



Flora, Fauna and Aquatic Assessment Report

BWC2/25 Blacktown Workers Sports Club

Site A: Outdoor Sports Facilities – 221 Walters Road, Arndell Park

Site B: Seniors Living Village – 170 Reservoir Road, Arndell Park

Client: **Paynter Dixon Constructions Pty Ltd**
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Abbreviations

Abbreviation	Description
BWSC	Blacktown Workers Sports Club
CEEC	Critically endangered ecological community
CPLS	Cumberland Plain Land Snail
CPW	Cumberland Plain Woodland
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environmental Protection and Biodiversity Conservation Act 1999</i>
FM	NSW <i>Fisheries Management Act 1994</i>
LGA	Local Government Area
MNES	Matters of National Significance under the EPBC Act
NW Act	NSW <i>Noxious Weeds Act 1993</i>
OEH	NSW Office of Environment and Heritage
PDC	Paynter Dixon Constructions
RFEF	River-flat Eucalypt Forest
SPW	Shale Plains Woodland
TEC	Threatened Ecological Community
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>
VMP	Vegetation Management Plan
WM Act	NSW <i>Water Management Act 2000</i>

March 2018 Update

This report was produced in December 2015 for the Blacktown Workers Sports Club Masterplan, and included an assessment of:

- Planning Proposal to include 'recreation facility (outdoor)' on Lot 14 Sec 4 DP6796 and Lot 10 DP818679,
- Development Application for the outdoor sports facilities on Lot 14 Sec 4 DP6796 and Lot 10 DP818679, and
- Site Compatibility Certificate for a Seniors Living Village on Lot 201 DP880404.

Since this time, this report has been modified and updated to Version 5 (dated January 2017) to assess the impacts resulting from the outdoor sports facility only. Consequently, two development applications for the sporting field development have approved by Blacktown City Council – one DA for civil works and another for sporting field use. The presence of a riparian corridor through the site required the preparation of a vegetation management plan (VMP) and a controlled activity approval (CAA) from the Department of Primary Industries (DPI Water). As two separate DA's were lodged in relation to this development, two CAA have also been issued DPI Water. Works on the site development and implementation of the VMP have commenced.

The report below provided an initial ecological assessment of the entire masterplan for the site, which includes the Seniors Living Village on Lot 201 DP880404 (Site B). Although modifications to the design of the Seniors Living Village have occurred since the time this report was written, the report still provides an accurate assessment of the ecological values of Site B. Given that Site B contains two non-native vegetation communities - Planted Eucalypts and Casuarinas and Exotic Grassland and limited fauna habitat, the ecological values of the site are low. As such, the development of the site for a Seniors Living Village is an appropriate use of the site from an ecological aspect and the details in this report can be considered for the Site Compatibility Certificate application.

Executive summary

Blacktown Workers Sports Club (BWSC) have appointed Paynter Dixon Constructions Pty Ltd (PDC) to prepare a Masterplan for the lands owned by the BWSC. Eco Logical Australia (ELA) were engaged by PDC to prepare a Flora, Fauna and Aquatic Assessment of the proposed Masterplan.

This report has been prepared to assess the impacts of the BWSC masterplan on Flora, Fauna and Aquatic ecosystems within the study area. Given the integrated nature of the master plan this report has been prepared for all three components needed to facilitate the development:

- Planning Proposal to include 'recreation facility (outdoor)' on Lot 14 Sec 4 DP6796 and Lot 10 DP818679,
- Development Application for the outdoor sports facilities on Lot 14 Sec 4 DP6796 and Lot 10 DP818679, and
- Site Compatibility Certificate for a Seniors Living Village on Lot 201 DP880404.

The study area of the proposed masterplan is bound by Reservoir Road to the east, Penny Place to the south, Walters Road to the west and Holbeche Road to the north, within Blacktown City Council LGA. Adjacent existing land use is industrial and includes large warehouses. The existing BWSC is located on Reservoir Road, with a hotel to the immediate north and a restaurant further north at the corner of Holbeche Road and Reservoir Road.

Previous ecological assessments of the site were undertaken between 1998 and 2006 for a proposed sporting fields and later an industrial development, neither of which eventuated. Under the current Masterplan for the BWSC land, two main components are proposed – Site A will comprise outdoor sporting facilities, and Site B a seniors living residential development (approximately 800 units).

Under the Blacktown LEP 2015, Site A is zoned IN1 General Industrial, IN2 Light Industrial and W1 Natural Waterways along Bungarribee Creek, which flows in a north-westerly direction through the north-west corner of the Site A. Site B is zoned RE2 Private Recreation.

A site inspection was undertaken by ELA on 3 November 2015. The vegetation was validated as Shale Plains Woodland, a sub-community of Cumberland Plain Woodland (CPW) along the northern section of the site and Alluvial Woodland along Bungarribee Creek. A nocturnal survey and two nights of bat detection was undertaken on 25 and 26 November 2015.

Cumberland Plain Woodland is listed as a critically endangered ecological community (CEEC) under the NSW *Threatened Species Conservation Act 1995* (TSC Act). Depending on remnant size and condition criteria, CPW is also listed as critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. In this case, the vegetation within the study area does not meet the definition of CPW under the EPBC Act, but it does under the TSC Act.

The Alluvial Woodland along Bungarribee Creek is a sub-community of the listed Endangered Ecological Community (EEC) River Flat Eucalypt Forest (RFEF) under the TSC Act. Under the proposed Masterplan, this vegetation will be largely retained and restored by implementation of the VMP (ELA 2015).

The remainder of the site consisted of planted vegetation (including endemic and non-endemic Eucalypt species) and exotic grassland. This planted vegetation does not contain an understorey and is not considered to be a native vegetation community.

No threatened flora species have been previously found at the site and during the site inspection none were observed. It is unlikely that threatened flora species would occur at the site given the highly disturbed and degraded nature of the site.

Threatened fauna species recorded onsite included *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail-bat), *Scoteanax tasmaniensis* (Greater Broad-nosed Bat) and possible records of *Myotis macropus* (Large-footed Myotis) and *Falsistrellus tasmaniensis* (Eastern False Pipistrelle). *Meridolum corneovirens* (Cumberland Plain Land Snail - CPLS) was recorded immediately north of the study area around the irrigation dam.

CPLS was found within CPW along the south facing slope of the irrigation dam. Five empty shells and two live snails were found within leaf litter at the base of the trees. Searches for CPLS were undertaken within the study area but did not detect the species. The species is unlikely to occur within the study area given the highly disturbed nature of the ground including dumped fill, regular slashing up to the base of trees and a paucity of leaf litter and fallen debris.

The population of CPLS adjacent to the irrigation dam lacks connectivity with other patches of CPW and is highly isolated and vulnerable. Removal or disturbance to this vegetation would likely cause a significant impact to the species. Under the current Masterplan, this vegetation will be retained and no impacts to the CPLS are expected.

While the nocturnal survey detected 4 threatened microbats, it is unlikely that the bats are roosting within the stags (standing dead trees) and hollow-bearing trees on the site, as no bats were observed emerging from the hollows. It is most likely the bats are passing through the site while foraging, particularly along Bungarribee Creek. *Myotis macropus* is likely to be foraging over the ponded water area in the stand of CPW and over the irrigation dam. It is also likely that insects attracted to the sport field lights will attract microbat foraging.

The site may provide potential foraging habitat for a number of highly mobile threatened fauna including Grey-headed Flying-fox, Little Eagle, Square-tailed Kite and Varied Sittella. Such species may use the site infrequently during foraging. But habitat is considered marginal for these species and impacts to these species through loss of habitat is unlikely to result given the location of better quality habitat in the locality including Prospect Dam.

The field survey validated the 'top of bank' of Bungarribee Creek, a 2nd order stream in the Eastern Creek catchment. The creek is in moderate condition with patches of good quality riparian vegetation, but with limited fish habitat. *A Controlled Activity Approval (CAA) will be required for works within 40 m of top of bank.* A 20 m riparian buffer has been applied to Bungarribee Creek in accordance with DPI Water's riparian guidelines. The inner 50% of this buffer is to be restored as a fully structured riparian community. Any non-riparian corridor uses of the outer 50% will require 1:1 offsetting elsewhere along the corridor to maintain an average 20 m width on each side measured from the top of bank. *The proposed development will not have a significant impact on threatened species under the Fisheries Management Act.*

In summary, the proposed masterplan will result in the following impacts:

Impacts resulting from the construction of Site A (proposed outdoor sporting facilities):

- Removal of 0.66 ha of TSC Act listed CPW

- Removal of 0.11 ha of TSC Act listed RFEF, to be offset within the riparian corridor
- Removal of 5 hollow-bearing stags and 2 hollow-bearing trees.
- Removal/modification of 3.98 ha of exotic grassland

Impacts resulting from the construction of Site B (Seniors Living Village):

- Removal of 0.24 ha of planted vegetation
- Removal/modification of 2.56 ha of exotic grassland

An assessment of significance under Section 5A of the *Environmental Planning and Assessment Act 1979* was undertaken for the following endangered ecological communities and threatened species:

- Cumberland Plain Woodland
- River-flat Eucalypt Forest
- *Meridolum corneovirens* (Cumberland Plain Land Snail - CPLS),
- Microbats including *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail-bat), *Scoteanax tasmaniensis* (Greater Broad-nosed Bat) *Myotis macropus* (Large-footed Myotis) and *Falsistrellus tasmaniensis* (Eastern False Pipistrelle).

No significant impacts to these threatened species and endangered ecological communities are likely to result from the proposed masterplan.

Mitigation measures include:

- Retention and protection of identified CPLS habitat
- Offsetting impacts to Bungarribee Creek through restoration of RFEF (including the of 304 m² of new or offset through implementation of a VMP.
- Installation of microbat boxes throughout the retained vegetation to offset the loss of stags and hollow-bearing trees from the site.
- Sediment and pollutant controls, and management of the hydrological regime.

1. Introduction

1.1 Study area

The location of the study area is shown in **Figure 1**, and is bounded by Reservoir Road to the east, Penny Place to the south, Walters Road to the west and Holbeche Road to the north. Adjacent existing land use is industrial and includes large warehouses. The BWSC is located on Reservoir Road, with a hotel to the immediate north and a restaurant further north at the corner of Holbeche Road and Reservoir Road.

The study area is within the Blacktown City Council LGA. Under the Blacktown LEP 2015, the site is zoned IN1 General Industrial and IN2 Light Industrial in the western half and RE2 Private Recreation in the eastern part. Bungarabee Creek flows in a north-westerly direction through the north-west corner of the site and is zoned W1 Natural Waterways.

1.2 Description of project

Blacktown Workers Sports Club (BWSC) have appointed Paynter Dixon Constructions Pty Ltd (PDC) to prepare a Masterplan for the lands owned by the BWSC. Eco Logical Australia (ELA) have been engaged by PDC to prepare a Flora, Fauna and Aquatic Assessment of the proposed Masterplan.

Previous ecological assessments of the site were undertaken between 1998 and 2006 for proposed sporting fields and later for an industrial development, neither of which eventuated. Under the current Masterplan for the BWSC land, two main components are proposed - improved sporting facilities (Site A) and a seniors living residential development (Site B) as shown in **Figure 2**.

More specifically, the Masterplan will involve the following works:

Site A:

- Soccer and rugby league grandstand
- Two full-sized soccer fields
- Two under-nines soccer fields
- Two synthetic cricket pitch
- Childs play ground
- Two cricket nets and store
- Restoration of Bungarabee Creek through a Vegetation Management Plan (VMP) including additional offset areas for impacts to the riparian zone.
- Pedestrian paths and bridges including one crossing of Bungarabee Creek
- Two rugby league fields
- Two new car parks
- Private road (boom-gated)

Site B

- 10 residential buildings containing approximately 800 units constructed within Site B on the corner of Penny Place and Reservoir Road, including an internal private road and pedestrian paths
- New private road to access Site B

This report will be used for the following purposes:

- Planning Proposal on Site A land – to amend Blacktown LEP 2015 to include 'recreation facility (outdoor)' to enable the development of sports fields and associated facilities.
- Development Application on Site A land - for proposed outdoor sports facilities.
- Site Compatibility Certificate on Site B land - for Seniors Living Village.

1.3 Key terms

The “subject site” is defined by this report as the area directly impacted by the proposed masterplan as shown later in the report in **Figure 14**.

The “study area” is defined as the subject site and surrounding areas that may be indirectly impacted by the proposal such as edge effects, and changes in light and hydrology. The boundaries of the study area are shown in **Figure 1**.

“Survey area” refers to the area shown on the locality map (**Figure 1**), and includes areas outside of the study area that may have been surveyed during the site inspection if necessary to determine vegetation type and condition.

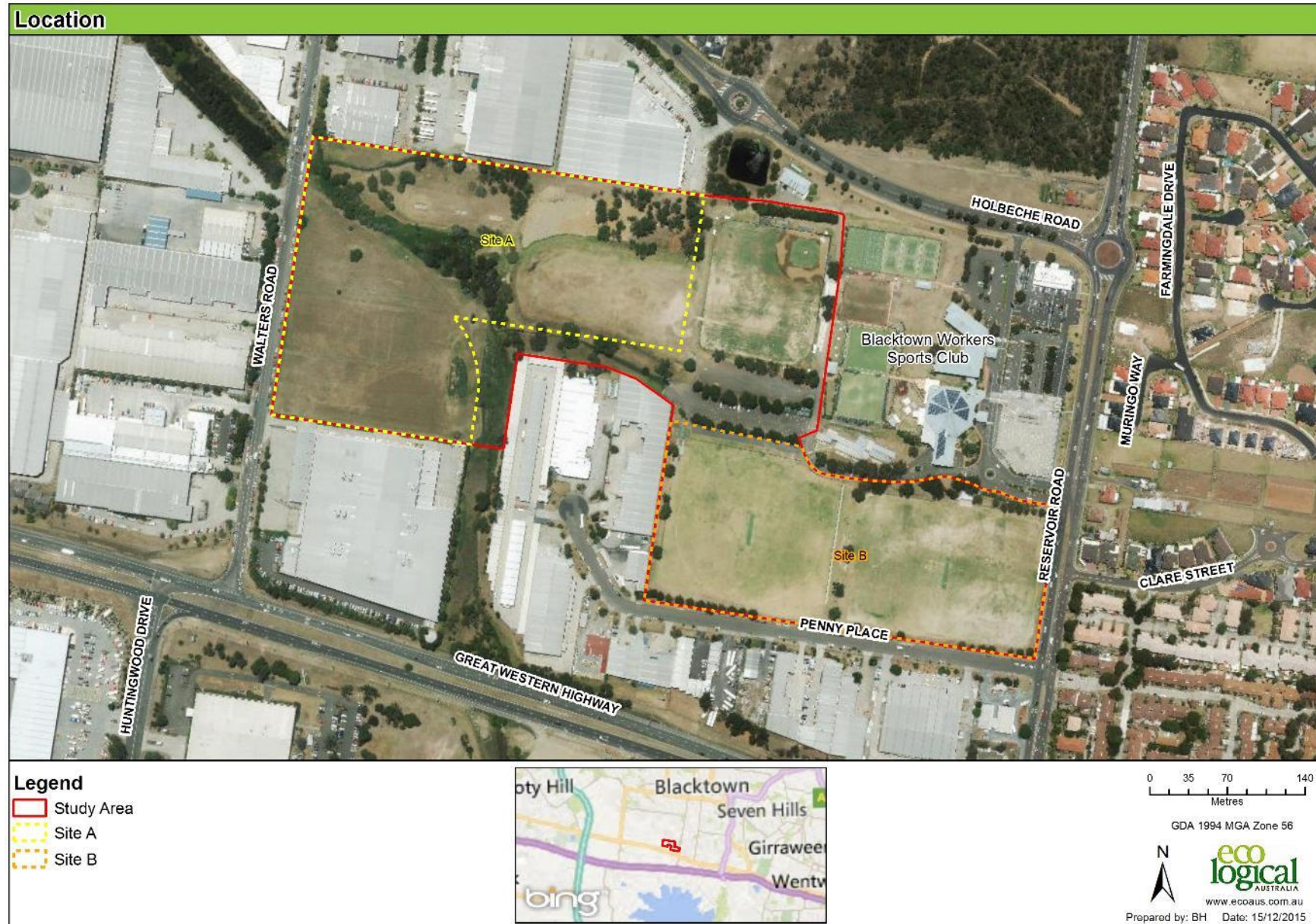


Figure 1: Locality map of the study area at the Blacktown Workers Sports Club.



2 Legislative Context

Name	Relevance to the project
Commonwealth	
<i>Environmental Protection and Biodiversity Conservation Act 1999</i>	Matters of National Environmental Significance (MNES) previously recorded within a 5km radius of the subject site were identified via a search of the Protected Matters Search Tool (PMST). During the site inspection, no MNES were detected on the site. The Grey-headed Flying-fox is a federally listed species that may infrequently visit the site. However, the small amount of potential foraging habitat at the site is not considered important habitat for this species and its removal will have a negligible impact on the species, given the species is highly mobile and more suitable habitat occurs within the region. Therefore, no assessment under the EPBC Act is required and a referral to the Commonwealth Department of Environment is not required.
State	
<i>Environmental Planning and Assessment Act 1979</i>	The NSW EP&A Act is the principal planning legislation for the state, providing a framework for the overall environmental planning, and assessment of development proposals. The proposed development requires consent from Blacktown City Council under Part 4 of the EP&A Act. This report addresses the assessment of significance for impacts to threatened species and endangered ecological communities in accordance with s5A of the Act and concludes that there are no significant impacts likely to result from the proposal. Under section 5A of the EP&A Act the consent authority is to consider whether the development is likely to have a significant impact on endangered ecological communities, endangered populations or threatened species listed in the TSC Act and FM Act.
<i>Threatened Species Conservation Act 1995</i>	The land on which the development is proposed is not biodiversity certified under s126 of the TSC Act and therefore impacts to threatened species and endangered ecological communities listed under the TSC Act are required in accordance with s5A of the EP&A Act.
<i>Noxious Weeds Act 1993</i>	The site contains seven Class 4 weeds listed under the NW Act. Class 4 weeds <i>must not be sold, propagated or knowingly distributed</i> .
<i>Fisheries Management Act 1994 (FM Act)</i>	The FM Act lists threatened aquatic species which require consideration when addressing the potential impacts of a proposed development. If a proposed development is likely to significantly affect a threatened species, population or their habitats, a SIS is required to be prepared. No waterways on site are mapped as Key Fish Habitat by NSW Fisheries, therefore, Part 7 permits under the FM Act do not apply (e.g. permit to dredge, reclaim or block fish passage).

<i>Water Management Act 2000 (WM Act)</i>	A controlled activity approval under the WM Act is required for certain types of developments and activities that are carried out in or on waterfront land, which is land within 40 m of a river, lake or estuary. The NSW Department of Primary Industries – Water (DPI Water) have prepared guidelines for riparian corridors on waterfront land, including guidance on vegetated riparian zones (VRZ) and infrastructure development within this area. The study area contains Bungarribee Creek, a 2nd order ‘river’ under the WM Act. This report outlines the requirements of the WM Act and the guidelines conducive to ensure the protection of riparian corridors and to inform discussions with DPI Water, ahead of applying for a Controlled Activity Approval.
Planning Instruments	
Blacktown LEP 2013	The study area is zoned IN1 General Industrial, IN2 Light Industrial, RE2 Private Recreation and W1 Natural Waterways under the Blacktown LEP. Bungarribee Creek is zoned as Zone W1 Natural Waterways as shown in Figure 9. 1) Objectives of zone • To protect the ecological and scenic values of natural waterways. • To prevent development that would have an adverse effect on the natural values of waterways in this zone. • To provide for sustainable fishing industries and recreational fishing. • To enable works associated with the rehabilitation of land towards its natural state. 2) Permitted without consent • Environmental protection works 3) Permitted with consent • Environmental facilities; Flood mitigation works; Recreation areas 4) Prohibited Business premises; Hotel or motel accommodation; Industries; Multi dwelling housing; Recreation facilities (major); Residential flat buildings; Restricted premises; Retail premises; Seniors housing; Service stations; Warehouse or distribution centres; Any other development not specified in item 2 or 3. As such, the proposed recreational facilities (if considered to be major) are prohibited within the W1 zone. However this assessment report is being used to support a planning proposal on Site A land to amend Blacktown LEP 2015 to include 'recreation facility (outdoor)' to enable the development of sports fields and associated facilities. Clause 7.2 Terrestrial Biodiversity layer applies to parts of the site as shown in Figure 3.

