17-23 MERRIWA STREET, GORDON

Species Impact Statement

For:

Brewster Murray Pty Ltd

May 2014

Final

CUMBERLAND ECOLOGY

PO Box 2474, Carlingford Court 2118
www.cumberlandecology.com.au

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Report No. 14029RP1

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

Approved by:	David Robertson
Position:	Director
Signed:	David Robertson
Date:	*19 May, 2014*

CERTIFICATION

I, *Hong Huang,* Associate Director of Brewster Murray Pty Ltd, of *Level 6, 99 York Street, Sydney, NSW - 2000*, being the applicant for the development consent DA0474/13, Lot 40 in DP 803006, at 17-23, Merriwa Street, Gordan in the Ku-ring-gai Local Government Area, have read and understood this species impact statement. I understand the implications of the recommendations made in the statement and accept that they may be placed as conditions of consent or concurrence for the proposal.

Signed:

Date:

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Glossary of Terms

Abundance:	A quantification of the population of the species or community.
Affected species:	Subject species, populations and communities likely to be affected by the proposal.
Conservation status:	An indicator of how likely a threatened species is to remain alive at present or in the near future. Many factors are used to assess a species' conservation status, including: the number remaining, the overall increase or decrease in the population over time, breeding success rates and known threats.
Development:	As defined in the EP&A Act means: (a) the use of land, and (b) the subdivision of land, and (c) the erection of a building, and (d) the carrying out of a work, and (e) the demolition of a building or work, and (f) any other matter or thing referred to in section 26 that is controlled by an environmental planning instrument, but does not include any development of a class or description prescribed by the regulations for the purposes of this definition.
Director-General:	Director-General of OEH.
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:	The area within a 5 km radius of the centre of the subject site.
OEH:	NSW Office of Environment and Heritage.
Proposal:	The development, activity or action proposed.

Region:	As defined in the TSC Act, means for the purposes of the provision in which it is used, a bioregion defined in a national system of bioregionalisation that is determined (by the Director-General under subsection (4) to be appropriate for those purposes. In this case, the Bioregion refers to the Sydney Basin Bioregion.
Study area:	The subject site and surrounding developments along Merriwa Street and Fitzsimons Lane that are likely to be affected by the proposal, either directly or indirectly.
Subject site:	The area in which development will occur, being Lot 40 in DP 803006, also known as 17-23 Merriwa Street, Gordon ,which includes the building footprint, carpark, access road and any associated infrastructure as shown in **Figure 2.1**.
Subject species:	Threatened species that are known or considered likely to occur in the study area.
TSC Act:	NSW *Threatened Species Conservation Act 1995*.

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Executive Summary

S1 Purpose

Cumberland Ecology has been commissioned by Brewster Murray Pty Ltd on behalf of Meissen Propoerties IB Pty Ltd to prepare a Species Impact Statement (SIS) for a proposed development at 17-23 Merriwa Street, Gordon in the Ku-ring-gai Local Government Area (LGA). The proposed development involves the demolition of the existing commercial office building and construction of a new mixed-use development within Lot 40 in DP 803006 (hereafter referred to as the subject site).

This SIS has been prepared in accordance with the Director General's Requirements (DGRs), issued on 22 April 2014 by the NSW Office of Environment and Heritage (OEH). The purpose of this SIS is to allow the applicant to identify threatened flora and fauna issues and to consider and ameliorate those issues. Although the SIS has been prepared primarily to meet the requirements of the New South Wales *Threatened Species Conservation Act 1995* (TSC Act), it also assesses the impact to threatened flora and fauna and migratory avifauna listed by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Therefore, within this document threatened flora and fauna refer to populations, species and communities listed by the TSC Act and/or the EPBC Act.

S2 Background

During the planning phase of this Development Application an arborist report was prepared by Earthscape Horticultural Services (EHS) that identified potential impacts to trees within the subject site; trees that would require removal for the proposed development; and necessary protection measures for trees to be retained (EHS 2013). The trees proposed for removal included one *Eucalyptus paniculata* (Grey Ironbark) individual, which was identified as a potential remnant of the original Sydney Turpentine Ironbark Forest (STIF) community.

As STIF is listed as an endangered ecological community (EEC) under the TSC Act and a critically endangered ecological community (CEEC) under the EPBC Act, Ku-ring-gai Council (Council) raised concerns regarding the potential local extinction of the local occurrence of STIF within and adjacent to the development area. Council raised further concerns regarding insufficient ecological assessment with regard to "... *impacts of the development upon the endangered onsite STIF community in accordance with Section 5a of the Environmental Planning Assessment Act 1979*" (EP&A Act).

Cumberland Ecology considered the matter and expressed the opinion that technically, the tree on site does comply with the TSC Act definition, even though it currently has very little to no potential to regenerate naturally and has no native understorey. In consideration of this, the proponent has requested the preparation of a SIS.

The issued Director General's Requirements (DGRs) specified the threatened species, populations and communities that were to be assessed as subject species within the SIS..

S2.1 Location

The subject site is approximately 0.4 ha in size and is zoned as B4 – Mixed use under the *Ku-ring-gai Local Environmental Plan (Local Centres) 2012*.

The subject site is bounded by Fitzsimons Lane to the north, Merriwa Street to the south and developments to the east and west. The surrounding land use is largely made up of a mix of residential and commercial buildings.

S2.2 Existing Vegetation

Vegetation within and around the subject site consists largely of urban landscaping (exotic and planted native species) with scattered fragments of native vegetation. The remnant fragments of native vegetation within the subject site and wider study area consists predominantly of highly disturbed Sydney Turpentine Ironbark Forest and Blue Gum High Forest across an urban environment.

The subject site is highly modified and the vegetation predominantly consists of planted species (including locally-indigenous, non-local native and exotic species) in a landscaped setting. Locally indigenous trees planted on site include *Angophora costata* (Smooth barked Apple) and *Syncarpia glomulifera* (Turpentine). Potential remnant STIF trees within the subject site include one *Syncarpia glomulifera* individual and one *Eucalyptus paniculata* (Grey Ironbark) individual (EHS 2013).

The *Syncarpia glomulifera* individual is located in a mulched landscape path towards the back of the existing building near Fitzsimons Lane and is to be retained. The *Eucalyptus paniculata* individual is present on a mown nature strip beside a paved area along Fitzsimons Lane and is to be removed as part of the proposed development.

The *Eucalyptus paniculata* tree, though existing above pavement, technically represents the EEC STIF under the TSC Act (NSW Scientific Committee 1998) since by that definition the community can be reduced to occurrences of scattered trees without understorey. Due to its small size, being less than one hectare, and lack of native understorey the remnant on the subject site does not conform to the description of STIF listed under the EPBC Act (Threatened Species Scientific Committee 2005).

S3 Field Survey Results

S3.1 Flora

The vegetation across the subject site consists of a mix of planted species which do not conform to any definition of a native vegetation community and two potential remnant native STIF trees. No native ground cover occurs: the ground cover is made up of planted species in mulched and landscaped areas. Due to the paving and other landscaping, the locally

indigenous native trees present on site, whether planted or remnant, have effectively no natural regenerative capacity.

A total of 76 flora species were recorded within the subject site, of which 57 (75%) are exotic species. The 19 native species present on site (25%) consist of a mix of non-local native species and locally indigenous species.

Three individuals of *Syzygium paniculatum* (Magenta Lilly Pilly), a species listed as Endangered under the TSC Act and Vulnerable under the EPBC Act, were recorded within landscaped areas of the subject site. This species is commonly planted as an ornamental tree and is not endemic to this area. Furthermore these three individuals will not be removed as part of the proposed development. The proposed development, therefore, will not have any significant impacts on any threatened flora listed under the TSC Act and/or EPBC Act.

No threatened flora species were listed as subject species in the DGRs and no further threatened flora species were identified as subject species.

S3.2 Fauna

A range of fauna species are known from within a 5 km radius of the subject site (hereafter referred to as the locality) based on records from sources such as the OEH and NSW Bionet Atlas. However, due to the level of disturbance experienced on the site and surrounding area, the paucity of native vegetation and the relative isolation from other areas of habitat, the subject site and study area are unlikely to support a large diversity of native fauna species. Those species present are also likely to be urban-aggressive species that are common to disturbed habitats such as Noisy Miner (*Manorina melanocephala*), Rainbow Lorikeet (*Trichoglossus haematodus*) and Brushtail Possum (*Trichosurus vulpecula*).

The trees on the subject site do not support hollow-dwelling fauna. No tree hollows occur within the subject site. Similarly, fallen timber or dense understorey vegetation, representing potential fauna habitat is not present within the subject site.

A single Ringtail Possum (*Pseudocheirus peregrinus*) drey was recorded within a *Syzygium paniculatum* tree near the Merriwa Street frontage. The drey was located over 10m high within the tree and could not be checked for evidence of occupation.

Relatively low quality, potential foraging habitat is present for a small number of threatened fauna including: the Gang-gang Cockatoo (*Callocephalon fimbriatum*) (and its population in the Hornsby and Ku-ring-gai Local Government Areas), Powerful Owl *(Ninox strenua)*, Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Eastern Freetail-bat (*Mormopterus norfolkensis*), Little Bentwing-bat (*Miniopterus australis*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Grey-headed Flying-fox (*Pteropus poliocephalus)*. Key habitat features for the majority of species however, such as hollow-bearing trees for roosting and dense vegetation for foraging, are absent.

No threatened fauna were recorded across the subject site and most are considered unlikely to occur. Of the threatened subject species listed above, the species considered likely to be affected by the proposed development, based on location and number of records in the

locality include the Gang-gang Cockatoo (*Callocephalon fimbriatum*) (and its population in the Hornsby and Ku-ring-gai Local Government Areas), Powerful Owl *(Ninox strenua)*, Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Grey-headed Flying-fox (*Pteropus poliocephalus)*. However, potential habitat for these species within the study area is limited to marginal forgaring habitat. As these species are highly mobile and utilise large foraging areas, the proposed development is unlikely to have any significant impact on these threatened species. The vegetation on the subject site represents a very small fragment of the broader foraging range for each of the species potentially occurring.

S4 Impacts

The proposal will require the removal of planted species and a single remnant *Eucalyptus paniculata* individual. Based on the spread of the branches (EHA 2013), the drip zone of the *Eucalyptus paniculata* individual covers an area of approximately 270m^2 or 0.027 ha

Hence, the proposal will involve the effective clearance of 0.027 ha of low condition STIF. The occurrence of STIF on the subject site currently has very little function as an ecological community due to its highly modified and degraded form and the context in which it exists. Moreover, left in its current condition, a "do nothing" scenario, the tree is not likely to survive in the long term. As it senesces, there would be no legal requirement to replace it and there is very little to no possibility that it could regenerate naturally. Therefore in the current context, a "do nothing" scenario is not viable for the continued occurrence of STIF within the subject site in the long term.

Clearance of the STIF and other vegetation located within the subject site will remove a very small area of potential foraging habitat for some threatened species (mentioned above). This foraging habitat is marginal, containing no hollows and no understorey habitat. The threatened species that could use the trees on the subject site from time to time would not heavily rely on them for foraging.

STIF has been highly cleared and modified across its range, leaving the majority of remnants as small scattered patches. Most of the smaller patches are on private land and if all such patches were to be removed without compensatory habitat or replacement as the land is redeveloped, then most remnants would disappear. This has potential to reduce the long term viability of the STIF community across its range through cumulative loss. Hence although the STIF tree on site has a relatively low conservation value, there is value in providing compensatory replanting to maintain the occurrence of the community on site in the long term.

S5 Ameliorative and Compensatory Measures

In NSW ecological impacts are typically ameliorated according to the following hierarchy of measures:

- Avoid – where possible developments should be designed to avoid significant ecological impacts;

- Mitigate – where ecological impacts are to occur, amelioration measures should be deployed to reduce the severity of impacts; and
- Compensate – where it is impossible to totally avoid or mitigate impacts, compensatory offsets should be considered.

As mentioned above and discussed within the SIS it is not feasible to conserve the *Eucalyptus paniculata* tree as part of the proposed development.

Some mitigation measures will be implemented. Pre-construction measures such as pre-clearance fauna surveys to check for any nesting or roosting fauna and move to adjacent habitat is unwarranted due to the lack of nesting or roosting habitat offered by the trees present.

During construction, management should include sediment control and reduction measures in order to mitigate effects of stormwater and surface runoff on surrounding land. Appropriate protection measures, as outlined in the arborist report (EHS 2013), should be placed around all trees to be retained, in particular for the locally indigenous species. Precautions should also be taken to ensure that no pollution escapes the construction site. Landscaping for the proposed development currently includes designation of an onsite offset area for the replanting of STIF. Landscaping for the remainder of the property includes planting of a mix of non-native garden species and native species, including 4 diagnostic STIF species.

Compensatory offsets will be provided to compensate for the loss of the tree in the long term. An on-site offset area will be set aside for replanting of STIF as part of landscaping measures for the proposed development. This would include replanting of at least two *Eucalyptus paniculata* individuals as well as shrub and understorey species characteristic of STIF within an area of 600 m^2 or 0.06 ha, providing an offset ratio of 2:1. The offset area proposed to be replanted for the regeneration of STIF (trees, shrubs, herbs and grasses) will include sourcing local species and / or seeds of local provenance for re-vegetation effort.

The planting of characteristic STIF understorey species in addition to the canopy species will result in a patch of higher quality STIF than that proposed to be removed. The proposed offset will therefore provide a net improvement of biodiversity values over time and will have appropriate legal security over the land to secure the STIF in the long-term.

S6 Conclusion

The proposal will require the clearing of a single remnant tree of STIF, resulting in an impact entailing the removal of 0.027 ha of low condition habitat without understorey. In its current condition the STIF cannot self-regenerate in the long term. Although there will be an impact to the community within the subject site, the overall impact on the community in the wider locality is not considered to be of major ecological significance.

Notwithstanding the small scale of impact, offsetting is warranted to prevent a small cumulative loss of the community from the locality. If the proposed offset is implemented and maintained, this impact will be compensated for with a larger area of higher quality STIF

with greater long-term security, maintaining the presence of STIF in the wider area and the locality.

Chapter 1

Introduction

1.1 Purpose

Cumberland Ecology has been commissioned by Brewster Murray Pty Ltd on behalf of Meissen Propoerties IB Pty Ltd to prepare a Species Impact Statement (SIS) for a proposed development at 17-23 Merriwa Street, Gordon in the Ku-ring-gai Local Government Area (LGA) (**Figure 1.1**). The proposed development involves the demolition of the existing commercial office building and construction of a new mixed-use development within Lot 40 in DP 803006 (hereafter referred to as the subject site) which retains limited native vegetation.

The proposed development would require the clearing of one *Eucalyptus paniculata* tree, which complies with the Endangered Ecological Community (EEC) Sydney Turpentine Ironbark Forest (STIF) under the *Threatened Species Conservation Act 1995* (TSC Act). This community does not comply with the listing for CEEC STIF under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The purpose of this SIS is to identify threatened species issues and provide appropriate amelioration for adverse impacts resulting from the proposal. This SIS has been prepared in accordance with Section 109 and 110 of the *Threatened Species Conservation Act 1995* (TSC Act) and with the requirements of the Director General of the Office of Environment and Heritage (OEH), which are provided in **Appendix A**.

Although this SIS has been prepared primarily to meet the requirements of the New South Wales (NSW) TSC Act, the impact to threatened flora and fauna listed by the Commonwealth EPBC Act has also been assessed. Within this document, threatened flora and fauna include populations, species and communities listed by the TSC Act and/or the EPBC Act.

The main objectives of this SIS are to:

- Identify threatened species issues and provide appropriate amelioration for adverse impacts resulting from the proposal;
- Provide an appropriate level of background information and assessment to facilitate determinations and licensing processes;
- Assist consent and determining authorities in the assessment of the Development Application under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act);

- Assist the Director-General in deciding whether or not concurrence should be granted for the purposes of Parts 4 or 5 of the EP&A Act;
- Assist the Director-General or the Minister for the Environment when consulted for the purposes of Parts 4 or 5 of the EP&A Act;
- Assist the Director-General in the assessment of Section 91 License applications lodged under the TSC Act; and
- Provide preliminary information if needed to the Commonwealth Department of the Environment (DoE) to assist the assessment of a Referral if the proposal is referred to DoE.

This document has been structured to comply precisely with the DGRs. Throughout the SIS at the start of each major section the relevant parts of the DGRs are reproduced in italics in order to demonstrate how each SIS section complies with statutory requirements.

1.2 Background

1.2.1 Location

The subject site is approximately 0.4 ha in size and is zoned as B4 – Mixed use under the *Ku-ring-gai Local Environmental Plan (Local Centres) 2012*. (**Figure 1.2**)

The subject site is bounded by Fitzsimons Lane to the north, Merriwa Street to the south and developments to the east and west. The surrounding land use is largely made up of a mix of residential and commercial buildings.

1.2.2 Assessment History

During the planning phase of this Development Application, an arborist report was prepared by Earthscape Horticultural Services (EHS). The report (provided in **Appendix B**) identified potential impacts to trees, trees that would require removal for the proposed development and necessary protection measures for trees to be retained (EHS 2013). The trees proposed for removal included one *Eucalyptus paniculata* (Grey Ironbark) individual, which was identified as a potential remnant of the original Sydney Turpentine Ironbark Forest (STIF) community.

As STIF is listed as an endangered ecological community (EEC) under the TSC Act and a critically endangered ecological community (CEEC) under the EPBC Act, Ku-ring-gai Council (Council) raised concerns regarding the potential local extinction of the local occurrence of STIF within and adjacent to the development area. Council raised further concerns regarding insufficient ecological assessment with regard to "*... impacts of the development upon the endangered onsite STIF community in accordance with Section 5a of the Environmental Planning Assessment Act 1979*" (EP&A Act).

Cumberland Ecology considered the matter and expressed the opinion that technically, the tree on site does comply with the TSC Act definition, though it currently has no prospect of regenerating naturally and has no understorey.

In consideration of this, the proponent has requested that Director-General's Requirements (DGRs) for an SIS be issued as a precautionary approach to the assessment of the proposal. Note that the remnants occurring on the subject site conform only to the TSC Act definition of the community and not to the EPBC Act due to its small size and poor condition.

1.3 Legislative Requirements

This SIS has been prepared in accordance with Sections 109 and 110 of the TSC Act, which describes the form and content of a SIS, with the exception of those matters limited or modified in the DGRs as listed in Section 1.4 below. The requirements of the Director-General of the OEH were sought pursuant to Section 111 of the TSC Act. DGRs for the project were issued on 22 April 2014.

