12 June 2019

David Walker
Senior Town Planner
Premise (NSW) Pty Ltd
154 Peisley Street
Orange NSW 2800

Dear David

Re: Flora and Fauna Assessment for new Community Recycling Centre at Hepher Road, Campbelltown NSW
Project no. 28340

Biosis Pty Ltd was commissioned by Premise to complete a flora and fauna assessment to support the proposed Community Recycling Facility at Hepher Road, Campbelltown NSW (the study area) (see Figure 1). The proposed development is being assessed under Part 4 of the NSW *Environmental Planning and Assessment Act* (EP&A Act). The proposal has been deemed designated development due to its proximity to natural waterbodies and an Environmental Impact Statement (EIS) is required to support the project.

The study area is located within the *Western Sydney Interim Designated Area* and therefore, and in accordance with the NSW *Biodiversity Conservation (Savings and Transitional) Regulation 2017,* Part 7, Section 27 Clause (f), the following is noted for this project:

- Flora and fauna assessments are to be assessed under the provisions of the former NSW *Threatened Species Conservation Act 1995* (TSC Act).
- The transitional arrangements only apply to development consents made on or before the 24 November 2019.
- The transitional arrangements only apply if a Species Impact Statement submitted in connection with the application is submitted on or before 24 May 2020 (if applicable).

Purpose

The purpose of this flora and fauna assessment is to assess the ecological values of the study area. This assessment will also aim to determine the presence of any threatened ecological communities (TECs) within the study area and, where possible, assess the potential impacts of the project on any threatened species, populations and/or ecological communities (biota), or their habitat, listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the former NSW *Threatened Species Conservation Act 1995* (TSC Act).

Study area

The study area is located south of the Hume Highway within the City of Campbelltown Local Government Area (LGA). Surrounding land use is predominantly industrial with large-scale factory sheds bordering the site to the north and south. In the broader landscape, residential suburbs occupy areas south of the study area, with Campbelltown Central Business District (CBD) located 1.3 kilometres to the south. North of the

Hume Highway there are large areas of cleared, undeveloped rural land. The vegetated riparian corridor of Biriwiri Creek is also located to the north of the study area (Figure 1).

The study area is approximately 8.93 hectares in area, consisting of Lot 104 DP1056782, being separated into two sections by Hepher Road (Figure 2).The proposed development footprint, covering 0.29 hectares, is located in the southern portion of Lot 104 DP1056782 and includes a waste management facility, car parks and other ancillary facilities (the subject site) (see Figure 2).

Method

Database and literature review

Prior to completing a field investigation, information provided by Premise as well as other key information was reviewed, including:

- Commonwealth Department of the Environment and Energy (DEE) Protected Matters Search Tool for matters protected by the EPBC Act.
- NSW Office of Environment and Heritage (OEH) BioNet Atlas of NSW Wildlife, for items listed under the TSC Act.
- NSW DPI *Biosecurity Act 2015* for Priority listed weeds for the Greater Sydney Local Land Services (LLS) area.
- OEH Vegetation Information System (VIS) mapping, including:
  - *Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands* (SCIVI) (Tozer et al. 2010).
  - *The Native Vegetation of the Cumberland Plain, western Sydney: systematic classification and field identification of communities* (Tozer 2003).

The implications for the project were assessed in relation to key biodiversity legislation and policy including:

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environmental Planning and Assessment Act 1979*
- Former *Threatened Species Conservation Act 1995*
- *Biodiversity Conservation (Savings and Transitional) Regulation* 2017
- *Water Management Act 2000*
- *Biosecurity Act 2015*

Field investigation

A field investigation of the study area was undertaken on 19 February 2019 by Kayla Asplet (Project Zoologist) and Bianca Klein (Project Botanist). Vegetation within the study area was surveyed using a combination of the Biodiversity Assessment Method (OEH 2017a) plots/transects and the random meander technique (Cropper 1993) over 10 person hours.

A habitat-based assessment was completed to determine the presence of suitable habitat for threatened species previously recorded (OEH 2019) or predicted to occur (Commonwealth of Australia 2019) within a 5 kilometre radius of the study area. This list was filtered according to species descriptions, life history, habitat preference and soil preference to determine those species most likely to be present within the study area.

Results

General environment

Regional soil landscape mapping indicates that the study area occurs on the Blacktown (bt) soils landscape of the Wianamatta Group: a combination of Ashfield Shale – laminite and dark grey siltstone, with the occasional calcareous claystone, laminite and coal. Soils associated with this landscape are shallow to moderately deep red - brown podzolic soils on crests, upper slopes and well-drained areas, with deep yellow soils on lower slopes and in drainage depressions. Vegetation is typically almost completely cleared tall open forest and woodland, with traces of remnant Cumberland Plain Woodland remaining. The composition of the soil is highly influential on the vegetation communities observed.

In general, the study area is in poor condition, with evidence of historical vegetation and soil disturbances, which have encouraged the recruitment of weeds. The centre of the study area forms a bowl-like basin, which is prone to inundation. The proposed development footprint has been located above the flood prone areas of the study area (see Figure 2).

The study area contains two tributaries of Biriwiri Creek, which flow from the north (fourth order) and northwest (third order), before joining and flowing to the south east as a fourth order stream. Within the study area these creeklines have been highly modified and lack functional habitat for aquatic flora and fauna.

Vegetation communities

Prior to the field investigation, Biosis reviewed the native vegetation communities that have been mapped in the broader landscape (Tozer 2003, Tozer et al. 2010). Four TECs have been mapped, including:

- *Moist Shale Woodland in the Sydney Basin Bioregion* (Endangered, BC Act), and listed as *Western Sydney Dry Rainforest and Moist Woodland on Shale* (Critically Endangered, EPBC Act).
- *Cumberland Plain Woodland in the Sydney Basin Bioregion* (Critically Endangered, BC Act), and a component of *Cumberland Plain Shale-Gravel Transition Forest* (Critically Endangered, EPBC Act).
- *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner bioregions* (Swamp Oak Floodplain Forest) (Endangered, BC Act), and listed as *Coastal Swamp Oak Floodplain Forest of the New South Wales and South East Queensland ecological community* (Endangered, EPBC Act).
- *River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregion* (Endangered, BC Act), currently under assessment for listing under the EPBC Act.

A key focus of the field investigation was to assess the vegetation of the study area against the final determinations for the above listed TECs to determine presence or absence.

The native vegetation of the study area was found to consist of two communities, Swamp Oak Floodplain Forest and Freshwater Wetlands (Figure 2). The remainder of the vegetation of the study area consists of native plantings and exotic grasslands. The structure, floristic composition and condition of these communities are described below.

Swamp Oak Floodplain Forest

A total of 1.81 hectares of Swamp Oak Floodplain Forest (Endangered, BC Act) is present as two patches within the study area, with 0.07 hectares of this community occurring within the subject site (see Figure 2).

Within the study area this community has been subject to weed infestation and is considered to be in poor condition. The canopy largely consists of a monoculture of Swamp Oak *Casuarina glauca,* with Spotted Gum *Corymbia maculata* and Rough-barked Apple *Angophora floribunda* present as scattered trees. The mid storey stratum is limited as a result of historical under-scrubbing, and contains juvenile Swamp Oak plants only. Very few native species are present in the ground layer, the most common being Kangaroo Grass *Themeda australis* and Weeping Grass *Microlaena stipoides* var. *stipoides*, occurring in scattered patches. The dominant exotic flora species were Asparagus Fern *Asparagus asparagoides*, African Boxthorn *Lycium ferocissimum,* and grasses including Rhodes Grass *Chloris gayana* and Paspalum *Paspalum dilatatum* (Plate 1).

One floristic plot/transect was completed within this community in accordance with the BAM. Analysis of the floristic cover and abundance data determined that the patch of Swamp Oak Floodplain Forest aligns with the BC Act final determination for this community, but does not meet the EPBC condition thresholds of the Commonwealth conservation advice (DEE 2018). This assessment is detailed in Table 1 and Table 2 below.

In order to be considered a Matter of National Environmental Significance (MNES), areas of the ecological community must meet both:

- The key diagnostic characteristics (see Table 1).
- At least the minimum condition thresholds for 'Category C' (see Table 2).

Table 1 Key diagnostic characteristic assessment

Key diagnostic characteristic	Characteristic present	Notes
Occurs from south-east Queensland to southern NSW within the South Eastern Queensland, NSW North Coast, Sydney Basin, or South East Corner bioregions	Yes	Study area is within the Sydney Basin Bioregion
Occurs in coastal catchments at elevations up to 50 m ASL, typically less than 20 m ASL, on coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated. There are also minor occurrences on coastal dune swales or flats, particularly deflated dunes and dune soaks.	No	The elevation ranges from 68-70 metres above sea level across the study area.
Occurs on soils derived from unconsolidated sediments (including alluvium), typically hydrosols (grey-black clay-loam and/or sandy loam soils) and sometimes organosols (peaty soils). It may occur in transitional soils (or catenas) where shallow unconsolidated sediments border lithic substrates.	Yes	Study area occurs on the Blacktown soils landscape of the Cumberland Plain, where residual, sandy soils are present.
Has an open woodland, woodland, forest, or closed forest structure, with a tree canopy that has a total crown cover of at least 10 per cent.	Yes	Vegetation is of an open forest structure.
Has a canopy of trees dominated by *Casuarina glauca* (swamp-oak, swamp she-oak).	Yes	Swamp Oak was the only canopy species present within the surveyed

		area.