	For land mapped as “Biodiversity” the consent authority must consider whether the development will have: (i) <i>any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and</i> (ii) <i>any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and</i> (iii) <i>any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and</i> (iv) <i>any adverse impact on the habitat elements providing connectivity on the land, and</i> <i>Any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development</i> These issues are addressed within this report in Section 6.8.
Blacktown DCP 2013	Part E addresses development in the Industrial Zones.



Figure 3: Terrestrial Biodiversity Layer (Clause 7.2 Blacktown LEP 2015) that applies to parts of the site.

3 Methods

3.1 Literature review

3.1.1 Database searches

A desktop literature review was undertaken to identify threatened species, populations and ecological communities listed under the TSC Act and the EPBC Act that could potentially occur within the study area. The following documentation and mapping was reviewed:

- Topographic maps
- Aerial photographs (Google Earth, Six Maps and Nearmap)
- A search of the NSW OEH Bionet database, which includes previous records of threatened and migratory listed under the TSC Act and the EPBC Act
- A 5km radius search of the Protected Matters Search Tool (PMST) (EPBC Act)
- FM Act listed protected and threatened species and populations, including species profiles, 'Primefact' publications and expected distribution maps
- NSW DPI threatened and protected species records viewer
- Western Sydney Vegetation Mapping (NPWS 2002)
- Other relevant projects previously undertaken by ELA in the locality.

Searches of the Atlas of NSW Wildlife (Bionet), FM Act listed species and the online EPBC Act Protected Matters Search Tool were performed on 2 November 2015. Searches used a radius of 5 km around the study area (Bionet), the coordinates -33.792953, 150.891871 (EPBC Act Protected Matters Search Tool) and the Hawkesbury-Nepean catchment (FM Act listed species).

Species from the database searches were combined to produce a list of threatened fauna and flora species that may potentially utilise the study area, with an assessment of the likelihood of occurrence for each species included in **Appendix A**. The likely occurrence of each species was determined before field survey by reviewing records in the area, considering the habitat available and using expert knowledge on the ecology of each species. This was then reviewed following field survey.

Five terms for the likelihood of occurrence of species are used in this report, as defined below:

- "known" = the species was or has been observed on the study area
- "likely" = a medium to high probability that a species uses the study area
- "potential" = suitable habitat for a species occurs on the study area, but there is insufficient information to categorise the species as likely, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the study area
- "no" = habitat at study area and in the vicinity is unsuitable for the species.

3.1.3 Previous ecological studies

Two developments have been previously proposed for the study area. In 1998 it was proposed for creation of a trunk drainage system, earthworks and filling to create playing fields and in 2006 for an industrial development (warehouses). Neither development eventuated. Therefore, a number of ecological assessments have already been conducted for the site. These reports are listed below and have been reviewed as part of this assessment.

The site condition appears to have deteriorated since these reports were prepared. Previously there was only three recorded hollow-bearing trees, yet these were not mapped or located in the 1998 report (Environmental and Land Management Consultants 1998). At present, there are a large number of hollow-bearing trees and stags due to the flooding of the woodland from the irrigation dam overflow and dumping of fill. Also, previous studies indicated that the CPW on the site contained an understorey, which is now absent and regularly slashed, apart from the small steep section of CPW immediately adjacent to the irrigation dam.

Environmental and Land Management Consultants (1998). *Flora and Fauna Assessment Report, Proposed Development Lot 14 Section 4 DP 818679 Walters Road, Blacktown.*

- Assessment was only undertaken within the current proposed site A (sporting fields);
- Vegetation transects were undertaken in both vegetation communities
- Methodology included full fauna survey - call playback (for owls and marbled frogmouth), spotlighting, Elliot (small mammal) traps (over 2 trap nights), large mammal cage traps over 2 nights, anabat recording (2 consecutive nights) and habitat searches
- Vegetation was determined to be CPW with high weed invasion and RFEF along the creekline (which at that time was not a listed EEC under the TSC Act).
- Recorded three hollow-bearing trees but the location is not shown.
- Did anabat survey but only recorded *Mormopterus* sp.
- States that suitable habitat is present for a number of threatened fauna species including mobile species Square-tailed Kite, Glossy Black Cockatoo, Swift Parrot, Superb Parrot, Painted Honeyeater, Regent Honeyeater, Yellow-bellied Sheath-tailed bat, Eastern Little Mastiff-bat, Little Bent-wing Bat, Common Bent-wing Bat, Greater Broad-nosed Bat and less mobile species such as Green and Golden Bell Frog, Giant Burrowing Frog, Squirrel Glider, Koala and CPLS.
- Recorded Grey-headed Flying Fox on the site.
- A SEPP44 Koala Habitat Assessment concluded that the site contained potential koala habitat, but not core koala habitat.
- No threatened flora were detected on site, however a number were still considered to have suitable habitat on site including *Acacia pubescens*, *Darwinia biflora*, *Dillwynia tenuifolia*, *Micromyrtus minutiflora*, *Persoonia nutans*, *Pimelea spicata*, *Pultenaea parviflora*,
- Concluded that no significant impacts would result from the removal of vegetation for creation of the sporting fields.

Gunninah Environmental Consultants (2001). *Lot 14 Section 4 DP818679 Walters Road, Blacktown Proposed Industrial Development- Flora and Fauna Assessment. Report prepared for Paynter Dixon Constructions*

- Proposed development involved removal of vegetation and diversion of the creek, earthworks and filling to allow construction of industrial warehouses.
- Methodology included call playback, anabat detector, spotlighting and diurnal herpetofauna and bird census, targeted searches for CPLS.
- Confirmed vegetation communities as Cumberland Plain Woodland and Sydney Coastal River-flat Forest (both TSC Act listed EECs).
- Recorded a few small tree-hollows in the CPW (but too small for parrots, forest owls and arboreal mammals).
- No threatened flora or fauna species were recorded.
- Habitat for threatened birds was considered to be relatively limited on the study area when compared with larger bushland patches throughout western Sydney, including the nearby Prospect Reservoir catchment area.

- Habitat for threatened reptiles are not present on the study area (eg. Heath monitor).
- Threatened mammal species are unlikely to use the site, except for individuals of some threatened microbats which are highly mobile and wide-ranging.
- Resources for Grey-headed Flying Fox are extremely limited on the study area consisting only of a few flowering eucalypts which may provide occasional nectar for individuals of this species.
- CPLS was not detected and was considered highly unlikely to be present
- Concluded that no significant impacts would result from the removal of vegetation for the proposed industrial development.

Marine Pollution Research Pty Ltd (2002). *Proposed Bungarribee Creek Diversion Lot 14 DP 8796 Walters Road Arndell Park, Aquatic Ecological Survey*. Report prepared for Gunninah Environmental Consultants Pty Ltd.

- Report prepared to address NSW Fisheries letter requesting information on fish species and habitat within Bungarribee Creek, in response to the proposed diversion of the creek to allow for industrial development of the site.
- Fish trapping and macroinvertebrate sampling indicate that Bungarribee Creek provides suitable habitat for a variety of macroinvertebrate fauna, Long-finned Eel and potential habitat for native fish.
- During sampling, only the Plague Minnow and Long-finned Eel were observed.
- The presence of juvenile and adult carp in Bungarribee Creek suggests there is adequate fish passage from the Hawkesbury River up Eastern Creek to Bungarribee Creek.
- Bungarribee Creek within the study area should be rated as good aquatic habitat and minimal fish habitat.
- None of the fish listed as threatened under the Fisheries Management Act are likely to occur on the site given the degraded nature of the remnant creek habitats and the impassable nature of the cascade below the study area.
- The vulnerable Adams Emerald Dragonfly is unlikely to occur at the site.

Gunninah Environmental Consultants (2004). *Lot 14 Section 4 DP818679 Walters Road, Blacktown Proposed Industrial Development- Supplementary Biological Assessment*.

- Supplementary report to the original report of 2001 due to change in the proposed scope, whereby Bungarribee Creek will not be diverted and will be rehabilitated.
- A brief site inspection in 2004 revealed that no major alterations to the site of the condition of the vegetation present had occurred since the original investigation in 2001.
- Under the new proposal, the stand of Grey Box (CPW) in the north-eastern part of the study area is proposed to be retained and rehabilitated.
- The original conclusion in 2001 based on removal of all vegetation within the study area was “not-significant”. The altered proposal to retain rehabilitate the CPW in the north eastern part of the site and the RFEF along the creek will again be a non-significant impact.

A vegetation management plan for the retention and rehabilitation of Bungarribee Creek was prepared by Urban and Rural Design (2006) (updated 2008). Review of this report will be included in the VMP prepared to be prepared by ELA as part of the Controlled Activity Approval.

3.2 Field survey

A field survey was conducted on 3 November 2015 by ELA Ecologist Karen Spicer and Aquatic Ecologist Ian Dixon. The weather was cloudy, light winds with light drizzle (4mm recorded). The temperature during the survey was between 19-21 degrees.

The field survey consisted of validating vegetation communities and their condition, searching for threatened flora and Cumberland Plain Land Snail. A fauna habitat assessment was undertaken within the study area and opportunistic fauna sightings were noted. Fourteen person hours were utilised to complete the survey. Details of the aquatic/riparian methodology are detailed below.

On 25 and 26 November a nocturnal fauna survey was undertaken including Anabat detecting, stag watching and spotlighting. The weather on the 25th was hot, with a maximum temperature that day of 35 degrees. On the 26th, the survey was undertaken following a gusty southerly change which reduced the daytime maximum of 39 degrees to 19 degrees and strong winds during the survey period.

3.2.1 Vegetation community and condition assessment

Vegetation mapping was undertaken using aerial photography, and ground-truthing of the Western Sydney Vegetation Mapping (NPWS 2002). A description of the vegetation community including species present and condition were assigned to each mapped polygon. The accuracy of the mapped boundaries by NPWS 2002 was determined and validated along with consideration of EEC listed under the TSC and EPBC Acts.

The definition of EECs on the Cumberland Plain for TSC Act listed communities often includes highly degraded patches of vegetation. However, the Commonwealth definition of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest is much more restrictive in the vegetation that will meet this definition (**Table 1**). An assessment was conducted during the field survey to determine if remnant or planted CPW vegetation satisfied the definition of the under the EPBC Act.

The table below outlines the EPBC Act condition thresholds for patches that meet the description for the community criteria. The condition thresholds were applied to vegetation surveyed within the study area to determine the appropriate condition code.

Table 1: EPBC categories and thresholds for Cumberland Plain Woodland / Shale-Gravel Transition Forest

Category and Rationale	Thresholds
A. Core thresholds that apply under most circumstances: patches with an understorey dominated by natives and a minimum size that is functional and consistent with the minimum mapping unit size applied in NSW.	Minimum patch ¹ size is ≥ 0.5 ha; AND $\geq 50\%$ of the perennial understorey vegetation cover ² is made up of native species.
OR	
B. Larger patches which are inherently valuable due to their rarity.	The patch size is ≥ 5 ha; AND $\geq 30\%$ of the perennial understorey vegetation cover is made up of native species.
OR	
C. Patches with connectivity to other large native vegetation remnants in the landscape.	The patch size is ≥ 0.5 ha; AND $\geq 30\%$ of the perennial understorey vegetation cover is made up of native species; AND The patch is contiguous ³ with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) that is ≥ 5 ha in area.
OR	
D. Patches that have large mature trees or trees with hollows (habitat) that are very scarce on the Cumberland Plain.	The patch size is ≥ 0.5 ha in size; AND $\geq 30\%$ of the perennial understorey vegetation cover is made up of native species; AND The patch has at least one tree with hollows per hectare or at least one large tree (≥ 80 cm dbh) per hectare from the upper tree layer species outlined in the Description and Appendix A.

¹ A *patch* is defined as a discrete and continuous area that comprises the ecological community, outlined in the Description. Patches should be assessed at a scale of 0.04 ha or equivalent (e.g. 20m x 20m plot). The number of plots (or quadrats or survey transects) per patch must take into consideration the size, shape and condition across the site. Permanent man-made structures, such as roads and buildings, are typically excluded from a patch but a patch may include small-scale disturbances, such as tracks or breaks or other small-scale variations in native vegetation that do not significantly alter the overall functionality of the ecological community, for instance the easy movement of wildlife or dispersal of spores, seeds and other plant propagules.

² Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers (as outlined in the Description and Appendix A) with a life-cycle of more than two growing seasons (Australian Biological Resources Study, 2007). Measurements of perennial understorey vegetation cover exclude annuals, cryptogams, leaf litter or exposed soil (although these are included in a patch of the ecological community when they do not alter functionality as per footnote 3 and the Description and Condition Thresholds are met).

³ Contiguous means the woodland patch is continuous with, or in close proximity (within 100 m), of another patch of vegetation that is dominated by native species in each vegetation layer present.

Source: DEWHA (2009a) Advice to the Minister for the Environment, Heritage and the Arts from the Threatened Species Scientific Committee (the Committee) on an Amendment to the List of Threatened Ecological Communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

3.2.2 Fauna Survey and Habitat Assessment

Fauna surveys occurred as part of the habitat assessment and, apart from a nocturnal survey, involved incidental sightings of fauna only, apart from a nocturnal survey. Searches for habitat considered appropriate for the presence of *Litoria aurea* (Green and Golden Bell Frog) occurred, particularly along the riparian area. All hollow bearing trees and stag trees were recorded across the site.

Targeted searches for *Meridolum corneovirens* (Cumberland Plain Land Snail - CPLS) and its habitat were undertaken. The CPLS can be surveyed all year round, although periods of inactivity may occur during drought when individuals may then burrow deeper into the soil profile. CPLS is most active at night and after rainfall of up to 40 mm when snails are attracted to the soil surface to forage. Timing of the field surveys was optimal (during rain), as the soil and leaf litter was moist.

CPLS surveys involved searching through loose leaf litter and scraping topsoil with hand trowels to a depth of approximately 5 cm at the base (or within 2 m) of preferred foraging and sheltering habitats including *Eucalyptus* trees within CPW, fallen debris, clumps of native grass and leaf litter. Both live CPLS and shells from dead CPLS are considered a positive record for this species.

Opportunistic observations of fauna were noted during the field survey. Potential fauna habitat resources associated with threatened species were recorded when present. These include:

- Foraging resources (i.e. sap feed trees, flowering trees and shrubs).
- Connectivity with other vegetation.
- Presence of hollow bearing trees, dead standing timbers (i.e. stags) and/or coarse bark.
- Accumulation of leaf litter.
- Large woody debris.
- Presence of standing or flowing water bodies.
- Rocks and rocky outcrops.
- Disturbance history.

Nocturnal fauna survey

A nocturnal fauna survey was undertaken by two ELA ecologists across two consecutive nights on 25 – 26 November 2015. The surveys targeted threatened mammals in particular, microchiropteran bats, and were undertaken in accordance with the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004). Detailed methodology undertaken is shown in **Table 2**. The location of bat detectors (Anabat units) and survey effort are shown in Figure 4. **Error! Reference source not found.**

Anabat 1 was located next to the artificially flooded area within the woodland. Anabat 2 was located west of Anabat 1 adjacent to Walters Road, facing the edge of riparian vegetation on Bungarribee Creek. Earth works was undertaken on 26 November within the woodland area near Anabat 1. The device was moved for the second night to ensure no damage to the device. The new location is mapped as Anabat 3. In summary:

- Anabat 1: 1 night 25/11
- Anabat 2: 2 nights 25-26/11
- Anabat 3: 1 night 26/11.

Conditions on the second night (26 November) were windy and cool which was not ideal for bat activity detection.

Table 2: Nocturnal fauna survey methodology

Guild/target species	DEC (2004) recommendations	ELA survey methodology
Nocturnal surveys	Spotlighting and stag watching to observe potential roost hollows for 30 minutes prior to sunset and 60 minute after sunset.	Two nights of spotlighting and stag watching surveys conducted by two ecologists, for 30 minutes prior to sunset and 60 minute after sunset.
Microchiropteran bats (Echolocation)	Two activated recording devices (Anabats) for the entire night (min of 4 hours) starting at dusk for two nights	Two Anabat units programmed to record through the entire night (6pm – 6am) over two consecutive nights.
Threatened mammals spotlighting surveys	Spotlight surveys along at least 2 x 200 m transects per 5 hectares, should be repeated on two separate nights where possible.	Two nights of spotlighting following stag watching, for an additional 30 minutes after sunset.

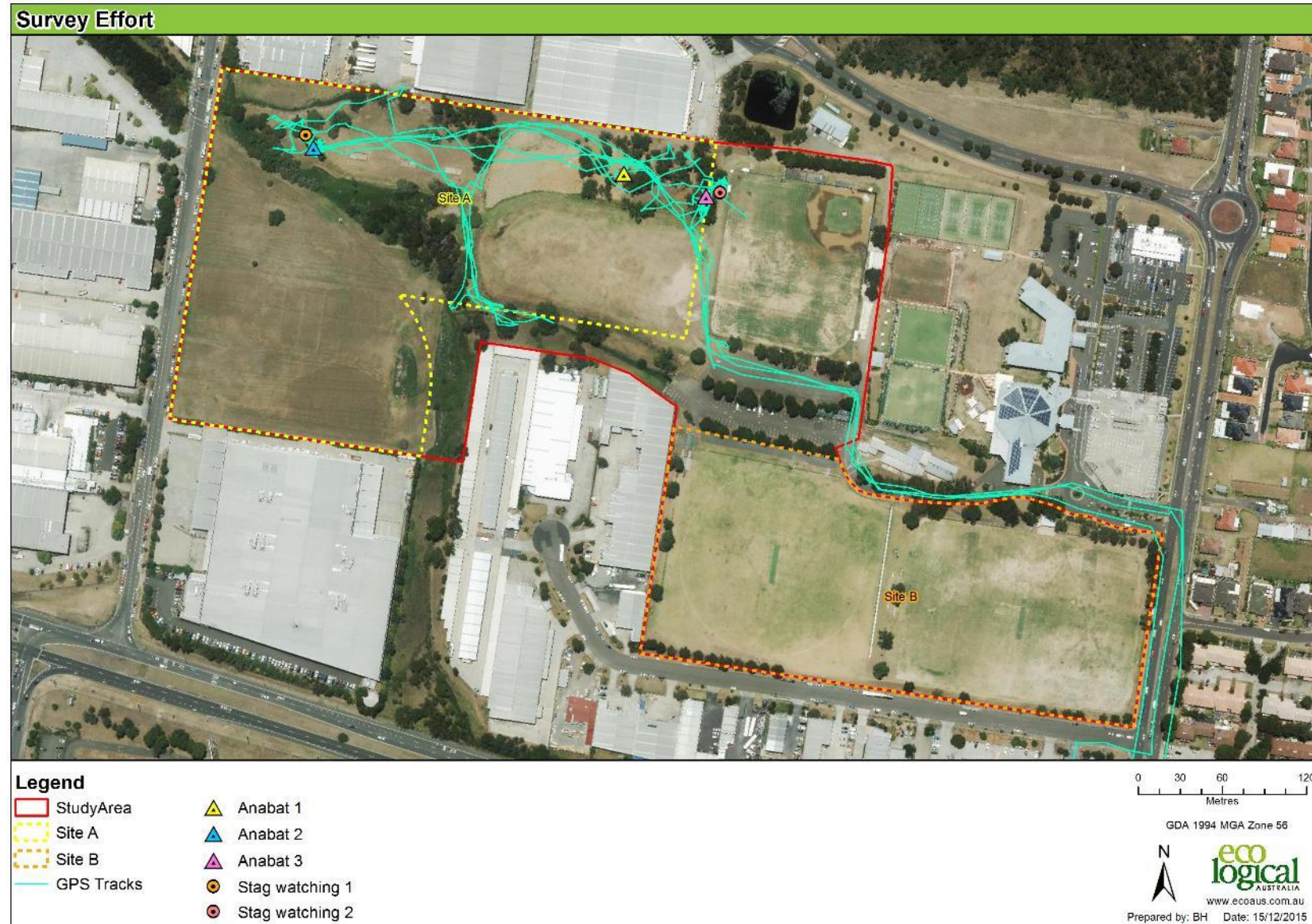


Figure 4: Survey effort and methodology for nocturnal survey.

