will not cause a significant impact to this population of *Darwinia biflora*. This species is known from numerous records within Lane Cove National Park and throughout

Ku-ring-gai Council (DECCW, 2010). An Assessment of Significance is provided in **Appendix D** for this species.

A number of additional threatened flora species may have previously occurred within the development footprint (see **Table 3.2**). However, given that these species have not been recorded within the recent surveys of the subject land and the highly modified nature of the habitat on the subject land, these species are not considered likely to presently occur and therefore no impact assessment is considered necessary.

4.4 Fungus

The habitat requirements of the threatened fungi species and the endangered ecological community recorded from the locality of the subject land are similar. These fungi have been recorded along the banks of the north-eastern arm of Gore Creek and its tributaries in Lane Cove National Park, in warm temperate forests (Kearney 2000). Ecological requirements of most of these species, though poorly known, are likely to involve dense tree canopy and sandstone rocks (Kearney 2000).

The areas on the subject land that would be affected by the future development do not constitute such habitat. The only area that may provide potential habitat for these species of fungus is within the Core Riparian Zone of the watercourse which with appropriate construction management should not undergo secondary impacts.

4.5 Fauna

4.5.1 Fauna Habitat

The fauna habitats present on the subject land is limited to areas of native vegetation that will remain intact under any future development. The relatively small areas of native vegetation to be impacted provide suitable, albeit limited habitat features for a range of native fauna, including threatened species. These habitat features provide potential foraging, nesting and shelter habitat for these species. At the conclusion of the development the revegetation of the riparian corridor will provide an additional 0.285ha of habitat for many species.

The primary areas of fauna habitat occur within the forest communities that will remain intact under future development of the subject land, and in adjacent protected areas. Fauna habitat within the remainder of the subject land has been heavily altered by clearing and existing development.

4.5.2 Corridors

The vegetation on the site forms the southern edge of a corridor of vegetation along Blue Gum Creek. There will be a minor reduction in the width of this corridor under future development. However, this will be re-established through the revegetation of the watercourse through the subject land. The quality of this vegetation will be improved and maintained on the subject site through management under the site's VMP. In the long term the vegetation within the corridor through the site will be improved.

4.5.3 Threatened Species

i. Introduction

Although no threatened fauna species were recorded on the subject land during surveys, habitat assessment combined with known records of nearby occurrences indicate that a number of these species are likely to occur adjacent to the subject land. These species therefore have the potential to occasionally utilise the small areas of suitable habitat within the development footprint (see **Table 3.2**). Potential impacts to species and likelihood of occurrence on the subject land are discussed below. Assessments of significance have been prepared for these species and are provided in **Appendix D**.

ii. Varied Sittella (Daphoenositta chrysoptera)

The subject land provides a small area of suitable foraging habitat and potential breeding habitat for the Varied Sittella. The future development will largely impact upon the disturbed part of the subject land and therefore the minimal loss and modification of habitat for this species is not considered to be significant. When taken in the context of the adjacent Blue Gum Reserve and Lane Cove National Park and the extensive area of suitable foraging and breeding habitat that these protected areas provide, it is considered extremely unlikely that future development will impact significantly on this species.

iii. Little Lorikeet (Glossopsitta pusilla)

Suitable, albeit limited, foraging habitat is present in the form of flowering canopy tree species across the subject land and potential breeding habitat in the form of hollow bearing smooth bark trees which constitute undisturbed vegetation. Future development will largely impact upon the disturbed part of the subject land and therefore is not considered likely to cause a significant impact on the breeding habitat for this species. The area that the species could potentially forage across will be reduced, however by taking this loss into the context of the adjacent available habitat within Blue Gum Reserve and Lane Cove National Park and the provision of landscaping trees for foraging, the loss of this foraging habitat is not considered to be significant.

iv. Gang-gang Cockatoo (Callocephalon fimbriatum)

Forage habitat for this species is limited to the E2 Conservation Lands while it is considered that the breeding habitat for this species is not present due to the lack of tree hollows and the fragmentation of habitat within the subject land. A small area of the suitable habitat for this species will be modified for bushfire management as a result of the current proposal. It is not considered likely that the species would be impacted significantly as a result of the current proposal due to the modification of this small area of land and considering the vast area of suitable foraging habitat for the species in the adjacent Lane Cove National Park.

v. Powerful Owl (Ninox strenua) and Barking Owl (Ninox connivens)

The subject land provides a small area of suitable foraging habitat for these species while the riparian corridor provides potential roosting habitat within the dense vegetation. Future development will remove some of the potential foraging habitat for the Powerful Owl and the Barking Owl, as well as preferred prey species such as the Common Ringtail Possum (*Pseudocheirus peregrinus*). The potential roosting habitat for these species will not be impacted by future development but is likely to be improved through the re-establishment of native vegetation in and around the creek, such a process will also provide better habitat for the Common Ringtail Possum.

Modification of a small area of potential foraging habitat for these species will occur. However, given the size and marginal quality of this habitat to be lost, as well as the large area of better quality foraging habitat within the adjacent Blue Gum Reserve and Lane Cove National Park, it is considered unlikely that a significant impact from the future development will occur on these species.

vi. Grey-headed Flying-fox (Pteropus poliocephalus)

A small area of foraging habitat for the Grey-headed Flying-fox will be lost in the form of flowering canopy species across the subject land as a result of the Proposal. However, habitat removal is not considered likely to constitute significant impact upon the species. The adjacent Blue Gum Reserve and Lane Cove National Park contain extensive areas of suitable vegetation for foraging for this species and additional feed species will be planted in garden plantings across the subject land at the conclusion of the project. No maternal roosting camps are known across the subject land and as such it is considered unlikely that there will be a significant impact upon this species as a result of the removal of foraging habitat.

vii. Eastern Bentwing-bat (Miniopterus schreibersii oceanensis)

The subject land provides limited foraging habitat for the Eastern Bentwing-bat; however it does not provide any suitable roosting or breeding habitat for this cave-dependant species. A small area of potential foraging habitat for the Eastern Bentwing-bat will be

modified for fire protection as part of the future development. However, this species is likely to continue foraging across the subject land at the conclusion of the development and extensive areas of suitable foraging habitat are present within Blue Gum Reserve and Lane Cove National Park. It is therefore considered unlikely that any significant impacts will occur on this species as a result of the future development.

4.6 Impacts on Blue Gum Reserve and Lane Cove National Park

The future development will have no direct impacts upon Blue Gum Reserve and Lane Cove National Park. Possible indirect effects on these protected areas are associated with water run-off into the park and weed invasion if these issues were left unmanaged.

Future development has the potential to increase the sediment, pollutant and nutrient loads that reach the Lane Cove River via water run-off. The potential impacts of sediment will be mitigated through appropriate sediment and erosion control measures implemented during construction. Under future development, appropriate design and implementation of sediment and erosion control would provide opportunities for improvements to water quality of run-off into Blue Gum Creek. A site specific document outlining these measures will be prepared closer to the date of construction, the document will make reference to relevant information within the Approved NSW Recovery Plan for the Large Forest Owls (DEC(NSW), 2006).