Table 2 Condition threshold assessment

Condition thresholds					Study area
Patch size/quality	Large patch*: The patch is at least 5 ha	Medium patch: The patch is at least 2 ha and less than 5 ha	Small contiguous patch: The patch is at least 0.5 ha and less than 2 ha, and is connected to a larger area of native vegetation of at least 5 ha	Small patch: The patch is at least 0.5 ha and less than 2 ha	Small patch. The patch at the study area is not connected to >5ha of native vegetation in the locality.
High Quality • **Predominantly native understorey** • **Non-native species comprise less than 20% of total understorey vegetation cover**	CATEGORY A A large patch that meets key diagnostics and has a predominantly native understorey.	CATEGORY B A medium patch that meets key diagnostics and has a predominantly native understorey OR A small patch that meets key diagnostics and has a predominantly native understorey and is contiguous with another large area of native vegetation.		CATEGORY C A small patch that meets key diagnostics and has a predominantly native understorey	The small patch meets all but one key diagnostic but has understorey that is predominantly exotic

* A patch is a discrete and mostly continuous area of the ecological community, as defined by the key diagnostics, but can include small-scale variations, gaps and disturbances. The edge of the patch extends to the outer edge of swamp oak tree canopy. Where the canopy is sparse or interrupted, the edge of the patch is defined by the shortest distance between the outer edges of the canopies of each of the outermost trees. When it comes to defining a patch of the ecological community allowances are made for "breaks" up to 30 metres between areas that meet the key diagnostics. Such breaks may be the result of watercourses or drainage lines, tracks, paths, roads, gaps made by exposed areas of soil, and areas of localised variation in vegetation that do not meet the key diagnostics.

Based on the assessments shown in Table 1 and Table 2, the patch of Swamp Oak Floodplain Forest at the study area does not meet the specified thresholds for protection as a MNES under the EPBC Act. The patch is considered a 'small patch' with a predominantly exotic understorey. Consequently, impacts to this community at the study area will not require referral to the Commonwealth Minister for the Environment.

Freshwater Wetlands

A total of 1.3 hectares of the BC Act listed community; *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* is present within the study area. The Freshwater Wetlands community occurs as small patches within the study area, both north and south of Hepher Road (Figure 2). The predominant species present include Broad-leaved Cumbungi *Typha orientalis*, Slender Knotweed *Persicaria decipiens*, *Amphibromus nervosus* and Common Couch *Cynodon dactylon*. The community occurs in both a moderate and low condition state (see Figure 2), with low condition being more degraded and consisting of more exotic species relative to the moderate condition patch. Exotic flora

species recorded within the Freshwater Wetland were primarily within the ground layer stratum and included Purple top *Verbena bonariensis* and Paspalum. Exotic vegetation, consisting of mainly exotic grasses is present throughout the remainder of the study area. No threatened species were encountered during the field investigation.

Threatened species

Flora

Background searches identified 21 threatened flora species and 59 threatened fauna species recently recorded (OEH 2019) or predicted to occur (DEE 2019) within a 10 kilometre radius of the study area. Marginal habitat for the following threatened flora species is present:

- Native Pear *Marsendia viridiflora* subsp. *viridiflora* (Endangered, BC Act)
- Spiked Rice-flower *Pimelea spicata* (Endangered, BC Act and EPBC Act)

Native Pear has previously been recorded within 5 kilometres of the study area. It grows in a variety of habitats including woodland communities on the Cumberland Plain.

Spiked Rice-flower has previously been recorded within 5 kilometres of the study area as recently as 2018. Like Native Pear, this small shrub is also associated with woodland communities on the Cumberland Plain. Potential habitat for these species within the study area was considered to be areas of Swamp Oak Floodplain Forest, however no threatened flora were recorded during the field investigation and the survey effort is considered sufficient for the potential detection of these two species.

Fauna

One threatened fauna species, Green and Golden Bell Frog *Litoria aurea,* listed as Endangered under the BC Act and Vulnerable under the EPBC Act, was considered to have potential to occur within the study area. Threatened species recorded within 5 kilometres or predicted to occur by background searches have been assessed for their potential to occur (see Appendix 3). Those species considered most likely to occur in the study area are considered to occur on occasion for foraging only. Habitat features present for threatened species are discussed in further detail below.

The wetland in the north of the study area is separated from the subject site by Hepher Road. This wetland occurs as a shallow depression containing aquatic vegetation with limited open water and surrounded by exotic grassland. This area provides potential habitat for Green and Golden Bell Frog, which breeds in shallow, slow flowing ephemeral pools exposed to sunlight (Pyke & White 1996, Pyke et al. 2002). There are three previous records of Green and Golden Bell Frog within 500 metres of the study area. These records are located to the west, within vegetation connected to the study area by Biriwiri creek. There is a wetland to the west of the study area that could provide refuge for these species during times of drought, but is unlikely to support breeding given that it consists of a deep, shaded pool with trees fringing the edges and limited emergent aquatic vegetation. Surrounding areas of exotic grassland may provide dispersal opportunities for Green and Golden Bell Frog. An assessment of the potential impacts of the proposal on Green and Golden Bell Frog is provided in Appendix 3.

The wetland in the north of the study area and pond to the west of the study area may provide habitat for common wetland birds such as ducks, egrets and cormorants. Habitat within these areas is considered unlikely to support threatened species or populations due to the small size, degraded condition and habitat features present. These areas will not be directly impacted by the proposed development and are unlikely to undergo indirect impacts such as altered hydrology, as the proposed development is downstream of the northern wetland, and water flow from the subject site flows to the south east, away from the pond to the

west of the study area. In addition, runoff controls and mitigation to ensure protection of these areas will be included as management measures for this proposal.

Two hollow-bearing trees, each with one medium sized hollow, were recorded during field investigations. These provide potential roosting or nesting resources for threatened parrot species such as Little Lorikeet *Glossopsitta pusilla* and microchiropteran bats such as Southern Myotis *Myotis macropus.* One of the hollow-bearing trees occurs to the west of the study area adjacent to the open pond, the other occurs to the south of the subject site. No hollow-bearing trees will be removed by the proposed development and hollow-dependant fauna are considered unlikely to be impacted.

A small number of Eucalyptus trees occurring within the study area may provide foraging resources on occasion for nectar-feeding species such as Grey-headed Flying-fox *Pteropus poliocephalus*, Gang-gang Cockatoo *Callocephalon fimbriatum* and Little Lorikeet *Glossopsitta pusilla*. Although these species may occur on occasion throughout the study area, the area of impact is only 0.07 hectares. All other trees will remain with the study area and there are larger areas of higher quality habitat surrounding the Georges River and Heathcote National Park to the east.

Swamp Oak *Casuarina glauca* may occasionally provide foraging resources for cockatoo species, including Glossy Black-cockatoo *Calyptorhynchus lathami*, which feed primarily on Allocasuarina and Casuarina species. The trees of the study area may occasionally be utilised by Glossy Black-cockatoos, however, there were no foraging signs observed on site and the study area is considered unlikely to support a local population of this species.

Open exotic grassland of the study area may provide foraging for birds of prey. This habitat will be retained as part of the proposal.

Fauna recorded in the study area during the field investigation were common species generally associated with open areas and a small number of common waterbirds. Fauna species recorded within the study area included:

- Australian Magpie *Cracticus tibicen*
- Australian Pelican *Pelecanus conspicillatus*
- Australian Raven *Corvus coronoides*
- Australian Wood Duck *Chenonetta jubata*
- Black Swan *Cygnus atratus*
- Brown Thornbill *Acanthiza pusilla*
- Common Myna *Sturnus tristis*
- Crimson Rosella *Platycercus elegans*
- Eurasian Coot *Fulica atra*
- Grey Butcherbird *Cracticus torquatus*
- Magpie-lark *Grallina cyanoleuca*
- Masked Woodswallow *Artamus personatus*
- Red Wattlebird *Anthochaera carunculata*
- Sulphur-crested Cockatoo *Cacatua galerita*
- Willie Wagtail *Rhipidura leucophrys*

Priority weeds

The Biosecurity Act outlines biosecurity risks and impacts, which in relation to the current assessment includes those risks and impacts associated with weeds. A biosecurity risk is defined as the risk of a biosecurity impact occurring, which for weeds includes the introduction, presence, spread or increase of a pest into or within the State or any part of the State. A pest plant has the potential to out-compete other organisms for resources, including food, water, nutrients, habitat and sunlight and /or harm or reduce biodiversity.

A priority weed is any weed identified in a local strategic plan, for a region that includes that land or area, as a weed that is or should be prevented, managed, controlled or eradicated in the region. Where a local strategic plan means a local strategic plan approved by the Minister under Division 2 of Part 4 of the LLS Act.

The General Biosecurity Duty states:

- *All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.*

Six priority weed species were recorded within the study area and are listed in Table 4 along with their associated biosecurity duty.

Table 3 Priorty weeds and associated biosecurity duty

Scientific name	Common name	General Biosecurity Duty
Olea europaea* subsp. *cuspidata	African Olive	***Mandatory measure*** *Must not be imported into the State or sold*
Lycium ferocissimum	African Boxthorn	***Mandatory measure*** *Must not be imported into the State or sold*
Senecio madagascariensis	Fireweed	***Prohibition on dealings*** *Must not be imported into the State or sold*
Rubus fruticosus* spp. *aggregate	Blackberry	***Mandatory measure*** *Must not be imported into the State or sold*
Asparagus aethiopicus	Ground asparagus	***Prohibition on dealings*** *Must not be imported into the State or sold*
Asparagus asparagoides	Bridal Creeper	***Prohibition on dealings*** *Must not be imported into the State or sold*

As such to prevent the above listed biosecurity impacts from occurring as a result of the presence of the above listed Priority Weeds within the study area, all practical steps should be taken to control and eradicated the weeds from the study area prior to vegetation removal.

Water Management Act

Campbelltown City Council is regarded as a public authority and therefore exempt from Section 91E (1) of the Act in relation to all controlled activities that it carries out in, on or under waterfront land.

SEPP No. 44 – Koala Habitat Protection

The study area occurs within Campbelltown Local Government Area and as such, SEPP 44 applies. The study area supports Forest Red Gum *Eucalyptus teriticornis*, a Koala feed tree species as defined in Schedule 1 of the SEPP. Koala feed trees, identified above, do not make up 15 % of the total number of trees in the upper or lower strata of the tree component. Therefore the vegetation within the study area is not considered potential Koala habitat as defined under SEPP No. 44.