All fauna and flora work was carried out under the NSW OEH Scientific Licence number S11164 and the NSW Department of Primary Industries Animal Research Authority Trim File No. 08/135.

1.4 DGR Matters Which Have Been Limited or Modified

The following Section 110 Matters need only be addressed where relevant

i. Threat abatement plans

At this time, no threat abatement plans have been approved in accordance with the TSC Act which are relevant to this proposal.

ii. Recovery Plans

At this time, no recovery plans have been approved in accordance with the TSC Act which are relevant to this proposal.

iii. Key Threatening Processes

- Clearing of native vegetation
- Forest eucalypt dieback associated with overabundant psyllids and bell miners
- Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations
- Infection of native plants by *Phytophthora cinnamomi*
- Invasion and establishment of exotic vines and scramblers

- Invastion of native communities by exotic perennial grasses
- Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae
- Invasion, establishment and spread of Lantana (*Lantana camara* L.sens. lat)
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
- Loss of hollow-bearing trees
- Predation by the feral cat *Felis catus* (Linnaeus, 1758)

iv. Critical habitat

At this time, the areas of declared critical habitat are not relevant to this proposal.

Figure 1.1. Aerial Photograph of the Gordon Local Centre (Ku-ring-gai LEP (Local Centres) 2012)

Figure 1.2. Zoning of the Subject Site

Contextual Information

This chapter covers the following Director General's Requirements:

DGR 2. CONTEXTUAL INFORMATION

2.1 Description of the Proposal, Subject Site and Study Area

DGR 2.1 Description of proposal, subject site and study area

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

2.1.1 Nature

The proposed development involves the demolition of the existing commercial office building and construction of a new mixed-use development within Lot 40 in DP 803006. Documents related to the proposed development that are referenced below are provided as Appendices within the Statement of Environmental Effects (SEE) by JBA Planning (JBA 2013).

The components associated with this proposal include

i. Buildings and other structures

The proposal will involve the removal of the existing commercial building located on the subject site and the construction of mixed use development comprising of two seven storey buildings (Building A in the south fronting Merriwa Street and Building B in the North fronting Fitzsimons Lane) accommodating in total 117 units. The development also includes a ground floor commercial/retail tenancy of 100m^2, a linked underground basement parking area comprising 153 car spaces, common open spaces, provision of a through-site pedestrian link between Merriwa Street and Fitzsimons Lane and the provision for private landscaped areas on ground floor areas.

Details of the development are shown in architectural plans prepared by Brewster Murray provided in **Appendix C**.

ii. Installation and maintenance of utilities

The site is currently served by water, electricity, gas and telecommunications. These existing utilities shall be augmented / upgraded as required (SEE - Section 3.9: Infrastructure and services).

iii. Access routes

Vehicular access is to be maintained from Merriwa Street and Fitzsimmons Lane. Thus there will be no change to vehicular access and no new access routes are to be created.

iv. Drainage infrastructure

The subject site is not flood prone and stormwater flows will not be any higher than current flows. The proposal is not expected to adversely impact downstream properties due to stormwater or flooding beyond currently existing levels.

Drainage infrastructure plans have been prepared by J&M Group Pty Ltd Hydraulic and fire service consultants (November 2013) and are provided as an Appendix to the SEE.

v. Bushfire hazard reduction

The subject site is not bushfire prone land and therefore the proposed development does not include bushfire hazard reduction measures.

vi. Landscaping

Landscaping is proposed to take place on the subject site in accordance with Landscape Plan prepared by Site Design Studios and provided in **Appendix D**. The Landscaping currently includes an area designated as an onsite offset area for replanting of STIF. This offset area will be planted with native species only, 100% of which are listed as diagnostic species of STIF in the Final Determination for this community (NSW Scientific Committee 1998)). Landscaping for the remainder of the property includes planting of native (indigenous and non-local native) and common exotic garden species.

2.1.2 Extent

For the purposes of this SIS, the current proposal includes the redevelopment of Lot 40 in DP 803006 (the subject site). The total area of the proposed works within the DA comprises approximately 0.4 hectares.

2.1.3 Location

Development is proposed on the subject site as indicated in **Figure 2.1**, being Lot 40 in DP 803006, also known as 17-23 Merriwa Street, Gordon.

2.1.4 Timing

Construction is proposed to commence on late 2014, subject to development approval.

2.1.5 Layout

The layout (footprint) of the proposed development is shown in **Figure 2.1** and in architectural plans prepared by Brewster Murray provided in **Appendix C.**

2.1.6 Description of the Subject Site

The subject site is zoned as B4 – Mixed use under the *Ku-ring-gai Local Environmental Plan (Local Centres) 2012.* (**Figure 1.2**)

The subject site is approximately 0.4 ha in size and is shown in **Figure 2.1**. The subject site has a moderate south westerly gradient **(Figure 2.2)** and is bounded by Fitzsimons Lane to the north, Merriwa Street to the south and developments to the east and west. The surrounding land use is largely made up of a mix of residential and commercial buildings.

The subject site is highly modified and the vegetation predominantly consists of planted species, including locally-indigenous, non-local native and exotic species, in landscaped areas. Locally indigenous trees planted on site include *Angophora costata* (Smooth barked Apple) and *Syncarpia glomulifera* (Turpentine). Potential remnant STIF trees within the subject site include one *Syncarpia glomulifera* individual and one *Eucalyptus paniculata* (Grey Ironbark) individual (EHS 2013).

The *Syncarpia glomulifera* individual is located in a mulched landscape path towards the back of the existing building near Fitzsimons Lane and is to be retained. The *Eucalyptus paniculata* individual is present on a mown nature strip beside a paved area along Fitzsimons Lane and is to be removed as part of the proposed development.

The *Eucalyptus paniculata* tree, though existing above pavement, technically represents the EEC STIF under the TSC Act (NSW Scientific Commitee 2011, NSW Scientific Committee 1998) as by that definition the community can be reduced to occurrences of scattered trees without understorey. Due to its small size, being less than one hectare, and lack of native understorey the remnant on the subject site does not conform to the description of STIF listed under the EPBC Act (Threatened Species Scientific Committee 2005).

2.1.7 Description of the Study Area

The study area includes the subject site, subject lands and any additional areas that are likely to be affected by the proposal, either directly or indirectly. For the purposes of this SIS, the study area includes the surrounding developed areas of Merriwa Street and Fitzsimons Lane (**Figure 2.1**). The study area occurs wholly within Ku-ring-gai LGA, in the Sydney Basin Bioregion.

The soil landscape of the study area is Glenorie. The Glenorie Landscape occurs on both steep and undulating to rolling low hills on Wianamatta Group shales. The soil landscape typically supports tall open wet sclerophyll forest with dominant tree species being *Eucalyptus saligna* (Sydney Blue Gum), *Eucalyptus pilularis* (Blackbutt), *Syncarpia glomulifea* (Turpentine) and *Eucalyptus paniculata* (Grey Ironbark) (Chapman and Murphy 1989).

The vegetation within the study area is characteristic of a shale derived soil landscape in a developed environment, consisting largely of exotic and planted urban landscapes with scattered fragments of native vegetation. The remnant fragments of native vegetation within the study area consists of highly disturbed Sydney Turpentine Ironbark Forest. The Critically Endangered Ecological Community Blue Gum High Forest also occurs as scatttered remnants across an urban environment in areas adjacent to the study area. Details of the vegetation communities occurring within the wider locality are provided in **Section 2.3.**

The fire history of the study area is unknown; however it is likely that the native trees within the study area have not experienced fire for many decades if at all. The vegetation does not show signs of recent burns, for example, blackened trunks. This is due to the isolated location and urban setting of the study area.

2.2 Land Tenure Information

DGR 2.2 *Land tenure information*

The registered proprietor of the subject site is SPUT No. 10 Pty Ltd (ACN 165 714 929). The subject site is zoned as B4 – Mixed use under the *Ku-ring-gai Local Environmental Plan (Local Centres) 2012*

The study area is highly developed and is made up of private residential and commercial property tenure of various zonings. Parts of Fitzsimons Lane within the study area are also zoned B4 – Mixed use while the eastern parts along Merriwa Street are zoned as R3 – Medium Density Residential or R4 – High Density Residential under the *Ku-ring-gai Local Environmental Plan (Local Centres) 2012.* (Figure 1.2).

The western parts of Merriwa Street lie outside the boundary of the *Ku-ring-gai Local Environmental Plan (Local Centres) 2012.* This section of the study area is zoned R2 – Low Density Residential under the Draft Ku-ring-gai Local Environmental Plan 2013 will replace the outdated Ku-ring-gai Planning Scheme Ordinance 1971 for all areas outside the six local centres. **Figure 2.4** shows the zoning within the locality.

2.3 Vegetation

DGR 2.3 *Vegetation*

The vegetation communities in the locality have been mapped by the Office of Environment and Heritage (OEH) as part of the broad-scale mapping project Sydney Metropolitan Catchment Management Authority (SMCMA) Vegetation Mapping (OEH 2013a, b).

The distribution of the vegetation communities occurring within the locality as mapped by the SMCMA is shown in **Figure 2.3**. The SMCMA map units have been verified and refined within the subject site by ground-truthing vegetation communities (refer to **Figure 4.2**).

The Endangered Ecological Community Sydney Turpentine Ironbark Forest is known to occur within the study area. Other TSC Act listed Critically Endangered (CEEC) and Endangered Ecological Communities (EEC), as mapped by OEH (2013 a, b), that are known to occur in the wider locality include:

- Blue Gum High Forest in the Sydney Basin Bioregion (CEEC);
- Coastal saltmarsh in the NSW North Coast, Sydney Basin (EEC);
- Coastal Upland Swamp in the Sydney Basin Bioregion (EEC);
- Duffys Forest ecological community in the Sydney Basin Bioregion (EEC);
- Swamp oak floodplain forest of the NSW North Coast (EEC); and
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (EEC).

A broad range of communities, as mapped by OEH (2013 a, b), are known to occur in the locality. These vegetation communities have been described as per the SMCMA mapping (OEH 2013a, b) with reference to Tozer *et al. (2010)* and relevant Scientific Committee determinations for Endangered Ecological Communities and are provided in Sections 2.3.1 – 2.3.22 below. Table 2.1 provides a summary of the reservation status of the vegeation communties as per the SMCMA mapping (OEH 2013a). Areas of native vegetation are shown in **Figure 2.5**.

2.3.1 Sydney Turpentine Ironbark Forest

The SMCMA mapping for Sydney Turpentine Ironbark Forest (Map Unit: S_WSF09) corresponds to the TSC Act EEC listing for Sydney Turpentine Ironbark Forest (NSW Scientific Committee 1998) and the EPBC Act CEEC listing for Turpentine Ironbark Forest of the Sydney Basin Bioregion

Sydney Turpentine-Ironbark Forest is a tall open forest with an open shrub layer and grassy groundcover found on shale and shale-enriched sandstone soils on the coast and hinterland of Sydney. The primary distribution of this forest is in areas receiving between 900 and 1250 millimetres of mean annual rainfall at elevations between 10 and 180 metres above sea level. Having been extensively cleared this unit now occurs predominantly as scattered remnants on shale derived soils on the rim of the Cumberland plain and in the lower Blue Mountains (Tozer et al. 2010).

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	**Cover (%) (+/- SD)**	**Floristics**
Trees	23 ± 6	35 ± 20	*Syncarpia glomulifera, Angophora costata, Eucalyptus pilularis,Eucalyptus resinifera, Eucalyptus paniculata* subsp. *paniculata,Eucalyptus fibrosa, Eucalyptus crebra*

Small Trees	9 ± 6	23 ± 20	*Pittosporum undulatum, Syncarpia glomulifera*
Shrubs	2.9 ± 1.9	16 ± 13	*Pittosporum undulatum, Leucopogon juniperinus, Polyscias sambucifolia, Breynia oblongifolia, Ozothamnus diosmifolius,Notelaea longifolia, Hibbertia aspera* subsp. *aspera, Dodonaea triquetra, Pittosporum revolutum, Bursaria spinosa*
Ground covers	0.8 ± 04	50 ± 26	*Microlaena stipoides* var. *stipoides, Dianella caerulea, Pratia purpurascens, Entolasia marginata, Entolasia stricta, Lepidosperma laterale, Lomandra longifolia, Echinopogon caespitosus* var. *caespitosus, Dichondra repens, Lomandra multiflora, Themeda australis, Aristida vagans, Pseuderanthemum variabile*
Vines and Climbers	n/a	n/a	*Pandorea pandorana, Billardiera scandens, Glycine microphylla, Eustrephus latifolius, Glycine clandestina*

2.3.2 Blue Gum High Forest

The SMCMA mapping for Sydney Turpentine Ironbark Forest (Map Unit: S_WSF01) corresponds to the CEEC listing for Blue Gum High Forest under the TSC Act (NSW Scientific Committee 2008) and EPBC Act.

Blue Gum High Forest is a tall eucalypt forest characterised by an open mesic tree/shrub layer and an open moist groundcover. This tall forest has a restricted distribution on wet shale ridges of the Hornsby plateau in northeast Sydney where annual rainfall exceeds 1000mm and at elevations above 100m ASL. Most of Blue Gum High Forest's original range has been cleared for urban development (Tozer et al. 2010).

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	**Cover (%) (+/- SD)**	**Floristics**
Trees	32 m ±8	33% ±12	*Eucalyptus saligna, Eucalyptus pilularis, Eucalyptus paniculata,Syncarpia glomulifera, Angophora costata*
Small Trees	13 m ±7	24% ±18	*Pittosporum undulatum, Syncarpia glomulifera, Elaeocarpus reticulatus, Acacia implexa.*
Shrubs	4.3 m ±3.2	17% ±18	*Pittosporum undulatum, Leucopogon juniperinus, Polyscias sambucifolia, Breynia oblongifolia, Ozothamnus diosmifolius, Notelaea longifolia, Hibbertia aspera* subsp. *aspera, Dodonaea triquetra, Pittosporum revolutum, Bursaria spinosa*
Ground covers	1.1 m ±0.8	52% ±31	*Microlaena stipoides* var. *stipoides, Dianella caerulea, Pratia purpurascens, Entolasia marginata, Entolasia stricta, Lepidosperma laterale, Lomandra longifolia, Echinopogon caespitosus* var. *caespitosus, Dichondra repens, Lomandra multiflora, Themeda australis, Aristida vagans, Pseuderanthemum variabile*
Vines and Climbers	N/A	N/A	*Pandorea pandorana, Billardiera scandens, Glycine microphylla,Eustrephus latifolius, Glycine clandestina*

2.3.3 Coastal Enriched Sandstone Dry Forest

The SMCMA mapping for Coastal Enriched Sandstone Dry Forest (Map Unit: S_DSF04) does not correspond to a State or Commonwealth listed threatened ecological community.

Coastal Enriched Sandstone Dry Forest is a tall open eucalypt forest with an understorey of dry sclerophyll shrubs with ferns and forbs amongst the ground cover commonly found on the upper slopes and dry gullies of Sydney urban areas. It is widespread on the Hornsby plateau in areas that receive greater than 1000 millimetres of mean annual rainfall and are at elevations less than 200 metres above sea level. It extends north of the Sydney area into the hinterland of the Central Coast.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Trees	20 m ±5	29% ±16	*Angophora costata Corymbia gummifera, Eucalyptus piperita,Eucalyptus pilularis, Eucalyptus umbra, Syncarpia glomulifera*
Small Trees	8 m ±4	20% ±15	*Allocasuarina littoralis, Banksia serrata, Elaeocarpus reticulatus,Pittosporum undulatum, Ceratopetalum gummiferum*
Shrubs	3.4 m ±2.0	19% ±14	*Acacia ulicifolia, Leptospermum trinervium, Persoonia levis, Acacia suaveolens, Acacia terminalis Lomatia silaifolia, Dodonaea triquetra,Banksia spinulosa*
Ground covers	1.3 m ±0.6	27% ±21	*Dianella caerulea, Entolasia stricta, Lomandra longifolia, Pteridium esculentum, Xanthosia pilosa*
Vines and Climbers	N/A	N/A	*Smilax glyciphylla, Billardiera scandens, Cassytha pubescens*

2.3.4 Coastal Enriched Sandstone Moist Forest

The SMCMA mapping for Coastal Enriched Sandstone Moist Forest (Map Unit: S_WSF02) does not correspond to a State or Commonwealth listed threatened ecological community.

Coastal Enriched Sandstone Moist Forest is a tall open eucalypt forest with a distinctive mesic shrub and small tree layer. This community is has a patchy but widespread distribution across the Sydney area, typically in sandstone gullies and sheltered slopes enriched by clay material associated with Narrabeen sandstone or Hawkesbury sandstone It occurs at elevations between 10 and 120 metres above sea level and mean annual rainfall of 850-1250 millimetres per annum.

A floristic and structural summary of this community is provided below.

	Height (m)	Cover (%)	Floristics

	(+/- SD)	(+/- SD)	
Trees	25 m ±6	34% ±15	*Angophora costata, Syncarpia glomulifera, Eucalyptus piperita,Eucalyptus pilularis, Eucalyptus saligna, Eucalyptus botryoides*
Small Trees	10 m ±5	30% ±21	*Elaeocarpus reticulatus, Pittosporum undulatum, Ceratopetalumapetalum, Allocasuarina torulosa, Glochidion ferdinandi*
Shrubs	4.1 m ±2.9	25% ±18	*Notelaea longifolia, Pittosporum undulatum, Dodonaea triquetra, Leucopogon lanceolatus* var. *lanceolatus, Polyscias sambucifolia, Pittosporum revolutum, Breynia oblongifolia, Myrsine variabilis*
Ground covers	1.3 m ±0.7	28% ±20	*Dianella caerulea, Lomandra longifolia, Calochlaena dubia, Entolasia stricta, Pteridium esculentum, Poa affinis, Pseuderanthemum variabile, Lepidosperma laterale, Microlaena stipoides* var. *stipoides,Entolasia marginata, Gonocarpus teucrioides,*
Vines and Climbers	N/A	N/A	*Smilax glyciphylla, Pandorea pandorana, Eustrephus latifolius, Hibbertia dentata, Billardiera scandens, Cissus hypoglauca*

2.3.5 Coastal Flats Tall Moist Forest

The SMCMA mapping for Coastal Flats Tall Moist Forest (Map Unit: S_WSF36) does not correspond to a State or Commonwealth listed threatened ecological community.

