

ROOTY HILL STATION

Ecological Assessment

For:

TfNSW

November 2017

Final Report



**PO Box 2474
Carlingford Court 2118**

Report No. 17201RP1

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

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Glossary of Terms

CEEC	Critically Endangered Ecological Community
CPW	Cumberland Plain Woodland
DoEE	Commonwealth Department of the Environment and Energy
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GPS	Global Positioning System
LGA	Local Government Area
Locality	The area within a 5 km radius of the centre of the subject site
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
the proposed works	Easy Access Station Upgrades and a Multi-storey Commuter Car Park at the subject site
Subject site	Within part of Rooty Hill Railway Station (Figure 1.1), bound by the railway line to the south, the M7 to the east, Premier Lane to the west and Rooty Hill Skate Park to the north.
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>

Executive Summary

S1 Introduction

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been commissioned by pitt&sherry on behalf of Transport for NSW (TfNSW) to conduct an ecological assessment for the Easy Access Upgrade and Commuter Car Park within part of Rooty Hill Railway Station (the 'subject site'). The purpose of this report is to describe the current biodiversity values of the subject site and to assess the potential impacts of the proposed upgrades on flora and fauna, particularly threatened species, populations and communities that are listed under the former New South Wales (NSW) *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

S2 Background

The subject site is located within the Blacktown Local Government Area (LGA). It is 1.44 ha in area and contains existing paved areas such as the commuter carpark and footpaths, as well as some patches of vegetation.

Transport for NSW (TfNSW) is proposing an Easy Access Station Upgrades and a Multi-storey Commuter Car Park at the subject site. This will likely require clearance of all existing vegetation within the subject site.

S3 Methods

Database analysis, vegetation/flora surveys, fauna habitat surveys and incidental fauna observations were undertaken during October 2017. Flora surveys involved recording the presence of flora species using the random meander survey technique and targeted threatened flora surveys. All vascular plants were recorded or collected and later identified to species level where possible. Fauna surveys included a habitat assessment and any incidental observations of birds and other vertebrates.

S4 Results

Vegetation within the subject site was found to consist of Cumberland Plain Woodland (canopy only) (0.04 ha), Urban Native/ Exotic Vegetation (0.34 ha) and Exotic Grassland (0.16 ha). Cumberland Plain Woodland is listed as a Critically Endangered Ecological Community (CEEC) under both the TSC Act and EPBC Act. This community is in a highly modified form as it comprises of canopy trees over pavement and planted gardens.

Surveys by Cumberland Ecology recorded 76 flora species. Of these, approximately 83% are exotics and 17% are native. No threatened flora species were recorded or are likely to occur within the subject site owing to its highly disturbed nature.

The desktop assessment showed that a number of threatened fauna species have been recorded from the locality and have the potential to occur within the subject site. From the desktop assessment and subsequent site inspections, ten threatened fauna species are considered as having potential to occur within the subject site. An additional two migratory species listed under the EPBC Act have the potential to forage aerially above the subject site. These potentially occurring fauna species are highly mobile and are expected to move between areas of remaining habitat within the immediate vicinity of the subject site and the wider area. These species are therefore not considered dependent upon the degraded habitats present within the subject site.

S5 Impact Assessment

The proposed upgrade works will predominantly clear existing cleared areas which consist of an existing commuter carpark and footpaths. Up to 0.04 ha of Cumberland Plain Woodland (canopy only), 0.34 ha of Urban Native/ Exotic Vegetation and 0.16 ha of Exotic Grassland is proposed to be cleared.

Some foraging habitat for threatened fauna species will be removed for the proposed upgrade works, however none of the known and potentially occurring threatened fauna species are likely to be dependent on the habitats present within the subject site for their survival. The species with potential to occur are highly mobile species that can access resources from a wide area. Assessments of Significance have determined that the proposed works are unlikely to have a significant impact on these threatened fauna species.

S6 Mitigation Measures

A number of mitigation measures are recommended for the proposed project. The mitigation measures recommended to be implemented include:

- Vegetation protection;
- Erosion, sedimentation and pollution control;
- Clearing surveys;
- Weed control measures;
- Revegetation; and
- Offsetting

S7 Conclusion

Despite the impacts of previous disturbance and the location of the subject site within a highly fragmented landscape, the proposed works will require the clearing of vegetation that forms highly marginal suitable habitat for some threatened fauna species.

Up to 0.04 ha of Cumberland Plain Woodland (canopy only), 0.34 ha of Urban Native/ Exotic Vegetation and 0.16 ha of Exotic Grassland will be cleared for the proposed upgrades to Rooty Hill Station.

The vegetation and habitat occurring within the subject site is highly modified as much of the site has been historically cleared and exotic species are dominant.

Based upon the assessment undertaken in this report, no significant impact is expected to occur to threatened species, populations or communities as a result of the proposed demolition works of the subject site. Therefore, the preparation of a Species Impact Statement (SIS) is not warranted. A referral to the Commonwealth Department of the Environment and Energy, under the EPBC Act is also not required.

Introduction

1.1 Purpose

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been commissioned by pitt&sherry on behalf of Transport for NSW (TfNSW) to conduct an ecological assessment for the Easy Access Upgrade and Commuter Car Park within part of Rooty Hill Railway Station (the 'subject site') (**Figure 1.1**). The subject site is within the wider Rooty Hill study area.

The purpose of this report is to describe the current biodiversity values of the subject site and to assess the potential impacts of the proposed upgrades on flora and fauna, particularly threatened species, populations and communities that are listed under the former New South Wales (NSW) *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is noted that the NSW *Biodiversity Conservation Act 2016* (BC Act) has replaced the TSC Act as of 25 August 2017. This report has been prepared as per requirements under the former TSC Act in accordance with transitional provisions of the BC Act.

The specific objectives of this report are to:

- Describe the vegetation communities on the subject site;
- Describe fauna habitats and fauna usage of the subject site;
- Identify any threatened species, populations or ecological communities (as listed under the TSC Act and/or EPBC Act) existing on the subject site;
- Assess the likelihood of occurrence of threatened species, populations or communities (as listed under the TSC Act and/or EPBC Act) within the subject site;
- Assess the potential impact of the project on threatened communities, flora and fauna, including the completion of Assessments of Significance under Section 5A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act); and
- Where relevant, recommend mitigation measures to reduce the impacts of the proposed works on biodiversity values.

1.2 Background

1.2.1 Site Description

The subject site is located north of the rail corridor at Rooty Hill Station within the Blacktown Local Government Area (**Figure 1.1**). The subject site is approximately 1.44 ha in area and is bound by the railway line to the south, the M7 to the east, Premier Lane to the west and Rooty Hill Skate Park to the north. The subject site contains existing paved areas such as the commuter carpark and footpaths, as well as some patches of vegetation.

i. Zoning

The subject site is zoned as B2 – Local Centre, SP2 Infrastructure - Depot and SP2 Infrastructure - Rail Corridor under the *Blacktown Local Environmental Plan 2015* (**Figure 1.2**).

The objectives of B2 – Local Centre zoning are:

- *To provide a range of retail, business, entertainment and community uses that serve the needs of people who live in, work in and visit the local area.*
- *To encourage employment opportunities in accessible locations.*
- *To maximise public transport patronage and encourage walking and cycling.*
- *To encourage the development of an active local centre that is commensurate with the nature of the surrounding area.*

The following actions are permitted without consent:

- *Nil*

The following actions are permitted with consent

- *Boarding houses; Centre-based child care facilities; Commercial premises; Community facilities; Educational establishments; Entertainment facilities; Function centres; Information and education facilities; Medical centres; Passenger transport facilities; Recreation facilities (indoor); Registered clubs; Respite day care centres; Restricted premises; Roads; Service stations; Shop top housing; Tourist and visitor accommodation; Water reticulation systems; Any other development not specified in item 2 or 4*

The objectives of SP2 – Infrastructure zoning are:

- *To provide for infrastructure and related uses.*
- *To prevent development that is not compatible with or that may detract from the provision of infrastructure.*

- *To ensure that development does not have an adverse impact on the form and scale of the surrounding neighbourhood.*

The following actions are permitted without consent:

- *Environmental protection works; Flood mitigation works*

The following actions are permitted with consent

- *Roads; The purpose shown on the Land Zoning Map, including any development that is ordinarily incidental or ancillary to development for that purpose*

1.2.2 Description of the Proposed Works

Transport for NSW (TfNSW) is proposing an Easy Access Station Upgrades and a Multi-storey Commuter Car Park at the Rooty Hill study area. The footprint of these works is shown in **Figure 1.3**. At this stage it is assumed that all vegetation within the subject site will be cleared for these upgrades, but there is potential for some of the vegetation to be retained.



Legend

Subject Site

Image Source:
Image © 2017 NearMap Pty Ltd
(Dated 22-8-2017)

Coordinate System: MGA Zone 56 (GDA 94)



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0 10 20 30 40
m

Figure 1.1. Location of the Subject Site



Legend

Subject Site

Zone

B2 - Local Centre

R4 - High Density Residential

SP2 - Infrastructure

Image Source:
Image © 2017 NearMap
(Dated 22-8-2017)

Data Source:
Blacktown City Council (2015).
LEP-Land Zoning Map

Coordinate System: MGA Zone 56 (GDA 94)

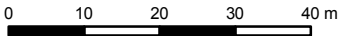
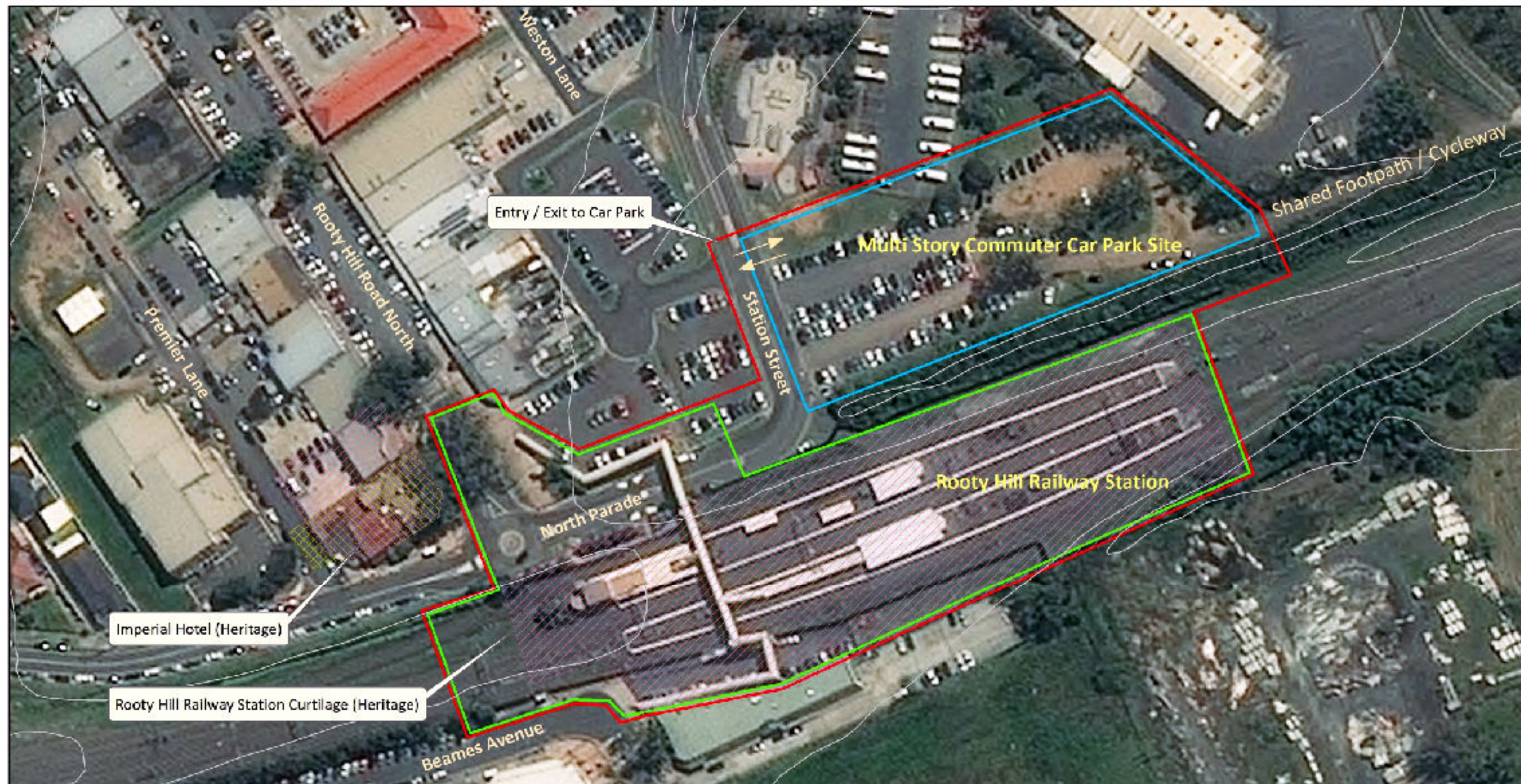