No further consideration is required.

Impact assessment

The proposed waste management facility will involve the following impacts to ecological features:

- Removal of 0.07 hectares of Swamp Oak Floodplain Forest EEC.
- Removal of 0.07 hectares of low quality foraging habitat for Glossy Black Cockatoo.
- Indirect impacts to Freshwater Wetlands and Green and Golden Bell Frog habitat as a result of altered hydrology.

A test of significance has been prepared to assess the potential for impacts of the proposed development on Swamp Oak Floodplain Forest and Green and Golden Bell Frog in accordance with the BC Act. A Significant Impact Criteria Assessment has also been undertaken for Green and Golden Bell Frog in accordance with the EPBC Act. These assessments are provided in Appendix 4 and Appendix 5.

The assessment determined that the development would not be considered a significant impact to Swamp Oak Floodplain Forest as it will result in the removal of 0.07 hectares of low condition vegetation. The study area contains a further 12.9 hectares of similar condition Swamp Oak Floodplain Forest, the project will result in the removal of 0.54% of the total community within the study area.

Recommendations

Given there are requirements for removal of some native vegetation including canopy trees, the focus of the following recommendations is to minimise disturbance to any surrounding native vegetation and fauna habitat. These recommendations are:

- To the fullest extent practicable, minimise disturbance to any native vegetation surrounding the study area.
- Where possible, retained trees should be protected in accordance with Australian Standard *AS4970 – 2009 Protection of Trees on Development Sites*, during construction, operation and decommissioning of the site compound.
- Appropriate erosion and sediment control measures should be installed surrounding the impact site to avoid sedimentation of receiving water bodies or other indirect impacts to surrounding biodiversity values.
- Temporary frog exclusion fencing should be erected to the north of Hepher Road to divert any dispersing frogs around the construction site and towards Biriwiri creek.
- In the unlikely event that unexpected threatened species are identified during the project, works should cease and an ecologist should be contacted immediately.

- Soil transportation should be minimised within, into or out of the study area to reduce the spread of weeds.
- Six priority weeds were identified within the study area (Table 4). Appropriate measures should be implemented to minimise the spread of these species.

I trust that this advice is of assistance to you however please contact me if you would like to discuss any elements of this ecological advice further.

Yours sincerely

Sarah Allison
Zoologist

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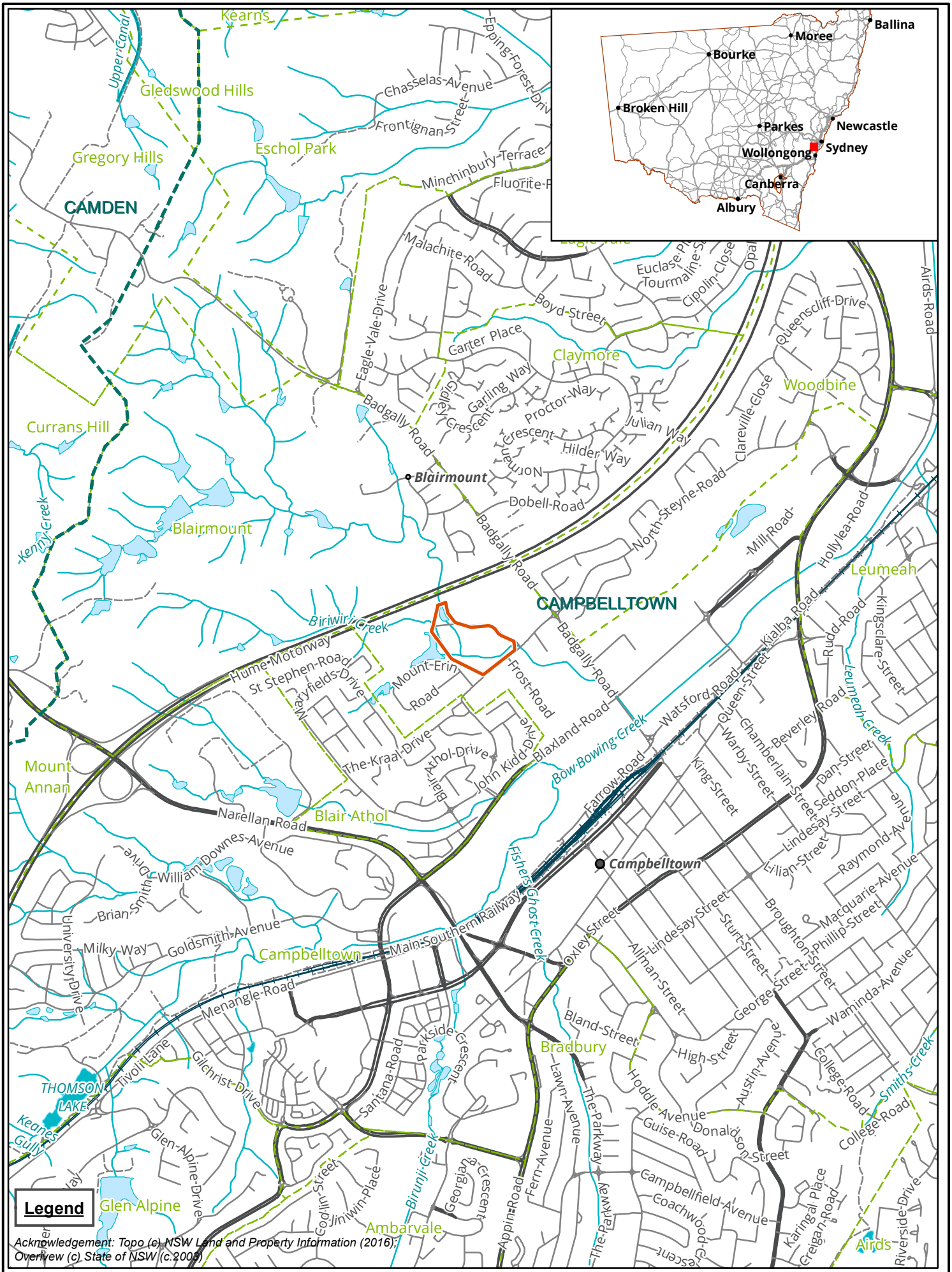
Appendices



Acknowledgement: Topo (c) NSW Land and Property Information (2016); Overview (c) State of NSW (c.2008)

Figure 1 Location of the study area

Matter: 28340
Date: 06 May 2019,
Checked by: KAA, Drawn by: DK, Last edited by: dkazemi
Location:P:\28300s\28340\Mapping\

Scale 1:25,000 @ A4, GDA 1994 MGA Zone 56

Biosis Pty Ltd
Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Legend

- Study area
- Flood extend (client data)
- Waste facility footprint (subject site)
- Hollow-bearing trees

Strahler Order

- 1
- 3
- 4

Weed Species

- Rubus fruticosus - *Blackberry complex*

Plant Community Type - Condition

- 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley - Low
- 781 - Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion - Low
- 781 - Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion, Moderate
- Urban Native/Exotic - Other
- Exotic grassland

Figure 2 Study Area and Subject Site

0 25 50 75 100

Metres

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 28340
Date: 17 May 2019,
Checked by: KAA, Drawn by: DK, Last edited by: dkazemi
Location:P:\28300s\28340\Mapping
28340_F2_StudyArea

Legend

Study area

Search area

Threatened Flora

- 10009 - Grevillea parviflora subsp. parviflora
- 10896 - Marsdenia viridiflora subsp. viridiflora
- 11422 - Hibbertia puberula
- 1822 - Lepidium hyssopifolium
- 2473 - Persicaria elatior
- 2579 - Maundia triglochinoides
- 2618 - Leucopogon exolasius
- 3860 - Acacia pubescens
- 4055 - Eucalyptus benthamii
- 4134 - Eucalyptus nicholii
- 4248 - Melaleuca deanei
- 5494 - Clematis fawcettii
- 5573 - Pomaderris brunnea
- 5871 - Thesium australe
- 6190 - Pimelea spicata
- 7963 - Isotoma fluviatilis subsp. fluviatilis
- 8675 - Allocasuarina glareicola
- 8907 - Eucalyptus scoparia
- 9569 - Leucopogon fletcheri subsp. fletcheri
- 4007 - Callistemon linearifolius*
- 4464 - Genoplesium baueri*
- 5458 - Persoonia hirsuta*
- 9411 - Gyrostemon thesioides*
- 9615 - Pterostylis saxicola*

* Record is listed as sensitive under OEH's Sensitive Species Data Policy and cannot be shown at this scale

Threatened flora records within 10000m of the 28340 _ Hepher Road Campbelltown FFA study

0 750 1,500 2,250 3,000 3,750

Metres

Scale: 1:75,000 @ A3

Coordinate System: GDA 1994 NSW Lambert

N

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 28340 _ Hepher Road Campbelltown FFA
Date: 12 February 2019,
Checked by: 12/02/2019, Drawn by: , Last edited by: bdale
Location:P:\28300s\28340\Mapping
28340_F4_ThrFlora_autoGen

Species list

Amphibians

3042 - Giant Burrowing Frog
3116 - Red-crowned Toadlet
3166 - Green and Golden Bell Frog
3169 - Green-thighed Frog

Birds

0164 - Red Knot
0174 - Bush Stone-curlew
0183 - Black-necked Stork
0197 - Australasian Bittern
0214 - Freckled Duck
0218 - Spotted Harrier
0225 - Little Eagle
0226 - White-bellied Sea-Eagle
0230 - Square-tailed Kite*
0246 - Barking Owl*
0248 - Powerful Owl*
0250 - Masked Owl*
0260 - Little Lorikeet
0265 - Glossy Black-Cockatoo*
0268 - Gang-gang Cockatoo*
0302 - Turquoise Parrot*
0309 - Swift Parrot*
0380 - Scarlet Robin
0405 - Olive Whistler
0504 - Speckled Warbler
0549 - Varied Sittella
0603 - Regent Honeyeater
0652 - Diamond Firetail
268 - Gang-gang Cockatoo*
6 - Gang-gang Cockatoo*
8127 - Brown Treecreeper (eastern subspecies)
8303 - Black-chinned Honeyeater (eastern subspecies)
8367 - Hooded Robin (south-eastern form)
8519 - Dusky Woodswallow
8888 - Red-crowned Parakeet (Lord Howe Is. subsp.)