3.2.3 Aquatic and riparian assessment

Riparian corridors were delineated from a combination of desktop and field-validated mapping. Desktop mapping used surveyed contour data and aerial imagery (Nearmap, Google Earth and Six Maps) to identify the likely top of bank for watercourses appearing on the 1:25,000 topographic map (Map Sheet 9030-2N Prospect). Field validation confirmed or adjusted the top of bank mapping. The creek was walked and mapped with a GPS unit (often ~1 m accuracy) on a Getac tablet. Accuracy decreased in dense vegetation cover (<5 m), and if necessary GPS points were adjusted post-field survey against the aerial mapping.

Each creek on the 1:25,000 map is classified using the Strahler stream order, which is a numerical measure of its branching complexity. Using this method, each stream receives a corresponding 'vegetated riparian zone' (VRZ) buffer in accordance with the DPI Water's *Guidelines for Riparian Corridors on Waterfront Land*. The VRZ on each side plus the channel make up the 'riparian corridor' (RC). VRZs are recommended for watercourses as a means of ensuring stability to the watercourse, improvement in nutrient filtering and water quality, and provision of habitat for terrestrial and aquatic fauna.

All land within 40 m of the mapped creeks is considered 'waterfront land' under the WM Act, unless consultation with DPI Water removes this requirement. The Guidelines recommend that a 1st order watercourse requires a 10 m riparian buffer; 2nd order 20 m; 3rd order 30 m; 4th order and greater 40 m. Buffers apply to each side of the waterway and are measured from the field-validated top of bank. Where a creek does not have a defined channel, bed and bank, or does not demonstrate geomorphic river processes, the creek may not meet the definition of a 'river' under the WM Act. However, this does not always apply if there is a defined channel further upstream.

The waterway was visually assessed and rated as excellent to poor using aquatic, riparian and geomorphic indicators of stream health.

3.5 Limitations

A comprehensive flora and fauna survey was not conducted due to the existing degraded condition of the site. According to the *Vertebrate Fauna Survey* conducted for the NSW Comprehensive Regional Assessment (NPWS, 1998) an intensive survey should utilise a variety of survey methodologies and include varying climatic and seasonal conditions to produce an extensive census of fauna and flora species within the subject area. However, the methodologies used in this study were considered adequate given previous ecological assessments of the study area and disturbance history.

Except where specifically noted, the top of bank survey was undertaken using hand-held GPS units. It is noted that these units can have errors in the accuracy of the locations taken of approximately 20 m (subject to availability of satellites on the day). Contours and aerial mapping were used to crosscheck all data points.

It should be noted that the species list (**Appendix B** and **Appendix C**) is not an exhaustive list of species present in the study area. Some species may not have been present in the aboveground flora or were difficult to detect due to lack of suitable reproductive material.

4. Existing environment

4.1 Database and literature review

4.1.1 Landscape context

Landscape and soils

The study area is relatively level to gently undulating with a number of filled and levelled areas including existing playing field in the south east (Site B proposed seniors living residential development). An area of levelled fill has been placed in proposed Site A (Sporting fields) to the south an existing patch of CPW. Stockpiles of fill have also been dumped within this patch of CPW as shown in **Figure 5**.

The Penrith 1:100 000 Geological Series Sheet 9030 shows the site occurring within the Middle Triassic, Wianamatta Group Bringelly Shale Formation. This formation weathers over time to form silty clay soils with trace sand and occasional ironstone gravel bands or lenses (Brink & Assoc. 2007).

The site occurs within the Blacktown residual landscape. This soil landscape is characterised by gently undulating rises on Wianamatta Group Ashfield Shales. Dominant soils include brownish black loam to clay loam with low to moderate fertility and moderate erosion hazard (Chapman and Murphy 1989).

Brink and Associates (2007) confirmed a residual soil profile overlaying shale bedrock at the site. Alluvial soils were encountered adjacent to Bungarribee Creek and the drainage line that enters the creek from the east (Brink & Assoc. 2007).

Watercourses and drainage

One waterway is identified on the 1:25,000 drainage map (**Figure 7**). Bungarribee Creek is a 2nd order stream that dissects the site, flowing from the south (Great Western Hwy) to north-west (Walters Rd). When compared to aerial photography taken in 1977 and 2014 (<http://maps.blacktown.nsw.gov.au/>), the alignment of the creek is substantially different to the coarse topographic drainage map which leaps from the main channel to a side tributary (**Figure 8**).

Bungarribee Creek flows into Eastern Creek approximately 3.5km north west of the site. Both creeks form part of the South Creek drainage basin which discharges into the Hawkesbury River at Windsor. Bungarribee Creek is approximately 4 km long and has a catchment of 700 ha. The headwaters occur to the south of the study area in semi-rural land as shown in the hydroline map (**Figure 7**). An unnamed open drainage channel extends from the western edge of the existing carpark and flows into Bungarribee Creek. This drainage channel is piped from the edge of the carpark to the east.

Council have mapped the general alignment of the creek as W1 – Natural Waterways, although the actual location of the creek and its riparian vegetation slightly exit the W1 zone on its bend (**Figure 8**).

No waterways within the study area are mapped as 'Key Fish Habitat' by NSW Fisheries.

An irrigation dam that was constructed in the 1970s is located west of the maintenance shed near Holbeche Road. The overflow of this dam is piped underground and is discharged into the central area of woodland vegetation as shown in **Table 6**.



Figure 5: Areas of fill and ponded water within the central woodland area.



Figure 6: The outlet from the irrigation dam drains into the central woodland area and forms an area of ponded water.

Desktop Waterway Review



Figure 7: The hydroline 1:25 000 map of the site



Figure 8: Field-validated top of bank and riparian zone buffer

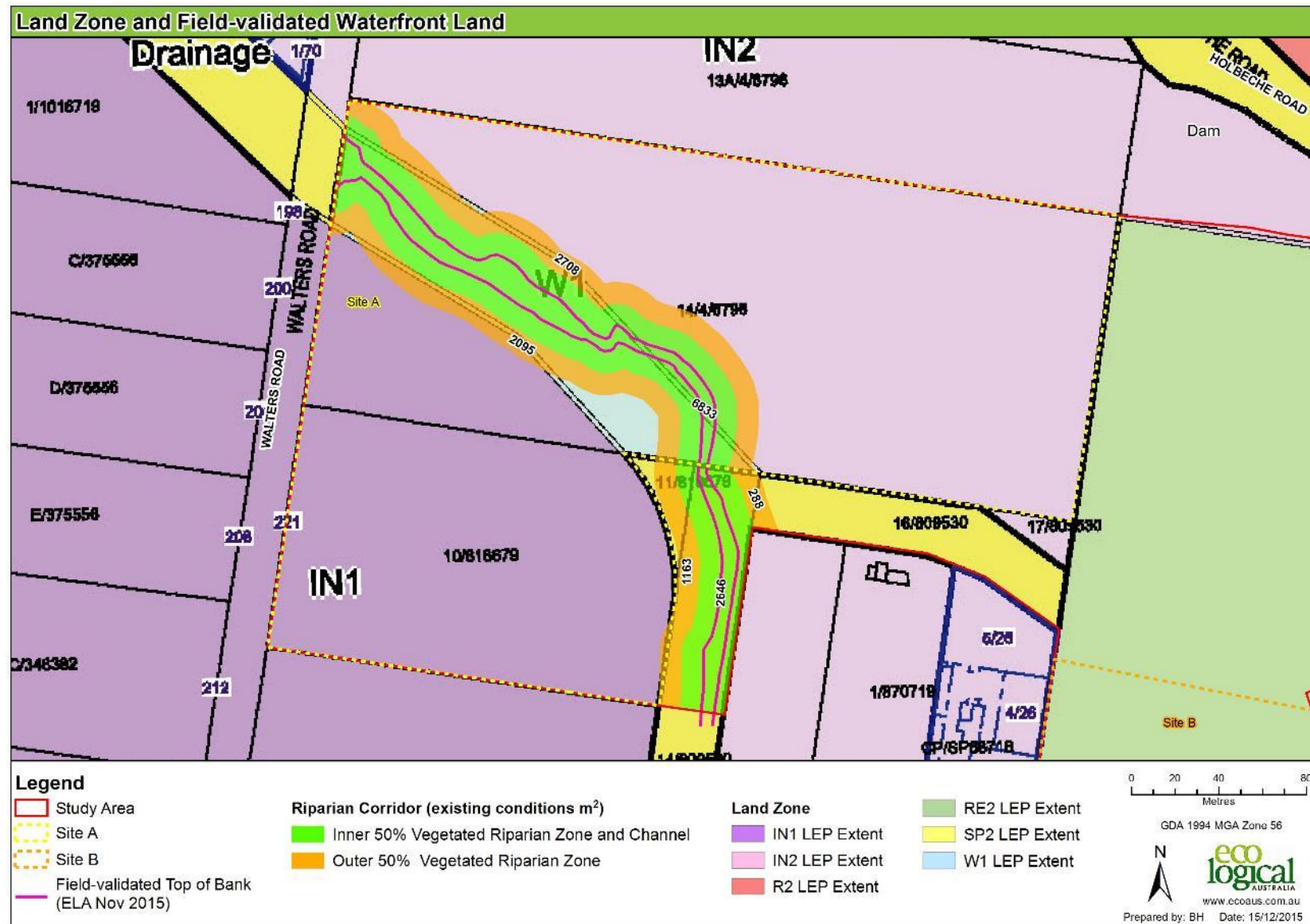


Figure 9: Validated location of Bungarribee Creek and the existing W1 Natural Waterways zoning.

Land use

Previous land use is discussed in a heritage advice report to Paynter Dixon (2015) and includes:

- The study area formed part of the original 2000 acre land grant taken up by John Campbell in 1822
- Prior to 1930, a farm house and associated outhouses were constructed on the north and south side of Bungarribee Creek
- Poultry and pig farming either side of Bungarribee Creek.
- Market gardens within the study area
- Extensive clearing resulted but some areas of CPW as they Alluvial Woodland were retained.
- By the 1970s, sporting fields were created within the south-eastern portion of the study area and buildings were constructed in the current location of the Blacktown Sports Workers Club.

4.1.2 Threatened ecological communities

Broad-scale vegetation mapping (NPWS 2002) showed that the study area was mapped as Shale Plains Woodland and Alluvial Woodland (**Figure 10**). Shale Plains Woodland is a sub-community of Cumberland Plain Woodland (CPW), a critically endangered ecological community (TSC Act and EPBC Act assuming criteria are met, see Section 3.3). Alluvial Woodland is consistent with the endangered ecological community River Flat Eucalypt Forest (RFEF) listed under the TSC Act.

4.1.3 Threatened flora

The desktop literature review identified a total of 13 threatened flora species listed under the TSC and/or EPBC Acts, which have been recorded within a 5 km radius of the study area (see **Appendix A**).

No threatened flora species have been previously recorded on the study area. The closest records are:

- *Persoonia nutans* – 400 m east (collected in 1802 as a RBG specimen)
- *Pterostylis saxicola* - 400 m east (collected in 1804)
- *Pimelea spicata* – 2 km southeast at Prospect Reservoir (many clustered records from 1993 – 2013).

4.1.4 Threatened fauna

The desktop literature review identified a total of 33 fauna species consisting of 28 threatened fauna and 5 migratory birds. The threatened fauna included 13 bird species, 10 mammals, 1 reptile, 3 amphibians and 1 invertebrate listed under the TSC and/or EPBC Acts, which have been recorded within a 5 km radius of the study area (see **Appendix A**).

No threatened fauna species have been previously recorded within the study area. The closest records in relation to the study area are:

- Green and Golden Bell Frog – 2km southeast on the edge of Prospect Reservoir (observed in 1967).
- Little Eagle – 1.5 km southeast at Prospect Reservoir (observed in 1999).
- Square-tailed Kite – 6 km southwest (observed in 2008)
- Swift Parrot – 600 m southeast (observed 2001)
- Latham's Snipe – one record, 3.5km south at Prospect Dam (observed in 1989)
- Varied Sittella – Around Prospect Dam in 1989, 1999 and 2011)
- Grey-headed Flying-fox – 200 m southwest (observed 2004)
- *Mormopterus norfolkensis* (Eastern Freetail-bat) – several records around Prospect Dam in 2011.
- Eastern Bentwing-bat – many records around Prospect Dam in 2011
- *Myotis macropus* (Southern Myotis) – Prospect Dam in 2011

- Eastern False Pipistrelle – one record 5km northwest in 2012
- Little Bentwing-bat – 3.5 km northwest recorded with Anabat in 2015.
- Greater Broad-nosed Bat – 3 km southwest on Eastern Creek in 2006.
- Cumberland Plain Land Snail – approximately 200m north from the irrigation dam at the study area on the northern side of Holbeche Road (observed in 2008) and 250 m south on the southern side of the Great Western Highway (observed in 2005) and several records around Prospect Dam from 2011.

4.1.5 Threatened aquatic fauna

A review of the NSW Fisheries database of threatened species found that none have been recorded within the Blacktown LGA. The Protected Matters Search Tool (PMST) for species listed under the EPBC Act returned *Macquaria australasica* (Macquarie Perch) and *Prototroctes maraena* (Australian Grayling) as potentially occurring within a 5 km radius of the site.



Figure 10: Western Sydney vegetation mapping of the study area and surrounding area (NPWS 2002).

5. Field survey results

5.1 Vegetation communities

The vegetation survey validated the vegetation within the site as two native vegetation communities as shown in **Figure 11**:

- Alluvial Woodland, which is consistent with the endangered ecological community River-flat Eucalypt Forest (RFEF) (TSC Act listed); and
- Shale Plains Woodland (CPW), which is a sub-community of the critically endangered ecological community Cumberland Plain Woodland (CPW) (TSC Act listed).

A third community was mapped as Planted Eucalypts and Casuarina. The remainder of the site (unmapped) was exotic grassland.

Alluvial woodland

Alluvial Woodland was mapped along the Bungarribee Creek and extended along the eastern unnamed drainage line. The condition of the vegetation is discussed in Section 5.4. The dominant canopy species included *Melaleuca styphelioides*, *Melaleuca decora*, *Casuarina glauca* and *Eucalyptus tereticornis*. The structure and condition of the Alluvial Woodland along Bungarribee Creek is discussed in Section 5.4.

Alluvial Woodland was degraded along the eastern unnamed drainage line and consists of large canopy species of *Eucalyptus amplifolia*, *Eucalyptus tereticornis*, and *Melaleuca styphelioides*. The ground cover is regularly slashed and there is a lack of native understorey and groundcover.

Shale plains woodland

The vegetation within the Shale Plains Woodland consisted of two patches located along the northern boundary of proposed Site A and the south west edges of the irrigation dam, all located within the western half of the study site (Site A). The central patch is located within an artificially flooded area, as an overflow pipe from the irrigation dam flows into this area and had created a small area of ponded water (**Figure 6**). Other regular disturbances including slashing of the ground cover, soil disturbance and dumping of fill has led to a decline in the tree health, with many dead standing trees, which are referred to in this report as stags.

The trees within the western patch of Shale Plains Woodland were in better health but like the central patch, the ground cover has been regularly slashed. The woodland around the south west slope of the irrigation dam appears to be regrowth, as the trees are smaller. This section of woodland has not been slashed and contained leaf litter, understorey and ground cover species.

Dominant canopy species within the Shale Plains Woodland included *Eucalyptus moluccana* (Grey Box), *Eucalyptus tereticornis* (Forest Red-gum) and *Eucalyptus crebra* (Narrow-leaved Ironbark), which occasional *Angophora floribunda* (Rough-barked Apple), *Angophora subvelutina* and *Casuarina glauca*.

No understorey species were present within the central and western patch except for a small number of wetland plants that have established around the ponded area including *Cyperus* sp. *Persicaria decipiens*, *Typha domingensis* (Narrow-leaved Cumbungi), *Juncus usitatus* (Common Rush) and *Schoenoplectus validus*. *Araujia sericifera* (Moth Vine) occurred around the base of some trees.

The ground cover was dominated by exotic grasses including *Paspalum dilatatum* (Paspalum) and *Pennisetum clandestinum* (Kikuyu). Other herbs and ground covers included the natives *Dichondra*

repens (Kidney Weed), *Einadia trigonos* (Fishweed), *Glycine tabacina*, and exotic species *Sida rhombifolia*, *Plantago lanceolata*, *Bidens pilosa*, and *Anagallis arvensis* (Scarlet Pimpernel).

The understorey within the woodland near the irrigation dam included the weed species *Lycium ferocissimum* (African Box Thorn), *Ligustrum lucidum* (Large-leaf Privet), *Ligustrum sinense* (Small-leaf Privet), *Lantana camara* (Lantana), *Cotoneaster glaucophyllus*, *Olea europaea* subsp. *cuspidata* (African Olive) and the native species *Acacia falcata* and *Bursaria spinosa*. The groundcover consisted of the weed species *Briza subaristata*, *Ehrharta erecta*, *Sida rhombifolia*, *Vicia angustifolia*, and *Verbena bonariensis*, and the native species *Bothriochloa macra*, *Desmodium varians* and *Dichondra repens*,

Planted Eucalypts and Casuarina

Planted Eucalypts and Casuarina are mapped within the central carpark area, landscaped areas along the entrance into the Sports Club and around the periphery and central section of the playing fields. These species have been planted and are mown and grow upon filled areas and are not a native vegetation community. The tree species included *Eucalyptus microcorys* (Tallowwood), *Casuarina glauca* (Swamp Oak), *Eucalyptus grandis* (Flooded Gum), *Corymbia gummifera* (Red Bloodwood), *Lophostemon confertus* (Brushbox), *Grevillea robusta* (Silky Oak) and *Pinus* sp.



Figure 11: Validated vegetation mapping, locations of hollow-bearing trees and CPLS habitat.

5.2 Flora

The field survey undertaken within the study area identified 74 flora species, comprised of 25 native species, 10 non-endemic planted native species, and 38 exotic species. A flora list for the study area is presented in **Appendix B**.

5.2.1 Threatened flora

A list of threatened flora species known to occur within a 5 km radius of the study area has been collated (**Appendix A**). No threatened flora species have been previously recorded on the site, none were observed during the field survey and given the highly degraded condition of the site none are expected to occur.

5.2.2 Noxious weeds

Seven plant species recorded within the study area are listed as noxious weeds within Blacktown Council LGA. The noxious weeds present, their management class and whether they are a Weed of National Significance (WoNS) is presented in **Table 3** below. All of these species occur in the open stormwater drain.

Table 3: Noxious weeds and WoNS present in the study area

Noxious Weed Species	Noxious Weed Class	WoNS
<i>Gleditsia triacanthos</i> (Honey Locust)	4	N
<i>Lantana camara</i>	4	Y
<i>Ligustrum lucidum</i> (Large-leaf Privet)	4	N
<i>Ligustrum sinense</i> (Small-leaf Privet)	4	N
<i>Lycium ferocissimum</i> (African Box Thorn)	4	Y
<i>Olea europaea</i> subsp. <i>cuspidata</i> (African Olive)	4	N
<i>Rubus fruticosus</i> (Blackberry)	4	Y

Class 3 = Regionally Controlled Weeds; That pose a serious threat to primary production or the environment of an area to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.

Class 4 – Locally Controlled Weeds; That pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.

5.3 Fauna species and habitats

5.3.1 Fauna

A total of 21 fauna was identified during the survey (**Appendix C**). These include one invertebrate, 2 amphibians and 14 birds and 7 mammals.

