36 LYN PARADE, PRESTONS

Species Impact Statement

For:

Timpag Investments Pty Ltd

September 2016

Final

cumberland ecology

PO Box 2474
Carlingford Court 2118

Report No. 14150RP1

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.

Version	Date Issued	Amended by	Details
1	13/09/2016	MF	Final version for DA submission

Approved by: Dr David Robertson

Position: Director

Signed: David Robertson

Date: *14 September, 2016*

Table of Contents

Table of Contents *(Cont'd)*

Table of Contents *(Cont'd)*

List of Appendices

List of Tables

List of Figures

List of Figures

List of Photographs

Glossary of Terms

EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
CEEC	Critically Endangered Ecological Community
DGRs	Director Generals Requirements
EEC	Endangered Ecological Community
LGA	Local Government Area
OEH	Office of Environment and Heritage
SIS	Species Impact Statement
Study Area	Area bounded by Bernera, Jedda, Wonga and Kurrajong Roads Prestons
Subject Site	Area directly affected by the proposal
TSC Act	NSW *Threatened Species Conservation Act 1995*

Executive Summary

S1 Purpose

Cumberland Ecology has been commissioned by Timpag Investments Pty Ltd to prepare a Species Impact Statement (SIS) for a proposed development at 36 Lyn Parade (Lot 10 DP1003837), Prestons within the Liverpool City Council Local Government Area (LGA) (**Figure 1.1**). The proposed development involves the construction of an industrial warehouse on Lot 10 DP1003837 (hereafter referred to as the "subject site"). The SIS will also assist in the lifting of the 88B instrument that exists for environmentally sensitive areas on the subject site.

This SIS has been prepared in accordance with the Director General's Requirements (DGRs), issued on 7 December 2015 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, ecological investigations were carried out by Cumberland Ecology to identify the vegetation communities and threatened species within the subject site to inform of the development potential. The result of these investigations identified the presence of the endangered vegetation community Cooks River/Castlereagh Ironbark Forest, and the threatened flora species *Acacia pubescens* (Downy Wattle).

As Cooks River/Castlereagh Ironbark is listed as an Endangered Ecological Community (EEC) under the TSC Act and as a Critically Endangered Ecological Community (CEEC) under the EPBC Act, preliminary discussions with Liverpool Council raised concerns regarding the potential local extinction of the local occurrence of the community within and adjacent to the subject site. *Acacia pubescens* (Downy Wattle) is listed as Vulnerable under both the TSC Act and the EPBC Act and due to the proposed clearance of all individuals within the subject site, concerns about the occurrence in the study area and locality was also raised.

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 1 ha in size and is zoned as IN3 – Heavy Industrial under the Liverpool Local Environmental Plan 2008.

The subject site is bounded by Lyn Parade to the west and industrial buildings to the east, north and south. The surrounding land use consists of industrial buildings, being located within an industrial estate.

The study area is the area bounded by Bernera, Jedda, Wonga and Kurrajong Roads, Prestons, and is approximately 215 ha in size.

S2.2 Existing Vegetation

Vegetation within the subject site and study area consists largely of remnant patches of fragmented native vegetation. The fragmented patches of native vegetation consist predominantly of degraded low to moderate quality Cooks River/Castlereagh Ironbark Forest, with some small areas of moderate to good quality occurrences of the community, and to a lesser extent, River-flat Eucalypt Forest, Cumberland Plain Woodland, Shale-Gravel Transition Forest and Castlereagh Swamp Woodland across an urban environment.

The vegetation on the subject site is entirely comprised of Cooks River/Castlereagh Ironbark Forest with a canopy stratum containing small trees and a variable understorey. The small trees are characteristic tree species found in Cooks River/Castlereagh Ironbark Forest, including *Eucalyptus fibrosa* (Red Ironbark) and *Melaleuca decora*. A dense shrub layer exists in the understorey consisting of *Melaleuca nodosa* (Prickly-leaved Paperbark), *Melaleuca decora*, *Dillwynia sieberi*, *Cryptandra spinescens*, *Bursaria spinosa* (Blackthorn) and occurrences of *Acacia pubescens* (Downy Wattle). The soils are predominantly clay derived from Tertiary alluvium with some shale influence evident. The condition of the vegetation is degraded and of low to moderate quality with a lack of canopy trees and exotic dominated understorey, though it has some native species diversity and regeneration of native species.

The occurrence of Cooks River/Castlereagh Ironbark Forest within the subject site qualifies as conforming with the EEC listing for Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion under the TSC Act (NSW Scientific Committee, 2002). This community also conforms to the CEEC listing of Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion under the EPBC Act (Threatened Species Scientific Committee, 2015).

S3 Field Survey Results

S3.1 Flora

The following vegetation communities were identified and mapped within the study area:

- Cooks River/Castlereagh Ironbark Forest;
- Cumberland Plain Woodland;

- River-flat Eucalypt Forest;
- Shale Gravel Transition Forest;
- Swamp Oak Forest; and
- Freshwater Wetland

Occurrences of these communities within the study area were degraded and in low to moderate condition, with the occurrences of the communities in the south-eastern corner of the study area being in moderate to good condition, likely due to the restriction of access.

Of these communities listed above, only Cooks River/Castlereagh Ironbark Forest occurs within the subject site and is considered to be affected by the proposed development.

The patch within the subject site is a regrowth occurrence of the community that is degraded and isolated from remaining native vegetation within the study area and locality due to the highly developed industrial surroundings. Although there will be an impact to the community within the subject site, the overall impact on the community in the study area and wider locality is not considered to be significant due to its degraded nature and its isolation.

One threatened flora species, *Acacia pubescens* (Downy Wattle), a species listed as Vulnerable under both the TSC Act and EPBC Act, was recorded within the subject site. A total of 84 individuals were recorded within the subject site and greater than 220 individuals were recorded within the study area.

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 condition 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, culverts and soaks, representing potential fauna habitat is not present within the subject site. However, one stag is present on the subject site with decorticating bark and is considered to have potential to provide limited fauna habitat value.

Relatively low quality potential foraging habitat is present for a small number of threatened fauna, likely the more mobile microchiropteran bats and avifauna, including Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), Eastern Freetail-bat (*Mormopterus norfolkensis*), Little Bentwing-bat (*Miniopterus australis*), Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), Grey-headed Flying-fox (*Pteropus poliocephalus),* Gang-gang Cockatoo

(*Callocephalon fimbriatum*), Swift Parrot (*Lathamus discolor*) and Little Lorikeet (*Glossopsitta pusilla*). Key habitat features for the majority of species however, such as hollow-bearing trees for roosting, are absent.

One potential record of the threatened fauna species Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) was identified within the subject site. However, it is likely that this species was passing through the area as it is a highly mobile species, and would not be considered to be affected by the proposal. No other threatened fauna species were identified within the subject site. Potential habitat for these species within the study area is limited to marginal foraging 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

S4.1 Direct Impacts

The proposal will require the removal of all vegetation within the subject site, comprising 0.90 ha of Cooks River/Castlereagh Ironbark Forest, which is listed as an EEC under the TSC Act and a CEEC under the EPBC Act, and 84 individuals of *Acacia pubescens* (Downy Wattle) listed as Vulnerable under both the TSC Act and the EPBC Act. The impacts of the proposal on the community and threatened flora species are considered in detail within this SIS.

No threatened fauna species are expected to be significantly affected by the removal of potential foraging habitat within the subject site. Most of the species affected are highly mobile and the subject site would only represent a small area of the total home range for each of these fauna species.

S4.2 Indirect Impacts

Indirect impacts that will result from the proposal include the increased fragmentation of habitats in the locality. The proposed removal of this small area of vegetation and habitat would add to fragmentation and reduce the extent of fauna corridors than that of current conditions.

Other indirect impacts include increased edge-effects due to the increased urban development and associated weed invasion. Uncontrolled stormwater run-off has the potential to indirectly impact on the native vegetation present, through the increase in nutrients and potential for soil erosion. However, all indirect impacts are considered to be manageable through the implementation of mitigation measures.

S5 Ameliorative 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.

Ameliorative measures as part of the proposal include pre-construction measures, during-construction measures and compensatory strategies.

Pre-construction measures such as pre-clearance fauna surveys to check for any nesting or roosting fauna and move them to adjacent habitat will be required due to the presence of habitat features suitable for native fauna within the subject site. During construction, management should include sediment control and reduction measures in order to mitigate effects of stormwater and surface runoff on surrounding land. Precautions should also be taken to ensure that no pollution escapes the construction site.

Compensatory strategies include the use of the OEH BioBanking Scheme to purchase BioBanking credits to fulfil the credit requirement for the clearance of native vegetation and threatened species on the subject site. Suitable BioBanking credits will be sought in accordance with the offsetting rules of the BioBanking Assessment Methodology 2014 (BBAM) and retired to compensate for the loss of Cooks River/Castlereagh Ironbark Forest and *Acacia pubescens* as a result of the proposed development.

Where the entire credit requirement cannot be sourced, other compensatory strategies will be explored such as contribution to restoration works within the locality.

S6 Conclusion

The proposal will require the clearing of 0.90 ha of Cooks River/Castlereagh Ironbark Forest of moderate to low condition habitat with a dominance of exotic grass in the understorey. In its current condition, the community cannot regenerate to its pre-disturbance condition in the long term, even with active management. Although there will be an impact to the community within the subject site, the overall impact on the community in the study area and wider locality is not considered to be of major ecological significance.

A total of 84 individuals of the threatened flora species *Acacia pubescens* will be cleared as a result of the proposal. Whilst this is a significant impact on the species within the subject site, it is considered to be a moderate impact in the context of the study area and locality with a loss of approximately 27% and 15% respectively, of the species. The removal of *Acacia pubescens* individuals is considered to have a moderately significant impact on this species.

Notwithstanding the small scale of impact to Cooks River/Castlereagh Ironbark Forest from the proposed development, offsetting is warranted to prevent a small cumulative loss of the community from the locality. If the corresponding BioBanking credits required for the proposal are bought and retired, this impact will be compensated for by the conservation and

management in perpetuity of an area of Cooks River/Castlereagh Ironbark Forest and individuals and habitat for *Acacia pubescens*, maintaining the presence and maintenance of the community and threatened flora species within the locality.

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Chapter **1**

Introduction

1.1 Purpose

Cumberland Ecology has been commissioned by Timpag Investments Pty Ltd to prepare a Species Impact Statement (SIS) for the proposed clearance of vegetation at 36 Lyn Parade, Prestons (Lot 10 DP1003837) (hereafter referred to as the "subject site") within the Liverpool City Council Local Government Area (LGA) (**Figure 1.1**). All vegetation is proposed to be cleared for the eventual development of the subject site, involving the construction of an industrial warehouse.

The proposed vegetation clearance will require the clearing of 0.90 hectares (ha) of Cooks River/ Castlereagh Ironbark Forest, which conforms to the Endangered Ecological Community (EEC) Cooks River/Castlereagh ironbark forest in the Sydney Basin Bioregion, listed under the *New South Wales Threatened Species Conservation Act 1995* (TSC Act). The community also conforms to the Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion listed as a Critically Endangered Ecological Community (CEEC) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A referral to the Minister for the Environment will be prepared in due course.

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 TSC Act and the Director General of the Office of Environment and Heritage (OEH) requirements (DGRs), copies of which are provided in **Appendix A**.

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 or request for Part 5 approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act);

- Assist the Director-General of the OEH 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 of the OEH or the Minister for the Environment when consulted for the purposes of Parts 4 or 5 of the EP&A Act; and
- Assist the Director-General of the OEH in the assessment of Section 91 Licence applications lodged under the TSC Act.

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. A compliance table is also included in **Appendix B**.

1.2 Background

The subject site is located at Lot 10 DP1003837, also known as 36 Lyn Parade, Prestons, and covers an area of approximately 1 ha. The subject site is zoned IN3 – Heavy Industrial under the *Liverpool Local Environment Plan 2008* (LZN - 010) as shown in **Figure 1.2**. The subject site is bounded on three sides by industrial developments, with Lyn Parade bounding the site in the west. Currently an 88B instrument exists on the subject site to prevent the clearing of native vegetation and threatened species under the EP&A Act.

The development proposal includes the clearance of all vegetation for the eventual development of the following:

- Construction of an industrial warehouse and workshop;
- Vehicle entry from Lyn Parade; and
- Landscaped open areas.

1.3 Need for a Species Impact Statement

The proposal for the clearance of native vegetation will require the clearing of 0.90 ha of vegetation within the subject site that conforms to Cooks River/Castlereagh Ironbark Forest. This community exists as small canopy trees above a groundcover that is dominated by native herbs and grasses, though some exotics are present. All vegetation within the subject site will be removed as a result of the proposed development. The vegetation community meets the criteria for the definition of Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion as per the Final Determination for the community under the TSC Act, and the definition of Cooks river/Castlereagh Ironbark Forest of the Sydney Basin Bioregion as per the Final Determination under the EPBC Act.

84 individuals of the threatened flora species *Acacia pubescens* have also been recorded within the subject site. All *Acacia pubescens* will be removed from the subject site as a result

of the proposed development. *Acacia pubescens* is listed as Vulnerable under both the TSC Act and the EPBC Act.

Clearing of the vegetation within the subject site may contribute to the decline in the extent of the community within the bioregion and may result in the loss of habitat for some threatened fauna, including microchiropteran bats and birds. The removal of the threatened flora may also contribute to the decline of the species within the bioregion and locality.

For all of the above reasons, Timpag Investments Pty Ltd requested the DGRs for an SIS be issued as a precautionary approach to the assessment of the proposal.

1.4 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 1.5*** 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 7 December 2015.

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.

1.5 DGR Matters Which Have Been Limited or Modified

The following Section 110 Matters need only be addressed by this SIS where relevant:

i. Threat Abatement Plans

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

ii. Recovery Plans

The following recovery plans are relevant to this proposal:

- The *Acacia pubescens* Recovery Plan; and
- The Cumberland Plain Recovery Plan.

iii. Key Threatening Processes

The following key threatening processes are relevant to this proposal:

- Clearing of native vegetation; and
- Loss of hollow-bearing trees.

iv. Critical Habitat

At this time, no areas of declared critical habitat were relevant to this proposal.

Coordinate System: MGA Zone 56 (GDA 94)

HOXTON PARK ROAD
Cabramatta Creek
JEDDA ROAD
Maxwells Creek
LYN PARADE
WESTLINK M7
BERNERA ROAD
KURRAJONG ROAD
South Western Motorway

Legend

- Subject Site
- Study Area
- Waterway
- Main Road

N
Grid North

Image Source:
Image © 2016 Aerometrex
(dated 1-1-2014)

Data Source:
© Copyright Commonwealth of Australia
(Geoscience Australia) 2006

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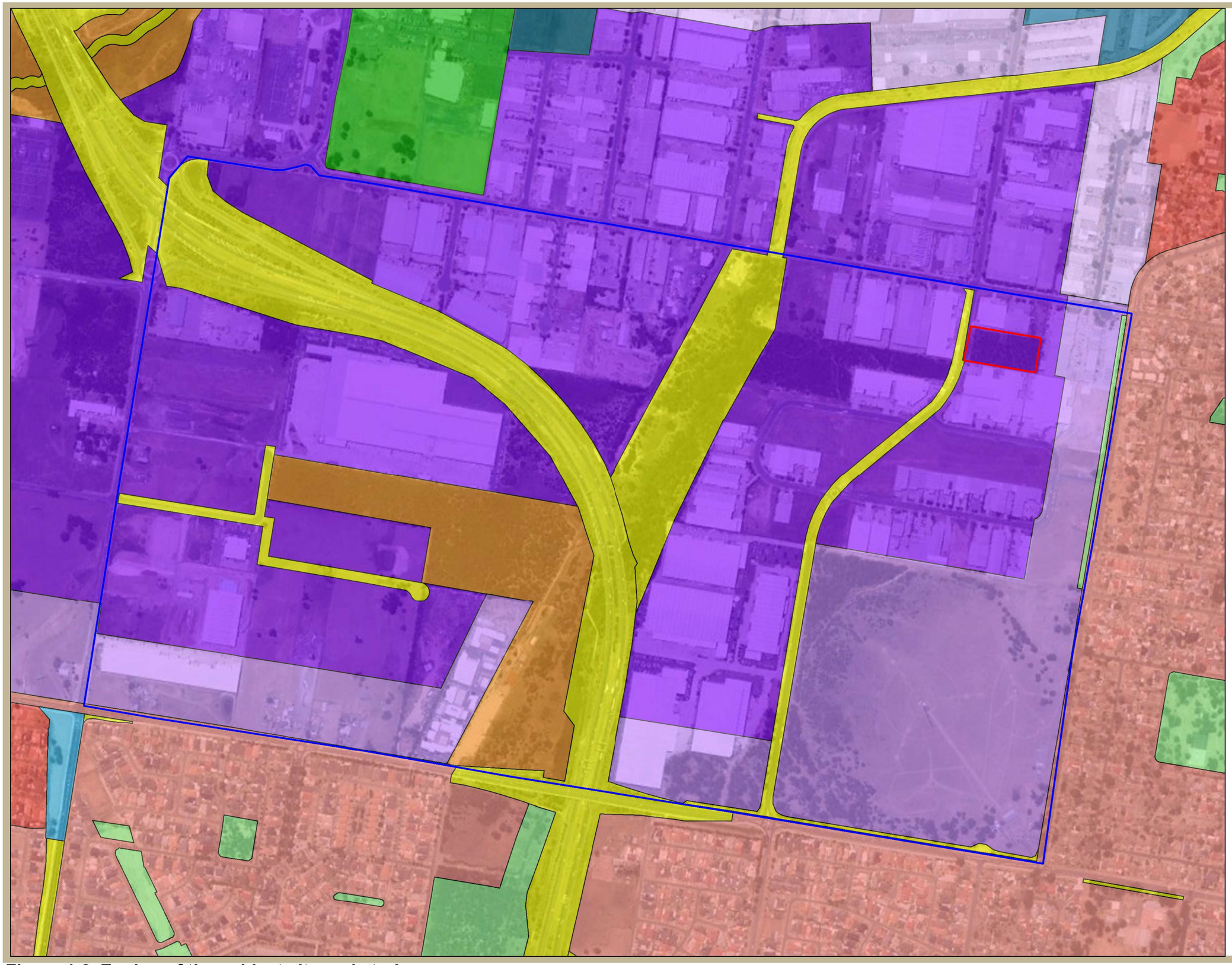
250 0 250 500 750 1000 m

I:\...114150\Figures\RP1_SIS\20160913\Figure 1.1. Aerial Photograph_Subject Site_Study Area

Figure 1.1. Aerial photograph and location of the subject site and study area

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Subject site
- Study area

Land Zoning

- B1: Neigbourhood Centre
- B6: Enterprise Corridor
- E2: Environmental Conservation
- IN1: General Industrial
- IN2: Light Industrial
- IN3: Heavy Industrial
- R2: Low Density Residential
- R3: Medium Density Residential
- RE1: Public Recreation
- RE2: Private Recreation
- SP2: Infrastructure

N
Grid North

Image Source:
Image © 2016 Aerometrex
(dated 1-1-2014)

Data Source:
Liverpool LEP 2008

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I:\...\14150\Figures\RP1_SIS\20160913\Figure 1.2. Zoning_Subject Site

100 0 100 200 300 400 m

Figure 1.2. Zoning of the subject site and study area

Chapter 2

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 Description of the Proposal

i. Nature

The proposed development involves the clearance of vegetation within Lot 10 DP1003837. A concept plan for the construction of a warehouse/ facility within the subject site has been developed. The building is a large single unit with an area of approximately 5600 m^2 and an office attached at the front of the building with area of 352 m^2. Light Landscaping will run along the right boundary with accessible car parking.

ii. Extent

For the purposes of the SIS, the current proposal includes the development of Lot 10 DP1003837 (the subject site). The total area of the proposed works within the DA comprises approximately 1 ha.

iii. Location

Development is proposed on the subject site as indicated in **Figure 2.1**, being Lot 10 DP1003837, also known as 36 Lyn Parade, Prestons.

iv. Timing

Construction is proposed to commence within one year, subject to development approval.

v. Layout

The layout (footprint) of the concept plan for the proposed development is shown in **Figure 2.2**.

2.1.2 Description of the Subject Site

The subject site is zoned as IN3 – Heavy Industrial under the Liverpool Local Environmental Plan 2008.

The subject site is approximately 1 ha in size and is shown in **Figure 2.1**. The subject site is bounded by Lyn Parade to the west and industrial buildings to the east, north and south. The surrounding land use consists of industrial buildings, being located within an industrial estate. The site is relatively flat and slopes gently towards Lyn Parade to the west.

The vegetation on the subject site is comprised of a canopy stratum containing small trees and a variable understorey. The canopy trees are characteristic tree species found in the native vegetation community referred to as Cooks River/Castlereagh Ironbark Forest, including *Eucalyptus fibrosa* (Red Ironbark) and *Melaleuca decora*. A dense shrub layer exists in the understorey consisting of *Melaleuca nodosa* (Prickly-leaved Paperbark), *Melaleuca decora*, *Dillwynia sieberi*, *Cryptandra spinescens*, *Bursaria spinosa* (Blackthorn) and occurrences of *Acacia pubescens* (Downy Wattle). The soils are predominantly clay derived from Tertiary alluvium with some shale influence evident.

Due to the species listed above, the vegetation within the subject site qualifies as conforming with the EEC listing for Cooks River/Castlereagh Ironbark Forest under the TSC Act (NSW Scientific Committee, 2002). This community also conforms to the CEEC listing of Cooks River/Castlereagh Ironbark Forest under the EPBC Act (Threatened Species Scientific Committee, 2015).

The shrub species *Acacia pubescens* is listed as Vulnerable under both the TSC Act and EPBC Act and is characterised by its hairy brachlets.

There is evidence of illegal dumping of rubbish within the subject site, with several locations observed. This includes dumped cars, tyres, tiles, metal and general rubbish.

2.1.3 Description of the Study Area

The study area is bounded by Bernera, Jedda, Wonga and Kurrajong Roads, Prestons (see **Figure 2.1**) and includes the subject site and land directly or indirectly impacted by the proposed development. The study area occurs wholly within the Liverpool City Council LGA, in the Sydney Basin Bioregion.

The soil landscapes of the study area are identified from the Penrith 1:100,000 Soils Landscapes Series map prepared by the Soil Conservation Service of NSW. The soil landscape map indicates that the study area is underlain by two soil landscape groups, Blacktown landscape group and South Creek landscape group.

The Blacktown soil landscape occurs in the eastern half of the study area and along the western border. It usually occurs on gently undulating rises over Wianamatta Group shales. The soils range from shallow to moderately deep (less than 1 m thick) and are hard setting, mottled textured clay soils. Soils are typically moderately reactive with highly plastic subsoil, have a low soil fertility and poor soil drainage.

The South Creek soil landscape group occurs in flood plains, valley flats and drainage depressions of channels on the Cumberland Plain. The soils are often deep, layered sediments overlying bedrock or relict soils.

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 largely intact, though somewhat disturbed Cooks River/Castlereagh Ironbark Forest. The EEC's River-flat Eucalypt Forest and Shale Gravel Transition Forest and CEEC Cumberland Plain Woodland also occur as scattered remnants across an urban environment in areas adjacent to the study area.

Fire history of the study area is unknown; however it is unlikely that the native trees within the study area have 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 urban and industrial setting of the study area.

2.2 Plans, Maps and Data

DGR 2.2 *Provision of relevant plans, maps and data*

The following plans, maps and images shall be provided at a scale of 1:500 or larger:

- *A plan of the development on the subject site.*
- *A colour aerial image of the subject site.*
- *A map showing the location of all threatened species found on the subject site during surveys conducted for the SIS, as well as previous records obtained from the Atlas of NSW Wildlife and other data sources.*
- *A map showing the distribution of subject species habitat on the subject site.*
- *A map showing the distribution of vegetation type, identifying endangered ecological communities, on the subject site.*

The following plans, maps and images shall be provided at a scale of 1:5000 or greater:

- *A map of the study area, sowing the location of the subject site.*
- *A colour aerial image of the study area, showing the location of the study site.*

- *A map showing the location of all threatened species found in the study area during surveys conducted for the SIS, as well as previous records obtained from the Atlas of NSW Wildlife and other data sources.*
- *A map showing the distribution of subject species habitat in the study area.*
- *A map showing the distribution of vegetation type, identifying endangered ecological communities, in the study area.*
- *A map of the study area showing property boundaries, differentiating tenure (private, Crown or Government agency tenure) and indicating the security and management of the vegetation and threatened species within different properties.*

The following plans, maps and images shall be provided at a scale of 1:25000 or larger:

- *A map of the locality, showing areas of native vegetation (identifying endangered ecological communities) and other threatened species habitat, as well as threatened species records obtained from the Atlas of NSW Wildlife and other data sources.*

ArcMap-compatible GIS data shall be provided directly to OEH and shall consist of:

- *All survey sites (plot/quadrat and transect locations, random meander tracks, targeted threatened species search areas, trap locations, call-playback sites, call listening or recoding sites, spotlighting sites, avian point count sites or area search polygons, stag watch locations and echo-location detection sites, etc.).*
- *All vegetation mapping data for the study area presented in the SIS*
- *The development footprint (including entire area to be cleared).*

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

Chapter 1

- Aerial Photograph of the subject site (**Figure 1.1**); and
- Zoning of the subject site (**Figure 1.2**)

Chapter 2

- Location of the subject site and study area (**Figure 2.1**)
- Proposed development layout (**Figure 2.2**)

Chapter 3

- Vegetation within the locality (**Figure 3.1**)

- Threatened flora recorded within the locality (**Figure 3.2**)
- Threatened fauna recorded within the locality (**Figure 3.3**)

Chapter 4

- Vegetation communities within the subject site (**Figure 4.1**)
- Vegetation communities within the study area (**Figure 4.1**)
- Flora and fauna survey locations (**Figure 4.2**)
- Locations of subject species within the subject site and study area (**Figure 4.3**)
- Subject species habitat within the subject site and study area (**Figure 4.1**)
- Locations of habitat features within the subject site and study area (**Figure 4.4**)

Chapter 5

- Location of *Acacia pubescens* in the Sydney region (**Figure 5.1**)

Chapter 6

- Vegetation community affected by the proposed development within the subject site (**Figure 6.1**)
- Extent of Cooks River/Castlereagh Ironbark Forest within E2 Lands, National Parks and Nature Reserves within the region (**Figure 6.2**)

Coordinate System: MGA Zone 56 (GDA 94)

Legend

- Subject Site
- Study Area
- Waterway

Grid North

Image Source:
Image © 2016 Aerometrex
(dated 1-1-2014)

Data Source:
© Copyright Commonwealth of Australia
(Geoscience Australia) 2006

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I:\...\14150\Figures\RP1_SIS\20160913\Figure 2.1. Location_Subject Site and Study Area

Figure 2.1. Location of the subject site and study area

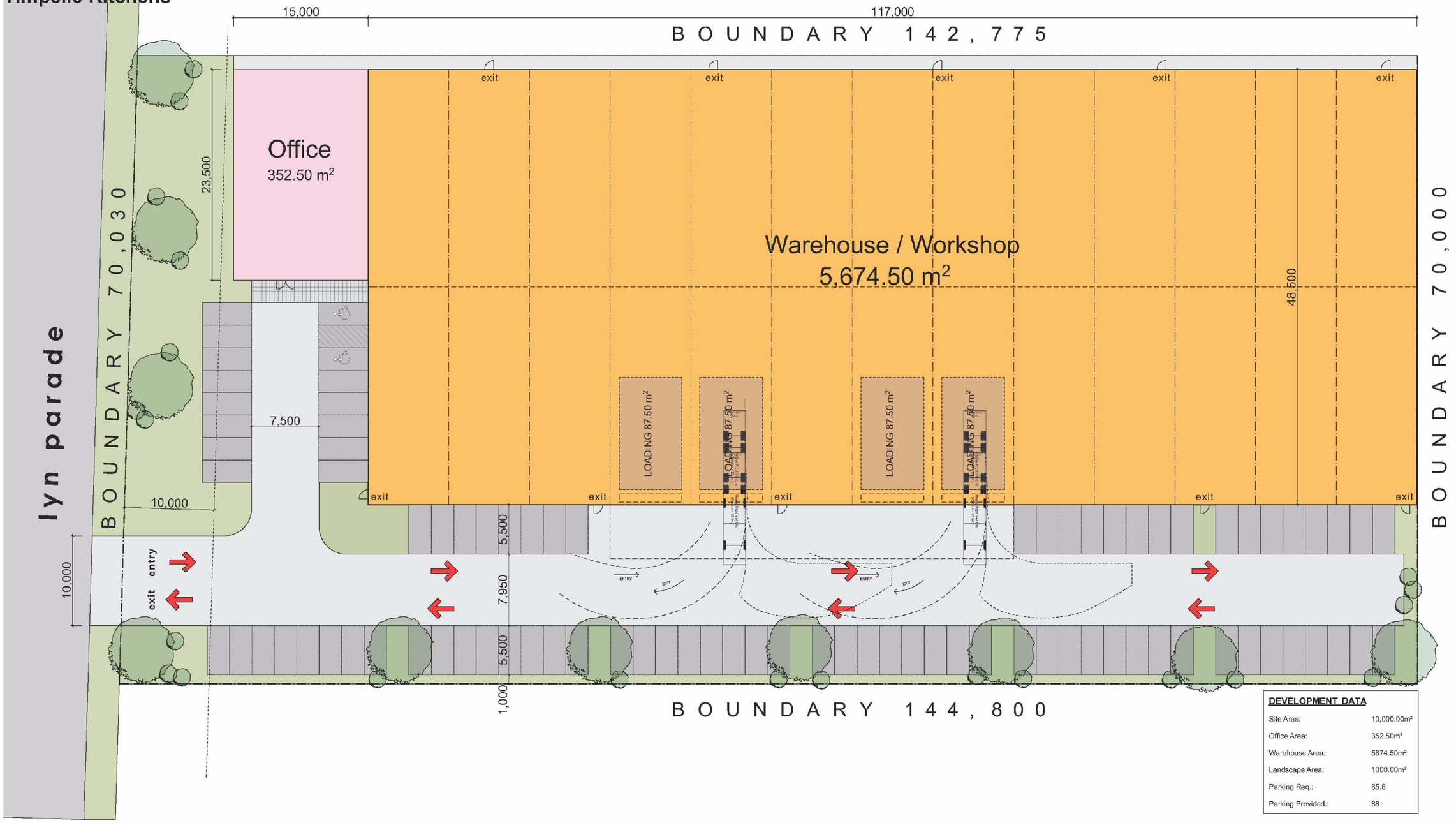
100 0 100 200 300 400 m

INDUSTRIAL DEVELOPMENT

Lot 10, Lyn Parade Prestons

Timpelle Kitchens

Concept plans require further checking for DCP compliance and may be subject to change
Subject to Council approval



1

Concept Sketch Plan
1:200

- All dimensions and floor areas are to verified by the Builder prior to commencement of any building work.
- Any discrepancies are to be brought to the attention of the designer.
- Levels shown are approximate unless accompanied by reduced levels.
- Figured dimensions must be taken in preference to scaling.
- All boundary clearances must be verified by the surveyor prior to the commencement of any building works.
- Where engineering drawings are required such must take preference to this drawing.
- All services to be located and verified by the Builder with relevant authorities before any building work commences.

issue	amendment	date	drwn	chkd
A	Concept for review	20.07.16	bt	bt

brett taylor + associates
residential | industrial | commercial
po box 135 hoxton park nsw 2171
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NORTH

Client Name: Timpelle Kitchens

Project Name: INDUSTRIAL DEVELOPMENT

Project Address: Lot 10 Lyn Parade, Prestons ,NSW 2170

Drawing Title: Concept Sketch

Scale:	Status:	Date:
as noted	-	20-Jul-16

Project No:	Drawing No.:	Drawn By:	Issue
2016-024	SK01	BT	A

I:\...\14150\Figures\RP1\20160913\Figure 2.2. Concept Plan

Figure 2.2. Concept plan of the proposed development

Image Source: Brett Taylor + Associates, Drawing No: SK01, Concept Sketch. 20-07-2016.

cumberland ecology

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)).