Mammals

1008 - Spotted-tailed Quoll
1133 - Greater Glider
1136 - Yellow-bellied Glider
1137 - Squirrel Glider
1150 - Eastern Pygmy-possum
1162 - Koala
1280 - Grey-headed Flying-fox
1321 - Yellow-bellied Sheathtail-bat
1329 - Eastern Freetail-bat
1346 - Little Bentwing-bat
1353 - Large-eared Pied Bat
1357 - Southern Myotis
1361 - Greater Broad-nosed Bat
1372 - Eastern False Pipistrelle
1834 - Eastern Bentwing-bat

Reptiles

2287 - Rosenberg's Goanna
2676 - Broad-headed Snake*

* Record is listed as sensitive under OEH's Sensitive Species Data Policy and cannot be shown at this scale

Threatened fauna records within 10000m of the 28340 _ Hepher Road Campbelltown FFA study

0 720 1,440 2,160 2,880 3,600

Metres
Scale: 1:72,000 @ A3
Coordinate System: GDA 1994 NSW Lambert

N

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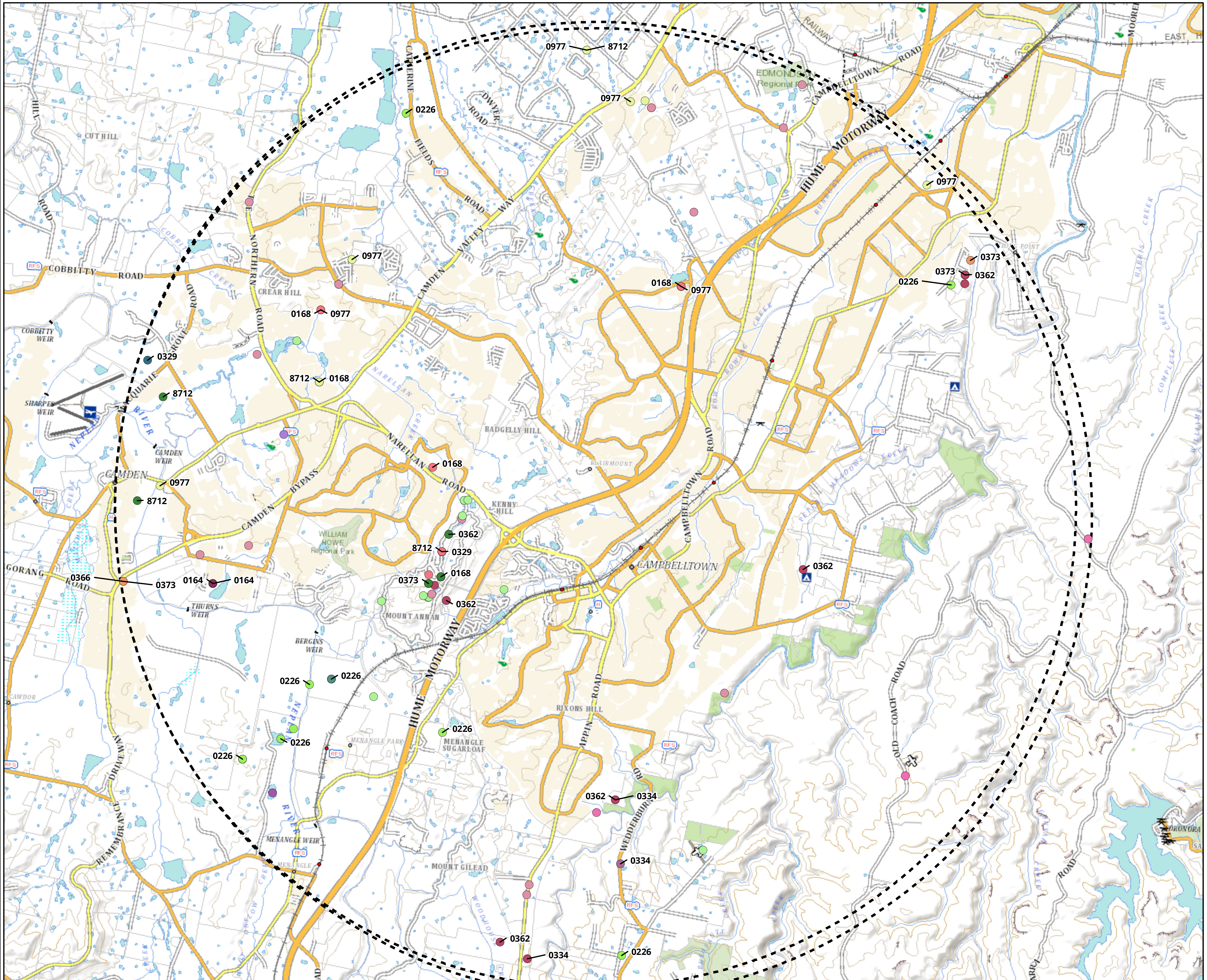
Newcastle, Sydney, Wangaratta & Wollongong

Legend

Threatened Fauna

- Amphibians
- Birds
- Invertebrates
- Mammals
- Reptiles
- Search Area
- Study area

Matter: 15743
Date: 12 February 2019,
Checked by: 12/02/2019, Drawn by: SMV, Last edited by: bdale
Location:P:\28300s\28340\Mapping
28340_F5_ThrFauna_autoGen



Acknowledgements: © Department of Finance, Services & Innovation 2018;
NSW Office of Environment and Heritage's Atlas of NSW Wildlife, which holds data frmo a number of custodians. Data obtained 12/02/2019

Legend

- Study Area
- Search Area

Migratory fauna

- 0164 - Red Knot
- 0168 - Latham's Snipe
- 0226 - White-bellied Sea-Eagle
- 0329 - Rainbow Bee-eater
- 0334 - White-throated Needletail
- 0362 - Rufous Fantail
- 0366 - Satin Flycatcher
- 0373 - Black-faced Monarch
- 0977 - Cattle Egret
- 8712 - Eastern Great Egret
- None - Barn Swallow
- None - Cattle Egret
- None - Latham's Snipe
- None - Rainbow Bee-eater
- None - Sharp-tailed Sandpiper
- None - White-throated Needletail

* Record is listed as sensitive under OEH's Sensitive Species Data Policy and cannot be shown at this scale

Figure 6: Migratory Fauna within xkm of the Study Area

0 750 1,500 2,250 3,000 3,750

Metres

Scale: 1:75,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney,Wangaratta & Wollongong

Matter: 28340
Date: 12 February 2019,
Checked by: 12/02/2019, Drawn by: SMV, Last edited by: bdale
Location:P:\28300s\28340\Mapping\28340_F6_MigFauna_autoGen

Appendix 3 Threatened species likelihood of occurrence

A3.1 Threatened flora species

The following table includes a list of the threatened flora species and ecological communities that have potential to occur within the study area. The list of species is sourced from the NSW BioNet Wildlife Atlas and the Protected Matters Search Tool (DEE; accessed on 12/02/2019).

Examples of criteria for determining the likelihood of occurrence for threatened biota as a guide for writing the rationale for likelihood have been listed below.

Likelihood of occurrence	Potential criteria
High	• Species/ecological communities recorded in study area during current or previous assessment/s. • Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. • Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). • Study area is within species natural distributional range (if known). • Species has been recorded within five kilometres or from the relevant catchment/basin.
Medium	• Records of terrestrial biota within <five kilometres or 10 kilometres> of the study area or of aquatic species in the relevant basin/neighbouring basin. • Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	• No records within five kilometres of the study area or for aquatic species, the relevant basin/neighbouring basin. • Marginal habitat present (low quality & extent). • Substantial loss of habitat since any previous record(s).
Negligible	• Habitat not present in study area • Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.

Table A.1 Threatened flora species recorded / predicted to occur within 5 kilometres of the study area

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		BC	EPBC					
Acacia pubescens	Downy Wattle	V	VU	2008		Low	Not detected during field survey.	A spreading shrub primarily confined to the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers at Barden Ridge, Oakdale and Mountain Lagoon. Grows in Cooks/River Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland, usually within roadside and bushland remnants. Grows on shale, sandstone, alluvium and gravely soils, often including ironstone.
Eucalyptus scoparia	Wallangarra White Gum	E1	VU	2017		Low	Not detected during field survey.	Small tree restricted to three populations near Tenterfield including within Bald Rock National Park. Grows on rocky outcrops, hilltops and slopes in a variety of communities including New England Dry Sclerophyll Forests, Tableland Clay Grassy Woodlands, Northern Tableland Wet

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		BC	EPBC					
								Sclerophyll Forests and Northern Escarpment Dry Sclerophyll Forests. Grows on granite or rhyolite substrates in well drained soils.
Genoplesium baueri	Bauer's Midge Orchid	E1	EN	1967		Low	Flood prone-land, species prefers well-drained soils and sandstone substrates not present within the study area. Topololgy geomorphology and location considered not suitable.	Terrestrial orchid with 13 populations totalling 2 plants distributed between Ulladulla and Port Stephens. Grows on moss gardens in a variety of communities including Sydney Coastal Dry sclerophyll Forests, Sydney Coastal Heaths, Sydney Montane Heaths, Southern Lowland Wet Sclerophyll Forests and Sydney Hinterland Dry Sclerophyll Forests. Grows on sandstone substrates.
Hibbertia puberula		E1		2016		Low	Not detected during field survey. This species occurs on sandy soil associated with sandstone. Therefore, the soil and landscape position (floodplain) present in the study area is unlikely to support this species.	Small shrub with a distribution extending from Wollemi National Park south to Morton National Park and the south coast near Nowra. Grows in a variety of communities including Southern Tableland Dry Sclerophyll Forests, Sydney Coastal Dry Sclerophyll Forests, Sydney Hinterland Dry Sclerophyll Forests, Coastal Heath Swamps, Coastal Valley