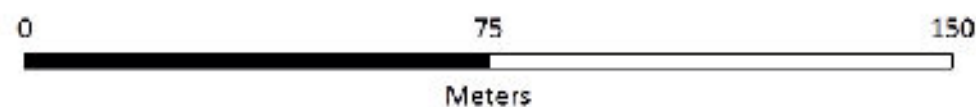
Figure 1.2. Land Zoning of the Subject Site



LEGEND

- Rooty Hill Study Area
- Site 1 Easy Access Station Upgrades
- Site 2 Multi Story Commuter Car Park
- Entry / Exit
- State Heritage Item
- General Heritage Item
- contours (2m)

1:1,200



Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



PROPOSAL AREA

Location: TfNSW - Rooty Hill Easy Access
Station Upgrade and Multi-Story Car Park
Created: 20-10-2017
Sheet Size: A3
Coordinate System:
Universal Transverse Mercator

pitt&sherry

Figure 1.3. Development Footprint

Image Source: Pitt and Sherry 2017

Methodology

2.1 Database Analysis and Literature Review

Database analysis was conducted for the locality using both the NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife (OEH 2017i) and the Commonwealth Department of the Environment and Energy (DoEE) Protected Matters Search Tool (DoEE 2017). The locality is defined as the area within a 5 km radius of the subject site. The Atlas of NSW Wildlife Database search was used to generate records of threatened flora and fauna species listed under the TSC Act within the locality of the subject site. The Protected Matters Search Tool generated a list of Matters of National Environmental Significance listed under the EPBC Act potentially occurring within the locality of the subject site. For the purpose of this report, marine animals have been excluded. The lists generated from these databases were reviewed against available knowledge of the subject site, in conjunction with the abundance, distribution and age of records, to ascertain the likelihood of occurrence of threatened species within the subject site.

2.2 Flora Survey

Flora surveys were undertaken within the subject site on 19 October 2017 by a botanist and ecologist over a two hour period. Surveys included vegetation mapping, quadrat sampling and targeted threatened flora searches. Further details of each of the survey methods are provided below.

All vascular plants recorded or collected were identified using keys and nomenclature provided in Harden (1990-1993). Where known, taxonomic and nomenclatural changes have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2017).

2.2.1 *Vegetation Mapping*

Cumberland Ecology conducted vegetation surveys to revise and update the vegetation mapping prepared by OEH. The vegetation within the subject site was then ground-truthed to examine and verify the mapping of the condition and extent of the different vegetation communities. Where vegetation community boundaries were found to differ from the OEH mapping, of the location of proposed new boundaries was recorded using a hand-held Global Positioning System (GPS) and mark-up of aerial photographs.

The resultant information was synthesised using a Geographic Information System (GIS) to create a spatial database that was used to interpret and interpolate the data to produce a vegetation map of the subject site.

2.2.2 Random Meander Survey

Random meander surveys were undertaken to detect flora species located within the subject site. These surveys were undertaken within all vegetation communities. **Figure 2.1** shows the area traversed.

2.2.3 Targeted Threatened Flora Surveys

Targeted threatened flora searches for species known from the locality were undertaken via random meander within areas of suitable habitat. The locations of threatened flora specimens observed during surveys were recorded using a hand-held GPS.

2.3 Fauna Survey

Fauna surveys were undertaken within the subject site on 19 October 2017. Surveys included a fauna habitat assessment and incidental observations. Further details of each of the survey methods are provided below.

2.3.1 Habitat Assessments

The assessment included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks and soaks. Structural features considered included the nature and extent of the understorey and ground stratum and extent of canopy. The survey also included an assessment of the presence of habitat features suitable for use by threatened fauna species known from the locality.

2.3.2 Incidental Observations

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

2.4 Limitations

Vertebrate fauna and vascular flora of the locality are well known based upon a sizeable database of past records and various published reports. The surveys by Cumberland Ecology added to the existing database and helped to provide a clear indication of the likelihood that various species occur, or are likely to occur within the subject site. The data obtained from database assessment and surveys of the subject site furnished an appropriate level of information to support this assessment.

The weather conditions at the time of the flora surveys were generally favourable for plant growth and production of features required for identification of most species. Shrubs,

grasses, herbs and creepers were readily identifiable in most instances. It is expected that not all flora species present would have been recorded during surveys. In addition, owing to time constraints not all areas were able to be adequately surveyed. Despite this, it is considered that sufficient information has been collected to assess issues including conservation significance of the flora, condition and viability of bushland and likely impact on native vegetation. An assessment of the likelihood of occurrence of threatened flora species recorded within the locality of the subject site in the database searches was undertaken to supplement the flora survey.

Limited targeted fauna surveys were undertaken for this assessment, which relied on database analysis and fauna habitat assessment. In general, opportunistic observations of fauna provide a "snapshot" of some of the fauna present that were active during time of the survey. The data produced by the surveys is intended to be indicative of the types of species that could occur and not an absolute census of all vertebrate fauna species occurring within the subject site. Therefore not all fauna utilising the subject site are likely to have been recorded during surveys. An assessment of the likelihood of occurrence of threatened and migratory fauna species listed for the locality in the database searches was undertaken to supplement the fauna surveys. The combination of these techniques is considered appropriate for assessing the habitat values of the site for threatened fauna within the subject site.



Legend



-  Subject Site
-  Random Meander Surveys

Image Source:
Image © 2017 NearMap
(Dated 22-8-2017)

Coordinate System: MGA Zone 56 (GDA 94)



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0 10 20 30 m

Figure 2.1. Survey Locations within the Subject Site

Results

3.1 Vegetation Communities

Previous broad-scale mapping conducted by OEH (2013) indicates that the subject site and wider Rooty Hill Station study area is unmapped. Surveys by Cumberland Ecology for this assessment identified the following vegetation communities within the subject site:

- Cumberland Plain Woodland (canopy);
- Urban Native/Exotic Vegetation; and
- Exotic Grassland.

The distribution of these communities is shown in **Figure 3.1**. Descriptions of each of the vegetation communities are provided below.

3.1.1 *Cumberland Plain Woodland (canopy)*

TSC Act Status: Critically Endangered Ecological Community (EEC) - Cumberland Plain Woodland in the Sydney Basin Bioregion

EPBC Act Status: Critically Endangered Ecological Community (EEC)

Cumberland Plain Woodland (CPW) is present throughout a total of 0.04 ha within the subject site as scattered trees. The canopy species within the subject site are four mature *Eucalyptus moluccana* (Grey Box) (**Photograph 3.1** and **3.2**) trees. These trees are present over concrete areas and planted gardens.

Directly south of the mature tree within the commuter carpark, there is one *E. moluccana* sapling and a smaller tree (approximately 10 m high) which could potentially be considered regeneration of CPW from the remnant tree. Note the area calculation of CPW does not include these trees owing to their small size.

Eucalyptus moluccana is a dominant canopy species of the CPW community. Soils within the subject site are heavily clay influenced (typical of CPW). CPW canopy trees were also sighted outside of the subject site in the wider area such as along Station Street.



Photograph 3.1 *Eucalyptus moluccana* within existing commuter car park



Photograph 3.2 *Eucalyptus moluccana* located at Rooty Hill Road North

3.1.2 Urban Native/Exotic Vegetation

TSC Act Status: Not listed

EPBC Act Status: Not listed

Urban Native/ Exotic Vegetation is the dominant vegetation type within the subject site (0.34 ha). Species include planted native canopy species such as *Eucalyptus amplifolia* subsp. *amplifolia* (Cabbage Gum) and *Melaleuca decora* located within the existing

commuter car park (**Photograph 3.3**). It is evident that there are recent plantings located directly adjacent to the car park (**Photograph 3.4**).

Vegetation located along the drainage line along the southern boundary of the subject site is dominated by a canopy of exotic and non-endemic native species including *Erythrina crista-galli* (Cockspur Coral Tree), *Quercus robur* (English Oak), *Morus alba* (White Mulberry) and *Grevillea robusta* (Silky Oak) (**Photograph 3.5**), although the native endemic species *Melia azedarach* (White Cedar) and *Eucalyptus moluccana* (Grey Box) are present. Generally this area of vegetation is dominated by weeds such as shrubs *Ligustrum lucidum* (Large-leaved Privet), *Cestrum parqui* (Green Cestrum) *Ulmus parvifolia* (Chinese Elm), and groundcovers such as *Tradescantia fluminensis* (Wandering Jew), *Bidens pilosa* (Cobblers Pegs), *Sida rhombifolia* (Paddy's Lucerne), *Verbena bonariensis* (Purpletop) and *Ehrharta erecta* (Panic Veldtgrass) (**Photograph 3.6**). Some non-endemic native shrubs are present within this vegetation, namely *Callistemon viminalis* (Weeping Bottlebrush).

Urban Native/ Exotic Vegetation located on Rooty Hill Road North comprises of species such as the native canopy species *Casuarina cunninghamiana* (River Oak) directly adjacent to the pedestrian footbridge, and exotic *Lagerstroemia indica* (Crepe Myrtle) over *Agapanthus praecox* subsp. *orientalis* (African Lily) (**Photograph 3.7**).



Photograph 3.3 Planted vegetation within the commuter car park



Photograph 3.4 Native plantings adjacent to carpark



Photograph 3.5 Predominantly exotic vegetation along drainage line

construction works are currently taking place within the grassland adjacent to Rooty Hill Skate Park (Photograph 3.8).