The potential weed invasion transference from the subject land is not considered to be an issue due to the preparation of a Vegetation Management Plan (VMP) to control weed invasion across the subject land during and after construction.

Chapter 5

Mitigation Measures

5.1 Introduction

Future development will utilise avoidance and mitigation measures to minimise any potential impacts to the ecological values of the subject land as well as adjoining vegetation that may be indirectly impacted by the project. The process of avoidance and mitigation is as follows:

- Avoid: to the extent possible, developments should be designed to avoid or minimise ecological impacts; and,
- Mitigate: where certain impacts are unavoidable through design changes, mitigation measures should be introduced to ameliorate the ecological impacts of the future development.

This chapter provides an assessment of the avoidance measures and recommended mitigation measures for the proposed project.

5.2 Avoidance Measures

A portion of the site (5,775m^2) is proposed to be zoned as E2 Environmental Conservation. Any future development will avoid this portion of the site.

Within the remainder of the site, the proponent has planned the future development around the important ecological features of the site. The population of *Darwinia biflora* will not be impacted. Habitat for this species will be improved as part of the future development due to the management of adjacent vegetation in the APZ preventing overshadowing and die-off of the species. The riparian corridor will not be impacted and where possible important fauna habitat features such as hollow-bearing trees will be retained in the preferred project phase of the proposal, in the long term the quality of this riparian area will be improved. In short, where practically possible, all impacts on ecologically important areas have been avoided to date and will be avoided in future project works.

5.3 Recommended Mitigation Measures

5.3.1 Introduction

A number of mitigation measures are recommended to be utilised for the proposed project. These mitigation measures include those to be undertaken during the construction, operational and post-operational phases of the proposed project. It is proposed that mitigation measures be incorporated into the conditions of consent.

5.3.2 Construction and Operational Phases

During the construction and operational phases there is the potential for a number of direct and indirect impacts to ecological values. Potential impacts to flora and fauna occurring in these phases that can be managed include: unnecessary vegetation removal, runoff, sedimentation, erosion and pollution. As some of the subject land is located on sloped land, it is recommended that precautions be taken to minimise the impacts further down the slope. Recommended mitigation measures to be undertaken within the construction and operational phase are detailed below.

i. Access, signage and demarcation

Site inductions are to be given by the civil contractor to ensure all site workers and visitors are aware of any sensitive vegetation. Access to adjoining vegetation should only be granted if conducting or overseeing mitigation measures.

The development footprint should be clearly demarcated and signed, where appropriate, to ensure no vegetation beyond these boundaries is removed. Temporary fencing can be erected to ensure construction and operational activities are contained within the development footprint.

ii. Erosion, Sediment and Pollution Control

During the construction and operational phases, precautions should be taken to ensure that no sediment or pollution enters adjoining vegetation. To reduce sedimentation on the construction site, erosion control measures need to be implemented. This may involve minimising the amount of exposed soils on the site at any given time. Silt traps should be established to prevent the impacts of sedimentation on the adjoining vegetation. During development, precautions should be taken to ensure that no pollution escapes the construction site. Pollution traps and efficient removal of pollution to an off site location will help to minimise pollution impacts.

Increased pollutant and nutrient loads from storm water run-off, which could potentially reach Blue Gum Reserve and Lane Cove National Park can be mitigated appropriately

through measures such as rainwater tanks, gross pollutant traps, bioretention systems, ponds and other small scale storm water management measures.

iii. Water Management

To prevent excess runoff flowing off the building site, barriers should be established to divert the flow of water away from the adjoining vegetation and into appropriate drainage systems. Filters within the barriers will minimise the amount of sedimentation entering the waterways.

iv. Habitat Retention

Where possible, the following habitat features should be retained:

- Mature native trees to provide feeding and potential nesting habitat;
- Hollow-bearing trees to provide nesting and roosting habitat for fauna species; and
- Riparian areas, to allow for the persistence of riparian habitats within the subject land.

5.3.3 Post-operational Phase

i. Management of Darwinia biflora

It is recommended that the small area of the subject land supporting a population of *Darwinia biflora* continue to be managed, and the management of this species be incorporated into a Vegetation Management Plan for the site. The establishment of lawn/exotic vegetation in the vicinity of this species would result in permanent loss of the *Darwinia biflora*. Any native ground cover around the species should be kept open and low in the vicinity of the *Darwinia biflora*. Weeds would need to be controlled if this option were implemented. As at 9 June 2010, the patch was estimated to have 30% exotic species in the ground cover, by percentage of total projective foliage cover. Potential habitat for *Darwinia biflora* exists surrounding the identified patch of this species.

ii. Rehabilitation and management of vegetation

The vegetation within the areas that are to be conserved should be managed and rehabilitated in attempt to reform a community composition and structure reminiscent of the original forms of the community they area derived from. Weed removal should be the initial focus and the propagation and replanting of local native seed is recommended to hasten community recovery. The site should be subject to ongoing management under a

VMP to improve and maintain the quality of the vegetation across the subject site post-development.

5.4 Additional Survey Requirements

It is recommended that a small number of additional surveys be undertaken prior to the grant of development consent to ensure that any additional threatened species issues are managed appropriately. These surveys and their appropriate timing are listed below:

- Threatened owl surveys at the conclusion of the winter breeding period to avoid and potential disruptions to breeding owls;
- Additional threatened flora surveys during spring when more species are flowering; and
- Anabat surveys for threatened microchiropteran bats during spring when these species are active.

Given that the *Woodlands* development footprint sits largely within the already developed portion of the subject land, these further surveys are not expected to materially alter the planning proposal from its current form.

Chapter 6

Conclusion

Cumberland Ecology has reassessed the flora and fauna values of the subject land in an attempt to identify any future constraints to future development and reassess any potential impacts on threatened flora and fauna. In response to Willoughby Council concerns, the potential impacts of future developments on State and Commonwealth listed CEEC's and threatened species have been addressed.

The vegetation and fauna habitats within the subject land are highly modified following a long history of development. Exotic and landscaped urban vegetation dominates the subject land, while small isolated occurrences of the following two native vegetation communities which conform to the following Sydney Metro CMA Mapping units (DECCW, 2009);

- Hornsby Enriched Sandstone Exposed Woodland; and
- Coastal Shale-Sandstone Forest.

None of these communities are considered to conform to Endangered Ecological Communities under State or Commonwealth legislation. The communities vary in condition from those that are highly disturbed and actively managed as APZs, through vegetation that is weed invaded and impacted from edge effects, to some isolated areas that are comparatively undisturbed with minor weed invasion.

One State and Commonwealth vulnerable flora species was recorded within a small area of the subject land along the western boundary (*Darwinia biflora*). The species currently exists within an area managed as an APZ and will not be directly impacted by the proposal but its current habitat will continue to be managed under bushfire protection legislation. A site specific VMP will be prepared to ensure this species is not impacted through indirect impacts.

A limited range of fauna habitats occur within the study area and only common urban fauna species of northern Sydney were detected during surveys of the subject land. No threatened fauna species were identified during recent surveys, however the subject land contains potential, albeit limited, habitat features for a number of threatened species including Eastern Bent-wing Bat, Powerful Owl, Barking Owl, Varied Sittella, Little lorikeet and Grey-headed Flying Fox.