5.3.2 Threatened fauna

Threatened fauna species recorded onsite included *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail-bat), *Scoteanax tasmaniensis* (Greater Broad-nosed Bat) and possible records of *Myotis macropus* (Large-footed Myotis) and *Falsistrellus tasmaniensis* (Eastern False Pipistrelle). *Meridolum corneovirens* (Cumberland Plain Land Snail - CPLS) was recorded just outside the study area as shown in **Figure 11**.

The CPLS was found within CPW along the south facing slope of the irrigation dam (**Figure 11**) to the immediate north of the study area. Five empty shells and two live snails were found within leaf litter at

the base of the trees (**Figure 12**). Searches for CPLS undertaken within the study area did not detect the species. The species is unlikely to occur within the study area given the highly disturbed nature of the ground including dumped fill, a regularly slashed ground cover up to the base of trees and a paucity of leaf litter and fallen debris.

The population of CPLS next to the irrigation dam lacks connectivity with other patches of CPW and is highly isolated and vulnerable. CPLS was recorded in 2008 approximately 200 m north from the irrigation dam on the northern side of Holbeche Road (BioNet 2015). It is likely that the population once extended south into the study area north into CPW vegetation above Holbeche Road. The construction of Holbeche Road is likely to have fragmented this population. Removal or disturbance to the vegetation surrounding the irrigation dam would likely cause a significant impact to the species. Under the current Masterplan, this vegetation will be retained and no impacts to the CPLS are expected.

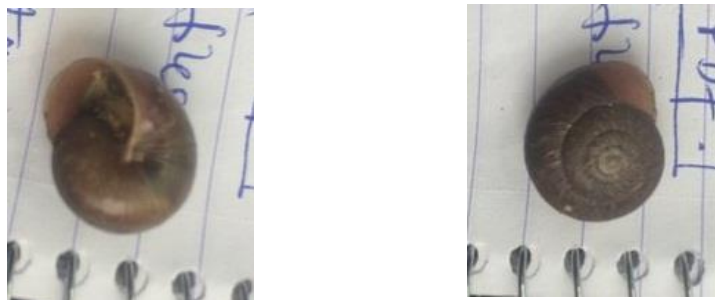


Figure 12: Photo of the CPLS shells and live snails found at the site.

In relation to the nocturnal survey, there were 211 passes recorded from Anabat detectors placed at two sites east of Blacktown Workers Sports Club. Approximately 82% of passes submitted were able to be identified to genus or species with the remainder being too short or of low quality preventing positive identification.

There were up to 11 species identified including potentially up to four vulnerable species listed under the NSW TSC Act 1995 which are listed below in **Table 4**. The entire results are shown in **Appendix D** and the other 7 species are listed in **Appendix C**.

Table 4: Microbat results for threatened species showing level of detection on the site.

Scientific name	Common name	Definite	Possible
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		x
<i>Myotis macropus</i>	Large-footed Myotis / Long-eared Bat		x
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	x	
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	x	

While the nocturnal survey detected four threatened microbats, it is unlikely that that bats were roosting within the stags (standing dead trees) and hollow-bearing trees on the site, as no bats were observed emerging from the hollows. It is more likely that the bats were passing through the site while foraging,

particularly along Bungarribee Creek. *Myotis macropus* is likely to be foraging over the ponded water area in the stand of CPW and over the irrigation dam. It is also likely that insects attracted to the sport field lights will attract microbat foraging.

5.3.3 Fauna habitat

Vegetation within the study area provides suitable habitat for a number of common peri-urban species. The habitat features relevant to each fauna group are identified in **Table 5**.

Table 5: Habitat features and associated fauna groups (guilds) recorded within the study area.

Habitat Features	Guild	Presence in study area
Remnant vegetation	Birds, microchiropteran bats (microbats), megachiropteran bats (fruit bats), arboreal mammals, reptiles	The Alluvial Woodland along Bungarribee Creek and some of the large trees along the eastern drainage line are remnant vegetation. The CPW along the northern boundary of study area is also remnant vegetation, although the trees in the central patch are dying due to ground disturbance and ponding water.
Winter flowering species	Winter migratory birds, arboreal mammals and megachiropteran bats (fruit bats)	<i>Eucalyptus tereticornis</i> is a winter flowering trees that occur within the study area. Some of the planted trees including <i>Eucalyptus microcorys</i> and <i>Eucalyptus grandis</i> may flower during the winter.
Hollow-bearing trees	Birds and arboreal mammals (gliders and microbats)	Four hollow-bearing trees were mapped within the study area. The hollows are small and only likely to be utilised by microbats. A nocturnal survey found that the microbats do not appear to be roosting within the tree hollows.
Stags	Birds, particularly birds of prey, reptiles, amphibians, micro bats	Several stags occur within the study area, five of which contain small hollows that are likely to be utilised by microbats only. However, during the nocturnal survey no microbats were observed emerging from these trees.
Leaf litter	Reptiles, amphibians, invertebrates	Leaf litter is largely absent from the site, except within the regrowth CPW around the irrigation dam. The threatened species CPLS was found within this leaf litter.
Coarse woody debris	Terrestrial mammals, reptiles, invertebrates	One fallen log was observed along the eastern drainage line but otherwise this habitat feature was generally lacking absent from the study area.
Watercourse	Amphibians, water birds	Watercourses include Bungarribee Creek and the eastern drainage line. Water bodies were present as the irrigation dam and the near Holbeche Road and the artificial area of ponded water within the central patch of CPW.

Habitat Features	Guild	Presence in study area
Vegetative corridor	Birds, reptiles, arboreal and small mammals	The vegetation along Bungaribee Creek is part of a riparian corridor that extends to the northwest, although Walter Road and other roads intersect the creek.
Mistletoe	Birds	None observed.
Native/ Exotic grassland	Migratory wetland birds (Egrets) and predator species	Exotic grassland is the dominant landscape feature throughout the study area. Some areas included filled and levelled areas to create sporting fields.

The site may provide potential foraging habitat for a number of highly mobile threatened species including Grey-headed Flying-fox, Little Eagle, Square-tailed Kite and Varied Sittella. Such species may use the site infrequently during foraging, as habitat for these species is considered marginal, given the location of better habitat in the locality including Prospect Dam.

5.4 Riparian and Aquatic Assessment

Bungaribee Creek is an intermittent 2nd order stream feeding Eastern Creek. Its headwaters drain a vegetated catchment near the M4 Motorway, then gathers stormwater drainage past the Great Western Highway and built areas. Once within the site, the creek flows beyond buildings and a small concrete ford to form a more natural creek with small pools, gravel/sand runs and wide reed beds (**Figure 13**). Fish habitat was limited to a small pool downstream of the ford and a narrow, shallow channel elsewhere. A minor barrier to fish passage occurs just upstream of Walters Rd, where water drops off a vertical slump into the culvert pool.

The riparian canopy is scattered, but dominated by *Casuarina glauca* and *Melaleuca* spp. forming the RFEF community. Although historically disturbed, there were small areas of good quality native vegetation. Successful tree recruitment (various trunk diameters) is apparent in forested areas, but there is a distinct lack of riparian recruitment in open areas dominated by reeds and/or exotic groundcovers. Dominate riparian weeds are *Rorippa nasturtium-aquaticum* (Watercress), *Rumex crispus* (Curled Dock) and *Tradescantia fluminensis* (Wandering Jew); with scattered high-impact species, such as *Arundo donax* (Giant Reed), *Juncus acutus* (Sharp Rush) and *Rubus fruticosus* (Blackberry).

Slashing occurs on the adjacent grassed areas, often up to the tree line or where too boggy to mow. Patches of exposed soil and sheet erosion occur near the bend, but banks were generally stable. Overall, the creek was in moderate condition.

Recent minor earthworks in the north of the study area appear to have influenced the local hydrology, especially beyond the outer bend of Bungaribee Creek. This was evident by dieback of *Melaleuca* sp. trees and establishment of water-tolerant species, such as *Typha domingensis*, *Schoenoplectus validus* and *Cotula coronopifolia*. These species are also tolerant to salinity, especially *Cotula*, which suggest saline soils may have also contributed to tree dieback. This vegetated floodplain forms part of the RFEF community and appears to be influenced by overbank spills and overland flows from near the dam. For the purpose of top of bank mapping, this area was not considered part of the Bungaribee Creek channel. The field-validated top of bank mapping and associated riparian buffers are shown in **Figure 8**.

Two unmapped, defined drainage lines enter Bungarribee Creek: one flowing from the east (piped under carpark) and another leading from an industrial complex in the north. As these unmapped drainage lines do not form part of the main channel, they are not identified as ‘rivers’ under the WM Act.

Once the creek leaves the site through culverts beneath Walters Rd it travels as a continuous riparian corridor for 3 km to Eastern Creek.



Figure 13: Creek photographs starting at ford (top left) heading upstream (left to right) towards Walters Rd

6 Impact assessment

6.1 Summary of impacts

The proposed masterplan as supplied by PDC on 3 December 2015 is displayed over the ecological constraints of the subject site to demonstrate the location and extend of the impacts (**Figure 14**). Future minor amendments to this masterplan are unlikely to change the significance of impacts as described below.

Both direct and indirect impacts during the construction of the proposed works and long-term impacts post construction have been considered for the impact assessment. A summary of the impacts are provided in **Table 6**.

Table 6: Summary of the impacts on vegetation types

Vegetation	Direct Impact Total (ha)	Indirect Impact Total (ha)	Total within the survey area (ha)	% of survey area impacted
SITE A				
River-flat Eucalypt Forest (Alluvial Woodland)	0.11	0.19	1.13	10.00%
Cumberland Plain Woodland (Shale Plains Woodland)	0.66	0.08	0.75	87.76%
Exotic Grassland	3.98	0.78	5.37	74.07%
SITE B				
Planted Eucalypts and Casuarina	0.24	0.38	0.82	29.37%
Exotic Grassland	2.56	1.54	12.37	20.71%
TOTAL	7.64	3.17	15.06	50.74%

6.2 Avoidance

The proposed construction footprint was determined with an objective to minimise impacts on the ecological values of the site wherever possible. In particular, the riparian area has been retained and offset as required to meet the NSW Office of Water requirements for controlled activities.

6.3 Direct impacts

The proposal is likely to result in the following direct impacts:

Site A – Outdoor Sporting Facilities:

- Removal of 0.11 ha of RFEF
- Removal of 0.66 ha of CPW
- Removal of five (100%) hollow-bearing stags
- Removal of two (50%) hollow-bearing trees.
- Removal / modification of 3.98 ha of exotic grassland.

Site B – Seniors Living Village

- Removal of 0.24 ha Planted Eucalypts and Casuarinas
- Removal / modification of 2.56 ha of exotic grassland.

6.3.1 Clearing of vegetation

There are minor impacts proposed to the RFEF. While 0.11 ha will be removed to construct the proposed masterplan and 0.19 ha indirectly impacted, this represents an impact to 10% of the extant RFEF. These impacts will be offset as part of a Vegetation Management Plan (VMP), and the entire stretch of Bungarribee Creek within the subject site (zoned W1) will be restored and rehabilitated in perpetuity. Overall, extent of the RFEF will remain unchanged and the condition will be improved, through a reduction in weeds over time through implementing the VMP.

The CPW vegetation to be cleared, as described in Section 5.1, consists of canopy species with no understorey and a very disturbed ground layer dominated by exotic grasses. Most of the CPW vegetation will be cleared (0.66 ha or 87.76 %) under the proposed masterplan. The condition of the CPW is poor, with many trees in the central patch either dead (stags) or showing decline. This is most likely due to the ponding water from the irrigation dam overflow.

While most of the this community type will be removed, the section to be retained around the irrigation dam is considered to be the best condition within the subject due to the presence of leaf litter, ground covers and understorey plants. The condition of this patch is still considered to be relatively poor, given the degree of invasion by weed species within the understorey, the relatively small size of the patch and the isolation from other patches of CPW. However, this area provides habitat for the CPLS, a threatened species listed under the TSC Act and is therefore of high conservation value.

The planted Eucalypts and Casuarinas are considered to be of low ecological constraint given that the vegetation was originally planted as a landscape feature and not as part of a native vegetation community. The planted trees do not contain any understorey and the ground cover is either mulched or consists of exotic lawn. Approximately 0.62 ha of this vegetation will be impacted, of which 0.38 ha will be indirectly impacted. This represents 29.37 % of the existing extent, so a large number of planted trees will be retained, particularly within the proposed residential area.

Exotic grassland is the main vegetation type within the subject site, with 12.37 ha present including the existing sporting fields. Under the proposed masterplan, there will be 9.16 ha of exotic grassland impacted (53.62%). However this is an overestimate, as a large proportion of the masterplan will create additional sporting fields which are essential managed “exotic” lawn.

6.3.2 Loss of habitat

The removal of the vegetation within the subject site will reduce habitat for common peri-urban birds, reptiles and arboreal mammals. The site may provide potential foraging habitat for a number of highly mobile threatened fauna including Grey-headed Flying-fox, Little Eagle, Square-tailed Kite and Varied Sittella. Such species may use the site infrequently during foraging and habitat is considered marginal for these species given the location of much higher quality habitat in the locality including Prospect Dam.

No impact assessment was considered necessary, as impacts to these species through loss of habitat on the subject site would be negligible.

Five hollow-bearing trees and four stags containing hollows were mapped on the site. These hollows are small and most likely used by microbats for roosting or common peri-urban birds or possums. While four threatened microbats were detected foraging within the subject site, none were observed emerging from the hollows. Therefore no threatened fauna species are likely to be using these trees as roosting habitat.

6.4 Indirect impacts

Indirect impacts on vegetation and habitat features have been calculated using a 5 m buffer from the edge of the development footprint. This accounts for potential disturbance to the soil including elevated nutrient levels, changes in plant composition and establishment of weeds both during and post construction.

The proposed works may result in indirect impacts that could include:

- Increase in sediment and nutrient flow into adjacent RFEF.
- Possible increase in weeds, however, the site is already subject to a long history of weed invasion.
- Increased edge effects and fragmentation.
- Future littering and trampling of vegetation by pedestrians.

6.4.1 Increase in sediments and nutrient flow

There is potential that increased nutrients and sediments will enter into adjacent RFEF as a result of disturbance to the soil profile during the construction phase and during the operational phase from stormwater runoff. However, under the current masterplan, a water quality device will be installed at two locations to intercept stormwater draining from the proposed carpark areas prior to discharging into Bungarribee creek.

6.4.2 Spread of exotic species

The site has a long history of weed invasion and a large number of exotic species are well established within the subject site. The proposed masterplan has the potential to spread weed seed through the movement of soil and machinery transporting weeds throughout the site. However, given the existing condition of the site, this impact is likely to be marginal. The implementation of the VMP for Bungarribee Creek will over time result in a net reduction in the diversity of extent of weed species.

6.4.3 Habitat fragmentation

The restoration of the RFEF through implementing of the VMP will maintain and improve the vegetation within the riparian corridor. No fragmentation of RFEF is expected to result.

The existing CPW within the subject site is fragmented from other stands of native vegetation. The removal of the CPW to allow construction of the masterplan will clear the western and central stands of CPW but the CPW around the irrigation dam will remain. This CPW patch is already highly fragmented and isolated and the masterplan will not exacerbate this.

6.5 Riparian assessment

Based on a riparian zone analysis map provided by PDC on 15 December 2015, the proposed development will encroach into the outer riparian zones in three locations totalling 304 m². Under the guidelines, there are to be no impacts the inner riparian zones. Impacts to the outer riparian zone will be offset as part of the VMP. The entire riparian zone will need to be fully revegetated with a fully functional

and fully structured community including trees, shrubs etc. This includes the existing riparian zone and the additional offset areas.

No threatened species under the FM Act are likely to occur on site (**Appendix A**).

The proposed works have the potential to change local hydrology with increased runoff from buildings and roads. Water quality may be influenced by a change in land use, such as increased pollutants from roads, change in pH from concrete pipes and increased nutrients from fertilisers used on gardens or sporting fields. These changes, if unmitigated, could result in localised erosion and poor water quality.

Restoration of the riparian corridor will have a positive impact, with a reduction in weeds and a fully structured riparian community. Deep rooted trees will aid in the uptake of nutrients from groundwater.

6.6 Key threatening process

The Key Threatening Processes (KTPs) “Clearing of native vegetation” as listed under the TSC Act and EPBC Act are relevant to the proposed development. However, as this report demonstrates, the current condition of the vegetation across the site is relatively poor and is dominated by exotic species. While there will be a removal of native trees within the CPW, these trees are currently in decline, and in time, given the current land practices are maintained, the vegetation would eventually die.



Figure 14: Proposed masterplan and ecological constraints

6.7 Impact assessment – TSC Act

Section 5A of the EP&A Act sets out seven factors that must be addressed as part of an Assessment of Significance (7 part test). This enables a decision to be made as to whether there is likely to be a significant effect on the species and, hence, if a Species Impact Statement (SIS) is required.

An Assessment of Significance is required for the following:

- Cumberland Plain Woodland
- River-flat Eucalypt Forest
- *Meridolum corneovirens* (Cumberland Plain Land Snail) (CPLS)
- Microbats (*Saccolaimus flaviventris* (Yellow-bellied Sheath-tail-bat), *Scoteanax tasmaniensis* (Greater Broad-nosed Bat) and possible records of *Myotis macropus* (Large-footed Myotis) and *Falsistrellus tasmaniensis* (Eastern False Pipistrelle).

The impact assessments are contained in **Appendix E** and conclude that a significant impact of threatened species or their habitat is unlikely to result from the proposed works. A species impact statement is not required.

6.8 Terrestrial Biodiversity Layer – Blacktown LEP 2015

Clause 7.2 Terrestrial Biodiversity layer applies to parts of the site as shown in **Figure 3**.

For land mapped as “Biodiversity” the consent authority must consider whether the development will have:

- any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and
- any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and
- any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and
- any adverse impact on the habitat elements providing connectivity on the land, and
- Any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development

The condition, ecological values and significance of the flora and fauna within the study area can be summarized as:

- Two EEC's are present as CPW (degraded due to current land management practices with dieback of the canopy in places) and RFEF (moderate weed invasion with good potential for restoration);
- No threatened flora are present within the study area and none likely to occur.
- Four threatened microbat species utilise the site for foraging but are unlikely to roost on the site.
- CPLS occurs within a small fragment of CPW next to the irrigation dam just to the north of the study area.

The assessments of significance for these threatened species and EECs are contained in **Appendix E** and demonstrate that while there are some adverse impacts to these species and EEC's, they are not considered to be significant impacts that are likely to cause the local extinction of EEC's or threatened species. There are no impacts expected to result to the CPLS or their habitat. Measures to avoid, minimise or mitigate the impacts of the proposed development are outlined in Section 7.

7 Recommendations

7.1 General

In order to mitigate against the impacts identified in the previous section, we recommend that the following actions are undertaken:

7.1.1 Prior to construction

- The boundaries of impact areas should be clearly delineated using temporary fences or similar means to prevent encroachment of the works into the surrounding areas.
- Trees to be removed should be clearly marked prior to clearing and low impact techniques of removal should be used, where possible. An ecologist should be present on site during the dropping of hollow-bearing stags and trees to capture any fauna present within the tree and relocate into appropriated habitat nearby.
- Vegetation for removal should be used on-site for habitat features or mulched for soil erosion control. Any sections of hollows from felled trees should be retained if possible and erected by a professional tree-climber/arborist within the trees that will remain onsite.
- Fallen logs that occur within the subject site should be relocated into the riparian zone for their habitat value.
- Sediment and erosion control measures to be installed near drainage lines and adjacent the riparian corridor.
- The CPLS habitat area to be fenced off as a no-go zone to prevent inadvertent damage to the area.
- Site induction to highlight the areas of high conservation significance and the rationale of the mitigation measures to all workers on site.

7.1.2 During construction

- Storage areas should be located away from the drainage lines and dams to minimise risk of pollution and adverse impact to aquatic ecosystems.
- Sediment and erosion control measures should be regularly checked and maintained.
- Exposed areas of soil to be revegetated / returfed as soon as possible to reduce soil erosion.
- Revegetation and landscape planting should be consistent with Cumberland Plain Woodland species and use provenance seeds.
- Wash down machinery before and after entering the site to limit weed spread.
- Implementation of the approved VMP.