Coastal Flats Tall Moist Forest is a tall eucalypt community with layers of small rainforest trees and mesic shrubs found on coastal flats and adjoining slopes in areas with alluvial soils that are clay rich. It generally occurs in areas that receive more than 1150 millimetres of mean annual rainfall and is situated on elevations less than 40 metres above sea level.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Trees	27.2 m ±4.3	21.6% ±6.1	*Eucalyptus botryoides, Eucalyptus saligna, Eucalyptus pilularis, Angophora floribunda, Syncarpia glomulifera, Angophora costata*
Small Trees	14.3 m ±1.8	65% ±17.4	*Acmena smithii, Glochidion ferdinandii, Livistona australis,Backhousia myrtifolia, Melaleuca linariifolia, Melaleuca styphelioides*
Shrubs	3.4 m ±1.9	17.5% ±10.6	*Eupomatia laurina, Clerodendrum tomentosum, Acacia irrorata, Ficus coronata, Notelaea longifolia, Synoum glandulosum* subsp. *glandulosum, Pittosporum undulatum, Pittosporum revolutum*
Ground	0.7 m ±0.4	42.5% ±31.6	*Blechnum cartilagineum, Calochlaena dubia, Gahnia melanocarpa,Hypolepis muelleri,*

covers			*Microlaena stipoides* var. *stipoides, Entolasia marginata, Hydrocotyle peduncularis, Carex* spp., *Oplismenus imbecillis*
Vines and Climbers	N/A	N/A	*Cissus hypoglauca, Morinda jasminoides, Clematis aristata, Geitonoplesium cymosum, Stephania japonica, Hibbertia dentata*

2.3.6 Coastal Sandstone Foreshores Forest

The SMCMA mapping for Coastal Sandstone Foreshores Forest (Map Unit: S_DSF06) does not correspond to a State or Commonwealth listed threatened ecological community.

Coastal Sandstone Foreshores Forest is an open forest with a moist shrub and ground cover layer found on sheltered sandstone slopes along the foreshores of Sydney's major waterways and coastal escarpments. This forest is restricted to sandstone soils derived from either Hawkesbury or Narrabeen geology and is found in areas with a combination of low elevation (between two and 45 metres above sea level) and mean annual rainfall that exceeds 1100 millimetres per annum.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	**Cover (%) (+/- SD)**	**Floristics**
Trees	18 m ±7	30% ±14	*Angophora costata, Banksia integrifolia, Eucalyptus piperita,Eucalyptus botryoides, Eucalyptus pilularis*
Small Trees	6 m ±4	24% ±17	*Glochidion ferdinandi, Pittosporum undulatum, Allocasuarina littoralis, Breynia oblongifolia, Notelaea longifolia, Dodonaea triquetra, Elaeocarpus reticulatus, Polyscias sambucifolia, Acacia longifolia, Myrsine variabilis*
Ground covers	1.1 m ±0.5	27% ±21	*Dianella caerulea, Pteridium esculentum, Lomandra longifolia, Entolasia stricta, Imperata cylindrica* var. *major, Microlaena stipoides* var. *stipoides, Poa affinis, Themeda australis, Xanthorrhoea arborea, Lepidosperma laterale, Pratia purpurascens*
Vines and Climbers	N/A	N/A	*Smilax glyciphylla, Billardiera scandens, Pandorea pandorana, Glycine clandestina*

2.3.7 Coastal Sandstone Gallery Rainforest

The SMCMA mapping for Coastal Sandstone Gallery Rainforest (Map Unit: S_RF02) does not correspond to a State or Commonwealth listed threatened ecological community.

This warm-temperate rainforest is found on sandy alluvium or rocky streams in deep protected sandstone gully systems across the greater Sydney region, more commonly in the eastern portions of the Hornsby and Woronora plateaus. This commmunity forms small

disjunct patches restricted to very incised Hawkesbury sandstone gullies and sandstone alluvium and occurs in higher rainfall zones (greater than 900 millimetres per annum).

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Emergent	24 m ±16	18% ±19	*Syncarpia glomulifera, Eucalyptus piperita*
Trees	15 m ±7	55% ±42	*Ceratopetalum apetalum, Callicoma serratifolia, Tristaniopsis laurina,Acmena smithii, Pittosporum undulatum, Melaleuca linariifolia*
Shrubs	4.0 m ±3.5	45.0% ±43	*Acacia parramattensis, Acacia longifolia Austromyrtus tenuifolia,Leptospermum polygalifolium* subsp. *polygalifolium, Acmena smithii*
Ground covers	0.5 m ±0.0	36% ±56	*Calochlaena dubia, Doodia caudata, Lomandra longifolia, Juncus usitatus, Oplismenus* spp., *Viola hederacea*
Vines and Climbers	N/A	N/A	*Morinda jasminoides, Cassytha pubescens*

2.3.8 Coastal Sandstone Gully Forest

The SMCMA mapping for Coastal Sandstone Gully Forest (Map Unit: S_DSF09) does not correspond to a State or Commonwealth listed threatened ecological community.

Coastal Sandstone Gully Forest is an open eucalypt forest which has a diverse sclerophyll shrub stratum and an open groundcover dominated by sedges. Distribution is along the eastern area of the Hornsby and Woronora plateaux at elevations up to 500 metres above sea level. It occurs on lower slopes of sandstone gullies in areas with an annual average rainfall of 1000 - 1550mm.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Trees	16 m ±6	30% ±14	*Angophora costata, Corymbia gummifera, Eucalyptus piperita,Eucalyptus sieberi*
Small Trees	8 m ±5	29% ±23	*Banksia serrata, Ceratopetalum gummiferum*
Shrubs	3.6 m ±1.7	30% ±18	*Leptospermum trinervium, Persoonia levis, Banksia ericifolia* subsp. *ericifolia, Persoonia pinifolia, Dillwynia retorta, Platysace linearifolia,Acacia terminalis, Acacia suaveolens, Pimelea linifolia, Epacrislongiflora, Lambertia formosa, Petrophile pulchella, Pultenaea stipularis, Woollsia pungens, Bossiaea heterophylla*
Ground covers	1.3 m ±0.7	22%±16	*Entolasia stricta, Lomandra longifolia, Caustis flexuosa, Gonocarpus teucrioides, Lomatia silaifolia, Pteridium esculentum, Xanthosia tridentata, Lepyrodia*

			scariosa, Lomandra obliqua, Dianella caerulea, Lepidosperma laterale, Xanthosia pilosa, Doryanthes excelsa
Vines and Climbers	N/A	N/A	*Smilax glyciphylla*

2.3.9 Coastal Sandstone Heath-Mallee

The SMCMA mapping for Coastal Sandstone Heath-Mallee (Map Unit: S_HL081) does not correspond to a State or Commonwealth listed threatened ecological community.

Coastal Sandstone Heath-Mallee is widespread across the coastal Hawkesbury sandstone plateaus of the Sydney region. It varies in structure, ranging from a treeless heath to a low open woodland with mallees and is common on exposed skeletal soils along narrow ridges and exposed slopes of both the Woronora and Hornsby plateaus. This community is associated with the wetter zones of the sandstone plateau where mean annual rainfall exceeds 1100 millimetres per annum. It ranges in elevation between 50 and 250 metres above sea level.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	**Cover (%) (+/- SD)**	**Floristics**
Trees	7 m ±3	17% ±13	*Angophora hispida, Banksia serrata, Corymbia gummifera, Eucalyptus obstans, Eucalyptus luehmanniana, Eucalyptus haemastoma. Eucalyptus multicaulis*
Shrubs	3.08 m ±1.3	49% ±24	*Banksia ericifolia* subsp. *ericifolia, Boronia ledifolia, Leptospermum trinervium, Leucopogon microphyllus, Acacia suaveolens, Leptospermum arachnoides, Grevillea oleoides, Hakea teretifolia,Banksia oblongifolia, Hakea dactyloides, Lambertia formosa, Leptospermum squarrosum, Darwinia fascicularis, Conospermum taxifolium, Hakea gibbosa, Pimelea linifolia, Epacris microphylla, Epacris pulchella, Kunzea capitata, Persoonia lanceolata, Hemigenia purpurea, Petrophile pulchella, Pultenaea tuberculata, Banksia marginata, Allocasuarina distyla*
Ground covers	0.8 m ±0.5	36% ±20	*Lomandra obliqua, Xanthorrhoea media, Actinotus minor, Cyathochaeta diandra, Dampiera stricta, Caustis pentandra, Schoenus imberbis, Lepyrodia scariosa*

2.3.10 Coastal Sandstone Riparian Forest

The SMCMA mapping for Coastal Sandstone Riparian Forest (Map Unit: S_DSF08) does not correspond to a State or Commonwealth listed threatened ecological community.

Coastal Sandstone Riparian Forest occurs in narrow sandstone gorges and minor creek lines of the sandstone plateaus. Though restricted in extent, the community is widespread across the gully lines of the major sandstone plateaus and often forms a mosaic with other riparian vegetation

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Trees	19 m ±9	23% ±25	*Angophora costata, Eucalyptus piperita*
Small Trees	8 m ±1	35% ±35	*Ceratopetalum apetalum, Acacia terminalis, Ceratopetalum gummiferum, Elaeocarpus reticulatus, Leptospermum polygalifolium, Callicoma serratifolia, Tristaniopsis laurina*
Shrubs	4.0 m	10%	*Epacris longiflora,* subsp. *polygalifolium, Dodonaea triquetra, Grevillea mucronulata, Banksia ericifolia* subsp. *ericifolia, Logania albiflora, Notelaea longifolia, Acacia obtusifolia, Leucopogon lanceolatus, Lomatia myricoides, Persoonia pinifolia, Podocarpus spinulosus*
Ground covers	1.8 m ±1.0	10% ±5	*Lomandra longifolia, Calochlaena dubia, Entolasia stricta, Sticherus flabellatus, Caustis flexuosa, Gleichenia dicarpa, Gonocarpus teucrioides, Opercularia aspera, Lepidosperma laterale, Schoenus melanostachys, Bauera rubioides, Gahnia sieberiana, Gleichenia microphylla*
Vines and Climbers	N/A	N/A	*Smilax glyciphylla, Billardiera scandens, Cassytha pubescens*

2.3.11 Coastal Sandstone Rock Plate Heath

The SMCMA mapping for Coastal Sandstone Rock Plate Heath (Map Unit: S_HL09) does not correspond to a State or Commonwealth listed threatened ecological community.

Coastal Sandstone Rock Plate Heath is a stunted open to sparse heath or shrub community restricted to rock platforms found on exposed Hawkesbury sandstone ridgetops across Sydney's coastal plateaus, mostly in areas of high coastal rainfall (1200-1500mm).

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Shrubs	2.0 m	55% ±49	*Kunzea ambigua, Leucopogon microphyllus, Banksia ericifolia* subsp. *ericifolia, Darwinia fascicularis, Epacris microphylla, Leptospermum trinervium, Persoonia pinifolia, Allocasuarina littoralis, Calytrix tetragona, Dillwynia retorta, Hakea sericea, Hakea teretifolia, Monotoca ledifolia, Pultenaea tuberculata,*

			Zieria laevigata
Ground covers	0.5 m	35% ±7	*Drosera peltata, Lepidosperma viscidum, Lepyrodia scariosa, Schoenus ericetorum, Cyathochaeta diandra, Empodisma minus, Poranthera ericifolia, Thelionema umbellatum, Tricostularia pauciflora*

2.3.12 Coastal Shale-Sandstone Forest

The SMCMA mapping for Coastal Shale-Sandstone Forest (Map Unit: S_WSF06) does not correspond to a State or Commonwealth listed threatened ecological community.

Coastal Shale-Sandstone Forest is often a tall open eucalypt forest with a sparse layer of dry sclerophyllous shrubs and a grassy ground cover that occurs on clay-influenced soils associated with residual shale or lateritic capping, shale bands in the sandstone bedrock or downslope shale wash on exposed sandstone slopes. The community is found in areas that receive an average of more than 900 millimeteres of rainfall per annum and are between 2 and 372 metres above sea level.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	**Cover (%) (+/- SD)**	**Floristics**
Trees	24 m ±6	37% ±18	*Angophora costata, Corymbia gummifera, Eucalyptus pilularis,Syncarpia glomulifera, Eucalyptus resinifera*
Small Trees	9 m ±6	20% ±17	*Pittosporum undulatum, Allocasuarina littoralis*
Shrubs	3.9 m ±2.9	25% ±16	*Lomatia silaifolia, Acacia linifolia, Banksia spinulosa Hakea sericea, Persoonia levis, Polyscias ambucifolia, Bossiaea obcordata,Dodonaea triquetra, Leptospermum trinervium, Goodenia hederacea, Lomandra multiflora*
Ground covers	0.9 m ±0.4	34% ±26	*Entolasia stricta, Dianella caerulea, Phyllanthus hirtellus, Lomandra obliqua, Lepidosperma laterale, Pteridium esculentum, Lomandra longifolia, Austrostipa pubescens, Imperata cylindrica* var. *major, Microlaena stipoides* var. *stipoides, Themeda australis, Brunoniella pumilio*
Vines and Climbers	N/A	N/A	*Billardiera scandens, Cassytha pubescens, Smilax glyciphylla*

2.3.13 Coastal Upland Damp Heath Swamp

The SMCMA mapping for Coastal Upland Damp Heath Swamp (Map Unit: S_FrW01) corresponds to the TSC Act EEC listing for Coastal Upland Swamp in the Sydney Basin Bioregion (NSW Scientific Committee 2012).

Coastal Upland Damp Heath Swamp is one of two hanging or upland swamp communities within the Sydney metropolitan area found on impeded soils in creek headwaters and other seepage zones associated with the elevated sandstone plateau of the Sydney Basin Bioregion. This community occurs on damp rather than wet peaty soils and forms a treeless sedgeland with an overstorey of open low-growing shrubs.

This community is situated in two discrete habitats – the drier margins of wetter coastal upland swamps or the zones of the sandstone plateau where annual rainfall falls below 1200 millimetres per annum in areas up to 600 metres above sea level.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Trees			
Small Trees			
Shrubs	4.0 m ±1.7	19% ±27	*Banksia ericifolia* subsp. *ericifolia, Hakea teretifolia, Epacris obtusifolia, Banksia oblongifolia, Pimelea linifolia, Baeckea imbricata, Leptospermum squarrosum, Sprengelia incarnata, Lambertia formosa, Dillwynia floribunda, Grevillea oleoides, Grevillea sericea, Hakea dactyloides, Mirbelia rubiifolia, Viminaria juncea, Epacris microphylla*
Ground covers	0.7 m ±0.3	47% ±33	*Dampiera stricta, Leptocarpus tenax, Xanthorrhoea resinosa, Actinotus minor, Lepyrodia scariosa, Empodisma minus, Cyathochaeta diandra, Drosera spatulata, Haemodorum corymbosum, Ptilothrix deusta, Schoenus brevifolius, Mitrasacme polymorpha, Stylidium graminifolium, Bauera microphylla, Blandfordia nobilis, Lindsaea linearis, Selaginella uliginosa, Stylidium lineare*
Vines and Climbers	N/A	N/A	*Cassytha glabella*

2.3.14 Coastal Upland Wet Heath Swamp

The SMCMA mapping for Coastal Upland Wet Heath Swamp (Map Unit: S_FrW02) corresponds to the TSC Act EEC listing for Coastal Upland Swamp in the Sydney Basin Bioregion (NSW Scientific Committee 2012).

Coastal Upland Wet Heath Swamp is a wet heath-open sedgeland community that has a sparse to dense heath layer. Some sites closely resemble an open sedgeland but is distinguished by the broad hairy leaves of the low-growing shrub swamp banksia (*Banksia robur*). Typically this community occupies zones in or proximate to drainage lines where water seepage is more constant than it is in more elevated parts of the swamp. Soils are peaty and regularly waterlogged. The soil moisture levels are in part sustained by high coastal rainfall and mists that occur on the coastal edges of sandstone escarpments.

Coastal Upland Wet Heath Swamp is restricted to the coastal zone where mean annual rainfall exceeds1200 millimetres or greater.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Trees			
Small Trees			
Shrubs	1.5 m	5-35%	*Hakea teretifolia, Banksia ericifolia* subsp. *ericifolia, Banksia robur, Viminaria juncea, Sprengelia incarnata, Banksia oblongifolia, Dillwynia floribunda, Leptospermum juniperinum, Boronia parviflora, Epacris obtusifolia, Isopogon anemonifolius*
Ground covers	Up to 1 m	70-90%	*Empodisma minus, Leptocarpus tenax, Gleichenia dicarpa, Xanthorrhoea resinosa, Entolasia stricta, Lepyrodia scariosa, Selaginella uliginosa, Dampiera stricta, Gahnia sieberiana, Lepidosperma limicola, Mitrasacme polymorpha, Blandfordia nobilis, Chorizandra sphaerocephala*
Vines and Climbers	N/A	N/A	*Cassytha glabella*

2.3.15 Coastal Warm Temperate Rainforest

The SMCMA mapping for Coastal Warm Temperate Rainforest (Map Unit: S_RF03) does not correspond to a State or Commonwealth listed threatened ecological community.

Coastal Warm Temperate Rainforest (Tozer et al. 2010) is a tall closed forest with an understorey of mesic shrubs, and small trees of various above a sparse ground cover of ferns. It is found along the deep sheltered gullies in clay loams derived from underlying Narrabeen shale and occasionally basalt. The fertile substrate in combination with the high coastal rainfall (greater than 1200 millimetres per annum) and warm climate, are sufficient to support an extensive area of rainforest in sites less than 350 metres above sea level.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Emergent	40 m	40%	*Eucalyptus pilularis, Eucalyptus saligna, Syncarpia glomulifera*
Trees	21 m ±8	49% ±32	*Ceratopetalum apetalum, Doryphora sassafras, Cryptocarya glaucescens, Callicoma serratifolia Schizomeria ovata, Polyosma cunninghamii*
Small Trees	12 m ±6	42% ±25	*Acmena smithii, Synoum glandulosum, Guioa semiglauca, Ficus coronata, Livistona australis, Eupomatia laurina, Diospyros australis*

Shrubs	1.7 m ±0.8	35% ±39	*Trochocarpa laurina, Wilkiea huegeliana, Notelaea longifolia, Tasmannia insipida*
Ground covers	0.8 m ±0.3	12% ±10	*Blechnum cartilagineum, Doodia aspera, Adiantum formosum, Gymnostachys anceps, Calochlaena dubia, Pyrrosia rupestris, Lastreopsis microsora , Pseuderanthemum variable*
Vines and Climbers	N/A	N/A	*Eustrephus latifolius, Morinda jasminoides, Smilax australis, Pandorea pandorana, Parsonsia straminea*

2.3.16 Estuarine Mangrove Forest

The SMCMA mapping for Estuarine Mangrove Forest (Map Unit: S_SW01) does not correspond to a State or Commonwealth listed threatened ecological community.