The results of seven part tests based on the predicted concept plan indicate that no significant impacts on any threatened species, including *Darwinia biflora*, are likely as a

result of the proposal. While small amounts of habitat will be lost for some fauna species, the impact of this loss is unlikely to be significant given the provision of additional habitat for these species through the planting of native landscaped gardens and by considering the extensive area of suitable habitat within Blue Gum Reserve and Lane Cove National Park.

With appropriate management the occurrence of *Darwinia biflora* on the subject land is not likely to be significantly impacted by secondary processes and no individuals will be removed as part of the proposal.

The assessment of impacts based on the results of the Seven Part tests for the proposal indicates that no significant impacts will occur on any threatened flora or fauna species as a result of future development. The northern portion of the site is proposed to be zoned E2 Environmental Conservation and this portion will remain intact under future development of the remainder of the site.

The following mitigation and management measures are recommended to assist in the minimisation of impacts to flora and fauna:

- Erosion, sediment and pollution control, particularly during construction;
- Management of water during construction;
- Retention of important habitat features;
- Management of *Darwinia biflora* under a site specific Vegetation Management Plan (VMP);
- Rehabilitation and management of vegetation under a site specific VMP.

A small number of additional surveys are also recommended to ensure threatened species issues are identified prior to construction.

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Appendix A

Flora Species Recorded within the Subject Land

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
Trees						
Altingiaceae	*	*Liquidambar styraciflua*	Liquidambar	x		
Araucariaceae	*	*Araucaria cunninghamii*	Hoop Pine		x	
Araceae	*	*Livistona australis*	Cabbage Palm			x
	*	*Schefflera actinophylla*	Umbrella Tree	x	x	
Bignoniaceae	*	*Jacaranda mimosifolia*	Jacaranda	x	x	x
Casuarinaceae		*Allocasuarina littoralis*	Black She-Oak	x	x	x
		Allocasuarina torulosa	Forest Oak		x	
	*	*Casuarina glauca*	Swamp Oak		x	x
Cunoniaceae		*Callicoma serratifolia*	Callicoma	x	x	
		Ceratopetalum apetalum	Coachwood		x	
		Ceratopetalum gummiferum	Christmas Bush	x	x	
Elaeocarpaceae		*Elaeocarpus reticulatus*	Blueberry Ash	x	x	x
Euphorbiaceae		*Glochidion ferdinandi var. ferdinandi*	Cheese Tree		x	x
Fabaceae - Faboideae	*	*Erythina sykesii*	Coral Tree	x		
Fabaceae - Mimosoideae		*Acacia decurrens*	Green Wattle		x	
		Acacia implexa	Hickory Wattle	x		
		Acacia parramattensis	Parramatta Wattle	x	x	x
Lauraceae	*	*Cinnamomum camphora*	Camphor Laurel	x		x
	*	*Laurus nobilis*	Bay Laurel			x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
Meliaceae	*	*Mela azedarach*	White Cedar			x
Moraceae	*	*Ficus benjamina*	Weeping Fig			x
Myrtaceae		*Acmena smithii*	Lily Pilly		x	
		Angophora costata	Smooth-barked Apple	x	x	x
		Angophora floribunda	Rough-barked Apple		x	
		Angophora hispida	Dwarf Apple	x		
	*	*Corymbia citriodora*	Lemon-scented Gum		x	
		Corymbia eximia	Yellow Bloodwood	x		
		Corymbia gummifera	Red Bloodwood	x	x	x
		Eucalyptus grandis	Flooded Gum			x
	*	*Eucalyptus cinerea*	Argyle Apple		x	
		Eucalyptus haemastoma	Scribbly Gum	x	x	x
	*	*Eucalyptus microcorys*	Tallowwood		x	
		Eucalyptus pilularis	Blackbutt	x	x	x
		Eucalyptus piperita	Sydney Peppermint	x	x	x
		Eucalyptus resinifera	Red Mahogany			x
	*	*Eucalpytus robusta*	Swamp Mahogany		x	
		Eucalyptus saligna	Sydney Blue Gum	x		
	*	*Eucalpytus sp.*			x	x
		Syncarpia glomulifera	Turpentine	x	x	x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
		Melaleuca linariifolia	Snow-in-summer		x	
	*	*Melaeuca bracteata*	Black Tea Tree			x
		Tristaniopsis laurina	Water Gum		x	
Oleaceae	*	*Ligustrum lucidum*	Large-leaved Privet	x	x	x
	*	*Olea europaea ssp cuspidata*	African Olive			x
Pittosporaceae		*Pittosporum undulatum*	Sweet Pittosporum	x	x	x
Podocarpaceae	*	*Podocarpus elatus*	Plum Pine		x	x
Proteaceae		*Banksia serrata*	Old Man Banksia		x	x
Salicaceae	*	*Populus alba*	White Poplar	x		
Shrubs						
Anacardiaceae	*	*Toxicadendron succedanea*	Rhus			X
Apocynaceae	*	*Comphocarpus fruticosus*	Narrow-leaved Cotton Bush	x		
Araceae	*	*Schefflera sp.*			x	
	*	*Schefflera actinophylla*	Umbrella Tree			X
Araliaceae		*Astrotricha longifolia*			x	x
		Polyscias sambucifolia	Elderberry Panax	x	x	x
Araucariaceae	*	*Araucaria heterophylla*	Norfolk Is Pine seedling			x
Asteliaceae	*	*Cordyline stricta*	Narrow-leaved Palm Lily	x		
Asteraceae	*	*Chrysanthemoides monilifera ssp.*	Boneseed		x	x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
		monilifera				
	*	*Osteospermum ecklonis*	Cape Daisy	x		
		Ozothamnus diosmifolius	White Dogwood	x	x	
Baueraceae		*Bauera rubioides*	River Rose		x	
Cactaceae	*	*Opuntia stricta*	Prickly Pear	x		
Crassulaceae	*	*Cotyledon orbiculata*	Varkiesblaar	x		
Dilleniaceae		*Hibbertia bracteata*	Guinea Flower	x		
Elaeocarpaceae		*Tetratheca thymifolia*	Black-eyed Susan	x		
Epacridaceae		*Astroloma humifusum*	Cranberry Heath		x	x
		Leucopogon ?ericoides		x	x	x
		Leucopogon juniperinus	Prickly Beard-heath		x	x
		Leucopogon lanceolata				x
		Woollsia pungens		x	x	x
Ericaceae - Styphelioideae		*Epacris longifolia*	Fuchsia Heath	x		
		Epacris microphylla	Coast Coral Heath	x		
		Melichrus urceolatus	Urn-heath	x		
Euphorbiaceae		*Breynia oblongifolia*	Dwarfs Apples			x
		Micrantheum ericoides		x	x	x
		Glochidion ferdinandi				x
		Omalanthus nutans	Bleeding Heart	x	x	x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
Fabaceae - Caesalpinioideae	*	*Senna pendula var. glabrata*	Senna	x	x	x
Fabaceae - Fabiodeae		*Bossiaea heterophylla*	Variable Bossiaea	x		
	*	*Chamaecytisus palmensis*	Tagasaste	x		
	*	*Cytisus sp.*	Broom	x		
		Dillwynia retorta	Eggs and Bacon	x		x
		Gompholobim grandiflorum	Large Wedge Pea	x		
		Hardenbergia violacea	Purple Coral Pea	x		x
		Pultenaea daphnoides	Large-leaf Bush-pea	x		
		Pultenaea flexilis	Graceful Bush Pea		x	x
		Pultenaea stipularis			x	
		Viminaria juncea	Native Broom	x		
Fabaceae - Mimosoideae	*	*Acacia baileyana*	Cootamundra Wattle	x		
		Acacia brownii	Heath Wattle	x		
		Acacia decurrens	Green Wattle sapling			
	*	*Acacia floribunda*	Sally Wattle		x	
		Acacia linifolia	Flax Wattle	x	x	x
		Acacia longifolia	Sydney Golden Wattle	x	x	x
		Acacia suaveolens	Sweet Wattle	x	x	x
		Acacia terminalis	Sunshine Wattle	x		
		Acacia ulicifolia	Prickly Moses		x	x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
Lamiaceae	*	*Westringia fruticosa*	Coast Rosemary		x	
Lauraceae	*	*Cinnamomum camphora*	Camphor Laurel (sapling)		x	x
Loganiaceae		*Logania albiflora*			x	
Malaceae	*	*Cotoneaster glaucophyllus*	Cotoneaster	x	x	
Malvaceae	*	*Hibiscus sp. cv.*				x
Melastomataceae	*	*Tibouchina granulosa*	Lasiandra	x		