3.1 Identifying Subject Species

DGR 3.1 Identifying subject species

DGR 3.1.1 Assessment of available information

In determining these species (the subject species), consideration shall be given to the habitat types present within the study area, recent records of threatened species or populations in the locality and the known distribution of threatened species.

Databases such as the OEH Atlas of NSW Wildlife, Australian Museum and Royal Botanic Gardens should be consulted to assist in compiling the list. It should be noted that if the OEH Atlas is the only database that is referred to, sue to data exchange agreements, the data provided by OTH will only include that which OEH is a custodian for. In many cases, this may only be a small subset of the data available. Other databases must also be consulted to create a comprehensive list of subject species.

The following species shall be considered for inclusion in the list of subject species:

Threatened Species

Scientific name	Common name
Meridolum corneovirens	Cumberland Land Snail
Pultenaea pedunculata	Matted Bush-pea
Acacia pubescens	Downey Wattle

Endangered ecological communities

Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion

Shale Gravel transition Forest in the Sydney Basin Bioregion
River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Cumberland Plain Woodland in the Sydney Basin Bioregoin

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 the habitats present in the study area. Database analysis was undertaken using the OEH Atlas for NSW Wildlife database (OEH, 2015a) and the Royal Botanic Gardens PlantNET database (Botanic Gardens Trust, 2015). The Atlas of NSW Wildlife was used to generate records of threatened flora and fauna species and populations listed under the TSC Act and EPBC Act within the locality of the study area. PlantNET was used to generate a list of threatened flora records within the locality of the study area.

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 study area. Consideration was also given to those threatened species listed in the DGRs.

Mapping prepared by NSW Vegetation Information System (VIS) and Sydney Metropolitan Area (SMA) Vegetation Mapping (OEH, 2013) was consulted to assist in determining ecological communities to be included within the list of subject species.

3.1.2 Endangered Ecological Communities

A number of critically endangered and endangered ecological communities have been identified within the locality, as per the Sydney Metro Area (SMA) vegetation mapping (OEH, 2013) (see **Figure 3.1**) including the following:

- Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion (TSC Act Vulnerable Ecological Community (VEC));
- Castlereagh swamp woodland community (TSC Act EEC);
- Cooks River/Castlereagh Ironbark For Cooks River/Castlereagh ironbark forest in the Sydney Basin Bioregion (TSC Act EEC; EPBC Act CEEC);
- Cumberland Plain Woodland in the Sydney Basin Bioregion (TSC Act EEC; EPBC Act CEEC);
- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (TSC Act EEC);
- Moist Shale Woodland in the Sydney Basin Bioregion (TSC Act EEC; EPBC Act CEEC);

- River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (TSC Act EEC);
- Shale gravel transition forest in the Sydney Basin Bioregion (TSC Act EEC; EPBC Act CEEC); and
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (TSC Act EEC).

Of these communities, only Cooks River/Castlereagh Ironbark Forest occurs within the subject site and study area, while Cumberland Plain Woodland, River-flat Eucalypt Forest and Shale Gravel Transition Forest occur within the study area but not within the subject site. These are all considered to be subject endangered ecological communities. A small patch of the EEC Freshwater wetland is located within the study area, however it is not considered to be a subject species as it will not be impacted directly or indirectly by the proposed development.

3.1.3 Threatened species and populations

Threatened flora and fauna species recorded in the locality by the Atlas of NSW Wildlife (OEH, 2015a) have been mapped in relation to the study area, as shown in **Figure 3.2** and **Figure 3.3 respectively**. The number and age of records of threatened species and populations as well as migratory avifauna recorded within 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 assessed for the likelihood of occurrence. The threatened species and populations considered as 'subject species' for this SIS include:

i. *Threatened Species*

a. Flora

- *Acacia pubescens* (Downy Wattle); and
- *Pultenaea pedunculata* (Matted Bush-pea).

b. Fauna

- Cumberland Plain Land Snail (*Meridolum corneovirens*);
- Spotted Harrier; and
- Little Eagle.

Table 3.1 Likelihood of Occurrence of threatened flora and fauna within the study area and subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	5 km search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
FLORA								
Apocynaceae	*Marsdenia viridiflora* subsp. *viridiflora*	*Marsdenia viridiflora* R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	E		7	Grows in vine thickets and open shale woodland. Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys.	Unlikely to occur. No suitable habitat present within the study area.	No
Ericaceae	*Leucopogon exolasius*	Woronora Beard-heath	V	V	1	This species is found along the upper Georges River area and in Heathcote National Park. It occurs in woodland on sandstone (OEH 2014) and prefers rocky hillsides along creek banks (DoE 2016). Flowering occurs in August and September. The species distribution overlaps with that of Shale/Sandstone Transition Forest (TSSC 2008).	Unlikely to occur. No suitable habitat present within the study area.	No
Fabaceae (Faboideae)	*Dillwynia tenuifolia*		V		1	It has a core distribution within the Cumberland Plain, where it may be locally abundant within scrubby, dry heath areas within Castlereagh Ironbark Forest and Shale/Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in the ecotone between these areas and Castlereagh Scribbly Gum Woodland.	Potential to occur. Some habitat is present within the study area and subject site. This species has not been recorded on the subject site or within the study area. Only one recorded location exists within the locality.	No

Table 3.1 Likelihood of Occurrence of threatened flora and fauna within the study area and subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	5 km search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Fabaceae (Faboideae)	*Pultenaea pedunculata*	Matted Bush-pea	E		11	This species occurs in a range of habitats, but is generally found among woodland vegetation, however it has also been found on road batters and coastal cliffs. On the Cumberland Plain the species prefers sites in clay or sandy-clay soils on Wianamatta Shale-derived soils. This species has been recorded within Cumberland Plain Woodland, shale-soil form of Shale Sandstone Transition Forests and Cooks River/Castlereagh Ironbark Forest.	Likely to occur. This species has been recorded within the study area. Suitable habitat is present in the study area and subject site.	Yes
Fabaceae (Mimosoideae)	*Acacia pubescens*	Downy Wattle	V	V	92	Occurs on alluviums, shales and the intergrade between shales and sandstones. Soils are characteristically gravely, often with ironstone. Occurs in open woodland and forest, in several vegetation communities including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.	Known to occur. Several records have been identified within the subject site. This species also occurs within the study area.	Yes
Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	1	Occurs in dry, grassy woodland, on shallow and infertile soils, mainly on granite.	Unlikely to occur. No suitable habitat present within the study area and subject site.	No
Myrtaceae	*Eucalyptus scoparia*	Wallangarra White Gum	E	V	1	Found in open eucalypt forest, woodland and heath on well-drained granite/rhyolite hilltops, slopes and rocky outcrops, typically at high altitudes. It is	Unlikely to occur. No habitat occurs within the subject site or study area. This location is out of the	No

Table 3.1 Likelihood of Occurrence of threatened flora and fauna within the study area and subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	5 km search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
						known from three locations near Tenterfield in Northern NSW.	known distribution of this species.	
Proteaceae	*Grevillea parviflora* subsp. *parviflora*	Small-flower Grevillea	V	V	11	Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Sydney region occurrences are usually on Tertiary sands and alluvium, and soils derived from the Mittagong Formation. Occurs in a range of vegetation types from heath to shrubby woodland to open forest.	Potential to occur. Suitable habitat exists within the study area and subject site. Records for this species are concentrated to the east of the study area.	No
Proteaceae	*Persoonia nutans*	Nodding Geebung	E	E	7	Associated with dry woodland, Castlereagh Scribbly Gum Woodland, Agnes Banks Woodland and sandy soils associated with tertiary alluvium, occasionally poorly drained. Also occurs in Shale Gravel Transition Forest and Castlereagh Ironbark Forest. Endemic to Western Sydney.	Potential to occur. Suitable habitat exists within the study area and subject site. Records for this species are concentrated to the east of the study area.	No
Thymelaeaceae	*Pimelea spicata*	Spiked Rice-flower	E	E	13	In western Sydney, it occurs on an undulating topography of well-structured clay soils, derived from Wianamatta shale. It is associated with Cumberland Plain Woodland (CPW), in open woodland and grassland often in moist depressions or near creek lines. Has been located in disturbed areas that would have previously supported CPW.	Potential to occur. Some suitable habitat exists within the study area and subject site. Limited records are widespread across the locality.	No
FAUNA								

Table 3.1 Likelihood of Occurrence of threatened flora and fauna within the study area and subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	5 km search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Amphibia								
Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E	V	1	Permanent or ephemeral swamps, dams and slow flowing streams with emergent vegetation such as reeds, particularly those containing bulrushes (*Typha* spp.) and Spikerushes (*Eleocharis* spp.). Optimal habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and sheltering sites available. Can occur in highly disturbed areas. It inhabits a variety of forest types including coastal forest, open woodland and cleared areas.	Unlikely to occur. No suitable habitat present.	No
Aves								
Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	V		1	Lives in a wide range of eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast.	Unlikely to occur. No suitable habitat present due to dense shrub layer.	No
Accipitridae	*Circus assimilis*	Spotted Harrier	V		1	Grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and	Unlikely to occur. Recorded within the study area. Limited habitat	No

Table 3.1 Likelihood of Occurrence of threatened flora and fauna within the study area and subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	5 km search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
						shrub steppe (e.g. chenopods). It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania.	present within the study area. No suitable habitat within the subject site due to dense shrub layer.	
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V		12	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. Found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment.	Unlikely to occur. Recorded within the study area. Limited habitat present in the study area. No suitable habitat within the subject site due to the dense shrub layer.	No
Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V		1	Generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. 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.	Unlikely to occur. No suitable habitat present.	No

Table 3.1 Likelihood of Occurrence of threatened flora and fauna within the study area and subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	5 km search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V		5	Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur. It is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW	Unlikely to occur. No suitable habitat present.	No
Falconidae	*Falco subniger*	Black Falcon	V		2	Inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. Usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts.	Potential to occur. Marginal habitat available within the study area. Limited recent records within the locality.	No
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V		12	Found in eucalypt forests and woodlands containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Inhabits most of mainland Australia except the treeless deserts and open grasslands.	Unlikely to occur. No suitable habitat present.	No
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V		12	Mostly occurs in dry, open eucalypt forests and	Unlikely to occur. Limited habitat	No

Table 3.1 Likelihood of Occurrence of threatened flora and fauna within the study area and subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	5 km search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
						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. Distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia.	available within the study area.	
Psittacidae	*Lathamus discolor*	Swift Parrot	E	E	7	On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes.	Unlikely to occur. Limited records and habitat available within the study area.	No
Strigidae	*Ninox strenua*	Powerful Owl	V		2	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains.	Unlikely to occur. Limited records and habitat available within the study area.	No

Table 3.1 Likelihood of Occurrence of threatened flora and fauna within the study area and subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	5 km search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Gastropoda								
Camaenidae	*Meridolum corneovirens*	Cumberland Plain Land Snail	E		156	Primarily inhabits Cumberland Plain Woodland. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Lives in a very small area on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains.	Likely to occur. Records within the study area. Suitable habitat present within the study area.	Yes
Mammalia								
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	1	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland.	Unlikely to occur. Limited habitat available within the study area. No suitable habitat within the subject site.	No
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V		3	Roosts in tree hollows and buildings; utilises mammal burrows in treeless areas. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Found across northern and eastern Australia.	Unlikely to occur. Limited records and habitat available within the study area.	No

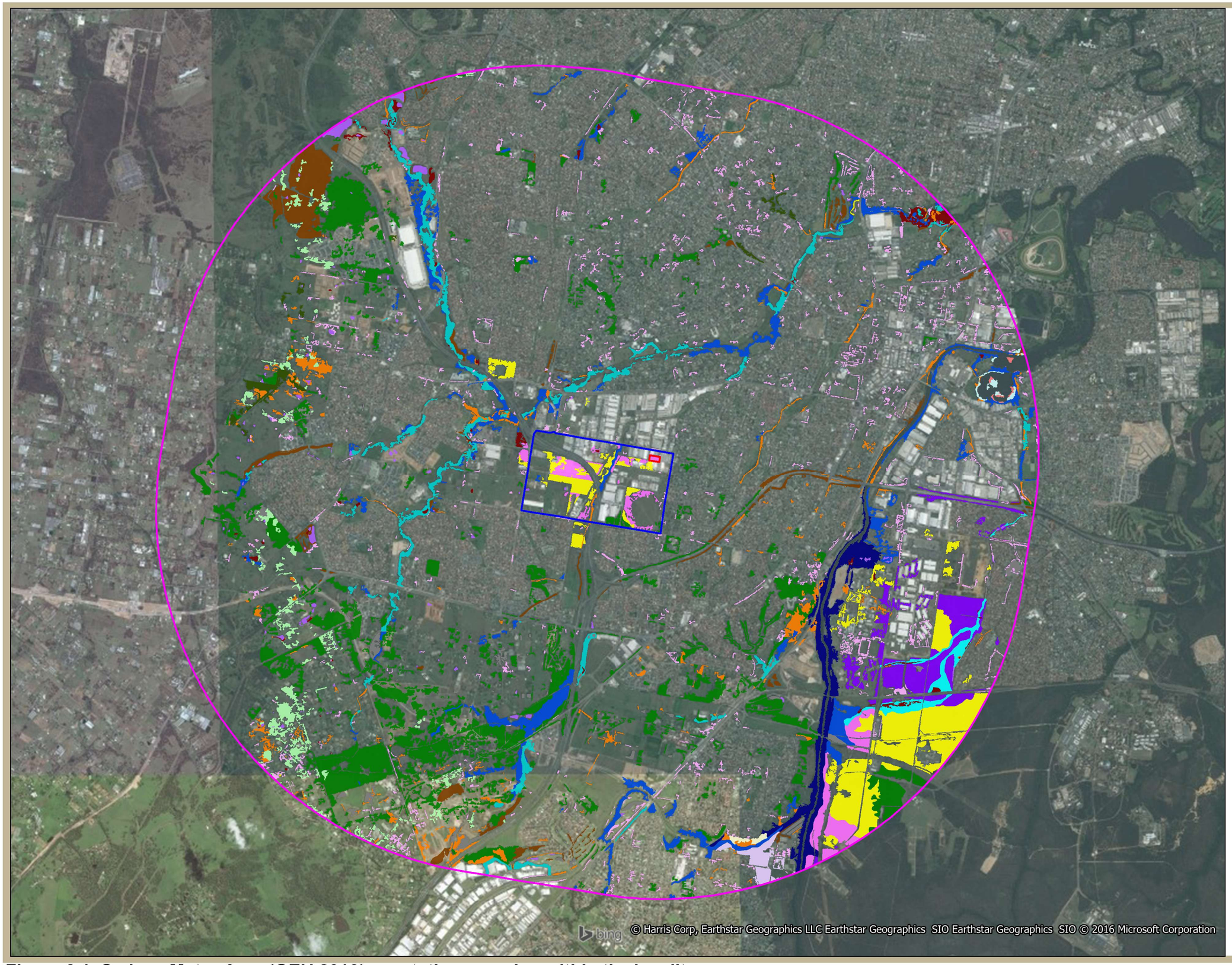
Table 3.1 Likelihood of Occurrence of threatened flora and fauna within the study area and subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	5 km search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V		23	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Found along the east coast from south Queensland to southern NSW.	Potential to occur. Potential habitat present within the study area.	No
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	V		1	Associated with dry hardwood forest and woodlands. Habitats typically include gum barked and high nectar producing species, including winter flower species. The presence of hollow bearing eucalypts is a critical habitat value.	Unlikely to occur. No suitable habitat present.	No
Phascolarctidae	*Phascolarctos cinereus*	Koala	V	V	9	Inhabit eucalypt woodlands and forests. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range.	Unlikely to occur. No suitable habitat present.	No
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	47	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria.	Potential to occur. Potential forage habitat present within the study area. No known breeding camps within the study area.	No
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V		5	Prefers moist habitats, with trees taller than 20m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in	Potential to occur. Potential habitat present within the study area.	No

Table 3.1 Likelihood of Occurrence of threatened flora and fauna within the study area and subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	5 km search	Habitat Requirements	Likelihood of Occurrence	Subject Species?
						buildings. Found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania.		
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V		11	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Occur along the east and north-west coasts of Australia.	Potential to occur. Highly mobile species which may utilise the site as part of a larger foraging area. No suitable roost habitat within the subject site.	No
Vespertilionidae	*Myotis macropus*	Southern Myotis	V		7	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage. Found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers.	Unlikely to occur. No permanent waterbodies present on the subject site. Limited habitat available within the study area.	No
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V		14	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.	Potential to occur. Highly mobile species which may utilise the site as part of a larger foraging area. No suitable roosting habitat present.	No

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Subject Site
- Study Area
- Locality (5km radius)

Vegetation Community

- Castlereagh Ironbark Forest
- Castlereagh Scribbly Gum Woodland
- Castlereagh Shale-Gravel Transition Forest
- Castlereagh Swamp Woodland
- Cumberland Shale Hills Woodland
- Cumberland Shale Plains Woodland
- Cumberland Moist Shale Woodland
- Cumberland Riverflat Forest
- Cumberland Swamp Oak Riparian Forest
- Hinterland Riverflat Eucalypt Forest
- Sydney Hinterland Grey Gum Ridgetop Forest
- Sydney Hinterland Apple-Blackbutt Gully Forest
- Estuarine Swamp Oak Forest
- Estuarine Reedland
- Coastal Freshwater Wetland
- Artificial Wetlands
- Plantations
- Urban Native and Exotic Cover
- Weeds and Exotics
- Cleared

Grid North

Data Source:
OEH (2013). The Native Vegetation of the Sydney Metropolitan Area. Office of Environment and Heritage NSW.

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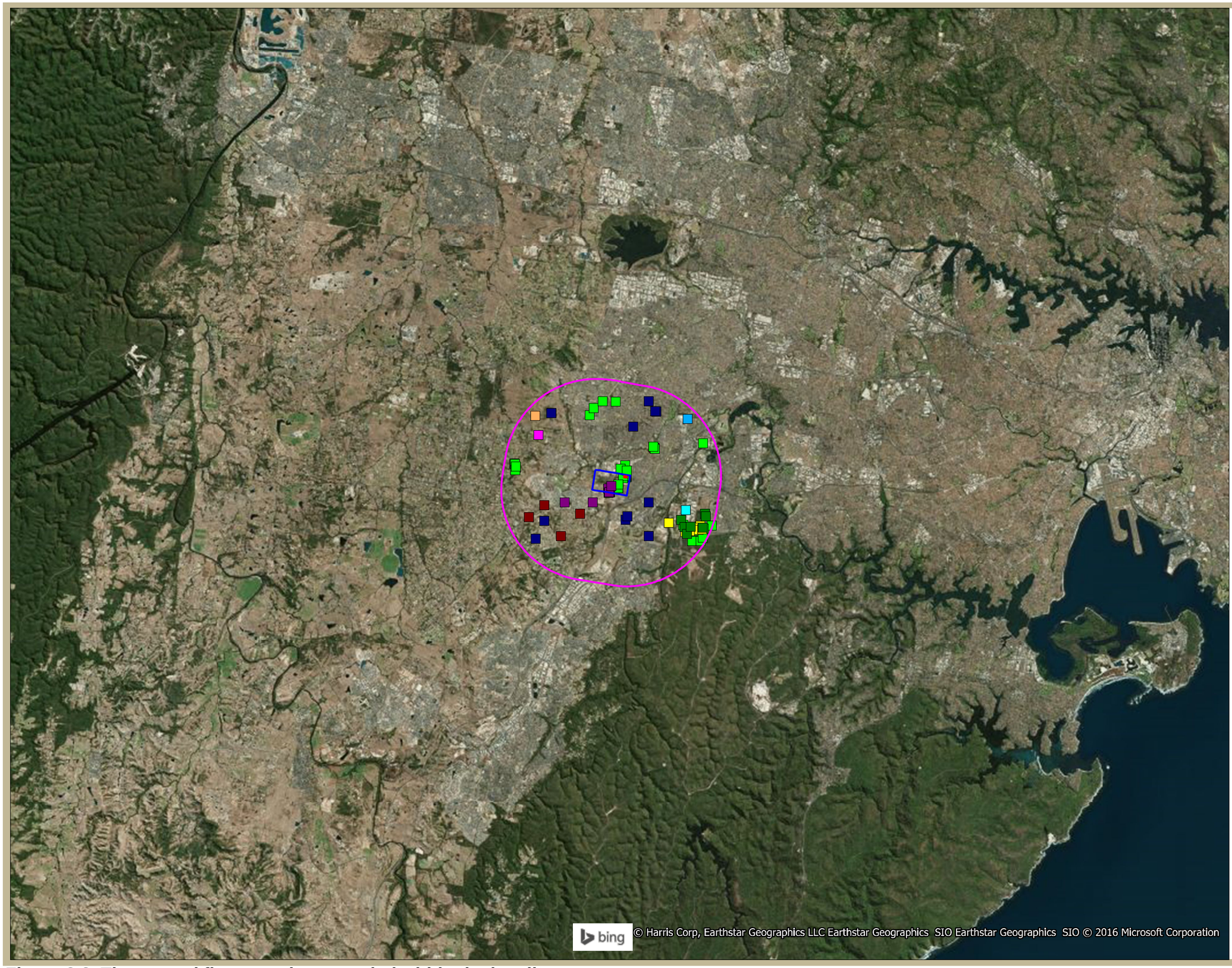
0.5 0 0.5 1 1.5 2 km

I:\...\14150\Figures\RP1_SIS\20160808\Figure 3.1. Sydney Metro Vegetation_Locality

Figure 3.1. Sydney Metro Area (OEH 2013) vegetation mapping within the locality

Coordinate System: MGA Zone 56 (GDA 94)



N
Grid North

Data Source:
BioNet Atlas of NSW Wildlife
© NSW Office of Environment and Heritage
dated 01/01/1980-13/01/2016

Map Scale: 1:250,000

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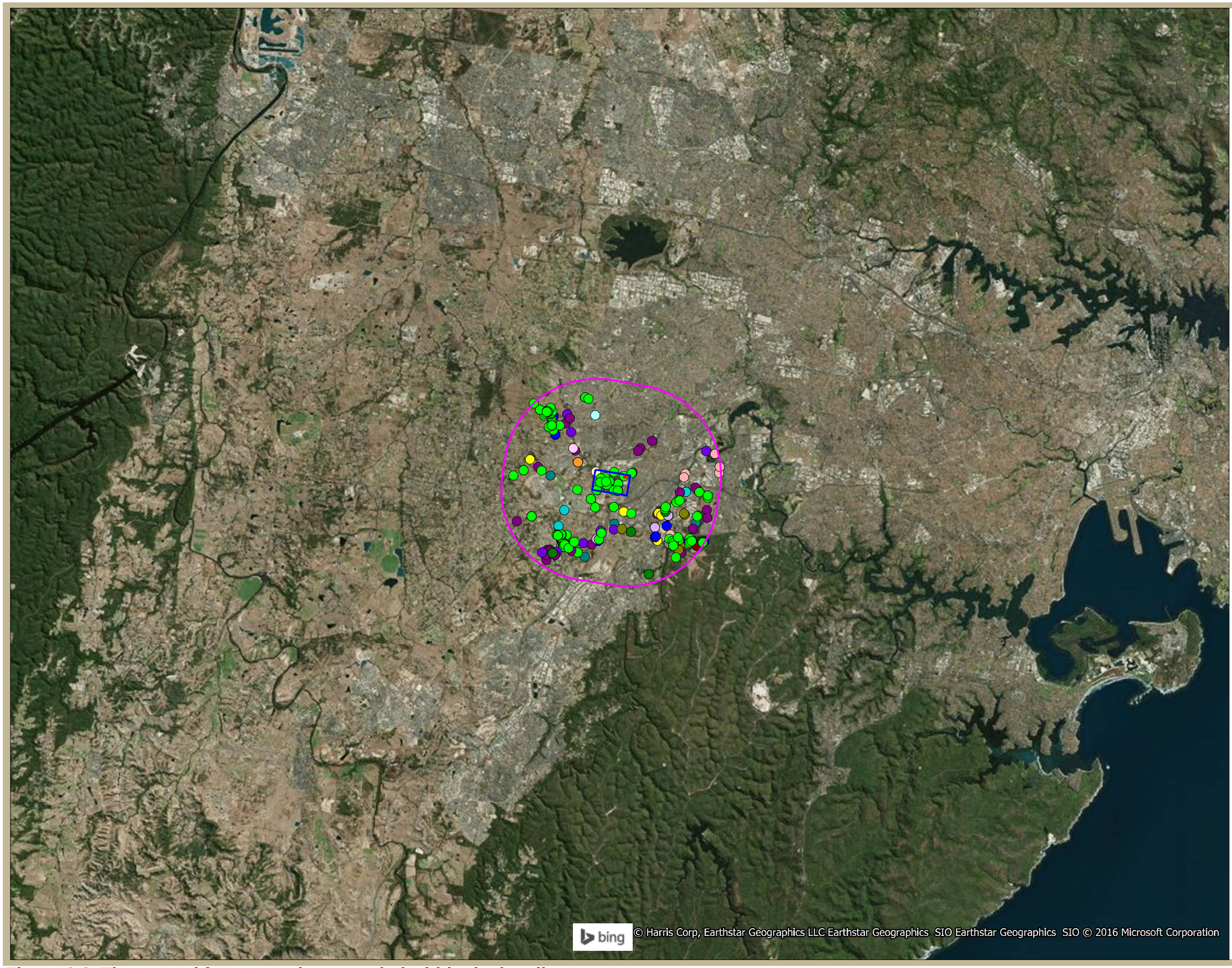
I:\...\14150\Figures\RP1_SIS\20160808\Figure 3.2. Threatened Flora Records_Locality

Figure 3.2. Threatened flora species recorded within the locality

2.5 0 2.5 5 7.5 10 m

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Subject Site
- Study Area
- Locality (5km radius)

Threatened Fauna Records

- Black Falcon
- Cumberland Plain Land Snail
- Eastern Bentwing-bat
- Eastern False Pipistrelle
- Eastern Freetail-bat
- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Greater Broad-nosed Bat
- Green and Golden Bell Frog
- Grey-headed Flying-fox
- Koala
- Little Eagle
- Little Lorikeet
- Powerful Owl
- Southern Myotis
- Speckled Warbler
- Spotted Harrier
- Spotted-tailed Quoll
- Squirrel Glider
- Swift Parrot
- Varied Sittella
- Yellow-bellied Sheathtail-bat

N
Grid North

Data Source:
BioNet Atlas of NSW Wildlife
© NSW Office of Environment and Heritage
dated 01/01/1980-13/01/2016

Map Scale: 1:250,000

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I:\...\14150\Figures\RP1_SIS\20160808\Figure 3.3. Threatened Fauna Records_Locality

Figure 3.3. Threatened fauna species recorded within the locality

2.5 0 2.5 5 7.5 10 m

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, including targeted threatened species surveys within the study area in January 2015, November 2015, February 2016 and March 2016. Additionally, previous studies conducted within the locality provided a useful database of information which has supplemented the surveys undertaken within the study area.

Flora and fauna surveys were conducted, where appropriate, in accordance with guidelines provided in the OEH (then DEC) *Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (Working Draft) (DEC (NSW), 2004)*. Each of the methods utilised by Cumberland Ecology is described in detail in ***Sections 4.2*** and ***Section 4.3*** below.

4.2 Survey Techniques

DGR 4.2 *Documentation of survey effort and technique*

DGR 4.2.1 *Description of survey techniques and survey sites*

4.2.1 Vegetation Mapping

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

Cumberland Ecology conducted additional vegetation mapping within the study area and subject site in January 2015, February 2016 and March 2016 to ground-truth the condition and extent of vegetation communities. The vegetation mapping was modified to reflect the site specific data from these surveys. The resultant information was synthesised using Geographic Information Systems (GIS) to create a vegetation map of the study area (see **Figure 4.1**). Mapping was completed using MapInfo Professional Version 15.0.

4.2.2 Flora Surveys

Cumberland Ecology conducted flora surveys of the study area on 22nd January 2015, 21st January 2016, 25th February 2016 and 3rd March 2016. These surveys involved the following:

- Flora plot and transects;
- Random meander surveys; and
- Targeted searches for threatened flora.

i. Flora plot and transects

Two (2) flora plot and transects using the BioBanking Assessment Methodology (BBAM) (DECC 2009) were collected. The location of the plots is shown in **Figure 4.2.** Plot locations were selected randomly in areas representative of the varying conditions of the vegetation within the study area. The following data was collected at each plot:

- Ground-truthing of existing vegetation maps and establishment of boundaries of the extent of vegetation communities within the study area;
- Native species richness recorded within each stratum of a 20 m x 20 m plot;
- Native over-storey projected foliage cover recorded at 10 points along a 50 m transect;
- Native mid-storey projected foliage cover recorded at 10 points along a 50 m transect;
- Native groundcover projected foliage cover recorded at 10 points along a 50 m transect for three life forms (shrubs, grasses and other);
- Weed species projective foliage cover expressed as a percentage of over-storey, mid-storey and ground cover along a 50 m transect;
- Number of trees with hollows where entrance width is over 5 cm and hollow is at least 1 m above ground within the 20 m x 50 m plot;
- The percentage of regenerating canopy species within the vegetation zone; and
- The total length in metres of fallen logs over 10 cm in diameter within the 20 m x 50 m plot.

In addition, native plant species richness within a 20 m x 20 m plot and full floristic data was also collected to enable classification of each vegetation zone to the best-fit NSW plant community type. The floristic data is presented in a combined flora list in **Appendix C**.

ii. Random meander surveys

Random meander surveys were undertaken to obtain information on species composition and community structure for flora species within the study area. Random meander transects were undertaken within all vegetation communities and are shown on **Figure 4.2**.

iii. Targeted threatened flora searches

Targeted searches for threatened flora species were conducted using the random meander survey method (Cropper 1993). Surveys included searching for individuals and suitable habitat for threatened flora species known from the locality.

4.2.3 Fauna Surveys

Cumberland Ecology conducted fauna surveys across the study area in November 2015, February 2016 and March 2016. All surveys were based on requirements found in the Draft Threatened Species Survey and Assessment Guidelines (DEC (NSW), 2004). Surveys conducted included the following:

- Habitat assessments;
- Diurnal bird surveys;
- Bat surveys;
- Cumberland Plain Land Snail searches; and
- Opportunistic observations.

A description of these survey techniques are provided below.

i. Habitat assessment

The nature and extent of fauna habitats within the study area were assessed and areas where threatened fauna species could reside or forage were identified. Site assessments for threatened and native fauna included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bushrock, caves and crevices, manmade structures, riparian areas, wetlands and waterbodies. The structural complexity of vegetation, the age structure of the woodland and the nature and extent of human disturbance throughout the study area was also considered. Structural features considered included the extent and nature of the understorey and ground stratum, extent of canopy and flowering characteristics of flora. Indirect indicators of fauna use of the site such as droppings, diggings, footprints, scratches, nests, burrow paths and runways were recorded.