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		BC	EPBC					
								Grassy Woodlands and Sydney Coastal Heaths. Grows on sandy soils, occasionally on clay soils.
Lepidium hyssopifolium	Aromatic Peppercress	E1	EN	2008		Low	Not detected during field survey. This species is known to be an opportunist and colonises bare areas following disturbance. Bare, open ground is not present within the study area.	Erect, perennial herb confined to three populations, one at Bathurst, one at Bungendore and one near Crookwell. An individual was collected from Armidale in 1945 and 1958. Grows in a variety of communities including Temperate Montane Grasslands, Southern Tableland Grassy Woodlands, New England Grassy Woodlands and Western Slopes Grassy Woodlands.
Leucopogon exolasius	Woronora Beard-heath	V	VU	2011		Low	Not detected during field survey. Soil landscape not considered consistent with habitat.	Erect shrub confined to the upper Georges River area and Heathcote National Park. Grows in a variety of communities including Sydney Coastal Dry Sclerophyll Forests, Sydney Hinterland Dry Sclerophyll Forests, Sydney Montane Dry Sclerophyll Forests, Eastern Riverine Forests, and Sydney Coastal Heaths. Grows on sandstone substrates.
Pimelea spicata	Spiked Rice-flower	E1	EN			Low	This species was not	Small erect or spreading shrub

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		BC	EPBC					
							detected during field survey, however there are records within 5 kilometres of the study area. On the Cumberland Plain, this species commonly co-occurs with Grey Box *Eucalyptus moluccana*, Forest Red Gum *E. tereticornis* and Stringybark *E. eugenoides*, with a predominantly native groundcover. The study area does not support the vegetation as described.	with populations occurring in two disjunct areas, one occurring on the Cumberland Plain from Marayong and Prospect Reservoir south to Narellan and Douglas Park, and the other occurring in the Illawarra from Landsdowne to Shellharbour and north Kiama. Grows in Maritime Grasslands and Coastal Valley Grassy Woodlands including Cumberland Plain Woodlands and Moist Shale Woodlands within the Cumberland Basin and in Coast Banksia Open Woodland Coastal Grasslands in the Illawarra region. Grows on well-structured clay soils.
Pterostylis saxicola	Sydney Plains Greenhood	E1	EN			Low	This species was not detected during field survey, however there are records within 5 kilometres of the study area. This species typically occurs in close association with sandstone rock	Deciduous terrestrial orchid restricted to a few small populations located in Western Sydney between Freemans Reach in the north and Picton in the south including Georges River National Park. Found growing near streams in depression on sandstone rock shelves above cliff lines faces,

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		BC	EPBC					
							shelves and platforms. Habitat for this species is not present within the study area.	moist, sheltered ridges and creek banks on mossy rocks in Temperate Montane Grasslands, Northern Warm Temperate Rainforests, Southern Warm Temperate Rainforests and Southern Tableland Wet Sclerophyll Forests. Grows in small pockets of shallow shale or shale/sandstone transition soils over sandstone substrates.

* - habitat descriptions have been adapted by qualified ecologists from the DEE Species Profile and Threats (SPRAT) Database, OEH Threatened Species online profiles and the NSW Scientific Committee final determinations for listed species, references within the above table are provided within the report reference list.

A3.2 Threatened Fauna species

The following table includes a list of the significant fauna species that have potential to occur within the study area. The list of species is sourced from the NSW BioNet Wildlife Atlas, BirdLife Australia data search and the Protected Matters Search Tool (DEE; accessed on 12/06/2019).

Notes to table:

#	species predicted to occur by the DEE database (not recorded on other databases)
##	species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched
Year	recorded on databases listed above
2018	recorded during current survey

Likelihood of occurrence	Potential criteria
High	• Species recorded in study area during current or previous assessment/s. • Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. • Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). • Study area is within species natural distributional range (if known). • Species has been recorded within 5 kilometres or from the relevant catchment/basin.
Medium	• Records of terrestrial species within 5 kilometres of the study area or of aquatic species in the relevant basin/neighbouring basin. • Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	• No records within 5 kilometres of the study area or for aquatic species, the relevant basin/neighbouring basin. • Marginal habitat present (low quality & extent). • Substantial loss of habitat since any previous record(s).
Negligible	• Habitat not present in study area • Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.

Table A.2 Threatened fauna species recorded, or predicted to occur, within 5 kilometres of the study area

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
Mammals								
Cercartetus nanus	Eastern Pygmy-possum		V		1997	Negligible	The study area does not support sufficient foraging resources in the form of both native flowering canopy and understory species. There are two hollows within the study area and no other habitat features such as hollow logs, hollow stumps or other refugia known to be used by the species (Rock crevices, Xanthorrhoea species or Banksia species) were recorded. Records within the locality are >20 years old.	Patchily distributed from the coast to the Great Dividing Range, and as far as Pillaga, Dubbo, Parkes and Wagga Wagga on the western slopes. Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Soft fruits are eaten when flowers are unavailable and it also feeds on insects. Will often nest in tree hollows, but can also construct its own nest. Because of its small size it is able to utilise a range of hollow sizes including very small hollows. Individuals will use a number of different hollows and an individual has been recorded using up to 9 nest sites within a 0.5 ha area over a 5 month period.
Falsistrellus tasmaniensis	Eastern False Pipistrelle		V		2015	Low	May occasionally occur within the study area. Marginal foraging habitat, potential roosting habitat occurs within two hollow-bearing trees which will not be impacted.	Distribution extending east of the Great Dividing Range throughout the coastal regions of NSW, from the Queensland border to the Victorian border. Prefers wet high-altitude sclerophyll and coastal mallee

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
								habitat, preferring wet forests with a dense understorey but being found in open forests at lower altitudes. Apparently hibernates in winter. Roosts in tree hollows and sometimes in buildings in colonies of between 3 and 80 individuals. Often change roosts every night. Forages for beetles, bugs and moths below or near the canopy in forests with an open structure, or along trails. Has a large foraging range, up to 136 ha. Records show movements of up to 12 km between roosting and foraging sites.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat		V		2017	Low	May occasionally forage within the study area, no suitable roosts within the study area.	Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred kilometres to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
								and forages for flying insects (particularly moths) above the tree canopy and along waterways.
Mormopterus norfolkensis	Eastern Freetail-bat		V		2017	Low	May roost in tree hollows, foraging habitat is marginal. The development will not result in impacts to roosting habitat.	Distribution extends east of the Great Dividing Range from southern Queensland to south of Sydney. Most records are from dry eucalypt forests and woodland. Individuals tend to forage in natural and artificial openings in forests, although it has also been caught foraging low over a rocky river within rainforest and wet sclerophyll forest habitats. The species generally roosts in hollow spouts of large mature eucalypts (including paddock trees), although individuals have been recorded roosting in the roof of a hut, in wall cavities, and under metal caps of telegraph poles. Foraging generally occurs within a few kilometres of roosting sites.
Myotis macropus	Southern Myotis		V		2017	Low	May occasionally fly through the study area. Potential roosting in hollow-bearing trees within the study area, foraging habitat adjacent to the study area includes open water within the	Scattered, mainly coastal distribution extending to South Australia along the Murray River. Roosts in caves, mines or tunnels, under bridges, in buildings, tree hollows, and even in dense foliage. Colonies occur close to

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
							freshwater wetlands to the west. No areas of roosting or foraging habitat will be impacted.	water bodies, ranging from rainforest streams to large lakes and reservoirs. They catch aquatic insects and small fish with their large hind claws, and also catch flying insects.
Petauroides volans	Greater Glider	VU			2009	Low	Study area is highly disturbed through past clearing and agricultural activities. Low number of hollows within the study area and part of a small patch of vegetation which is relatively poorly connected due to large roads and clearing of surrounding areas.	The distribution of the Greater Glider includes the ranges and coastal plain of eastern Australia, where it inhabits a variety of eucalypt forests and woodlands. Presence and density of Greater Gliders is related to soil fertility, eucalypt tree species, disturbance history and density of suitable tree hollows. Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe.
Petrogale penicillata	Brush-tailed Rock-wallaby	VU	E1		#	Negligible	No suitable habitat.	Occurs along the Great Dividing Range south to the Shoalhaven, and also occurs in the Warrumbungles and Mt Kaputar. Habitats range from rainforest to open woodland. It is found in areas with numerous ledges, caves and crevices particularly with northern aspects. The species forages on grasses and forbs.
Phascolarctos cinereus	Koala	VU	V		2018	Moderate	A small number of Forest Red Gum occur within the study area. These do not comprise 15% of the	In NSW the Koala mainly occurs on the central and north coasts with some populations in the western

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
							canopy species present. The surrounding area is highly modified with a major highway providing a barrier to dispersal in the north and a mix of industrial and residential development to the west, south and east isolating the study area from large areas of higher quality habitat further to the east along the Georges River and within Heathcote National Park. Riparian vegetation may provide some connectivity, however, this is degraded due to the surrounding development and clearing of canopy species. No feed trees will be removed by the proposed development.	region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include *Eucalyptus robusta, E. tereticornis, E. punctata, E. haemostoma* and *E. signata*. They are solitary with varying home ranges.
Pseudomys novaehollandiae	New Holland Mouse	VU			#	Negligible	No suitable habitat.	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. The home range of the New