Stands of mangroves form a low closed to open forest on mudflats in Sydney's harbour, river coves and estuaries. The distribution of mangrove appears dynamic and there is evidence that mangroves have colonised areas formerly occupied by saltmarsh and have established on sites of recent sediment accumulation

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	**Cover (%) (+/- SD)**	**Floristics**
Small Trees	7 m ±3	57% ±15	*Avicennia marina* var. *australasica, Aegiceras corniculatum*
Ground covers	1.0 m ±0.0	6% ±6	*Sarcocornia quinqueflora*

2.3.17 Estuarine Reedland

The SMCMA mapping for Estuarine Reedland (Map Unit: S_FrW06) does not correspond to a State or Commonwealth listed threatened ecological community.

Estuarine Reedland is characterised by tall dense swards of the common reed (*Phragmites australis*). It is found in environments inundated by saline or brackish water, including low-lying swamps on riverbanks, riverflat depressions, and banks on coastal lagoons that are open to tidal influence. This community is commonly encountered on the landward side of saltmarsh flats. This community is patchily distributed along lagoon fringes and riverflats of the Georges, Parramatta and Hacking rivers and in major brackish lagoons such as the Narrabeen Lakes.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Emergent	8 m	1%	*Casuarina glauca*
Ground covers	2.0 m	95%	*Juncus kraussii, Samolus repens, Baumea juncea, Lobelia anceps, Phragmites australis, Alternanthera denticulata, Apium prostratum, Cyperus polystachyos*

2.3.18 Estuarine Saltmarsh

The SMCMA mapping for Estuarine Saltmarsh (Map Unit: S_SW02) corresponds to the TSC Act EEC listing for Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions (NSW Scientific Committee 2004a).

Saltmarshes consist of low succulent herbs and rushes on tidally inundated land. These marshes form plains that adjoin open water and mangroves. Salinity varies greatly according to tidal influence, evaporation and fresh water accumulation. Chenopod species dominate areas more frequently inundated by the tides, while sea rush (*Juncus kraussii*) occupies the more elevated terrestrial margin.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Shrubs	0.5 m	4%	*Aegiceras corniculatum, Avicennia marina, Casuarina glauca, Rhagodia candolleana*
Ground covers	0.6 m ±0.3	58% ±21	*Samolus repens, Sarcocornia quinqueflora, Sporobolus virginicus, Juncus kraussii*

2.3.19 Estuarine Swamp Oak Forest

The SMCMA mapping for Estuarine Swamp Oak Forest (Map Unit: S_FoW08) corresponds to the TSC Act EEC listing for Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (NSW Scientific Committee 2004d).

Estuarine Swamp Oak Forest occurs immediately above tidal influence and fringes the margins of saline waterbodies that include rivers, lagoons and tidal lakes. Swamp oak (*Casuarina glauca*) forms dense monospecific stands above a thick ground cover of salttolerant herbs, rushes and sedges. The shrub layer is low-growing and sparse, comprising a mix of terrestrial species while others typical of wetlands. It is a community of relatively low species diversity that is widespread along the coast of the Sydney basin where it is rarely found at more than two meters above sea level.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Trees	15 m ±3	36% ±14	*Casuarina glauca*
Small Trees	6 m ±4	23% ±23	*Casuarina glauca, Avicennia marina,*
Ground covers	0.9 m ±0.5	40% ±21	*Juncus kraussii, Baumea juncea, Samolus repens, Phragmites australis, Sporobolus virginicus, Atriplex australasica, Suaeda australi, Goodenia ovata,*
Vines and Climbers	N/A	N/A	*Tetragonia tetragonioides*

2.3.20 Hornsby Enriched Sandstone Exposed Woodland

The SMCMA mapping for Hornsby Enriched Sandstone Exposed Woodland (Map Unit: S_DSF10) does not correspond to a State or Commonwealth listed threatened ecological community.

Hornsby Enriched Sandstone Exposed Woodland is a low open eucalypt woodland with an open to dense shrub layer. It occurs on sandstone ridges at the end of northern Sydney plateaus. These ridges are in landscapes dominated by shale substrates and a subtle influence appears to extend across a range of sandstone communities in the area.

This woodland occurs within a narrow band of mean annual rainfall (900-1100 millimetres) at low elevations (between 30 and 130 metres above sea level).

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Trees	14 m ±5	32% ±12	*Angophora hispida, Eucalyptus haemastoma, Corymbia gummifera, Eucalyptus piperita*
Shrubs	6 m ±3	20% ±12	*Micrantheum ericoides, Leptospermum trinervium, Allocasuarina littoralis, Acacia suaveolens, Banksia ericifolia* subsp. *ericifolia, Lambertia formosa, Grevillea buxifolia, Banksia serrata, Woollsia pungens, Xanthorrhoea media, Pultenaea tuberculata, Banksia oblongifolia, Phyllota phylicoides, Dillwynia retorta, Persoonia levis, Leucopogon microphyllus, Acacia longifolia, Kunzea ambigua*
Ground covers	1.2 m ±0.6	15% ±12	*Entolasia stricta, Actinotus minor, Cyathochaeta diandra, Dianella caerulea, Dampiera stricta, Boronia ledifolia, Austrostipa pubescens, Lomandra glauca*
Vines and Climbers	N/A	N/A	*Cassytha pubescens, Billardiera scandens*

2.3.21 Riverflat Paperbark Swamp Forest

The SMCMA mapping for Riverflat Paperbark Swamp Forest (Map Unit: S_FoW05) corresponds to the TSC Act EEC listing for Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (NSW Scientific Committee 2004e).

This community is found on low-lying alluvial flats of the Hawkesbury-Nepean, Parramatta and Georges river systems. It is an open to closed forest of tall paperbarks (*Melaleuca linariifolia/ Melaleuca styphelioides*). A sparse cover of emergent eucalypts is common though not ubiquitous.

This riverflat forest is most frequently found near backswamps in the narrow headwaters and inlets of alluvial flats not far from major waterways. It is known from a narrow elevational gradient between

three and 50 metres above sea level.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Emergent	20	5%	*Eucalyptus botryoides x saligna*
Small Trees	15 m ±3	57% ±23	*Melaleuca linariifolia, Glochidion ferdinandi, Leptospermum juniperinum*
Shrubs	5.0 m ±4.2	35% ±21	*Callistemon citrinus*
Ground covers	0.9 m ±0.8	38% ±19	*Gahnia sieberiana, Hydrocotyle laxiflora, Hypolepis muelleri, Pteridium esculentum, Calochlaena dubia, Entolasia marginata,Microlaena stipoides* var. *stipoides, Viola hederacea, Imperata cylindrica* var. *major, Isolepis cernua, Pratia purpurascens*
Vines and Climbers	N/A	N/A	*Cayratia clematidea*

Sydney Ironstone Bloodwood-Silvertop Ash Forest

The SMCMA mapping for Sydney Ironstone Bloodwood-Silvertop Ash Forest (Map Unit: S_DSF14) corresponds to the TSC Act EEC listing for Duffys Forest ecological community in the Sydney Basin Bioregion (NSW Scientific Committee 2004b).

This community forms a component of the shrubby forests and woodlands of coastal Sydney sandstone environments and is closely associated with rust-coloured ironstone mantles layered above sandstone ridgelines, with mean annual rainfall above 1100 millimetres. Elevation for the community ranges between 100 and 300 metres above sea level. Sites typically have no outcropping sandstone.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Trees	19 m ±4	40% ±21	*Corymbia gummifera, Eucalyptus haemastoma, Eucalyptus sieberi, Eucalyptus capitellata, Eucalyptus oblonga*
Small Trees	6 m ±5	34% ±17	*Banksia serrata, Leptospermum trinervium*
Shrubs	4.7 m ±2.6	32% ±20	*Persoonia levis, Banksia spinulosa, Lomatia silaifolia, Platysace linearifolia, Acacia myrtifolia, Persoonia pinifolia, Epacris pulchella, Micrantheum ericoides, Lambertia formosa, Boronia pinnata, Pultenaea tuberculata, Dillwynia retorta, Hakea dactyloides*
Ground covers	1.1 m ±0.6	31% ±22	*Entolasia stricta, Cyathochaeta diandra, Lindsaea linearis, Dampiera stricta, Lomandra obliqua, Phyllanthus hirtellus, Lepidosperma laterale, Austrostipa pubescens, Xanthosia tridentata*
Vines and Climbers	N/A	N/A	*Billardiera scandens*

2.3.22 Sydney North Exposed Sandstone Woodland

The SMCMA mapping for Sydney North Exposed Sandstone Woodland (Map Unit: S_DSF11) does not correspond to a State or Commonwealth listed threatened ecological community.

Sydney North Exposed Sandstone Woodland is widespread across the Hawkesbury sandstone plateau of northern Sydney and the hinterland of the Central Coast. It occurs on free-draining sandy soils in exposed locations such as crests, ridges and exposed gully slopes. Soil development is generally poor. This community is found within areas that receive more than 900 millimetres of mean annual rainfall and is restricted to elevations between 200 and 500 metres above sea level.

A floristic and structural summary of this community is provided below.

	Height (m) (+/- SD)	Cover (%) (+/- SD)	Floristics
Small Trees	8 m	15%	*Banksia serrata, Corymbia gummifera, Eucalyptus haemastoma, Corymbia eximia*
Shrubs	2.5 m	35%	*Acacia suaveolens, Allocasuarina distyla, Banksia ericifolia* subsp. *ericifolia, Boronia ledifolia, Gompholobium grandiflorum, Hakea dactyloides, Lambertia formosa, Leptospermum trinervium, Platysace linearifolia, Pultenaea tuberculata*
Ground covers	0.7m	15%	*Cyathochaeta diandra, Entolasia stricta, Lepidosperma concavum, Lepyrodia scariosa, Lomandra glauca*

Table 2.1 Reservation Status of Native Vegetation Communities within the SMCMA

Vegetation Community	TSC Act	EPBC Act	Map Unit Code	Area (Hectares) in Reserves Managed by the Commonwealth (Per Cent of Extant Area)	Area (Hectares) in Reserves Managed by the State (Per Cent of Extant Area)	Area (Hectares) in Reserves Managed by Local Government (Per Cent of Extant Area)	Area (Hectares) in Reserves on Private Land (Per Cent of Extant Area)	Total Reserved Area (Hectares)
Blue Gum High Forest	Blue Gum High Forest in the Sydney Basin Bioregion	Blue Gum High Forest of the Sydney Basin Bioregion	S_WSF01	0 +0 (0%)	10.8 +<.1 (3%)	101 +18.4 (33%)	0 +0 (0%)	112
Coastal Enriched Sandstone Dry Forest			S_DSF04	0 +0 (0%)	526 +0.9 (30%)	697 +13.1 (40%)	0 +0 (0%)	1223
Coastal Enriched Sandstone Moist Forest			S_WSF02	1.5 +0 (0%)	337 +0 (31%)	402 +0 (37%)	0 +0 (0%)	741
Coastal Flats Tall Moist Forest			S_WSF36	0 +0 (0%)	42.6 +5.9 (86%)	4.7 +0 (9%)	0 +0 (0%)	47.3
Coastal Sandstone Foreshores Forest			S_DSF06	9.7 +0.9 (1%)	165 +1.9 (25%)	228 +4.9 (35%)	0 +0 (0%)	403
Coastal Sandstone Gallery Rainforest			S_RF02	0 +0 (0%)	134 +0 (57%)	70.6 +0 (30%)	0 +0 (0%)	205
Coastal Sandstone Gully Forest			S_DSF09	0 +0 (0%)	13,062 +27.1 (73%)	1419 +12.1 (8%)	7.3 +0 (0%)	14,488
Coastal Sandstone Heath-			S_HL08	0 +0 (0%)	8500 +11 (82%)	269 +2.9 (3%)	1.7 +0 (0%)	8771

Table 2.1 Reservation Status of Native Vegetation Communities within the SMCMA

Vegetation Community	TSC Act	EPBC Act	Map Unit Code	Area (Hectares) in Reserves Managed by the Commonwealth (Per Cent of Extant Area)	Area (Hectares) in Reserves Managed by the State (Per Cent of Extant Area)	Area (Hectares) in Reserves Managed by Local Government (Per Cent of Extant Area)	Area (Hectares) in Reserves on Private Land (Per Cent of Extant Area)	Total Reserved Area (Hectares)
Mallee								
Coastal Sandstone Riparian Forest			S_DSF08	0 +0 (0%)	317 +0 (58%)	42.4 +0 (8%)	<.1 +0 (0%)	359
Coastal Sandstone Rock Plate Heath			S_HL09	0 +0 (0%)	182 +0 (78%)	7.0 +0 (3%)	0 +0 (0%)	189
Coastal Shale-Sandstone Forest			S_WSF06	0 +0 (0%)	158 +10.2 (39%)	88.7 +10.8 (22%)	0 +0 (0%)	247
Coastal Upland Damp Heath Swamp	Coastal Upland Swamp in the Sydney Basin Bioregion		S_FrW01	0 +0 (0%)	324 +0 (47%)	14.9 +0 (2%)	0 +0 (0%)	339.0
Coastal Upland Wet Heath Swamp	Coastal Upland Swamp in the Sydney Basin Bioregion		S_FrW02	<.1 +0 (0%)	1048 +<.1 (74%)	52.2 +0 (4%)	0 +0 (0%)	1100
Coastal Warm Temperate Rainforest			S_RF03	0 +0 (0%)	305 +0 (75%)	9.0 +0 (2%)	0.3 +0 (0%)	314

Table 2.1 Reservation Status of Native Vegetation Communities within the SMCMA

Vegetation Community	TSC Act	EPBC Act	Map Unit Code	Area (Hectares) in Reserves Managed by the Commonwealth (Per Cent of Extant Area)	Area (Hectares) in Reserves Managed by the State (Per Cent of Extant Area)	Area (Hectares) in Reserves Managed by Local Government (Per Cent of Extant Area)	Area (Hectares) in Reserves on Private Land (Per Cent of Extant Area)	Total Reserved Area (Hectares)
Estuarine Mangrove Forest			S_SW01	<.1 +0 (0%)	546 +0 (59%)	42.8 +0 (5%)	0 +0 (0%)	589
Estuarine Reedland			S_FrW06	0 +0 (0%)	23.0 +0 (30%)	8.0 +0 (11%)	0 +0 (0%)	31.0
Estuarine Saltmarsh	Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions		S_SW02	0 +0 (0%)	190 +0.1 (83%)	8.8 +0.7 (4%)	0 +0 (0%)	199
Estuarine Swamp Oak Forest	Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions		S_FoW08	0 +0 (0%)	114 +1.3 (37%)	46.2 +0.1 (15%)	0 +0 (0%)	160

Table 2.1 Reservation Status of Native Vegetation Communities within the SMCMA

Vegetation Community	TSC Act	EPBC Act	Map Unit Code	Area (Hectares) in Reserves Managed by the Commonwealth (Per Cent of Extant Area)	Area (Hectares) in Reserves Managed by the State (Per Cent of Extant Area)	Area (Hectares) in Reserves Managed by Local Government (Per Cent of Extant Area)	Area (Hectares) in Reserves on Private Land (Per Cent of Extant Area)	Total Reserved Area (Hectares)
Hornsby Enriched Sandstone Exposed Woodland			S_DSF10	0 +0 (0%)	142 +1.6 (40%)	135 +1.4 (38%)	0 +0 (0%)	277
Riverflat Paperbark Swamp Forest	Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions		S_FoW05	0 +0 (0%)	5.6 +1.0 (32%)	4.3 +0 (24%)	0 +0 (0%)	9.9
Sydney Ironstone Bloodwood-Silvertop Ash Forest	Duffys Forest ecological community in the Sydney Basin Bioregion		S_DSF14	0 +0 (0%)	359 +<.1 (64%)	42.5 +0.5 (8%)	0.4 +0 (0%)	402

Table 2.1 Reservation Status of Native Vegetation Communities within the SMCMA

Vegetation Community	TSC Act	EPBC Act	Map Unit Code	Area (Hectares) in Reserves Managed by the Commonwealth (Per Cent of Extant Area)	Area (Hectares) in Reserves Managed by the State (Per Cent of Extant Area)	Area (Hectares) in Reserves Managed by Local Government (Per Cent of Extant Area)	Area (Hectares) in Reserves on Private Land (Per Cent of Extant Area)	Total Reserved Area (Hectares)
Sydney North Exposed Sandstone Woodland			S_DSF11	0 +0 (0%)	7859 +7.6 (85%)	462 +8.0 (5%)	4.9 +0 (0%)	8326
Sydney Turpentine-Ironbark Forest	Sydney turpentine-ironbark forest	Sydney Turpentine Ironbark Forest of the Sydney Basin Bioregion	S_WSF09	0 +0 (0%)	32.2 +3.6 (7%)	170 +14.5 (37%)	0.9 +0 (0%)	203

2.4 Plans and Maps

DGR 2.4 *Plans and Maps*

The following maps are provided at the end of each chapter within the SIS:

Chapter 1.