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

Locations of habitat assessment points are shown on **Figure 4.2**.

ii. Diurnal Bird Surveys

Visual observation and call identification of diurnal birds was carried out during the November 2015 surveys. Two (2) 30 minute diurnal bird census points were surveyed between two ecologists equating to a total of 60 minutes survey effort at each diurnal bird census survey point. Diurnal birds were also identified and recorded as they were encountered throughout the duration of other surveys.

The location of diurnal bird surveys are shown on **Figure 4.2**.

iii. Bat Surveys

Microchiropteran bats (microbats) were surveyed on the subject site through the use of Anabat Z-caim and SongMeter2BAT+ (SM2) units to record ultrasonic bat recordings and harp traps.

Two units were employed during the survey to record calls of microbats and were left at each survey location for two nights. Units were set before dusk each evening and set to automatically switch off after dawn. Calls recorded on each unit were analysed to determine which species were present within the subject site. In conjunction to this, two harp traps were set up along potential flight paths to catch any bats that may be utilising the area and were left at each survey location for two nights. Traps were checked each morning after dawn. Locations of the Anabat, SM2 and harp traps are shown on **Figure 4.2**.

iv. Cumberland Plain Land Snail searches

A survey of Cumberland Plain Land Snail activity was conducted on an adaptation of the methodology known as the Regularised Grid-Based Spot Assessment Technique (RGB-SAT) protocol developed by Biolink (Biolink, 2008), generally used to detect Koala scats. The spot assessment technique did not adhere strictly to a grid based protocol, but rather sampled representative sites within the study area, with a greater density of survey effort within the subject site.

A total of 22 sampling points were collected across the study area. Searches of five minutes in duration were made within one metre of each tree for either live snails, or snail shells. Trees that were targeted included those which provided suitable habitat for the species, predominantly those with a diameter at breast height (DBH) of over 10cm and having a layer of bark around their base. Typical species included *Eucalyptus moluccana* (Grey Box).

v. Opportunistic observations

Any vertebrate fauna species that were observed, heard calling, or otherwise detected on the basis of tracks or signs were recorded and listed in the species list for 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

Recent surveys conducted by Cumberland Ecology in January 2015, January 2016, February 2016 and March 2016 within the study area are summarised in **Table 4.1**.

Table 4.1 Flora surveys conducted within the study area

Survey Technique	Date	Number of Plots	Person Hours
20x50 Floristic BioBanking Plot	22/01/2015	2	12
Random Meander Survey	25/02/2016	n/a	16
Random Meander Survey	03/03/2016	n/a	16
Random Meander Survey	20/06/2016	n/a	16
Threatened Flora Search	22/01/2015	n/a	6
Threatened Flora Search	21/01/2016	n/a	16
Threatened Flora Search	25/02/2016	n/a	16
Threatened Flora Search	03/03/2016	n/a	16
Threatened Flora Search	20/06/2016	n/a	16

4.3.2 Fauna Survey Effort

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

Table 4.2 Fauna surveys conducted within the study area

Survey Technique	Date	Total Survey Effort
Habitat assessment	22 January 2015, 25 February 2016, 3 March 2016, 20 June 2016	32 person hours
Diurnal bird census	18-19 November 2015	1.33 person hours (4 x 20 min searches)
Anabat and SM2	18-19 November 2015	48 person hours (2 units x 12 hours for 2 nights)
Harp trap	18-19 November 2015	48 person hours (2 traps x 12 hours for 2 nights)

Table 4.2 Fauna surveys conducted within the study area

Survey Technique	Date	Total Survey Effort
Cumberland Plain Land Snail search	22 January 2015, 25 February 2016, 3 March 2016	2 person hours (24 trees x 5 min searches)
Incidental Observations	throughout survey periods	n/a

4.3.3 Weather Conditions

Weather conditions during flora and fauna surveys were generally appropriate for detection of a variety of flora and fauna. Surveys were undertaken in late Spring (November 2015), mid Summer (January 2015 and January - February 2016), early Autumn (March 2016) and mid Winter (June 2016). A summary of weather conditions in the wider locality of the study area during the flora and fauna survey periods is provided below in **Table 4.3**.

Weather station data was obtained from the Automatic Weather Station at Holsworthy Aerodrome NSW (AWS066161) (Bureau of Meteorology, 2016).

Table 4.3 Weather conditions during surveys

Date	Min Temperature (ºC)	Max Temperature (ºC)	Rainfall (mm)
22/01/2015	20.0	29.8	2.2
18/11/2015	12.5	36.9	0
19/11/2015	14.6	38.9	0
21/01/2016	21.4	38.7	0
25/02/2016	18.7	40.3	0
03/03/2016	19.6	32.7	0
20/06/2016	12.0	18.9	29.0

4.3.4 Survey Personnel

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

Table 4.4 Survey personnel

Survey Personnel	Role	Contact Details
David Robertson	Project Manager/Ecologist	(02) 9868 1933
Bryan Furchert	Botanist	(02) 9868 1933
Cecilia Phu	Botanist	(02) 9868 1933
Katrina Wolf	Ecologist	(02) 9868 1933
Emily Cave	Ecologist	(02) 9868 1933
Matthew Freeman	Ecologist	(02) 9868 1933
Alex Pursche	Ecologist	(02) 9868 1933
Michelle Frolich	Ecologist	(02) 9868 1933

4.4 Survey Results

DGR 4.2 *Documentation of survey effort and technique*

DGR 4.2.2 *Documenting survey effort and results*

4.4.1 Vegetation Communities

The following vegetation communities were identified and mapped within the study area (see **Figure 4.1**):

- Cooks River/Castlereagh Ironbark Forest;
- Cumberland Plain Woodland;
- River-flat Eucalypt Forest;
- Swamp Oak Forest; and
- Shale Gravel Transition Forest.

Of these communities listed above, only Cooks River/Castlereagh Ironbark Forest occurs within the subject site and is considered to be affected by the proposed development.

i. Cooks River/Castlereagh Ironbark Forest

This community occurs across almost the entirety of the subject site and is approximately 0.90 ha in size. The community is a degraded, regrowth occurrence of the community, completely lacking in remnant trees, with a relatively intact shrub layer, and a ground layer frequently dominated by an exotic grass. Dumped rubbish is common within the community

occurrence, and the patch is isolated from other occurrences of the community by urban development.

The canopy layer is characterised by a small tree sized, regrowth layer of scattered *Eucalyptus fibrosa* (Red Ironbark) and *Melaleuca decora.* A dense shrub layer is present within the subject site and dominated by *Melaleuca nodosa* (Prickly-leaved Paperbark), *Melaleuca decora*, *Dillwynia sieberi* and *Cryptandra spinescens*. Other shrub species include *Bursaria spinosa* (Blackthorn), *Ozothamnus diosmifolius* (Rice Flower), *Denhamia silvestris* (Narrow-leaved Orangebark) and *Acacia pubescens* (Downy Wattle).

The ground layer is sparse and dominated by the exotic grass *Eragrostis curvula* (African Lovegrass), and other exotic species such as *Verbena bonariensis* (Purpletop), *Bidens pilosa* (Cobbler's Pegs), and *Senecio madagascariensis* (Fireweed) are common. Native grass species occur less frequently within the ground layer and include *Entolasia stricta* (Wiry Panic), *Paspalidium distans*, and *Aristida vagans* (Threeawn Speargrass). Other native ground layer species include *Lepidosperma laterale*, *Lomandra filiformis subsp. filiformis* (Wattle Mat-rush), *Cheilanthes sieberi* and *Brunoniella australis* (Blue Trumpet).

Climbers within this community include the natives *Cassytha pubescens* (Devil's Twine), *Glycine clandestina,* and *Glycine microphylla*, and the exotic weeds *Asparagus asparagoides* (Bridal Creeper) and *Araujia sericifera* (Moth Vine). The native mistletoe *Amyema gaudichaudii* is a common occurrence on *Melaleuca* spp. within the community, and *Amyema miquelii* occurs on some of the *Eucalyptus fibrosa* individuals.

An example of the characteristics of this community is shown in **Photograph 4.1**.

Photograph 4.1 Cooks River/Castlereagh Ironbark Forest within the subject site

4.4.2 Flora

i. Threatened species

Targeted threatened species searches within the study area recorded three threatened flora species including:

- *Acacia pubescens* (Downy Wattle),
- *Marsdenia viridiflora*, and
- *Pultenaea parviflora* (Sydney Bush-pea).

a. Acacia pubescens (Downy Wattle)

This species is a spreading shrub, 1-5 metres high with brilliant yellow flowers, bipinnate leaves and conspicuously hairy branchlets. It occurs on alluviums, shales and at the intergrades between shales and sandstones. This species occurs in open woodland and forest, in a variety of vegetation communities including Cooks River/Castlereagh Ironbark Forest, Alluvial Woodland, Shale/Gravel Transition Forest and Cumberland Plain Woodland (NSW NPWS, 2003).

Approximately 84 individuals were recorded within the subject site and over 220 individuals were recorded within the study area. Locations of the records are shown on **Figure 4.3** and examples of *Acacia pubescens* recorded within the subject site are shown in **Photograph 4.2** and **Photograph 4.3**.

Photograph 4.2 *Acacia pubescens* plant recorded within the subject site

Photograph 4.3 Close-up of *Acacia pubescens* showing the hairy branchlets

4.4.3 Fauna

i. Fauna habitat

Fauna habitat within the subject site is predominantly forest vegetation with a dense shrub layer. Small areas of cleared land exist within the subject site, generally along the property fencelines as well as a small area in the centre of the subject site that is void of canopy though an exotic ground layer persists. This vegetation can provide habitat for foraging avifauna, however as the trees are young, no hollows were detected and therefore it is not considered to provide roost or breeding habitat for avifauna or microbats. A stag with decorticating bark was recorded within the western portion of the subject site and may provide roost habitat for microbats, though no visible signs of use were detected during surveys. No visible hollows were observed in this stag.

Log piles and rubbish dumped within the subject site may provide shelter, roost or breeding habitat for reptiles. Though no threatened species of reptiles were identified during surveys, they may still provide habitat for non-threatened species.

Across the study area, fauna habitat features include hollow bearing trees, culverts, soaks, log piles and fallen logs. These features are shown in **Figure 4.4**. Hollow bearing trees are predominantly located in the vegetation in the south-east of the study area where stands of larger remnant trees exist. Fauna habitat within the study area is limited due to the highly disturbed and fragmented vegetation and clearing for urban and industrial development. The habitat is largely degraded.

ii. Diurnal bird surveys

A total of thirteen bird species were recorded during diurnal bird surveys of the subject site. These species were common for the area and habitat type. It is likely that additional common species utilise the subject site and surrounds as part of a larger foraging habitat and so this list is not exhaustive. A species list for the subject site based on the surveys is provided in **Table 4.5**.

No threatened bird species were recorded during the diurnal bird surveys.

Table 4.5 Diurnal bird species recorded within the subject site

Family	Scientific Name	Common Name
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo
Columbidae	*Streptopelia chinensis*	Spotted Dove
Maluridae	*Malurus cyaneus*	Superb Fairy-wren
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater
Meliphagidae	*Lichenostomus penicillatus*	White-plumed Honeyeater
Monarchidae	*Grallina cyanoleuca*	Magpie-lark
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush
Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet
Sturnidae	*Sturnus tristis*	Common Myna

iii. Microbat surveys

Bat calls recorded on the Anabat and SM2 were analysed for threatened bat species. Data was recorded on the Anabat but no data was recorded on the SM2. Analysis of the calls on the Anabat by Cumberland Ecology's Zoologist detected two non-threatened bat species, Gould's Wattled Bat and White-striped Freetail-bat, and one possible detection of the threatened species Yellow-bellied Sheathtail-bat, listed as Vulnerable under the TSC Act.

No threatened microchiropteran bat species were recorded during the targeted survey using the harp trap.

Threatened species recorded are shown in **Figure 4.3**.

iv. Cumberland Plain Land Snail searches

Targeted searches for the Cumberland Plain Land Snail did not detect the presences of this species. Trees identified as potential habitat within the subject site for this species were considered to provide low suitability of habitat.

v. Opportunistic observations

No other fauna species were encountered during the survey periods.

vi. Threatened and Migratory species

Potentially occurring threatened fauna species that are likely to occur within the subject site and surrounds consist largely of avifauna and bats. Additional to those species confirmed as present on the subject site, potentially occurring threatened fauna species include:

- Eastern Bentwing-bat;
- Eastern Freetail-bat;
- Grey-headed Flying Fox;
- Little Eagle; and
- Black Falcon.

The occurrence of the majority of threatened fauna species is considered to be limited to occasional passage through the subject site as part of a wider foraging range.

Coordinate System: MGA Zone 56 (GDA 94)

Grid North

Legend

- Subject site
- Study area

Vegetation Community

- Cooks River / Castlereagh Ironbark Forest
- Cooks River Swamp Forest
- Cumberland Plain Woodland
- Shale Gravel Transition Forest
- River-flat Eucalypt Forest
- Swamp Oak Forest
- Freshwater Wetland
- Planted Natives
- Cleared

Image Source:
Image © 2016 Aerometrex
(dated 1-1-2014)

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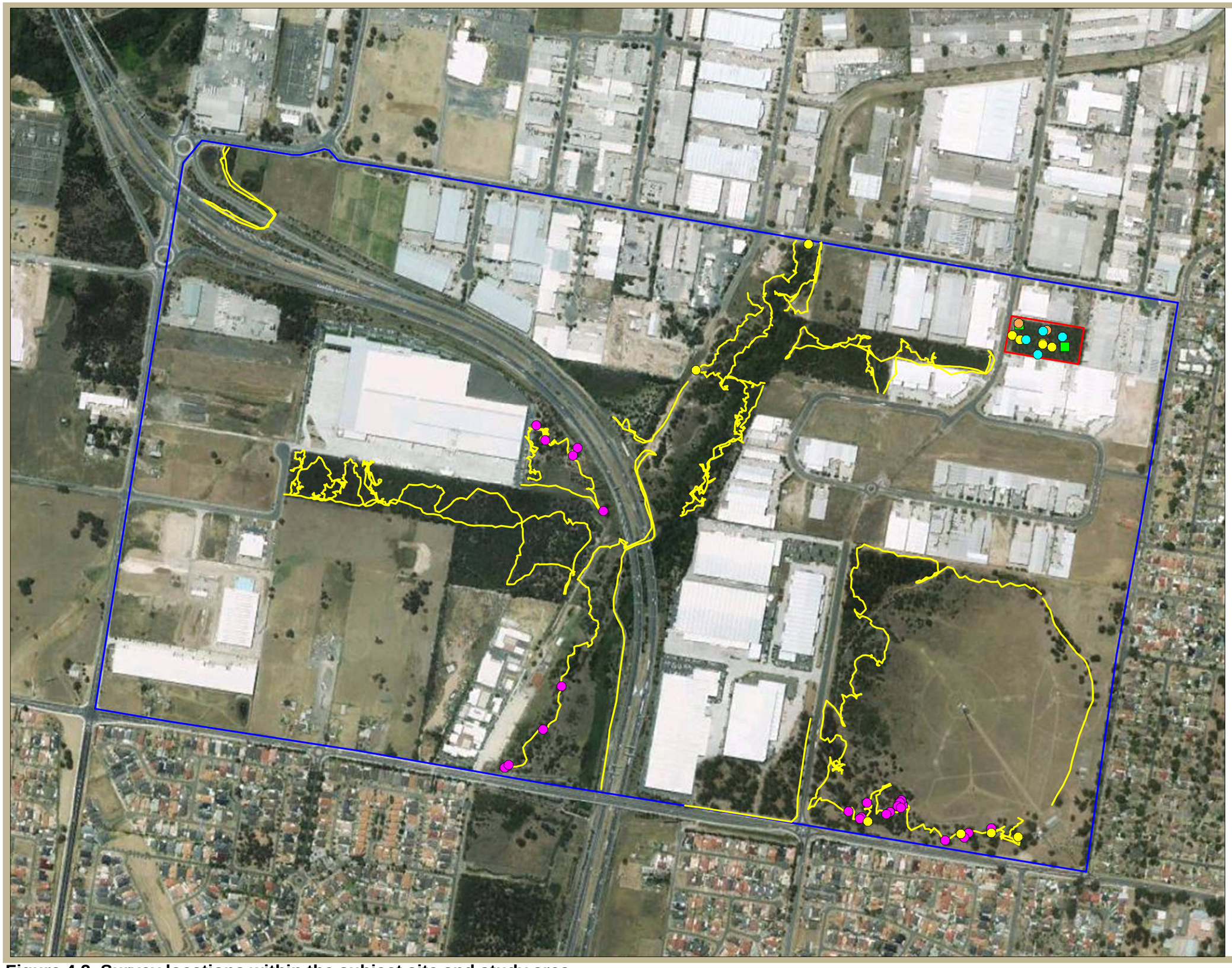
I:\...\14150\Figures\RP1_SIS\20160808\Figure 4.1. Vegetation Communities_Study Area

Figure 4.1. Vegetation communities within the subject site and study area

100 0 100 200 300 400 m

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Subject site
- Study area

Survey Locations

- Flora Quadrat Location
- Bat Echolocation Device/Harp Trap
- Bird Census Point
- Cumberland Plain Land Snail Search
- Habitat Assessment
- Random Meander Transect

Grid North

Image Source:
Image © 2016 Aerometrex
(dated 1-1-2014)

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I:\...\14150\Figures\RP1_SIS\20160808\Figure 4.2. Survey Locations_Study Area

Figure 4.2. Survey locations within the subject site and study area

100 0 100 200 300 400 m

Coordinate System: MGA Zone 56 (GDA 94)

Legend

- Subject site
- Study area

Threatened Flora

- *Acacia pubescens*
- *Marsdenia viridiflora*
- *Pultaneaea parviflora*

Grid North

Image Source:
Image © 2016 Aerometrex
(dated 1-1-2014)

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I:\...\14150\Figures\RP1_SIS\20160913\Figure 4.3. Threatened Species_Study Area

Figure 4.3. Threatened species recorded within the subject site and study area

100 0 100 200 300 400 m

Coordinate System: MGA Zone 56 (GDA 94)

Legend

- Subject site
- Study area
- Waterway

Habitat Features

- Hollow-bearing Tree
- Wetland vegetation
- Dam/Water pool
- Culvert
- Stag with decorticating bark
- Nest
- Log pile

Grid North

Image Source:
Image © 2016 Aerometrex
(dated 1-1-2014)

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I:\...\14150\Figures\RP1_SIS\20160913\Figure 4.4. Habitat Features_Study Area

Figure 4.4. Habitat features within the subject site and study area

100 0 100 200 300 400 m

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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.

i. Vegetation communities

The subject site is approximately 1 ha in size, with 0.90 ha comprising the native vegetation community Cooks River/Castlereagh Ironbark Forest. This community is listed as a CEEC under both the TSC Act and the EPBC Act. The proposed development will result in the complete removal of the 0.90 ha of this community. The remaining 0.10 ha of the subject site is comprised of cleared areas and exotic groundcover.

A more detailed discussion of the impacts to the CEEC recorded within the subject site and study area is provided in ***Chapter 6***.

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; and
- Loss of hollow-bearing trees.

The key threatening processes above listed occurring as a result of the proposal will remove suitable features for a range of native fauna species including threatened species. The habitat utilised by threatened species is within the Cooks River/Castlereagh Ironbark Forest. This area provides suitable forage habitat for threatened bats and birds known to occur in the locality.

The proposed development will not result in the loss of hollow-bearing trees as none have been recorded within the subject site. Other habitat features present within the site that will be removed include log piles and dumped rubbish, however it is not considered that these features provide suitable habitat for threatened species and as such impacts will be minor.

Although the habitat for threatened species provided by the native vegetation within the subject site will be removed, these impacts are considered to have only minor impacts on the threatened species likely to use them. The habitat to be removed is relatively small and suitable habitat will be retained within the study area and locality.

iii. Threatened species

The clearing of vegetation within the subject site will directly remove potential, albeit marginal, foraging habitat for highly mobile threatened fauna species, such as the Swift Parrot, microchiropteran bats and Grey-headed Flying Fox. However, the subject site lacks important habitat features, such as hollow-bearing trees. This scarcity of habitat features suggests that it would be unlikely for these species to be dependent on the habitats present. The majority of threatened species within the locality are likely to only utilise the habitat within the subject site as part of a much broader foraging range.

One threatened flora species will be affected by the proposed development. The 84 individuals and 0.90 ha of habitat for *Acacia pubescens*, a species listed as Vulnerable under both the TSC Act and EPBC Act will be removed from the subject site. However, these impacts are considered to have minor impacts on the remaining records of this species within the study area and locality, with approximately 37 ha of potential habitat and over 220 individuals remaining within the study area. Further discussion on the broader population of this species is provided in **Section 5.3.1**.

Although suitable habitat for threatened species will be impacted as a result of the proposal, the impacts are not seen to significantly impact any of these species such that a local population would be placed at risk of extinction in the short or long-term. Suitable habitat for all affected species will be retained within the study area and locality.

5.1.2 Indirect Impact of Development

i. Habitat fragmentation

The clearing of native vegetation can result in 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 development will remove approximately 0.90 ha of 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 vegetation within the subject site is located at the edge of a larger patch of remnant native vegetation. Fragmentation of the patch will not occur, however the loss of vegetation within the subject site will result in further encroachment on the remaining patch of native vegetation. Proposed removal of this small area of vegetation and habitat is not expected to result in further fragmentation of native vegetation; however it will result in a slight decrease in size of the vegetated corridor, extending the distance to fragmented remnants in the residential areas to the east of the subject site.

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 subject site is surrounded by developments and disturbed areas already exist, the vegetation within the subject site currently experiences the negative impacts of edge effects. As all vegetation within the subject site will be removed, impacts from edge effects will not perpetuate. The area of remnant vegetation to the west of the subject site, would currently also experience the negative impacts of edge effects, as it is also surrounded by existing developments with its eastern border on Lyn Parade. Although the proposal will increase the edge effects on vegetation and habitat within the study area, these effects are likely to have only minor impacts on the flora and fauna present as they currently utilise habitat experiencing these effects.

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 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 development 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. Sediment and erosion controls will be implemented to reduce any potential impacts on waterways during the construction phase of the project. The design also includes the installation of stormwater drains to ensure that stormwater will be channelled to an appropriate location and ensures sedimentation and erosion does not occur more than at present. Due to the highly industrial surrounding, the risk of erosion of the surrounding area is much reduced.

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 likely to be affected by the action (Section 110 (2)(c)).

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. The species and populations selected as "affected" include threatened flora and fauna species that are known to occur in the locality, with database records in the locality and with suitable habitat within the subject site.

Due to the highly urbanised setting of the subject site and the dense shrubby vegetation present within the subject site, the subject species identified within **Chapter 3** have been refined and assessed as affected species.

Acacia pubescens is considered most likely to be affected by the proposal and is therefore assessed in subsequent sections of this chapter.

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

> *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 and habitat utilisation

DGR 5.2.2 Discussion of other populations in the region

DGR 5.3 Assessment of habitat

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*

The condition of habitat within the study area and its suitability for subject species shall be discussed. Matters to be included, where relevant, are:

- *Specific habitat features (e.g. frequency and location of stags, hollow bearing trees, culverts, rock shelters, rock outcrops, crevices, caves, drainage lines, soaks etc.) and the density of understorey vegetation and groundcover.*
- *The prevalence of introduced species, species of weeds present and an estimate of the total weed cover as a percentage of each vegetation community, whether trampling or grazing is apparent, effects of erosion, prevalence of rubbish dumping, history of resource extraction or logging and proximity to roads.*
- *Details of the subject sites fire history (e.g. frequency, time since last fire, intensity) and the source of fire history (e.g. observation, local records).*

The significance of the habitat of the subject site for subject species, in comparison to the known habitat for those species within the region, shall be assessed.

DGR 5.4 *Discussion of conservation status*

For each species or populations likely to be affected, details of its local, regional and State-wide conservation status,...[and]... its habitat requirements ... (Section 110(2)(c)).

5.3.1 Acacia pubescens

i. *Discussion of local and regional abundance and distribution*

a. Discussion of other known local populations and habitat utilisation

A total of 84 individuals of *Acacia pubescens* have been recorded within the subject site (See **Figure 4.4**). These records vary from saplings (<0.5 m tall) to mature shrubs (approximately 5 m tall). Habitat available within the subject site for this species is provided in the Cooks River/Castlereagh Ironbark Forest, comprising 0.90 ha.

More than 220 individuals of this species have been recorded within the study area, with a further 240 individuals known within the locality from database records. Records are located predominantly in the eastern portion of the study area dated between 1999 and 2004. Two of these recorded locations are listed as having a size of 200 individuals. Locations of *Acacia pubescens* records within the locality are concentrated in four areas, being Moorebank, Prestons, West Hoxton Park and the Green Valley-Bonnyrigg area (see **Figure 3.2**). A population also occurs at Ashcroft with an outlying record located at

Liverpool. Approximately 37 ha of potential habitat for *Acacia pubescens* is present within the study area and a further 1,342 ha of potential habitat is present within the locality.

Most of the recorded locations of *Acacia pubescens* within the locality are on private properties or disturbed road verges, and only one of the populations at Moorebank is located within the Holsworthy Military reserve. There are no recorded locations of this species within any conservation areas in the locality. The population at Ashcroft is located on the outskirts of Ireland Park within the Liverpool LGA.

The clearance of this species within the subject site comprises approximately 27% of individuals recorded within the study area and approximately 20% of individuals known to occur within the locality. Whilst the clearance of individuals within the study area is significant, it will not have a significant impact on the viability of the species within the locality. Several locations of *Acacia pubescens* will remain within the study area and locality, with a large proportion of habitat remaining. Only 2% of habitat within the study area will be removed and less than 1% of habitat within the locality will be removed.

b. Discussion of other populations in the region

Acacia pubescens is found exclusively within the Sydney region. The species is predominantly located in the Milperra, Beverly Hills, Rookwood, Wetherill Park and Pitt Town areas, with outliers at Mountain Lagoon, Woodford, Oakdale and Menai (see **Figure 5.1**).

There are approximately 4,900 locations of *Acacia pubescens* recorded since 1980 on the Cumberland Plain with the majority of records concentrated between Milperra, Beverly Hills, Rookwood Cemetery and Wetherill Park. Based on the database records, it is estimated that there is approximately 300 populations or more, spread across the region. Populations range in size from a few individuals up to 5,000 plants. Of these, 78 recorded locations comprising ten populations occur within conservation reserves on the Cumberland Plain, being Scheyville National Park, Prospect Nature Reserve and Georges River National Park. It is estimated that approximately 11,000 individuals are located within these conservation reserves. A further six populations are recorded in the wider region within Wollemi National Park, Burragorang State Conservation Area and Blue Mountains National Park.

Approximately 13 recorded locations of this species occur within E2 – Environmental Conservation lands across the region, with an estimated 200 individuals. Records within this zone will be subject to management for nature conservation.

The clearance of *Acacia pubescens* within the subject site is not considered to be a significant impact on the species within the region and the viability of the species is not expected to decrease as a result of the proposal due to the large number of individuals and populations and available habitat that will remain and are currently conserved across the region.

ii. Assessment of habitat

a. Description of habitat values

Suitable and known habitat for *Acacia pubescens* occurs within the subject site and study area, predominantly found within the Cooks River/Castlereagh Ironbark Forest which comprises the entirety of the subject site. This species is often associated with the understorey species *Melaleuca nodosa*, *Melaleuca styphelioides*, *Angophora bakeri*, *Ozothamnus diosmifolius*, *Acacia parramattensis*, *Dillwynia sieberi*, *Bursaria spinosa*, *Themeda australis*, *Lomandra longifolia*, *Aristida vagans* and other species that are characteristic of the vegetation communities it is found in. The habitat available within the subject site is degraded, dominated by the exotic grass *Eragrostis curvula* (African Lovegrass) and dumped rubbish is common throughout.

Within the study area, habitat for *Acacia pubescens* consists of Cooks River/Castlereagh Ironbark Forest, Cumberland Plain Woodland, Shale-Gravel Transition Forest, River-flat Eucalypt Forest and Castlereagh Swamp Woodland vegetation communities (see **Figure 4.1**). These communities are degraded in areas, are also dominated by exotic species such as *Senecio madagascariensis* (Fireweed), *Bidens pilosa* (Cobbler's Pegs), *Chloris gayana* (Rhodes grass) and *Asparagus asparagoides* (Bridal Creeper) and have experienced rubbish dumping to varying degrees.

Acacia pubescens is commonly recorded in disturbed areas surrounded by exotic species, though this is not considered to be its natural habitat. Its ability to survive in and tolerate disturbance has allowed it to inhabit areas of the subject site and study area that are highly disturbed and are dominated by exotic groundcover. The proximity of the subject site and areas of this species' occurrences within the study area to roads and the urban environment is relatively close, with individuals recorded along the perimeter of the vegetation/road interface.

The fire history of the subject site and study area is relatively unknown. Observations indicate that the available habitat within the subject site and study area has not been subject to recent fires. It is estimated that the last fire would likely have occurred over ten years ago, if not longer. Therefore, the frequency of fire within the study area is estimated to occur every 10-20 years, whilst the recommended interval is 5-7 years (OEH, 2016a). As the study area and locality is highly urbanised, the frequency of fires within the region would be much reduced.

iii. Discussion of conservation status

a. Local, regional and State-wide conservation status

Acacia pubescens is listed as Vulnerable under Schedule 2 of the TSC Act. It is also listed as Vulnerable under Schedule 1, Part 2 of the EPBC Act.

b. Threatening processes

There are two key threatening processes that are currently known to affect *Acacia pubescens* including:

- **Clearing of native vegetation** as this reduces the abundance of available habitat; and
- **High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition** as high frequency may result in a decline of the species.

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.

c. Habitat requirements

Acacia pubescens occurs in open woodland and forest in a number of vegetation communities including Alluvial Woodland, Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. It occurs in gravelly clay or sandy soils on alluviums, shales and at the intergrade between shales and sandstones (NSW NPWS, 2003; OEH, 2016a). It is associated with species such as *Melaleuca decora, Eucalyptus fibrosa, Melaleuca nodosa*, *Melaleuca styphelioides, Ozothamnus diosmifolius, Acacia parramattensis, Dillwynia sieberi, Bursaria spinosa, Acacia falcata, Exocarpos cupressiformis, Themeda australis, Lomandra longifolia, Microlaena stipoides, Aristida vagans, Dianella longifolia* and other species characteristic of the above vegetation communities.

This species have also been recorded in open, disturbed areas surrounded by exotic species (NSW NPWS, 2003).

d. Other documentation

Acacia pubescens has been assigned to the "Site-managed species" management stream under the Saving our Species program. The management objective of this project aims to secure the species in the wild for 100 years and maintain its conservation status under the TSC Act (OEH, 2016b). The OEH has identified and established three sites where conservation activities need to take place to ensure the conservation of this species. These sites include Mountain Lagoon, Hawkesbury (encompassing the Pitt Town and Windsor populations) and Bankstown-Liverpool (encompassing the populations in the area between Menai, Bardwell Park, Ryde and Cecil Hills).

The *Acacia pubescens* Recovery Plan (NSW NPWS, 2003) was developed by the NSW National Parks and Wildlife Service (NPWS) with the main objective of preventing the species from becoming endangered, by reducing the loss of habitat and by implementing management regimes focussed on maintaining representative populations across the species' range.

No threat abatement plan is relevant to this species and no critical habitat has been identified by the Director-General of the OEH for this species.