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
								Holland Mouse can range from 0.44 ha to 1.4 ha. The New Holland Mouse is a social animal, living predominantly in burrows shared with other individuals. The species is nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal. It is likely that the species spends considerable time foraging above-ground for food, predisposing it to predation by native predators and introduced species. Breeding typically occurs between August and January, but can extend into autumn.
Pteropus poliocephalus	Grey-headed Flying-fox	VU	V		2018	Low	No camps within the study area, species is highly nomadic and may forage on flowering Eucalyptus and Melaleuca species on occasion but is unlikely to occur within the study area on a regular basis.	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies, commonly in dense riparian vegetation.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat		V		2017	Low	May occasionally occur in the study area. One hollow-bearing	Found throughout NSW in habitats including wet and dry sclerophyll

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
							tree occurs within the study area and another to the east of the boundary. These may provide roosting opportunity and will not be impacted by the proposed development. Foraging habitat is marginal and will not be significantly reduced.	forest, open woodland, acacia shrubland, mallee, grasslands and desert. They roost in tree hollows in colonies and have also been observed roosting in animal burrows, abandoned Sugar Glider nests, cracks in dry clay, hanging from buildings and under slabs of rock. Forages for insects above the canopy in forests.
Scoteanax rueppellii	Greater Broad-nosed Bat		V		2017	Low	May occasionally occur in the study area. One hollow-bearing tree occurs within the study area and another to the east of the boundary. These may provide roosting opportunity and will not be impacted by the proposed development. Foraging habitat is marginal within the study area and of higher quality in areas surrounding such as Heathcote National Park to the east.	Occurs along the Great Dividing Range and in coastal areas. Occurs in woodland and rainforest, preferring open habitats or openings in wetter forests. Often hunts along creeks or river corridors. Preys upon beetles and other large, flying insects, other bats and spiders. Roosts in hollow tree trunks and branches.
Birds								
Calidris ferruginea	Curlew Sandpiper	CE	E1		#	Negligible	No suitable habitat.	Inhabits sheltered intertidal mudflats. Also non-tidal swamps, lagoons and lakes near the coast. Infrequently recorded inland.
Callocephalon fimbriatum	Gang-gang Cockatoo		V		2018	Low	May occasionally occur in the study area. Low number of	In summer, occupies tall montane forests and woodlands, particularly in

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
							eucalyptus trees providing potential foraging resources on occasion. Unlikely to occur on a regular basis within the study area and no suitable breeding habitat occurs within the study area.	heavily timbered and mature wet sclerophyll forests. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.
Calyptorhynchus lathami	Glossy Black-Cockatoo		V		2015	Low	May occasionally occur in the study area.	Inhabits forest with low nutrients, characteristically with key Allocasuarina species. Tends to prefer drier forest types. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead.
Circus assimilis	Spotted Harrier		V		2000	Low	Foraging habitat occurs within the study area and is considered marginal due to previous disturbance and ephemerality. No nests were located during field surveys and the proposed impact will be a small area 0.21 hectares, unlikely to significantly reduce the overall foraging area for this species.	The Spotted Harrier is found throughout Australia but rarely in densely forested and wooded habitat of the escarpment and coast. Preferred habitat consists of open and wooded country with grassland nearby for hunting. Habitat types include open grasslands, acacia and mallee remnants, spinifex, open shrublands,

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
Daphoenositta chrysoptera	Varied Sittella		V		2018	Low	Could occasionally occur within the study area, however, unlikely to be a resident of the study area given lack of rough-barked trees and eucalypts. Habitat is marginal due to previous land use including clearing and introduction of exotic flora species. Not recorded during field survey.	The Varied Sittella is a sedentary species which inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands, paperbarks or mature Eucalypts. The Varied Sittella feeds on arthropods gleaned from bark, small branches and twigs. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.
Glossopsitta pusilla	Little Lorikeet		V		2018	Low	May occur on occasion to forage on a low number of flowering Eucalyptus species within the study area. Small area (0.21 hectares) will be impacted by the proposed development and does not contain flowering eucalypts.	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m,

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
								mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.
Grantiella picta	Painted Honeyeater	VU	V		#	Low	No records within the locality, no mistletoe detected during field survey. Uncommon east of the Great Dividing Range.	Found mainly in dry open woodlands and forests, where it is strongly associated with mistletoe. Often found on plains with scattered eucalypts and remnant trees on farmlands.
Hieraaetus morphnoides	Little Eagle		V		2014	Low	No nests recorded during field survey. This species may occur on occasion foraging over the study area. The species forages over large home ranges and the removal of 0.21 hectares is unlikely to impact foraging resources for this species.	The Little Eagle is most abundant in lightly timbered areas with open areas nearby providing an abundance of prey species. It has often been recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. The Little Eagle nests in tall living trees within farmland, woodland and forests.
Lathamus discolor	Swift Parrot	CE	E1		2018	Low	May occasionally occur within the study area foraging on flowering Eucalyptus but unlikely to be supported by vegetation within the study area given the low quality, low number of eucalyptus for foraging and small area. The proposed development will remove exotic grassland and 0.07	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
							hectares of Swamp Oak Floodplain Forest and is unlikely to provide habitat for the Swift Parrot.	as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.
Lophoictinia isura	Square-tailed Kite		V		2018	Low	No nests recorded during field survey. This species may occur on occasion foraging over the study area. The species forages over large home ranges and the removal of 0.21 hectares is unlikely to impact foraging resources for this species.	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by Eucalyptus longifolia, *Corymbia maculata*, E. elata, or E. smithii. Individuals appear to occupy large hunting ranges of more than 100 km2. They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
Neophema pulchella	Turquoise Parrot		V		2012	Low	No nesting habitat occurs within the study area. The study area may provide low quality foraging habitat on occasion but is considered unlikely to support a local population given the occurrence of exotic species, previous history of land clearing and surrounding land uses.	Occurs in open woodlands and eucalypt forests with a ground cover of grasses and understorey of low shrubs. Generally found in the foothills of the Great Divide, including steep rocky ridges and gullies. Nest in hollow-bearing trees, either dead or alive; also in hollows in tree stumps. Prefer to breed in open grassy forests and woodlands, and gullies that are moist.
Ninox strenua	Powerful Owl		V		2017	Low	No nesting habitat occurs within the study area. This species may occur on occasion foraging over the study area. The species forages over large home ranges and the removal of 0.21 hectares is unlikely to impact foraging resources for this species.	The Powerful Owl occupies wet and dry eucalypt forests and rainforests. It may inhabit both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm. It has a large home range of

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
								between 450 and 1450 ha.
Numenius madagascariensis	Eastern Curlew	CE			#	Negligible	No habitat within the study area.	Occurs in sheltered coasts, especially estuaries, embayments, harbours, inlets and coastal lagoons with large intertidal mudflats or sandflats often with beds of seagrass.
Pandion cristatus	Osprey		V		#	Low	No foraging or nesting habitat occurs within the study area.	Found in coastal waters, inlets, estuaries and offshore islands. Occasionally found 100 km inland along larger rivers. It is water-dependent, hunting for fish in clear, open water. The Osprey occurs in terrestrial wetlands, coastal lands and offshore islands. It is a predominantly coastal species, generally using marine cliffs as nesting and roosting sites. Nests can also be made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.
Petroica boodang	Scarlet Robin		V		2011	Low	Marginal foraging habitat occurs for this species as the study area does not contain logs or woody debris and is predominantly covered by weeds. This species may occur on occasion within the study area but higher quality	The Scarlet Robin inhabits dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. During autumn and winter it moves to more open and cleared areas. The Scarlet Robin forages amongst logs

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
							habitat is likely to occur within vegetation along the Georges River and adjacent to was not encountered during field investigation.	and woody debris for insects. The nest is an open cup of plant fibres and cobwebs, sited in the fork of a tree.
Rostratula australis	Australian Painted Snipe	EN	E1		#	Low	No suitable habitat. Wetlands in the north of the study area do not contain suitable dense vegetation for this cryptic species. The ephemeral wetland may occasionally provide habitat suitable for this specie but is unlikely to support the local population. No records of this species occur within 5km.	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, but have been recorded in brackish waters. Forages on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter.
Stictonetta naevosa	Freckled Duck		V		2006	Low	No suitable habitat occurs within the study area for this species. Wetlands to the west may occasionally provide refuge and foraging for this species but is unlikely to be suitable for breeding.	The Freckled Duck breeds in permanent fresh swamps that are heavily vegetated. Found in fresh or salty permanent open lakes, especially during drought. Often seen in groups on fallen trees and sand spits.
Amphibians								
Litoria aurea	Green and Golden Bell Frog	VU	E1		2015	Moderate	A small number of local records (3) within 300 metres of the study area. Study area provides potential habitat in the north. This area will not be impacted by the	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VIC. The

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
							proposed development. 0.21 hectares of potential foraging and dispersal habitat will be removed for the development. Higher quality habitat exists within the surrounding landscape.	species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks, although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take approximately 10-12 weeks to develop, feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species.
Litoria raniformis	Southern Bell Frog	VU	E1		#	Low	No records within 5 km. Not within species known range.	In NSW the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral swamps or billabongs with an abundance of bulrushes and other emergent vegetation along

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
								floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. Outside the breeding season animals disperse away from the water and take shelter beneath ground debris such as fallen timber and bark, rocks, grass clumps and in deep soil cracks.
Pseudophryne australis	Red-crowned Toadlet		V		2016	Low	No suitable habitat within the study area.	Occurs on wetter ridge tops and upper slopes of sandstone formations on which the predominant vegetation is dry open forests and heaths. This species typically breeds within small ephemeral creeks characterised by a series of shallow pools that feed into larger semi-perennial streams.
Fish								
Macquaria australasica	Macquarie perch	EN		EN	#	Low	Waterways within the study area are not suitable for this species and are highly modified, shallow concrete lines ditches. No records occur within the locality (5km), the closest known population has been recorded in the Georges River, which occurs approximately 4 km to the south-east of the	Macquarie Perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. Macquarie perch are found in both river and lake habitats, especially the upper

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description*
		EPBC	BC	FM				
							study area.	reaches of rivers and their tributaries
Molluscs								
Meridolum corneovirens	Cumberland Plain Land Snail		E1		2017	Low	A low number of potential host trees occur within the study area (Forest Red Gum) and searches during field investigation did not detect the species. The study area is highly disturbed through previous land clearing and presence of exotic and weedy species.	Most likely restricted to Cumberland Plain, Castlereagh Woodlands and boundaries between River-flat Forest and Cumberland Plain Woodland. It is normally found beneath logs, debris and amongst accumulated leaf and bark particularly at the base of trees. May also use soil cracks for refuge.