- Aerial Photograph of the Gordon Local Centre (Ku-ring-gai LEP (Local Centres) 2012) **(Figure 1.1)**
- Zoning of the Subject Site **(Figure 1.2)**

Chapter 2

- Location of the Subject Site and Study area **(Figure 2.1)**
- Topography of the Subject Site and Study area **(Figure 2.2)**
- Vegetation Communities in the Locality **(Figure 2.3)**
- Land Use in the Locality **(Figure 2.4)**
- Native Vegetation in the Locality **(Figure 2.5)**

Chapter 3

- Threatened Flora recorded within the Locality **(Figure 3.1)**
- Threatened Fauna recorded within the Locality **(Figure 3.2)**

Chapter 4

- Flora and Fauna Survey Locations **(Figure 4.1)**
- Vegetation Communities in the Study Area **(Figure 4.2)**

Figure 2.1. Location of the Subject Site and Study Area

Figure 2.2. Topography of the Subject Site and Study Area

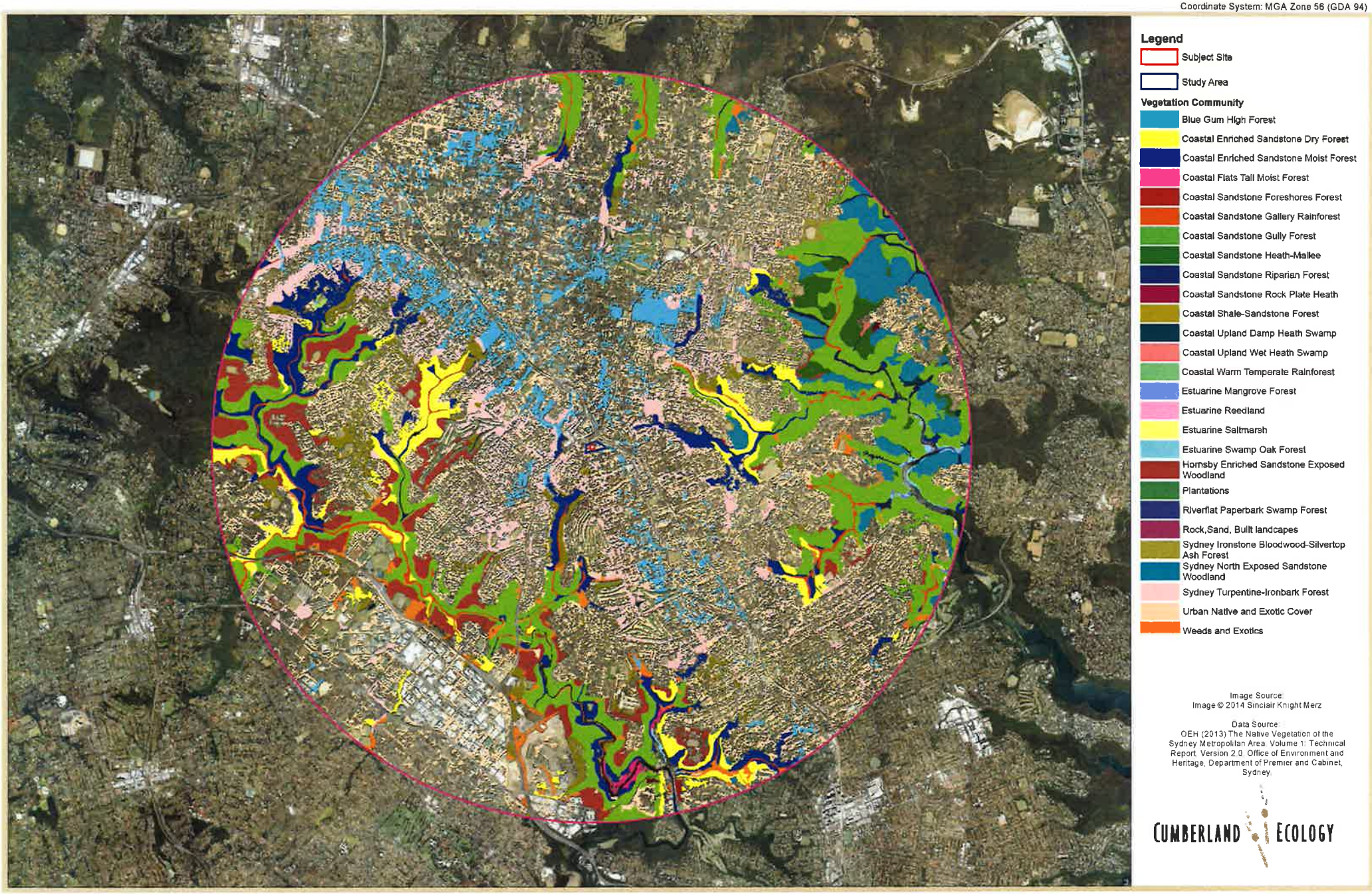

Figure 2.3. Vegetation Communities within the Locality (SMCMA 2013)

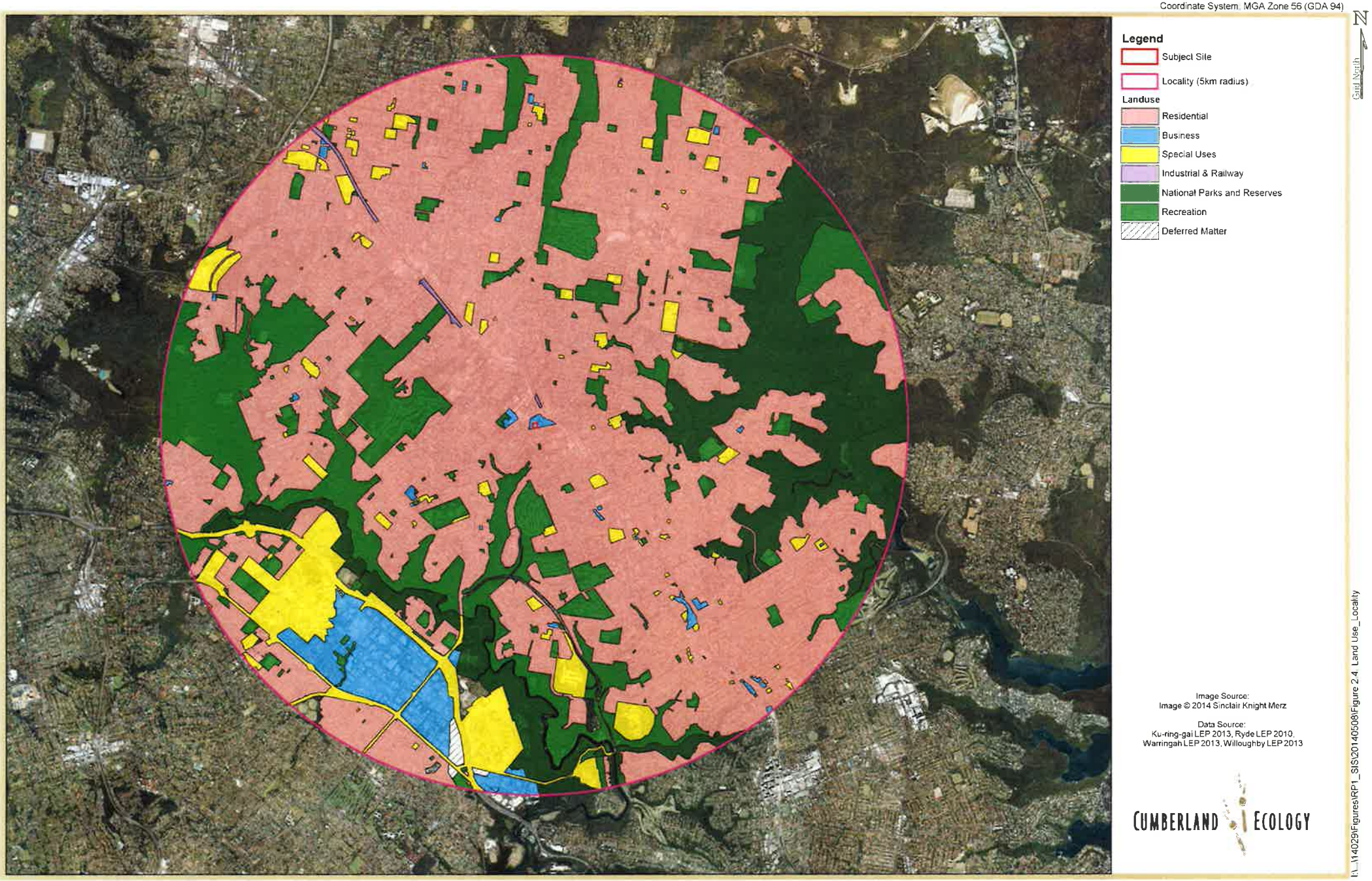

Figure 2.4. Land Use in the Locality

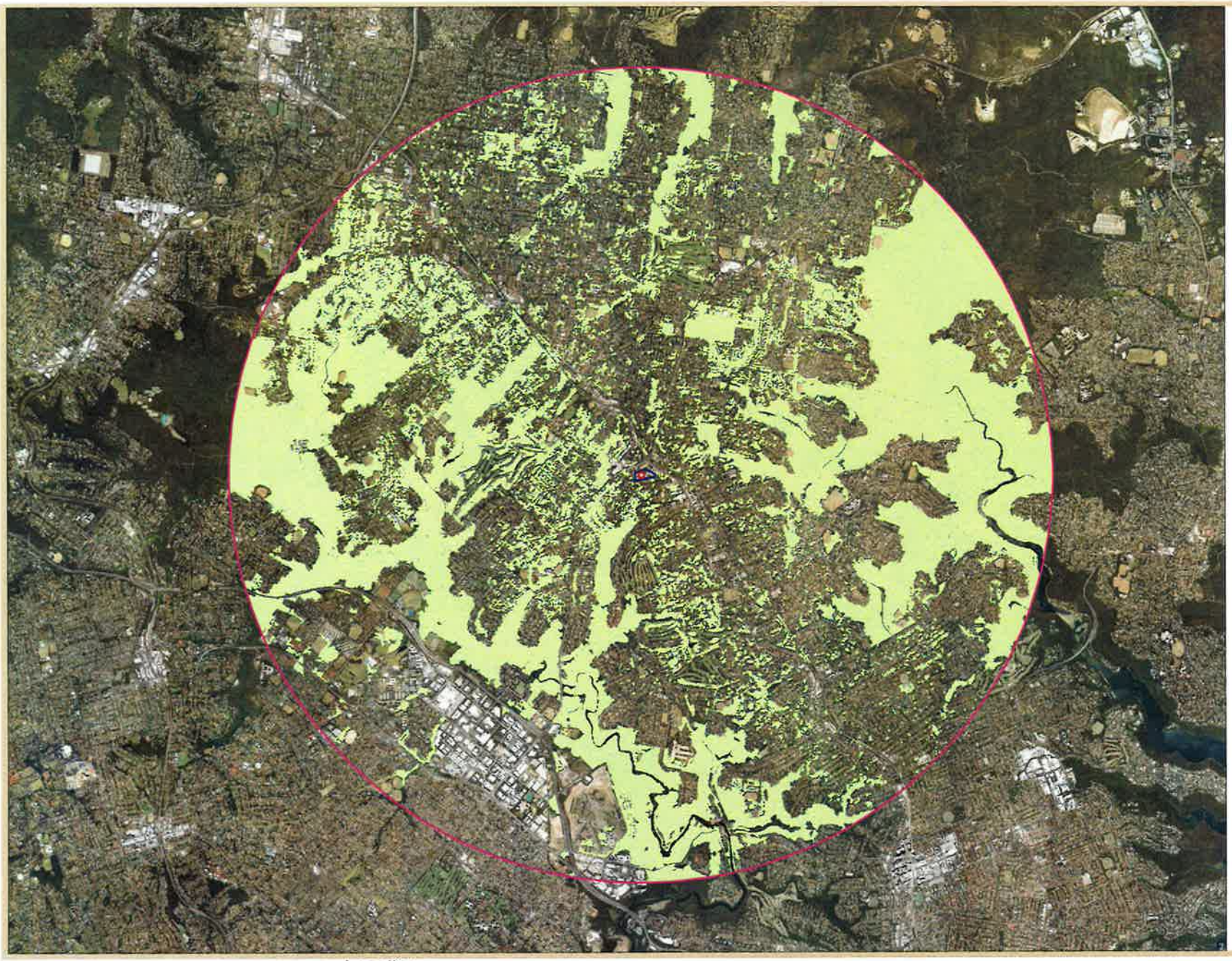

Figure 2.5. Native Vegetation within the Locality

Chapter 3

Initial Assessment

This chapter covers the following Director General's Requirements:

DGR 3 INITIAL ASSESSMENT

A general description of the threatened species or populations known or likely to be present in the area that is the subject of the action and in any area that is likely to be affected by the action (Section 110(2)(a)).

A general description of the ecological community present in the area that is the subject of the action and in any area that is likely to be affected by the action (Section 110(3)(a)).

3.1 Identifying Subject Species, populations and Ecological Communities

DGR 3.1 *Identifying subject threatened species, populations and ecological communities ('subject species')*

DGR 3.1.1 *Assessment of available information*

Database analyses and a review of the current literature for records of threatened species occurring within the locality were examined for the likelihood of threatened species to occur in habitats present within the study area. Database analysis was undertaken using the OEH Atlas of NSW Wildlife Database (OEH 2014a). The Atlas of NSW Wildlife Database search was used to generate records of threatened flora and fauna species and populations listed under the TSC Act within the locality of the subject site. Migratory avifauna protected under the EPBC Act were also included in the Atlas search.

Mapping prepared by NSW Vegetation Information System (VIS) and Sydney Metropolitan Catchment Management Authority (SMCMA) Vegetation Mapping was consulted to assist in determining ecological communities to be included within the list of subject species. The abundance, distribution and age of records generated within the search area also provided supplementary information for the assessment of likelihood of occurrence of those threatened species within the subject lands. Consideration was also given to those threatened species listed in the DGRs.

3.1.1 Critically Endangered and Endangered Ecological Communities

The following critically endangered and endangered ecological communities have been recorded within the locality:

- Blue Gum High Forest in the Sydney Basin Bioregion;
- Coastal saltmarsh in the NSW North Coast, Sydney Basin;
- Coastal Upland Swamp in the Sydney Basin Bioregion;
- Duffys Forest ecological community in the Sydney Basin Bioregion;
- Swamp oak floodplain forest of the NSW North Coast;
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions; and
- Sydney Turpentine Ironbark Forest.

Of these communities only STIF occurs within the subject site and study area is considered as a subject endangered ecological community (EEC). Highly degraded fragments of the critically endangered ecological community (CEEC), Blue Gum High Forest are present near the southern border of the study area. However this CEEC is not considered to be a subject species as it will not be impacted, directly or indirectly by the proposed development.

3.1.2 Threatened species and populations

The number and age of records of threatened species and populations as well as migratory avifauna recorded within in the locality was used to assess the likelihood of occurrence of threatened species and populations and migratory species within the subject site and wider study area. The threatened species or populations that occur or have potential to occur in the study area were identified as 'the subject species'

Table 3.1 provides a complete list of the threatened flora and fauna and migratory avifauna, assessed for the likelihood of occurrence. The threatened species and populations considered as 'subject species' for this SIS include:

i. Threatened species

- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Powerful Owl (*Ninox strenua*);
- Eastern Freetail Bat (*Mormopterus norfolkensis*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);
- Little Bent-wing Bat (*Miniopterus australis*);

- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*); and
- Grey-headed Flying Fox (*Pteropus poliocephalus*).

ii. Threatened population

- Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
Flora	Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V		3	Found in dry sclerophyll forest on the coast and adjacent ranges	Unlikely as no suitable habitat available.	No
Flora	Myrtaceae	*Darwinia biflora*		V	V	159	Darwinia biflora occurs in Sandstone Ridgetop woodlands where the weathered shale-capped ridges intergrade with Hawkesbury Sandstone.	Unlikely as no suitable habitat available.	No
Flora	Ericaceae	*Epacris purpurascens var. purpurascens*		V		10	Found in various habitat types, mainly containing strong shale influence.	Unlikely as no suitable habitat available.	No
Flora	Myrtaceae	*Eucalyptus camfieldii*	Camfield's Stringybark	V	V	11	Found in exposed areas on sandstone ridges, slopes and plateaus near tall coastal heath or low open woodland.	Unlikely as no suitable habitat available.	No
Flora	Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	2	Often found in dry grassy woodland mainly on infertile soils.	Unlikely as no suitable habitat available.	No

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
Flora	Haloragaceae	*Haloragodendron lucasii*		E1	E	17	Found in dry sclerophyll forest.	Unlikely as no suitable habitat available.	No
Flora	Myrtaceae	*Melaleuca deanei*	Deane's Paperbark	V	V	5	Found in marshy heath on coastal sandstone plateaus. Restricted to sandstones of Sydney and south coast.	Unlikely as no suitable habitat available.	No
Flora	Thymelaeaceae	*Pimelea curviflora var. curviflora*		V	V	4	Occurs in open forest on sandy soil derived from sandstone and on lateritic soils.	Unlikely as no suitable habitat available.	No
Flora	Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	E1	V	7	Found only in NSW in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. Occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest on the south coast. Central coast populations occur on gravels, sands,	Confirmed. Present on site but occurs as a planting only, not in its natural state.	No

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
							silts and clays in riverside gallery rainforests and remnant littoral rainforest communities		
Flora	Elaeocarpaceae	*Tetratheca glandulosa*		V		20	Occur in areas of shale-sandstone transition habitat.	Unlikely as no suitable habitat available.	No
Amphibia	Myobatrachidae	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	1	Inhabits heath, woodland and open forest with sandy soils. Generally lives in the heath or forest and will travel several hundred metres to creeks to breed.	Unlikely as no suitable habitat available.	No
Amphibia	Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E1	V	3	Large permanent freshwater wetlands, with dense stands of reeds.	Unlikely as no suitable habitat available.	No
Amphibia	Myobatrachidae	*Pseudophryne australis*	Red-crowned Toadlet	V		48	Occurs in open forests, at periodically wet drainage lines below sandstone ridges. Mainly found on Hawkesbury and Narrabeen Sandstones.	Unlikely as no suitable habitat available.	No

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
Aves	Apodidae	*Apus pacificus*	Fork-tailed Swift		C,J,K		Non-breeding visitor to all parts of Australia. Mostly found over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh of inland plains	Low. May pass over the site on migratory path.	No
Aves	Ardeidae	*Ardea ibis*	Cattle Egret		C, J		Occurs in tropical and temperate grasslands, woodlands, terrestrial wetlands and cropland with poor drainage.	Unlikely as no suitable habitat available.	No
Aves	Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	E1	E	1	Occurs mainly in densely vegetated freshwater wetlands and, rarely, in estuaries or tidal wetlands	Unlikely as no suitable habitat available.	No
Aves	Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper		C,J,K		In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low	Unlikely as no suitable habitat available.	No

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
							vegetation.		
Aves	Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V		24	Occurs in tall mountain forests and woodlands during summer. In winter, found at lower altitude open eucalypt forests and woodlands. 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	Low. This species may pass through the area as part of a larger foraging area. No breeding or roosting habitat present	Yes
Aves	Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	E2		23	More often found in forest and woodland habitats containing old growth attributes. Known occurrences in Lane Cove National Park and Pennant Hills Park as well as other forested gullies.	Low. This species may pass through the area as part of a larger foraging area. No breeding or roosting habitat present	Yes
Aves	Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V		5	Inhabits open forest and woodlands of the coast and the Great Dividing	Unlikely as no suitable habitat	No