Moraceae		*Ficus rubiginosa*	Rusty Fig		x	
	*	*Morus nigra*	Mulberry	x		
Myrtaceae		*Angophora cordata*	Dwarf Apple		x	
		Austromyrtus tenuifolia			x	
		Baeckea virgata			x	
		Callistemon citrinus	Crimson Bottlebrush	x		
		Callistemon linearis			x	
		Darwinia biflora		x		x
		Kunzea ambigua	Tick Bush	x	x	x
		Leptospermum polygalifolium	Yellow Tea Tree	x	x	x
		Leptospermum trinervium	Paperbark Tea Tree			x
	*	*Melaleuca armillaris*	Bracelet Honey-myrtle		x	
Ochnaceae	*	*Ochna serrulata*	Mickey Mouse Plant	x	x	x
Oleaceae	*	*Ligustrum sinense*	Small-leaved Privet	x	x	x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
		Notelaea longifolia	Large Mock Olive		x	x
Onagraceae	*	*Ludwigia peruviana*			x	
Phyllanthaceae		*Breynia oblongifolia*	Coffee Bush	x	x	
		Phyllanthus hirtellus	Thyme Spurge	x		
Pittosporaceae		*Pittosporum revolutum*	Yellow Pittosporum			x
Proteaceae		*Banksia ericifolia*	Heath Banksia	x	x	
		Banksia oblongifolia		x	x	
	8	*Banksia spinulosa*	Hairpin Banksia	x	x	
		Grevillea buxifolia	Grey Spider Flower	x	x	
		Grevillea linearis		x	x	x
	*	*Grevillea robusta*	Silky Oak (sapling)		x	
		Hakea dactyloides	Finger Hakea	x		
		Hakea sericea	Needlebush	x		
		Lambertia formosa	Mountain Devil	x	x	
		Lomatia silaifolia	Crinkle Bush	x	x	
		Persoonia lanceolata	Lance Leaf Geebung	x		
		Persoonia levis	Broad-leaved Geebung	x	x	
		Persoonia linearis	Narrow-leaved Geebung	x		
Rhamnaceae		*Pomaderris discolor*		x		
		Pomaderris elliptica			x	x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
Rutaceae		*Choisya comosum*	Mexican Orange Blossum	x		
		Correa reflexa			x	
		Zieria smithii	Stinkwood		x	x
Sapindaceae		*Dodonaea triquetra*	Common Hop Bush	x	x	x
Solanaceae	*	*Cestrum parqui*	Green Cestrum	x		
	*	*Solanum mauritianum*	Tobacco Weed	x	x	
	*	*Solanum nigrum*	Black-berry Nightshade	x		
Sterculiaceae	*	*Brachychiton acerifolius*	Flame Tree (sapling)		x	x
		Lasiopetalum ferugineum	Rusty Petals	x	x	x
Verbenaceae	*	*Lantana camara*	Lantana	x	x	x
Arecaceae	*	*Arecastrum romazoffianum*	Cocos Palm		x	
	*	*?Archontophoenix sp.*				x
	*	*Livistona australis*	Cabbage Palm		x	
	*	*Phoenix canariensis*	Canary Is Date Palm	x	x	
Xanthorrhoeaceae		*Xanthorrhoea concava*	a Grasstree		x	x
		Xanthorrhoea media	a Grasstree	x		
		Xanthorrhoea minor	a Grasstree		x	
Herbs - Dicots						
Apiaceae		*Actinotus helianthi*	Flannel Flower	x		x
		Actinotus minor	Lesser Flannel Flower	x		x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
		Centella asiatica	Pennywort		x	x
		Hydrocotyle peduncularis				x
		Xanthosia pilosa			x	
		Xanthosia tridentata				x
Asteraceae	*	*Ageratina adenophora*	Crofton Weed	x	x	
	*	*Bidens pilosa*	Farmers Friends	x	x	x
	*	*Cirsium vulgare*	Spear Thistle	x		
	*	*Conyza sp.*	a Fleabane		x	x
	*	*Conyza sumatrensis*	Tall Fleebane	x		
	*	*Coreopsis lanceolata*	Coreopsis	x		
	*	*Hypochaeris radicata*	Flatweed		x	x
	*	*Senecio madagascariensis*	Fireweed	x		
	*	*Solvia sp.*	Bindii		x	
	*	*Sonchus oleraceus*	Sow Thistle		x	
	*	*Taraxacum officinale*	Dandelion	x		
	*	*Hypochaeris radicata*				
Balsaminaceae	*	*Impatiens sp. cv*	Impatiens		x	
Boraginaceae	*	*Heliotropium amplexicaule*	Blue Heliotrope		x	
Brassicaceae	*	*Capsella bursa-pastoris*	Shepherds Purse			
	*	*Cardamine hirsuta*				x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
Campanulaceae		*Wahlenbergia gracilis*	Australian Bluebell	x		
Caryophyllaceae	*	*Stellaria media*	Chickweed			x
Clusiaceae	*	*Cerastium glomeratum*	Mouse-eared Chickweed		x	
	*	*Polycarpon tetraphyllum*	Four-leaf All-seed		x	
Convolvulaceae		*Dichondra repens*	Kidney Plant			x
Crassulaceae	*	*Bryophyllum delagoense*	Mother-of-Millions	x		
Fumariaceae	*	*Fumaria muralis*				x
Geraniaceae	*	*Geranium sp.*	Geranium	x		
		Geranium homeanum	Storksbill			x
Haloragaceae		*Gonocarpus teucrioides*			x	
Malvaceae	*	*Modiola caroliniana*				x
	*	*Pavonia hastata*		x	x	x
	*	*Sida rhombifolia*	Paddys Lucerne	x	x	x
Nyctaginaceae	*	*Bougainvillea sp.*		x		
Oxalidaceae		*Oxalis sp.*			x	
	*	*Oxalis pes-caprae*				x
Phytolaccaceae	*	*Phytolacca octandra*	Inkweed	x		
Plantaginaceae	*	*Plantago lanceolata*	Lambs Tongue			x
Polygolaceae	*	*Acetosa sagittata*	Turkey Rhubarb		x	
		Rumex brownii				x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
Proteaceae	*	*Macadamia tetraphylla*				x
Rosaceae		*Duchesnia indica*	Irish Strawberry			x
Rubiaceae		*Pomax umbellata*				x
	*	*Richardia stellaria*				x
Scrophulariaceae	*	*Veronica arvensis*				x
		Veronica plebeia	Trailing Speedwell		x	
Solanaceae		*Cestrum parqui*	Green Cestrum seedling			x
		Solanum nigrum	Blackberry Nightshade			x
Verbenaceae	*	*Verbena bonariensis*	Purpletop	x		
	*	*Verbena quadrangularis*	Purpletop	x		
Violaceae		*Viola hederacea*	Ivy-leaved Violet	x		
	*	*Viola odorata*	Violet		x	
Herbs - Monocots						
Agavaceae	*	*Agave americana*	Century Plant	x		
	*	*Yucca aloifolia*	Dagger Plant	x		
Alliaceae	*	*Nothoscordum borbonicum*	Onion Weed		x	
Amaryllidaceae	*	*Agapanthus praecox*	Agapanthus	x		x
	*	*Agapanthus sp.*	Agapanthus		x	
Anthericaceae	*	*Chlorophytum cymosum*	Spider Lily		x	
Araceae	*	*Typhonium sp.*			x	x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
Asparagaceae	*	*Asparagus densiflora*	Fern Asparagus			x
	*	*Asparagus aetheopicus*	Asparagus fern	x	x	
Arthropodiaceae		*Chlorophytum comosum*	Spider Lily			x
Bambusaceae	*	*Bambusa sp.*				x
Bromeliaceae	*	*Aechmea sp.*	Bromeliaed	x		
Commelinaceae		*Commelina cyanea*	Native Wandering Jew	x		x
	*	*Tradescantia fluminensis*	Wandering Jew		x	
Cyperaceae		*Caustis flexuosa*	Curly Sedge	x	x	x
		?Cyathochaeta diandra				x
		Cyperus gracilis			x	
		Fimbristylis dichotoma	Common Fringe-sedge	x		
		Gahnia sieberiana	Red-fruit Saw-sedge	x		
		Lepidosperma laterale	Broad Sword-sedge	x	x	x
		Schoenus melanostachys	Rifle Grass		x	
Haemodoraceae		*?Haemodorum sp.*				x
Iridaceae	*	*Dietes bicolor*		x		
	*	*Freesia refracta*	Freesia		x	x
Juncaceae		*Juncus usitatus*		x		
Liliaceae	*	*Ophiopogon japonicus*	Mondo Grass			x
Lomandraceae		*Lomandra filiformis*	Wattle Mat-rush	x	x	x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
		Lomandra longifolia	Spiny-headed Mat-rush	x	x	x
		Lomandra multiflora	Many-headed Mat-rush			x
		Lomandra obliqua	Fishbone Mat-rush	x	x	x
Orchidaceae		*Cryptostylis sp.*			x	
	*	*Epidendrum ibaguense*	Crucifix Orchid	x		
Phormiaceae		*Dianella caerulea var producta*	Rough Flax Lily	x	x	x
		Dianella revoluta	Paroo Lily		x	
Plantaginaceae	*	*Plantago lanceolata*	Lamb's Tongues	x		
Typhaceae		*Typha orientalis*	Cumbungi	x		
Zingiberaceae	*	*Hedychium gardneranum*	Indian Ginger		x	
	*	*Hedychium sp.*	Ginger Lily	x		
Grasses						
Poaceae	*	*Andropogon virginicus*	Whisky Grass	x	x	
		Aristida vagans	a Three-awned grass			x
		Austrodanthonia bipartita	Wallaby Grass	x		
	*	*Axonopus affinis*	Carpet Grass			x
	*	*Bromus catharticus*	Prairie Grass			x
	*	*Cortaderia selloana*	Pampas Grass	x	x	x
	*	*Cynodon dactylon*	Couch Grass	x	x	
		Digitaria parviflora	Finger Grass		x	