* - habitat descriptions have been adapted by qualified ecologists from the DEE Species Profile and Threats (SPRAT) Database, OEH Threatened Species online profiles and the NSW Scientific Committee final determinations for listed species, references within the above table are provided within the report reference list.

Appendix 3.1 Migratory species (EPBC Act listed)

Includes records from the following sources:

- NSW BioNet Wildlife Atlas (refer to Section 2.1)
- DEE database (accessed on 12/06/2019)
- BirdLife Australia data search
- Current survey

Bold denotes species recorded in the study area during the current assessment.

Table A.3 Migratory fauna species recorded or predicted to occur within 10 kilometres of the study area

Scientific name	Common name	Most recent record
Actitis hypoleucos	Common Sandpiper	#
Apus pacificus	Fork-tailed Swift	#
Ardea ibis	Cattle Egret	2017
Ardea modesta	Eastern Great Egret	2006
Calidris ferruginea	Curlew Sandpiper	#
Calidris melanotos	Pectoral Sandpiper	#
Cuculus optatus	Oriental Cuckoo	#
Gallinago hardwickii	Latham's Snipe	2016
Hirundapus caudacutus	White-throated Needletail	2016
Merops ornatus	Rainbow Bee-eater	2010
Monarcha melanopsis	Black-faced Monarch	2008
Motacilla flava	Yellow Wagtail	#
Numenius madagascariensis	Eastern Curlew	#
Pandion cristatus	Osprey	#
Rhipidura rufifrons	Rufous Fantail	2012
Symposiachrus trivirgatus	Spectacled Monarch	#
Tringa nebularia	Common Greenshank	#

* - habitat descriptions have been adapted by qualified ecologists from the DSEWPaC Species Profile for listed migratory species, references within the above table are provided within the report reference list

Appendix 4 Assessment of significance

Swamp Oak Floodplain Forest

The following description is taken from the NSW Scientific Committee determination:

Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Swamp Oak Floodplain Forest generally occurs below 20 metres (rarely above 10 metres) elevation in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community may vary from open forests to low woodlands, scrubs or reed lands with scattered trees. It generally occupies low-lying parts of floodplains, alluvial flats, drainage lines, lake margins and fringes of estuaries; habitats where flooding is periodic and soils show some influence of saline ground water. This latter habitat feature sets it apart from other floodplain communities.

The composition of Swamp Oak Floodplain Forest is primarily determined by the frequency and duration of waterlogging and the level of salinity in the groundwater. Composition also varies with latitude. The understorey is characterised by frequent occurrences of vines, *Parsonsia straminea*, *Geitonoplesium cymosum* and *Stephania japonica* var. *discolor*, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter. The composition of the ground stratum varies depending on levels of salinity in the groundwater. On the fringes of coastal estuaries, where soils are more saline, the ground layer may include the threatened grass species, *Alexfloydia repens,* as well as *Baumea juncea*, *Juncus kraussii*, *Phragmites australis*, *Selliera radicans* and other saltmarsh species.

The Swamp Oak Floodplain Forest within the study area is subject to weed incursion and is lacking a functional midstorey as a result of historical under scrubbing. The canopy primarily consists of Swamp Oak with scattered individuals of Spotted Gum and Rough-barked Apple occurring.

The area of forest within the study area measures approximately 1.8 hectares, and within a 5 kilometres radius was measured at approximately 5 hectares (Tozer et al. 1010).

In the case of a threatened species, whether the proposed development or activity 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.

a) 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.

b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

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 proposal will result in the removal of 0.07 hectares of Swamp Oak Floodplain Forest from the study area, which equates to approximately 1.4 % from the locality. 1.74 hectares will be retained within the study area. The area to be removed is small and when coupled with the intended retainment of the remaining forest within the study area, it is unlikely to result in extinction of the community at the local scale. The current situation is that the forest is threatened by the ongoing invasion from exotic species.

The proposed project could influence drainage patterns currently existing at the study area. However given the spatial location of the community within the study area and the surrounding built-up land use in the local area, drainage patterns are unlikely to change significantly as a result of the project. However, safeguards should be implemented to manage runoff from the development. Therefore, the changes to landuse and levels of the land are unlikely to result in a reduction in the extent of the community such that it would be placed at risk of extinction.

It is therefore considered unlikely that the proposal will reduce the extent of the community such that its local occurrence is likely to be placed at risk of extinction because:

- The proposal will remove approximately 0.07 hectares (1.4%) of low condition community from the locality, based on previous mapping within the area (Tozer et al. 2010). This is considered a small area and unlikely to result in extinction.
- Potential indirect impacts that could affect extent (weed invasion, trampling, stormwater, flooding) will be managed and mitigated through site specific management plans.

Potential modification of the composition of the Swamp Oak Floodplain Forest has already occurred as a result of weed invasion from exotic species.

Therefore, the proposal is unlikely to result in modification to the Swamp Oak Floodplain Forest to an extent where its local occurrence is placed at risk of extinction.

c) In relation to the habitat of a threatened species, population or ecological community:
i The extent to which habitat is likely to be removed or modified as a result of the action proposed, and
ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The proposal will remove 0.07 hectares of existing habitat for this community 1.74 hectares of existing Swamp Oak Floodplain Forest will be retained within the study area.

The proposal will result in the removal of an area of community on the edge of patch, and will not fragment the community in a way as to separate it into two or more discrete patches.

The habitat to be removed as a result of the proposal is currently in low condition and occurs on the edge of a lager patch of this community. Therefore it is considered of low importance to the long-term survival of the community in the locality.

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

No critical habitat has been declared for Swamp Oak Floodplain Forest.

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

No recovery plan or threat abatement plan has been approved for Swamp Oak Floodplain Forest.

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

The proposal could constitute part of the key threatening process clearing of native vegetation.

Conclusion

The proposed development is unlikely to constitute a significant impact on Swamp Oak Floodplain Forest given the following:

- The area to be removed is 1.4 % of that within the locality, which is not considered significant.
- Any indirect impacts such as changes to drainage are being managed through site-specific management plans.
- The patch would not be fragmented or further isolated by other patches of the community.

Green and Golden Bell Frog *Litoria aurea*

The Green and Golden Bell Frog is listed as Endangered under the BC Act and as Vulnerable under the EPBC Act. The species was known to be formerly distributed along the east coast from the NSW north coast near Brunswick Heads, southwards to Victoria where it extended into east Gippsland. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations (OEH 2017).

Green and Golden Bell Frog are known to inhabit marshes, dams and stream-sides, particularly those containing bullrushes or spikerushes. Optimum conditions include water-bodies that are unshaded, free of predatory fish such as Eastern Gambusia *Gambusia holbrooki* and have features such as large rocks and grassy areas (i.e. Kikuyu grass) bordering for diurnal sheltering (Pyke & White 1996, Pyke et al. 2002). Many of the remaining populations of Green and Golden Bell Frog occur in highly disturbed environments (Pyke et al. 2002). Green and Golden Bell Frog may disperse between suitable breeding habitat and refuge habitat during periods when ephemeral pools dry out, connectivity between these areas is considered important for the ongoing survival and reproductive success of the species.

OEH lists a number of key threatening processes for the Green and Golden Bell Frog. Key threatening processes acting on this species include:

- Alterations to drainage patterns and storm water run-off.
- Pathogens such as Frog Chytrid Fungus.
- Predation by feral animals and predation by predatory fish (i.e. Mosquito Fish).
- Herbicides and other weed controls.
- Alterations of habitat including changes in salinity and overgrowth of pond vegetation leading to a decline in water temperature.
- Road mortality.
- Loss of suitable breeding habitat through alteration by infilling and destruction of wetlands.
- Small population size (decreased resilience).
- Drying of breeding habitat due to climate change.
- Lack of landscape connectivity leading to isolation of small populations.
- Heavy metal pollution.
- Vehicle traffic impacting habitat.

According to OEH records, Green and Golden Bell Frog has been previously recorded in the northern portion of the study area within the Coastal Freshwater Lagoon vegetation community, just north of the subject site..

(a) in the case of a threatened species, whether the proposed development or activity 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,

Impacts that could affect the life-cycle of a threatened species include destruction, isolation or degradation of breeding habitat or foraging resources that the species is reliant upon for successful breeding or survival. The proposed development will not result in the removal or isolation of breeding or foraging habitat for the Green and Golden Bell Frog. The development will result in the removal of 0.07 hectares of Swamp Oak

Floodplain Forest and 0.21 hectares of exotic grassland. Green and Golden Bell Frog may disperse across this area between potential habitat in the north of the study area and habitat to the west. Connectivity between the two areas of potential habitat is primarily through the fourth order stream, which extends from the north towards the south and branches towards potential habitat in the west. Provided the appropriate measures are implemented, it is unlikely the development will prevent dispersal between areas of potential habitat as it will not create a barrier along the fourth order stream connecting these two areas.

Habitat within the study area is considered to be marginal for this species, and given the above listed factors it is unlikely the proposed works will 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.

(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 0.21 hectares of potential dispersal habitat will be removed as a result of the proposal.

Potential Green and Golden Bell Frog habitat occurs in the wetland to the north of the study area and to the west (outside of the study area). The subject site does not occur in an area of potential Green and Golden Bell Frog habitat. The subject site was positioned in an area that is not prone to flooding and will be in an area of the highest elevation within the study area (Figure 2).