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
							Range where stands of sheoak occur. Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species). Nest in large tree hollows.	available.	
Aves	Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V		1	Eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Unlikely as no suitable habitat available.	No
Aves	Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1		1	Associated with tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats, and occasionally woodlands and grasslands and floodplains. Forages in fresh or saline waters up to 0.5m deep, mainly in open fresh waters, extensive sheets of shallow water over grasslands or sedgeland,	Unlikely as no suitable habitat available.	No

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
							mangroves, mudflats, shallow swamps with short emergents vegetation and permanent billabongs and pools on floodplains.		
Aves	Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V		4	Mostly occurs in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their ranges, and in remnant woodland patches and roadside vegetation. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees are also used.	Unlikely as no suitable habitat available.	No
Aves	Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea Eagle		C		Australian distribution along the coastline; in NSW, also extends inland along some of the larger waterways. Generally forage over large expanses of open water, in-	Unlikely as no suitable habitat available.	No

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
							shore waters and open terrestrial habitats.		
Aves	Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V		4	The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland, or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch.	Unlikely as no suitable habitat available.	No
Aves	Apodidae	*Hirundapus caudacutus*	White-throated Needletail		C,J,K		Non-breeding visitor to Australia. Occur over most types of habitat, particularly above wooded areas including open forest and rainforest, between trees or in clearings and below the canopy. Less commonly recorded flying above woodland and treeless areas, such as grassland or swamps.	Low. May pass over the site on migratory path.	No

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
Aves	Ardeidae	*Ixobrychus flavicollis*	Black Bittern	V		1	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation	Unlikely as no suitable habitat available.	No
Aves	Psittacidae	*Lathamus discolor*	Swift Parrot	E1	E	4	Inhabit open eucalypt forests and woodlands, including box–ironbark communities, and farmland with remnant patches of eucalypt woodland.	Unlikely as the species is found more often in box-ironbark forests and woodlands.	No
Aves	Anatidae	*Nettapus coromandelianus*	Cotton Pygmy-Goose	E		4	Found in freshwater lakes, lagoons, swamps and dams, particularly those vegetated with waterlilies and other floating and submerged aquatic vegetation	Unlikely as no suitable habitat available.	No
Aves	Strigidae	*Ninox connivens*	Barking Owl	V		3	Found in open forest and woodland, including fragmented remnants, often next to farmland.	Unlikely as no suitable habitat available.	No
Aves	Strigidae	*Ninox strenua*	Powerful Owl	V		69	Habitat for this species is widespread	Low. This species	Yes

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
							and is primarily tall moist eucalypt forest of the eastern tableland edge and the mosaic of wet and dry sclerophyll forests occurring on undulating gentle terrain nearer the coast. Optimal habitat includes a tall shrub layer and abundant hollows supporting high densities of arboreal marsupials. Pairs occupy large, probably permanent home and nest in large hollows.	will use fragmented habitats and may pass through the area as part of a larger foraging area. No breeding habitat present	
Aves	Petroicidae	*Petroica boodang*	Scarlet Robin	V		1	Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn	Unlikely as no suitable habitat available.	No

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
							and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris.		
Aves	Psittacidae	*Polytelis swainsonii*	Superb Parrot	V	V	1	Found in eucalypt dominated forests and woodlands.	Unlikely as no suitable habitat available.	No
Aves	Columbidae	*Ptilinopus superbus*	Superb Fruit-Dove	V		4	Most often occurs in rainforest and closed forests but also found in eucalypt or acacia woodland. Requires fruit-bearing trees.	Unlikely as no suitable habitat available.	No
Mammalia	Burramyidae	*Cercartetus nanus*	Eastern Pygmy-possum	V		2	Found in forested areas from rainforest to sclerophyll forest.	Unlikely as no suitable habitat available.	No
Mammalia	Vespertilionidae	*Chalinolobus*	Large-eared Pied	V	V	1	Inhabit well-timbered areas	Unlikely as no	No

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
		dwyeri	Bat				containing gullies. High site fidelity and roost in caves, crevices in cliffs and old mine workings frequenting low to mid-elevation dry open forest and woodland close to these features.	suitable habitat available.	
Mammalia	Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	5	Occurs in wide variety of habitats from open woodland to rainforests in large remnants. Dens in tree hollows, hollow logs or rock crevices.	Unlikely as no suitable habitat available.	No
Mammalia	Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V		1	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows.	Unlikely as no suitable habitat available.	No
Mammalia	Peramelidae	*Isoodon obesulus obesulus*	Southern Brown Bandicoot (eastern)	E1	E	89	Found in forested areas including heathland, shrubland, heathy open forest and woodland.	Unlikely as no suitable habitat available.	No
Mammalia	Vespertilionidae	*Miniopterus australis*	Little Bentwing-bat	V		2	Inhabit well timbered areas including rainforest, wet and dry sclerophyll	Low. This species may pass through	Yes

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
							forest, Melaleuca swamps and coastal forests. Roost in caves, artificial structures and tree hollows. Forage for small insects beneath the canopy of densely vegetated habitats	the area as part of a larger foraging area. No breeding or roosting habitat present	
Mammalia	Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V		29	Forages in forested areas, catching moths and other flying insects above the tree tops. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures	Low. This species may pass through the area as part of a larger foraging area. No breeding or roosting habitat present	Yes
Mammalia	Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V		6	Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in man-made structures	Low. This species may pass through the area as part of a larger foraging area. No breeding or roosting habitat present	Yes

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
Mammalia	Petauridae	*Petaurus australis*	Yellow-bellied Glider	V		1	Inhabit tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	Unlikely as no suitable habitat available.	No
Mammalia	Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	889	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Possible. This species can travel up to 50km to forage and may pass through the area as part of a larger foraging area. No roosting camps are present in the locality	Yes
Mammalia	Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V		3	Roosts singly or in small groups in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forage in most habitats and appear to defend aerial territories.	Possible. Might utilise the site as part of a larger foraging area	Yes

Table 3.1 Threatened species and Migratory avifauna recorded in the Locality and the Assessment of the Likelihood of Occurrence within the Study Area

Class	Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records (locality)	Habitat Requirements	Likelihood of Occurrence (Unlikely, Low, Possible, Confirmed)	Subject Species
Reptilia	Varanidae	*Varanus rosenbergi*	Rosenberg's Goanna	V		5	Occurs in open forests, woodland and heath where termite mounds occur.	Unlikely as no suitable habitat available.	No

Figure 3.1. OEH Threatened Flora Recorded within the Locality

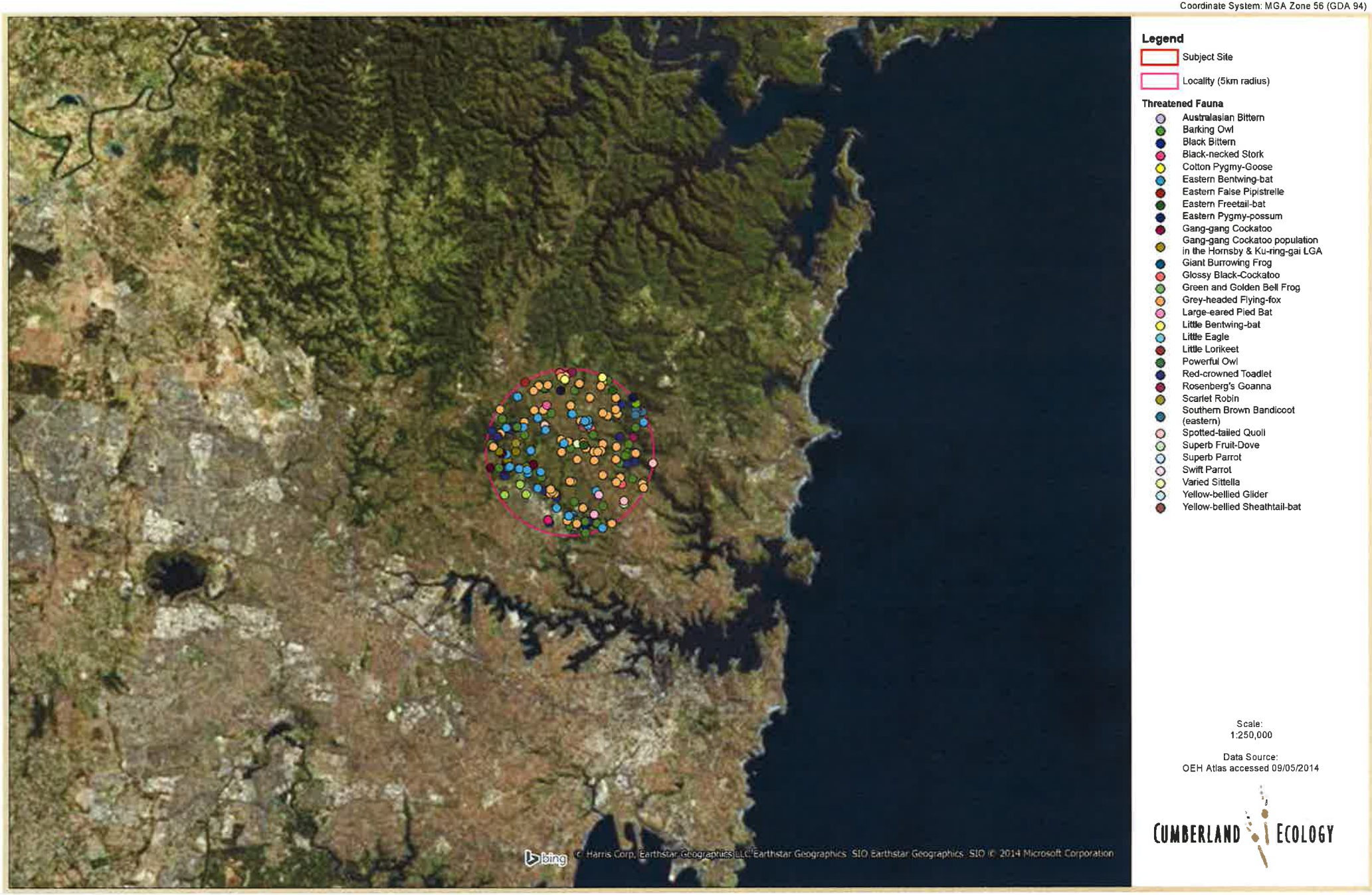

Figure 3.2. OEH Threatened Fauna Recorded within the Locality

Chapter 4

Survey

This chapter covers the following Director General's Requirements:

DGR 4 SURVEY

4.1 Requirement to Survey

DGR 4.1 Requirement to survey

Cumberland Ecology undertook flora and fauna surveys within the subject site and study area in March and April 2012. As there is appropriate pre-existing data for many species, no additional surveys were undertaken outside of the study area.

The methods utilised by Cumberland Ecology are described in detail in Sections 4.2 and 4.3 below. Surveys were conducted by suitably qualified personnel. Details of personnel involved within the preparation of this SIS are provided within **Appendix E**.

4.2 Survey Techniques

DGR 4.2 Documentation

DGR 4.2.1 Description of survey techniques and survey locations

4.2.1 Preliminary site inspection

Cumberland Ecology conducted an initial inspection of the site to determine current ecological conditions in March 2014. This inspection included visual and photographic observations of the vegetation and habitats present within the subject site

The observations made during this site inspection along with available data of threatened species occurrences obtained from the Atlas of NSW Wildlife Database were then used to guide the flora and fauna surveys conducted in April 2012.

4.2.2 Vegetation Mapping

Broad scale SMCMA vegetation mapping (OEH 2013) has been undertaken across the study area and surrounds.

Cumberland Ecology conducted additional vegetation mapping within the subject site in April 2014 to ground-truth the condition and extent of the extent of STIF present within the proposed development footprint.

Due to access limitations to surrounding private lands, verification of the SMCMA mapping within the wider study area was limited to visual observations from publically accessible areas along Merriwa Street and Fitzsimons Lane.

The resultant information was synthesized using Geographical Information Systems (GIS) to create a vegetation map of the study area. Mapping was completed using MapInfo Version 11.

4.2.3 Flora Survey

The March 2014 site inspection determined that the vegetation within the subject site and study area consisted of highly modified and landscaped areas, which did not conform to any described native vegetation unit and therefore would not support any threatened flora species.

The flora survey conducted in April 2014 was therefore limited to random meanders to record flora species present within the subject site. Detailed flora quadrats and threatened species searches were deemed unnecessary due to the dominance of paved and landscaped areas within the subject site.

Photographs were taken at random locations to document condition of vegetation within the subject site. The locations of these photo points are provided in **Figure 4.1.**

All vascular plants recorded or collected were identified using keys and nomenclature provided in Harden (1990-1993). Recent name changes to plant names have been incorporated into this report, and the names are derived from PlantNET (Botanic Gardens Trust 2012). A complete list of all flora species recorded within the subject site is provided in **Appendix F**.

4.2.4 Fauna Survey

Cumberland Ecology conducted fauna surveys across the study area in April 2014. Due to the highly developed nature of the subject site and wider study area, fauna surveys were limited to a general fauna habitat assessment.

The assessment included consideration of important indicators of habitat condition and complexity including the occurrence of habitats such as tree hollows, nests, fallen logs and bush rock Structural features considered included the nature and extent of the understorey and ground stratum and extent of canopy. Any incidental fauna species that were observed,

heard calling or otherwise detected on the basis of tracks or signs were recorded and listed in the total species list for the study area.

Figure 4.1. Flora and Fauna Survey Locations

Figure 4.2. Vegetation Communities in the Study Area

4.3 Survey Effort

DGR 4.2 *Documentation*

DGR 4.2.2 *Documenting survey effort and results*

4.3.1 Flora Survey Effort

Flora survey methods and survey effort for the study area are summarised in **Table 4.1**.

Table 4.1 Flora survey effort

Survey Method	Dates	Survey Effort	Person Hours
Incidental observations	17/03/2014, 22/04/2014	Throughout survey period	8
Vegetation Mapping	22/04/2014	Throughout survey period	5
Random Meanders	22/04/2014	Throughout survey period	5

4.3.2 Fauna Survey Effort

Fauna survey methods and survey effort for the study area are summarised in **Table 4.2**.

Table 4.2 Fauna survey effort

Survey Method	Dates	Survey Effort	Person Hours
General Habitat Assessment	22/04/2014	Throughout survey period	5
Incidental observations	17/03/2014, 22/04/2014	Throughout survey period	8

4.3.3 Weather Conditions

Weather conditions during flora and fauna surveys were generally appropriate for detection of a variety of flora and fauna. A summary of weather conditions in the wider locality of the study area (Terrey Hills weather station) during the flora and fauna survey periods is provided in **Table 4.3**.

Table 4.3 Weather observations during flora and fauna surveys

Date	Target Survey Group	Temperature Minimum (°C)	Temperature Maximum (°C)	Rainfall (mm)
17/03/2014	Flora, Fauna	12.4	25.8	11.0

Table 4.3 Weather observations during flora and fauna surveys

Date	Target Survey Group	Temperature Minimum (°C)	Temperature Maximum (°C)	Rainfall (mm)
22/04/2014	Flora, Fauna	12.4	23.4	0.0

4.3.4 Survey Personnel

The details of survey personnel are provided in **Table 4.4**.

Table 4.4 Survey personnel

Survey Personnel	Company	Role	Contact Details
Dr David Robertson	Cumberland Ecology	Director	(02) 9868 1933
Dr. Gitanjali Katrak	Cumberland Ecology	Project Manager/Ecologist	(02) 9868 1933
Bryan Furchert	Cumberland Ecology	Botanist	(02) 9868 1933

4.3.5 Limitations

The vegetation and fauna habitat on the subject site is extremely minimal and simplified. For this reason, survey effort has readily and effectively provided adequate information for the purposes of this SIS.

Vertebrate fauna and vascular flora of the locality is well known based upon a sizeable database of past records. The surveys by Cumberland Ecology added to the existing database and helped to provide a clear indication of the likelihood that various species occur, or are likely to occur within the study area.

Generally, the data obtained from database analysis and current surveys of the study area furnished an appropriate level of information to support the project assessment.

i. Flora

Flora surveys for this SIS were undertaken during one site visit, in April 2014. The weather conditions at the time of the flora surveys were generally favourable for plant growth and production of features required for identification of most species. Shrubs, grasses, herbs and creepers were readily identifiable in most instances.

Although the flora survey relies on one inspection, it is considered that sufficient information has been collected to assess issues including condition and viability of the flora, and likely impact on native vegetation given the highly modified and landscaped nature of the subject site.

ii. Fauna

The fauna surveys have limitations in that they are a "snapshot" investigation in time and illustrate a view of the fauna that were active during the time of the surveys. The data produced by the surveys is intended to be indicative of the types of species that could occur and not an absolute census of all vertebrate fauna species occurring within the study area. It is considered that the fauna surveys conducted have been adequate to be able to assess potential impacts to species.

4.4 Survey Results

DGR 4.2 *Documentation*

DGR 4.2.2 *Documenting survey effort and results*

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

4.4.1 Vegetation Communities

Two vegetation communities, Sydney Turpentine Ironbark Forest (STIF) and Planted/Landscaped Areas, occur within the subject site and wider study area. Planted and Landscaped vegetation is the dominant community within both the subject site and study area. Descriptions of these vegetation communities is provided in the following sections.

i. Sydney Turpentine Ironbark Forest (STIF)

a. Subject site

STIF within the subject site exists as a single *Eucalyptus paniculata* individual on a mown nature strip beside a pavement along Fitzsimons Lane (**Photograph 4.1**). The tree is approximately 15 m in height and has a drip zone that covers an area of approximately 0.027 ha, This drip zone area has been mapped as STIF (**Figure 4.2**). Due to the spread of branches, part of drip zone lies outside the subject site boundary. However for the purposes of this SIS, the entire drip zone as been assessed as occurring completely within the subject site as the main trunk of the tree occurs within the subject site.

The condition of this community is highly modified and degraded. The understorey beneath the drip zone and along Fitzsimons Lane (**Figure 4.1 – PP1 and PP2**) is dominated by exotic grasses such as *Pennisetum clandestinum* (Kikuyu), *Ehrharta erecta* (Panic Veldtgrass and *Sporobolus africanus* (Parramatta Grass). The area is also largely landscaped with several planted species (**Photograph 4.2**)

Given current conditions, it is highly unlikely that *Eucalyptus paniculata* can regenerate within the subject site. The lack of regeneration of the canopy species and extremely limited occurrence of native species in the understorey is due to the extensively modified built

environment surrounding the vegetation. Thus, the long term viability of this vegetation community is highly doubtful.