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
	*	*Ehrharta erecta*	Veldt Grass		x	x
		Entolasia marginata	Bordered Panic	x		x
		Entolasia stricta	Wiry Panic	x	x	x
	*	*Eragrostis curvula*	African Love-grass		x	x
		Imperata cylindrica var. major	Blady Grass	x	x	
	*	*Melinus repens*	Red Natal Grass		x	x
		Microlaena stipoides	Weeping Meadow-grass		x	x
		Oplismenus aemulus	Basket Grass		x	x
		Panicum simile			x	
	*	*Paspalum dilatatum*	Paspalum	x		x
	*	*Paspalum urvillei*	Vasey Grass		x	
	*	*Pennisetum clandestinum*	Kikuyu	x		x
		Poa labillardierei	Tussock Grass	x		
		Setaria palmifolia				x
	*	*Stenotaphrum secundatum*	Buffalo Grass			x
Ferns						
Adiantaceae		*Adiantum hispidulum*	Rough Maidenhair Fern		x	
Blechnaceae		*Blechnum ambiguum*			x	
Cyatheaceae		*Cyathea australis*	Rough Tree-fern	x		
	*	*Cyathea cooperi*	Straw Tree Fern		x	

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
Davalliaceae	*	*Nephrolepis cordifolia*	Fishbone Fern	x	x	x
Dennstaedtiaceae		*Pteridium esculentum*	Bracken Fern	x	x	x
Dicksoniaceae		*Calochlaena dubia*	False Bracken Fern		x	
Dryopteridaceae	*	*Cyrtomium falcatum*	Holly Fern	x		
Gleicheniaceae		*Gleichenia dicarpa*	Pouched Coral Fern	x	x	
		Gleichenia microphylla	Scrambling Coral Fern	x		
Lindsaeaceae		*Lindsaea microphylla*	Lacy Wedge Fern		x	
Sinopteridaceae	*	*Pellaea sp. cv.*				x
Vines						
Apocynaceae		*Parsonsia straminea*	Common Silkpod	x		
Araceae	*	*Monstera deliciosa*	Fruit Salad Plant	x	x	
Araliaceae	*	*Hedera helix*	English Ivy		x	x
Asclepiadaceae	*	*Araujia sericifera*	Moth Vine		x	x
Asparagaceae	*	*Asparagus plumosus*	Climbing Asparagus			x
Basallaceae	*	*Anredera cordifolia*	Medeira Vine	x		
Caprifoliaceae	*	*Lonicera japonica*	Japanese Honeysuckle		x	x
Convolvulaceae	*	*Ipomoea purpurea*	Morning Glory		x	x
Dilleniaceae		*Hibbertia dentata*	Trailing Guinea Flower			x
Dioscoreaceae		*Dioscorea transversa*	Native Yam	x		
Fabaceae - Faboideae		*Glycine clandestina*		x	x	x