5.4 Feasible Alternatives

DGR 5.5 *Description of feasible alternatives*

> *A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed, having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development (Section 110(2)(h)).*

There are three broad alternatives to the proposal:

- Do nothing;
- Alternative development layout; and
- Reduced scale.

These are discussed below.

5.4.1 Do Nothing

If nothing is done and no development occurs, the remnant native vegetation and threatened flora species within the subject site, Cooks River/Castlereagh Ironbark Forest and *Acacia pubescens*, are likely to survive in the long term *in situ*, although the condition is likely to continue to degrade. Further development of the locality is inevitable, and the increased threat of weed invasion, introduction of pest species and rubbish dumping will contribute to the degradation of the vegetation.

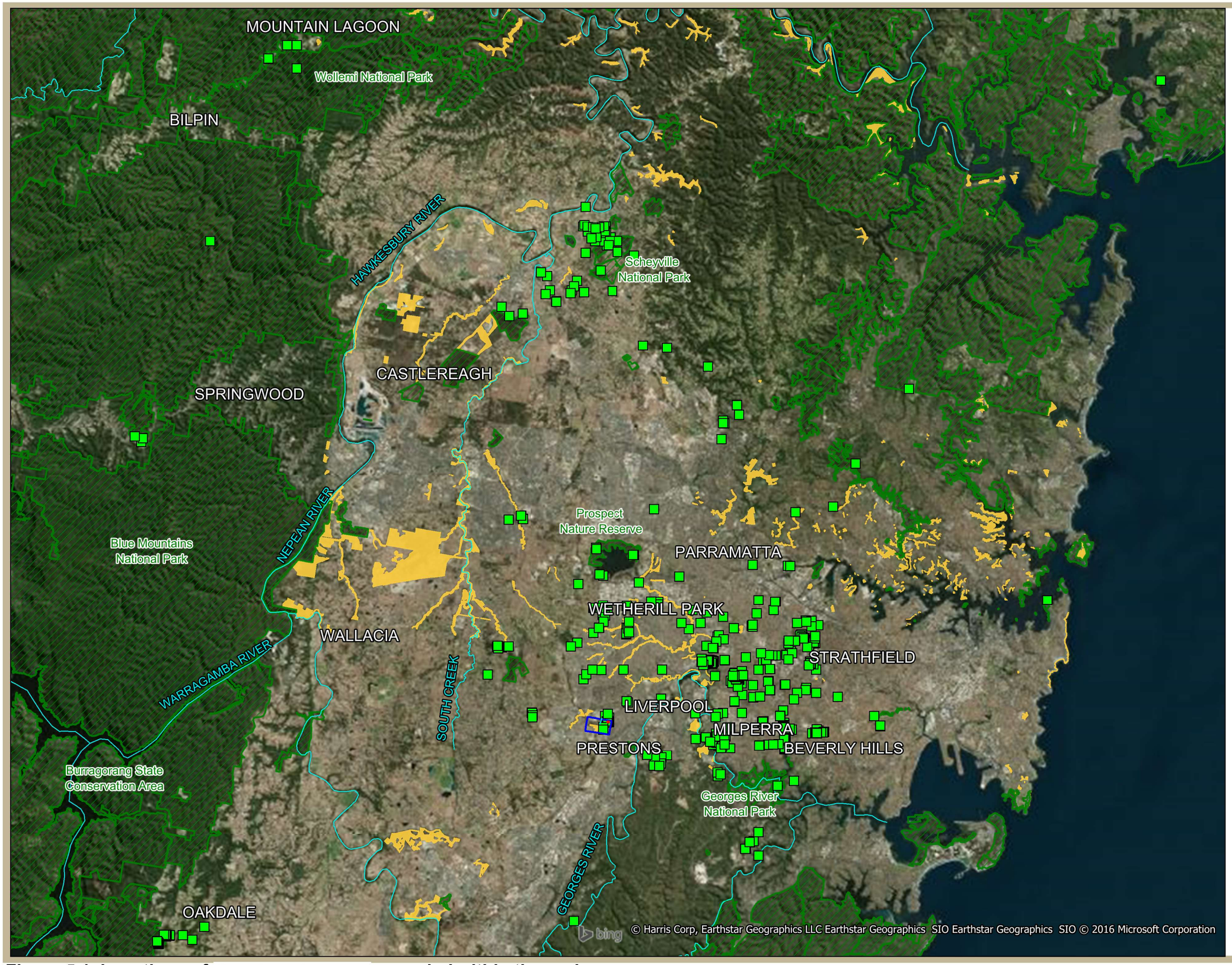
5.4.2 Alternative Development Layout

The proposed development is constrained by the size of the subject site and the proximity to existing industrial developments. Alternative layouts were not considered viable in terms of social and economic constraints for sustainable development.

5.4.3 Reduced Scale

A reduction in the scale of the proposed development was not considered, as any reduction would be considered commercially unviable due to the restriction in available area for development. It is considered that any retention of existing vegetation within the subject site would be unviable and not provide any additional benefit to the remaining vegetation within the study area, as it would be a smaller fragmented patch that would be isolated from remaining native vegetation.

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Subject Site
- Study Area
- E2- Environmental Conservation Zoning
- National Parks and Reserves
- Waterway
- *Acacia pubescens*

N
Grid North

Image Source:
Image © 2016 Aerometrex
(dated 1-1-2014)

Data Source:
© Copyright Commonwealth of Australia
(Geoscience Australia) 2006;
NPWS (2012). NPWS Estate
Data - Version 2/2012.;
BioNet Atlas of NSW Wildlife
© NSW Office of Environment and Heritage
dated 01/01/1980-21/01/2016
Map Scale: 1:250,000

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F:\...\14150\Figures\RP1_SIS\20160808\Figure 5.1. Acacia pubescens Records_Region

Figure 5.1. Locations of *Acacia pubescens* recorded within the region

2.5 0 2.5 5 7.5 10 km

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Chapter **6**

Assessment of Likely Impacts on Endangered Ecological Communities

This chapter covers the following DGRs:

DGR 6 *ASSESSMENT OF LIKELY IMPACTS ON ENDANGERED ECOLOGICAL COMMUNITIES*

6.1 Assessment of Endangered Ecological Communities Likely to be Affected

DGR 6.1 *Assessment of endangered ecological communities likely to be affected*

> *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)).*

One EEC has been determined to occur within the subject site and is likely to be affected by the proposed development. A total of approximately 0.90 ha of Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion occurs almost entirely across the subject site (see **Figure 6.1**). This community is listed as an EEC under the TSC Act and a CEEC under the EPBC Act.

Cooks River/Castlereagh Ironbark Forest within the subject site occurs on clay soils, is degraded and occurs as a regrowth occurrence of the community completely lacking in remnant trees. It has a dense shrub layer and the understorey is dominated by the exotic grass *Eragrostis curvula* (African Lovegrass). This community conforms to both the TSC Act listing and the EPBC Act listing for the community, as disturbed occurrences are considered to conform to the listings (NSW Scientific Committee, 2011).

More information regarding the floristics and structure of the community within the subject site and study area can be found in **Chapter 4**.

Examination of the final determination for this community, the descriptions by Tozer *et al.* (2010) and mapping prepared by the SMA have been utilised as part of this assessment.

6.2 Assessment of Habitat

DGR 6.2 *Assessment of habitat*

A full description of the type, location, size and condition of the habitat of the ecological community and details of the distribution and condition of similar habitat in the region (Section 110 (3)(c)).

DGR 6.2.1 *Description of disturbance history and recovery capacity*

If the site shows signs of disturbance, details should be provided of the site's disturbance history. An assessment should be made of the ability of the ecological community to recover to a state representative of its pre-disturbance condition. This assessment will include consideration of the site's in-situ and migratory resilience and will be accompanied by a map of the recovery capacity of the ecological community across the site. Consideration should be given to the results (preliminary or otherwise) of restoration projects being undertaken at other sites that contain the ecological community when assessing its recovery capacity.

DGR 6.2.2 *Extent of habitat removal*

The location, nature and extent of habitat removal or modification which may result from the proposed action including the cumulative loss of habitat from the study area (including all proposed DAs and those areas in the subject area already with development consent or identified for development) and the impacts of this on the viability of the endangered ecological community in the locality.

This shall include an assessment of the proportion of the endangered ecological community to be affected by the proposal, in relation to the total extent of the endangered ecological community, and the impact of this on the viability of the endangered ecological community in the study area and locality.

6.2.1 Cooks River/Castlereagh Ironbark Forest

Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion is dominated by *Eucalyptus fibrosa* (Red Ironbark) and *Melaleuca decora*, sometimes with *Eucalyptus longifolia* (Woollybutt) (OEH, 2015b). It has a relatively dense shrub layer that is typical for the community with *Melaleuca nodosa* (Prickly-leaved Paperback) commonly occurring. It occurs on clay soils on Tertiary alluvium, or on shale soils on Wianamatta Shale including the Birrong Soil Landscape and associated shale lowlands (NSW Scientific Committee, 2011).

The geographic distribution of Cooks River/Castlereagh Ironbark Forest within the Sydney Basin is highly restricted and is currently estimated to cover an area less than 1,500 ha. The current distribution of the community is highly fragmented and occurs throughout Western Sydney, with the largest patches occurring in the Castlereagh and Holsworthy areas. Smaller fragmented patches also occur in the Kemps Creek area and the Canterbury-Auburn-Strathfield-Bankstown-Parramatta-Holroyd areas (NSW Scientific Committee, 2011).

The majority of the remnant occurrences of the community are surrounded by urban and industrial development, with a small proportion conserved in National Parks and Nature Reserves. Consequently, the distribution of Cooks River/Castlereagh Ironbark Forest is severely fragmented and such fragmentation contributes to a large reduction in the ecological function of the community (NSW Scientific Committee, 2011).

Within the study area this community occurs on clay soils with some influence of shale laterites as a mix of remnant trees and regrowth occurrences. Remnant patches have less frequent occurrences of larger trees in the canopy. These remnants occur in close proximity to Maxwells Creek through the central portion of the study area. Species predominantly consist of *Eucalyptus fibrosa* (Red Ironbark) and *Melaleuca decora*, with occasional occurrence of *Eucalyptus longifolia* (Woollybutt). The areas of regrowth of this community consist largely of a small tree layer of *Melaleuca decora*, *Melaleuca nodosa* (Prickly-leaved Paperbark) and *Eucalyptus longifolia* (Woollybutt).

Most areas of this community within the study area are degraded, and have a ground layer dominated by weed species. Dumped rubbish is also common within the community across the study area and is more prevalent within the subject site, areas along Maxwells Creek and the large patch of the community in the western portion of the study area.

i. Description of disturbance history and recovery capacity

The majority of the study area was presumably cleared in the mid to late 1800's when the Liverpool area was established as a settlement and developed following construction of the post office in the early 1900's. As the majority of vegetation within the study area is comprised of regrowth occurrences of the remnant communities, it can be assumed that the remnant vegetation was largely cleared and has been allowed to regenerate in areas. Since that time, substantial clearing of surrounding areas has taken place, resulting in the highly urbanised areas that currently exist.

Disturbance on the subject site has likely included historical clearing of remnant vegetation which has been allowed to naturally regenerate to its current regrowth form. It is estimated that the regrowth would be between 10-20 years old. Continued degradation of the community has occurred likely due to the effects of rubbish dumping, human disturbances and the increasing pressure of development surrounding the subject site. However, there is evidence of continuing regeneration of native species, though the dominance of exotic grass and other exotic ground cover species is prevalent. The overall disturbance levels are not considered to be severe such that the viability of the community is threatened in the short term. In the long term, the disturbances may increase with increasing industrial development surrounding the subject site and continued fragmentation of the patch will likely occur which will threaten the viability of Cooks River/Castlereagh Ironbark Forest.

The evidence of natural regeneration of native species is prevalent in all stratum. This indicates that the soil-stored seed bank is intact, albeit small, and the natural regeneration potential of the community is moderate to high. However, parts of the subject site show frequent dominance of exotic species, many of which are recognised as "transformer weeds', which indicates that the soil-stored seed bank would also contain these species. 'Transformer weeds' have the potential to degrade the community over time.

Owing to changes to the natural vegetation and habitat over a prolonged period, it is concluded that the community function of this example of Cooks River/Castlereagh Ironbark Forest has been greatly reduced, as indicated by the:

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

Although this area has been reduced and modified, the remaining vegetation would likely regenerate to good condition Cooks River/Castlereagh Ironbark Forest with the following management actions:

- Weed management to eradicate problematic weeds present;
- Removal of dumped rubbish;
- Restriction of human disturbances and access; and
- Eliminate further land clearing.

The current extent of this community in the subject site, with urban development on three sides and zoned as Heavy Industrial, means that it faces significant edge-effects, and representation of its pre-disturbance condition is fairly unlikely. Active management will increase the condition of the community to a good quality example, however it is unlikely that the community will recover to a state that would be a representation of its pre-disturbance condition, as there is a low species diversity and it is unlikely that any additional species would be stored within the soil-seed bank. Any restoration efforts would rely on weed management, which could assist in the recovery of this community in the locality.

ii. Extent of Habitat Removal

The proposed development will result in complete removal of a total of 0.90 ha of all Cooks River/Castlereagh Ironbark Forest from the subject site, which is of a degraded condition. This loss of habitat represents approximately 2% of Cooks River/Castlereagh Ironbark Forest known to occur within the study area and less than approximately 1% of Cooks River/Castlereagh Ironbark Forest within the locality.

Within the study area and locality, Cooks River/Castlereagh Ironbark Forest is likely to have been previously cleared for urban and industrial development. The areas of the community within the study area are located in areas zoned for IN3: Heavy Industrial (approximately

2.64 ha), IN1: General Industrial (approximately 6.06 ha), E2: Environment Conservation (approximately 8.18 ha) and SP2: Infrastructure – Drainage (approximately 1.29 ha). Approximately 45% of all Cooks River/Castlereagh Ironbark Forest within the study area and approximately 17% within the locality will be conserved within E2 zoned lands.

It is likely that further development of the study area will result in some further clearing of Cooks River/Castlereagh Ironbark Forest, as approximately 77% of the study area is zoned as Industrial (52% as Heavy Industrial and 24% as General Industrial). However, the remnants of the community conserved within the E2 zoned land within the study area will ensure the viability of the community in the long-term and maintain habitat and connectivity with native vegetation along Maxwells Creek.

6.3 Discussion of conservation status

DGR 6.3 *Discussion of conservation status*

> *For each ecological community present, details of its local, regional and State-wide conservation status...[and]...its habitat requirements...(Section 110(3)(b)).*
>
> *Assessment should include reference to the threatening processes that are generally accepted by the scientific community as affecting the endangered ecological community and are likely to be caused or exacerbated by the proposal. Assessment should also include reference to any approved or draft recovery plans which may be relevant to the proposal.*

DGR 6.3.1 *Significance within a local context*

> *An assessment of the community on the subject site in relation to other sites in the study area and in the locality. The tenure and long term security of other sites shall be examined as part of this discussion.*

The relative significance of the subject site for the endangered ecological community shall be discussed. The assessment of the community should be considered in terms of the following features including size of the remnant, the quality of the habitat and the level of disturbance on this site in comparison to other sites in the study area and locality.

6.3.1 Conservation status

Cooks River/Castlereagh Ironbark Forest is listed as an EEC under the TSC Act and as a CEEC under the EPBC Act. The occurrence of this community within the subject site has been determined as corresponding to both the TSC Act listing and the EPBC Act listing.

i. Key Threatening Processes

Cooks River/Castlereagh Ironbark Forest is threatened by the following key threatening processes:

- Clearance of native vegetation;

- Invasion of native plant communities by exotic perennial grasses as this may result in competition with native understorey and ground layer species;
- Invasion and establishment of exotic vines and scramblers as this may result in competition with native understorey and ground layer species; and
- Invasion by a variety of weeds have been listed as key threatening processes. These include invasion by exotic vines and creepers and exotic perennial grasses.

Other threatening processes that have relevance to the fauna associated with Cooks River/Castlereagh Ironbark Forest include:

- Removal of dead wood and dead trees.

Other threats to the community include:

- The main threat is further clearing for urban development, and the subsequent impacts from fragmentation;
- Habitat degradation from inappropriate access and disturbance from people and rubbish dumping;
- Urban run-off, which leads to increased nutrients and sedimentation;
- Weed invasion, including exotic vines and scramblers, and exotic perennial grasses; and
- Inappropriate fire regimes, which have altered the appropriate floristic and structural diversity.

ii. Habitat Requirements

Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion mainly occurs on areas of clay soils on Tertiary alluvium, or on shale soils on Wianamatta Shale including the Birrong Soil Landscape and associated shale lowlands (NSW Scientific Committee, 2011).

iii. Recovery or Threat Abatement Plan

The Cumberland Plain Recovery Plan is applicable to this community and was developed by the former NSW Department of Environment, Climate Change and Water (DECCW) (2011). The recovery plan was developed to promote the recovery of threatened species, populations and ecological communities on the Cumberland Plain.

The overall objective of the plan is to provide for the long-term survival and protection of the threatened biodiversity of the Cumberland Plain (DECCW, 2011). The specific objectives of the recovery plan are:

- **Objective 1**: To build a protected area network, comprising public and private lands, focused on the priority conservation lands.

Securing land to be managed for conservation outcomes underpins the recovery efforts on the Cumberland Plain.

- **Objective 2**: To deliver best practice management for threatened biodiversity across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where the primary management objectives are compatible with biodiversity conservation

- **Objective 3**: To develop an understanding and enhanced awareness in the community of the Cumberland Plain's threatened biodiversity, the best practice standards for its management, and the recovery program

- **Objective 4**: To increase knowledge of the threats to the survival of the Cumberland Plain's threatened biodiversity, and thereby improve capacity to manage these in a strategic and effective manner.

There are no specific Threat Abatement Plans relevant to this community.

6.3.2 Significance within a local context

Cooks River/Castlereagh Ironbark Forest comprises the majority (approximately 45%) of native vegetation that remains within the study area. The total area of the community within the subject site is 0.90 ha and is a degraded regrowth occurrence, with an understorey frequently dominated by exotic grass and a canopy of small trees. The community is also subject to ongoing rubbish dumping. When considered in the context of the study area, being approximately 215 ha in total (of which approximately 40 ha is native vegetation), the subject site represents a small portion of intact areas of habitat and approximately 5% of the remaining Cooks River/Castlereagh Ironbark Forest.

Remaining occurrences of Cooks River/Castlereagh Ironbark Forest within the study area are largely degraded, though a good quality example of the community occurs in the north-west corner of the south-eastern patch of the community. The patch of Cooks River/Castlereagh Ironbark Forest on the subject site is isolated from the remaining areas of the community with industrial developments on three sides (north, east and south) and road infrastructure on the fourth (western) side. Limited connectivity exists to the patch of native vegetation to the west of the subject site, with no other connectivity links due to industrial developments immediately surrounding the patch and residential developments further east.

Within the locality, Cooks River/Castlereagh Ironbark Forest comprises approximately 4% of all remaining native vegetation, based on the SMA vegetation mapping (OEH, 2013). When considered in the context of the locality, the community within the subject site represents approximately 0.5% of remaining native vegetation and approximately 1.5% of all remaining occurrences of Cooks River/Castlereagh Ironbark Forest. The community within the subject site represents a very minor portion of intact areas of habitat.

Most of the lands within the study area and locality are privately owned, with a small portion zoned as E2: Environmental Conservation lands. Approximately 45% of Cooks River/Castlereagh Ironbark Forest is conserved within E2 lands in the study area and 17% of

Cooks River/Castlereagh Ironbark Forest is conserved within the locality. There are no National Parks or Nature Reserves located within the study area or locality, and as such there is no conservation of the community within these areas. The extent of Cooks River/Castlereagh Ironbark Forest within E2 Lands, National Parks and Nature Reserves is shown in **Figure 6.2**.

The removal of 0.90 ha of the community within the subject site does not contribute significantly to the extent of the community within the study area or the locality and will not impact significantly on the viability of Cooks River/Castlereagh Ironbark Forest in the long-term.

6.4 Feasible Alternatives

DGR 6.4 *Description of feasible alternatives*

> *A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed having regard to the biophysical, economic and social considerations and the principles of ecological sustainable development (Section 110(3)(e)).*

Where a Statement of Environmental Effects, Environmental Impact Statement or Review of Environmental Factors deals with these matters, the SIS may refer to the relevant section of the SEE, EIS or REF.

As discussed in **Section 5.4**, alternative development layouts and a reduced scale have all been considered, but were not commercially viable in terms of social and economic constraints for sustainable development. The only feasible alternative is to not proceed with the development of the subject site, although in the long-term, without active management of Cooks River/Castlereagh Ironbark Forest, and with further developments within the study area, the viability of the community within the subject site will decrease.

Coordinate System: MGA Zone 56 (GDA 94)

Legend

Subject site

Vegetation Community

Cooks River/Castlereagh Ironbark Forest

Exotic

N

Grid North

Image Source:
Image © 2016 Aerometrex
(dated 1-1-2014)

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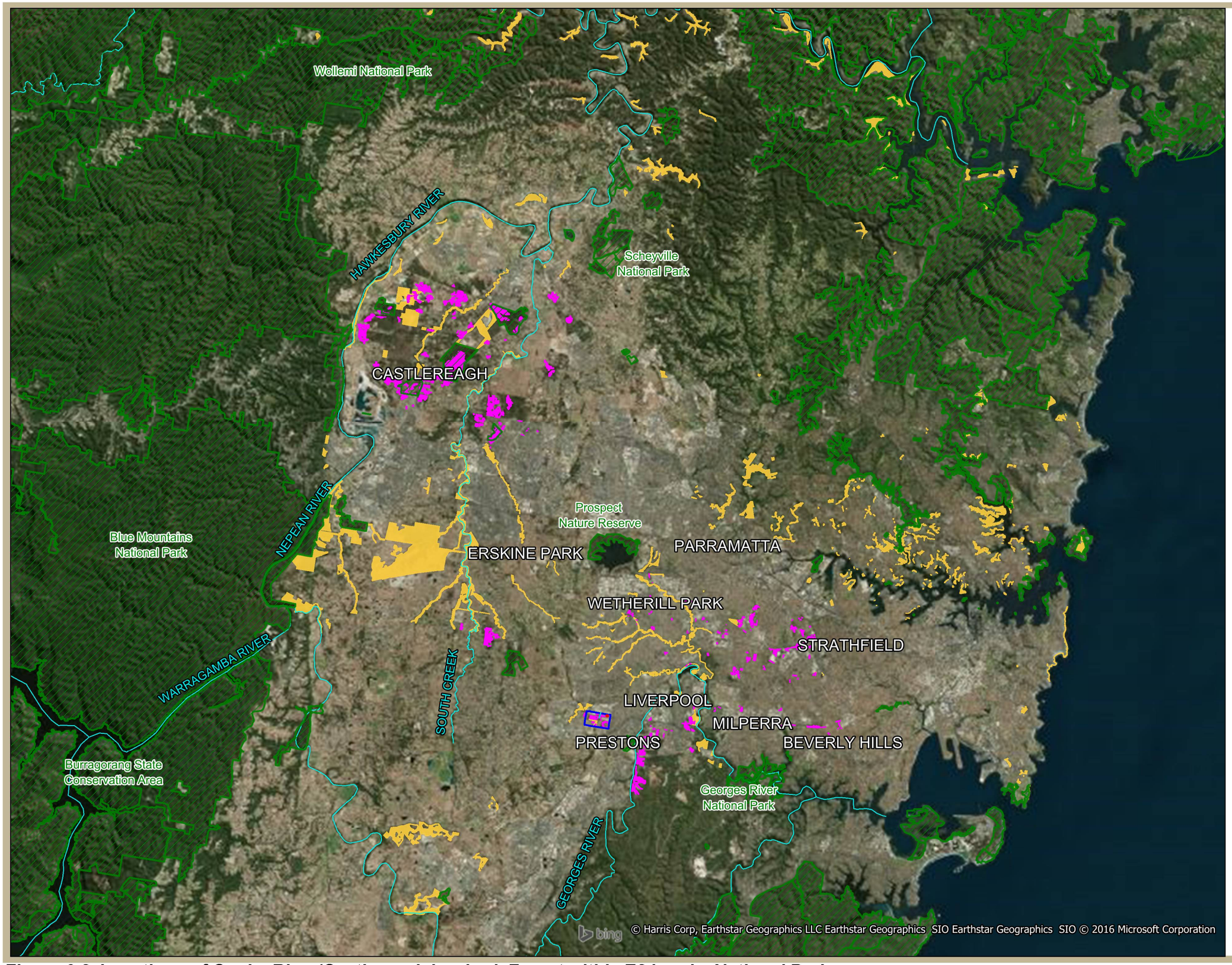
I:\...\14150\Figures\RP1_SIS\20160808\Figure 6.1. Vegetation Extent_Subject Site

100 0 100 200 300 400 m

Figure 6.1. Vegetation extent within the subject site

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Subject Site
- Study Area
- E2- Environmental Conservation Zoning
- National Parks and Reserves
- Cooks River/Castlereagh Ironbark Forest
- Waterway

N
Grid North

Image Source:
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Data Source:
© Copyright Commonwealth of Australia (Geoscience Australia) 2006;
NPWS (2012). NPWS Estate Data - Version 2/2012.;
DECCW (2008) Native Vegetation of the Cumberland Plain 2008 update.
OEH (2013) The Native Vegetation of the Sydney Metropolitan Area. Volume 1: Technical Report. Version 2.0. Office of Environment and Heritage, Department of Premier and Cabinet, Sydney.

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2.5 0 2.5 5 7.5 10 km

I:\...\14150\Figures\RP1_SIS\20160913\Figure 6.2. CooksRiver_Castlereagh IB Forest_Region

Figure 6.2. Locations of Cooks River/Castlereagh Ironbark Forest within E2 Lands, National Parks and Nature Reserves within the region

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Chapter 7

Ameliorative Measures

This chapter covers the following Director-General's Requirements:

DGR 7 *AMELIORATIVE MEASURES*

7.1 Description of Ameliorative Measures

DGR 7.1 *Description of ameliorative measures*

> *A full description and justification of the measures proposed to mitigate any adverse effect of the action on the species and populations and ecological community including a compilation (in a single section of the statement) of those measures (Section 110 (2)(i) and Section 110 (3)(f)).*

Ameliorative measures as part of the proposed development include during-construction measures and some compensatory strategies. Pre-construction measures such as pre-clearance fauna surveys to check for any nesting or roosting fauna and move them to adjacent habitat will be required due to the presence of habitat features suitable for native fauna within the subject site. Compensatory strategies are discussed in **Section 7.1.1**.

Potential impacts to flora and fauna occurring in the construction phase relating to the proposed development and which can be managed include: runoff, sedimentation, erosion and pollution. Precautions need to be taken to minimize the drainage impacts downslope and at the storm water end point. Sediment control and reduction measures should be implemented to reduce sediment runoff into storm water drains to reduce impacts on-site and downslope.

During development, precautions should be taken to ensure that no pollution escapes the construction site. Pollution traps and regular removal of pollution to an off-site location would assist to minimize pollution impacts. A Waste Management Plan will be developed to mitigate waste and pollution entering the surrounding environment.

7.1.1 Compensatory strategies

DGR 7.1.1 *Compensatory strategies*

> *Any offsets proposed shall be consistent with the OEH Principles for the use of biodiversity offsets in NSW (http://www.environment.nsw.gov.au/biooffsets/oehoffsetprincip.htm).*

Compensatory strategies include the use of the OEH BioBanking Scheme to purchase BioBanking credits to fulfil the credit requirement for the clearance of native vegetation and threatened species on the subject site. A preliminary BioBanking assessment using the BioBanking Assessment Methodology 2014 (BBAM) (OEH, 2014a) has been undertaken to inform of the credit requirement for the complete removal of 0.90 ha of Cooks River/Castlereagh Ironbark Forest and 84 individuals of *Acacia pubescens* within the subject site, with 27 ecosystem credits and 1596 species credits required respectively. The BioBanking Credit Report is provided in **Appendix D**.

To compensate for the removal of Cooks River/Castlereagh Ironbark Forest and individuals of *Acacia pubescens*, BioBanking credits for both the ecosystem credits and species credits will be sought to offset the entire credit requirement for the proposed development. These credits will be bought and retired in order to offset some or all of the impacts of the proposed development. Credits sought will be in accordance with the offsetting rules under the BBAM.

Where the entire credit requirement cannot be sourced from sellers of the credits, other compensatory strategies will be explored such as contribution to restoration works within the locality.

7.1.2 Translocation

DGR 7.1.2 *Translocation*

There is no proposal for any translocation of flora or fauna from or within the subject site.

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Chapter 8

Assessments of Significance

This chapter covers the following Director General's Requirements:

DGR 8 ASSESSMENT OF SIGNIFICANCE OF LIKELY EFFECT OF PROPOSED ACTION

8.1 Affected Species

8.1.1 Acacia pubescens

Acacia pubescens is listed as Vulnerable under both the TSC Act and EPBC Act. There have been approximately 84 records of the species recorded within the subject site.

Acacia pubescens is a spreading shrub, 1 - 5 m high with brilliant yellow flowers, bipinnate leaves (divided twice pinnately) and conspicuously hairy branchlets. The species occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. The species occurs in open woodland and forest, in a variety of plant communities, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland (OEH, 2012).

Assessment of Significance

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

The proposed action will remove all of the individuals within the subject site as well as approximately 0.90 ha of potential habitat for this species. This constitutes the entire habitat available for this species within the subject site. Habitat for this species is available within the study area and locality. Due to the abundance of this species within the subject site, and limited habitat available in the locality, the proposed action is considered likely to have an adverse effect on the local population and could potentially place the viable local population at the risk of extinction.

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

There are currently no endangered populations of this species listed under Part 2 of Schedule 1 of the TSC Act.

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

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

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

Not applicable to threatened species.

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

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

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

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

The proposed action will result in the removal of approximately 0.90 ha of potential habitat for this species. There will not be any potential habitat retained within the subject site however; there are areas of potential habitat available in the locality.

The proposed action requires clearing at the edge of the distribution of available habitat. As such the removal of habitat within the subject site will not cause further fragmentation or isolation of the habitat in the locality.

The species within the locality has been significantly impacted by past development and its distribution has been restricted to favourable habitats that are fragmented and isolated. Due to its limited distribution and lack of available habitat, further removal of habitat for this species is considered to have a significant impact on the long-term survival of the species in the locality.

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

No critical habitat for this species has currently been listed in the critical habitat registry by the Director-General of the OEH.

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

The recovery plan for this species aims to prevent the status of *Acacia pubescens* from becoming endangered by reducing habitat loss and by implementing management regimes aimed at maintaining representative populations across the species' range. The proposed

action is not consistent with this objective as it will remove individuals from the population and reduce potential habitat available for the species.

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

The proposed development will result in the following key threatening process:

- Clearing of native vegetation

The vegetation to be cleared consists of Cooks River/Castlereagh Ironbark Forest. This community provides suitable habitat for *Acacia pubescens*. Clearing of native vegetation is therefore relevant to *Acacia pubescens* as it reduces the area of habitat available for this species.

Conclusion

The project will remove approximately 84 individuals and approximately 0.90 ha of favourable habitat for *Acacia pubescens.* Due to the abundance of this species within the subject site and the presence of habitat available in the locality, the proposed action is considered to have a moderately significant effect on the local population. Taking into consideration the ameliorative measures, the removal of this species from the subject site is considered to be adequately offset such that overall the proposed impact will not significantly affect this species in the locality.