Photograph 3.6 Exotic dominated vegetation along drainage line



Photograph 3.7 Vegetation near roundabout at North Parade and Rooty Hill Road North

3.1.3 Exotic Grassland

TSC Act Status: Not listed

EPBC Act Status: Not listed

Exotic Grassland is present throughout a total of 0.16 ha within the subject site. Groundcover is dominated by exotic species such as *Eragrostis curvula* (African Lovegrass), *Stenotaphrum secundatum* (Buffalo Grass) and *Cynodon dactylon* (Couch). Some



Photograph 3.8 Exotic grassland

3.2 Flora Species

3.2.1 General Species

Over 70 flora species were recorded throughout the subject site during surveys. The dominant plant families encountered within the subject site are represented by the Poaceae, Asteraceae and Myrtaceae. Species present within the subject site consists of a mix of exotics (83%) and native species including non-endemic planted species (17%). A flora species list is provided in **Appendix A**.

3.2.2 Threatened Species

No threatened flora species were recorded within the subject site. An analysis of the likelihood of occurrence on the subject site for each threatened flora species recorded within the locality is provided in **Appendix B**. It is unlikely that any threatened flora species naturally occur within the subject site as it is highly disturbed. Areas of grassland have been continually mown short and the majority of the subject site is paved carpark.

3.2.3 Priority Weeds

The *Noxious Weeds Act 1993* no longer applies and problematic weeds are handled under the *NSW Biosecurity Act 2015*. The subject site is located within the Priority region for Greater Sydney. There is one species listed within the subject site as a priority weed:

Cestrum parqui (Green Cestrum). This species is not listed as a Weed of National Significance.



Legend

- Subject Site
 - Small Eucalyptus moluccana Sapling
 - Small Eucalyptus moluccana Tree
- Vegetation Community**
- Cumberland Plain Woodland (Canopy)
 - Exotic Grassland
 - Urban Native/Exotic Vegetation

Image Source:
Image © 2017 NearMap
(Dated 22-8-2017)

Coordinate System: MGA Zone 56 (GDA 94)

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0 10 20 30 m

Figure 3.1. Vegetation Communities within the Subject Site

3.3 Fauna

3.3.1 Fauna Habitat

The subject site provides moderate value habitat for many fauna species, mainly within the denser vegetation located along the manmade drainage line. There is some highly marginal potential habitat for tree hollow-dependent fauna as one tree present potentially contains small hollows (see **Table 3.1** below and **Figure 3.3** for habitat features). Although there are some exotic flora species within the subject site, these can provide potential foraging resources for nectivorous mammals and birds that may use the subject site from time to time as part of a larger foraging range.

The drainage line provides potential, albeit degraded habitat for native frog species although none were heard during the site inspection.

There are several culverts that could be suitable for some microchiropteran bat species to roost in (see **Photograph 3.9** for example).

As the groundcover throughout the subject site is dominated by exotic species and has been continually mown, targeted searches for the Cumberland Plain Land Snail were not undertaken due to the lack of suitable habitat. The Cumberland Plain Land Snail is listed as Endangered under the TSC Act.

Table 3.1 Fauna habitat items recorded within the subject site

Habitat ID	Type	Species	Description of Habitat
H1	Habitat Tree	<i>Eucalyptus moluccana</i>	Mature tree with potential small hollow and mistletoe
H2	Culvert	-	Culvert: one - potential microbat habitat
H3	Culvert	-	Culvert: three - potential microbat habitat
H4	Habitat Tree	<i>Eucalyptus moluccana</i>	1 Noisy Miner nest, 1 Grey Butcherbird nest



Photograph 3.9 Culverts within manmade drainage line

3.3.2 General Species

Six bird and two reptile species were recorded during the site inspection. These are listed in **Table 3.2**. It is likely that other common urban adapted species would also occur on occasion such as the Rainbow Lorikeet (*Trichoglossus haematodus*) and Australian Magpie (*Cracticus tibicen*).

Table 3.2 Fauna species recorded in the subject site

Family	Scientific Name	Common Name
Aves		
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing
Corvidae	<i>Corvus coronoides</i>	Australian Raven
Meliphagidae	<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark
Sturnidae	<i>Acridotheres tristis</i> *	Indian Myna
Reptilia		
Agamidae	<i>Intellagama lesueurii</i>	Eastern Water Dragon
Elapidae	<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake

*denotes exotic species

3.3.3 Threatened Species

A number of threatened fauna species have been recorded from the locality and have the potential to occur within the subject site. An analysis of the likelihood of occurrence within the subject site for each threatened fauna species recorded or predicted to occur within the locality has been conducted and is presented in **Appendix C**. Ten threatened fauna species are considered as having potential to occur within the subject site. A discussion of the potentially occurring and known threatened fauna species is provided below.

i. *Little Eagle*

The Little Eagle (*Hieraaetus morphnoides*) occurs throughout the mainland except within more densely vegetated parts of the Dividing Range (OEH 2017f). It occurs within open eucalypt forest, woodland, open woodland as well as Sheoak or Acacia woodlands and riparian woodlands of interior NSW. It is listed as Vulnerable under the TSC Act.

Potential foraging and breeding habitat for this species occurs within the subject site. The species could forage within parts of the vegetation on the subject site as part of its wider foraging range. Although the species could breed within the subject site, no large raptor nests were observed during surveys.

ii. *Powerful Owl*

The Powerful Owl (*Ninox strenua*) is distributed from Mackay to south western Victoria, mainly on the coastal side of the Great Dividing Range. This species occurs in many vegetation types from woodland and open sclerophyll to tall open wet forest and rainforest. It requires large tracts of native vegetation but can survive in fragmented landscapes. It roosts in dense vegetation and nests in large tree hollows (OEH 2017g). The Powerful Owl is listed as Vulnerable under the TSC Act.

Potential foraging habitat for this species occurs within the subject site. The species is known to utilise fragmented vegetation as well as larger tracts of forest and woodland. The subject site is considered to only provide marginal foraging habitat for this species. No large tree hollows are present so no breeding habitat is present. The Powerful Owl also would more likely nest within larger tracts of intact native vegetation.

iii. *Grey-headed Flying-fox*

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is distributed along the east coast from Bundaberg in Queensland to Melbourne, Victoria. It occurs as far west as the western slopes of the Great Dividing Range in northern NSW. It occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Grey-headed Flying-foxes migrate according to the availability of native fruits, nectar and pollen. They roost in large “camps” which are generally within 20 km of a food source (NSW Scientific Committee 2004). The Grey-headed Flying-fox is listed as Vulnerable under the TSC Act and the EPBC Act.

Potential foraging habitat for this species occurs within the subject site. Grey-headed Flying-foxes live in specific roost camps, the locations of which are well-known within the Sydney region. No camps were observed within the subject site. The nearest camp is located over 10 km east of the subject site at Parramatta Park, Parramatta (Ku-ring-gai Bat Conservation Society 2017).

iv. *Yellow-bellied Sheath-tail-bat*

The Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*) occurs across northern and eastern Australia. It forages in many habitats, with or without trees and roosts in tree hollows and buildings, or in burrows where trees are absent (OEH 2017j). The species is listed as Vulnerable under the TSC Act.

Potential foraging and breeding habitat for this species occurs within the subject site. The species could forage within the subject site as part of its wider foraging range. The species could potentially roost within tree hollows on or near to the subject site.

v. *Eastern Freetail-bat*

The Eastern Freetail-bat (*Mormopterus norfolkensis*) is listed as Vulnerable under the TSC Act. The species occurs from southern NSW to south Queensland along the east coast (OEH 2017c). The Eastern Freetail-bat hunts in forested areas, catching moths and other flying insects above the tree tops. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.

The species could potentially forage within the subject site as part of a wider foraging range, and could potentially roost in hollows or stormwater culverts on or near the subject site.

vi. *Eastern False Pipistrelle*

The Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) is distributed along south-east coast and ranges of Australia. It inhabits moist habitats with trees taller than 20m. The species generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. It preys on insects above or just below tree canopy and forages up to 12km from roost sites (OEH 2017b). The Eastern False Pipistrelle is listed as Vulnerable under the TSC Act.

Potential foraging and breeding habitat for this species occurs within the subject site. The species could forage within the forested vegetation of the subject site as part of its wider foraging range. The species could potentially roost within tree hollows on or near the subject site.

vii. *Little Bentwing-bat*

The Little Bentwing-bat (*Miniopterus australis*) is found from Cape York in Queensland to Wollongong in NSW. It inhabits well timbered habitats in a variety of vegetation types including moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub (OEH 2017e). Roosting habitat

comprises of caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings. The species is listed as Vulnerable under the TSC Act.

Potential foraging and breeding habitat for this species occurs within the subject site. The species could forage within the subject site as part of its wider foraging range. The species could potentially roost within tree hollows and culverts on or near the subject site.

viii. *Eastern Bentwing-bat*

The Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), occurs throughout the east and north-west coast of Australia. They hunt in forested areas above the canopy, and roost primarily in caves, however derelict mines, storm-water tunnels, buildings and other man-made structures can be utilised (OEH 2017a). The species is listed as Vulnerable under the TSC Act.

Potential foraging and breeding habitat for this species occurs within the subject site. The species could forage within the subject site as part of its wider foraging range. The species could potentially roost within the culverts on or near to the subject site.

ix. *Southern Myotis*

The Southern Myotis (*Myotis macropus*) is listed as Vulnerable under the TSC Act. The species occurs across the top-end and south to western Victoria, in the coastal band from the north-west of Australia and is typically found within 100km of the coast, except along any major rivers (OEH 2017h). The Southern Myotis forages over streams and pools catching insects and fish. The species roosts close to water in caves, mines, tree hollows, storm water channels, bridges, buildings or in dense foliage.

The species could potentially forage in habitat nearby the subject site at Angus Creek east and south of the subject site as part of a wider foraging range, and could potentially roost in hollows or culverts on or near the subject site. Although degraded, the drainage line within the subject site could also provide foraging habitat for the Southern Myotis.

x. *Greater Broad-nosed Bat*

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) occurs from the Atherton Tableland to north-eastern Victoria. It is found in various habitats being most commonly found in tall wet forest. The species predominantly roosts in tree hollows but also roosts in buildings. The Greater Broad-nosed Bat flies approximately 3 to 6m above creek and river corridors (OEH 2017d). The species is listed as Vulnerable under the TSC Act.

Potential foraging and breeding habitat for this species occurs within the subject site. The species could forage within the subject site as part of its wider foraging range. The species could potentially roost within tree hollows on or near the subject site.

xi. *Migratory Species*

Two species listed as migratory under the EPBC Act may potentially pass through the locality. These are the Fork-tailed Swift (*Apus pacificus*) and White-throated Needletail

(*Hirundapus caudacutus*) which are aerial species that may forage aerially above the subject site on occasion, but would unlikely utilise it directly.