Table A.1 FLORA SPECIES RECORDED IN THE SUBJECT LANDS

Family		Species Name	Common Name	HLA (2003)	CE (2007)	CE (2010)
		Glycine microphylla				x
		Kennedia rubicunda	Dusky Coral Pea	x	x	x
	*	*Wisteria sinensis*	Wisteria	x		
Lauraceae		*Cassytha glabella*	Devils Twine	x		
		Cassytha pubescens	Devils Twine	x	x	x
Pittosporaceae		*Billardiera scandens*	Common Appleberry	x	x	x
Rosaceae	*	*Rubus ulmifolius*	Blackberry	x	x	
Rubiaceae		*Morinda jasminoides*	Jasmine Morinda			x
Smilaceae		*Smilax glyciphylla*	Sarsaparilla	x	x	x

* denotes exotic species

Appendix B

Cumberland Ecology 2010 Quadrat Data

Table B.1 2010 QUADRAT DATA

Family	Scientific Name	Common Name	Q1	Q2	Q3
Trees					
Casuarinaceae	Allocasuarina littoralis	Black She-Oak	2	2	
Elaeocarpaceae	Elaeocarpus reticulatus	Blueberry Ash #	2	3	
Euphorbiaceae	Glochidion ferdinandi				
	var ferdinandi	Cheese Tree	1		
Myrtaceae	Angophora costata	Smooth-barked Apple	1	1	
	Corymbia gummifera	Red Bloodwood		adj	
	Eucalyptus haemastoma	Scribbly Gum		adj	
	Eucalyptus pilularis	Blackbutt		5	
	Eucalyptus piperita	Sydney Peppermint	5	5	
	Eucalyptus resinifera	Red Mahogany	1		
	Syncarpia glomulifera	Turpentine	5	adj	
Oleaceae	*Ligustrum lucidum	Large-leaved Privet	1		
Pittosporaceae	Pittosporum undulatum	Sweet Pittosporum	6		
Proteaceae	Banksia serrata	Old Man Banksia	dead		
Shrubs					
Araliaceae	Astrotricha longifolia			2	
	Polyscias sambucifolia	Elderberry Panax		3	3
Asteraceae	*Chrysanthemoides				
	monilifera ssp monilifera	Boneseed		1	
Casuarinaceae	Allocasuarina littoralis	Black She-oak			2
Epacridaceae	Astroloma humifusum	Cranberry Heath			1
	Leucopogon ericoides			2	3
	Leucopogon juniperinus	Prickly Beard-heath	2		1
	Leucopogon lanceolata			1	
	Woollsia pungens			3	1
Euphorbiaceae	Breynia oblongifolia	Dwarfs Apples		1	1
	Glochidion ferdinandi	Cheese Tree #	3		
	Micrantheum ericoides			1	3
	Omalanthus nutans	Bleeding Heart	adj		
Fabaceae	Dillwynia retorta	Eggs & Bacon		1	
	Pultenaea flexilis	Graceful Bush Pea		2	1
	Acacia linifolia	Flax Wattle		1	

Table B.1 2010 QUADRAT DATA

Family	Scientific Name	Common Name	Q1	Q2	Q3
	Acacia longifolia	Sydney Golden Wattle	1		
	Acacia parramattensis	Parramatta Wattle #	1		
	Acacia suaveolens	Sweet Wattle		1	
	Acacia ulicifolia	Prickly Moses	adj	2	
	*Senna pendula var glabrata	Senna	1		
Lauraceae	*Cinnamomum camphora	Camphor Laurel #	3	1	
Loganiaceae	Logania albiflora			3	
Myrtaceae	Darwinia biflora				4
	Kunzea ambigua	Tick Bush		5	4
	Leptospermum polygalifolium	Yellow Tea Tree			1
	Leptospermum trinervium	Paperbark Tea Tree		1	1
	Syncarpia glomulifera	Turpentine #	1		
Ochnaceae	*Ochna serrulata	Mickey Mouse Plant	4	3	
Oleaceae	*Ligustrum lucidum	Large-leaved Privet #	2		
	*Ligustrum sinense	Small-leaved Privet #	3	1	
	Notelaea longifolia	Large Mock Olive		1	
Pittosporaceae	Pittosporum revolutum	Yellow Pittosporum		3	
	Pittosporum undulatum	Sweet Pittosporum #		2	
Proteaceae	Grevillea linearis		1	3	2
Rhamnaceae	Pomaderis elliptica			3	1
Rutaceae	Zieria smithii			2	
Sapindaceae	Dodonaea triquetra	Common Hop Bush		2	1
Sterculiaceae	*Brachychiton acerifolius	Flame Tree #	1		
	Lasiopetalum ferugineum	Rusty Petals	2	2	
Verbenaceae	*Lantana camara	Lantana	2	1	
Arecaceae	*?Archontophoenix sp.		1		
Xanthorrhoeaceae	Xanthorrhoea concava	a Grasstree		1	
Herbs - Ferns					
Davalliaceae	*Nephrolepis cordifolia	Fishbone Fern		2	
Dennstaedtiaceae	Pteridium esculentum	Bracken Fern	3	1	
Sinopteridaceae	*Pellaea sp. cv.			1	

Table B.1 2010 QUADRAT DATA

Family	Scientific Name	Common Name	Q1	Q2	Q3
Herbs - Dicots					
Apiaceae	Actinotus helianthus	Flannel Flower		1	
	Actinotus minor	Lesser Flannel Flower		1	
	Centella asiatica	Pennywort	1		
	Xanthosia tridentata			1	
Asteraceae	*Bidens pilosa	Farmers Friends	3		
	*Conyza sp	a Fleabane	1		
	*Hypochaeris radicata	Flatweed	2		
Malvaceae	*Pavonia hastata				3
	*Sida rhombifolia	Paddys Lucerne	1		
Rubiaceae	Pomax umbellata			1	
	*Richardia stellaria		4		
Herbs - Monocots					
Asparagaceae	*Asparagus densiflorus	Fern Asparagus	3	2	
Commelinaceae	Commelina cyanea	BlueWandering Jew	1		
Cyperaceae	Caustis flexuosa	Curly Sedge		1	
	?Cyathochaeta diandra			1	
	Lepidosperma laterale	Broad Sword-sedge		1	
Haemodoraceae	?Haemodorum sp.	Bloodroot			1
Iridaceae	*Freesia refracta	Freesia	2		
Lomandraceae	Lomandra filiformis	Wattle Mat-rush	2	1	
	Lomandra longifolia	Spiny-headed Mat-rush	2	3	1
	Lomandra multiflora	Many-headed Mat-rush		1	
	Lomandra obliqua	Fishbone Mat-rush		2	
Phormiaceae	Dianella caerulea var producta	Rough Flax Lily	2	2	3
Poaceae	Aristida vagans	a Three-awned Grass			1
	*Ehrharta erecta	Veldt Grass	3		
	Entolasia marginata	Margined Panic	2		
	Entolasia stricta	Wiry Panic	2	3	1
	*Eragrostis curvula	African Love-grass		2	2
	*Melinus repens	Red Natal Grass			3
	Microlaena stipoides	Weeping Meadow-grass	2	2	1
	*Setaria palmifolia		1		