8.1.2 Cooks River/Castlereagh Ironbark Forest

The Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion is a dry sclerophyll open-forest to low woodland, with a canopy dominated by Broad-leaved Ironbark (*Eucalyptus fibrosa*) and Paperbark (*Melaleuca decora*) (OEH, 2015b). The canopy may also include Eucalyptus species such as Woollybutt (*E. longifolia*). The dense shrubby understorey consists of Prickly-leaved Paperbark (*Melaleuca nodosa*) and Peach Heath (*Lissanthe strigosa*), with a range of 'pea' flower shrubs, such as *Dillwynia tenuifolia*, Hairy Bush-pea (*Pultenaea villosa*) and Gorse Bitter Pea (*Daviesia ulicifolia*). The sparse ground layer contains a range of grasses and herbs (OEH, 2015b).

The community occurs predominantly in the Cumberland subregion between Castlereagh and Holsworthy, as well as around the headwaters of the Cooks River. Cooks River/Castlereagh Ironbark Forest is listed as an Endangered Ecological Community under the TSC Act and a Critically Endangered Ecological Community under the EPBC Act (OEH, 2015b).

The entire subject site is comprised of Cooks River/Castlereagh Ironbark Forest. There have been moderate disturbances to the community associated with surrounding development, however the community is in moderate condition.

Assessment of Significance

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

Not applicable.

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

Not applicable.

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

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

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

The proposed action will result in the removal of approximately 0.90 ha of Cooks River/Castlereagh Ironbark Forest community within the subject site. The Cooks River/Castlereagh Ironbark Forest within the subject site is a fragmented and isolated patch with limited connectivity to a larger area of this community on land to the west.

Several remaining patches of the community within the study area are of similar or better condition of which 45% of the community within the study area is conserved within E2 lands. The community to be removed within the subject site constitutes a very small portion of the remainder of the community within the study area and locality and as such, the proposed development is not considered to significantly impact on the ecological community within the study area and locality, or place the ecological community at risk of extinction.

There will not be any modifications to the composition of the community as the community will be completely removed from the subject site and is isolated from the remaining occurrences within the study area. Currently there would be little exchange of genetic diversity due to the highly urbanised and fragmented nature of native vegetation within the locality so that the removal of the community within the subject site would not place the composition of the community at risk of extinction.

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

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

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

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

The proposed action will result in the removal of approximately 0.90 ha of Cooks River/Castlereagh Ironbark Forest within the subject site.

Cooks River/Castlereagh Ironbark Forest occurs within the locality as fragmented patches of vegetation, surrounded by various developments. The subject site comprises a portion of this fragmented community on the most eastern point of its distribution and is already isolated due to developments on three sides of the subject site and road infrastructure on the other. As such, the removal of this community within the subject site will not further fragment or isolate the community.

Within the locality, this community has been significantly impacted upon by past development and its distribution has been restricted to fragmented and isolated patches. Due to the small area of the community to be removed by the proposed development, further removal of the community is not considered to have a significant impact on the long-term survival of the community in the locality.

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

There is no critical habitat for Cooks River/Castlereagh Ironbark Forest currently listed by the Director-General of the OEH.

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

The community is included within the Cumberland Plain Recovery Plan (DECCW, 2011). The overall objective of this recovery plan is to provide for the long-term survival and protection of the threatened biodiversity of the Cumberland Plain. The threats to Cooks River/Castlereagh Ironbark Forest are further loss and fragmentation of habitat, weed invasion, frequent fire and urban run-off. The removal of the community from the subject site is considered to threaten the objectives of the recovery plan due to further loss of habitat.

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

The following key threatening processes are relevant to Cooks River/Castlereagh Ironbark Forest occurring within the subject site:

- 'Clearing of native vegetation' as this reduces the area of habitat available for this community; and

- 'Invasion of native plant communities by exotic perennial grasses' that readily invade disturbed sites and communities as they can dominate and suppress native flora species.

The primary key threatening process relevant to the proposed development is the clearing of native vegetation, as approximately 0.90 ha of Cooks River/Castlereagh Ironbark Forest will be removed within the subject site. The proposed development is not considered to exacerbate the key threatening process of invasion by exotic perennial grasses further than current conditions.

Conclusion

The proposed development will result in the removal of a small area (0.90 ha) of Cooks River/Castlereagh Ironbark Forest. The community within the subject site is a regrowth occurrence of the community, is degraded and is set within an environment that is becoming highly urbanised. The community has been fragmented and isolated and considering the likely increase in industrial developments in an area zoned for Heavy Industrial use, further loss of the small patch of habitat is not considered to significantly impact the community in the locality.

8.2 Potential Species

8.2.1 Yellow-bellied Sheathtail-bat

The Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) is listed as Vulnerable under the TSC Act. It is found in a range of habitats including forest, agricultural and urban areas across northern and eastern Australia. It requires tree hollows, buildings, abandoned mammal dens or burrows for roosting (OEH, 2014b). Yellow-bellied Sheathtail-bats forage on insects from 2m to 25m above the ground, depending on the environment (Law & Chidel, 2011). The species roosts singly or in groups of up to six, in large tree hollows and buildings.

Assessment of Significance

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

Only three records of the species are recorded from the locality. The Yellow-bellied Sheathtail-bat utilises tree hollows for nesting. There are no hollow-bearing trees within the subject site. The area of 0.90 ha of native vegetation on the subject site to be removed is small, and the species are mobile and would have the ability to utilise surrounding habitat.

There are three records of the Yellow-bellied Sheathtail-bat in the locality. These records are located approximately 3.6 km to the south-east of the subject site.

The removal of a small area of degraded vegetation from the subject site will not place a viable local population at risk of extinction. The Yellow-bellied Sheathtail-bat is a highly

mobile species that accesses resources from across a wide area and it is not expected that this species would depend upon resources contained in the study area or subject site for its survival.

Therefore the proposal is not likely to place a viable local population of the species at risk of extinction because suitable foraging habitat exists in the study area and wider locality which is outside of the development footprint.

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

Not applicable.

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

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

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

Not applicable.

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

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

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

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

Effectively 0.90 ha of potential native foraging habitat will be removed as part of the proposed development. This habitat exists as foraging habitat composed of regrowth occurrences of native vegetation. No roost or breeding habitat is available within the subject site.

The native habitat proposed for removal is already relatively isolated and exists along a streetscape within a highly developed urban area. Similar habitat connectivity through the locality is by scattered remnant patches which extend through a large area of the locality.

The proposal will cause minor further fragmentation of its scattered distribution within the locality.

As the potential habitat on the subject site represents only a very small area available to the species in the locality and the species is mobile, the proposal is not likely to decrease the movement of individuals and gene flow between areas of potential habitat throughout the locality or within or between local populations.

The proposal would remove only a small area of potential habitat for the species in relation to the habitat available within the locality. For this reason, clearance of habitat from the subject site is not considered significant in a local context as the subject site is likely to only provide minimal foraging habitat for the species. Habitat of greater significance is available in larger areas of bushland within Western Sydney Parklands to the west, Leacock Regional Park and Holsworthy Military Reserve to the south-east of the study area. These areas are more likely to provide roosting and foraging habitat for this species. It is therefore considered that the habitat provided on the subject site is not important for the long-term survival of the species in the wider locality.

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

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

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

No recovery plan has been prepared for this species. No specific Threat Abatement Plan is relevant to this species, however the Action Plan for Australian Bats provides a recovery outline (Duncan *et al.*, 1999). No critical habitat for this species has currently been identified by the Director-General of the OEH

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

The proposal's actions would constitute the key threatening process of "Clearing of native vegetation". As the vegetation to be removed on the subject site is highly modified by its current context being buildings around it, it only constitutes marginal habitat for the Yellow-bellied Sheathtail-bat. The key threatening process of "Clearing of native vegetation" on the subject site is not likely to significantly affect this species.

Conclusion

The proposed development would result in the removal of a very small area of relatively degraded native vegetation that potentially provides some foraging habitat for the Yellow-bellied Sheathtail-bat. Any local population of this species is unlikely to depend on the resources contained on the subject site for its survival and large areas of suitable habitat

remain in the locality with much of that being in conservation reserves. Such reserves will remain in perpetuity and contain far higher habitat value than the marginal habitat proposed to be removed from the subject site. The proposal is not considered to significantly impact the Yellow-bellied Sheathtail-bat.

Chapter 9

Additional Information

This chapter covers the following Director-General's Requirements:

DGR 9 ADDITIONAL INFORMATION

9.1 Qualifications and Experience

DGR 9.1 Qualifications and experience

> *A species impact statement must include details of the qualifications and experience in threatened species conservation of the person preparing the statement and of any other person who has conducted research or investigations relied on in preparing the statement (Section 110(4)).*

The Cumberland Ecology staff involved with the compilation of this SIS have many years of experience in ecology, flora and fauna assessments and threatened species legislation. The sub-consultants are specialist in their area of expertise. The details of the qualifications of key Cumberland Ecology staff involved in the preparation of this SIS, and relevant sub-consultants, are provided in **Appendix E**.

9.2 Other Approvals

DGR 9.2 Other approvals required for the development or activity

> *A list of any approvals that must be obtained under any other Act or law before the action may be lawfully carried out, including details of the conditions of any existing approvals that are relevant to the species or population or ecological community (Sections 110(2)(j) and 110(3)(g)).*

The proposal will be assessed under Part 5 of the Environmental Planning and Assessment Act 1979. The development application will be lodged concurrently with this SIS.

A referral to the Department of Environment and Energy will be prepared to assess the project under the EPBC Act, due to the impacts to Cooks River/Castlereagh Ironbark Forest and *Acacia pubescens*, which are both a Matter of National Environmental Significance.

9.3 Licensing Matters Relating to the Survey

DGR 9.3 *Licensing matters relating to the survey*

Cumberland Ecology currently holds the following licences:

- Scientific licence (Section 132 C) (National Parks and Wildlife Act 1974)

9.4 Section 110 (5) Reports

DGR 9.4 *Section 110 (5) reports*

Impact assessment was conducted after due consideration for the Environmental Impact Assessment Guidelines for relevant threatened species and the condition of potential habitats in the study area. Section 110 (5) reports utilised in preparation of this SIS are included in the References section of the SIS.

Chapter 10

Conclusion

This SIS has been prepared to assess the occurrence of the endangered ecological community, Cooks River/Castlereagh Ironbark Forest and threatened species, which may be affected by the proposed development of the subject site. The proposed development will require the clearing of 0.90 ha of Cooks River/Castlereagh Ironbark Forest of moderate to low condition habitat with a dominance of exotic grass in the understorey. In its current condition, the community cannot regenerate to its pre-disturbance condition in the long term, even with active management. Although there will be an impact to the community within the subject site, the overall impact on the community in the study area and wider locality is not considered to be of major ecological significance.

The community within the subject site conforms to the EEC listing under the TSC Act and to the CEEC listing under the EPBC Act. The patch within the subject site is a regrowth occurrence of the community that is degraded and isolated from remaining native vegetation within the study area and locality due to the highly developed industrial surroundings. Although there will be an impact to the community within the subject site, the overall impact on the community in the study area and wider locality is not considered to be significant due to its degraded nature and its isolation.

One threatened flora species, *Acacia pubescens*, was recorded within the subject site. A total of 84 individuals of *Acacia pubescens* will be removed as a result of the proposal. Whilst this is a significant impact on the species within the subject site, it is considered to be a moderate impact in the context of the study area and locality with a loss of approximately 27% and 15% respectively, of the species. The removal of *Acacia pubescens* individuals is considered to have a moderately significant impact on this species. However, this loss can be compensated for through the proposed compensatory measures of the purchase and retirement of BioBanking credits, contributing to the protection and management of the species in perpetuity within the locality.

One possible recording of the threatened fauna species Yellow-bellied Sheathtail-bat was identified within the subject site. It is assumed that this possible occurrence of this species is likely to be due to the species passing through the site. No other threatened fauna species were recorded within the subject site. It is likely that some highly mobile threatened fauna, such as birds and bats, have the potential to pass through the subject site as part of a wider foraging range and some potential, albeit marginal, habitat for a number of threatened fauna species will be removed. However, the removal of habitat is not considered likely to have a significant impact on these species.

After considering the material analysed in the SIS and the ecological value of the vegetation, habitat and threatened flora species to be removed, at a small scale focussing only on the subject site, a technically significant impact upon vegetation communities present will occur, as all of the EEC and threatened flora will be removed. However, at a broader scale within the study area and locality, the proposal will only minimally impact the occurrence of Cooks River/Castlereagh Ironbark Forest and moderately impact on the *Acacia pubescens*.

Notwithstanding the small scale of impact to Cooks River/Castlereagh Ironbark Forest from the proposed development, offsetting is warranted to prevent a small cumulative loss of the community from the locality. If the corresponding BioBanking credits required for the proposal are bought and retired, this impact will be compensated for by the conservation and management in perpetuity of an area of Cooks River/Castlereagh Ironbark Forest and individuals and habitat for *Acacia pubescens*, maintaining the presence and maintenance of the community and threatened flora species within the locality.

cumberland ecology

Chapter 11

References

Andrews, A. (1990). "Fragmentation of Habitat by Roads and Utility: A Review." *Australian Zoologist* **26**(3 & 4): 130-141.

Biolink (2008). *The utility of regularised, grid-based SAT (RGB-SAT) sampling for the purposes of identifying areas being utilised by koalas (Phascolarctos cinereus) in the South-east Forests of NSW - A Pilot Study*. Biolink, NSW.

Botanic Gardens Trust (2015). "PlantNET." Accessed: 2015, from http://www.rbgsyd.nsw.gov.au/search_plant_net.

Bureau of Meteorology (2016). "Climate Data Online." from http://www.bom.gov.au/climate/data/.

DEC (NSW) (2004). *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft)*. Department of Environment and Conservation (NSW), Hurstville.

DECCW (2011). *Approved Cumberland Plain Recovery Plan*. DECCW, Hurstville.

Duncan, A. B., Baker, G. B. and Montgomery, N., Eds. (1999). *The Action Plan for Australian Bats*. Environment Australia, Canberra.

Ewers, R. M. and Didham, R. K. (2006). "Confounding factors in the detection of species responses to habitat fragmentation." *Biological Reviews* **81**: 117-142.

Law & Chidel (2011). *Forest Bats in NSW*. Industry & Investment, Forest Science Centre.

Murcia, C. (1995). "Edge effects in fragmented forests: implications for conservation." *Trends in Ecology and Evolution* **10**(2): 58-62.

NSW NPWS (2003). *Downy Wattle (Acacia pubescens): Recovery Plan*. NSW National Parks and Wildlife Service, Hurstville, NSW.

NSW Scientific Committee (2002). *Cooks River/Castlereagh ironbark forest in the Sydney Basin Bioregion - endangered ecological community listing*. NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee (2011). *Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion - Determination to make a minor amendment to Part 3 of Schedule 1 of the Threatened Species Conservation Act*.

OEH (2012). *Downy Wattle - profile*. Office of Environment and Heritage, Hurstville.

OEH (2013). *The Native Vegetation of the Sydney Metropolitan Area*. Office of Environment and Heritage, Sydney.

OEH (2014a). *BioBanking Assessment Methodology 2014*. Office of Environment and Heritage, Sydney.

OEH (2014b). *Yellow-bellied Sheathtail-bat - profile*. Office of Environment and Heritage, Hurstville.

OEH (2015a). "Atlas of NSW Wildlife." Accessed: 2013, from http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx.

OEH (2015b). *Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion - profile*. Office of Environment and Heritage, Hurstville, NSW.

OEH (2016a, 23 February 2016). "Downy Wattle - profile." from http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10023.

OEH (2016b). "Downy Wattle (*Acacia pubescens*)." *Saving Our Species* Accessed: 03 August, 2016, from

http://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10023.

Threatened Species Scientific Committee (2015). *Approved Conservation Advice (including listing advice) for Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion*. Department of the Environment, Canberra.

Appendix A

Director General's Requirements

NSW GOVERNMENT | Office of Environment & Heritage

DOC15/478207

Mr Joe Timpano
Director
Timpag Investments Pty Ltd
PO Box 441
HOXTON PARK NSW 2171

Dear Mr Timpano

REQUEST FOR DIRECTOR GENERAL'S REQUIREMENTS FOR THE PREPARATION OF A SPECIES IMPACT STATEMENT FOR Lot 10 DP 1003837, 36 Lyn parade Prestons

Thank you for your letter of 18 November 2015 requesting the requirements of the Director-General of the Office of Environment and Heritage (OEH) for a species impact statement (SIS) for the proposal cited above.

The purpose of an SIS is to:

- allow the applicant or proponent to identify threatened species issues and provide appropriate amelioration for adverse impacts resulting from the proposal;
- assist consent and determining authorities in the assessment of a development application under Part 4 or request for Part 5 approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act);
- assist the Director-General of OEH 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 of OEH or the Minister for the Environment when consulted for the purposes of Parts 4 or 5 of the EP&A Act; and
- assist the Director-General of OEH in the assessment of Section 91 Licence applications lodged under the *Threatened Species Conservation Act 1995* (TSC Act).

DEFINITIONS

The definitions given below are relevant to these requirements:

development has the same meaning as in the EP&A Act.
activity has the same meaning as in the EP&A Act.
proposal is the development, activity or action proposed
subject site means the area directly affected by the proposal.
study area **means the area bounded by Bernera, Jedda, Wonga and Kurrajong Roads Prestons.**
locality is the area within a 5 km radius of the subject site.

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subject species means those threatened species that are known or considered likely to occur in the study area.

All other definitions are the same as those contained in the TSC Act.

MATTERS WHICH HAVE BEEN LIMITED OR MODIFIED

I consider that the following Section 110 matters need not be addressed by your SIS.

- Section 110(2)(g) and 110(3)(d). The matters raised in these sections of the TSC Act have been clarified by the requirements below.

I consider that the following Section 110 matters need only be addressed where relevant:

1 All reference to threat abatement plans. No threat abatement plans have been approved in accordance with the TSC Act which are relevant to this proposal.

2 All reference to recovery plans. The following recovery plan(s) are relevant to this proposal:
- The *Acacia pubescens* Recovery Plan
- The Cumberland Plain Recovery Plan

3 All reference to key threatening processes. The following key threatening process(es) are relevant to this proposal:
- Clearing of native vegetation (as defined and described in the final determination of the Scientific Committee to list the key threatening process)
- Loss of hollow-bearing trees

4 All reference to critical habitat. At the time of writing, no areas of declared critical habitat were relevant to this proposal.

The proponent should be aware that recovery plans may be approved, critical habitat may be declared and key threatening processes may be listed between the issue of these requirements and the granting of consent. If this occurs these additional matters will need to be addressed in the SIS and considered by the consent, determining or concurrence authority.

MATTERS TO BE ADDRESSED

The TSC Act provides that the SIS must meet all the matters specified in Sections 109 and 110 of the TSC Act with the exception of those matters limited above. The requirements outlined in Sections 109 and 110 (excluding the matters limited above) have been repeated below (italics) along with the specific Director-General's Requirements for your proposal.

1 FORM OF THE SPECIES IMPACT STATEMENT

1.1 A species impact statement must be in writing (Section 109 (1))
1.2 A species impact statement must be signed by the principal author of the statement and by:
(a) the applicant for the licence, or
(b) if the species impact statement is prepared for the purposes of the Environmental Planning and Assessment Act 1979, the applicant for development consent or the proponent of the activity proposed to be carried out (as the case requires) Section 109(2)).

The applicant (not the representative of the proponent) must sign the following declaration: "I…[insert name], of ..[address], being the applicant for the development consent…[insert DA number, Lot & DP numbers, street, suburb and LGA names] 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."

2. CONTEXTUAL INFORMATION

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))

A full description of the action includes a description of all associated actions, including, but not restricted to: installation and maintenance of utilities, fire asset protection zones, access routes; and changes in surface water flows. Actions that occur both on and off the subject land as a result of the proposal must be assessed.

2.2 Provision of relevant plans, maps and data

The following plans, maps and images shall be provided at a scale of 1:500 or larger:

- A plan of the development on the subject site.
- A colour aerial image of the subject site.
- A map showing the location of all threatened species found on the subject site during surveys conducted for the SIS, as well as previous records obtained from the Atlas of NSW Wildlife and other data sources.
- A map showing the distribution of subject species habitat on the subject site.
- A map showing the distribution of vegetation type, identifying endangered ecological communities, on the subject site.

The following plans, maps and images shall be provided at a scale of 1:5000 or greater

- A map of the study area, showing the location of the subject site
- A colour aerial image of the study area, showing the location of the study site.
- A map showing the location of all threatened species found in the study area during surveys conducted for the SIS, as well as previous records obtained from the Atlas of NSW Wildlife and other data sources.
- A map showing the distribution of subject species habitat in the study area.
- A map showing the distribution of vegetation types, identifying endangered ecological communities, in the study area.
- A map of the study area showing property boundaries, differentiating tenure (private, Crown or Government agency tenure) and indicating the security and management of the vegetation and threatened species within different properties.

The following plans, maps and images shall be provided at a scale of 1:25000 or larger:

- A map of the locality, showing areas of native vegetation (identifying endangered ecological communities) and other threatened species habitat, as well as threatened species records obtained from the Atlas of NSW Wildlife and other data sources.

ArcMap-compatible GIS data shall be provided directly to OEH and shall consist of:

- All survey sites (plot/quadrat and transect locations, random meander tracks, targeted threatened species search areas, trap locations, call-playback sites, call listening or recording sites, spotlighting sites, avian point count sites or area search polygons, stag watch locations and echo-location detection sites, etc.).
- All vegetation mapping data for the study area presented in the SIS
- The development footprint (including the entire area to be cleared)

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)).

3.1 Identifying subject species

3.1.1 Assessment of available information

In determining these species (the subject species), consideration shall be given to the habitat types present within the study area, recent records of threatened species or populations in the locality and the known distribution of threatened species.

Databases such as the OEH Atlas of NSW Wildlife, Australian Museum and Royal Botanic Gardens should be consulted to assist in compiling the list. It should be noted that if the OEH Atlas is the only database that is referred to, due to data exchange agreements, the data provided by OEH will only include that which OEH is a custodian for. In many cases, this may only be a small subset of the data available. Other databases must also be consulted to create a comprehensive list of subject species.

The following species shall be considered for inclusion in the list of subject species:

Threatened Species

Scientific name	Common name
Meriodolum corneovirens	Cumberland Land Snail
Pultenaea pedunculata	Matted Bush-pea
Acacia pubescens	Downey Wattle

Endangered ecological communities

Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion
Shale Gravel Transition Forest in the Sydney Basin Bioregion
River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Cumberland Plain Woodland in the Sydney Basin Bioregion

This list is not exhaustive. One of the roles of a SIS is to determine which species may be utilising a development site given the limitations of existing databases.

The proponent should be aware that additional species, populations, and ecological communities could be added to the schedules of the TSC Act between the issue of these requirements and the granting of consent. If this occurs, these additional matters will need to be addressed in the SIS and considered by the consent, determining, or concurrence authority.

4 SURVEY

4.1 Requirement to survey

A fauna and flora survey is to be conducted in all accessible properties the *study area*. OEH shall be contacted to assist with gaining access to private properties in the study area.

Targeted surveys shall be conducted for all subject species determined in accordance with Section 3 above. Previous surveys and assessments may be used to assist in addressing this requirement. Species of taxonomic uncertainty shall be confirmed by a recognised authority such as the Australian Museum or National Herbarium at the Royal Botanic Gardens, Sydney.

Surveys shall be carried out in accordance with the OEH Threatened Species Survey and Assessment Guidelines (http://www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm).

4.2 Documentation of survey effort and technique

4.2.1 Description of survey techniques and survey sites

Survey technique(s) should be described and a reference given, where available, outlining the survey technique employed.

Survey site(s) shall be identified on a clearly keyed map. The size, orientation and dimensions of quadrat or length of transect should be clearly noted for each type of survey technique undertaken. AMG grid references for the survey site(s) shall be provided

4.2.2 Documenting survey effort and results

Survey effort shall be provided in person hours per survey technique per hectare or trap nights or call recording hours or similar relevant effort metric. This shall be recorded separately for each survey site..

Personnel details including name of surveyor(s) and contact phone number. The person who identified records (e.g., anabat, hair tubes, scat analysis) should also be identified.

Weather conditions at the time of each survey shall be noted with reference to the Bureau of Meteorology Automatic Weather Station at Holsworthy (http://www.bom.gov.au/products/IDN60901/IDN60901.95761.shtml).

5 ASSESSMENT OF LIKELY IMPACTS ON THREATENED SPECIES AND POPULATIONS

Section 5 needs only be addressed if threatened species or endangered populations are likely to be affected.

Assessment of impacts must include the assessment of indirect impacts and those of associated activities, including, but not restricted to: installation and maintenance of utilities, access and egress routes; and changes in surface water flows. These actions or impacts may occur on or off the subject land.

Where relevant, assessment of impacts must also include an assessment of impacts from the provision of fire protection zones. If, as part of the development, there will be a requirement to provide fuel free and/or fuel reduced zones in retained bushland, the impacts of this on any threatened species and/or populations must be addressed as part of the impacts of the overall proposal. Proponents should also consider recommendations in 'Planning for Bushfire Protection' (planningNSW 2001) and consider the use of perimeter roads as an option in providing fuel free zones and reducing impacts on retained bushland.

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)(c)).

This requirement is asking you to refine your list of subject species and populations (given the outcome of survey and analysis of likely impacts) in order to identify which threatened species or endangered populations may be affected and the nature of the impact.

The remaining requirements in this section need only be addressed for those species that are likely to be affected by the proposal.

5.2 Discussion of local and regional abundance

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

5.2.1 Discussion of other known local populations and habitat utilisation

An estimate of the numbers of individuals of subject species utilising the subject site, how these individuals use the subject site (e.g. residents, transients, adults, juveniles, nesting, foraging) and the area of habitat on the subject site shall be provided.

A discussion of other known population(s) of subject species in the study area and the locality shall be provided. This shall include population size and habitat area estimates. The long-term security of other populations (including tenure and management regime) shall be examined as part of this discussion. The relative significance of the subject site for threatened species or endangered populations in the study area and locality shall be discussed.

Population and habitat area estimates for populations outside the study area may be obtained from database records and other information sources (no survey required). OEH shall be contacted to determine if unpublished information can be provided.

Discuss the significance of the population(s) on the subject site to the viability of the threatened species or endangered population in the study area and locality.

5.2.2 Discussion of other populations in the region

Provide a summary of known information of other populations of subject species within the region. Include numbers of populations, estimated population sizes, habitat areas, security of tenure and management regime where available.

Discuss the significance of the population(s) on the subject site to the viability of the threatened species or endangered population in the region.

5.3 Assessment of habitat

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)).

5.3.1 Description of habitat values

The condition of the habitat within the study area and its suitability for subject species shall be discussed. Matters to be included, where relevant, are:

- Specific habitat features (e.g. frequency and location of stags, hollow bearing trees, culverts, rock shelters, rock outcrops, crevices, caves, drainage lines, soaks etc.) and the density of understorey vegetation and groundcover
- The prevalence of introduced species, species of weeds present and an estimate of the total weed cover as a percentage of each vegetation community, whether trampling or grazing is apparent, effects of erosion, prevalence of rubbish dumping, history of resource extraction or logging and proximity to roads
- Details of the subject site's fire history (e.g. frequency, time since last fire, intensity) and the source of fire history (e.g. observation, local records)

The significance of the habitat of the subject site for subject species, in comparison to the known habitat for those species in the region, shall be assessed.

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,...[and]... its habitat requirements ... (Section 110(2)(c))

Assessment shall include reference to any approved or draft recovery plans (see http://www.environment.nsw.gov.au/threatenedspecies/RecoveryPlans.htm) which may be relevant to the proposal.

5.5 Description of feasible alternatives

A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed, having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development (Section 110(2)(h)).

Where a Statement of Environmental Effects, Environmental Impact Statement or Review of Environmental Factors deals with these matters, the SIS may refer to the relevant section of the SEE, EIS or REF.

6 ASSESSMENT OF LIKELY IMPACTS ON ENDANGERED ECOLOGICAL COMMUNITIES

Section 6 need only be addressed when endangered ecological communities are likely to be affected.

Assessment of impacts must include the assessment of indirect impacts and those of associated activities, including, but not restricted to: installation and maintenance of utilities, access and egress routes; and changes in surface water flows. These actions or impacts may occur on or off the subject land.

Assessment of impacts must also include an assessment of impacts from the provision of fire protection zones. If, as part of the development, there will be a requirement to provide fuel free and/or fuel reduced zones in retained bushland, the impacts of this on any endangered ecological communities must be addressed as part of the impacts of the overall proposal. Proponents should also consider recommendations in 'Planning for Bushfire Protection' (planningNSW 2001) and consider the use of perimeter roads as an option in providing fuel free zones and reducing impacts on retained bushland.

6.1 Assessment of endangered ecological communities likely to be affected

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))

This must include reference to the ecological community as described by the NSW Scientific Committee, including maps of the extent and condition of the community with particular reference to those parts of the community that may only be represented by soil stored seed with no above ground components of the community present.

6.2 Assessment of habitat

A full description of the type, location, size and condition of the habitat of the ecological community and details of the distribution and condition of similar habitats in the region (Section 110 (3)(c)).

6.2.1 Description of disturbance history and recovery capacity

If the site shows signs of disturbance, details should be provided of the site's disturbance history. An assessment should be made of the ability of the ecological community to recover to a state

representative of its pre-disturbance condition. This assessment will include consideration of the site's in-situ and migratory resilience and will be accompanied by a map of the recovery capacity of the ecological community across the site. Consideration should be given to the results (preliminary or otherwise) of restoration projects being undertaken at other sites that contain the ecological community when assessing its recovery capacity.

6.2.2 Extent of habitat removal

The location, nature and extent of habitat removal or modification which may result from the proposed action including the cumulative loss of habitat from the study area (including all proposed DAs and those areas in the subject area already with development consent or identified for development) and the impacts of this on the viability of the endangered ecological community in the locality.

This shall include an assessment of the proportion of the endangered ecological community to be affected by the proposal, in relation to the total extent of the endangered ecological community, and the impact of this on the viability of the endangered ecological community in the study area and locality.

6.3 Discussion of conservation status

For each ecological community present, details of its local, regional and State-wide conservation status...[and]... its habitat requirements...(Section 110(3)(b))

Assessment should include reference to the threatening processes that are generally accepted by the scientific community as affecting the endangered ecological community and are likely to be caused or exacerbated by the proposal. Assessment should also include reference to any approved or draft recovery plans (See http://www.environment.nsw.gov.au/threatenedspecies/RecoveryPlans.htm) which may be relevant to the proposal.

6.3.1 Significance within a local context

An assessment of the community on the subject site in relation to other sites in the study area and in the locality. The tenure and long term security of other sites shall be examined as part of this discussion.

The relative significance of the subject site for the endangered ecological community shall be discussed. The assessment of the community should be considered in terms of the following features including the size of the remnant, the quality of the habitat and the level of disturbance on this site in comparison to other sites in the study area and locality.

6.4 Description of feasible alternatives

A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development (Section 110(3)(e)).

Where a Statement of Environmental Effects, Environmental Impact Statement or Review of Environmental Factors deals with these matters, the SIS may refer to the relevant section of the SEE, EIS or REF.

7 AMELIORATIVE MEASURES

7.1 Description of ameliorative measures

A full description and justification of the measures proposed to mitigate any adverse effect of the action on the species and populations and ecological community including a compilation (in a single section of the statement) of those measures (Section 110 (2)(i) and Section 110 (3)(f)).