Legend

- Subject Site
- Habitat Feature

Image Source:
Image © 2017 NearMap
(Dated 22-8-2017)

Coordinate System: MGA Zone 56 (GDA 94)



cumberland
ecology

0 10 20 30 m

Figure 3.2. Habitat Features on the Subject Site

Impact Assessment

4.1 Impacts to Vegetation Communities and Habitat

4.1.1 *Vegetation Removal*

The primary impact resulting from the proposed upgrade works is the clearing of vegetation and associated habitat within the subject site. Approximately 0.04 ha of CPW (canopy) is present on the subject site, all of which is currently proposed to be removed, although there is the potential for some of the trees to be retained. Other vegetation to be removed comprises of up to 0.34 ha of Urban Native/ Exotic Vegetation and 0.16 ha of Exotic Grassland. Currently all of this vegetation is proposed to be removed, however it is likely that some will be retained depending on the final development footprint which is still being finalised. Past and current use of the subject site and surrounding areas has entailed clearing and modification of the majority of native vegetation. The CPW present within the subject site is highly modified, with canopy trees existing over a predominantly exotic groundcover and paved areas. No characteristic understorey or groundcover CPW species were recorded. An Assessment of Significance of the impacts to this community is provided in **Appendix D**. This assessment concluded that the proposed upgrade works are not likely to result in a significant impact to this community.

4.1.2 *Loss of Specific Habitat Features*

In addition to the clearance of broad habitats within the subject site, a number of specific habitat features will be removed, including

- Nectar-producing trees;
- One hollow-bearing tree; and
- Bird nests.

4.1.3 *Impact on Remaining Vegetation and Habitats*

The proposed works have the potential to indirectly impact remaining vegetation and habitats. These impacts include:

- Habitat fragmentation - affects biodiversity by reducing the amount of available habitat for some species to occupy due to increased distances between habitat patches;

- Edge effects – affects biodiversity through microclimatic changes in light, temperature, humidity and wind, which can favour a suite of different species and therefore cause significant changes to the ecology of the patch (Lindenmayer and Fischer 2006);
- Alteration to hydrological regimes – affects biodiversity through modification of hydrology necessary for vegetation and habitat survival, such as surface water drainage patterns; and
- Increased sedimentation and erosion – affects biodiversity through the smothering of vegetation, increasing turbidity of waterways and transportation of weed matter and nutrients; and
- Weeds and feral animals – affects biodiversity through increased competition for resources.

4.2 Impacts to Flora Species

No threatened flora species are present in the subject site or are likely to occur.

The project has the potential to result in a number of direct and indirect impacts to flora species in general within the subject site. In addition to the direct removal and modification of vegetation within the subject site, potential indirect impacts to flora species include:

- Weed invasion;
- Run-off, erosion and sedimentation; and
- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

A number of mitigation measures are proposed to minimise these impacts. These are discussed further in **Chapter 5**.

4.3 Impacts to Fauna Species

The proposed works have the potential to result in a number of direct and indirect impacts to fauna species within the subject site. In addition to the direct removal and modification of vegetation within the subject site, potential indirect impacts to fauna species include:

- Habitat disturbance during the construction phase of the project (e.g. changes in noise levels);
- Runoff, erosion and sedimentation;
- Increased pollution;
- Hydrological changes resulting in altered fauna habitats; and

- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

A number of other threatened fauna species are considered to have the potential to occur within the subject site (see **Section 3.3.3**). The subject site provides foraging opportunities for these threatened fauna but is unlikely to exclusively support a local population of any threatened fauna species.

These species may forage on or near the subject site from time to time as part of a much larger range. Assessments of Significance for these species are provided in **Appendix C**. These assessments concluded the project will not significantly impact these species.

Likewise, any migratory birds are unlikely to utilise the subject site and surrounding vegetation for roosting or feeding, as they are highly mobile, aerial species. Therefore the proposed works are not considered likely to have a significant impact on any migratory fauna species.

Mitigation Measures

A number of mitigation measures are recommended for the proposed project. These measures should be implemented to minimise impacts to biodiversity values within adjoining habitats.

5.1 Vegetation Protection

To avoid unnecessary removal or damage to any adjoining vegetation outside of the subject site, the clearing area should be clearly demarcated and signed, where appropriate, to ensure no vegetation beyond these boundaries is removed. Clearing works and equipment should be excluded from areas outside the clearing area. Site inductions are to be provided by the civil contractor to ensure all site workers and visitors are aware of any no-access areas.

5.2 Erosion, Sedimentation and Pollution Control

Potential impacts to flora and fauna occurring in the construction phase that can be managed include: run-off, sedimentation, erosion and pollution. To reduce sedimentation on the construction site, erosion control measures should be implemented. This includes minimising the amount of exposed soils on the site at any given time. All soil stockpiles should be adequately covered when not in use to prevent erosion during heavy rainfall. Sediment fences should be established around the perimeter of the development area to prevent the impacts of sedimentation on the adjoining vegetation. During development, precautions should be taken to ensure that no pollution, such as petrochemical substances or water containing suspended solids, escapes the construction site. Pollution traps and removal of pollution to an off-site location would help to minimise pollution impacts.

5.3 Pre-clearing and Clearing Surveys

Pre-clearing surveys are to be undertaken by a suitably qualified ecologist. Pre-clearing surveys will include:

- Demarcation of key habitat features as hollow-bearing trees, fallen logs and bushrock; and

- Provision of a report following the completion of a pre-clearing survey, detailing the location and type of each habitat feature.

To minimise impacts to native fauna species, clearing should be undertaken in the following two-stage process under the supervision of a suitably qualified ecologist:

- The initial phase of clearing will involve clearing around identified habitat features and leaving the features overnight;
- The second stage will involve clearing of the habitat features left overnight followed by an inspection.

An ecologist should investigate all fallen trees for the presence of hollows not detected prior to clearing. Inspections should be undertaken of these hollows for native fauna.

An ecologist should be present while clearing to rescue animals injured during the clearance operation. Provisions will be made to protect any native fauna during clearing activities by the following means:

- All persons working on vegetation clearing will be briefed about the possible fauna present and should avoid injuring any fauna;
- Animals disturbed or dislodged during the clearance but not injured should be assisted to move to the adjacent bushland; and
- If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized).

5.4 Weed Control Measures

Priority weed species occurring within the subject site should be managed in order to prevent further spread. Prior to any vegetation clearance, priority weeds in the shrub layer should be demarcated in order for these to be disposed of separately from native material. All groundcover should be disposed of in a manner that will prevent spread as the majority is exotic grass.

5.5 Revegetation

It is recommended that if any landscaping is required for the proposed upgrade works that species typical of CPW are incorporated, including canopy, shrubs and groundcovers. Species can be chosen from the final determination for the community (<http://www.environment.nsw.gov.au/determinations/cumberlandwoodlandsFD.htm>).

5.6 Offsetting

TfNSW has prepared a Vegetation Offset Guide (TfNSW, 2016) to assist in meeting the biodiversity sustainability target and to provide a framework for a consistent approach to offset impacts to vegetation on applicable TfNSW projects.

The following ratios for the provision of replacement trees would be applied:

- eight trees for every tree with a diameter at breast height (DBH) greater than 60cm;
- four planted trees for every tree with a DBH of 15cm-60cm;
- two trees for every tree with a DBH less than 15cm.

The Vegetation Offset Guide would be applied to the proposed project during detailed development of the landscape plan to identify any potential to offset within the bounds of the site. Additional offset vegetation planting would be planted at an alternative site in consultation with Council.

Conclusion

Despite the impacts of previous disturbance and location within a highly fragmented landscape, the proposed upgrade works will require the clearing of native vegetation that forms suitable habitat for some threatened fauna species. Past and current use of the subject site has entailed clearing and modification of the majority of pre-existing native vegetation.

Approximately 0.54 ha of vegetation will be cleared for the proposed development, consisting of up to 0.04 ha of Cumberland Plain Woodland (CPW) (canopy), 0.34 ha of Urban Native/Exotic Cover and 0.16 ha of Exotic Grassland.

Within the subject site the CPW community is in relatively low condition. The community lacks native species within the ground and midstorey layers, and exists as canopy remnants over planted gardens and paved areas. The long-term viability of CPW within the subject site has previously been reduced as the community has previously been fragmented by various developments and past land uses (including existing commuter carparks) with the local extent existing as patches of varying conditions and sizes.

Some threatened species have been recorded from the locality, and some have the potential to occur within the subject site. Threatened fauna species have the potential to occur within the subject site based on the presence of suitable habitat and records in the locality.

The mitigation measures recommended to be implemented included:

- Vegetation protection;
- Erosion, sedimentation and pollution control;
- Pre-clearing and clearing surveys;
- Weed control measures;
- Revegetation.
- Offsetting

No significant impact is predicted to occur to threatened species, populations or communities as a result of the proposed development. Therefore, the preparation of a Species Impact Statement (SIS) is not warranted. A referral to the Commonwealth Department of the Environment, under the EPBC Act is also not required.

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Appendix A

Flora Species List

Table A.1 Flora species recorded within the subject site

Family	*	Scientific Name	Common Name	RMS1	RMS2	RMS3	RMS4
Canopy							
		<i>Eucalyptus</i>					
Myrtaceae		<i>amplifolia</i> subsp. <i>amplifolia</i>	Cabbage Gum	X			
Myrtaceae		<i>Corymbia maculata</i>	Spotted Gum				X
Myrtaceae		<i>Eucalyptus moluccana</i>	Grey Box		X		X
Sub-canopy							
Casuarinaceae		<i>Casuarina cunninghamiana</i>	River Oak				X
Fabaceae			Cockspur Coral				
(Faboideae)	*	<i>Erythrina crista-galli</i>	Tree		X		
Fagaceae	*	<i>Quercus robur</i>	English Oak		X		
Meliaceae		<i>Melia azedarach</i>	White Cedar		X		
Moraceae	*	<i>Morus alba</i>	White Mulberry		X		
Myrtaceae		<i>Corymbia maculata</i>	Spotted Gum				X
Myrtaceae		<i>Eucalyptus moluccana</i>	Grey Box		X		
Proteaceae		<i>Grevillea robusta</i>	Silky Oak		X		
Shrubs							
			Canary Island				
Arecaceae	*	<i>Phoenix canariensis</i>	Date Palm		X		
Arecaceae	*	<i>Washingtonia filifera</i>			X		
			Japanese Sacred				
Berberidaceae	*	<i>Nandina domestica</i>	Bamboo				X
Bignoniaceae	*	<i>Tecoma stans</i>	Yellow Bignonia		X		
Casuarinaceae		<i>Casuarina glauca</i>	Swamp Oak	X			
Fabaceae							
(Caesalpinioideae)	*	<i>Senna pendula</i> var. <i>glabrata</i>	Winter Cassia		X		
Fabaceae			Cockspur Coral				
(Faboideae)	*	<i>Erythrina crista-galli</i>	Tree		X		
Fabaceae							
(Mimosoideae)		<i>Acacia parramattensis</i>	Parramatta Wattle	X			
Lythraceae	*	<i>Lagerstroemia indica</i>	Crepe Myrtle			X	
			Weeping				
Myrtaceae		<i>Callistemon viminalis</i>	Bottlebrush		X		