7.1.3 Post construction

- Ongoing management of weeds within the study site to prevent the spread of weeds throughout the site.
- Retention and protection of identified CPLS habitat, as while this land is currently outside of the study area for the masterplan, it is still part of the BWSC land and managed as such.
- Installation of 9 microbat boxes, or as determined by Blacktown Council, throughout retained vegetation to offset the loss of stags and hollow-bearing trees.
- Measures are in place to mitigate impacts to the creek, such as sediment and pollutant controls, and management of the hydrological regimes.

7.2 Riparian zone

The field survey validated the location of waterfront land under the WM Act. A Controlled Activity Approval (CAA) will be required for works within waterfront land and consultation with the Department of Primary Industries – Water (DPI Water) is recommended at an early stage to avoid reworking designs post submission to Council (Integrated DA). Designs and construction works should ensure they meet the Guidelines for Riparian Corridors on Waterfront Land (NOW 2012):

- The Riparian Corridor (RC) is made up of the channel plus a Vegetated Riparian Zone (VRZ) on each bank (measured from top of bank).
- VRZ widths should be consistent with the DPI Water Guidelines for the corresponding stream order (i.e. 20 m on each side of Bungarribee Creek measured from top of bank) and are to be fully vegetated in accordance with the RC Matrix rules (see page 3 of NOW 2012).
- The RC should be maintained or rehabilitated with fully structured native vegetation.
- Non-RC uses in the outer 50% of the VRZ require offsetting (1:1 ratio) adjacent to the riparian corridor to maintain an average 20 m VRZ width.
- The inner 50% VRZ is for native endemic riparian plant species only, unless an approved detention basin or crossing is proposed. The channel is for aquatic habitat.
- Discharge outlets should not encroach the inner 50% of the VRZ.
- Cycleways or paths no wider than four metres total disturbance footprint can be built in the outer 50% of the VRZ. Footbridge crossings (footings) and associated lead-in footpath paths should not encroach the inner 50% of the VRZ, where possible.
- Fences are not permitted in the inner 50% of the VRZ. Fences and maintenance access in the outer 50% of the VRZ requires riparian offsets (1:1 ratio).

To minimise indirect or adverse changes to the riparian and aquatic values along Bungarribee Creek, designs should aim to regulate runoff and trap pollutants before they enter the creek. During construction, a Construction Environmental Management Plan (CEMP) would be prepared to include measures to:

- Limit transport of weed propagules
- Control drainage and sediment laden runoff
- Minimise dust and litter.

A Vegetation Management Plan (VMP) would be required to support a CAA under the WM Act. The VMP would aim to:

- Control weeds
- Encourage natural regeneration
- Ensure restoration planting proposed in the riparian area is consistent with species naturally occurring in RFEF.

8 Conclusion

This flora, fauna and aquatic/riparian assessment was prepared for Paynter Dixon to assess impacts of the proposed Blacktown Workers Sports Club Masterplan (Site A and Site B) at Reservoir Road, Arndell Park.

ELA identified two native vegetation communities within the subject site: Cumberland Plain Woodland (CPW) (listed as critically endangered, TSC Act) and River-flat Eucalypt Forest (RFEF) (listed as an endangered ecological community under the TSC Act). Both these communities only occur within Site A. Two other non-native communities, Planted Eucalypts and Casuarinas and Exotic Grassland also occur within the subject site. However, Planted Eucalypts and Casuarinas only occurs within Site B.

The proposed masterplan will involve impacts to 87.76% of CPW, 10% of RFEF, 29.37% of Planted Eucalypts and Casuarina and 53.62% of exotic grassland within the subject site. In terms of important habitat features, 9 hollow-bearing trees will be removed.

No threatened flora species were detected and none are likely to occur at the site given the past land use and existing level of disturbance.

Four threatened fauna were identified within the study area: (*Saccolaimus flaviventris* (Yellow-bellied Sheath-tail-bat), *Scoteanax tasmaniensis* (Greater Broad-nosed Bat) and possible records of *Myotis macropus* (Large-footed Myotis) and *Falsistrellus tasmaniensis* (Eastern False Pipistrelle). *Meridolum corneovirens* (Cumberland Plain Land Snail) (CPLS) was found in CPW on the southwest slope of the BWSC irrigation dam. Impacts to these species are unlikely to be significant, given that CPLS habitat will not be impacted. The presence of microbats within the study area appears to be for foraging only and not roosting.

Following the application of Assessments of Significance, it was concluded that the proposal is unlikely to have a significant effect on threatened species, populations, ecological communities or their habitats. A Species Impact Statement is not required for the proposal. Measures are recommended to mitigate impacts, including installation of nest boxes within the riparian corridor.

In terms of the aquatic assessment, the proposed development will not have a significant impact on threatened species under the FM Act. Potential indirect impacts from overland water runoff can be mitigated through detention and pollution controls. A Controlled Activity Approval will be required for works within 40 m of top of bank. Consultation with the DPI Water is recommended at an early stage to ensure a streamlined Integrated Development Approval through Council. A Vegetation Management Plan for the restoration of Bungaribee Creek will form part of this approval process.

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Appendix A Likelihood of occurrence

Summary of initial assessment to determine the likelihood of occurrence of threatened species, populations and ecological communities in the impact assessment area.

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. This assessment applies to the impact assessment area only, not to the entire subject site. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

- “known” = the species was or has been observed on the site
- “likely” = a medium to high probability that a species uses the site
- “potential” = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- “unlikely” = a very low to low probability that a species uses the site
- “no” = habitat on site and in the vicinity is unsuitable for the species.

FLORA

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	Likelihood of occurrence	Habitat directly/ indirectly impacted	Impact Assessment Required
<i>Acacia pubescens</i>	Downy Wattle	V	V	Restricted to the Sydney region around the Bankstown-Fairfield-Rookwood and Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon.	Open woodland and forest, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. Occurs on alluviums, shales and at the intergrade between shales and sandstones.	No	No	No
<i>Allocasuarina glareicola</i>		E1	E	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool.	Castlereagh woodland on lateritic soil. Found in open woodland with <i>Eucalyptus parramattensis</i> , <i>Eucalyptus fibrosa</i> , <i>Angophora bakeri</i> , <i>Eucalyptus sclerophylla</i> and <i>Melaleuca decora</i> .	No	No	No
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E1	E	Restricted to eastern NSW, from Brunswick Heads on the north coast to Gerroa in the Illawarra region, and as far west as Merriwa in the upper Hunter River valley.	Dry rainforest; littoral rainforest; <i>Leptospermum laevigatum</i> - <i>Banksia integrifolia</i> subsp. <i>Integrifolia</i> (Coastal Tea-tree– Coastal Banksia) coastal scrub; <i>Eucalyptus tereticornis</i> (Forest Red Gum) or <i>Corymbia 47ulrushe</i> (Spotted Gum) open forest and woodland; and <i>Melaleuca armillaris</i> (Bracelet Honey myrtle) scrub.	No	No	No
<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E1	E	Has been recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens.	Dry sclerophyll forest and moss gardens over sandstone.	No	No	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	Likelihood of occurrence	Habitat directly/ indirectly impacted	Impact Assessment Required
<i>Grevillea juniperina</i> subsp. <i>Juniperina</i>	Juniper-leaved Grevillea	V		Endemic to Western Sydney, centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town.	Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest, on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium.	No	No	No
<i>Marsdenia viridiflora</i> subsp. <i>Viridiflora</i>	Marsdenia viridiflora R. Br. Subsp. Viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	E2		Razorback Range, also recorded at Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys.	Vine thickets and open shale woodland.	No	No	No
<i>Persoonia nutans</i>	Nodding Geebung	E1	E	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south.	Northern populations: sclerophyll forest and woodland (Agnes Banks Woodland, Castlereagh Scribbly Gum Woodland and Cooks River / Castlereagh Ironbark Forest) on 48ulrush and alluvial sediments. Southern populations: tertiary alluvium, shale sandstone transition communities and Cooks River / Castlereagh Ironbark Forest.	No	No	No
<i>Pilularia novae-hollandiae</i>	Austral Pillwort	E1		In NSW, recorded from suburban Sydney, Khancoban, the Riverina between Albury and Urana, Oolambeyan National Park near Carathool and at Lake Cowal near West Wyalong.	Shallow swamps and waterways, roadside table drains, subalpine grassy plains.	No	No	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	Likelihood of occurrence	Habitat directly/ indirectly impacted	Impact Assessment Required
<i>Pimelea curviflora</i> var. <i>curviflora</i>		V	V	Confined to the coastal area of the Sydney and Illawarra regions between northern Sydney and Maroota in the north-west and Croom Reserve near Albion Park in the south.	Woodland, mostly on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes.	No	No	No
<i>Pimelea spicata</i>	Spiked Rice-flower	E1	E	Two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama).	Well-structured clay soils. <i>Eucalyptus moluccana</i> (Grey Box) communities and in areas of ironbark on the Cumberland Plain. Coast Banksia open woodland or coastal grassland in the Illawarra.	No	No	No
<i>Pomaderris brunnea</i>	Brown Pomaderris	E	V	In NSW, found around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands.	Moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	No	No	No
<i>Pterostylis gibbosa</i>	Illawarra Greenhood	E1	E	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra).	Open forest or woodland, on flat or gently sloping land with poor drainage.	No	No	No
<i>Thesium australe</i>	Austral Toadflax	V	V	In eastern NSW it is found in very small populations scattered along the coast, and from the Northern to Southern Tablelands.	Grassland on coastal headlands or grassland and grassy woodland away from the coast.	No	No	No

FAUNA

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	Likelihood of occurrence	Habitat directly/ indirectly impacted	Impact Assessment Required
<i>Apus pacificus</i>	Fork-tailed Swift	P	C,J,K, Mar	Recorded in all regions of NSW.	Riparian woodland. swamps, low scrub, heathland, saltmarsh, grassland, Spinifex sandplains, open farmland and inland and coastal sand-dunes.	Potential flyover / limited foraging	Negligible	No
<i>Ardea alba</i>	Great Egret	P	C, J, Mar	Widespread, occurring across all states/territories. Also a vagrant on Lord Howe and Norfolk Island.	Swamps and marshes, grasslands, margins of rivers and lakes, salt pans, estuarine mudflats and other wetland habitats.	Potential flyover / limited foraging	Negligible	No
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E1	E	Found over most of NSW except for the far north-west.	Permanent freshwater wetlands with tall, dense vegetation, particularly <i>Typha</i> spp. (Bulrushes) and <i>Eleocharis</i> spp. (spikerushes).	Unlikely	No	No
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Recorded from Rockhampton in Qld south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney basin and the NSW north-west slopes.	Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country.	Unlikely	No	No
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		Distribution in NSW is nearly continuous from the coast to the far west.	Inhabits eucalypt forests and woodlands, mallee and <i>Acacia</i> woodland.	Potential flyover / limited foraging	Negligible	No
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E1	E	There are three main populations: Northern – southern Qld/northern NSW, Central – Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern – Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border.	Central and southern populations inhabit heath and open woodland with a healthy understorey. In northern NSW, habitat comprises open forest with dense tussocky grass understorey.	No	No	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	Likelihood of occurrence	Habitat directly/ indirectly impacted	Impact Assessment Required
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Qld.	Rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	No	No	No
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range.	Tall (greater than 20m) moist habitats.	Yes	Yes	Yes
<i>Grantiella picta</i>	Painted Honeyeater	V		Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas.	Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.	No	No	No
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	South eastern NSW and Victoria, in two distinct populations: a northern population in the sandstone geology of the Sydney Basin as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria.	Heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	No	No	No
<i>Hieraaetus morphnoides</i>	Little Eagle	V		Throughout the Australian mainland, with the exception of the most densely-forested parts of the Dividing Range escarpment.	Open eucalypt forest, woodland or open woodland, including sheoak or <i>Acacia</i> woodlands and riparian woodlands of interior NSW.	Potential flyover / limited foraging	Negligible	No
<i>Hirundapus caudacutus</i>	White-throated Needletail	P	C,J,K	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide.	Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland.	No	No	No
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E1	V	Largely confined to Triassic and Permian sandstones within the coast and ranges in an area within approximately 250 km of Sydney.	Dry and wet sclerophyll forests, riverine forests, coastal heath swamps, rocky outcrops, heaths, grassy woodlands.	No	No	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	Likelihood of occurrence	Habitat directly/ indirectly impacted	Impact Assessment Required
<i>Litoria aurea</i>	Green and Golden Bell Frog	E1	V	Since 1990, recorded from ~50 scattered sites within its former range in NSW, from the north coast near Brunswick Heads, south along the coast to Victoria. Records exist west to Bathurst, Tumut and the ACT region.	Marshes, dams and stream-sides, particularly those containing Typha spp. (52ulrushes) or <i>Eleocharis</i> spp. (spikerushes). Some populations occur in highly disturbed areas.	No	No	No
<i>Litoria raniformis</i>	Southern Bell Frog	E1	V	In NSW, only known to exist in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. A few recent unconfirmed records have also been made in the Murray Irrigation Area.	Permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. Also found in irrigated rice crops.	No	No	No
<i>Lophoictinia isura</i>	Square-tailed Kite	V		In NSW, it is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast.	Timbered habitats including dry woodlands and open forests, particularly timbered watercourses.	Potential flyover / limited foraging	Negligible	No
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E1		Areas of the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool, west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains.	Primarily inhabits Cumberland Plain Woodland. Also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest.	Yes	Unlikely	Yes
<i>Merops ornatus</i>	Rainbow Bee-eater	P	J	Distributed across much of mainland Australia, including NSW.	Open forests and woodlands, shrublands, farmland, areas of human habitation, inland and coastal sand dune systems, heathland, sedgeland, vine forest and vine thicket.	No	No	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	Likelihood of occurrence	Habitat directly/ indirectly impacted	Impact Assessment Required
<i>Miniopterus australis</i>	Little Bentwing-bat	V		East coast and ranges south to Wollongong in NSW.	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub.	Unlikely	No	No
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V		In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga.	Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland.	Unlikely	No	No
<i>Monarcha melanopsis</i>	Black-faced Monarch	P	Bonn, Mar	In NSW, occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Widden Valley, Wollemi National Park and Wombeyan Caves. It is rarely recorded farther inland.	Rainforest, open eucalypt forests, dry sclerophyll forests and woodlands, gullies in mountain areas or coastal foothills, Brigalow scrub, coastal scrub, mangroves, parks and gardens.	Unlikely	No	No
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		Found along the east coast from south Qld to southern NSW.	Dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	Unlikely	No	No
<i>Motacilla flava</i>	Yellow Wagtail	P	C,J,K	Regular summer migrant to mostly coastal Australia. In NSW recorded Sydney to Newcastle, the Hawkesbury and inland in the Bogan LGA.	Swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land, lawns.	Potential flyover / limited foraging	Negligible	No
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	P	Bonn, Mar	In NSW, widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains.	Eucalypt-dominated forests, especially near wetlands, watercourses, and heavily-vegetated gullies.	Unlikely	No	No
<i>Myotis macropus</i>	Southern Myotis	V		In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers.	Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation up to 20m.	Yes	Yes	Yes
<i>Petroica boodang</i>	Scarlet Robin	V		In NSW, it occurs from the coast to the inland slopes.	Dry eucalypt forests and woodlands, and occasionally in mallee, wet forest, wetlands and tea-tree swamps.	Unlikely	No	No

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	Likelihood of occurrence	Habitat directly/ indirectly impacted	Impact Assessment Required
<i>Petroica phoenicea</i>	Flame Robin	V		In NSW, breeds in upland areas, and in winter many birds move to the inland slopes and plains, or occasionally to coastal areas. Likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands.	Breeds in upland tall moist eucalypt forests and woodlands. In winter uses dry forests, open woodlands, heathlands, pastures and native grasslands. Occasionally occurs in temperate rainforest, herbfields, heathlands, shrublands and sedgeland at high altitudes.	Unlikely	No	No
<i>Phascolarctos cinereus</i>	Koala	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands.	Eucalypt woodlands and forests.	No	No	No
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	P	V	Fragmented distribution across eastern NSW.	Open heathlands, woodlands and forests with a heathland understorey, vegetated sand dunes.	No	No	No
<i>Rhipidura rufifrons</i>	Rufous Fantail	P	Bonn, Mar	Coastal and near coastal districts of northern and eastern Australia, including on and east of the Great Divide in NSW.	Wet sclerophyll forests, subtropical and temperate rainforests. Sometimes drier sclerophyll forests and woodlands.	Unlikely	No	No
<i>Rostratula australis</i>	Australian Painted Snipe	E1	E, Mar	In NSW most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys.	Swamps, dams and nearby marshy areas.	Unlikely	No	No
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		Both sides of the great divide, from the Atherton Tableland in Qld to north-eastern Victoria, mainly along river systems and gullies. In NSW it is widespread on the New England Tablelands.	Woodland, moist and dry eucalypt forest and rainforest.	Yes	Yes	Yes

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	Likelihood of occurrence	Habitat directly/indirectly impacted	Impact Assessment Required
<i>Tyto novaehollandiae</i>	Masked Owl	V		Recorded over approximately 90% of NSW, excluding the most arid north-western corner. Most abundant on the coast but extends to the western plains.	Dry eucalypt forests and woodlands from sea level to 1100 m.	Unlikely	No	No

AQUATIC

Scientific name	Common name	Status		Habitat associations	Local records	Likelihood of Occurrence	
		TSC Act	EPBC Act			Pre-survey	Post-survey
Fish							
<i>Archaeophya adamsi</i>	Adam's Emerald Dragonfly	E (FM Act)	-	Adam’s emerald dragonflies are one of Australia’s rarest dragonflies. The species is only known from a few sites in the greater Sydney region. Larvae have been found in small creeks with gravel or sandy bottoms, in narrow, shaded riffle zones with moss and rich riparian vegetation (NSW Department of Primary Industries, 2014).	0	Unlikely	Unlikely
<i>Austrocordulia leonardi</i>	Sydney Hawk Dragonfly	E (FM Act)	-	The known distribution of the species includes three locations in a small area south of Sydney, from Audley to Picton. The species is also known from the Hawkesbury-Nepean, Georges River and Port Hacking drainages. The Sydney hawk dragonfly has specific habitat requirements, and has only ever been collected from deep and shady riverine pools with cooler water. Larvae are found under rocks where they co-exist with <i>Austrocordulia refracta</i> (NSW Department of Primary Industries, 2014).	0	Unlikely	Unlikely
<i>Bidyanus bidyanus</i>	Silver Perch	V	CE	Silver perch are a moderate to large freshwater fish native to the Murray-Darling river system. Present in the Hawkesbury-Nepean as a result	0	Unlikely	Unlikely

Scientific name	Common name	Status		Habitat associations	Local records	Likelihood of Occurrence	
		TSC Act	EPBC Act			Pre-survey	Post-survey
		(FM Act)		of stocking. Silver perch seem to prefer fast-flowing, open waters, especially where there are rapids and races, however they will also inhabit warm, sluggish water with cover provided by large woody debris and reeds. Habitat is predominantly in lowland and slope waterways. Adults migrate upstream in spring and summer to spawn.			
<i>Maccullochella macquariensis</i>	Trout cod	E (FM Act)	E	The Trout Cod is endemic to the southern Murray-Darling river system, including the Murrumbidgee and Murray Rivers, and the Macquarie River in central NSW. Present in the Hawkesbury-Nepean as a result of stocking. Migrates wholly within fresh water (potamodromous). Prefers deep flowing freshwaters with woody debris.	0	Unlikely	Unlikely
<i>Maccullochella peelii peelii</i>	Murray cod	-	V	Migrates wholly within fresh water (potamodromous). Habitat is predominantly in lowland and slope waterways. Present in the Hawkesbury-Nepean as a result of stocking.	0	Unlikely	Unlikely
<i>Macquarie australasica</i>	Macquarie Perch	E (FM Act)	E	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	0	Unlikely	Unlikely