Photograph 4.1 *Eucalyptus paniculata* individual along Fitzsimons Lane

Photograph 4.2 Landscaped area of the subject site along Fitzsimons Lane

One individual of *Syncarpia glomulifera* (Turpentine) is also present towards the back of the current building. This tree (T31) has been also been identified as a potential remnant of STIF in the arborist report (EHS 2013) despite being located on a mulched garden bed (**Photograph 4.3**). As this individual is to be retained with appropriate protection measures, it has been mapped as part of the planted/landscaped community for the purposes of this SIS report. Another individual of *Syncarpia glomulifera* (T24) as well as two individuals (T22 and T23a) of *Angophora costata* (Smooth-barked Apple), an associated canopy species of STIF, have been identified as planted species (EHS 2013) and have been mapped as part of the Planted/Landscaped areas. Positive diagnostic groundcover species (herbs and grasses) of STIF recorded within the subject site occurred as scattered individuals among planted exotic species in mulched garden beds in areas mapped as Planted/Landscape.

Photograph 4.3 Potential remnant *Syncarpia glomulifera* located at the rear of the building (Fitzsimons Lane view)

Floristic data collected from the subject site was compared to the list for STIF within Tozer et al. (2010). Of the 95 positive diagnostic species listed within Tozer et al. (2010), only one species, *Eucalyptus paniculata*, has been recorded within the area mapped as STIF. Tozer et al. (2010) notes that a 0.04ha plot within this community is expected to contain at least 23 positive diagnostic species provided that the total number of native species within the plot is 40 or greater. Due to the lack of native species within this community, Tozer et al.'s threshold is not met.

The mapping of STIF is precautionary and the likely extent of natural regeneration is anticipated to be very low to nonexistent. In areas not covered by buildings, pavers or mulched garden bed, the native seed bank appears to be exhausted, evidently by past and current land uses.

Despite its highly modified and degraded condition, the small STIF habitat present within the subject site is technically considered to conform to the listing under the TSC Act listing which does not discriminate between a functioning community and a highly simplified form with only a representative canopy species present. The EPBC Act listing however provides minimal requirements for condition and patch size for the vegetation to be considered the CEEC. Due to the low quality of the STIF on the subject site and the small size of this area,

none of the community on the subject site is considered to constitute the community as defined under the EPBC Act which is required to be 1 ha or greater.

b. Study area

Within the study area this community occurs largely as scattered canopy trees of *Eucalyptus paniculata* and *Syncarpia glomulifera* over highly modified understorey. The study area is highly developed and the STIF canopy trees as well as associated canopy tree species such as *Angophora costata* and *Eucalyptus saligna* (Sydney Blue Gum) could be composed of a mix of remnant and planted specimens given the high level of landscaping present within the study area. Stands of STIF canopy trees in the study area generally have exotic planted garden species groundcover if any, and are mostly located either above mulched garden bed or on nature strips beside paved areas (**Photographs 4.4 – 4.5**). The shrub layer is either absent or comprised of exotic planted garden species. Native groundcover species within the majority of the study area are also poorly represented.

Eucalyptus paniculata and *Syncarpia glomulifera* were not observed naturally regenerating within the study area. The lack of regeneration of the canopy species and extremely limited occurrence of native species in the understorey is due to the extensively modified built environment surrounding the vegetation and land management practices (**Photographs 4.6 – 4.7**). Consequently, the long term viability of this vegetation community within the study area is doubtful.

Photograph 4.4 Eucalypt trees in garden beds in the study area (Fitzsimons Lane)

Photograph 4.5 Potential remnant and planted trees on nature strips along Merriwa Street

ii. Planted/Landscaped Areas

a, Subject site

Planted/Landscaped areas dominate the subject site and cover an area of 0.095 ha. One planted individual of *Syncarpia glomulifera* and two planted individuals of *Angophora costata* occur within the subject site. Other planted trees within the subject site include *Eucalyptus microcorys* (Tallowwood), *Corymbia citriodora* (Lemon-scented Gum), *Casuarina glauca* (Swamp Oak), *Callistemon viminalis* (Weeping Bottlebrush) and *Syzygium paniculatum* (Magenta Lilly Pilly).

The understorey within the subject site is dominated by non-local native species and exotic species (**Photograph 4.6 – 4.7**). A complete list of flora species present within the subject site is provided in **Appendix F**.

Some scattered individuals of positive diagnostic groundcover species for STIF, such as *Pratia purpurascens* (White root), *Veronica plebeia* (Trailing Speedwell), *Dianella caerulea* (Blue Flax Lily) and *Oplismenus aemulus* (Basket Grass) were recorded amongst planted species in mulched garden beds. However, these are common native species that are present in a wide range of native vegetation communities and are not exclusive to STIF.

Photograph 4.6 Planted trees on garden beds along western section of the subject site

Photograph 4.7 Planted areas within the subject site

b, Study area

The wider study area is highly developed and is dominated by planted and exotic vegetation (**Photograph 4.8**). Planted trees in the study area consist of a mix of locally indigenous species (eg *Eucalyptus saligna*), non-local natives (eg *Corymbia maculata* (Spotted Gum)) and exotic species (eg *Cinnamomum camphora* (Camphor Laurel)). Common planted understorey species include *Lomandra longifolia* (Mat Rush) and *Clivia miniata* (Clivia) within garden beds and *Pennisetum clandestinum* (Kikuyu) in nature strips along Merriwa Street and Fitzsimons Lane.

Photograph 4.8 Exotic dominated vegetation in the study area

iii. Adjacent Vegetation

Vegetation in the areas adjacent to the study area is generally similar to the vegetation within the study area. The vegetation within the adjacent lots is dominated by exotic planted garden species with remnant trees. Modified STIF and Blue Gum High Forest occurs along road verges and is scattered throughout residential areas surrounding the study area.

4.4.2 Flora

i. General species

A total of 76 flora species were recorded within the subject site during the surveys undertaken for this assessment. Seventy-five percent of the flora species recorded within the

subject site are exotic and planted native species. The 19 native species (25%) recorded within the subject site consist of a mix of non-local native species and locally indigenous species. A total species list for the subject lands is provided in **Appendix F.**

Five of the exotic species recorded within the subject site – *Cinnamomum camphora* (Camphor laurel), *Ligustrum lucidum* (Broad-leaved Privet), *Ligustrum sinense* (Small-leaved Privet) *Ochna serrulata* (Mickey Mouse Plant) and *Olea europaea ssp. cuspidata* (African Olive) – are listed as Class 4 weeds within Ku-ring-gai LGA (NSW Department of Primary Industries 2012).

ii. Threatened species

Three individuals of *Syzygium paniculatum* (Magenta Lilly Pilly) a species listed as Endangered under the TSC Act and Vulnerable under the EPBC Act, were recorded within landscaped areas of the subject site. This species is commonly planted as an ornamental tree and is not endemic to this area. These three individuals will not be removed as part of the proposed development. No other threatened flora species were recorded within the subject site or are considered likely to occur. Searches for threatened flora species could not be conducted within private lands in the wider study area due to access limitations. However threatened flora species are considered unlikely to occur within the study area due to high level of development and landscaping.

4.4.3 Fauna

i. Fauna habitat

Limited fauna habitats occur within the study area. Due to the level of disturbance experienced on the site and surrounding area, the paucity of native vegetation and the relative isolation from other areas of habitat, the subject site and study area are unlikely to support a large diversity of native fauna species. Those species present are also likely to be urban-aggressive species that are common to disturbed habitats such as Noisy Miner (*Manorina melanocephala*), Rainbow Lorikeet (*Trichoglossus haematodus*) and Brushtail Possum (*Trichosurus vulpecula*).

The trees on the subject site do not support hollow-dwelling fauna. No tree hollows occur within the subject site. Similarly, fallen timber or dense understorey vegetation, representing potential fauna habitat is not present within the subject site.

A single Ringtail Possum (*Pseudocheirus peregrinus*) drey was recorded within a *Syzygium paniculatum* tree (Fig 4.1 – PP6) near the Merriwa Street frontage. The drey was located over 10m high within the tree and could not be checked for evidence of occupation.

The habitat features available provide marginal potential foraging, shelter and possible breeding opportunities for fauna. Key habitat features recorded within the subject site and wider study area include:

- Minimal leaf litter and debris – shelter habitat for reptiles; and

- Nectar-producing trees – foraging habitat for insects, blossom dependant birds, arboreal mammals, microchiropteran bats and megachiropteran bats (flying-foxes).

These key habitat features provide low condition habitat for a range of fauna, including some species that are listed as threatened under the TSC Act.

ii. General species

A total of seven vertebrate fauna species were recorded during surveys for the current assessment. The recorded fauna species constitutes hardy native species that are well adapted to urban environments. The low number of fauna species recorded within the study area is likely a reflection of the location within an urban environment. A total species list for the study area is provided in **Table 4.5** below.

Table 4.5 Fauna species recorded in the study area

Class	Common name	Scientific Name	Observation type
Aves	Australian Raven	*Corvus coronoides*	Visual observation
Aves	Australian Magpie	*Cracticus tibicen*	Visual observation
Aves	Laughing Kookaburra	*Dacelo novaeguineae*	Vocalisations
Aves	Sulphur-crested Cockatoo	*Cacatua galerita*	Visual observation
Aves	Eastern Rosella	*Platycercus eximius*	Visual observation
Aves	Rainbow Lorikeet	*Trichoglossus haematodus*	Visual observation
Aves	Noisy Miner	*Manorina melanocephala*	Visual observation
Mammalia	Ringtailed possum	*Pseudocheirus peregrinus*	Drey constructed in tree

iii. Threatened and Migratory species

No threatened fauna species were recorded within the subject site and very few species are considered likely to occur. Potentially occurring threatened fauna species that could potentially occur within the study area consist of avifauna and bats. Potentially occurring threatened fauna species within the study area include:

- Gang-gang Cockatoo (*Callocephalon fimbriatum*), including individuals of the endangered population in the Hornsby and Ku-ring-gai Local Government Areas;
- Powerful Owl (*Ninox strenua*);
- Eastern Freetail Bat (*Mormopterus norfolkensis*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*);
- Little Bent-wing Bat (*Miniopterus australis*);

- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*); and
- Grey-headed Flying Fox (*Pteropus poliocephalus*).

Due the limited fauna habitat present within the study area, the occurrence of these threatened fauna species is considered to be limited to occasional passage through the study area as part of a wider foraging range.

Potential migratory bird species (as listed under the EPBC Act) that could potentially pass though the study area as part of a migratory pathway include the Fork-tailed Swift (*Apus pacificus*) and White-throated Needletail (*Hirundapus caudacutus*)

Chapter 5

Assessment of Likely Impacts on Threatened Species and Populations

This chapter covers the following Director General's Requirements:

DGR 5 *ASSESSMENT OF LIKELY IMPACTS ON THREATENED SPECIES AND POPULATIONS*

5.1 Assessment of Likely Impacts

5.1.1 Direct Impacts of Development

The primary and direct impact resulting from the proposed development is the loss of vegetation and associated habitat within the subject site. **Figure 4.2** shows the distribution of the two vegetation communities mapped within the subject site.

i. Vegetation communities

The subject site is approximately 0.4 ha in size, of which 0.027 ha comprises a highly degraded version of the native vegetation community, Sydney Turpentine Ironbark Forest (STIF), which is listed as an EEC under the TSC Act. The STIF community within the subject site is represented by a single *Eucalyptus paniculata* individual over a mown, exotic understorey. The remaining area of the subject site is comprised of planted/landscaped vegetation and existing buildings.

The *Eucalyptus paniculata* individual is to be removed as part of the proposed development, thereby resulting in the total removal of the STIF vegetation from the subject site. A more detailed discussion of impacts to the EEC recorded within the subject site and study area is provided in **Chapter 6**. Some areas of the planted/landscaped vegetation will also be removed as part of the proposed development.

ii. Loss of Specific Habitat Features

The following key threatening process is applicable to the habitat to be removed from the subject site:

- Clearing of native vegetation.

Very limited habitat occurs across the subject site which may provide suitable features for a range of native fauna species including threatened species. The habitat features listed in

Section 4.4.3 will be removed from the subject site. However, the removal of these habitat features are considered to have only minor implications for some threatened fauna species due to the modified ecological context they are within and the high mobility of the species.

iii. Threatened species

The clearing of vegetation (STIF and planted species) within the subject site will directly remove potential, albeit marginal, foraging habitat for highly mobile threatened fauna species such as the Grey-headed Flying Fox (*Pteropus poliocephalus*) and Powerful Owl (*Ninox sternua*) However, the subject site, and study area as a whole, generally lack important habitat features, such as hollow-bearing trees. This paucity of habitat features suggests that it would be unlikely for these species to be dependent on the habitats present.

No threatened flora species are considered likely to be affected by the proposed development. The three individuals of *Syzygium paniculatum*, a species listed as Endangered under the TSC Act and Vulnerable under the EPBC Act is not considered to be an affected species as it is frequently planted as an ornamental plant and does not occur naturally within the subject site.

5.1.2 Indirect Impacts of Development

i. Habitat fragmentation

The other impact due to loss of vegetation will be habitat fragmentation. Habitat fragmentation is the process whereby habitat loss results in the division of large, continuous habitats into small, isolated habitat fragments (Ewers and Didham 2006). The area between fragments is typically man-made and largely inhabitable by the species that previously existed in the area. The ecological impacts of habitat fragmentation include (Andrews 1990):

- Changes in the number of species in fragments;
- Changes to the composition of faunal assemblages; and
- Changes to ecological processes in fragments such as food chains, predator-prey interactions, plant-animal pollination and dispersal associations.

The proposed project will remove 0.027 ha of native vegetation/habitat within the subject site. The vegetation and associated habitats in the study area and locality are affected by fragmentation due to urban development. The proposed removal of this small area of vegetation and marginal habitat would very minimally add to fragmentation further than current conditions. .

ii. Edge effects

"Edge effects" are impacts occurring at an interface between natural environments and disturbed or developed land. The following are types of edge effects that can occur (Murcia 1995):

- Abiotic effects, involving changes in the environmental conditions that result from proximity to a structurally dissimilar matrix;
- Direct biological effects, which involve changes in the abundance and distribution of species caused directly by the physical conditions near the edge; and
- Indirect biological effects which involve changes in species interactions, such as predation, competition, herbivory and biotic pollination and seed dispersal.

Given that the vegetation within the subject site exists as a single tree, edge effect will not impact remaining vegetation within the area.

iii. Alteration to hydrological regimes

Changes to drainage lines can affect the integrity, structure and composition of habitat and thus, have secondary impacts on the species that rely on them. Given that the vegetation communities occurring near to the subject site are not reliant on specific hydrological regimes, and that they exist in an urbanised environment with engineered drainage, it is unlikely that any alteration as a result of the proposed project will significantly impact these communities.

iv. Increased sedimentation and erosion

Increased sediment and eroded material can smother retained vegetation, cause dieback of herbs and shrubs and reduce regeneration of groundcover species. Sediment and eroded material can also contain weed matter and nutrients. Given that the vegetation communities occurring near to the subject site exist in an urbanised environment with engineered drainage, it is unlikely that any alteration as a result of the proposed project will significantly impact these communities. However, sediment control and reduction measures should be implemented to reduce sediment runoff into urban stormwater systems in order to mitigate affect to environments receiving such stormwater.

5.2 Assessment of Species Likely to be Affected

DGR 5.1 Assessment of species likely to be affected

> *An assessment of which threatened species or population known or likely to be present in the area are likely to be affected by the action (Section 110(2)(b)).*

Affected species are defined within the SIS as subject species and populations likely to be affected by the proposal. The impacts include the direct impact of loss of habitat through clearing and/or indirect impacts. Owing to the extreme modification of vegetation and habitat, few species have potential to occur. Those species and populations and communities selected as "affected" include threatened fauna species that are known to occasionally occur in suburban areas in the locality, with database records in the locality, and with the propensity to forage in disturbed habitat on occasion.

The following threatened species and populations include those that are considered most likely be affected by the proposal and are therefore assessed in subsequent sections of this chapter:

i. Threatened species

- Gang-gang Cockatoo (*Callocephalon fimbriatum*);
- Powerful Owl (*Ninox strenua*);
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*); and
- Grey-headed Flying Fox (*Pteropus poliocephalus*).

ii. Threatened population

- Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas

This list of species has been refined from the list of subject species (see Chapters 3 and 4) based on the listing in the DGRs, their known occurrence in and around the study area, their likelihood of occurrence, specific habitat requirements, results from surveys and the extent of impacts. The remaining subject species listed in Chapters 3 and 4 are not analysed further as they are not considered likely to occur in the study area (based on general species distribution information) and/or are not known to utilise the habitat types of the subject area.

No threatened flora species are considered likely to occur within the study area. The level of past and current disturbance of the study area greatly reduces the possibility of any threatened flora species existing as soil-stored seed.

The habitats present in the study area provide very limited resources to support a large range of fauna species. The vegetation is predominately isolated from larger and more contiguous habitats proximate to the study area and throughout the locality. Due to this fragmentation and high level of disturbance, the study area is likely to offer only marginal habitat for a number of the subject species likely to occur ('affected species').

5.3 Analysis of Affected Species

The following DGRs have been addressed for each affected species and populations.

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

An estimate for the local and regional abundance of those species or populations (Section 110(2)(d))

DGR 5.2.1 *Discussion of other known local populations*

DGR 5.3 *Assessment of habitat*

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

DGR 5.3.1 *Description of habitat values*

DGR 5.3.2 *Discussion of habitat utilisation*

DGR 5.4 *Discussion of conservation status*

For each species or population likely to be affected, details of its local, regional and State-wide conservation status, the key threatening processes generally affecting it, its habitat requirements and any recovery plan or threat abatement plan applying to it (Section 110(2)(c)).

An assessment of whether those species or populations are adequately represented in conservation reserves (or other similar protected areas) in the region (Section 110(2)(e)).

An assessment of whether any of those species or populations is at the limit of its known distribution (Section 110(2)(e1)).