7.1.1 Compensatory strategies

Any offsets proposed shall be consistent with the OEH Principles for the use of biodiversity offsets in NSW (http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm).

7.1.2 Translocation

OEH does not consider that translocation of threatened species, populations and ecological communities is an appropriate ameliorative strategy for the purposes of considering impacts of a particular development/activity. OEH strongly supports the view that development proposals which may impact on a significant local population of threatened species, populations or ecological communities as determined by the SIS should aim to:

i. Minimise the impacts by considering all possible alternatives to the development, such that a significant impact is not likely; and

ii. Manage the remaining habitat (if any) to ensure that the local population continues to exist in the long term.

The translocation of threatened species, populations and ecological communities is only supported by OEH in specific conservation programs (e.g. recovery planning) but only as a last resort, and only when in-situ conservation options have been exhausted. Such programs should only be reconsidered following extensive investigation of a demonstrated long term financial commitment on behalf of the applicant.

8. ASSESSMENT OF SIGNIFICANCE OF LIKELY EFFECT OF PROPOSED ACTION

An assessment of significance (s.5A EP&A Act) is to be provided for each of the subject species. This assessment must be carried out in accordance with the *Threatened species assessment guidelines* (DECC 2007) (www.environment.nsw.gov.au/threatenedspecies/tsaguide.htm) and must incorporate the relevant information from sections 5.1 to 7 of these SIS requirements. On the basis of these assessments a conclusion is to be provided concerning whether, based on more detailed assessment through the SIS process and consideration of alternatives and/or ameliorative measures proposed in the SIS, the proposal is still considered likely to have a significant effect on threatened species, populations or ecological communities or their habitats.

9 ADDITIONAL INFORMATION

9.1 Qualifications and experience

A species impact statement must include details of the qualifications and experience in threatened species conservation of the person preparing the statement and of any other person who has conducted research or investigations relied on in preparing the statement (Section 110(4))

9.2 Other approvals required for the development or activity

A list of any approvals that must be obtained under any other Act or law before the action may be lawfully carried out, including details of the conditions of any existing approvals that are relevant to the species or population or ecological community (Sections 110(2)(j) and 110(3)(g)))

In providing a list of other approvals the following shall be included:

- Where a consent is required under Part 4 of the *Environmental Planning and Assessment Act 1979*, the name of the consent authority and the timing of the development application should be included; or
- Where an approval(s) is required under Part 5 of the *Environmental Planning and Assessment Act 1979*, the name of the determining authority(ies), the basis for the approval and when these approvals are proposed to be obtained should be included.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

An action will require the approval of the Federal Minister for the Environment (in addition to any State or Local Government approval or determination) if that action will have, or is likely to have, a significant impact on a matter of national environmental significance. Threatened species and communities listed in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are considered to be a matter of national environmental significance.

Many of the species and ecological communities listed in the *Threatened Species Conservation Act 1995* (NSW) are also listed in the Commonwealth EPBC Act. Further information regarding the operation of the EPBC Act (including Federally listed threatened species and communities) may be obtained from the Department of Environment website www.environment.gov.au or by contacting the Department on 1800 803 772.

9.3 Licensing matters relating to the survey

Persons conducting flora and fauna surveys must have appropriate licences or approvals under relevant legislation. The relevant legislation and associated licences and approvals that may be required are listed below:

National Parks and Wildlife Act 1974:
- General Licence (Section 120) to harm or obtain protected fauna (this may include threatened fauna).
- Licence to pick protected native plants (Section 131).
- Scientific Licence (Section 132C) to authorise the carrying out of actions for scientific, educational or conservation purposes.

Threatened Species Conservation Act 1995:
- Licence to harm threatened animal species, and/or pick threatened plants and/or damage the habitat of a threatened species (Section 91).

Animal Research Act 1985:
- Animal Research Authority to undertake fauna surveys.

9.4 Section 110 (5) reports

Section 110(5) of the Threatened Species Conservation Act 1995 has the effect of requiring OEH to provide that information regarding the State-wide conservation status of the subject species as it has available, in order to satisfy ss.110(2) & (3) of the Act. To this end, a number of publications have been produced and are available at:

http://threatenedspecies.environment.nsw.gov.au/index.aspx

Proponents and consultants should note that OEH has no further published information available to satisfy s.110(5) of the Act and that purchase or receipt and use of the above profiles can be taken to have satisfied the requirements of ss.110(2) & (3) in relation to the State-wide conservation status of the listed species, populations and ecological communities.

If you have any further questions about this issue, please contact Ray Giddins, Acting Team Leader Compliance and Regulation on 9995 6811 or at ray.giddins@environment.nsw.gov.au

Yours sincerely

DAVID TREWIN
Regional Manager, Greater Sydney
Regional Operations

7/12/2015

Contact officer: RAY GIDDINS
99956811

cc: Liverpool City Council

Appendix B

Compliance Table

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
FORM OF THE SPECIES IMPACT STATEMENT	1			
A species impact statement must be in writing	1.1			Section 109 (1)
A species impact statement must be signed by the principal author of the statement and by:	1.2	(a) the applicant for the licence, or (b) if the species impact statement is prepared for the purposes of the Environmental Planning and Assessment Act 1979, the applicant for development consent or the proponent of the activity proposed to be carried out (as the case requires). The applicant (not the representative of the proponent) must sign the following declaration: " I…[insert name], of...[address], being the applicant for the development consent... [insert DA number, Lot and DP numbers, street, suburb and LGA names] 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."	Certification	Section 109 (2)
CONTEXTUAL INFORMATION	2		Chapter 2	
Description of the	2.1	A species impact statement must include a full description of the action proposed,	Section 2.1	Section 110 (1)

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
proposal, subject site and study area		including its nature, extent, location, timing and layout. A full description of the action includes a description of all associated actions, including, but not restricted to: installation and maintenance of utilities, fire asset protection zones, access routes; and changes in surface water flows. Actions that occur both on and off the subject land as a result of the proposal must be assessed.		
Provision of relevant plans, maps and data	2.2	The following plans, maps and images shall be provided at a scale of 1:500 or larger: • A plan of the development on the subject site. • A colour aerial image of the subject site. • A map showing the location of all threatened species found on the subject site during surveys conducted for the SIS, as well as previous records obtained from the Atlas of NSW Wildlife and other data sources • A map showing the distribution of subject species habtiat on the subject site. • A map showing the distribution of vegetation type, identifying endangered ecological communities, on the subject site. The following plans, maps and images shall be provided at a scale of 1:5000 or greater: • A map of the study area, showing the location of the subject site. • A colour aerial image of the syudy area, showing the location of the study site. • A map showing the location of all threatened species found in the study area during surveys conducted for the SIS, as well as previous records obtained	See Section 2.2 for a list of Figures in each chapter of this SIS.	

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		from the Atlas of NSW Wildlife and other data sources. • A map showing the distribution of subject species habtiat in the study area. • A map showing the distribution of vegetation type, identifying endangered ecological communities, in the study area. • A map of the study area showing property boundaries, differentiating tenure (private, Crown or Government agency tenure) and indicating the securtiy and management of the vegetation and threatened species within different properties The following plans, maps and images shall be provided at a scale of 1:25000 or larger: • A map of the locality, showing areas of native vegetation (identifying endangered ecological communities) and other threatened species habitat, as well as threatened species records obtained from the Atlas of NSW Wildlife and other data sources. ArcMap-compatible GIS data shall be provided directly to OEH and shall consist of: • All survey sites (plot/quadrat and transect locations, random meander tracks, targeted threatened species search areas, trap locations, call-playback sites, calllistening or recording sites, spotlighting sites, avian point count sites or area search polygons, stag watch locations and echo-location detection sites, etc.). • All vegetation mapping data for the study area presented in the SIS.		

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		• The development footprint (including the entire area to be cleared).		
INITIAL ASSESSMENT	3	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.	Chapter 3	Section 110(2)(a)
Identifying subject threatened species	3.1		Section 3.1	
Assessment of available information	3.1.1	In determining these species (the subject species), consideration shall be given to the habitat types present within the study area, recent records of threatened species or populations in the locality and the known distribution of threatened species. Databases such as the OEH Atlas of NSW Wildlife, Australian Museum and Royal Botanic Gardens should be consulted to assist in compiling the list. It should be noted that if the OEH Atlas is the only database that is referred to, due to data exchange agreements, the data provided by OEH will only include that which OEH is a custodian for. In many cases, this may only be a small subset of the data available. Other databses must also be consulted to create a comprehensive list of subject species. The following species must be considered for inclusion in the list of subject species: **Threatened species** • Meriodolum corneovirens - Cumberland Land Snail • Pultenaea pedunculata - Matted Bush-pea	Section 3.1	

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		• Acacia pubescens - Downy Wattle **Endangered ecological communities:** • Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion • Shale Gravel Transition Forest in the Sydney Basin Bioregion • River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions • Cumberland Plain Woodland in the Sydney Basin Bioregion This list is not exhaustive. One of the roles of a SIS is to determine which species may be utilising a development site given the limitations of existing databases. The proponent should be aware that additional species, populations and ecological communities could be added to the schedules of the TSC Act between the issue of these requirements and the granting of consent. If this occurs, these additional matters will need to be addressed in the SIS and considered by the consent, determining, or concurrence authority.		
SURVEY	4		Chapter 4	
Requirement to survey	4.1	A fauna and flora survey is to be conducted in all accessible properties in the study area. OEH shall be contacted to assist with gaining access to private properties in the study area.	Section 4.1	

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		Targeted surveys shall be conducted for all subject species determined in accordance with Section 3 above. Previous surveys and assessments may be used to assist in addressing this requirement. Species of taxonomic uncertainty shall be confirmed by a recognised authority such as the Australian Museum or National Herbarium at the Royal Botanic Gardens, Sydney. Surveys shall be carried out in accordance with the OEH Threatened Species Survey and Assessment Guidelines (http://www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm).		
Documentation of survey effort and technique	4.2		Section 4.2	
Description of survey techniques and survey sites	4.2.1	Survey technique(s) should be described and a reference given, where available, outlining the survey technique employed. Survey site(s) shall be identified ona clearly keyed map. The size, orientation and dimensions of quadrats or lengths of transects should be clearly noted for each type of survey technique undertaken. AMG grid references for the survey site(s) shall be provided.	Section 4.2.1 - Section 4.2.3	
Documenting survey effort and results	4.2.2	Survey effort shall be provided in person hours per survey technique per hectare or trap nights or call recording hours or similar relevant effort metric. This shall be revorded separately for each survey site.	Section 4.3 - Section 4.4	

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		Personnel details including name of survey(s) and contact phone number. The person who identified records (e.g., anabat, hair tubes, scat analysis) should also be identified. Weather conditions at the time of each survey shall be noted with reference to the Bureau of Meteorology Automatic Weather Station at Holsworth (http://www.bom.gov.au/products/IDN60901/IDN60901.95761.shtml).		
ASSESSMENT OF LIKELY IMPACTS ON THREATENED SPECIES AND POPULATIONS	5	Section 5 needs only be addressed if threatened species or endangered populations are likely to be affected.	Chapter 5	
		Assessments of impacts must include the assessment of indirect impacts and those of associated activities, including, but not restricted to: installation oand maintenance of utilities, access and egress routes; and changes in surface water flows. These actions or impacts may occur on or off the subject land. Where relevant, assessment of impacts must also include an assessment of impacts from the provision of fire protection zones. If, as part of the development, there will be a requirement to provide fuel free and/or fuel reduced zones in reatined bushland, the impacts of this on any thraetened species and/or populations must be addressed as part of the impacts of the overall proposal. Proponents should also consider recommendations in 'Planning for Bushfire Protection' (planningNSW 2001) and consider the use of perimeter roads an as option in providing fuel free zones and	Section 5.1	

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		reducing impacts on retained bushland.		
Assessment of species likely to be affected	5.1	*an assessment of which threatened species or population known or likely to be present in the area are likely to be affected by the action.* This requirement is asking you to refine your list of subject species and populations (given the outcome of survey and analysis of likely impacts) in order to identify which threatened species or endangered populations may be affected and the nature of the impact. The remaining requirements in this section need only be addressed for those species that are likely to be affected by the proposal.	Section 5.2	Section 110 (2)(b)
Discussion of local and regional abundance	5.2	*an estimate for the local and regional abundance of those species or populations*	Section 5.3	Section 110 (2)(d)
Discussion of other known local populations and habitat utilisation	5.2.1	An estimate of the number of individuals of subject species utilising the subject site, how these individuals use the subject site (e.g. Residents, transients, adults, juveniles, nesting, foraging) and the area of habitat on the subject site shall be provided. A discussion of other known population(s) of subject species in the study area and the locality shall be provided. This shall include population size and habitat area estimates. The long-term security of other populations (including tenure and management regime) shall be examined as part of this discussion. The relative significance of the subject site for threatened species or endangered populations in the study area and locality shall be discussed.	Section 5.3	

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		Population and habitat area estimates for populations outside the study area may be obtained from database records and other information sources (no survey required). OEH shall be contacted to determine if unpublished information can be provided. Discuss the significance of the population(s) on the subject site to the viability of the threatened species or endangered population in the study area and locality.		
Discussion of other populations in the region	5.2.2	Provide a summary of known information of other populations of subject species within the region. Include numbers of populations, estimated population sizes, habitat areas, security of tenure and management regime where available. Discuss the significance of the population(s) on the subject site to the viability of the threatened species or endangered population in the region.	Section 5.3.1.i	
Assessment of habitat	5.3	*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 5.3.1.ii	Section 110 (2)(f)
Description of habitat values	5.3.1	The condition of the habitat within the study area and its suitability for subject species shall be discussed. Matters to be included, where relevant, are: • Specific habitat features (e.g. Frequency and location of stags, hollow bearing trees, culverts, rock shelters, rock outcrops, crevices, caves, drainage lines, soaks etc.) and the density of understorey vegetation and groundcover • The prevalence of introduces spedcies, species of weeds present and an estimate of the total weed cover as a percentage of each vegetation	Section 5.3.1.ii	

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		community, whether trampling or grazing is apparent, effects of erosion, prevalence of rubbish dumping, history of resource extraction or logging and proximity to roads • Details of the subject site's fire history (e.g. Frequency, time since last fire, intensity) and the source of fire history (e.g. Observation, local records) The significance of habitat of the subject site for subject species, in comparison to the known habitat for those species in the region, shall be assessed.		
Discussion of conservation status	5.4	*for each species or population likely to be affected, details of its local, regional and State-wide conservation status, ...[and]... its habitat requirements...* Assessment shall include reference to any approved or draft recovery plans (see http://www.environment.nsw.gov.au/threatenedspecies/RecoveryPlans.htm) which may be relevant to the proposal.	Section 5.3.1.iii	Section 110 (2)(c)
Description of feasible alternatives	5.5	*a description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed, having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development.* Where a Statement of Environmental Effects, Environmental Impact Statement or Review of Environmental Factors deals with these matters, the SIS may refer to the relevant section of the SEE, EIS or REF.	Section 5.4	Section 110 (2)(h)

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
ASSESSMENT OF LIKELY IMPACTS ON ENDANGERED ECOLOGICAL COMMUNITIES	6	Section 6 needs only be addressed when endangered ecological communities are likely to be affected.	Chapter 6	
		Assessments of impacts must include the assessment of indirect impacts and those of associated activities, including, but not restricted to: installation and maintenance of utilities, access and egress routes; and changes in surface water flows. These actions or impacts may occur on or off the subject land.		
		Assessment of impacts must also include an assessment of impacts from the provision of fire protection zones. If, as part of the development, there will be a requirement to provide fuel free and/or fuel reduced zones in reatined bushland, the impacts of this on any endangered ecological communities must be addressed as part of the impacts of the overall proposal. Proponents should also consider recommendations in 'Planning for Bushfire Protection' (planningNSW 2001) and consider the use of perimeter roads an as option in providing fuel free zones and reducing impacts on retained bushland.		
Assessment of endangered ecological communities likely to be affected	6.1	*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 6.1	Section 110 (3)(a)
		This must include reference to the ecological community as described by the NSW		

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		Scientific Committee, including maps of the extent and condition of the community with particular reference to those parts of the community that may only be represented by soil stored seed withi no above ground components of the community present.		
Assessment of habitat	6.2	*A full description of the type, location, size and condition of the habitat of the ecological community and details of the distribution and condition of similar habitats in the region.*	Section 6.2	Section 110 (3)(c)
Description of disturbance history and recovery capacity	6.2.1	If the site shows signs of disturbance, details should be provided of the site's disturbance history. An assessment should be made of the ability of the ecological community to recover to a state representative of its pre-disturbance condition. This assessment will include consideration of the site's in-situ and migratory resilience and will be accompanied by a map of the recovery capacity of the ecological community across the site. Consideration should be given to the results (preliminary or otherwise) of the restoration projects being undertaken at other sites that contain ecological communities when assessing its recovery capacity.	Section 6.2.1.i	
Extent of habitat removal	6.2.2	The location, nature and extent of habitat removal or modification which may result from the proposed action including the cumulative loss of habitat from the study area (including all proposed Das and those areas in the subject area already with development consent or identified for development) and the impacts of this on the viability of the endangered ecological community in the locality. This shall include an assessment of the proportion of the endangered ecological community to be affected by the proposal, in relation to the total extent of the endangered ecological community, and the impact of this on the viability of the	Section 6.2.1.ii	

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		endangered ecological community in the study area and locality.		
Discussion of conservation status	6.3	*for each species or population likely to be affected, details of its local, regional and State-wide conservation status, ...[and]... its habitat requirements...* Assessment should include reference to the threatening processes that are generally accepted by the scientific community as affecting the endangered ecological community and are likely to be caused or exacerbated by the proposal. Assessment should also include reference to any approved or draft recovery plans (See http://www.environment.nsw.gov.au/threatenedspecies/RecoveryPlans.htm) which may be relevant to the proposal.	Section 6.3	Section 110 (3)(b)
Significance within a local context	6.3.1	An assessment of the community on the subject site in relation to other sites in the study area and in the locality. The tenure and long term security of other sites shall be examined as part of this discussion. The relative significance of the subject site for the endangered ecological community shall be discussed. The assessment of the community should be considered in terms of the following features including the size of the remnant, the wuality of the habitat and the level of disturbance on this site in comparison to other sites in the study area and locality.	Section 6.3.2	
Description of feasible alternatives	6.4	*A description of any feasable alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development.*	Section 6.4	Section 110 (3)(e)

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		Where a Statement of Environmental Effects, Environmental Impact Statement or Review of Envirnmental Factors deals with these matters, the SIS may refer to the relevant section of the SEE, EIS or REF.		
AMELIORATIVE MEASURES	7		Chapter 7	
Description of ameliorative measures	7.1	*a full description and justification of the measures proposed to mitigate any adverse effect of the action on the species and populations and ecological community including co pilation (in a single section of the statement) of those measures.*	Section 7.1	Section 110 (2)(i) and Section (110 (3)(f)
Compensatory strategies	7.1.1	Any offsets proposed shall be consistent with the OEH Principles for the use of bidiversity offsets in NSW (www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm).	Section 7.1.1	
Translocation	7.1.2	OEH does not consider translocation of threatened species, populations and ecological communities is an appropriate ameliorative strategy for the purposes of considering impacts of a particular development/activity. OEH strongly supports the view that the development proposals which may impact on a significant local population of threatened species, populations or ecological communities as determined by the SIS should aim to: i. minimise the impacts by considered all possible alternatives to the development, such that a significant impact is not likely; and	Section 7.1.2	

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		ii. manage the remaining habitat (if any) to ensure that the local population continues to exist in the long term. The translocation of threatened species, populations and ecological communities is only supported by OEH in specific conservation programs (e.g. recovery planning) but only as a last resort, and only when in-situ conservation options have been exhausted. Such programs should only be reconsidered following extensive investigation of a demonstrated long term financial commitment on behalf of the applicant.		
ASSESSMENT OF SIGNIFICANCE OF LIKELY EFFECT OF PROPOSED ACTION	8	An assessment of significance (s. 5A EP&A Act) is to be provided for each of the subject species. This assessment must be carried out in accordance with the Threatened species assessment guidelines (DECC 2007) (www.environment.nsw.gov.au/threatenedspecies/tsaguide.htm) and must incorporate the relevant information from sections 5.1 to 7 of these SIS requirements. On the basis of these assessments a conclusion is to be provided concerning whether, based on more detailed assessment through the SIS process and consideration of alternatices and/or ameliorative measures proposed in the SIS, the proposal is still considered likely to have a significant effect on threatened species, populations or ecological communities or their habitats.	Chapter 8	
ADDITIONAL	9		Chapter 9	

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
INFORMATION				
Qualifications and experience	9.1	*A species impact statement must include details of the qualifications and experience in threatened species conservation of the person preparing the statement and of any other person who has conducted research or investigations relied on in preparing the statement.*	Section 9.1	Section 110 (4)
Other approvals required for the development or activity	9.2	*A list of any approvals that must be obtained under any other Act or law before the action may be lawfully carried out, including details of the conditions of any existing approvals that are relevant to the species or population or ecological community.* In providing a list of other approvals the following shall be included: • Where a consent is required under Part 4 of the Environmental Planning and Assessment Act 1979, the name of the consent authority and the timing of the development application should be included; or • Where an approval(s) is required under Part 5 of the Environmental Planning and Assessment Act 1979, the name of the determining authority(ies), the basis for the approval and when these approvals are proposed to be obtained should be included. <u>Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)</u> An action will require the approval of the Federal Minister for the Environment (in addition to any State or Local Government approval or determination) if that action will have, or is likely to have, a significant on a matter of national environmental significance. Threatened species and communities listed in the Environmental	Section 9.2	Section 110 (2)(j) and Section 110 (2)(g)

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		Protection and Biodiversity Conservation Act 1999 (EPBC Act) are considered to be a matter of national environmental significance. Many of these native species and ecological communities listed in the Threatened Species Conservation Act 1995 (NSW) are also listed in the Commonwealth EPBC Act. Further information regarding the operation of the EPBC Act (including Federally listed threatened species and communities) may be obtained from the Department of Environment website www.environment.gov.au or by contacting the department on 1800 8803 772.		
Licensing matters relating to conducting surveys	9.3	Persons conducting flora and fauna surveys must have appropriate licences or approvals under relevant legislation. The relevant legislation and associated licences and approvals that may be required are listed below: National Parks and Wildlife Act 1974: • General Licence (Section 120) to harm or obtain protected fauna (this may include . threatened fauna). • Licence to pick protected native plants (Section 131). • Scientific Licence (Section 132C) to authorise the carrying out of actions for scientific, educational or conservation purposes. Threatened Species Conservation Act 1995: • Licence to harm threatened animal species, and/or pick threatened plants and/or damage the habitat of a threatened species (Section 91).	Section 9.3	

Table B.1 Director General Requirements – Compliance Table

Matters to be addressed	Section within DGRs	Detail	Location within the SIS	TSC Act Section 109/110
		Animal Research Act 1985: • Animal Research Authority to undertake fauna surveys.		
Section 110(5) reports	9.4	Section 110(5) of the Threatened Species Conservation Act 1995 has the effect of requiring OEH to provide that information regarding the State-wide conservation status of the subject species as it has available, in order to satisfy ss.110(2) & (3) of the Act. To this end, a number of publications have been produced and are available at: http://threatenedspecies.environment.nsw.gov.au/index.aspx Proponents and consultants should note that OEH has no further published information available to satisfy s.110(5) of the Act and that purchase or receipt and use of the above profiles can be taken to have satisfied the requirements of ss.110(2) & (3) in relation to the State-wide conservation status of the listed species, populations and ecological communities.	Section 9.4	

Appendix C

Flora Species List

cumberland ecology

Table C.1. Flora Species List

Family	*	Scientific Name	Common Name	Q1	Q2	RMT1	RMT2	RMT3a	RMT3b	RMT4	RMT5	RMT6	RMT7	RMT8	RMT9	RMT10	RMT11	RMT12	RMT13	RMT14	RMT15	RMT16
Trees																						
Casuarinaceae		*Casuarina glauca*	Swamp Oak											X								X
Myrtaceae		*Angophora floribunda*	Rough-barked Apple						X					X								
Myrtaceae		*Eucalyptus amplifolia*	Cabbage Gum					X	X				X	X	X							X
Myrtaceae		*Eucalyptus fibrosa*	Red Ironbark				X			X		X	X		X	X	X	X	X		X	
Myrtaceae		*Eucalyptus longifolia*	Woollybutt				X		X	X			X	X				X				
Myrtaceae		*Eucalyptus moluccana*	Grey Box				X	X	X		X		X	X	X		X	X	X	X		
Myrtaceae		*Eucalyptus resinifera*	Red Mahogany				X								X							
Myrtaceae		*Eucalyptus sideroxylon*	Mugga Ironbark																		X	
Myrtaceae		*Eucalyptus tereticornis*	Forest Red Gum															X				X
Myrtaceae		*Melaleuca decora*								X												
Salicaceae	*	*Salix sp.*							X													
Small Trees																						
Casuarinaceae		*Casuarina glauca*	Swamp Oak				X	X	X						X			X	X	X		
Fabaceae (Mimosoideae)		*Acacia decurrens*	Black Wattle						X						X	X					X	X
Fabaceae (Mimosoideae)	*	*Acacia podalyriifolia*	Queensland Silver Wattle								X											
Myrtaceae		*Angophora floribunda*	Rough-barked Apple											X								
Myrtaceae		*Angophora subvelutina*	Broad-leaved Apple											X								
Myrtaceae		*Callistemon salignus*	Willow Bottlebrush										X									
Myrtaceae		*Eucalyptus amplifolia*	Cabbage Gum										X		X							
Myrtaceae		*Eucalyptus eugenioides*	Thin-leaved Stringybark							X											X	
Myrtaceae		*Eucalyptus fibrosa*	Red Ironbark	5	5										X							
Myrtaceae		*Eucalyptus globoidea*	White Stringybark										X									
Myrtaceae		*Eucalyptus longifolia*	Woollybutt				X						X									
Myrtaceae		*Eucalyptus moluccana*	Grey Box				X	X			X				X		X					
Myrtaceae		*Eucalyptus parramattensis*	Parramatta Red Gum																		X	
Myrtaceae		*Eucalyptus resinifera*	Red Mahogany				X								X							
Myrtaceae		*Eucalyptus tereticornis*	Forest Red Gum								X											
Myrtaceae		*Lophostemon confertus*	Brush Box								X											
Myrtaceae		*Melaleuca nodosa*	Prickly-leaved Paperbark															X				
Myrtaceae		*Melaleuca decora*		5	5			X	X	X		X	X	X	X			X	X	X	X	
Myrtaceae		*Melaleuca linariifolia*	Flax-leaved Paperbark						X													X
Myrtaceae		*Melaleuca styphelioides*	Prickly-leaved Tea Tree					X						X					X			X
Oleaceae	*	*Ligustrum lucidum*	Large-leaved Privet											X				X				
Salicaceae	*	*Salix alba*												X								
Santalaceae		*Exocarpos cupressiformis*	Cherry Ballart						X		X			X								
Herbs - Ferns and Allies																						
Pteridaceae		*Adiantum aethiopicum*	Common Maidenhair						X													
Pteridaceae		*Cheilanthes sieberi*		2	4		X	X			X							X	X		X	
Pteridaceae		*Pellaea falcata*	Sickle Fern	X														X				
Herbs - Climbers																						
Apocynaceae	*	*Araujia sericifera*	Moth Vine			X		X						X				X				X
Apocynaceae		*Marsdenia suaveolens*	Scented Marsdenia										X									
Apocynaceae		*Marsdenia viridiflora*	Native Pear									X	X									
Apocynaceae		*Tylophora barbata*	Bearded Tylophora										X						X			
Asparagaceae	*	*Asparagus asparagoides*	Bridal Creeper			X	X	X	X					X	X		X	X	X		X	
Basellaceae	*	*Anredera cordifolia*	Madeira Vine											X								
Convolvulaceae		*Polymeria calycina*					X				X							X				
Fabaceae (Faboideae)		*Desmodium varians*	Slender Tick-trefoil								X											
Fabaceae (Faboideae)		*Glycine clandestina*				X							X									
Fabaceae (Faboideae)		*Glycine microphylla*	Small-leaf Glycine		3			X	X					X	X		X	X				
Fabaceae (Faboideae)		*Glycine tabacina*					X	X			X				X	X					X	
Fabaceae (Faboideae)		*Hardenbergia violacea*	Purple Coral Pea					X		X				X	X		X					
Lauraceae		*Cassytha pubsecens*		2	3				X								X	X			X	
Loranthaceae		*Amyema gaudichaudii*		3						X			X	X				X		X	X	
Loranthaceae		*Amyema miquellii*		2							X							X		X	X	

cumberland ecology

Table C.1. Flora Species List

Family	*	Scientific Name	Common Name	Q1	Q2	RMT1	RMT2	RMT3a	RMT3b	RMT4	RMT5	RMT6	RMT7	RMT8	RMT9	RMT10	RMT11	RMT12	RMT13	RMT14	RMT15	RMT16
Pittosporaceae		*Billardiera scandens*	Hairy Apple Berry																		X	
Ranunculaceae		*Clematis aristata*	Old Man's Beard											X				X				
Ranunculaceae		*Clematis glycinoides*	Headache Vine					X	X													
Rosaceae	*	*Rubus fruticosus*	Blackberry									X		X								
Sapindaceae	*	*Cardiospermum grandiflorum*	Balloon Vine											X								
Shrubs																						
Apiaceae	*	*Foeniculum vulgare*	Fennel					X														
Apocynaceae	*	*Nerium oleander*	Oleander												X							
Asteraceae		*Cassinia sp.*															X					
Asteraceae		*Olearia microphylla*			2													X			X	
Asteraceae		*Ozothamnus diosmifolius*	Rice Flower	2	3							x				X	X	X			X	
Casuarinaceae		*Allocasuarina littoralis*	Black She-oak							X												
Cataceae	*	*Opuntia stricta*	Common Prickly Pear					X	X			X			X							
Celastraceae		*Denhamia silvestris*	Narrow-leaved Orangebark	2	2								X					X				
Dilleniaceae		*Hibbertia aspera*	Rough Guniea Flower										X								X	
Dilleniaceae		*Hibbertia diffusa*	Wedge Guniea Flower										X									
Ericaceae (Epacridoideae)		*Astroloma humifusum*	Native Cranberry										X									
Ericaceae (Epacridoideae)		*Brachyloma daphnoides subsp. da*	Daphne Heath																		X	
Ericaceae (Epacridoideae)		*Leucopogon juniperinus*	Prickly Berad-heath										X					X				
Ericaceae (Epacridoideae)		*Lissanthe strigosa subsp. Strigosa*	Peach Heath																		X	
Fabaceae (Caesalpinioideae)	*	*Senna pendula*												X								
Fabaceae (Faboideae)		*Daviesia ulicifolia*	Gorse Bitter Pea		2		X	X		X	X				X	X	X	X			X	
Fabaceae (Faboideae)		*Dillwynia parvifolia*																			X	
Fabaceae (Faboideae)		*Dillwynia sieberi*		5	5		X		X		X				X	X	X	X	X	X	X	
Fabaceae (Faboideae)		*Indigofera australis*	Australian Indigo									X	X	X	X			X				
Fabaceae (Faboideae)		*Pultenaea parviflora*	Sydney Bush-pea																		X	
Fabaceae (Faboideae)		*Pultenaea villosa*	Hairy Bush-pea				X			X			X	X								
Fabaceae (Mimosoideae)		*Acacia brownii*	Heath Wattle																		X	
Fabaceae (Mimosoideae)		*Acacia decora*	Western Silver Wattle	2											X			X				
Fabaceae (Mimosoideae)		*Acacia decurrens*					X	X				X		X			X					
Fabaceae (Mimosoideae)		*Acacia falcata*	Hickory Wattle	2			X	X		X			X				X		X		X	
Fabaceae (Mimosoideae)		*Acacia floribunda*	White Sally Wattle												X							X
Fabaceae (Mimosoideae)		*Acacia longifolia*					X							X								
Fabaceae (Mimosoideae)		*Acacia parramattensis*					X				X			X			X					
Fabaceae (Mimosoideae)	*	*Acacia podalyriifolia*	Queensland Silver Wattle					X														
Fabaceae (Mimosoideae)		*Acacia pubescens*	Downy Wattle	2	2					X			X			X		X			X	
Malvaceae		*Lasiopetalum ferrugineum*											X									
Meliaceae		*Melia azedarach*	White Cedar									X										
Moraceae	*	*Morus alba*	White Mulberry											X								
Myrsinaceae		*Myrsine variabilis*											X									
Myrtaceae		*Angophora floribunda*	Rough-barked Apple						X													
Myrtaceae		*Callistemon linearis*	Narrow-leaved Bottlebrush										X					X				
Myrtaceae		*Callistemon pinifolius*	Pine-leaved Bottlebrush																		X	
Myrtaceae		*Eucalyptus amplifolia*	Cabbage Gum						X					X								
Myrtaceae		*Eucalyptus fibrosa*	Red Ironbark				X			X						X						
Myrtaceae		*Eucalyptus moluccana*	Grey Box								X											
Myrtaceae		*Eucalyptus tereticornis*	Forest Red Gum								X						X					
Myrtaceae		*Kunzea ambigua*					X						X			X				X	X	
Myrtaceae		*Leptospermum parvifolium*																			X	
Myrtaceae		*Leptospermum polygalifolium*	Tantoon																			X
Myrtaceae		*Melaleuca decora*		5	5		X	X	X					X	X	X	X					
Myrtaceae		*Melaleuca erubescens*																			X	
Myrtaceae		*Melaleuca linariifolia*	Flax-leaved Paperbark						X					X								
Myrtaceae		*Melaleuca nodosa*	Prickly-leaved Paperbark	6	6		X		X	X	X		X					X	X		X	
Myrtaceae		*Melaleuca styphelioides*					X	X						X				X				
Myrtaceae		*Melaleuca thymifolia*	Thyme Honey-myrtle																		X	
Ochnaceae	*	*Ochna serrulata*	Mickey Mouse Plant						X													
Oleaceae	*	*Ligustrum lucidum*	Large-leaved Privet											X								