Scientific name	Common name	Status		Habitat associations	Local records	Likelihood of Occurrence	
		TSC Act	EPBC Act			Pre-survey	Post-survey
				both river and lake habitats, especially the upper reaches of rivers and their tributaries (NSW Department of Primary Industries, 2014). Habitat for this species is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods.			
<i>Prototroctes maraena</i>	Australian grayling	E (FM Act)	V	Australian grayling occur in freshwater streams and rivers, especially clear gravelly streams with a moderate flow, as well as estuarine areas. Australian grayling need to migrate to and from the sea to complete their life cycle (catadromous), and the construction of barriers such as dams and weirs has had a major impact on populations in some river systems.	0	Unlikely	Unlikely

Appendix B Flora list

Scientific Name	Common Name	Native / Exotic / Planted	Noxious Weeds	WoNS
<i>Acacia falcata</i>		N		
<i>Acer negundo</i>	Boxelder Maple	E		
<i>Acmena smithii</i>	Lillypilly	N/P		
<i>Allocasuarina littoralis</i>		N		
<i>Anagallis arvensis</i>	Scarlet Pimpernel	E		
<i>Angophora floribunda</i>	Rough-barked Apple	N		
<i>Angophora subvelutina</i>	Broad-leaved Apple	N		
<i>Araujia sericifera</i>	Moth Vine	E		
<i>Aristida ramosa</i>	Purple Wiregrass	N		
<i>Arundo donax</i>	Giant Reed	E		
<i>Bidens pilosa</i>	Farmers Friend	E		
<i>Briza subaristata</i>		E		
<i>Bothriochloa macra</i>	Red-leg Grass	N		
<i>Bromus catharticus</i>	Prairie Grass	E		
<i>Bursaria spinosa</i>	Blackthorn	N		
<i>Callistemon</i> sp.	Bottlebrush	N/P		
<i>Cotoneaster glaucophyllus</i>	Cotoneaster	E		
<i>Callistris</i> sp.		N		
<i>Casuarina glauca</i>	Swamp Oak	N/P		
<i>Cirsium vulgare</i>	Scotch Thistle	E		
<i>Corymbia gummiifera</i>	Red Bloodwood	N/P		
<i>Cotula coronopifolia</i>	Water Buttons	E		
<i>Cupressus sempervirens</i>		E/P		
<i>Cyperus</i> sp.		E		
<i>Cynodon dactylon</i>		E		
<i>Desmodium varians</i>		N		
<i>Dichondra repens</i>	Kidney Weed	N		
<i>Ehrharta erecta</i>	Panic Veldtgrass	E		
<i>Einadia trigonos</i>	Fishweed	N		

Scientific Name	Common Name	Native / Exotic / Planted	Noxious Weeds	WoNS
<i>Eucalyptus amplifolia</i>	Cabbage Gum	N		
<i>Eucalyptus crebra</i>	Narrow-leaved ironbark	N		
<i>Eucalyptus grandis</i>	Flooded Gum	N/P		
<i>Eucalyptus moluccana</i>	Grey Box	N		
<i>Eucalyptus microcorys</i>	Tallowwood	N/P		
<i>Eucalyptus tereticornis</i>	Forest Red Gum	N		
<i>Eucalyptus</i> sp.	Ironbark	N/P		
<i>Foeniculum vulgare</i>	Fennel	E		
<i>Gleditsia tricanthos</i>	Honey Locust	E	Class 4	
<i>Glycine tabacina</i>		N		
<i>Grevillea robusta</i>	Silky Oak	N/P		
<i>Lantana camara</i>	Lantana	E	Class 4	Y
<i>Ligustrum lucidum</i>	Large-leaved Privet	E	Class 4	
<i>Ligustrum sinense</i>	Small-leaved Privet	E	Class 4	
<i>Lophostemon confertus</i>	Brushbox	N/P		
<i>Lycium ferocissimum</i>	African Box Thorn	E	Class 4	Y
<i>Juncus usitatus</i>	Common Rush	N		
<i>Juncus acutus</i>	Sharp Rush	E		
<i>Melaleuca</i> sp.		N/P		
<i>Melaleuca decora</i>		N		
<i>Melaleuca linariifolia</i>	Flax-leaved Paperbark	N		
<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark	N		
<i>Modiola caroliniana</i>	Red-flowered Mallow	E		
<i>Morus abla</i>	White Mulberry	E		
<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	E	Class 4	
<i>Paspalum digatatum</i>	Paspalum	E		
<i>Pennisetum clandestinum</i>	Kikuyu	E		
<i>Persicaria deciphens</i>	Slender Knotweed	N		
<i>Persicaria hydropiper</i>	Water Pepper	N		
<i>Phragmites australis</i>	Common reed	N		
<i>Pinus</i> sp.		E/P		

Scientific Name	Common Name	Native / Exotic / Planted	Noxious Weeds	WoNS
<i>Plantago lanceolata</i>	Lamb's Tongues	E		
<i>Phoenix canariensis</i>	Canary Island Date Palm	E		
<i>Ricinus communis</i>	Castor Oil Plant	E		
<i>Rorippa nasturtium-aquaticum</i>	Watercress	E		
<i>Rubus fruticosus</i>	Blackberry	E	4	Y
<i>Rumex crispus</i>	Curled Dock	E		
<i>Typha domingensis</i>	Narrow-leaved Cumbungi	N		
<i>Schoenoplectus validus</i>		N		
<i>Sida rhombifolia</i>	Paddy's Lucerne	E		
<i>Solanum</i> sp.	Nightshade	E		
<i>Sonchus</i> sp.	Thistle	E		
<i>Tradescantia fluminensis</i>	Wandering Jew	E		
<i>Verbena bonariensis</i>	Purple Top	E		
<i>Vicia augustifolia</i>	Vetch	E		

Key:

N = native species endemic to the area

E = exotic

N/P = a planted native species not endemic to the area

E/P = exotic planted

Appendix C Fauna observations

Scientific Name	Common Name	Observation Type
Invertebrates		
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	O
Amphibia		
<i>Crinia signifera</i>	Common Eastern Froglet	W
<i>Limnodynastes peronii</i>	Striped Marsh Frog	W
Aves		
<i>Acrocephalus australis</i>	Australian Reed Warbler	W
* <i>Acridotheres tristis</i>	Common Myna	O
<i>Chenonetta jubata</i>	Australian Wood Duck	O
<i>Corvus coronoides</i>	Australian Raven	O
<i>Cracticus torquatus</i>	Grey Butcherbird	W
<i>Eolophus roseicapilla</i>	Galah	O
<i>Grallina cyanoleuca</i>	Magpie-lark	O
<i>Manorina melanocephala</i>	Noisy Miner	O
<i>Rhipidura leucophrys</i>	Willie wagtail	O
<i>Trichoglossus moluccanus</i>	Rainbow Lorikeet	O
<i>Vanellus miles</i>	Masked Lapwing	O
Mammals		
<i>Chalinolobus gouldi</i>	Goulds Wattled Bat	A
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	A
<i>Myotis macropus</i>	Large-footed Myotis	A
<i>Nyctophilus sp</i>	Long-eared Bat	A
<i>Scotorepens orion</i>	Eastern Broad-nosed Bat	A
<i>Tadarida australis</i>	White-striped Freetail-bat	A
<i>Vespadelus vulturnus</i>	Little Forest Bat	A

Observation Types:

O = Observed

W = heard

A = Anabat detector

*Introduced species

Bold indicates a Threatened Species

Appendix D Anabat Results

Four Anabat nights were undertaken on 25 – 26 October 2015 at Blacktown Sports Workers Club.

Bat calls were analysed using the program AnalookW (Version 3.8 25 October 2012, written by Chris Corben, www.hoarybat.com). Call identifications were made by Danielle Adams-Bennett and reviewed by Alicia Scanlon from Eco Logical Australia Pty Ltd who has seven years' experience using regional based guides to the echolocation calls of microbats in New South Wales (Pennay et al. 2004); and south-east Queensland and north-east New South Wales (Reinhold et al. 2001) and the accompanying reference library of over 200 calls from north-eastern NSW. Available: (<http://www.forest.nsw.gov.au/research/bats/default.asp>).

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Reinhold et al. 2001). To ensure reliable and accurate results the following protocols (adapted from Lloyd et al. 2006) were followed:

- Search phase calls were used in the analysis, rather than cruise phase calls or feeding buzzes (McKenzie et al. 2002)
- Recordings containing less than three pulses were not analysed and these sequences were labeled as short (Law et al. 1999)
- Four categories of confidence in species identification were used (Mills et al. 1996):
 - definite – identity not in doubt
 - probable – low probability of confusion with species of similar calls
 - possible – medium to high probability of confusion with species with similar calls
 - low – calls made by bats which cannot be identified to even a species group.
- *Nyctophilus* spp. are difficult to identify confidently from their calls and no attempt was made to identify this genus to species level (Pennay et al. 2004)
- Sequences not attributed to microbat echolocation calls were labeled as junk or non-bat calls and don't represent microbat activity at the site
- Sequences labelled as low or short can be used as an indicator of microbat activity at the site

There were 211 passes recorded from Anabat detectors placed at two sites west of Blacktown Workers Sports Club in Blacktown between 25 and 27 November 2015. Approximately 82% of passes submitted were able to be identified to genus or species with the remainder being too short or of low quality preventing positive identification.

There were up to 11 species identified including potentially up to **four vulnerable** species listed under the NSW TSC Act 1995 (**Table 7 - Table 10, Figure 15 - Figure 22**).

Site 1 was located next to a small dam and general microbat activity on the first night was high with calls on average every 8 minutes throughout the night. There were few long sequences or feeding buzzes recorded in the data set, indicating that the area was an important foraging, movement corridor and/or source of water resource for microbats at the time of the survey.

Chalinolobus gouldi (Goulds Wattled Bat), *Vespadelus vulturnus* (Little Forest Bat) and ***Myotis macropus*** (Southern Myotis) / *Nyctophilus* sp. (Long-eared Bat) was the most commonly recorded species. The remaining species identified were represented by 3 calls in total.

Conditions on the second night 26 November were windy and cool which may not be ideal for bats and therefore account for the low number of bats recorded. Due to ground works in the study area the Anabat was moved from the first location for the second night.

Site 2 was located east of Site 1 adjacent to Walters Road facing the edge of riparian vegetation on Bungarribee Creek. General microbat activity on the first night was high with calls recorded on average every seven minutes throughout the night. There were few long sequences or feeding buzzes recorded in the data set, indicating that the area was an important foraging or movement corridor resource for microbats at the time of the survey. ***Scoteanax rueppellii* (Greater Broad-nosed Bat)** and ***Chalinolobus gouldi*** (Goulds Wattled Bat) was the most commonly recorded species on the first night. The remaining species identified were represented by 23 calls. Microbat activity on the second night was less with only 30 calls recorded.

The calls of the ***Falsistrellus tasmaniensis* (Eastern False Pipistrelle)**, ***Scoteanax rueppellii* (Greater Broad-nosed Bat)** and ***Scotorepens orion*** (Eastern Broad-nosed Bat) are very difficult to separate because many elements of their calls overlap in the range 32 – 39 kHz.

The calls of ***Myotis macropus* (Large-footed Myotis)** are very similar to all *Nyctophilus* species and it is often difficult to separate these species. Calls can only be identified as *Nyctophilus* spp. when the time between calls (TBC) is higher than 95ms and the initial slope (OPS) is lower than 300. Calls can only be identified as **Large-footed Myotis** when the time between calls (TBC) is lower than 75ms and the initial slope (OPS) is greater than 400. Where the TBC is between 75 and 95ms and the OPS is between 300 and 400 calls are assigned mixed label of **Large-footed Myotis / Long-eared Bats**.

Table 7: Site 1 (Anabat01) results from one Anabat night 25 November 2015, Blacktown.

SCIENTIFIC NAME	COMMON NAME	DEFINITE	PROBABLE	POSSIBLE	TOTAL
<i>Chalinolobus gouldi</i>	Goulds Wattled Bat	19		1	20
<i>Falsistrellus tasmaniensis</i>*	Eastern False Pipistrelle			1	1
<i>Falsistrellus tasmaniensis</i>* / <i>Scotorepens orion</i>	Eastern False Pipistrelle / Eastern Broad-nosed Bat			1	1
<i>Myotis macropus</i>* / <i>Nyctophilus sp.</i>	Large-footed Myotis / Long-eared Bat			16	16
<i>Tadarida australis</i>	White-striped Freetail-bat	1			1
<i>Vespadelus vulturnus</i>	Little Forest Bat	12			12
Low					4
Short					19
TOTAL					74

Table 8: Site 2 (Anabat02) results from one Anabat night 25 November 2015, Blacktown.

SCIENTIFIC NAME	COMMON NAME	DEFINITE	PROBABLE	POSSIBLE	TOTAL
<i>Chalinolobus gouldi</i>	Goulds Wattled Bat	25			25
<i>Falsistrellus tasmaniensis</i>*	Eastern False Pipistrelle			1	1
<i>Falsistrellus tasmaniensis</i>* / <i>Scotorepens orion</i>	Eastern False Pipistrelle / Eastern Broad-nosed Bat			3	3
<i>Falsistrellus tasmaniensis</i>* / <i>Scoteanax rueppellii</i>*	Eastern False Pipistrelle / Greater Broad-nosed Bat			4	4
<i>Myotis macropus</i>* / <i>Nyctophilus sp.</i>	Large-footed Myotis / Long-eared Bat			7	7
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	1		4	5
<i>Scoteanax rueppellii</i>*	Greater Broad-nosed Bat	34			34
<i>Tadarida australis</i>	White-striped Freetail-bat			2	2
<i>Vespadelus darlingtoni</i> / <i>Vespadelus regulus</i>	Large Forest Bat / Southern Forest Bat			1	1
<i>Vespadelus regulus</i>	Southern Forest Bat	1			1
<i>Vespadelus vulturnus</i>	Little Forest Bat	2			2
Low					1
Short					8
TOTAL					94

* Threatened species

Table 9: Site 1 (Anabat01) results from one Anabat night 26 October 2015, Blacktown.

SCIENTIFIC NAME	COMMON NAME	DEFINITE	PROBABLE	POSSIBLE	TOTAL
<i>Chalinolobus gouldi</i>	Goulds Wattled Bat	5			5
<i>Myotis macropus</i>* / <i>Nyctophilus sp.</i>	Large-footed Myotis / Long-eared Bat			1	1
<i>Vespadelus vulturnus</i>	Little Forest Bat	1			1
Short					2
TOTAL					9

* Threatened species

Table 10: Site 2 (Anabat02) results from one Anabat night 26 October 2015, Blacktown.

SCIENTIFIC NAME	COMMON NAME	DEFINITE	PROBABLE	POSSIBLE	TOTAL
<i>Chalinolobus gouldi</i>	Goulds Wattled Bat	6			6
<i>Falsistrellus tasmaniensis</i> * / <i>Scotorepens orion</i>	Eastern False Pipistrelle / Eastern Broad-nosed Bat			6	6
<i>Myotis macropus</i> * / <i>Nyctophilus sp.</i>	Large-footed Myotis / Long-eared Bat			10	10
<i>Scoteanax rueppellii</i> *	Greater Broad-nosed Bat	2		3	5
<i>Vespadelus vulturnus</i>	Little Forest Bat	3			3
Short					3
TOTAL					33

* Threatened species

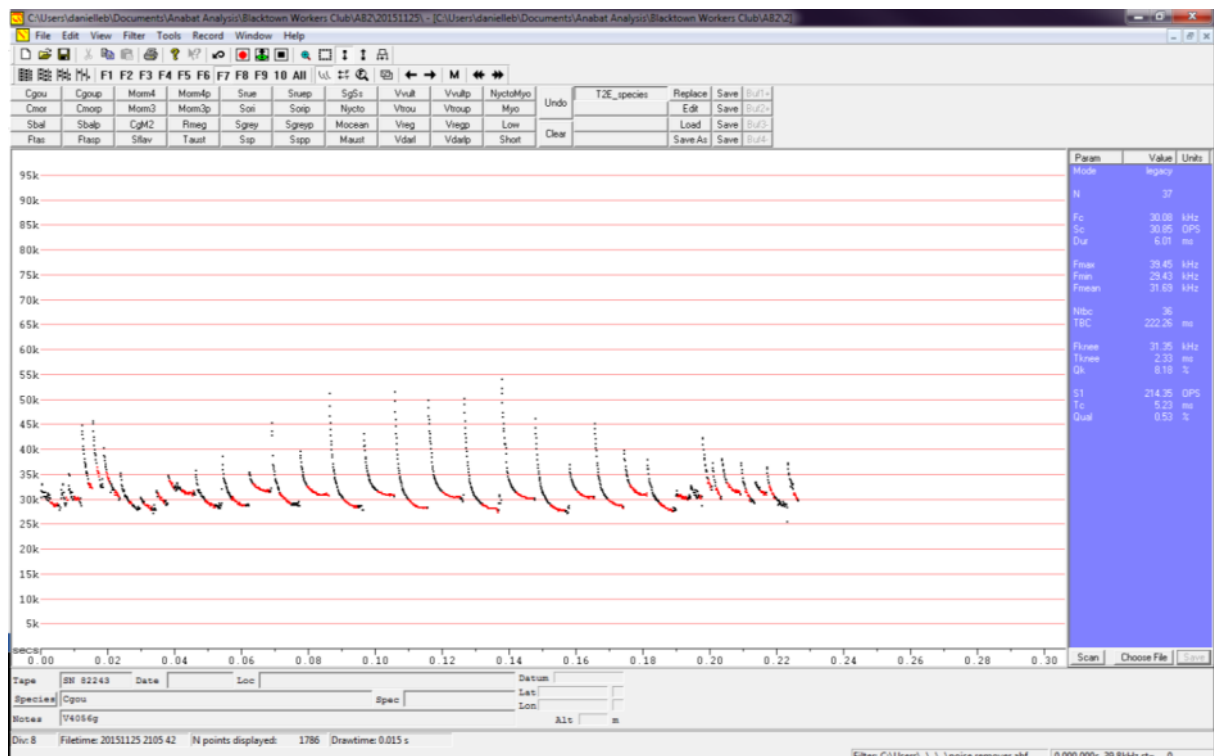


Figure 15: Call profile for *Chalinolobus gouldii* at Site 2, Blacktown at 2105 on 25 November 2015

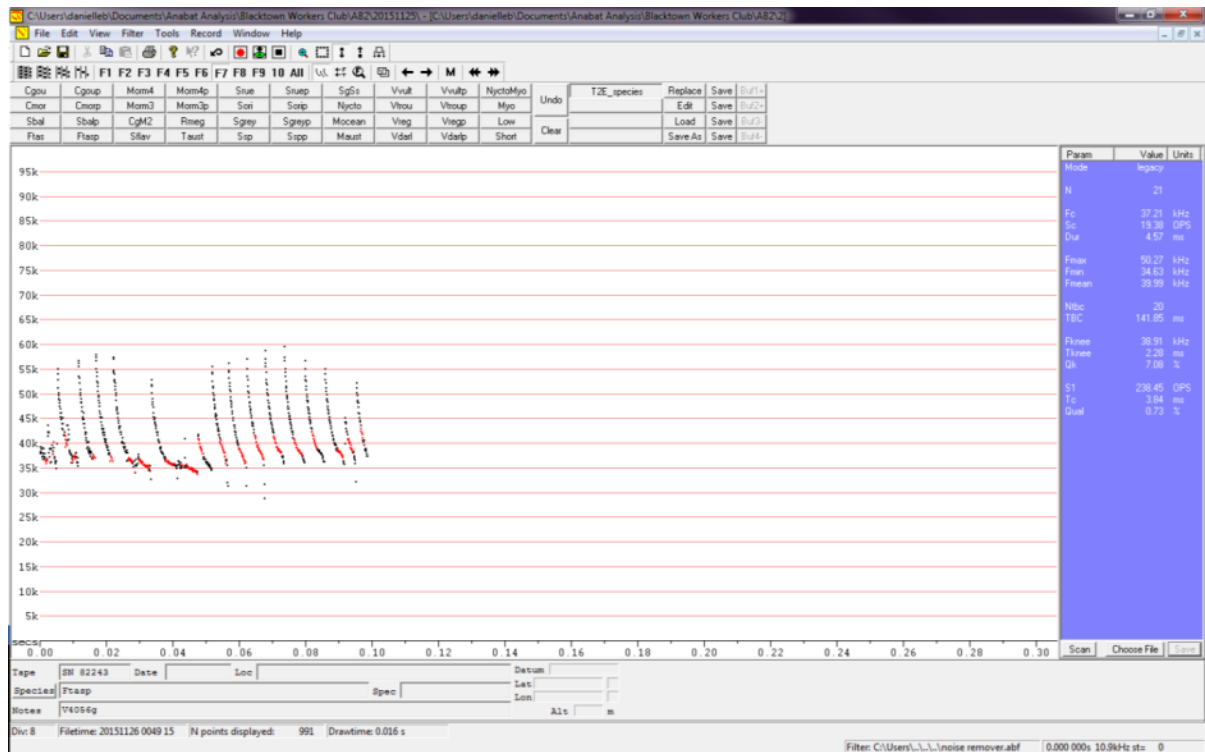


Figure 16: Possible call profile for *Falsistrellus tasmaniensis* recorded at Site 2, Blacktown at 0049 on 25 November 2015.