Table B.1 2010 QUADRAT DATA

Family	Scientific Name	Common Name	Q1	Q2	Q3
Vines					
Araliaceae	*Hedera helix	English Ivy	1		
Caprifoliaceae	*Lonicera japonica	Japanese Honeysuckle	3		
Dilleniaceae	Hibbertia dentata	Trailing Guinea Flower		2	
Fabaceae	Glycine clandestina				2
	Hardenbergia violacea	Purple Coral Pea			1
Lauraceae	Cassytha pubescens	Devils Twine		1	
Pittosporaceae	Billardiera scandens	Common Appleberry		2	
Asparagaceae	*Asparagus plumosus	Climbing Asparagus	1		
Smilaceae	Smilax glyciphylla	Sarsaparilla	3	3	

KEY

* = introduced species

adj = occurs adjacent to quadrat

= includes saplings and seedlings

Cover abundance in quadrat

1 = rare

2 = occasional

3 = common

4 = very common but less than 5%

5 = 5-25%

6 = 26-50%

7 = 51-75%

Appendix C

Cumberland Ecology 2010 Fauna Species List

Table C.1 FAUNA SPECIES LIST

Scientific Name	Common Name
Amphibians	
Crinia signifera	Common Eastern Froglet
Limnodynastes peronii	Striped Marsh Frog
Birds	
Acanthiza pusilla	Brown Thornbill
Acanthorhynchus tenuirostris	Eastern Spinebill
Anthochaera carunculata	Red Wattlebird
Cacatua galerita	Sulphur-crested Cockatoo
Cormobates leucophaeus	White-throated Treecreeper
Corvus coronoides	Australian Raven
Dacelo novaeguineae	Laughing Kookaburra
Grallina cyanoleuca	Magpie-lark
Gymnorhina tibicen	Australian Magpie
Manorina melanocephala	Noisy Miner
Ocyphaps lophotes	Crested Pigeon
Pardalotus punctatus	Spotted Pardalote
Pardalotus striatus	Striated Pardalote
Platycerous elegans	Crimson Rosella
Psophodes olivaceus	Eastern Whipbird
Ptilonorhynchus violaceus	Satin Bowerbird
Sericornis frontalis	White-browed Scrubwren
Strepera graculina	Pied Currawong
Trichoglossus haematodus	Rainbow Lorikeet

Appendix D

Assessments of Significance

D.1 Darwinia biflora

Darwinia biflora is a shrub that grows to 80 cm in height (DEC (NSW), 2005c). It relies on fire for germination of seed stores in soil, and is associated with *Eucalyptus haemastoma, Corymbia gummifera* and/or *E. squamosa* in woodland, open forest or scrub heath. It occurs in Sydney, in the Ryde, Baulkham Hills, Hornsby and Ku-ring-gai local government areas, where shale-capped ridges intergrade with Hawkesbury Sandstone. *Darwinia biflora* is listed as Vulnerable under Schedule 2 of the TSC Act and as Vulnerable under the EPBC Act.

(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 subject land provides known and potential habitat for *Darwinia biflora.* The primary known habitat is located on the western boundary of the subject land. Parts of the local population exist off the subject land within Lane Cove National Park.

The plants and seed bank contained within the subject land should be considered as part of a viable population. This is likely to be part of a population that extends in other areas of potential habitat in Lane Cove National Park. The recovery plan considers plants within 500m of each other to be part of the same population.

Darwinia biflora currently occurs within an Asset Protection Zone (APZ). Management of this APZ has lead to the spread of the species within the subject land, with most recorded plants being approximately 10-15cm in height indicating recent growth. Under the proposed project, *Darwinia biflora* will continue to be managed within an APZ.

Given the proposed management of the population on the subject land and given that the population extends into Lane Cove National Park, the local population is not likely to be placed at risk of extinction as a result of the proposal.

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

There are no populations of *Darwinia biflora* listed as endangered under the TSC Act.

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

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

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

No individuals of *Darwinia biflora* are proposed to be removed within the subject land. The population occurring on the subject land will continue to be managed within an APZ. Additional management measures will be utilised to protect the species.

The individuals will remain in proximity to the individuals within adjacent bushland, so pollen dispersal will still be possible between these areas.

Habitat will be retained on the subject land for the species. Therefore the species will persist within the locality and the local population is not likely to be affected by the proposal so as to effect its 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 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.*

The overall objective for *Darwinia biflora* described in the recovery plan is "to prevent the status of *Darwinia biflora* becoming endangered by reducing the continual loss of populations and by implementing management regimes aimed at maintaining representative populations across the species' range". The following main objectives are relevant to the proposal:

- Objective 11.1: To ensure that a representative sample of *Darwinia biflora* populations occurring on public and private lands are protected from habitat loss and managed for conservation.

- Objective 12.1: To reduce the impacts of threats at sites and to ensure that any planning and management decisions that are made that may affect the species, are based on information within this recovery plan.

The population of *Darwinia biflora* occurring on the subject land and adjacent Lane Cove National Park will be retained and managed.

Mitigation measures are proposed to manage the impacts to *Darwinia biflora* on the subject land and adjacent vegetation. The proposed management regime within the known habitat is considered to benefit the species.

No threat abatement plans are relevant to this species.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The proposal may impact *Darwinia biflora* through the following process:

- **Clearing of native vegetation** as this destroys populations of the species and their habitats.

The proposal may also exacerbate the following processes, further impacting on the species:

- **Invasion and establishment of exotic vines and scramblers** as these species smother native vegetation and seedlings as well as preventing recruitment;
- **Invasion, establishment and spread of *Lantana camara*** as this species may suppress native vegetation and seedlings through shading, nutrient competition, smothering and allelopathy; and
- **Infection of native plants by *Phytophthora cinnamomi*** as this species is susceptible and may be killed or damaged.

No individuals of *Darwinia biflora* are proposed to be removed from the subject land. The known habitat for this species will continue to be managed as an APZ. This type of management has been shown to benefit the species within the subject land.

The retained areas of vegetation are proposed to be managed under a Vegetation Management Plan, which include management of exotic species.

There are no signs that *Phytophthora cinnamomi* is currently impacting vegetation on the subject lands and it is not likely that the process will be exacerbated as a result of the proposal.

Conclusion

No individuals of *Darwinia biflora* are proposed to be removed from the subject land. Management measures are proposed to be implemented to minimise impacts to this species. *Darwinia biflora* is not considered to be adversely affected by the future development.

D.2 Fauna

The following Assessment of Significance applies to the following species that are known have the potential to occur on the subject lands:

- Varied Sittella (*Daphoenositta chrysoptera*);
- Little Lorikeets (*Glossopsitta pusilla*)
- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Powerful Owl (*Ninox strenua*);
- Barking Owl (*Ninox connivens*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*); and
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*).

The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. The Varied Sittella is listed as Vulnerable on Schedule 2 of the TSC Act.

In NSW Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands and have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. The Little Lorikeet is listed as Vulnerable on Schedule 2 of the TSC Act.