Table A.1 Flora species recorded within the subject site

Family	*	Scientific Name	Common Name	RMS1	RMS2	RMS3	RMS4
Myrtaceae		<i>Eucalyptus moluccana</i>	Grey Box		X		
Myrtaceae		<i>Eucalyptus</i> sp.		X			
Myrtaceae		<i>Melaleuca decora</i>		X			
			Large-leaved				
Oleaceae	*	<i>Ligustrum lucidum</i>	Privet		X		
Sapindaceae	*	<i>Acer negundo</i>	Box-elder Maple		X		
Solanaceae	*	<i>Cestrum parqui</i>	Green Cestrum		X		
Ulmaceae	*	<i>Ulmus parvifolia</i>	Chinese Elm		X		
Dicots							
Apiaceae	*	<i>Apium graveolens</i>	Celery		X		
Apiaceae	*	<i>Cyclospermum leptophyllum</i>	Slender Celery			X	
Asteraceae	*	<i>Bidens pilosa</i>	Cobblers Pegs		X		X
Asteraceae	*	<i>Cirsium vulgare</i>	Spear Thistle		X		
Asteraceae	*	<i>Conyza bonariensis</i>	Flaxleaf Fleabane	X		X	
Asteraceae	*	<i>Conyza sumatrensis</i>	Tall Fleabane		X		
Asteraceae		<i>Cotula australis</i>	Common Cotula		X		
Asteraceae	*	<i>Gamochaeta americana</i>	Cudweed		X		
Asteraceae	*	<i>Gamochaeta purpurea</i>	Purple Cudweed	X			
Asteraceae	*	<i>Gazania rigens</i>	Treasure Flower				X
			Willow-leaved				
Asteraceae	*	<i>Lactuca saligna</i>	Lettuce		X		
Asteraceae	*	<i>Lactuca serriola</i>	Prickly Lettuce		X	X	
Asteraceae	*	<i>Soliva sessilis</i>	Bindyi	X			
Asteraceae	*	<i>Sonchus asper</i>	Prickly Sowthistle		X		
			Common				
Asteraceae	*	<i>Sonchus oleraceus</i>	Sowthistle		X		
Asteraceae	*	<i>Tragopogon porrifolius</i>	Salsify		X		
Boraginaceae	*	<i>Heliotropium amplexicaule</i>	Blue Heliotrope	X			
Brassicaceae	*	<i>Brassica fruticulosa</i>	Twiggy Turnip		X		
			Four-leaved				
Caryophyllaceae	*	<i>Polycarpon tetraphyllum</i>	Allseed				X
Chenopodiaceae		<i>Einadia trigonos</i>	Fishweed		X		
Convolvulaceae	*	<i>Evolvulus nuttallianus</i>					X

Table A.1 Flora species recorded within the subject site

Family	*	Scientific Name	Common Name	RMS1	RMS2	RMS3	RMS4
Fabaceae							
(Faboideae)	*	<i>Vicia sativa</i>			X		X
			Red-flowered				
Malvaceae	*	<i>Modiola caroliniana</i>	Mallow		X		
Malvaceae	*	<i>Sida rhombifolia</i>	Paddy's Lucerne		X		
Plantaginaceae	*	<i>Plantago lanceolata</i>	Lamb's Tongues		X		
Polygonaceae	*	<i>Rumex crispus</i>	Curled Dock		X		
Rubiaceae	*	<i>Galium aparine</i>	Goosegrass		X		
			Black-berry				
Solanaceae	*	<i>Solanum nigrum</i>	Nightshade		X		
Verbenaceae	*	<i>Verbena bonariensis</i>	Purpletop		X		
Verbenaceae	*	<i>Verbena officinalis</i>	Common Verbena		X		
Climbers/Vines							
Apocynaceae	*	<i>Araujia sericifera</i>	Moth Vine		X		
Convolvulaceae	*	<i>Convolvulus arvensis</i>			X		
Monocots							
(Grasses)							
Poaceae	*	<i>Avena barbata</i>	Bearded Oats		X		
Poaceae	*	<i>Bromus catharticus</i>	Prairie Grass		X		X
Poaceae	*	<i>Chloris gayana</i>	Rhodes Grass		X		
Poaceae	*	<i>Ehrharta erecta</i>	Panic Veldtgrass		X		
Poaceae	*	<i>Eragrostis curvula</i>	African Lovegrass	X			
Poaceae	*	<i>Cenchrus clandestinus</i>	Kikuyu Grass		X		
Poaceae	*	<i>Cynodon dactylon</i>	Couch	X	X		
Poaceae	*	<i>Holcus lanatus</i>	Yorkshire Fog		X		
			Perennial				
Poaceae	*	<i>Lolium perenne</i>	Ryegrass		X		
Poaceae	*	<i>Paspalum dilatatum</i>	Paspalum	X	X		
Poaceae	*	<i>Setaria parviflora</i>		X			
Poaceae	*	<i>Sporobolus africanus</i>	Parramatta Grass	X			
Poaceae	*	<i>Stenotaphrum secundatum</i>	Buffalo Grass	X	X		

Table A.1 **Flora species recorded within the subject site**

Family	*	Scientific Name	Common Name	RMS1	RMS2	RMS3	RMS4
Monocots (Other)							
		<i>Agapanthus</i>					
Alliaceae	*	<i>praecox</i> subsp. <i>orientalis</i>	African Lily			X	
Alliaceae	*	<i>Nothoscordum gracile</i>	Onion Weed		X		
Commelinaceae	*	<i>Tradescantia fluminensis</i>	Wandering Jew		X		
Cyperaceae	*	<i>Cyperus eragrostis</i>	Umbrella Sedge		X		
Doryanthaceae		<i>Doryanthes excelsa</i>	Gynea Lily				X
Iridaceae	*	<i>Dietes grandiflora</i>					X
Juncaceae	*	<i>Juncus cognatus</i>			X		

*denotes exotic species, RMS = Random meander survey

Appendix B

Threatened Flora Likelihood of Occurrence

Table B.1 **Threatened flora likelihood of occurrence**

Family	Scientific Name	Common Name	TSC Act EPBC Records Act			Habitat Requirements	Likelihood of Occurrence
Apocynaceae	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	<i>Marsdenia viridiflora</i> R. Br. subsp. <i>viridiflora</i> population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	EP		23	Found in open shale woodland in vine thickets.	Unlikely to occur. No suitable habitat present on the subject site.
Apocynaceae	<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	0	Recorded from rainforest gullies, scrub and scree slopes. Typically occurs mainly at the ecotone between dry subtropical rainforest and sclerophyll forest/woodland.	Unlikely to occur. No suitable habitat present on the subject site.
Casuarinaceae	<i>Allocasuarina glaireicola</i>		E	E	0	Found in open woodland with <i>Eucalyptus parramattensis</i> , <i>Eucalyptus fibrosa</i> , <i>Angophora bakeri</i> , <i>Eucalyptus sclerophylla</i>	Unlikely to occur. No suitable habitat present on the subject site.

Table B.1 Threatened flora likelihood of occurrence

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
Fabaceae (Faboideae)	<i>Dillwynia tenuifolia</i>		V		80	and <i>Melaleuca decora</i> on lateritic soil. Locally abundant particularly 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 transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	Unlikely to occur. No suitable habitat present on the subject site.
Fabaceae (Faboideae)	<i>Pultenaea parviflora</i>		E	V	57	Endemic to the Cumberland Plain. Core distribution is from Windsor to Penrith and east to Dean Park. Found in scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale	Unlikely to occur. No suitable habitat present on the subject site.

Table B.1 Threatened flora likelihood of occurrence

Family	Scientific Name	Common Name	TSC Act EPBC Records Act			Habitat Requirements	Likelihood of Occurrence
						Gravel Transition Forest on tertiary alluvium or laterised clays and in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	
Fabaceae (Mimosoideae)	<i>Acacia pubescens</i>	Downy Wattle	V	V	9	Grows in dry sclerophyll forest and woodland in clay soils.	Unlikely to occur. Highly marginal suitable habitat present on the subject site but not recorded during surveys.
Fabaceae (Mimosoideae)	<i>Acacia bynoeana</i>	Bynoe's Wattle	E	V	0	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches.	Unlikely to occur. No suitable habitat present on the subject site.
Haloragaceae	<i>Haloragis exalata</i> subsp. <i>exalata</i>	Square Raspwort	V	V	0	Occurs in riparian habitats in protected, shaded and	Unlikely to occur. Highly marginal suitable

Table B.1 Threatened flora likelihood of occurrence

Family	Scientific Name	Common Name	TSC Act EPBC Records Act			Habitat Requirements	Likelihood of Occurrence
						damp situations.	habitat present on the subject site but not recorded during surveys. No existing known records within the locality.
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V		1	Found in dry sclerophyll forest.	Unlikely to occur. No suitable habitat present on the subject site.
Myrtaceae	<i>Micromyrtus minutiflora</i>		E	V	3	Found in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments.	Unlikely to occur. No suitable habitat present on the subject site.
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E	V	0	Rainforest species on sandy soils.	Unlikely to occur. No suitable habitat present on the subject site.
Orchidaceae	<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E	E	0	Grows in dry sclerophyll	Unlikely to occur.

Table B.1 Threatened flora likelihood of occurrence

Family	Scientific Name	Common Name	TSC Act EPBC Records Act			Habitat Requirements	Likelihood of Occurrence
						forest and moss gardens over sandstone.	No suitable habitat present on the subject site.
Orchidaceae	<i>Pterostylis gibbosa</i>	Illawarra Greenhood	E	E	0	All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage.	Unlikely to occur. No suitable habitat present on the subject site.
Orchidaceae	<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	E	0	Found in sclerophyll forests or woodland on shale/sandstone transition soils or shale soils over flat site. sheets of sandstone rock shelves above cliff lines and also in crevices between sandstone boulders.	Unlikely to occur. No suitable habitat present on the subject site.
Proteaceae	<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	V		161	Found in Cumberland Plain Woodland and Castlereagh Woodland often in small populations on road verges. Grows on	Unlikely to occur. Highly marginal suitable habitat present on the subject site but not recorded during surveys.

Table B.1 Threatened flora likelihood of occurrence

Family	Scientific Name	Common Name	TSC Act EPBC Records Act			Habitat Requirements	Likelihood of Occurrence
						reddish clay to sandy soils typically containing lateritic gravels.	
Proteaceae	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	V	V	1	Occurs in a range of vegetation types from heath and shrubby woodland to open forest on sandy or light clay soils usually over thin shales.	Unlikely to occur. No suitable habitat present on the subject site.
Proteaceae	<i>Persoonia nutans</i>	Nodding Geebung	E	E	3	Confined to aeolian and alluvial sediment below 60 ASL. More common on deeper sands and gently undulating low rises. Found in a range or sclerophyll forest and woodland vegetation communities often in association with Agnes Banks Woodland, Castlereagh Scribbly Gum Woodland and to a lesser extent Cooks	Unlikely to occur. No suitable habitat present on the subject site.