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

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

DGR 5.5.1 *Significance within a local context*

DGR 5.5.2 *Discussion of connectivity*

DGR 5.5.3 *Consideration of threatening processes*

5.3.1 *Gang-gang Cockatoo and Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas*

i. Discussion of local and regional abundance and distribution

a. Discussion of other known local populations

There are 22 records of the Gang-gang Cockatoo in the Ku-ring-gai LGA. This species has been recorded in the locality to the west - south west of the study area. The records may be part of the known population residing in the Ku-ring-gai and Hornsby LGAs which is listed as an endangered population because it is the only known Gang-gang Cockatoo breeding population in the Sydney metropolitan area. The population is estimated to include 18 to 40 breeding pairs. The population covers, but is not restricted to, Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east (NSW Scientific Committee 2001).

Twenty four individuals have been recorded within the locality. The study area is relatively small and no individuals have been detected within the study area. Any individuals utilising the study area would form part of the known population residing in the Ku-ring-gai and Hornsby LGAs and/or the broader, regional population.

b. Discussion of other known regional populations

In NSW, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes (OEH 2012, 2014c). Within the region, the Gang-gang Cockatoo has been recorded within Berowra Valley Regional Park and Lane Cove National Park. There are no threatened populations listed under the TSC Act other than that located in the Ku-ring-gai and Hornsby LGAs.

ii. Assessment of habitat

a. Description of habitat values

The majority of the study area was presumably cleared around 1850 to the early 1900s when the area of Gordon (then still known as Lane Cove) was established as a settlement and developed following the construction of the post office and railway station (Ku-ring-gai Historical Society Inc, 2008). Since that time, little to no natural regeneration of native vegetation has occurred, with most areas remaining as exotic grassland and planted garden among buildings.

There are no trees occurring within the study area which support hollows for use by the Gang-gang Cockatoo. Any potential foraging habitat in the study area either lacks an understorey altogether or lacks a dense enough understory and is therefore generally unfavourable to the species.

b. Discussion of habitat utilisation

No Gang-gang Cockatoos have been detected in the study area, but they are known to occur in the locality. As mentioned above, there are no hollow-bearing trees providing suitable habitat opportunity for a species the size of a cockatoo to nest. Gang-gang Cockatoos may potentially forage in the study area, as part of a larger foraging range. Feed trees available for the species within the study area include *Eucalyptus saligna, Eucalyptus paniculata* and possibly some planted non-endemic species such as *Eucalyptus microcorys,* which occur in landscaped areas.

The study area, and subject site in particular is not considered to be significant to the viability of the species and the majority of potential foraging habitat for this species will be retained within the study area. The species will remain viable within the locality because the subject site comprises a very small amount of potential foraging habitat in the locality, and the species would be utilising other areas of habitat in the locality.

iii. Discussion of conservation status

a. Local, regional and state-wide status

The Gang-gang Cockatoo is listed as Vulnerable under Schedule 2 of the TSC Act. It is not listed under the EPBC Act. Any individuals occurring are likely to form part of the locally significant population as described by the final determination. An endangered population of this species is listed under the TSC Act in the Hornsby and Ku-ring-gai LGAs within the locality. This group is significant because it is the only known Gang-gang Cockatoo breeding population in the Sydney metropolitan area.

b. Threatening processes

The following key threatening processes are known to affect the Gang-gang Cockatoo:

- **Clearing of native vegetation** as this reduces the abundance of foraging and nesting habitat;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat. As this species show high fidelity to selected nesting trees, loss of hollow bearing trees can impact on successful breeding;
- **Ecological consequences of high frequency fire** as foraging and nesting habitat may be damaged or destroyed;
- **Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species** as it infects and kills cells in the beak and feathers of parrot and cockatoo species;
- **Infection of native plants by *Phytophthora cinnamomi*** as vegetation that is utilised by this species may be susceptible and may be killed or damaged; and

- **Human-caused climate change** as it may alter the extent and nature of its preferred habitat.

c. Habitat requirements

Gang-gang Cockatoos are generally found in tall mountain forests and woodlands in heavily timbered and mature wet sclerophyll forests (OEH 2014c). The Gang-gang Cockatoo requires larger hollows in the trunks or large limbs of large trees in which to breed (NSW Scientific Committee 2005).

d. Other documentation

No recovery plan has been prepared for this species. No critical habitat for this species has currently been identified by the Director-General of the OEH. In the SWEPaC Threat Abatement Plan for Beak and Feather Disease affecting endangered psittacine species, the Gang-gang Cockatoo is listed as a species affected by the disease. The effects of the proposal are not contradictory to the objectives of the Threat Abatement Plan.

e. Assessment of adequacy of reservation

The Gang-gang Cockatoo occurs in many conservation reserves throughout the greater Sydney region, particularly north and north west of the study area. These areas include Lane Cove National Park, Berowra Valley Regional Park and Ku-ring-gai Chase National Park and farther afield within National Parks in the Blue Mountains area and also Yengo and Wollemi National Parks. The individuals occurring in those conservation areas are more secure than individuals occurring on private property closer to developed areas. The endangered population occurring in the Hornsby and Ku-ring-gai LGAs is represented within parks and reserves including Lane Cove National Park and Pennant Hills Park.

f. Limit of known distribution

In NSW, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes (NSW Scientific Committee 2005). The population in the Hornsby and Ku-ring-gai LGAs is bounded by Beecroft - Cheltenham in the west, Epping - North Epping in the south, Turramurra - South Turramurra in the east, and Thornleigh - Wahroonga to the north (NSW Scientific Committee 2001).

The study area falls within the known distribution of this species, and occurs near the border of the range for the endangered population as determined by the NSW Scientific Committee.

iv. Discussion of the likely effect of the proposal at local and regional scales

a. Significance within a local context

The proposal will remove only a very small area of potential, albeit marginal, foraging habitat for the species in relation to the habitat within the locality. The clearance of this small area of potential foraging habitat is not considered significant within the local context as larger

areas of higher quality habitat remain within the locality and wider region. These areas are more likely to provide nesting and foraging habitat for this species.

b. Discussion of connectivity

The vegetation within the study area and subject site is sparsely connected to vegetation in the locality as the study area is bounded by residential land holdings, main roads and general urban development. Scattered trees throughout these land holdings provide limited but some connectivity to other areas of more extensive and intact vegetation which is mostly to the west and north west of the study area.

The habitat to be removed as part of the proposal represents a very small portion of available habitat in the locality. Larger nearby bushland includes Dalrymple-Hay Nature Reserve to the north east, Lane Cove National Park to the west, Garigal National Park to the north-east and Berowra Valley Regional Park to the north-west of the study area. Smaller tracts of bushland occur in reserves around Gordon such as Sheldon Forest, Twin Creeks Reserve and Bushrangers Reserve, also providing habitat. All of these larger areas are sparsely connected by scattered trees within an urban environment with connectivity coming closest in their outer most extents.

Due to the loss of only a small proportion of potential foraging habitat in the locality and the highly mobile nature of this species, it is not expected that the proposal will decrease the ability of movement of individuals and gene flow between habitats or populations.

c. Consideration of threatening processes

The Gang-gang Cockatoo may be generally threatened by the following processes:

- Clearing of native vegetation

  The vegetation to be cleared for the proposal is not considered to form significant habitat for this species. Larger areas of bushland exist within the locality and these areas are considered to be more likely to constitute habitat for this species.

- Loss of hollow-bearing trees

  There are no hollow-bearing trees to be removed as part of the proposal and none large enough within the study area to affect the Gang-Gang Cockatoo.

- Ecological consequences of high frequency fire;

  The proposal is not likely to exacerbate the degradation of habitat resulting from an altered fire regime as the current fire regime (absence of fire) will be maintained.

- Infection by Psittacine circoviral (beak and feather) disease affecting endangered psittacine species;

  The proposal is not likely to increase the likelihood of infection by Psittacine circoviral (beak and feather) disease.

- Infection of native plants by Phytophthora cinnamomi; and

  The proposal is not likely to decrease potential habitat through infection of native plants by *Phytopthora cinnamomi*.

- Human-caused climate change.

  The proposal is not likely to alter the extent and nature of suitable habitat resulting from anthropogenic climate change.

Threats identified within the OEH profile for the Gang-gang Cockatoo relate to the key threatening processes outlined above.

5.3.2 Powerful Owl

i. Discussion of local and regional abundance and distribution

a. Discussion of other known local populations

There are 69 records of the Powerful Owl in Ku-ring-gai LGA and 69 records within the locality. The records of this species are scattered throughout the locality. The individuals' proximity to nearby reserves means that their current representation within the locality is relatively secure.

No individuals have been detected within the study area, despite records from the locality. The study area is relatively small and no individuals have been detected within the study area. Therefore, any individuals utilising the study area would form a component of the boarder population ranging outside of the locality.

b. Discussion of other known regional populations

In NSW, the Powerful Owl is widely distributed throughout the eastern forests from the coast inland to the tablelands, with scattered, mostly historical records on the western slopes and plains. Within the region, the Powerful Owl has been recorded within Berowra Valley Regional Park, Lane Cove National Park, Ku-ring-gai Chase National Park and Rouse Hill Regional Park.

ii. Assessment of habitat

a. Description of habitat values

The majority of the study area was presumably cleared around 1850 to the early 1900s when the area of Gordon (then still known as Lane Cove) was established as a settlement and developed following the construction of the post office and railway station (Ku-ring-gai Historical Society Inc, 2008). Since that time, little to no natural regeneration of native vegetation has occurred, with most areas remaining as exotic grassland and planted garden among buildings.

There are no trees occurring within the study area which support hollows for use by the Powerful Owl. The potential foraging habitat in the study area lacks a dense understorey. The native vegetation within the subject site lacks understorey completely. Despite this, it is possible that the very occasional opportunity for foraging still exist within the study area.

The study area and subject site is not considered to be significant to the viability of the species as it represents a very small amount of potential foraging habitat within the locality and wider region. This species would be expected to more heavily utilise other higher quality areas of habitat in the locality.

b. Discussion of habitat utilisation

The vegetation within the study area and subject site provide no nesting habitat as tree hollows are absent. This species nests in large tree hollows of at least 0.5m deep, in large eucalypts (diameter at breast height of 80-240cm) which would be at least 150 years old (OEH 2014e). The Powerful Owl may occasionally potentially forage within the study area as part of a much larger foraging range.

The study area and subject site is not considered to be significant to the viability of the species. The viability of this species within the locality will not be compromised as the study area and in particular, the subject site comprises only a very small and compromised amount of potential foraging habitat within the locality, and the species would be more heavily utilising other areas of habitat in the locality.

iii. Discussion of conservation status

a. Local, regional and state-side status

The Powerful is listed as Vulnerable under Schedule 2 of the TSC Act. It is not listed under the EPBC Act.

b. Threatening processes

The following key threatening processes are known to affect the Powerful Owl:

- **Clearing of native vegetation** as this reduces the abundance of foraging and nesting habitat;
- **Loss of hollow-bearing trees** as this reduces the abundance of nesting habitat. As this species show high fidelity to selected nesting trees, loss of hollow bearing trees can impact on successful breeding;
- **Removal of dead wood and dead trees** as this removes potential foraging and nesting habitat;
- **Ecological consequences of high frequency fire** as foraging and nesting habitat may be damaged or destroyed;

- **Infection of native plants by *Phytophthora cinnamomi*** as vegetation that is utilised by this species may be susceptible and may be killed or damaged; and
- **Human-caused climate change** as it may alter the extent and nature of its preferred habitat.

c. Habitat requirements

The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The species typically required large tracts of forest or woodland habitat, but is also known from fragmented landscapes. The Powerful Owl roosts by day in dense vegetation comprising species such as *Syncarpia glomulifera* (Turpentine), *Allocasuarina littoralis* (Black She-oak), *Acacia melanoxylon* (Blackwood), *Angophora floribunda* (Rough-barked Apple), *Exocarpus cupressiformis* (Cherry Ballart) and a number of eucalypt species (OEH 2014e).

d. Other documentation

A recovery plan has been prepared for large forest owls, including the Powerful Owl. The ultimate aim of the recovery plan is to ensure that the species it covers persist in the wild in NSW in each region where they presently occur (OEH 2014e). The proposal is not considered to threaten the objectives of the Recovery Plan.

No Threat Abatement Plan exists for this species. No critical habitat for this species has currently been identified by the Director-General of the OEH.

e. Assessment of adequacy of reservation

The majority of potential habitat for this species is restricted to conservation reserves and state forests, although the Powerful Owl also occurs within large areas of forest on other public lands and on private land, including suburban bushland (DEC (NSW) 2006). The Powerful Owl has been recorded in many national parks and state forests throughout its range in NSW (DEC (NSW) 2006). In the locality, Powerful Owl habitat is reserved mostly within reserves such as Dalrymple-Hay Nature Reserve, Lane Cove National Park Garigal National Park, and Ku-ring-gai Chase National Park.

f. Limit of known distribution

In NSW, the Powerful Owl lives in forests and woodland occurring in the coastal, escarpment, tablelands and western slopes, with records concentrated on the coast and tablelands (DEC (NSW) 2006). The study area falls within the known distribution of this species.

iv. Discussion of the likely effect of the proposal at local and regional scales

a. Significance within a local context

The proposal will remove only a very small area of potential foraging habitat for the species in relation to the habitat within the locality. Fundamentally, the subject site is a small portion of highly modified vegetation primarily surrounded by established urban development. The clearance of this small area of potential foraging habitat from the subject site is not considered significant within the local context as larger areas of higher quality habitat remain within the locality and wider region. Such areas of potential habitat which are conserved are within Dalrymple-Hay Nature Reserve, Lane Cove National Park Garigal National Park, Ku-ring-gai Chase National Park and Berowra Valley Regional Park. Other scattered smaller reserves throughout the locality, such as Sheldon Forest, will also provide some secure protected habitat. These areas are more likely to provide roosting, foraging and nesting habitat for this species.

b. Discussion of connectivity

The vegetation within the study area and subject site is sparsely connected to vegetation in the locality as the study area is bounded by residential land holdings, main roads and general urban development. Scattered trees throughout these land holdings provide limited but some connectivity to other areas of more extensive and intact vegetation which is mostly to the west and north west of the study area.

The habitat to be removed as part of the proposal represents a very small portion of available habitat in the locality. Larger nearby bushland includes Dalrymple-Hay Nature Reserve to the north east, Lane Cove National Park to the west, Garigal National Park to the north-east and Berowra Valley Regional Park to the north-west of the study area. Smaller tracts of bushland occur in reserves around Gordon such as Sheldon Forest, Twin Creeks Reserve and Bushrangers Reserve which also provide habitat. All of these larger areas are sparsely connected by scattered trees within an urban environment with connectivity coming closest in their outer most extents.

Due to the loss of only a small proportion of potential foraging habitat in the locality and the highly mobile nature of this species, it is not expected that the proposal will decrease the ability of movement of individuals and gene flow between habitats or populations.

c. Consideration of threatening processes

The Powerful Owl may be threatened by the following processes:

- Clearing of native vegetation

  The vegetation to be cleared for the proposal is not considered to form significant habitat for this species. Larger areas of habitat outlined above exist within the locality and these areas are considered to be more likely to constitute habitat for this species.

- Loss of hollow-bearing trees

  There are no hollow-bearing trees and to be removed as part of the proposal.

- Removal of dead wood and dead trees

  There is no dead wood or dead trees to be removed as part of the proposal.

- Ecological consequences of high frequency fire

  The proposal is not likely to exacerbate the degradation of habitat resulting from an altered fire regime as the current fire regime (absence of fire) will be maintained.

- Infection of native plants by *Phytophthora cinnamomi*

  The proposal is not likely to decrease potential habitat through infection of native plants by *Phytopthora cinnamomi*.

- Human-caused climate change

  The proposal is not likely to alter the extent and nature of suitable habitat resulting from anthropogenic climate change.

Other threats identified within the OEH profile for the Powerful Owl include:

- Habitat fragmentation of suitable forest and woodland through land clearing for residential and agricultural development.
- Road kills;
- Secondary poisoning; and
- Predation of fledglings by foxes, dogs and cats.

The proposed development is not anticipated to exacerbate these threats further than current conditions.

5.3.3 Grey-headed Flying-fox

i. Discussion of local and regional abundance and distribution

a. Discussion of other known local populations

There are 894 records of the Grey-headed Flying-fox in the Ku-ring-gai LGA and 889.records scattered throughout the locality.

Grey-headed Flying-foxes roost in colonies known as 'camps'. This species has strong site fidelity to camps and there are three camps which occur around the Sydney metropolitan area: Ku-ring-gai Flying-fox Reserve at Gordon, the Royal Botanic Gardens and Cabramatta

Creek Flying-fox Reserve. The closest camp to the subject land is at Gordon and it is likely that any records of the species within the locality are Flying-foxes foraging from this camp.

No individuals have been detected within the subject site. The study area is relatively small and no individuals have been detected within the study area. Therefore, any individuals utilising the study area would form a component of the boarder population ranging outside of the locality.

b. Discussion of other known regional populations

Grey-headed Flying-foxes are found within 200km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria (OEH 2014d). Within the wider locality, the Grey-headed Flying-fox has been recorded within Lane Cove National Park to the west, Garigal National Park to the north-east and Ku-ring-gai Chase National Park to the north of the study area and another large tract of bushland which occurs to the west of Hornsby's city centre. Farther afield, they have been recorded along almost the entire coastal fringe of NSW and it is likely that other regional populations occur.

ii. Assessment of habitat

a. Description of habitat values

The majority of the study area was presumably cleared around 1850 to the early 1900s when the area of Gordon (then still known as Lane Cove) was established as a settlement and developed following the construction of the post office and railway station (Ku-ring-gai Historical Society Inc, 2008). Since that time, little to no natural regeneration of native vegetation has occurred, with most areas remaining as exotic grassland and planted garden among buildings.

Although known to occur in the locality, no Grey-headed Flying-foxes have been detected in the study area. The vegetation within the study area does not support suitable roosting habitat and there is limited foraging habitat for this species. The Grey-headed Flying-fox would be likely to utilise the study area and subject site for foraging as part of a larger foraging range.

The study area and subject site is not considered to be significant to the viability of the species as it represents a very small amount of potential foraging habitat within the locality. This species would be expected to more heavily utilise other higher quality areas of habitat in the locality.

b. Discussion of habitat utilisation

Grey-headed Flying-foxes live in specific roost camps, the locations of which are well-known within the Sydney region, with the nearest camp located in Gordon. No camps were observed within the study area, with only foraging habitat being present. Feed trees available for the species within the study area include *Syncarpia glomulifera, Eucalyptus saligna, Eucalyptus paniculata* and possibly some planted non-endemic species which occur in landscaped areas.