The Gang-Gang Cockatoo is found from southern Victoria through south- and central-eastern New South Wales being recorded as far north as Coffs Harbour and as far west as Mudgee. The species undertakes a seasonal, altitudinal migration from tall mountain forests and woodlands preferring heavily timbered and mature wet sclerophyll forests in summer to drier more open eucalypt forests and woodlands in winter. The Gang-gang Cockatoo is listed as Vulnerable on Schedule 2 of the TSC Act while the Endangered Populations of this species are listed under Part 2 of Schedule 1 of the TSC Act.

The Powerful Owl is distributed from Mackay to south western Victoria, mainly on the coastal side of the Great Dividing Range. This species occurs in many vegetation types from woodland and open sclerophyll to tall open wet forest and rainforest. It requires large tracts of native vegetation but can survive in fragmented landscapes. It roosts in dense vegetation and nests in large tree hollows. The Powerful Owl is listed as Vulnerable on Schedule 2 of the TSC Act.

The Barking Owl is distributed throughout continental Australia except for the central arid regions. This species is flexible in its habitat use and ranges from closed forest to open areas, although woodland and open forest is the preferred foraging habitat. The Barking Owl requires large territories to obtain adequate food. This species roosts during the day in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as *Acacia* and *Casuarina* species. Nesting occurs in hollows of large, old trees. Living eucalypts are preferred though dead trees are also used. The Barking Owl is listed as Vulnerable on Schedule 2 of the TSC Act.

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is distributed along the east coast from Bundaberg in Queensland to Melbourne, Victoria. It occurs as far west as the western slopes of the Great Dividing Range in northern NSW. It occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Grey-headed Flying-foxes migrate according to the availability of native fruits, nectar and pollen. They roost in large "camps" which are generally within 20km of a food source. The Grey-headed Flying-fox is listed as Vulnerable on Schedule 2 of the TSC Act and under the EPBC Act.

The Eastern Bentwing-bat occurs along the east and north west coasts of Australia. It roosts in caves, derelict mines, storm water tunnels, buildings and other man made structures. It forages above the canopy in forested areas. This species also can potentially roost in some rock crevices and overhangs. The Eastern Bentwing-bat forms maternity colonies in caves and populations usually centre on such caves. The Eastern Bentwing-bat is listed as Vulnerable on Schedule 2 of the TSC Act.

(a) *In the case of a threatened species, whether the 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 habitat for these species occurs on the subject land, primarily in the form of foraging habitat. Tree hollows recorded on the subject land provided limited nesting habitat for the Little Lorikeet and Eastern Bentwing-bat.

A small portion of available habitat will be removed/modified from the subject land. The local populations of the species predicted to utilise the subject land are considered to inhabit adjacent areas of suitable habitat. Given that their mobility, these species will persist on the subject land and in surrounding areas such as the adjacent Blue Gum Reserve and Lane Cove National Park.

The majority of potential foraging and nesting habitat will be retained on the subject land, it is not likely that the proposal will affect the life cycle of these species such that viable local populations are 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 life cycles of the Endangered populations of the Gang-gang Cockatoo in the Ku-ring-gai and the Hornsby Local Government Areas are not likely to be impacted as a result of the proposal because the site does not form either an important breeding or foraging ground for the species. The populations are therefore not likely to be place at risk of extinction as a result of the proposal.

(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.

Potential habitat for these species exists within the subject lands. Approximately 0.05ha of native vegetation will be removed from the subject site and 0.09ha will be modified in terms of management regime, none of which constitutes significant habitat for these species. The area to be removed represents a small portion of the available habitat within the subject land and adjacent vegetation. Revegetation is proposed to occur within the cleared portions of the subject land not proposed for development.

Previous development has fragmented the vegetation on the subject land. The proposed project will not exacerbate the fragmentation further than current conditions. The subject land occurs at the edge of Blue Gum Reserve and Lane Cove National Park. Vegetation to be retained on the subject land adjoins this patch of vegetation. As such, the project will not cause habitat to become effectively isolated from currently interconnecting or proximate areas of habitat.

The habitat that will be removed/modified as a result of the proposal forms the fringe of a highly modified and fragmented area of habitat is not considered to be important for these species. Much larger areas of suitable habitat will remain in the vicinity of the subject land. Given the mobility these species, the presence of suitable adjacent habitat and its ability to adapt to disturbance within their home range, it is unlikely that any local populations will be adversely affected by the future development. Retained vegetation and bushland adjacent to the subject lands contains hollow-bearing trees and stags, containing nesting habitat for these species. The removal and modification of the vegetation on the subject land is not likely to have an adverse effect on the long-term survival of these species.

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

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

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

A recovery plan has been prepared for the Barking Owl and the large forest owls, which includes the Powerful Owl. The ultimate aim of the recovery plans is to ensure that the species it covers persist in the wild in NSW in each region where it presently occurs. The following main objectives of the Recovery Plan for the Large Forest Owls are relevant to the proposal:

- Objective 4: Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes; and

- Objective 5: Minimise further loss and fragmentation of habitat by protection and more informed management of significant owl habitat (including protection of individual nest sites).

In addition, the following main objective of the Barking Owl Recovery Plan is relevant to the proposal:

- Objective 3: Undertake threat abatement and mitigation.

The proposal does not involve the removal of significant owl habitat. The future development is considered to be consistent with the objectives in that it will not decrease or fragment the extent of significant habitat. Potential Powerful Owl and Barking Owl

habitat will remain in the locality, particularly in Blue Gum Reserve and Lane Cove National Park.

No recovery plan has been prepared for the other species being assessed.

No threat abatement plans are relevant to these species.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The proposal may impact these species on the subject lands through the following process:

- **Clearing of native vegetation** as this destroys populations of these species and their habitats.
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat;
- **Removal of dead wood and dead trees** as this reduces the abundance of nesting habitat;

The proposal may also exacerbate the following processes, further impacting on the species:

- **Competition from feral honeybees** as this fauna species competes with native species for tree hollows;
- **Infection of native plants by *Phytophthora cinnamomi*** as vegetation that are utilised by this species may be susceptible and may be killed or damaged.

The future development would result in the removal/modification of a minimal amount of potential habitat for these species. Areas of vegetation containing similar characteristics will be retained on the subject land outside of the development footprint. Known and potential habitat for these species occurs within the adjacent Blue Gum Reserve and Lane Cove National Park.

The future development will not increase competition from feral honeybees for hollows as the number of hollows to be removed is not significant.

There are no signs that *Phytophthora cinnamomi* is currently impacting vegetation on the subject lands and it is not likely that the process will be exacerbated as a result of the proposal.

Conclusion

The subject land contain potential habitat for the Varied Sittella, Little Lorikeet, Gang-gang Cockatoo, Powerful Owl, Barking Owl, Grey-headed Flying-fox and Eastern Bentwing-bat.

Potential local populations of these species are predicted to remain viable within the locality as suitable habitat will remain on the subject land. Although some vegetation will be removed/modified as a result of the proposal, substantial areas of similar habitat are conserved and additional vegetation recreated within the adjacent Blue Gum Reserve and Lane Cove National Park. These species are not considered to be adversely affected by the future development.