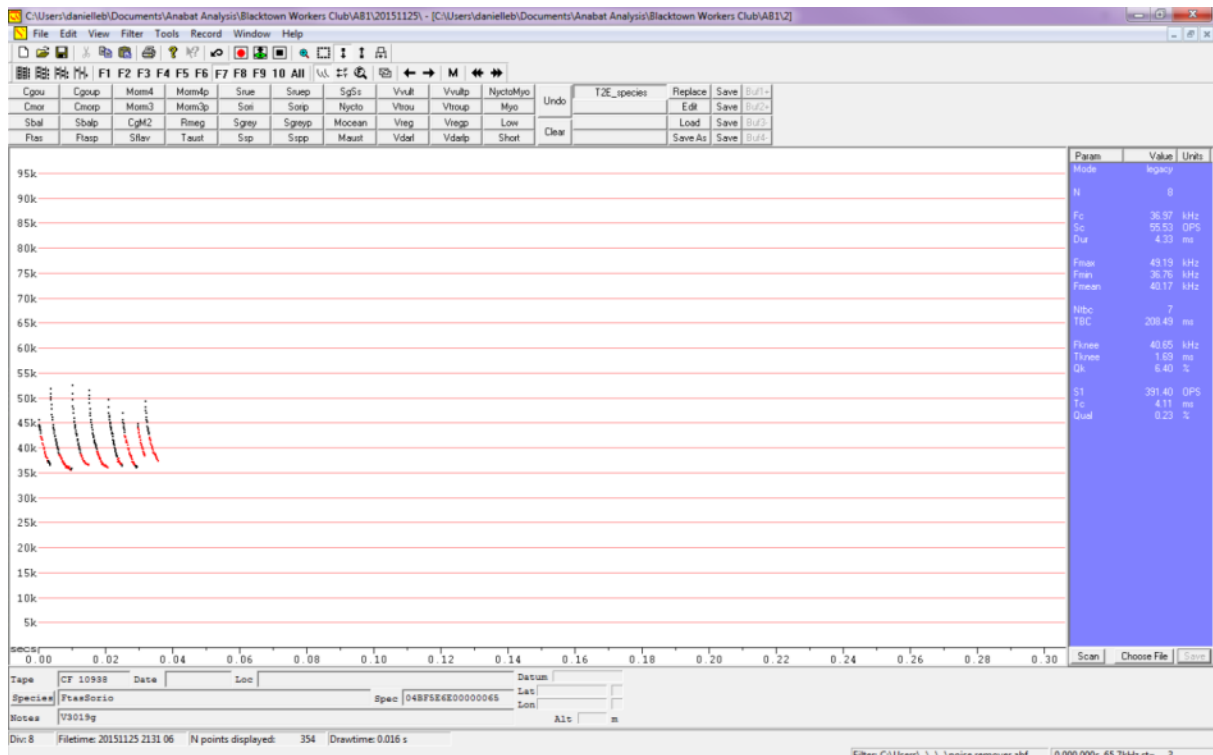


Figure 3: Probable profile call for *Falsistrellus tasmaniensis* / *Scotorepens orion* at Site 1, Blacktown at 2131 on 25 November 2015

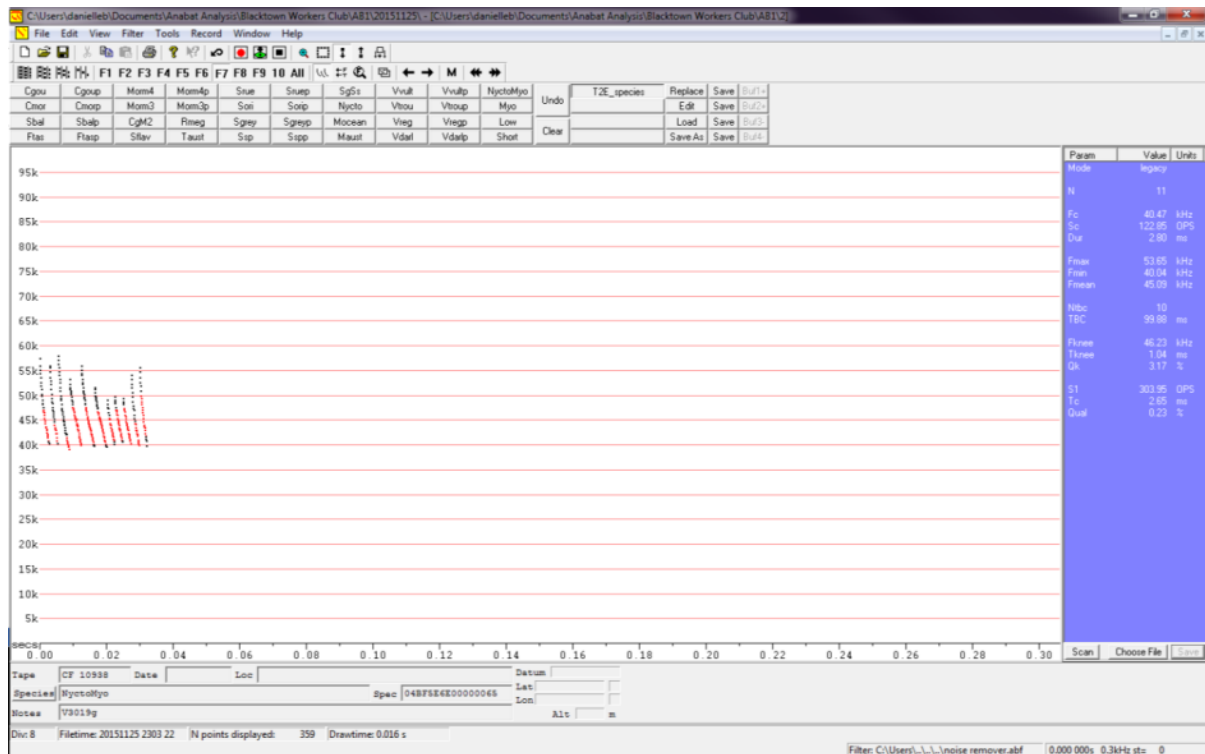


Figure 17: Call profile for *Myotis macropus* / *Nyctophilus* spp. recorded at Site 1, Blacktown at 2303 on 25 November 2015

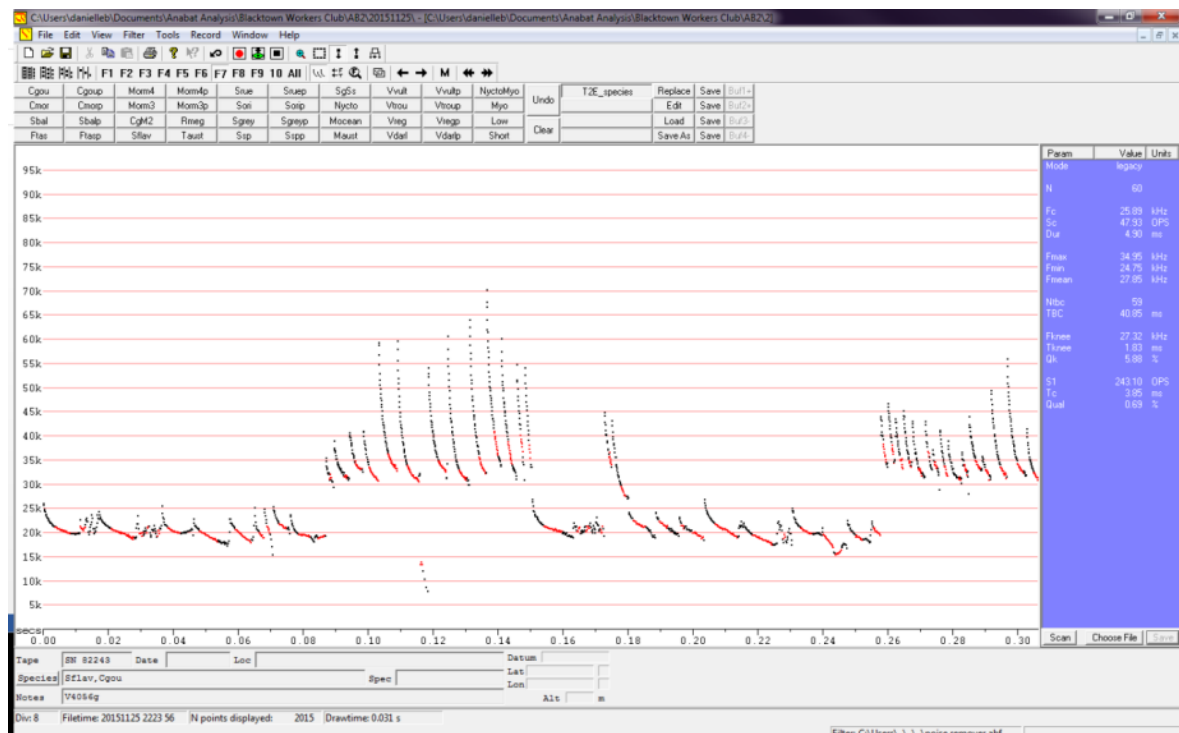


Figure 18: Call profile for *Saccolaimus flaviventris* also showing call for *Chalinolobus gouldii* recorded at Site 2, Blacktown at 2223 on 25 November 2015.

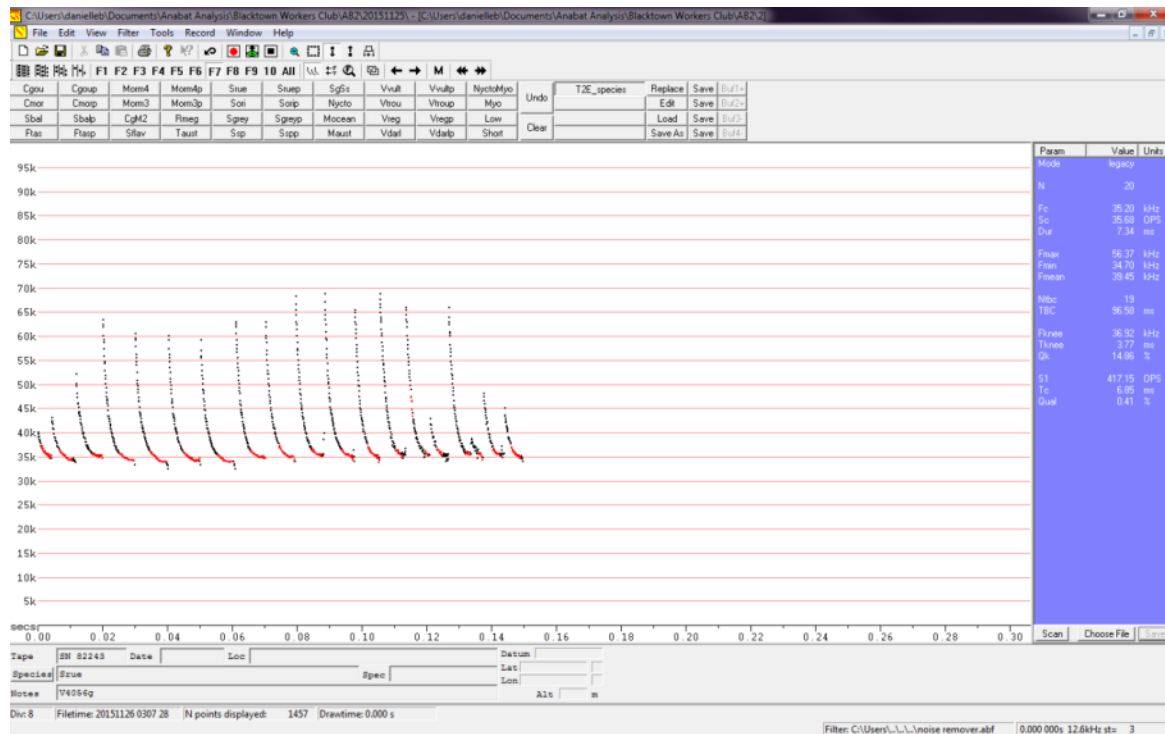


Figure 19: Call profile for *Scoteanax rueppellii* recorded at Site 2, Blacktown at 0307 on 25 November 2015.

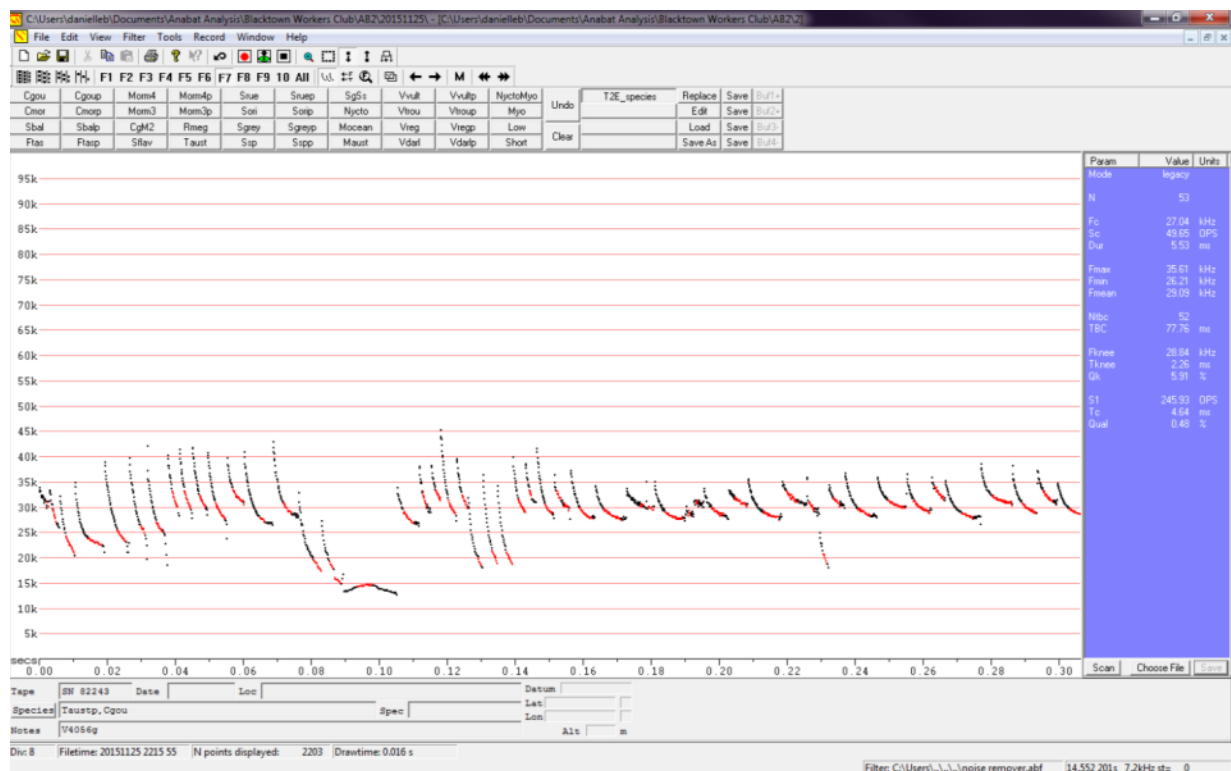


Figure 20: Possible call profile for *Tadaria australis* also showing call for *Chalinolobus gouldii* recorded at Site 2, Blacktown at 2215 on 25 November 2015.

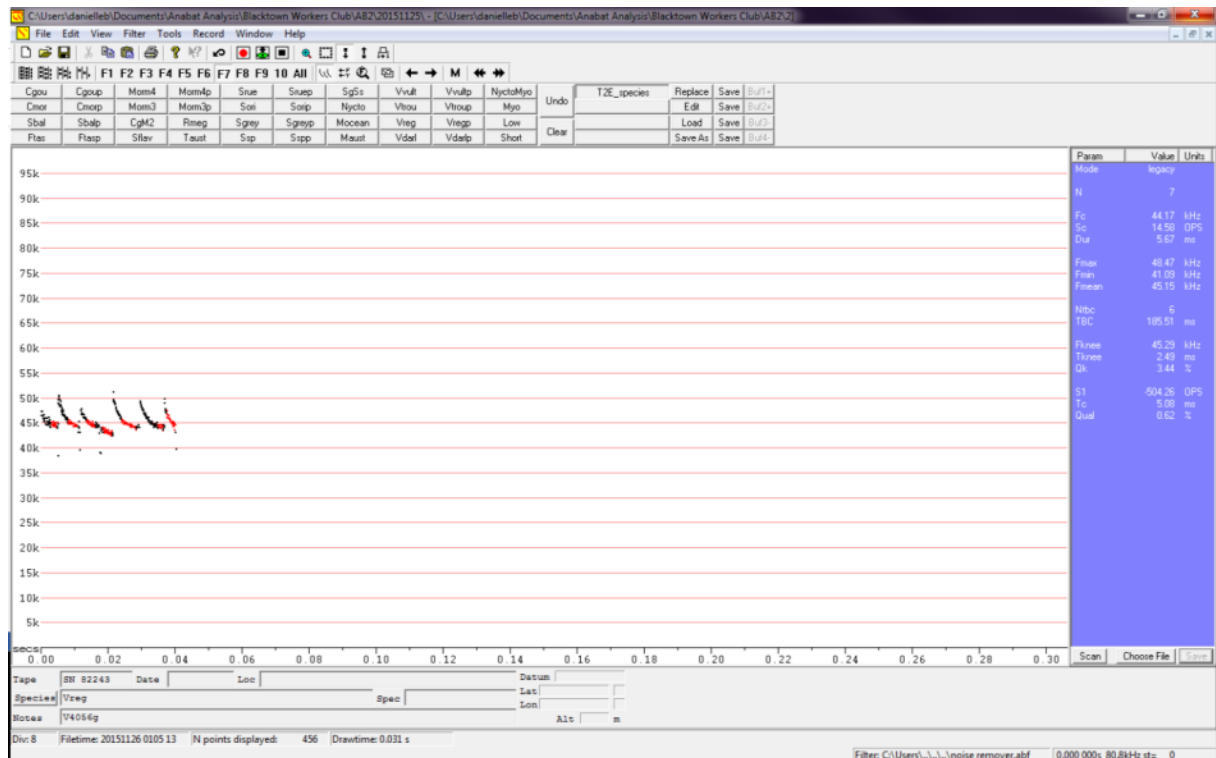


Figure 21: Call profile for *Vespadelus regulus* recorded at Site 2, Blacktown at 0105 on 25 November 2015.