The proposal will result in the removal of 0.21 hectares of vegetation which includes exotic grassland and Swamp Oak Floodplain Forest, potentially utilised for dispersal and marginal foraging habitat. Connectivity is maintained between habitats by Biriwiri creek, which has two branches running roughly north-south and west-southeast. The proposal therefore will not fragment or isolate habitat within the study area and surrounds.

The habitat to be removed is considered to contain marginal terrestrial foraging and dispersal habitat only. Habitat within the subject site is located outside of flood prone land and does not provide potential

breeding habitat. Given these factors, habitat within the subject site is considered to be marginal and unlikely to be important to the survival of the species in the locality.

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

There are no areas of critical habitat listed for the species. In addition the subject site does not provide breeding habitat, will not isolate or fragment habitat and is unlikely to be critical to the survival of the species.

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

The potential habitat to be removed from the study area would be considered of low importance when compared with higher quality dispersal habitat along Biriwiri creek and the potential foraging and breeding habitat to the north and west of the subject site. As the subject site does not support breeding or high-quality foraging habitat, this area is unlikely to be important to the long-term survival of 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.

Key threatening processes of relevance to the project for Green and Golden Bell Frog include the reduction of landscape connectivity leading to isolation of small populations. The proposal will result in the removal of 0.21 hectares of low quality vegetation and exotic vegetation from the subject site on land outside of flood-prone land within the study area. Previous records of the species occur to the north-west within Biriwiri creek. This creek is highly modified within the study area and provides some connectivity to wetlands to the north and west of the subject site. The subject site will not impact on the connectivity provided by Biriwiri creek and is considered unlikely to result in the operation of, or increase the impact of this key threatening process.

Infection of frogs by amphibian chytrid causing the disease chytridiomycosis is also listed as a key threatening process. Chytrid fungus is widespread and commonly found in frog populations throughout New South Wales. The works will occur in an area that is currently highly disturbed with surrounding areas developed for industrial and residential use, with rural areas surrounding. Given the surrounding land use, history of disturbance and small area of impact, the proposed development is considered unlikely to introduce or spread Chytrid and is therefore unlikely to lead to the operation of or increase in this threat.

Therefore the proposed works are unlikely to contribute to key threatening processes for Green and Golden Bell Frog.

Conclusion

The study area provides marginal habitat for the Green and Golden Bell Frog, including an area of potential breeding habitat in the north. The proposed development will impact on 0.21 hectares of potential dispersal habitat and low quality potential foraging habitat for the species. It is considered unlikely that works will indirectly impact the potential breeding habitat in the north as it is upstream and is separated Hepher Road. The proposed works are considered unlikely to significantly impact the Green and Golden Bell Frog given the following factors:

- The proposed works will not have an adverse effect on the life cycle of the species such that the local population is put at risk of extinction.
- The proposed works will not impact on habitat critical to the survival of the Green and Golden Bell Frog.

The proposed works will impact on a small area (0.21 hectares) of potential dispersal and marginal foraging habitat, it will not result in fragmentation or isolation of habitat for the species and the habitat is considered to be of low importance to the survival of the species.

- The proposed works will not significantly contribute to any key threatening processes for the Green and Golden Bell Frog.

More suitable habitat is likely to occur outside of the impact area and broader study area, where a small number of records of this species exist.

The risks to Green and Golden Bell Frog can be managed by the installation of a 'frog fence' to exclude frogs from the proposed construction works and direct them towards Biriwiri creek.

Appendix 5 Significant Impact Criteria assessments

EPBC Act Significant Impact Assessment Green and Golden Bell Frog

The Green and Golden Bell Frog is listed as Endangered under the EPBC Act and also as vulnerable under Schedule 2 of the BC Act. The species was known to be formerly distributed along the east coast from the NSW north coast near Brunswick Heads, southwards to Victoria where it extended into east Gippsland. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations (OEH 2017).

Green and Golden Bell Frog are known to inhabit marshes, dams and stream-sides, particularly those containing bullrushes or spikerushes. Optimum conditions include water-bodies that are unshaded, free of predatory fish such as Eastern Gambusia *Gambusia holbrooki* and have features such as large rocks and grassy areas (i.e. Kikuyu grass) bordering for diurnal sheltering (Pyke & White 1996, Pyke et al. 2002). Many of the remaining populations of Green and Golden Bell Frog occur in highly disturbed environments (Pyke et al. 2002). Green and Golden Bell Frog may disperse between suitable breeding habitat and refuge habitat during periods when ephemeral pools dry out, connectivity between these areas is considered important for the ongoing survival and reproductive success of the species.

The study area contains 0.21 hectares of marginal dispersal habitat for the Green and Golden Bell Frog in the form of exotic grassland and 0.07 hectares of Swamp Oak Floodplain Forest.

An action is likely to have a significant impact on a vulnerable species protected under the EPBC Act if there is a real chance or possibility that it will:

- *lead to a long-term decrease in the size of an important population of a species*

  Given that the species occurs mostly as isolated populations throughout its distribution, all populations of the Green and Golden Bell Frog are likely to be considered important populations.

  The proposed development will not result in the removal of breeding habitat and will impact on a small area (0.21 hectares) of potential foraging and dispersal habitat only. Higher quality habitat exists adjacently west of the study area, in the form of a deep pond providing potential refuge habitat during dry periods and an ephemeral wetland to the north across Hepher Road. The proposed development will not reduce connectivity through the landscape or the study area. Potential breeding and refuge habitat is connected through Biriwiri Creek.

  Given that the area to be removed does not provide significant foraging resources or breeding resources it is considered unlikely to result in the long-term decrease in the size of an important population.

- *Reduce the area of occupancy of an important population.*

  Green and Golden Bell Frog is now known only from 54 locations in New South Wales following significant reductions in the species numbers. The status of these populations has changed overtime, with the status of some populations unknown or presumed extinct (DEWHA 2009).

  The proposed development will remove 0.21 hectares of potential foraging and dispersal habitat, possibly utilised by adult frogs for moving between potential breeding and non-breeding sheltering habitat. Biriwiri creek connects areas of potential habitat and this connectivity will not be impacted by the proposed development. The study area provides additional areas of similar habitat and removal of this small area is considered unlikely to significantly impact dispersal through the area.

- *Fragment an existing important population into two or more populations.*

As stated above, the proposal will remove a small area of potential dispersal and foraging habitat. Connectivity between areas of higher quality habitat will be maintained through other parts of the study area along Biriwiri creek. The proposed development is unlikely to provide a significant barrier to dispersal and frog fences will be implemented to direct any frogs around the subject site. Therefore, the proposal is highly unlikely to fragment an existing important population of Green and Golden Bell Frog.

- *Adversely affect habitat critical to the survival of a species.*

The species utilises a variety of habitats at different stages of its life cycle. Suitable breeding habitat for the species consists of ponds or slow moving waterbodies that are shallow (less than 1 metre deep), exposed to sunlight and free of predatory fish (Pyke and White 1996). They also require foraging, dispersal and refuge habitat. Foraging habitat, including grassy areas adjacent to waterbodies is very important for the species (Pyke and White 1996, 2001). The species is known to be relatively mobile and can disperse over distances of 1.2 kilometres (Pyke and White 2001). The maintenance of dispersal corridors is key to the ongoing survival of the species in connectivity to key habitats. Low quality potential breeding habitat has been identified in the north of the study area. The small area of habitat within the subject site is not considered to be critical to the survival of the Green and Golden Bell Frog when compared with habitat in the study area and broader landscape.

- *disrupt the breeding cycle of an important population*

The proposed works will not impact breeding habitat and will result in removal of a small area of potential foraging/dispersal habitat considered to be of low quality. The proposal is therefore considered unlikely to disrupt the breeding cycle of an important population.

- *modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*

The removal of the small area (0.21 hectares) of potential low quality foraging and dispersal habitat within the study area is not considered likely to modify, destroy, remove, isolate or decrease the availability of habitat to the extent that the species is likely to decline.

- *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.*

The study area occurs as a highly disturbed patch within the broader landscape which includes existing industrial and residential areas and rural farmland to the west. Invasive species harmful to Green and Golden Bell Frog include European Fox *Vulpes vulpes* and exotic fish species like Eastern Gambusia *Gambusia holbrooki*.

These invasive species are unlikely to become established as a result of the development of 0.21 hectares of low-quality habitat within the study area.

- *Introduce disease that may cause the species to decline.*

Given the high level of disturbance and prevalence of Chytrid fungus throughout the environment, particularly in the lower-reaches of streams, it is likely that the Chytrid fungus is already exiting within the study area. The proposal is unlikely to further introduce Chytrid or other disease that may cause the species to decline because the fungal disease is known to be wide-spread through most systems and there are known background levels for the disease.

- *interfere substantially with the recovery of the species*

The proposed works will remove a small area of potential low quality foraging and dispersal habitat. The remainder of the study area will remain available for dispersal of the species. Therefore the works will not interfere substantially with the recovery of the species.

Conclusion

The proposed development is unlikely to significantly impact on Green and Golden Bell Frog occurring within the study area and wider locality as the small area of impact (0.21 hectares) will reduce potential dispersal and marginal foraging habitat only. The project is considered unlikely to significantly impact on the Green and Golden Bell Frog as it will not:

- *Lead to a long-term decrease in the size of an important population of a species.*
- *Reduce the area of occupancy of an important population.*
- *Fragment an existing important population into two or more populations.*
- *Adversely affect habitat critical to the survival of a species.*
- *Disrupt the breeding cycle of an important population.*
- *Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.*
- *Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.*
- *Introduce disease that may cause the species to decline.*
- *Interfere substantially with the recovery of the species.*

No areas of breeding habitat will be impacted and connectivity will be maintained throughout the wider study area through Biriwiri Creek. As such, a referral to the minister is not required.

Appendix 6 Plates

Plate 1 **Swamp Oak Floodplain Forest within the study area**

Plate 2 **Freshwater Wetlands within the study area**

Plate 3 **Exotic vegetation within the study area**