Table B.1 Threatened flora likelihood of occurrence

Family	Scientific Name	Common Name	TSC Act EPBC Records Act			Habitat Requirements	Likelihood of Occurrence
						River/Castlereagh Ironbark Forest and Shale Sandstone Transition Forest.	
Rhamnaceae	<i>Pomaderris brunnea</i>	Brown Pomaderris	E	V	0	Occurs in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Unlikely to occur. No suitable habitat present on the subject site.
Santalaceae	<i>Thesium australe</i>	Austral Toadflax	V	V	0	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.	Unlikely to occur. No suitable habitat present on the subject site.
Thymelaeaceae	<i>Pimelea curviflora</i> var. <i>curviflora</i>		V	V	1	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands	Unlikely to occur. No suitable habitat present on the subject site.
Thymelaeaceae	<i>Pimelea spicata</i>	Spiked Rice-flower	E	E	53	On the Cumberland Plain sites it is associated with Grey Box communities	Unlikely to occur. Highly marginal suitable habitat present on the

Table B.1 Threatened flora likelihood of occurrence

Family	Scientific Name	Common Name	TSC Act EPBC Records Act	Habitat Requirements	Likelihood of Occurrence
				(particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a better developed shrub and grass understorey. Coastal headlands and hilltops are the favoured sites.	subject site but not recorded during surveys. Subject site has been historically disturbed so the species is unlikely to occur.

*EP= Endangered Population, E = Endangered, V = Vulnerable

Appendix C

Threatened Fauna Likelihood of Occurrence

Table C.1 **Threatened fauna likelihood of occurrence within the subject site**

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
Amphibia							
Hylidae	<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	5	Inhabits a wide range of water bodies, particularly ephemeral ponds for breeding, with the exception of fast-flowing streams. Terrestrial habitat includes grassy low vegetation and diurnal shelter sites. In NSW, this species is commonly found in disturbed areas although vegetation diversity is positively associated with presence.	Unlikely to occur. No suitable habitat present on the subject site.
Myobatrachidae	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	0	Distribution is dependent on areas with native vegetation. Found in various vegetation communities including heath, woodland and open dry sclerophyll forest on a	Unlikely to occur. No suitable habitat present on the subject site.

Table C.1 Threatened fauna likelihood of occurrence within the subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
Aves						variety of soil types except those that are clay based. Associated with hanging swamps and perennial creeks in the northern portion of its range, and forest communities in the southern portion. Uses wet habitats for breeding.	
	Acanthizidae	<i>Chthonicola sagittata</i>	Speckled Warbler	V	1	Occurs in communities dominated by Eucalyptus, with a grassy understorey, most commonly occurring on rocky ridges and gullies.	Unlikely to occur. No suitable habitat present on the subject site.
	Accipitridae	<i>Hieraaetus morphnoides</i>	Little Eagle	V	8	Occurs in open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	Potential to occur. Highly mobile, aerial species that may utilise the subject site as part of a wider foraging range on occasion. No nests sighted so no breeding habitat is currently present.

Table C.1 **Threatened fauna likelihood of occurrence within the subject site**

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
Accipitridae	<i>Pandion cristatus</i>	Eastern Osprey	V		0	Found at littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands.	Unlikely to occur. No suitable habitat present on the subject site.
Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	C	0	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands.	Unlikely to occur. No suitable habitat present on the subject site.
Apodidae	<i>Hirundapus caudacutus</i>	White-throated Needletail		C,J,K	0	Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Occur over most types of habitat, particularly above wooded areas including open forest and rainforest, between trees or in clearings and	Potential to occur. Highly mobile, aerial species that may pass over the subject site but unlikely to utilise it directly.

Table C.1 **Threatened fauna likelihood of occurrence within the subject site**

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
						below the canopy.	
Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift		C,J,K	0	Forages aerially over a variety of habitats usually over coastal and mountain areas with a preference for wooded areas.	Potential to occur. Highly mobile, aerial species that may pass over the subject site but unlikely to utilise it directly.
Ardeidae	<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	0	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha</i> spp.) and spikerushes (<i>Eleocharis</i> spp.).	Unlikely to occur. No suitable habitat present on the subject site.
Artamidae	<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V		12	Found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations.	Unlikely to occur. Highly marginal suitable habitat present on the subject site. Species more likely to occur in larger tracts of vegetation such as Nurragingy Reserve.
Cuculidae	<i>Cuculus optatus</i>	Oriental Cuckoo		M	0	Inhabits forest and woodland.	Unlikely to occur. Although suitable habitat present on the subject site,

Table C.1 **Threatened fauna likelihood of occurrence within the subject site**

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
							the species is sparsely recorded in NSW.
Dasyornithidae	<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E	0	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	Unlikely to occur. No suitable habitat present on the subject site.
Meliphagidae	<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	2	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak.	Unlikely to occur. No suitable habitat present on the subject site.
Meliphagidae	<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V		1	Occupies mostly upper levels of drier open forests	Unlikely to occur. No suitable habitat present

Table C.1 **Threatened fauna likelihood of occurrence within the subject site**

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
						or woodlands dominated by on the subject site. box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>) and Forest Red Gum (<i>E. tereticornis</i>). In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central- west plains and the Riverina.	
Meliphagidae	<i>Grantiella picta</i>	Painted Honeyeater	V	V	0	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.	Unlikely to occur. No suitable habitat present on the subject site.
Monarchidae	<i>Monarcha melanopsis</i>	Black-faced Monarch		M	0	Wetter, denser forest, often at high elevations.	Unlikely to occur. No suitable habitat present on the subject site.

Table C.1 Threatened fauna likelihood of occurrence within the subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
Monarchidae	<i>Myiagra cyanoleuca</i>	Satin Flycatcher		M	0	Found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation.	Unlikely to occur. No suitable habitat present on the subject site.
Motacillidae	<i>Motacilla flava</i>	Yellow Wagtail		C,J,K	0	Prefers moist areas, such as the edges of sewage works and exposed mudbanks.	Unlikely to occur. No suitable habitat present on the subject site.
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		8	Eucalypt forest and woodlands, especially with rough barked species, smooth-barks with dead branches, mallee and acacia. Nests in living trees and feeds off insects in dead trees.	Unlikely to occur. Highly marginal suitable habitat present on the subject site. Species more likely to occur in larger tracts of vegetation such as Nurragingy Reserve.
Petroicidae	<i>Petroica boodang</i>	Scarlet Robin	V		2	Found in dry eucalypt forests and woodlands with open and grassy understorey with few scattered shrubs.	Unlikely to occur. No suitable habitat present on the subject site.
Petroicidae	<i>Petroica phoenicea</i>	Flame Robin	V		1	Occurs in upland tall moist	Unlikely to occur.

Table C.1 **Threatened fauna likelihood of occurrence within the subject site**

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
						eucalypt forests and woodlands, often on ridges and slopes for breeding. Prefers clearings or areas with open understoreys.	No suitable habitat present on the subject site.
Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet	V	1		Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Also utilises isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically	Unlikely to occur. Some suitable habitat present on the subject site, but species is not commonly known from the locality and would likely occur in larger tracts of native vegetation.

Table C.1 Threatened fauna likelihood of occurrence within the subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
						selecting hollows in the limb or trunk of smooth-barked Eucalypts.	
Psittacidae	<i>Lathamus discolor</i>	Swift Parrot	E	CE	5	Occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations.	Unlikely to occur. Some suitable habitat present on the subject site, but species is not commonly known from the locality and would likely occur in larger tracts of native vegetation.
Rhipiduridae	<i>Rhipidura rufifrons</i>	Rufous Fantail		M	0	Inhabits rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground.	Unlikely to occur. No suitable habitat present on the subject site.
Rostratulidae	<i>Rostratula australis</i>	Australian Painted Snipe	E	E	0	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	<i>Calidris ferruginea</i>	Curlew Sandpiper	E	CE,C,J,K	0	Occurs mainly on intertidal	Unlikely to occur.

Table C.1 Threatened fauna likelihood of occurrence within the subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
						mudflats in coastal areas including sheltered estuaries and bays. Less often found inland in appropriate water sources such as dams and lakes.	No suitable habitat present on the subject site.
Scolopacidae	<i>Numenius madagascariensis</i>	Eastern Curlew	CE,C,J,K	0		Prefers sheltered coasts, especially estuaries, bays, harbours, inlets and lagoons. Also known to occur in sewage farms, wetlands and mangroves. Species roosts on sandy spits and in low Saltmarsh or mangroves.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper	C,J,K	0		Inhabits coastal or inland wetlands, both saline or fresh. It is more commonly found on muddy edges or rocky shores.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	C,J,K	0		Species prefers muddy edges of shallow fresh or brackish wetlands with	Unlikely to occur. No suitable habitat present on the subject site.

Table C.1 Threatened fauna likelihood of occurrence within the subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
						inundated or low vegetation. Known to occur lagoons, swamps, lakes, dams, and other waterbodies. Roosts at the edges of wetlands.	
Scolopacidae	<i>Calidris melanotos</i>	Pectoral Sandpiper		J,K	0	Occurs at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	<i>Gallinago hardwickii</i>	Latham's Snipe		C,J,K	0	Inhabit open, freshwater wetlands with low, dense vegetation.	Unlikely to occur. No suitable habitat present on the subject site.
Scolopacidae	<i>Tringa nebularia</i>	Common Greenshank		C,J,K	0	Inhabits inland wetlands and sheltered coastal habitats.	Unlikely to occur. No suitable habitat present on the subject site.
Strigidae	<i>Ninox strenua</i>	Powerful Owl	V		1	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall	Potential to occur. Known to utilise fragmented landscapes, may utilise the subject site as part of a

Table C.1 **Threatened fauna likelihood of occurrence within the subject site**

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
						open wet forest and rainforest. Also occurs in fragmented habitats. Nests in hollows of large, old eucalypts.	larger foraging area. No breeding habitat present.
Mammalia							
Dasyuridae	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	6	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. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares; usually traverse their ranges along densely vegetated	Unlikely to occur. No suitable habitat present on the subject site.

Table C.1 **Threatened fauna likelihood of occurrence within the subject site**

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	2		creeklines. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Potential to occur. Highly mobile, aerial species that may pass over the subject site as part of a larger foraging range.
Molossidae	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	12		Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	Potential to occur. Highly mobile, aerial species that may pass over the subject site as part of a larger foraging range.
Muridae	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	V	0		Occurs in open habitats	Unlikely to occur.

Table C.1 Threatened fauna likelihood of occurrence within the subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
						(heathland, woodland and forest) with a heath understorey and vegetated sand dunes. The species prefers deep soft top soils in order to burrow.	No suitable habitat present on the subject site.
Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala	V	V	5	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	Unlikely to occur. No suitable habitat present on the subject site. Vegetation is too highly fragmented and disturbed. Although feed trees are present, they are highly fragmented and located within a busy urban area.
Pseudocheiridae	<i>Petauroides volans</i>	Greater Glider		V	0	Occurs in eucalypt forests and woodlands from north-eastern Queensland to the Central Highlands of Victoria. Usually found in taller, montane, moist	Unlikely to occur. No suitable habitat present on the subject site.

Table C.1 **Threatened fauna likelihood of occurrence within the subject site**

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
						eucalypt forests with relatively old trees. The species has a relatively small home range which consists of numerous tree hollows.	
Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	16	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Potential to occur. Highly mobile, aerial species that may pass over the subject site as part of a larger foraging range. No roost camps present.
Vespertilionidae	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	0	Found in well-timbered areas containing gullies. Roosts in caves, crevices in cliffs and old mine workings frequenting low to mid-elevation dry open forest and woodland close to these features.	Unlikely to occur. No suitable habitat present on the subject site as well-timbered gullies absent and no records from the locality.
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		3	Prefers moist habitats, with trees taller than 20 m.	Potential to occur. Highly mobile, aerial

Table C.1 **Threatened fauna likelihood of occurrence within the subject site**

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
						Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	species that may pass over the subject site as part of a larger foraging range.
Vespertilionidae	<i>Miniopterus australis</i>	Little Bentwing-bat	V	1		Moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Potential to occur. Highly mobile, aerial species that may pass over the subject site as part of a larger foraging range.
Vespertilionidae	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	29		Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Hunt in forested areas, catching moths and other flying insects above	Potential to occur. Highly mobile, aerial species that may pass over the subject site as part of a larger foraging range.