Table C.1. Flora Species List

Family	*	Scientific Name	Common Name	Q1	Q2	RMT1	RMT2	RMT3a	RMT3b	RMT4	RMT5	RMT6	RMT7	RMT8	RMT9	RMT10	RMT11	RMT12	RMT13	RMT14	RMT15	RMT16
Oleaceae	*	*Ligustrum sinense*	Small-leaved Privet								X											
Oleaceae		*Notelaea longifolia*	Large Mock-olive			X												X				
Oleaceae	*	*Olea europaea subsp. cuspidata*	African Olive								X			X								
Phyllanthaceae		*Breynia oblongifolia*	Coffee Bush										X									
Phyllanthaceae		*Phyllanthus hirtellus*	Thyme Spurge															X				
Pittosporaceae		*Bursaria spinosa*	Blackthorn	4	2		X	X	X		X			X	X	X	X	X	X		X	
Pittosporaceae		*Pittosporum revolutum*	Wild Yellow Jasmine													X						
Plumbaginaceae	*	*Plumbago auriculata*	Blue Plumbago			X																
Proteaceae		*Banksia spinulosa*	Hairpin Banksia																		X	
Proteaceae		*Hakea sericea*	Needlebush	2																	X	
Rhamnaceae		*Cryptandra spinescens*		5	5				X	X		X	X					X			X	
Rutaceae		*Zieria smithii*	Sandfly Zieria										X									
Santalaceae		*Exocarpos strictus*	Pale-fruit Ballart		4																	
Santalaceae		*Exocarpus cupressiformis*	Cherry Ballart	X												X	X	X				
Sapindaceae		*Dodonaea viscosa subsp. angustif*	Sticky Hop-bush									X	X		X							
Sapindaceae		*Dodonaea viscosa subsp. cuneata*	Hopbush					X		X				X								
Solanaceae	*	*Cestrum parqui*	Green Cestrum						X									X				
Solanaceae	*	*Lycium ferocissimum*	African Boxthorn					X	X			X										X
Thymelaeaceae		*Pimelea curviflora var. sericea*					X															
Thymelaeaceae		*Pimelea linifolia*	Slender Rice Flower	3									X					X			X	
Verbenaceae	*	*Lantana camara*	Lantana											X	X			X				
Herbs - Dicots																						
Acanthaceae		*Brunoniella australis*	Blue Trumpet	2	2		X	X	X		X			X	X			X	X			
Acanthaceae	*	*Thunbergia alata*	Black-eyed Susan											X								
Amaranthaceae		*Alternanthera denticulata*	Lesser Joyweed					X						X								
Anthericaceae	*	*Chlorophytum comosum*	Spider Plant			X																
Apiaceae		*Centella asiatica*	Indian Pennywort				X		X		X			X	X							
Apiaceae	*	*Cyclospermum leptophyllum*	Slender Celery														X					
Apiaceae	*	*Daucus carota*	Wild Carrot					X														
Apiaceae	*	*Foeniculum vulgare*	Fennel											X								
Asteraceae	*	*Ageratina adenophora*	Crofton Weed						X													
Asteraceae	*	*Bidens pilosa*	Cobblers Pegs			X		X						X								
Asteraceae	*	*Bidens subalternans*	Greater Beggar's Ticks														X					
Asteraceae		*Calotis lappulacea*	Yellow Burr-daisy										X				X					
Asteraceae	*	*Cirsium vulgare*	Spear Thistle								X			X				X				
Asteraceae	*	*Conyza bonariensis*				X					X											
Asteraceae	*	*Conyza sumatrensis*	Tall Fleabane			X			X					X				X	X			
Asteraceae		*Eclipta platyglossa*					X															
Asteraceae		*Euchiton sphaericus*					X	X			X										X	
Asteraceae	*	*Gamochaeta americana*	Cudweed															X				
Asteraceae	*	*Hypochaeris radicata*	Catsear								X							X				
Asteraceae	*	*Lactuca saligna*	Willow-leaved Lettuce					X														
Asteraceae		*Lagenophora stipitata*	Blue Bottle-daisy									X										
Asteraceae		*Senecio hispidulus*	Hill Fireweed					X														
Asteraceae	*	*Senecio madagascariensis*				X	X	X			X			X				X	X		X	
Asteraceae		*Senecio quadridentatus*	Cotton Fireweed			X					X											
Asteraceae		*Sigesbeckia orientalis*													X							
Asteraceae	*	*Sonchus oleraceus*	Common Sowthistle													X		X				
Asteraceae		*Taraxacum officinale*	Dandelion					X														
Asteraceae		*Vernonia cinerea*			3						X							X				
Asteraceae		*Vittadinia cuneata*	Fuzzweed								X					X						
Brassicaceae	*	*Brassica fruticulosa*	Twiggy Turnip			X															X	X
Cactaceae	*	*Opuntia stricta*	Common Prickly Pear			X																
Campanulaceae		*Wahlenbergia gracilis*	Sprawling Bluebell		X						X							X			X	
Caryophyllaceae	*	*Paronychia brasiliana*	Chilean Whitlow Wort								X											
Caryophyllaceae	*	*Spergularia sp.*									X											
Chenopodiaceae		*Atriplex semibaccata*	Creeping Saltbush																		X	
Chenopodiaceae		*Einadia hastata*	Berry Saltbush			X		X				X			X	X	X	X			X	

cumberland ecology

Table C.1. Flora Species List

Family	*	Scientific Name	Common Name	Q1	Q2	RMT1	RMT2	RMT3a	RMT3b	RMT4	RMT5	RMT6	RMT7	RMT8	RMT9	RMT10	RMT11	RMT12	RMT13	RMT14	RMT15	RMT16
Chenopodiaceae		*Einadia nutans*	Climbing Saltbush														X					
Chenopodiaceae		*Einadia nutans subsp. nutans*	Climbing Saltbush											X	X	X						
Chenopodiaceae		*Einadia nutans subsp. linifolia*		X				X				X						X				
Chenopodiaceae		*Einadia polygonoides*									X						X	X				
Chenopodiaceae		*Einadia trigonos*	Fishweed	X										X								
Clusiaceae		*Hypericum gramineum*	Small St John's Wort																X			
Clusiaceae	*	*Hypericum perforatum*	St John's Wort					X						X	X							
Convolvulaceae		*Dichondra repens*	Kidney Weed	X			X	X			X			X	X		X	X	X	X	X	
Crassulaceae	*	*Bryophyllum delagoense*	Mother-of-Millions					X						X			X					
Crassulaceae	*	*Bryophyllum pinnatum*	Resurrection Plant											X								
Crassulaceae	*	*Crassula multicava*						X	X					X				X				
Crassulaceae	*	*Crassula sarmentosa*							X					X								
Euphorbiaceae		*Chamaesyce drummondii*	Caustic Weed																		X	
Fabaceae (Faboideae)		*Indigofera australis*		1																		
Fabaceae (Faboideae)	*	*Trifolium repens*	White Clover			X																
Gentianaceae	*	*Centaurium tenuiflorum*				X																
Goodeniaceae		*Goodenia hederacea*	Forest Goodenia								X										X	
Goodeniaceae		*Goodenia paniculata*	Branched Goodenia				X						X		X						X	
Haloragaceae		*Gonocarpus teucrioides*	Raspwort															X				
Haloragaceae		*Haloragis sp.*					X															
Lamiaceae		*Plectranthus parviflorus*	Cockspur Flower				X	X	X					X	X	X	X	X	X	X		
Linaceae		*Linum marginale*	Native Flax																X			
Lobeliaceae		*Pratia purpurascens*	Whiteroot						X					X								
Malvaceae		*Sida corrugata*	Corrugated Sida								X											
Malvaceae	*	*Sida rhombifolia*	Paddy's Lucerne			X	X	X	X					X	X		X					
Oleaceae	*	*Olea europaea subsp. cuspidata*	African Olive								X			X								
Onagraceae		*Epilobium hirtigerum*													X							
Oxalidaceae		*Oxalis perennans*		1			X	X	X		X				X			X				
Phyllanthaceae		*Phyllanthus hirtellus*	Thyme Spurge																		X	
Phyllanthaceae		*Phyllanthus virgatus*									X											
Phyllanthaceae		*Poranthera microphylla*	Small Poranthera								X											
Plantaginaceae		*Plantago debilis*									X					X	X			X		
Plantaginaceae		*Plantago gaudichaudii*	Narrow Plantain				X	X														
Plantaginaceae		*Plantago lanceolata*	Lamb's Tongue					X						X			X					
Plantaginaceae		*Veronica plebeia*	Trailing Speedwell		X													X				
Polygonaceae		*Persicaria strigosa*	Spotted Knotweed						X													
Rubiaceae		*Opercularia diphylla*		3			X	X					X					X			X	
Rubiaceae		*Pomax umbellata*		2																		
Rubiaceae	*	*Richardia stellaris*									X											
Scrophulariaceae		*Eremophila debilis*	Winter Apple					X				X										
Solanaceae	*	*Solanum linnaeanum*	Apple of Sodom													X	X					
Solanaceae	*	*Solanum nigrum*	Black-berry Nightshade			X		X						X								
Solanaceae		*Solanum prinophyllum*	Foresrt Nightshade															X				
Solanaceae	*	*Solanum sisymbriifolium*							X		X							X				
Stackhousiaceae		*Stackhousia viminea*	Slender Stackhousia								X											
Verbenaceae	*	*Verbena bonariensis*	Purpletop			X	X	X	X					X	X							X
Herbs - Monocots																						
Poaceae		*Aristida ramosa*	Purple Wiregrass								X											
Poaceae		*Aristida vagans*	Threeawn Speargrass	2	2		X	X			X							X		X	X	
Poaceae		*Austrostipa pubescens*																			X	
Poaceae		*Austrostipa rudis*						X					X					X				
Poaceae		*Axonopus fissifolius*	Narrow-leaved Carpet Grass								X											
Poaceae		*Bothriochloa macra*	Red Grass					X			X											
Poaceae	*	*Briza subaristata*					X				X											
Poaceae	*	*Chloris gayana*	Rhodes Grass			X	X	x	X					X	X		X	X	X	X		X
Poaceae		*Chloris ventricosa*	Plump Windmill grass								X											
Poaceae	*	*Cortaderia selloana*	Pampas Grass												X							
Poaceae		*Cymbopogon refractus*	Barbed Wire Grass					X														

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Table C.1. Flora Species List

Family	*	Scientific Name	Common Name	Q1	Q2	RMT1	RMT2	RMT3a	RMT3b	RMT4	RMT5	RMT6	RMT7	RMT8	RMT9	RMT10	RMT11	RMT12	RMT13	RMT14	RMT15	RMT16
Poaceae		*Cynodon dactylon*				X	X	X			X			X								
Poaceae		*Dichelachne micrantha*	Shorthair Plumegrass					X			X											
Poaceae		*Digitaria parviflora*	Small-flowered Finger Grass															X	X			
Poaceae		*Echinopogon caespitosus*	Bushy Hedgehog-grass															X				
Poaceae	*	*Echinopogon ovatus*	Forest Hedgehog Grass								X											
Poaceae	*	*Ehrharta erecta*	Panic Veldtgrass			X			X		X						X	X				
Poaceae	*	*Ehrharta longiflora*				X																
Poaceae		*Entolasia marginata*	Bordered Panic						X									X				
Poaceae		*Entolasia stricta*	Wiry Panic	3	5		X				X							X			X	
Poaceae		*Eragrostis brownii*					X				X				X							
Poaceae	*	*Eragrostis curvula*	African Lovegrass	6	6		X		X		X				X	X	X				X	X
Poaceae		*Eragrostis leptostachya*	Paddock Lovegrass								X											
Poaceae		*Eriochloa pseudoacrotricha*	Early Spring Grass			X					X				X	X	X					
Poaceae		*Imperata cylindrica*	Blady Grass				X		X					X					X			
Poaceae	*	*Megathyrsus maximus*	Guinea Grass											X								
Poaceae		*Microlaena stipoides*	Weeping Grass				X	X	X		X			X	X							
Poaceae		*Oplismenus aemulus*					X											X				
Poaceae		*Oplismenus imbecillis*					X															
Poaceae		*Panicum effusum*	Hairy Panic								X								X			
Poaceae		*Paspalidium distans*		2	3		X	X			X				X			X				
Poaceae	*	*Paspalum dilatatum*	Paspalum		1		X	X	X		X			X	X							
Poaceae	*	*Pennisetum clandestinum*	Kikuyu Grass			X		X						X	X							X
Poaceae		*Rytidosperma caespitosum*					X															
Poaceae		*Rytidosperma racemosum*						X			X											
Poaceae		*Rytidosperma sp.*						X			X					X						
Poaceae	*	*Setaria parviflora*				X		X			X				X							
Poaceae		*Sporobolus creber*	Western Rat-tail Grass								X	X										
Poaceae		*Themeda triandra*					X	X	X		X				X				X			
Herbs - Monocots (Other)																						
Alstroemeriaceae		*Alstroemeria pulchella*	Christmas Lily											X								
Anthericaceae		*Arthropodium sp. B*																X				
Anthericaceae		*Caesia parviflora*	Pale Grass-lily						X									X				
Anthericaceae		*Tricoryne elatior*	Yellow Autumn-lilly				X		X		X											
Araceae	*	*Monstera deliciosa*	Fruit Salad Plant											X								
Asparagaceae	*	*Asparagus officinalis*	Asparagus				X	X	X		X							X				
Asparagaceae	*	*Yucca aloifolia*	Yucca Plant			X															X	
Commelinaceae		*Commelina cyanea*	Native Wandering Jew			X		X	X					X								
Commelinaceae	*	*Tradescantia fluminensis*	Wandering Jew											X								
Commelinaceae	*	*Tradescantia pallida*	Purple Queen											X								
Cyperaceae		*Carex inversa*					X	X			X											
Cyperaceae		*Carex longebrachiata*							X					X								
Cyperaceae	*	*Cyperus eragrostis*	Umbrella Sedge					X														
Cyperaceae		*Fimbristylis dichotoma*	Common Finge-sedge				X	X														
Cyperaceae		*Lepidosperma laterale*		4	5								X					X			X	
Cyperaceae		*Schoenus apogon*	Common Bog-rush				X															
Iridaceae	*	*Freesia sp.*	Freesia												X							
Juncaceae		*Juncus usitatus*					X				X			X					X			
Linaceae		*Linum marginale*	Native Flax					X														
Lomandraceae		*Lomandra filiformis subsp. coriacea*									X											
Lomandraceae		*Lomandra filiformis subsp. filiformis*	Wattle Mat-rush	3	4												X	X				
Lomandraceae		*Lomandra longifolia*	Spiney-headed Mat-rush				X		X					X								
Lomandraceae		*Lomandra multiflora*	Many-flowered Mat-rush							X			X		X			X	X		X	
Phormiaceae		*Dianella caerulea var. producta*																X				
Phormiaceae		*Dianella longifolia*	Blueberry Lily								X		X		X							
Phormiaceae		*Dianella revoluta*			X		X	X								X		X	X		X	
Typhaceae		*Typha orientalis*	Broadleaf Cumbungi					X														
Xanthorrhoeaceae		*Xanthorrhoea sp.*																			X	

** Denotes exotic species*

Appendix D

BioBanking Credit Report

BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 14/09/2016 Time: 10:09:19AM Calculator version: v4.0

Development details

Proposal ID:	0057/2015/1583D
Proposal name:	14150 - Development
Proposal address:	36 Lyn Parade Prestons NSW 2170
Proponent name:	Timpag Investments Pty Ltd
Proponent address:	PO Box 441 Hoxton Park NSW 2170
Proponent phone:	02 9868 1933
Assessor name:	David Robertson
Assessor address:	PO BOX 2474 Carlingford Court NSW 2118
Assessor phone:	02 9868 1933
Assessor accreditation:	0057

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Downy Wattle	An impact greater than that allowed;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report...
- ☐ Request for additional gain in site value
- ☐ Predicted threatened species not on site
- ☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Plant Community type	Area (ha)	Credits required	Red flag
Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion	0.90	26.78	Yes
Total	0.90	27	

Credit profiles

1. Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion, (ME002)

Number of ecosystem credits created 27

IBRA sub-region Cumberland - Sydney Metro

Offset options - vegetation types	Offset options - CMA sub-regions
Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion, (ME002)	Cumberland - Sydney Metro and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Downy Wattle	Acacia pubescens	84.00	1,596

Appendix E

Staff CV's

David Robertson

Director

Dr David Robertson is a senior ecologist with more than 30 years experience in ecological survey and research. David has been the director of Cumberland Ecology since 2003. He has a bachelor of science with majors in botany and zoology and a PhD in ecology.

Examples of consultancy work has included:

- Participation as senior ecological consultant for Department of Planning on the South Coast Environmental Panel;
- Provision of expert testimony, acting as a Court appointed expert for the Land and Environment Court;
- Management of high level flora and fauna investigations for Environmental Impact Assessments;
- Development of ecological management plans;
- Habitat reconstruction;
- Development of packages for compensatory habitats; and
- Management of negotiations about the level of mitigation measures required for flora and fauna impacts.

David is also very experienced at public speaking and has regularly provided expert testimony in court concerning ecological issues.

In previous work David was employed as the senior ecologist in charge of the Ecological Services Practice for ERM Australia. He also lectured in ecology and aquatic biology at Charles Sturt University, and was employed as a senior ecologist with the Australian Museum.

David has skills that allow him to work in both aquatic and terrestrial fields, management of threatened species, ecological risk assessment, wetland rehabilitation and management, and ecological research for environmental impact assessment.

Key Industry Sectors

- Mining and Rural Assessments;
- Linear Infrastructure (power, water, transport);
- Urban Development and Infrastructure.

Education

- Bachelor of Science (Honours), Ecology, University of Melbourne, 1980.
- Doctor of Philosophy, Ecology, University of Melbourne, 1986.

Professional Affiliations

- Ecological Society of Australia
- CEnvP
- EIANZ

International Experience

David has International experience in threatened species assessments have been completed in Hong Kong, China and Sri Lanka.

Work on threatened species has included preliminary survey and impact assessment, detailed impact assessment and mitigation, monitoring and plans of management.

His experience includes working for the KCRC Habitat Creation and Management Plan, assessments of impacts of construction on rare fishes for the West Rail project, development of mapping units for mapping Hong Kong flora and fauna habitats for the SUSDEV project and for the Green Island Ecological assessments.

Dr Robertson is familiar with the West Rail project and has helped write the Habitat Creation and Management Plan. He has visited the sites proposed for the wetland creation project and understands the habitat requirements of the target species such as the Painted Snipe and the Narrow-mouthed Frog.

David also has mangrove and tropical rainforest management experience in western Sri Lanka.

Key Competencies

Ecological Impact Assessment

David has directed numerous large ecological impact assessments for major projects in a variety of service sectors. These include the power industry, water supply, road construction and mining. Experience in ecological impact assessment for the power industry includes work done for Pacific Power, Transgrid, Powercoal, NorthPower and Powerlink.

Threatened Species Assessment

David has directed or managed numerous threatened species assessments in Australia and overseas on threatened species.

Across Australia, he has completed numerous projects on threatened species in response to state and commonwealth threatened species legislation. Such legislation includes the NSW *Threatened Species Conservation Act 1995*, *Queensland Nature Conservation Act 1994* and the *Victorian Flora and Fauna Conservation Guarantee 1998* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Provision of Strategic Ecological Advice

Strategic ecological advice has been provided to aid the selection of potential development sites in Australia, Hong Kong, Sri Lanka and China. Examples include: a model to help minimise problems with threatened species issues developed for use by Landcom.

Bushfire Assessments

A range of bushfire assessments have been prepared for sites ranging from small allotments for single dwellings to bushfire management plans for large sites (eg the ADI site at St Marys and Majura Field Firing Range in the ACT).

EPBC Experience

David has extensive experience with assessments under the EPBC Act. He has also worked many times with the Department of the Environment (DoE) in Canberra and has an extensive amount of experience in communicating with that organisation.

David has prepared numerous referrals for a wide range of projects since the gazettal of the EPBC Act. These have included referrals for projects in Victoria, ACT, NSW and Queensland and have entailed such diverse projects as coal mines, highways, transmission lines, residential and tourist developments and water supply projects.

David has also worked on complex ongoing assessments that are required for controlled actions to obtain approvals. He has done this for open cut coal mines, transmission lines, tourist developments, golf courses and water supply projects.

David is an excellent negotiator and presenter – and is adept at giving effective presentations to DoE and other organisations when required. Previously, for a number of projects he has also given direct presentations to Ministers. David has a thorough understanding of the EPBC process and can manage the passage of difficult projects in order to gain approvals.

He has also worked on several Brush-tailed Rock Wallaby projects including impact assessments and management plans for Rock Wallabies on the Timbarra Plateau, Shannon Creek and Chambigne Nature Reserve. As part of his work at Shannon Creek, David is working on an eight year monitoring project for Brush-tailed Rock-wallaby and foxes (which are a major threat to the wallaby).

Recent consultancy work has included:

- Work for the Land and Environment Court as an expert witness;
- Work for Department of Defence as expert on kangaroo management;
- Management of high level flora and fauna investigations for Environmental Impact Assessments;
- Threatened species investigations;
- Development of management plans;
- Development of packages for compensatory habitats;
- Ecological risk assessment.

Aquatic Assessments

David has been the senior ecological adviser for many environmental impact assessment and management projects that have entailed mangroves and saltmarsh. Examples of such projects have included:

- An independent review of the impacts of the proposed Tillegra Dam upon the Hunter Ramsar wetlands, which are listed as wetlands of international importance and matters of national environmental significance;
- Groote Eylandt Eastern Leases: baseline aquatic surveys in ephemeral waterways of a proposed manganese mine expansion on Groote Eylandt, Northern Territory;
- Project Stone: baseline aquatic survey in streams and wetlands of proposed open cut coal site, Galilee Basin;
- Project Katrina: baseline aquatic survey in streams and wetlands of proposed open cut coal site, Bowen Basin;
- James Ruse Drive Camellia – Parramatta Riverbank Management Plan to rehabilitate mangrove area from asbestos contamination from adjacent James Hardie site;
- Mt Thorley aquatic pollution Land and Environment Court case: Assessment of swamp and creek area following sediment contamination from mine;
- Tweed Land and Environment Court Case: Requirement for additional assessment of impacts of proposed development on aquatic flora/fauna;
- Morton St. Parramatta: Impacts of residential development on adjacent mangrove/ saltmarsh along Parramatta River; and
- Saltmarsh and mangrove assessments along Duck River.

Key Court Proceedings

David Robertson has extensive court experience as an expert witness. He is recognised as highly qualified due to a combination of his knowledge, skill and experience, and has been called as an expert witness in a variety of court cases, panels and tribunals.

Class 1 Proceedings

Project Venture Management Pty Limited v Warringah Shire Council & Anor [2006] NSWLEC 754

B T Goldsmith Planning Services Pty Limited v Blacktown City Council [2007] NSWLEC 229

Hanson South Coast Pty Limited v Eurobodalla Shire Council [2007] NSWLEC 493

Maybrook Manor Pty Limited v Warringah Council [2008] NSWLEC 1160

Mohamad El Dana v Bankstown City Council [2008] NSWLEC 1484

Champions Quarry Pty Limited v Lismore City Council [2011] NSWLEC 1071

Eco-Villages Australia Pty Ltd v Pittwater Council [2012] NSWLEC 49

Blakeney v Mosman Council [2013] NSWLEC 37

Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Limited [2013] NSWLEC 48

SHCAG Pty Ltd v Minister for Planning and Infrastructure and Boral Cement Limited [2013] NSWLEC 1032

Anglican Retirement Villages, Diocese of Sydney v Wollongong City Council [2013] NSWLEC 1181

Baclon Pty Ltd v Tweed Shire Council [2013] NSWLEC 1239

Penrith Lakes Development Corporation Ltd v Penrith City Council [2015] NSWLEC 9

Rocla Materials Pty Ltd & Anor ats The Trustee for the Gerald and Catherine Barnard Family Trust t/a Australian Walkabout Wildlife Park Pty Ltd. NSW Land and Environment Court Proceedings No. 10024 of 2014 (Decision Pending)

Class 3 Proceedings

Kalambaka Pty Limited v Minister Administering the Environmental Planning and Assessment Act 1979 [2009] NSWLEC 57

Maloney v Minister Administering the Environmental Planning and Assessment Act 1979 [2011] NSWLEC 121

Class 4 Proceedings

Hoxton Park Residents Action Group v Liverpool City Council (No 4) [2012] NSWLEC 67

Class 5 Proceedings

Director-General of the Department of Environment, Climate Change and Water v Walker Corporation Pty Ltd (No 2) [2011] NSWLEC 229

Chief Executive of the Office of Environment and Heritage v Rinaldo (Nino) Lani [2012] NSWLEC 115

Environment Protection Authority v Coal and Allied Operations Pty Ltd. [2013] NSWLEC 134

Environment Protection Authority v Riverina (Australia) Pty Ltd. [2014] NSWLEC 191.

Peer Reviews

Cumberland Ecology (2010). Review of Response to Submissions Relating to Continued Operations at Ulan Coal. Prepared for Department of Planning. Carlingford Court, NSW.

Cumberland Ecology (2010). Re: Review of Revised Statement of Commitments and Offset Strategy - Moolarben Coal Project. Prepared for Department of Planning. Carlingford Court, NSW.

Cumberland Ecology (2011). Peer Review of Wallarah Underground Coal Project. Prepared for Hansen Bailey. Carlingford Court, NSW.

Cumberland Ecology (2011). Peer Review of EcoLogical Report: "Proposed Framework for Assessing the Cumulative Risk of Mining on Natural Resource Assets in the Namoi Catchment". Prepared for Aston Resources. Carlingford Court, NSW.

Cumberland Ecology (2012). Peer Review of State and Commonwealth Ecological Impact Assessment Reports for the Proposed Mount Penny Coal Mine, Bylong. Prepared for Wells Environmental Services. Carlingford Court, NSW.

Significant Experience

Macropod Management - General

David has extensive experience working with macropods including kangaroos, wallabies, rock wallabies and species such as potoroos. He has prepared and implemented kangaroo management plans for a number of Department of Defence sites.

At St Marys (ADI), David prepared and implemented kangaroo management that entailed sterilisation of 4,000 animals, the largest project of this kind in Australia.

During 2008 at the former Belconnen Naval Transmitter Station, under constant media and public scrutiny, his team of ecologists successfully completed a sensitive and highly scrutinised kangaroo population management project. The project was undertaken to alleviate the extreme kangaroo grazing pressure on the Natural Temperate Grasslands which occur throughout the site. David managed a team of 24 staff under to achieve a major reduction in the kangaroo population. The threat of macropod starvation has receded and the Natural Temperate Grasslands have shown signs of recovery.

In addition, he has provided assessments and / or management plans for Department of Defence sites at Singleton, Majura, Gingin, Kapooka/Latchford Barracks, Orchard Hills and Puckapunyal.

David has also been involved in several Brush-tailed Rock Wallaby projects including impact assessments and management plans for Rock Wallabies on the Timbarra Plateau, Shannon Creek and Chambigne Nature Reserve. As part of the work at Shannon Creek, we are working on an eight year monitoring project for the Brush-tailed Rock-wallaby.

Macropod Management - Shannon Creek Monitoring Program

The Clarence Valley and Coffs Harbour Regional Water Supply Project includes construction of a 30,000 megalitre storage at Shannon Creek,

southwest of Grafton. The storage development involves the construction of the storage facility and associated infrastructure within the Shannon Creek valley as well as the construction of a new access road and pipeline into the valley and upgrading of the existing connecting local roads.

Under the approval conditions for the construction and operation of the Regional Water Supply, many of the threatened species, communities, vertebrate pests and weeds must be monitored throughout the area. The monitoring program commenced a number of years prior to the start of construction to enable collection of baseline data regarding population levels and distribution of the various species and communities. This includes monitoring in adjacent conservation reserves. The monitoring program is to continue throughout construction of the Regional Water Supply and into its operation. Monitoring of the Brush-tailed Rock wallaby at Shannon Creek has been undertaken during each of these sessions. The Brush-tailed Rock wallaby was monitored at Chambigne Nature Reserve during the first four monitoring sessions and at Koukandowie Nature

The monitoring program assesses a range of impacts which may be associated with the Regional Water Supply, including:

- The impact on macropod populations;
- Clearing of vegetation;
- Infection of native plants by the root-rot fungus Phytophthora cinnamomi;
- The invasion of native plant communities by exotic and perennial grasses; and
- Invasion of vertebrate pests along construction corridors.

The monitoring programme has yielded a large amount of data on most subject species/ communities with the majority of the results indicating continuing occurrence of threatened species and communities at known locations. The environmental impact statement for the Water Supply Project predicted that the Brush-tailed Rock wallaby populations would remain largely unaffected by the construction of the storage. The management measures which will be implemented for the project have the following objectives in regards to the Brush-tailed Rock wallaby:

- Maintain, protecting and/or enhancing habitat; and
- Maintenance of movement corridors.