Table C.1 Threatened fauna likelihood of occurrence within the subject site

Family	Scientific Name	Common Name	TSC Act	EPBC Act	Records	Habitat Requirements	Likelihood of Occurrence
						the tree tops.	
Vespertilionidae	<i>Myotis macropus</i>	Southern Myotis	V		9	Roosts close to water in caves, mines, tree hollows, storm water channels, bridges, buildings or in dense foliage. Forages over streams and pools catching insects and fish.	Potential to occur. Highly mobile, aerial species that may pass over the subject site as part of a larger foraging range. Foraging habitat nearby at Angus Creek east and south of the subject site.
Vespertilionidae	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		3	More commonly found in tall wet forest but also occurs in dry eucalypt forest. Roosts in tree hollows and buildings. Forages along creek and river corridors.	Potential to occur. Highly mobile, aerial species that may pass over the subject site as part of a larger foraging range. Foraging habitat nearby at Angus Creek east and south of the subject site.
Gastropoda							
Camaenidae	<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E		95	Primarily inhabits Cumberland Plain Woodland. Lives under litter of bark, leaves and logs, or shelters in loose	Unlikely to occur. No suitable habitat present on the subject site. Historically, suitable habitat would likely have been

Table C.1 **Threatened fauna likelihood of occurrence within the subject site**

Family	Scientific Name	Common Name	TSC Act EPBC Act Records	Habitat Requirements	Likelihood of Occurrence
				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.	present but exotic groundcover and cleared areas are now present throughout the subject site making the habitat unfavourable for the species.

E = Endangered, V = Vulnerable, CE = Critically Endangered, C = Listed on China Australia Migratory Bird Agreement, J = Listed on Japan Australia Migratory Bird Agreement, K = Listed on Republic of Korea Australia Migratory Bird Agreement

Appendix D

Assessments of Significance (7 Part Tests)

D.1 Endangered Ecological Communities

D.1.1 Cumberland Plain Woodland

Background

Cumberland Plain Woodland (CPW) typically comprises an open tree canopy layer, sometimes with a shrub layer and groundcover dominated by grasses and herbs. Dominant canopy species are *Eucalyptus moluccana* (Grey Box) and *E. tereticornis* (Forest Red Gum), often with *E. crebra* (Grey Ironbark), *E. eugenioides* (Narrow-leaved Stringybark), *Corymbia maculata* (Spotted Gum) or other less frequently occurring eucalypts, including *Angophora floribunda*, *A. subvelutina* (Broad-leaved Apple), *E. amplifolia* (Cabbage Gum) and *E. fibrosa* (Broad-leaved Ironbark) (OEH 2011). Soils within this community are derived from Wianamatta Group geology. CPW is listed as a Critically Endangered Ecological Community under the TSC and EPBC Act.

CPW exists as four mature *Eucalyptus moluccana*, a sapling and small tree.

The trees are currently set within a highly disturbed environment and have very little scope for regenerating naturally in the majority of areas where the community occurs. Vegetation on the subject site is highly disturbed from past land use as it contains predominantly exotic species and a native understorey and groundcover is absent. However, as the Final Determination of the TSC Act lists scattered trees, these individuals do form a part of the listed community.

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 total area of CPW present within the subject site is 0.04 ha. Of this, all of the community is proposed to be removed for the proposal. The proposed action will not result in an adverse effect on the extent of the ecological community as it currently exists in a highly fragmented and generally degraded form.

Within the subject site, the community is considered to be in relatively poor condition. The canopy trees exist over paved areas and planted gardens. The composition of the ecological community as provided in the final determination consists of a far greater number of native plants than that occurring on the subject site. The vegetation of the subject site is considered to be in poor condition as characteristic native species are absent. As a consequence, this vegetation in its current condition holds little ecological value. The removal of the community within the subject site is not considered to modify the remaining extent of this community such that its local occurrence is likely to be placed at risk of extinction. CPW occurs more extensively within the locality in larger patches in better condition, such as at Prospect Nature Reserve.

The proposed action will have no significant direct or indirect impacts on the composition of the ecological community such that its local occurrence is likely to be placed 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.

Up to 0.04 ha of CPW will be removed as a result of the proposed action.

The CPW occurring within the subject site and immediate surrounds has previously been fragmented by current and past land uses. Within this area, this community exists as two small fragmented patches (consisting of one tree and three trees). The proposed development will completely remove this community from the subject site.

The community within the subject site has already been impacted by previous and current land uses, mainly for the existing commuter carpark and existing footpaths and roads in a highly urbanised area adjacent to a train station. Characteristic groundcover and understorey CPW species are absent. Given the occurrence within small degraded fragmented patches and the condition of the vegetation, the area of habitat to be removed within the subject site is not considered to be important for the long-term survival of this community.

(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 CPW 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 overall objective of the Cumberland Plain Recovery Plan (DECCW 2011) is to provide for the long-term survival of the threatened biodiversity of the Cumberland Plain. Specific recovery objectives provided in the plan are:

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

The Recovery Plan acknowledges that Blacktown City Council contains priority conservation lands. However, the subject site itself has not been mapped within the boundary of these priority conservation lands. The threats to CPW are further loss and fragmentation of habitat, weed invasion, changes in fire regimes and urban run-off.

Within the subject site, the community is not considered to be significant. It has been highly degraded and fragmented from past clearing. A total of 0.04 ha of CPW is present within the subject site which is proposed to be removed.

The proposed development is not considered to threaten the objectives of the recovery plan.

No threat abatement plan is relevant to this community.

(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 CPW occurring within the subject site:

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

- '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; and
- 'Invasion and establishment of exotic vines and scramblers'.

The primary key threatening process relevant to the proposed development is the clearing of native vegetation, as up to 0.04 ha of Cumberland Plain Woodland (canopy) will be removed within the subject site. The proposed development is not expected to exacerbate the key threatening process of invasion by exotic species further than current conditions.

Conclusion

The local occurrence of Cumberland Plain Woodland in the subject site is comprised of a total of 0.04 ha in the form of canopy, all of which is proposed to be removed for the proposed upgrade works. The CPW on the subject site is set within an urbanised environment and has very little scope for regenerating naturally or long term survival. The proposed development will not have a significant impact on CPW on the subject site and subsequently no Species Impact Statement is required.

D.2 Fauna

D.2.1 Little Eagle

Background

The Little Eagle (*Hieraaetus morphnoides*) occurs throughout the mainland except within more densely vegetated parts of the Dividing Range. It occurs within open eucalypt forest, woodland, open woodland as well as Sheoak or Acacia woodlands and riparian woodlands of interior NSW. It is listed as Vulnerable under the TSC Act (OEH 2017f).

The species could potentially occur on the subject site as part of a wider foraging range. It would unlikely breed within the subject site, and no large raptor nests were sighted during the survey.

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 Little Eagle could potentially use the subject site as foraging habitat as part of a much larger foraging range. It is a highly mobile species that accesses resources from across a wide area and would not depend upon resources contained on the subject site for its survival. The proposal is not likely to place a viable local population of the Little Eagle at risk of extinction due to the limited amount of foraging habitat present within the subject site. Although potential breeding habitat is also present, no nests were sighted. It would unlikely breed in the subject site as vegetation is generally too sparse and fragmented.

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

Not applicable.

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

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

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

Not applicable.

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

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

(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.

Approximately 0.54 ha of vegetation will be cleared for the proposed works, most of this comprising of non-native communities. This represents a relatively small area of potential foraging habitat within the locality for the Little Eagle. Limited vegetation is present in and surrounding the subject site so connectivity of habitat will not be impacted from the proposed works.

The habitat occurring within the subject site has previously been fragmented from past land clearance. The proposed works will remove these remaining fragments from the subject site. The Little Eagle is highly mobile and would be able to move across the remaining fragments.

The proposed action will not remove, modify, fragment or isolate important habitat. The proposed works will require the clearing of marginal potential foraging habitat. The subject site would only likely provide foraging habitat as part of a wider range within the locality. Much larger areas of potential habitat occur throughout the wider locality in other areas including Nurragingy Reserve and Prospect Nature Reserve. These tracts of vegetation would provide more favourable nesting and foraging habitat for the 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).

There is no critical habitat listed for the Little Eagle 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 specific recovery plan has been prepared 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 following key threatening processes are likely to affect the Little Eagle:

- 'Clearing of native vegetation';
- 'Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners';
- 'Invasion and establishment of exotic vines and scramblers'; and
- 'Invasion of native plant communities by exotic perennial grasses'.

The key threatening process of 'Clearing of native vegetation', potentially impact habitat for the species further than current conditions. However, the vegetation on the subject site is not considered to constitute significant habitat for the Little Eagle. The clearing of native vegetation is not likely to significantly impact habitat for the potentially occurring Little Eagle, owing to its highly fragmented and degraded nature.

The proposed works are not considered to exacerbate the key threatening process of invasion by exotic flora species or presence of Noisy Miners further than current conditions.

Conclusion

The proposed upgrade works will only clear a marginal area of potential foraging habitat (up to 0.54 ha), mainly within areas that have already been previously disturbed. The proposal is not likely to place a viable local population of the species at risk of extinction. The Little Eagle is highly mobile and would be expected to move between areas of remaining habitat within the immediate vicinity of the subject site and wider area. The project is not likely to have a significant detrimental impact upon the potentially occurring Little Eagle.

D.2.2 Powerful Owl

Background

The Powerful Owl is distributed from Mackay to south western Victoria, mainly on the coastal side of the Great Dividing Range. This species occurs in many vegetation types from woodland and open sclerophyll to tall open wet forest and rainforest. It requires large tracts

of native vegetation but can survive in fragmented landscapes. It roosts in dense vegetation and nests in large tree hollows. The Powerful Owl is listed as Vulnerable under the TSC Act (OEH 2017g).

The species could potentially occur on the subject site as part of a wider foraging range. No breeding habitat is present as no large hollows occur on the subject site.

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 Powerful Owl could potentially use the subject site as foraging habitat as part of a much larger foraging range. They are a highly mobile species that accesses resources from across a wide area and would not depend upon resources contained on the subject site for its survival. The proposal is not likely to place a viable local population of the species at risk of extinction as only highly marginal disturbed habitat is present. No breeding habitat occurs within the subject site as large hollows are absent. The Powerful Owl would also likely utilise much larger areas of intact vegetation such as Nurrangy Reserve and Prospect Nature Reserve.

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

Not applicable.

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

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

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

Not applicable.

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

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

(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.

Approximately 0.54 ha of vegetation will be cleared for the proposed works. This represents a relatively small area of potential foraging habitat within the locality for the Powerful Owl. Limited vegetation is present in and surrounding the subject site so connectivity of habitat will not be impacted from the proposed works.

The habitat occurring within the subject site has previously been fragmented from past land clearance. The proposed works will clear these remaining fragments. The Powerful Owl is highly mobile and would be able to move across the remaining fragments.

The proposed action will not remove, modify, fragment or isolate important habitat. The proposed works will require the clearing of marginal potential foraging habitat. The subject site would only likely provide foraging habitat as part of a wider range within the locality. Much larger areas of potential habitat occur throughout the wider locality in other areas including Nurraringy Reserve and Prospect Nature Reserve. These tracts of vegetation would provide more favourable roosting and foraging habitat for the Powerful Owl. 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).

There is no critical habitat listed for the species 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.

A recovery plan has been prepared for large forest owls, including the Powerful Owl (DEC (NSW) 2006). The ultimate aim of the recovery plan is to ensure that the species it covers persist in the wild in NSW in each region where they presently occur. The proposal is not considered to threaten the objectives of that Recovery Plan. No Threat Abatement Plan exists for this species.

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

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

- 'Clearing of native vegetation';
- 'Invasion and establishment of exotic vines and scramblers';
- 'Invasion and establishment of exotic vines and scramblers'; and
- 'Invasion of native plant communities by exotic perennial grasses'.

The key threatening process of 'Clearing of native vegetation', 'potentially impact habitat for the species further than current conditions. However, the vegetation on the subject site is not considered to constitute significant habitat for the Powerful Owl. The clearing of native vegetation is not likely to significantly impact habitat for the potentially occurring Powerful Owl, owing to its highly fragmented and degraded nature. The proposed works are not considered to exacerbate the key threatening process of invasion by exotics further than current conditions.

Conclusion

The proposed works will only clear a marginal area of potential, degraded habitat (0.54 ha), mainly within areas that have already been previously disturbed. No significant habitat for the Powerful Owl will be removed within the subject site. The proposal is not likely to place a viable local population of the species at risk of extinction. The Powerful Owl is a highly mobile species and would be expected to move between areas of remaining habitat within the immediate vicinity of the subject site and wider area. The project is not likely to have a significant detrimental impact upon the potentially occurring Powerful Owl.

D.2.3 Grey-headed Flying-fox

Background

The Grey-headed Flying-fox is distributed along the east coast from Bundaberg in Queensland to Melbourne, Victoria. It occurs as far west as the western slopes of the Great Dividing Range in northern NSW. It occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Grey-headed Flying-foxes migrate according to the availability of native fruits, nectar and pollen. They roost in large "camps" which are generally within 20 km of a food source (NSW Scientific Committee 2004). The Grey-headed Flying-fox is listed as Vulnerable under the TSC Act and the EPBC Act.

Potential foraging habitat occurs within the subject site, but no roosting habitat occurs as no camps are present on or near the subject site.

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 Grey-headed Flying-fox is likely to use the subject site as foraging habitat as part of a much larger foraging range. They are a highly mobile species that accesses resources from across a wide area (between 20 – 50km from roost camp) and would not depend upon resources contained on the subject site for their survival. The proposal is not likely to place a viable local population of the species at risk of extinction as most of the potential habitat will be retained on the subject site. The species is known to forage on fragmented street trees as well as much larger areas of intact vegetation. No roost camps are present on or near the subject site. The nearest camp is located over 10 km east of the subject site at Parramatta Park, Parramatta (Ku-ring-gai Bat Conservation Society 2017).

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

Not applicable.

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

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

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

Not applicable.

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

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

(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.

Approximately 0.54 ha of vegetation will be cleared for the proposed works. This represents a relatively small area of potential foraging habitat within the locality for the Grey-headed Flying-fox. Limited vegetation is present in and surrounding the subject site so connectivity of habitat will not be impacted from the proposed works.

The habitat occurring within the subject site has previously been fragmented from past land clearance. The proposed works will clear the remaining fragments. The Grey-headed Flying-fox is highly mobile and would be able to move across these remaining fragments.

The proposed action will not remove, modify, fragment or isolate important habitat. The proposed works will require the clearing of marginal potential foraging habitat. The subject site would only likely provide foraging habitat as part of a wider range within the locality. Much larger areas of potential habitat occur throughout the wider locality in other areas including Nurranginy Reserve and Prospect Nature Reserve. These tracts of vegetation would provide more favourable foraging habitat for the Grey-headed Flying-fox. 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).

There is no critical habitat listed for this species 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.*

A National Draft Recovery Plan for the Grey-headed Flying-fox (DECCW 2009) has been prepared. A number of threats to this species are listed in the Plan, including the removal of critical habitat. The proposal will remove a small amount of highly marginal foraging habitat for this species, which is not critical habitat and is well-represented throughout the locality. No roost camps are present on or adjacent to the subject site. Therefore the proposal is not considered to threaten the objectives of the Recovery Plan.

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

The following key threatening processes are likely to affect the Grey-headed Flying-fox:

- 'Clearing of native vegetation';
- 'Invasion and establishment of exotic vines and scramblers'; and
- 'Invasion of native plant communities by exotic perennial grasses'.

The key threatening process of 'Clearing of native vegetation', 'potentially impact habitat for the species further than current conditions. However, the vegetation on the subject site is not considered to constitute significant habitat for the Grey-headed Flying-fox. The clearing of native vegetation is not likely to significantly impact habitat for the potentially occurring Grey-headed Flying-fox, owing to its highly fragmented and degraded nature.

The proposed works are not considered to exacerbate the key threatening process of invasion by exotics further than current conditions.

Conclusion

The proposed works will only clear a marginal area of habitat (0.54 ha), mainly within areas that have already been previously disturbed. No significant habitat for the Grey-headed Flying-fox will be removed within the subject site. The proposal is not likely to place a viable local population of the species at risk of extinction. It is highly mobile and would be expected to move between areas of remaining habitat within the immediate vicinity of the subject site and wider area. The project is not likely to have a significant detrimental impact upon the Grey-headed Flying-fox.

D.2.4 Microchiropteran Bats

This Assessment of Significance covers the following threatened microbat species:

- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);

- Little Bentwing-bat (*Miniopterus australis*);
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Southern Myotis (*Myotis macropus*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

All of these species are listed as Vulnerable under the TSC Act but are not listed under the EPBC Act. These species may use the subject site as part of a wider foraging range.

Potential roosting habitat exists for all of these species in the form of tree hollows and stormwater tunnels within and near the subject site.

Background

The Yellow-bellied Sheathtail-bat 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. Yellow-bellied Sheathtail-bats forage on insects from 2m to 25m above the ground, depending on the environment. It roosts singly or in groups of up to six, in large tree hollows and buildings (OEH 2017j). The Yellow-bellied Sheathtail-bat is listed as Vulnerable under the TSC Act.

The Eastern Freetail-bat is distributed along the east coast from southern Queensland to southern NSW. The species inhabits dry sclerophyll forest and woodland east of the Great Dividing Range. It roosts singly and communally, mainly in tree hollows but will also roost under decorticating bark or in man-made structures (OEH 2017c). The Eastern Freetail-bat is listed as Vulnerable under the TSC Act.

The Eastern False Pipistrelle is distributed along south-east coast and ranges of Australia. It inhabits moist habitats with trees taller than 20m. The species generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. It preys on insects above or just below tree canopy and forages up to 12km from roost sites (OEH 2017b). The Eastern False Pipistrelle is listed as Vulnerable under the TSC Act.

The Little Bentwing-bat is found from Cape York in Queensland to Wollongong in NSW. It inhabits well timbered habitats in a variety of vegetation types including moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub (OEH 2017e). Roosting habitat comprises of caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings. The species is listed as Vulnerable under the TSC Act.

The Eastern Bentwing-bat occurs throughout the east and north-west coast of Australia. They hunt in forested areas above the canopy, and roost primarily in caves, however derelict mines, storm-water tunnels, buildings and other man-made structures can be utilised (OEH 2017a). The species is listed as Vulnerable under the TSC Act.

The Southern Myotis is found from the north-west through to western Victoria along the coast. It forages over pools and streams. The Southern Myotis roosts in groups of 10-15

close to water in caves, but can also roost in mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage (OEH 2015d). The species is listed as Vulnerable under the TSC Act.

The Greater Broad-nosed Bat occurs from the Atherton Tableland to north-eastern Victoria. It is found in various habitats being most commonly found in tall wet forest. It predominantly roosts in tree hollows but also roosts in buildings. The Greater Broad-nosed Bat flies approximately 3 to 6m above creek and river corridors (OEH 2017d). The species is listed as Vulnerable under the TSC Act.

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 above listed microbat species are likely or known to use the subject site as foraging habitat as part of a much larger foraging range. They are all highly mobile species that accesses resources from across a wide area and would not depend upon resources contained on the subject site for their survival. The proposal is not likely to place a viable local population of any of these species at risk of extinction as only highly marginal degraded habitat will be removed. These species would also likely utilise much larger areas of intact vegetation such as Nurraringy Reserve and Prospect Nature Reserve and along riparian corridors in the locality. Potential roost habitat may be removed in the form of a potential hollow in one *E. moluccana*. However, it is unlikely that the culverts would be affected.

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

Not applicable.

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

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

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

Not applicable.

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

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

(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.

Approximately 0.54 ha of vegetation will be cleared for the proposed works. This represents a relatively small area of potential foraging habitat within the locality for these species. Limited vegetation is present in and surrounding the subject site so connectivity of habitat will not be impacted from the proposed works.

The habitat occurring within the subject site has previously been fragmented from past land clearance. The proposed works will clear the remaining fragments. Microchiropteran bats are highly mobile and would be able to move across the remaining fragments.

The proposed action will not remove, modify, fragment or isolate important habitat. The proposed works will require the clearing of marginal potential foraging habitat. The subject site would only likely provide foraging habitat as part of a wider range within the locality. Much larger areas of potential habitat occur throughout the wider locality in other areas including Nurragingy Reserve and Prospect Nature Reserve. These tracts of vegetation would provide more favourable foraging habitat for these 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).

There is no critical habitat listed for these species 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 Action Plan for Australian Bats provides a recovery outline for these species (Duncan et al. 1999). The proposed works are consistent with the objectives of this plan.

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

The following key threatening processes are likely to affect microchiropteran bats:

- 'Clearing of native vegetation';
- 'Invasion and establishment of exotic vines and scramblers'; and
- 'Invasion of native plant communities by exotic perennial grasses'.

The key threatening process of 'Clearing of native vegetation', 'potentially impact habitat for these species further than current conditions. However, the vegetation on the subject site is

not considered to constitute significant habitat for these species. The clearing of native vegetation is not likely to significantly impact habitat for the potentially occurring microbat species, owing to its highly fragmented and degraded nature.

The proposed works are not considered to exacerbate the key threatening process of invasion by exotics further than current conditions.

Conclusion

The proposed works will only clear a marginal area of potential, degraded habitat (0.54 ha), mainly within areas that have already been previously disturbed. No significant habitat for the assessed species will be removed within the subject site. The proposal is not likely to place a viable local population of any of these species at risk of extinction. These species are highly mobile and are expected to move between areas of remaining habitat within the immediate vicinity of the subject site and wider area. The project is not likely to have a significant detrimental impact upon any of the potentially occurring threatened fauna species discussed above.