To achieve the above objectives various management measures have been proposed within the Threatened Species Management Plan including the creation of a movement corridor between escarpments downstream of the dam wall to encourage the movement of Brush-tailed Rock wallaby between the escarpments and nature reserves. The corridor will include grassland, riparian habitat and woodland.

Additional monitoring of this habitat will remain in progress for some years to come, to establish whether control actions are required.

Urban Development - ADI site at St Marys

Dr David Robertson, the Principal, has worked on the site since 1997. It has almost certainly entailed the most intensive kangaroo herding and fertility control work yet conducted on a captive population.

The 1,500 ha ADI site has over 800 hectares of endangered Cumberland Plain Woodland and affiliated vegetation. It also supports a suite of threatened and regionally significant species that were threatened by overgrazing by Eastern Grey Kangaroos and Red Kangaroos, both of which had been introduced to this fenced property.

Ecological work by Dr Robertson at the ADI site has included ecological assessments and planning work for the rezoning of the 1,500 ha property, ecological impact assessment for Precincts within the ADI, ecological impact assessment for individual Development Applications, preparation of management plans (for weeds, feral animals, threatened species and kangaroos) and implementation of management plans.

Dr Robertson prepared a detailed Kangaroo Management Plan for the ADI Site, which entailed

herding, darting, fertility control and long term management and monitoring of kangaroos to reduce the population. A management plan was then implemented, hiring and managing veterinary surgeons, veterinary nurses, animal handling people and ecologists. This work entailed numerous herds of kangaroos over areas that were as large as 800 ha. During the course of the project he hired and managed over 100 staff (including casual herders).

Urban Development - Cooks Cove Development Area

This is a staged development application that Dr Robertson has been working on with team of other consultants including planning, engineering and land contamination specialists. The project involves the construction of a trade and technology park and associated infrastructure adjacent to Sydney Airport as well as the relocation of a golf course to an area that contains endangered ecological communities and threatened species that are protected under the Threatened Species Conservation Act and for some species, commonwealth and international law.

Dr Robertson's role in the project has been to assess the options for offsets and management of land for threatened species and to manage the negotiation and consultation process between the developer, state and federal governments and the public. His team has prepared detailed plans and related costs for the rehabilitation of wetlands on the site and the management of threatened species, which have been subject to public exhibition.

The development application has now been approved by both State and Federal governments and ongoing work concerning the detailed design is underway.

Urban Development - South Coast Sensitive Urban Lands Review – Experts Panel

This project involved independent review (for the Department of Planning in 2006) of planning and ecological issues concerning 17 sites zoned for urban development in the South Coast region (within Shoalhaven, Eurobodalla and Bega Valley LGAs) identified as being environmentally sensitive in the Draft South Coast Regional Strategy.

Following the release of the draft Strategy in May 2006, the Minister for Planning appointed an independent Expert Panel to investigate and report on the sensitive sites outlined in the strategy. Dr David Robertson was selected as a member of the Expert Panel.

Specifically, the Panel was required to determine the suitability and scale of any release for urban development within the sensitive sites. This involved review of written submissions, attendance at public hearings and provision of recommendations for each of the sites according to best planning and ecological outcomes. It also required intensive workshopping with local councils and other agencies such as National Parks and Wildlife and the Department of the Environment and Conservation.

Urban Development - Growth Centres, Kellyville - Biodiversity Assessment Program

North Kellyville forms part of the north-west Growth Centres land release area. The purpose of this project by was to contribute towards the creation of a precinct plan for North Kellyville. The precinct plan was informed by baseline technical studies that included: flora and fauna habitat; bushfire protection; land capability; areas of indigenous and non indigenous significance; flood analysis; and yield analysis.

Key objectives of this project included:

- The provision of a biodiversity assessment that included: a flora and fauna review; an analysis of ecological values and mapping of areas of high, moderate or low ecological value;
- Consideration of the statutory requirements for the protection, restoration and enhancement of threatened species, populations, ecological communities and their habitats;

- Recommended management frameworks for vegetation issues which enable long term conservation and management of these issues while facilitating the development outcomes for the precincts identified in the structure plan;
- Recommended measures to protect biodiversity values within areas identified by the Growth Centres SEPP; and
- Recommendations to ensure that precinct planning is consistent with the terms of any biodiversity certification granted to the SEPP.

Urban Development - SAN Hospital Wahroonga - Biodiversity Assessment and Biodiversity Management Plan

Dr Robertson has carried out numerous surveys in the Wahroonga area in the past, and he was requested to investigate the ecological values of the subject land for a Part 3A Application.

The bushland on the subject site contains significant ecological development constraints. The vegetation contains the endangered ecological communities Turpentine Ironbark Forest and Blue Gum High Forest, as waee as a suspected nesting location of the Powerful Owl. Additionally, the bushland on the site forms part of wildlife corridors with significant links to other habitat in the locality, particularly Land Cove National Park.

As a result of the sensitivity of the area, it was necessary to conduct up-to-date surveys, and assess the findings of numerous past reports in the light of this current survey data. After lengthy consultation with local council and government departments, it was decided that a Biodiversity Management Plan was required to ensure the progress of the development, as well the preservation of the site's sensitive ecological issues.

Rural Assessment - Emirates Hotels – Wolgan Valley Resort

Dr Robertson was commissioned by Emirates Hotels to submit a Public Environment Report to fully assess the impacts of the proposed construction and operation of the Emirates Wolgan Valley Resort upon matters protected under the Commonwealth Environment Protection and Biodiversity Conservation Act.

This involved assessing a wealth of available information concerning studies that had already been undertaken of the site (both ecological and otherwise) as well as conducting on-site field investigations to gather further information. Finally, a full assessment of the impacts of the project was produced, including consideration of alternative options, mitigation techniques and long-term management requirements. The report underwent public exhibition and Dr Robertson managed the consultation and review process for this. The project was approved by the Commonwealth government in early 2007.

Dr Robertson's team was also commissioned to prepare a Vegetation Management Plan for the 1,000+ ha site to address the ecological rehabilitation of the site and its enhancement for biodiversity. This included assessing the rehabilitation and regeneration requirements of an 8 km stretch of riparian corridor, as well as assessing the potential for reconstructing wildlife corridors across the site for a range of threatened fauna species.

Linear Infrastructure – General

David Robertson has trained and lead a team that have acted as lead ecological consultants and fauna rescue personnel on a number of major infrastructure projects over the past 5 years including the M2, M4 and M7 Upgrade Projects, the Eppiing to Thornleigh Third Track (ETTT) Project, the Seventh Avenue Airport Extension and the North West Growth Centre Package 2 Project for Sydney Water. .

Linear Infrastructure - Cooranbong Haul Road

This project entailed the provision of fauna survey and management services that were required to support the construction of a haul road linking Mandalong Mine to Newstan Rail Loading Facility.

The client required a Fauna Habitat and Movement Requirements Report assessing the likely impacts of the haul road on fauna and habitat connectivity. The report was prepared

prior to construction of the haul road as a condition of consent for the approval of the road. After the survey, Dr Robertson was able to recommend mitigation measures, such as:

- Realignment of proposed routes to avoid significant habitat features
- Pre-clearance surveys to relocate fauna prior to construction
- Road signage and fauna fencing to reduce roadkill
- Erosion control measures
- Fauna underpass and over pass locations
- Revegetation of selected areas and
- Ongoing monitoring.

This project called for extensive communication with the client and local council. Dr Robertson also assisted in the preparation of an EPBC Referral of Proposed Action due to the presence of threatened flora along the road alignment.

Mining Assessments – General

David Robertson has provided legal advice, baseline studies and management plans for a number of mining companies both here and overseas. These include the Tampakan Gold and Copper Mine in the Philippines, the Project Stone and Katrina mines in Queensland and a range of mines for BHP Billiton, Glencore, Xstrata and Shenhua across NSW.

Mining Assessment - Maules Creek

David Robertson and his team conducted a large-scale flora and fauna baseline study of 2,700 hectares of forest and woodland in the locality of Narrabri, New South Wales. The purpose of the study, which has been ongoing since 2008, was to assess the potential impacts of proposed open cut mining on biodiversity. Key biodiversity values of the Project Area include a number of threatened bird and bat species as well as threatened ecological communities such as the critically endangered Box Gum Woodland.

As part of the Project scope, David prepared a management plan to facilitate the ongoing management of flora and fauna on the future mine site and the adjacent land. The Flora and Fauna Management Plan prescribes land disturbance protocols such as pre-clearance surveys and timber salvage; ongoing weed and feral management and key performance indicators; and a comprehensive monitoring program to track management outcomes and inform reviews and audits.

David has also prepared a Biodiversity Offset Management Plan for the Project's offsite biodiversity offset properties. This plan makes provisions for the strategic management of the biodiversity offsets, including habitat and vegetation restoration and rehabilitation, weed and feral management, strategic grazing, bushfire management and comprehensive monitoring to track management outcomes..

Mining Assessment - Bengalla Continuation Project

David Robertson has acted as Project Director in the preparation of an Ecological Impact Assessment to support an State Significant Development application for the Bengalla Continuation of Mining Project (the Project). The Project impacts include clearing of Box Gum Woodland and Derived Native Grassland, a community listed under the TSC Act and EPBC Act, as well the removal of habitat for a range of threatened species and an endangered population.

David has led negotiations with State and Federal Government Authorities to develop appropriate offsets for the Project impacts. This includes the proponent participating in the Upper Hunter Strategic Assessment; an offsets fund being established by OEH that allows for upfront monetary contributions to satisfy project offsetting requirements for mining projects in the Upper Hunter, now and into the future. Cumberland Ecology is currently preparing an Assessment Report for submission as part of the UHSA, including summary of the results of extensive flora and fauna survey and calculations using the Biodiversity Certification Assessment Methodology (BCAM).

Mining Assessment - Mount Pleasant Mine

David Robertson was required to carry out a survey and analysis of the presence and condition of Box Gum Woodland in the area of the proposed development of a mine at Mt Pleasant. This highly degraded site existed largely as derived grassland, and as patches of remnant canopy trees with large areas of the study area considered to be the State and Commonwealth listed Endangered Ecological Community.

Further fauna surveys of the study area revealed that despite the degraded nature of the vegetation, the site provided habitat for a suite of threatened woodland birds and arboreal mammals. Provision of results and advice to the client will allow them to make an informed decision about the future of the proposed mining project.

Publications

Robertson, D.J. (1983) Vegetation management towards native mammal reintroduction at Gellibrand Hill State Park. Royal Australian Institute of Parks and Recreation 56 th National Conference Proceedings. 167/1-12.

Robertson, D.J. and Nannestad, C. editors.(1994) Proceedings of the forum on European Carp. Wagga Wagga, NSW. Murrumbidgee Catchment Management Committee.

Wark, M.C., White, M.D., Robertson, D.J. and Marriot, P.F.(1987). Regeneration of heath and heath woodland in the North Eastern Otway Ranges following the wildfire of February 1983. Proceedings of the Royal Society of Victoria 99(2): 51-88.

Wilson, B.A. and Robertson, D.J.(1990) Factors affecting small mammal distribution and abundance in the Eastern Otways. Proc. Ecol. Soc. Aust. 39(2):35-40

Holdway, D. A., Barry, M.J., Logan, D, Robertson D.J. (1994) Acute toxicity of pulse-exposed fenvalerate and esfenvalerate to larval crimson-spotted rainbow fish (Melanotaenia fluviatilis). Aquatic Toxicology

Robertson, A.I., King, A.J., Healey, M.R., Robertson, D.J. and Helliwell, S (1995). The impact of carp on billabongs. A report prepared for the Environment Protection Authority, NSW, Riverina Region.

Conference Papers

Robertson, D.J. (1983) Vegetation management towards native mammal reintroduction at Gellibrand Hill State Park. Royal Australian Institute of Parks and Recreation 56 th National Conference Latrobe University.

Robertson, D.J.(1991) Macrobenthic communities in four billabongs of the Murrumbidgee River: seasonal changes versus water quality. Australian Society for Limnology, Lorne.

Murray, P and Robertson D (1993) Methods for rapid assessment of macroinvertebrate communities using multivariate analysis. Australian Society for Limnology, Calloundra.

Hardwick L, Robertson D and Hillman T (1995) The relationship between macroinvertebrate communities and riparian vegetation in Tarcutta Creek, a lowland tributary of the Murrumbidgee River, NSW.

Robertson, D.J. (2011) Tampakan Copper-Gold Project - Analysis of the Fauna and Vascular Flora of the Tampakan project area, Mindanao, Philippines. International Botanical Congress, Melbourne.

Robertson, D.J. (2014) BioBanking in NSW. EAD Ecological Consultants, Exeter UK.

Martin, A., Robertson, D.J., Wilkinson G., (2015) Monitoring population trends in a population of the threatened brush-tailed rock-wallaby in North-eastern NSW. Ecological Society of Australia Annual Conference, Adelaide.

Katrina Wolf

Senior Project Manager / Ecologist

Experience

Katrina is a Senior Project Manager/Ecologist at Cumberland Ecology, with over eight years of ecological consulting experience. Katrina has managed and participated in numerous small- to large-scale projects and has extensive experience undertaking flora and fauna surveys, ecological impact assessment, biodiversity monitoring and peer reviews.

She has routinely been involved in ecological impact assessments of threatened flora and fauna species and endangered ecological communities, and routinely assesses projects in response to NSW and Commonwealth threatened species legislation. This has included projects within the urban, industrial, infrastructure and extraction sectors.

Project Management

Katrina has managed the ecological components of a suite of projects, including residential development applications, rezoning proposals and major projects. She often manages large teams of staff.

Katrina has managed several coal mining projects designated as State Significant Developments, and has also managed a residential rezoning project designated as a State Significant Site.

In her role as Senior Project Manager/Ecologist she has also consulted with the New South Wales (NSW) Department of Planning and Environment (DP&E), the NSW Office of Environment and Heritage (OEH) and Commonwealth Department of the Environment (DoE).

Report Preparation

Katrina has been the primary author on a variety of documents including:

- Ecological impact assessments (including both State and Commonwealth reports);
- Flora and fauna assessments (including Section 5A assessments);
- EPBC Act referrals;
- Strategic assessment report;
- Species impact statements;
- Biodiversity offsets reports; and
- Biodiversity monitoring reports.

Katrina also has experience in Geographic Information Systems (GIS) on a MapInfo platform. This has included preparation of vegetation maps, survey location maps and report figures.

Field Surveys

Katrina is actively involved in undertaking field surveys, with extensive experience in designing and undertaking flora and fauna surveys. In NSW, Katrina's field experience is within the Sydney Region, Hunter Valley, Western Blue Mountains, Gunndeah Basin, Central Coast and Mid North Coast. Katrina has also undertaken field surveys within the Bowen Basin and Galilee Basin in Queensland, and Groote Eylandt in the Northern Territory.

Field surveys have included:

- Impact surveys (vegetation mapping, quadrat surveys, BioBanking surveys, fauna surveys);
- Monitoring surveys (targeted threatened flora and fauna surveys, vegetation condition assessments); and
- Offset surveys (preliminary site inspections, vegetation mapping, BioBanking surveys, detailed fauna surveys).

Education

- Bachelor of Science (Environmental).

  The University of Sydney, 2007

- BioBanking Assessors Training Course.

  TAFE Ryde, 2010 (Accredited May 2013)

Cecilia Phu

Senior Project Manager / Ecologist

Experience

Cecilia Phu is a Senior Project Manager/Ecologist at Cumberland Ecology and has been working as an ecological consultant since 2007.

Cecilia routinely manages small to large-scale ecological studies for a variety of projects, including State Significant projects. As part of her work, Cecilia is directly involved in planning and undertaking ecological field studies (including monitoring studies, vegetation mapping and threatened species survey), and preparing impact assessment reports, species impact statements, biodiversity offsetting reports (including those for BioBanking assessments), monitoring reports and bushland management plans.

In her role as a senior project manager, Cecilia has consulted with the New South Wales (NSW) Department of Planning and Environment (DP&E), the NSW Office of Environment and Heritage (OEH) and Commonwealth Department of the Environment (DoE).

Cecilia has worked across NSW, including the Greater Sydney area, Western Blue Mountains, Central Coast, Hunter Valley, Southern Highlands, and Central and North West Slopes and Plains. Cecilia has also worked in central Queensland, in far north Queensland, in the Northern Territory and overseas in the Phiippines.

Cecilia has worked on many projects in response to state and commonwealth legislation and policy. Such legislation and policy include:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
- NSW *Environmental Planning and Assessment Act 1979*.
- NSW *Threatened Species Conservation Act 1995*.
- NSW *Fisheries Mangement Act 1992.*.
- Queensland *Nature Conservation Act 1994*.
- *Territory Parks and Wildlife Conservation Act 2000.*
- EPBC Act environmental offsets policy.
- NSW Biodiversity Offsets Policy for Major Projects.

Key Competencies

Field Survey

- Floristic survey, including plot based, transect and random meander sampling.
- Vegetation mapping and condition assessment.
- Targeted fauna survey, using a range of trapping methods.
- BioBanking survey.

Ecological Assessment

- Impact assessments (Framework for Biodiversity Assessment, BioBanking, Biocertification, Species Impact Statements).
- Offset assessments (EPBC offset assesment guide, BioBanking).
- Monitoring studies for approved activities.

Analysis

- Geospatial Information Systems (GIS).
- Statistical analyses using ePrimer and SPSS.
- BioBanking Calculator Tool

Industry Sectors

- Urban development (rezoning, subdivision, residential, commercial).
- Energy and resources.
- Public infrastructure (power, water, transport).

Qualifications

- Bachelor of Science, University of Sydney, 2006, (Honours) 2008.
- BioBanking Assessors Training Course. TAFE Ryde, 2009 (Accredited June 2015).

Professional Affiliations

- Ecological Society of Australia.

Key Projects

Flora and Fauna Impact Assessments

Cecilia has over eight years experience in conducting and managing ecological assessments in the Hunter region and the Gunnedah Basin for major mining projects. Additionally she has worked within the Galilee and Bowen Basins in north Queensland. Cecilia has also worked extensively in the Sydney Metropolitan area and has particular experience within the Sydney Growth Centres and the Western Sydney Employment Area. Cecilia has led and assisted in a number of infrastructure projects in NSW, including development of electricity substations and power line infrastructure for urban development and coal projects, water pipeline infrastructure and treatment plants, rail infrastructure and road upgrades.

BioBanking Assessments

Cecilia has assessed a number of impacts and offsets for projects using the BioBanking assessment methodology in the Sydney Basin and Hunter Valley regions. Work has included vegetation mapping, flora and fauna surveys and habitat assessments. Data collected during fieldwork was utilised within the BioBanking Credit Calculator.

Management Plans and Monitoring

Cecilia has prepared management plans for development and offsetting projects in the Sydney, north east NSW and western NSW areas. Such projects have involved monitoring of grazing, vegetation restoration and animal population census.

Other Projects

Cecilia has been involved in terrestrial and aquatic ecology studies for a gold mining project in the Philippines. She has worked closely with local botanists and zoologists in the Philippines and was involved in the preparation of the terrestrial ecology and aquatic reports for the Project's international Environmental Impact Statement.

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Dr Alexander Pursche

Project Manager / Ecologist

Alex Pursche is a Project Manager and Ecologist at Cumberland Ecology, based in Sydney. He has a PhD in Ecology, and a Bachelor of Science (Hons) in Ecology.

Alex has eight years experience in fauna monitoring, six of which have been gained working as an environmental contractor for mining and infrastructure clients in New South Wales, Queensland, and the Northern Territory. This included assessment of offset properties, subsidence monitoring, and environmental impact assessment studies for powerlines, pipelines, roadways, rail tracks, urban developments, and mines.

He has extensive experience in identifying terrestrial and marine vertebrate fauna including birds, mammals, reptiles, amphibians, and fish. Alex has experience operating in remote conditions and consistently delivers large scale surveys to clients in a timely manner.

Alex has experience in Geographic Information Systems (GIS - ArcMap) and uni-/multi-variate statistical analysis relevant for testing hypotheses for complex ecological interactions. Alex also has the capacity to produce reports to a high standard suitable for publication in peer reviewed scientific journals.

Recent consultancy work has included:

- Biodiversity Management Plans and monitoring;
- Species Impact Statements;
- Biodiversity Assessment Reports under the Framework for Biodiversity Assessment for State Significant Projects
- Biodiversity Assessment reports under the BioBanking Assessment Methodology
- EPBC referrals;
- Production of digitised maps; and
- Ecological impact assessment.

Education

Doctor of Philosophy, University of NSW 2013

Bachelor of Science (1st Class Honors) 2006

Key Industry Sectors

- Mining;
- Linear Infrastructure;
- State significant developments;
- Due Diligence and compliance reporting;
- Residential development; and
- Conservation.

Fields of Competence

- Fauna Surveys;
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;
- NSW *Threatened Species Conservation Act 1995*;
- NSW *Fisheries Management Act 1994;*
- NT *Territory Parks and Wildlife Conservation Act 2000*; and
- QLD *Nature Conservation Act 1992*.

Key Projects

Ecological Impact Assessments for residential developments

Alex has written fauna and flora impact assessments for residential developments for Great Lakes, Port Stephens, The Hills, Penrith, Bankstown, Warringah, and Pittwater LGAs.

Fauna Monitoring

Since 2010, Alex has worked monitoring vertebrate fauna for large scale mining and infrastructure projects in NSW, QLD, and NT. Tasks included general fauna assessment as well as targeted searches for listed threatened species.

Michelle Frolich

GIS Specialist

Michelle Frolich is a Sydney based GIS Specialist at Cumberland Ecology. She has detailed technical knowledge and experience in the interpretation and production of mapping products, including topographic modelling and classification and feature extraction using aerial photography and satellite imagery.

Michelle also has extensive experience and technical knowledge in the BioBanking and Bio-Certification Assessment Methodologies, and the Framework for Biodiversity Assessment. Michelle is closely involved in all major projects and is responsible for GIS development, mapping and analyses, as well as the training and mentoring of staff in GIS.

Recent consultancy work has included:

- GIS mapping and analysis for various mining projects for Environmental Assessments, Biodiversity Management Plans, Major Project applications and Referrals under the Commonwealth EPBC Act;
- Vegetation, threatened flora and fauna mapping for large- and small-scale projects;
- GIS mapping for and performing BioBanking assessments on large and small impact and offset sites;
- GIS mapping for, reporting of and performing Bio-Certification assessments for mining projects involved in the Upper Hunter Strategic Assessment; and
- GIS mapping for and performing assessments using the FBA for Major Projects.

Fields of Competence

- Geographic Information Systems (GIS);
- Image and spatial data analysis;
- BioBanking Assessment Methodology;
- OEH Bio-Certification Assessment Methodology;
- OEH Framework for Biodiversity Assessment; and
- Data and project management.

Key Industry Sectors

- Urban Development;
- Infrastructure; and
- Extraction industry.

Education

Bachelor of Science (Marine Science) (Honours), University of Sydney, 2007.

Key Projects

NSW and Queensland Mining Projects

Michelle has extensive experience working on GIS mapping for Part 3A Major Projects / State Significant Projects relating to mining in the Central Hunter Valley and Namoi CMA, NSW and in Western Queensland. She has been involved in the GIS mapping of vegetation communities, threatened flora and fauna species, produced detailed maps for field surveys, and high quality maps for reports.

OEH Upper Hunter Strategic Assessment

Michelle has been involved in the preparation, mapping and reporting for Biodiversity Certification Assessments for mining projects in the Upper Hunter Valley as part of the OEH Upper Hunter Strategic Assessment. She regularly liaises with OEH and has attended several workshop meetings.

BioBanking Assessments

Michelle has been invovled in the mapping for and assessment of projects using the BioBanking Assessment Methodology for small and large projects in the Sydney Basin, Hunter Valley and Namoi CMA. She has extensive experience using collected data within the BioBanking Credit Calculator, and in producing high quality maps for BioBanking Assessment reports. She has also assisted with field surveys to collect flora and fauna data as per the BioBanking Assessment Methodology field methodology. She regularly liaises with OEH staff and has attended several workshops and meetings.

Other Projects

Michelle has also worked on several other small scale projects in Sydney and throughout NSW, using GIS for the mapping of vegetation communities, threatened flora and fauna species, the production of field maps, image analysis, and produced high quality maps for reports. She has also assisted with field surveys for flora and fauna.

Bryan Furchert

Project Manager / Botanist

Bryan Furchert is a Project Manager and Botanist at Cumberland Ecology, based in Sydney. He has a Bachelor of Biodiversity and Conservation.

Bryan has six years' experience in bushland regeneration as a Team Leader. He has experience in assessment of degradation of native vegetation communities and identification of factors contributing to exotic weed invasion of communities on a site by site basis.

Bryan has extensive experience in vegetation management and community restoration within Hawkesbury Sandstone soil communities. He has undertaken botanical surveys of vegetation communities throughout the Sydney Basin Bioregion and the Brigalow Belt South Bioregion in New South Wales, and within the Northern Brigalow Belt Bioregion in Queensland.

Bryan also has experience in Geospatial Information Systems (MapInfo), statistical analysis of biodiversity values with biodiversity indices, and population census of fauna species.

Recent consultancy work has included:

- Vegetation Management Plans;
- Flora and fauna impact assessment;
- Species Impact Statements; and
- Monitoring studies.

Fields of Competence

- NSW *Noxious Weeds Act 1993*
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*;
- NSW *Threatened Species Conservation Act 1995*;
- Weeds of National Significance (WoNS) – identification and control; and
- Botanical surveys.

Key Industry Sectors

- Urban development;
- Industrial and logistics;
- Infrastructure; and
- Extraction.

Education

Bachelor of Biodiversity and Conservation, Macquarie University, 2012.

Diploma of Conservation and Land Management, Belmont TAFE, 2009.

Completed professional development courses have included:

- Recognising Water Weeds (DPI), and
- Aboriginal Site Awareness (The Aboriginal Heritage Office).

Key Projects

Botanical Surveys

Bryan regularly undertakes botanical surveying for site and BioBanking assessments, targeted threatened species searches, and identification and mapping of Critically Endangered and Endangered Ecological Communities.

State Significant Projects and Development Applications

Bryan has undertaken vegetation mapping for large extraction projects and prepared Vegetation Management Plans, Ecological Constraints Analyses, Ecological Impact Assessments, Flora and Fauna Assessments and Species Impact Statements for Development Applications.

He has worked extensively on the Epping to Thornleigh Third Track upgrade over three years, with works including botanical surveys, vegetation and vegetation clearance mapping, and preparation of Flora and Fauna Assessments and 7 Part Tests for threatened species and communities for ancillary works related to the project. Bryan has also undertaken a flora survey for Transport for NSW to review mapping of Blue Gum High Forest and potential impacts to the community adjacent to Normanhurst

Long-term Monitoring

Bryan has also undertaken flora monitoring and reporting for long term restoration projects for urban bushland remnants, and large biodiversity offset areas.

Matthew Freeman

Project Manager / Ecologist

Matthew Freeman is a Project Manager and Ecologist at Cumberland Ecology, based in Sydney. He has a Bachelor of Natural Science from the University of Western Sydney.

Matthew has three years experience in managing and undertaking fauna and flora surveys which have been gained working as an environmental contractor on residential, industrial, mining and infrastructure projects in New South Wales. He has been involved with numerous ecological impact assessments of threatened species and endangered ecological communities, and routinely assesses projects in response to NSW and Commonwealth threatened species legislation.

He also has extensive experience identifying terrestrial vertebrate fauna, including mammals, birds, reptiles, amphibians and fish.

Recent consultancy work has included:

- Pre-clearing assessment and clearing supervision for linear infrastructure projects;
- Threatened and feral fauna monitoring for large scale mining projects;
- Targeted threatened species surveys; and
- Preparation of Flora and Fauna Assessments.

Fields of Competence

- Fauna Surveys;
- Project Management/Coordination
- Report Writing;
- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999;* and
- NSW *Threatened Species Conservation Act 1995*;

Key Industry Sectors

- Residential development
- Linear Infrastructure;
- State significant developments,
- Mining, and;
- Conservation

Education

- Bachelor of Natural Science (Nature Conservation), University of Western Sydney, Hawkesbury, NSW. Graduated in 2012.

Key Projects

Ecological Impact Assessments for residential developments

Matthew has written flora and fauna impact assessments for residential developments for a variety of projects in the greater Sydney Metropolitan area.

Fauna Monitoring

Since 2014, Matthew has worked monitoring vertebrate fauna for large scale infrastructure and mining projects in NSW. This has included general fauna assessments, targeted searches for *EPBC Act* and *TSC Act* listed threatened species and monitoring feral vertebrate fauna species.

Recently, Matthew has been involved with the Long-nosed Bandicoot monitoring on Eastern Hill, which is a conservation project run by the Northern Beaches Council.

Mining Surveys

Matthew has conducted surveys for large-scale mining projects, involving general and targeted surveys for mammals, reptiles, amphibians and birds.

Matthew has been involved with ecological work including pre-clearance assessments and clearance supervision within the Whitehaven Maules Creek Coal Mine since 2014. In 2016 he filled in as the Project Manager responsible for a team of approximately 30 ecologists.

Emily Cave

Ecologist

Emily Cave is an Ecologist at Cumberland Ecology, based in Sydney. She has a Bachelor of Science (Honours) in Biology.

Emily has several years' professional experience as an on-call ecologist for a range of infrastructure and construction projects. She has an exemplary safety record involving both day and night works for a number of major projects such as the M2, M7 and M4 upgrades, Sydney Water North West expansion, and the Epping to Thornleigh Third Track project.

In addition, Emily has been involved in a wide range of flora and fauna surveys, particularly for residential and mining projects in NSW. She has extensive experience in vertebrate fauna survey, particularly ornithological census. Emily has experience in data analysis, data entry, habitat mapping, pre-clearing assessment and clearing supervision.

Recent consultancy work has included:

- Pre-clearing assessment and clearing supervision for linear infrastructure projects in western Sydney;
- Preparation of Ecological Impact Assessments for urban developments in Sydney; and
- Bird surveys for rehabilitated mine sites in Groote Eylandt, Northern Territory.

Fields of Competence

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999;*
- NSW *Threatened Species Conservation Act 1995*;
- Ecological surveys, particularly ornithological surveys and habitat assessment; and
- Data analysis and storage.

Key Industry Sectors

- Urban development; and
- Mining industries.

Education

Bachelor of Science (Honours) in Biology. Macquarie University, 2012

Key Projects

M4 Widening Project

Emily has undertaken pre-clearance surveys to identify noxious weeds, threatened flora and fauna habitat features for the M4 'WestConnex' widening project.

North West Growth Centre – Lend Lease

Emily has been a key member of the ecology team undertaking pre-clearance surveys and vegetation clearance supervision for the construction of a pipeline for Sydney Water in the Vineyard / Rouse Hill / Kellyville area. This involved flora identification, fauna identification and relocation, and dam dewatering procedures. Dam dewatering procedures involved monitoring the water source during pumping and ensuring that any fauna are caught and relocated to new suitable habitat.

Maules Creek - Whitehaven Coal

Emily was part of the team of ecologists involved in the clearance supervision of habitat trees within the Maules Creek coal mine. Clearance supervision involved fauna spotting and catching, and the re-inspection of felled trees after being left overnight.

Groote Eylandt– GEMCO/BHP Billiton

Emily assisted with fauna monitoring surveys for the Groote Eylandt Mining Company (GEMCO) -BHP Billiton within rehabilitated manganese mine sites. Surveys included setting up pitfall traps to collect ant samples, undertaking habitat assessments and diurnal bird surveys.