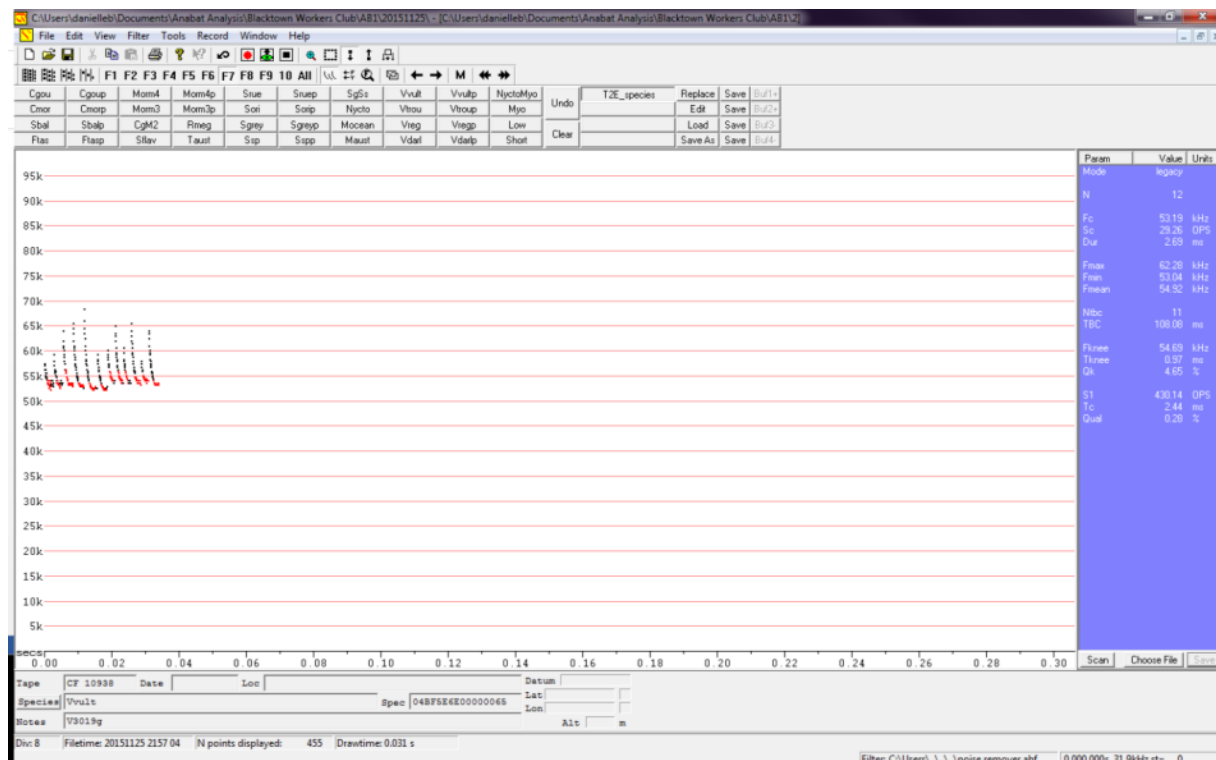


Figure 22: Call profile for *Vespadelus vulturnus* recorded at Site 1, Blacktown at 2157 on 25 November 2015.

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Appendix E Assessment of Significance

The Assessment of Significance (7-part test) is applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the Fisheries Management Act. The assessment sets out 7 factors, which when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether further assessment is required via a Species Impact Statement (SIS). All factors must be considered and an overall conclusion made based on all factors in combination. An SIS is required if, through application of the 7-part test, an action is considered likely to have a significant impact on a threatened species, population or ecological community.

An assessment of significance under Section 5A of the *Environmental Planning and Assessment Act 1979* was undertaken for the following endangered ecological communities and threatened species:

- Cumberland Plain Woodland
- River-flat Eucalypt Forest
- *Meridolum corneovirens* (Cumberland Plain Land Snail - CPLS),
- Microbats including *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail-bat), *Scoteanax tasmaniensis* (Greater Broad-nosed Bat) *Myotis macropus* (Large-footed Myotis) and *Falsistrellus tasmaniensis* (Eastern False Pipistrelle).

Cumberland Plain Woodland (Shale Plains Woodland)

Cumberland Plain Woodland (CPW) is listed as a Critically Endangered Ecological Community under the TSC Act. In the NPWS vegetation mapping of the Cumberland Plain, two forms of Cumberland Plain Woodland have been identified: Shale Hills Woodland and Shale Plains Woodland. The dominant canopy trees in CPW include *Eucalyptus moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum) and *E. crebra* (Narrow-leaved Ironbark), although *Corymbia maculata* (Spotted Gum) and *E. eugenioides* (Thin-leaved Stringybark) may also occur. The community typically has a shrub layer dominated by *Bursaria spinosa* (Blackthorn), with other shrubs, such as *Acacia implexa*, *Indigofera australis* and *Dodonaea viscosa* subsp. *cuneata*, also present. The diverse understorey layer is similar for both forms of Cumberland Plain Woodland. It is common to find grasses, such as *Themeda australis* (Kangaroo Grass), *Microlaena stipoides* var. *stipoides* (Weeping Meadow Grass) in the community, as well as herbs, such as *Dichondra repens* (Kidney Weed), *Brunoniella australis* (Blue Trumpet) and *Desmodium varians* (NPWS 2004).

Before European settlement, CPW was extensive across western Sydney, covering 125,000 hectares. In 2002 there was only 9% of the original extent, with a further 14 % remaining as scattered trees across the landscape (NPWS 2002). Cumberland Plain Woodland is an important part of the western Sydney landscape and occurs on the well-structured clay soils, derived from Wianamatta shale (NPWS 2004). It is well adapted to drought and fire and the understorey plants often rely on underground tubers or profuse annual seed production to survive adverse conditions (DECC 2009).

Cumberland Plain Woodland occurs in the Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly Local Government Areas.

Cumberland Plain Woodland is habitat for many flora and fauna species. Some threatened species supported by CPW include *Pimelea spicata* and *Meridolum corneovirens* (Cumberland Plain Land Snail).

Clearing for agriculture and urban development is the greatest threat to CPW. Given it exists now only in fragments, CPW is vulnerable to disturbances, such as weed invasion, increased soil nutrients, rubbish dumping and frequent fire. Weeds, such as *Eragrostis curvula* (African Lovegrass), *Olea europaea* subsp. *cuspidata* (African Olive) and *Chloris gayana* (Rhodes Grass), are major threats to the community (NPWS 2004).

Cumberland Plain Woodland was mapped within the study area, with varying condition according to past and current land management practices

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

CPW is not a threatened species and therefore this question does not apply.

- 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**

CPW is not an endangered population and therefore this question does not apply.

- 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**

The proposed action will result in the removal of approximately 0.66 ha of Cumberland Plain Woodland for construction of the proposed Blacktown Workers Sports Complex Masterplan. The proposed clearing will be restricted to the removal of mature remnant trees, some of which have died. The total clearing represents approximately 87.76 % of the total amount of Cumberland Plain Woodland present in the study area. DECC 2004 defines “the local occurrence” as:

The ecological community that occurs within the study area. However the local occurrence may include adjacent areas if the ecological community on the study area forms part of a larger contiguous area of that ecological community and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated.

Areas of CPW occur to the north of the subject site and would form part of the local occurrence as shown in (Figure 23). The presence of Holbeche Road is a barrier preventing the vegetation from being physically connected. However, genetic exchange via windblown seed dispersal would occur between the CPW within the subject and the vegetation to the immediate north. This patch of CPW is approximately 8.68 ha in size. Therefore, the local occurrence would be considered to be 8.68 ha + 0.75 ha (within the study area) = 9.43 ha. In this context, the removal of 0.66 ha within the local occurrence of 9.43 ha results in a 7 % reduction in the extent of the community.

Therefore, the proposed action is unlikely to place the local occurrence of Cumberland Plain Woodland community at risk of extinction.

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

The proposed clearing of CPW within the subject site involves the removal of mature canopy species. Under the current site maintenance, involving the overflow of the irrigation dam into the CPW resulting in ponding water and waterlogging of the soil and regularly slashing of the ground cover, the trees are either dead (stags) or showing signs of stress and dieback. Therefore, the composition of the CPW is already

substantially and adversely modified by current land practices. The proposed clearing would not place the local occurrence of CPW at risk of extinction, given the local occurrence includes areas to the north of Holbeche Road.

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

The proposed action will result in the removal of approximately 0.66 ha of CPW within the subject site consisting of mature remnant trees, which represents 87.76% of CPW within the subject site. In the context of the local occurrence of CPW (which includes areas to the north), this area represents 7 % of the local occurrence of CPW in the study area.

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

Under the proposed masterplan, 87.76% of CPW within the study area will be cleared. The remaining CPW will include a number of canopy trees to the south of the irrigation dam. These level of isolation and fragmentation for the remaining trees will increase. However, the remaining trees will still be part of the local occurrence of CPW, with genetic exchange between CPW surrounding the irrigation dam and the CPW north of Holbeche Road.

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 CPW within the subject site is not considered to be important due to the poor condition (dying trees) and lack of other vegetation strata. The CPW is present as mature canopy species with an exotic, regularly slashed ground cover. The soils in the central patch of CPW are artificially waterlogged, causing the dieback of canopy species. Given the continuation of these land management practices, the long-term viability of this patch of CPW is poor. The western patch of CPW is of better condition, as the soils are not waterlogged, but the ground cover is consists of exotic grasses and is regularly slashed, preventing the opportunity for natural recruitment.

e) 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 this community. No critical habitat has been declared in the study area.

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

CPW is included in the Cumberland Plain Recovery Plan (DECCW 2010). The Recovery Plan has the overall objective of providing for the long-term survival and protection of the threatened biodiversity of the Cumberland Plain. The specific recovery objectives (DECCW 2010) are:

1. To build a protected area network, comprising public and private lands, focused on the priority conservation lands;
2. To deliver best practice management for threatened biodiversity across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where the primary management objectives are compatible with biodiversity conservation;
3. To develop an understanding and enhanced awareness in the community of the Cumberland Plain's threatened biodiversity, the best practice standards for its management, and the recovery program Cumberland Plain Recovery Plan; and

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

The current land management practices are not consistent with the objectives set out in the plan, as slashing of the ground cover is preventing natural recruitment and artificially waterlogged soils and dumping of fill is causing tree dieback. The removal of the CPW to construct the masterplan is not consistent with the objectives of the recovery plan.

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

The proposed works to remove 0.66 ha of CPW is an action which is part of the key threatening process "*Clearing of Native Vegetation*".

Conclusion

The proposal would result in the removal of approximately 0.66 ha of CPW vegetation. The proposed clearance represents the majority of CPW at the site (87.76%). However, when considered in the context of the broader local occurrence of CPW, the vegetation to be removed represents 7% of the local occurrence and is not considered to be a significant reduction to the extent of the local occurrence. The future viability of most of the CPW on the site is poor due to the current land management practices, which are creating waterlogged soils and causing dieback of the trees. The practice of regular slashing is preventing natural recruitment and allowing the dominance of an exotic grassland ground cover. In consideration of these factors, it is unlikely that the proposed masterplan will contribute to a significant impact to the CPW and therefore, a Species Impact Statement is not required.



Figure 23: Local occurrence of Cumberland Plain Woodland

River-flat Eucalypt Forest (Alluvial Woodland)

River Flat Eucalypt Forest (RFEF) occurs on the river flats of the coastal floodplains of the NSW North Coast, the Sydney Basin, and the South East Corner Bioregions. It has a tall open tree layer of eucalypts, which may exceed 40 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality.

While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis* (Forest red gum), *E. amplifolia* (Cabbage gum), *Angophora floribunda* (Rough-barked Apple), and *A. subvelutina* (Broad-leaved Apple). *Eucalyptus baueriana* (Blue Box), *E. botryoides* (Bangalay), and *E. elata* (River Peppermint) may be common south from Sydney, *E. ovata* (Swamp Gum) occurs on the far south coast, *E. saligna* (Sydney Blue Gum) and *E. grandis* (Flooded Gum) may occur north of Sydney, while *E. benthamii* is restricted to the Hawkesbury floodplain (OEH 2013).

A layer of small trees may be present, including *Melaleuca decora*, *M. styphelioides* (Prickly-leaved Teatree), *Backhousia myrtifolia* (Grey Myrtle), *Melia azedarach* (White Cedar), *Casuarina cunninghamiana* (River Oak), and *C. glauca* (Swamp Oak). Scattered shrubs include *Bursaria spinosa*, *Solanum prinophyllum*, *Rubus parvifolius*, *Breynia oblongifolia*, *Ozothamnus diosmifolius*, *Hymenanthera dentata*, *Acacia floribunda*, and *Phyllanthus gunnii*.

The groundcover is composed of abundant forbs, scramblers and grasses, including *Microlaena stipoides*, *Dichondra repens*, *Glycine clandestina*, *Oplismenus aemulus*, *Desmodium gunnii*, *Pratia purpurascens*, *Entolasia marginata*, *Oxalis perennans*, and *Veronica plebeia*. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity, and other disturbance, and may have a substantial component of exotic shrubs, grasses, vines and forbs (NSW SC 2011).

RFEF has been mapped within the subject site along Bungarribee Creek and as individual mature trees along the eastern drainage line that flows into Bungarribee Creek. Vegetation varies in condition and species composition due to presence of exotic species and previous disturbances. Exotic weeds currently threaten the biodiversity of the community.

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

RFEF is an endangered ecological community and therefore this question is not applicable.

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

RFEF is an endangered ecological community and therefore this question is 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**

The RFEF within the study area is part of a local occurrence of Alluvial Woodland that extends to the northwest along Bungarribee Creek (**Figure 24**). The NPWS 2002 vegetation mapping does not map the

vegetation immediately north west study site as Alluvial Woodland, but given the presence of Alluvial Woodland approximately 750m along the creek, it is likely that vegetation in between is also Alluvial Woodland based on aerial photo interpretation. This local occurrence of RFEF is approximately 10.24 ha.

Under the proposed masterplan, approximately 0.3 ha or 10% of RFEF within the study area will be impacted (including 0.11 ha of direct impacts and 0.19 ha of indirect impacts). In the context of the local occurrence of this community, the direct and indirect impacts from the masterplan will impact approximately 2.93 % of the local occurrence. Such an impact will not place the local occurrence of RFEF EEC at risk of extinction.

ii. is likely to substantially and adversely modify the composition of the ecological community

The proposed masterplan will impact 11% of the RFEF within the study area including indirect impacts to approximately 0.19 ha of RFEF. This is unlikely to substantially and adversely modify the composition of the community. The masterplan has been designed to treat runoff from car parks and construction methods will aim to prevent the spread of weeds.

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

Approximately 0.11 ha of the RFEF within the subject site will be removed by the proposed works described in the masterplan.

Approximately 0.19 ha of RFEF occurs within 5 m of the proposed works and is therefore vulnerable to indirect impacts.

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

Fragmentation of the RFEF will not result from the proposed masterplan. The remnant trees that occur along the eastern drainage line will be retained. The areas directly impacted by the proposal include small areas (totalling 0.11 ha) along the outer riparian corridor. Construction of the masterplan will not create isolated patches of RFEF.

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,

Under the proposal 0.11 ha of RFEF will be removed. These areas to be impacted include areas of RFEF containing canopy species and a grassy understorey dominated by exotic species along the edge of the riparian zone. Overall, the amount and condition of the habitat to be impacted is not considered to be important to the long-term survival of the community. Particularly given the amount impacted is relatively small (0.11 ha).

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

No critical habitat of this community has been identified by the Office of Environment and Heritage on the Register of Critical Habitat.

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

There is currently no recovery plan or threat abatement plan for RFEF although priority actions have been identified by OEH. The Cumberland Plain Recovery Plan includes vegetation communities which are located on the Cumberland Plain which includes RFEF. The proposal would not conflict with these actions.

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

The action proposed constitutes the key threatening processes (KTP) *Clearing of Native Vegetation*. However, impacts to RFEF will be offset and overall there will be an improvement to this community through implementation of a VMP, including weeding and revegetation works.

Conclusion

On the basis of the above considerations, it is unlikely that the proposed development will result in a significant impact on RFEF. A Species Impact Statement is not required for the proposed development with respect to this EEC.



Figure 24: Local occurrence of Alluvial Woodland

Meridolum corneovirens (Cumberland Plain Land Snail)

Cumberland Plain Land Snail (CPLS) is listed as endangered under the TSC Act. The Cumberland Plain Land Snail is a native snail species with a typical adult shell diameter ranging between 25-30 mm.

Current knowledge suggests that Cumberland Plain Land Snail is restricted to the Cumberland Plain and Castlereagh Woodlands of Western Sydney and also along the fringes of River-flat Eucalypt Forest, especially where it meets Cumberland Plain Woodland. It is currently known from over 100 locations. However, most of these populations are scattered throughout the region and are often small and isolated (DEC 2007). Cumberland land snail typically occurs under logs and other debris, amongst leaf and bark accumulations and sometimes under grass clumps. Where possible it will burrow into loose soil (DEC 2007).

The Cumberland Plain Land Snail (CPLS) was recorded just outside of the study area within CPW on the southwest slope of the BWSC irrigation dam (**Figure 11**). The species was also recorded approximately 200m north from the irrigation dam on the northern side of Holbeche Road (Bionet 2015, observed in 2008) and 250 m south on the southern side of the Great Western Highway (observed in 2005). Several records in 2011 were made around Prospect Dam (Bionet 2015).

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

Factors likely to have an adverse impact on the CPLS include substantial loss of habitat, fragmentation of habitats, predation and changes in hydrology.

The CPLS was found within CPW along the southwest slope of the irrigation dam. The species was not found elsewhere within the subject site, despite searches within the RFEF and around the base of trees within the other two patches of CPW within the subject site. It is unlikely that the species occurs elsewhere within the subject site, given the lack of habitat and the highly disturbed ground layer that has a paucity of leaf litter and is regularly slashed.

The proposed masterplan will not impact the CPW where the CPLS has been found. The CPLS population occurs immediately north of the study area in a small, highly fragmented and relatively isolated patch of CPW that is not connected to other areas of habitat. This area is will retained and protected during the construction works. Therefore, the lifecycle of the CPLS should not be adversely impacted by the works.

- 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. Cumberland Plain Land Snail is not an endangered population.

- b) 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. Cumberland Plain Land Snail is not an endangered ecological community.

- 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**

The habitat of the CPLS within the subject site will not be removed or modified as a result of the proposed actions. The area is to be fenced off as a no-go zone during the construction phase.

- 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**

CPLS are known to move up to 350 m in their lifetime (Clark and Richardson, 2002). The proposed works will not impact the area of known CPLS habitat and will not increase the level of isolation or fragmentation for this species. The CPW within the study area was thoroughly searched but did not contain CPLS and given the high level of disturbance and lack of habitat, the species is unlikely to occur within the study area. Therefore, the removal CPW within the subject site will not remove or fragment potential habitat for the species.

- 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 area of CPW containing the CPLS will not be removed, modified, fragmented or isolated under the proposed masterplan. It is recommended that the area be fenced-off as a no-go zone.

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

No critical habitat of this species has been identified on the Register of Critical Habitat.

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

The CPLS is included in the Cumberland Plain Recovery Plan (DECCW 2011). The Recovery Plan has the overall objective of providing for the long-term survival and protection of the threatened biodiversity of the Cumberland Plain. The specific recovery objectives (DECCW 2011) are:

1. *To build a protected area network, comprising public and private lands, focused on the priority conservation lands [The 'priority conservation lands' are 25,566 ha of mapped lands with highest priority for conservation of the Cumberland Plain threatened biodiversity]*
2. *To deliver best practice management for threatened biodiversity across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where the primary management objectives are compatible with biodiversity conservation*
3. *To develop an understanding and enhanced awareness in the community of the Cumberland Plain's threatened biodiversity, the best practice standards for its management, and the recovery program Cumberland Plain Recovery Plan*
4. *To increase knowledge of the threats to the survival of the Cumberland Plain's threatened biodiversity, and thereby improve capacity to manage these in a strategic and effective manner.*

While the proposed works are not aligned with the recovery plan objectives, there will be no removal of CPLS habitat.

- 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 overall masterplan will involve '*Clearing of Native Vegetation*', which is a KTP under the TSC Act (OEH 2013). However, in relation to the CPLS habitat, there will be no impacts.

Conclusion

In summary:

- The vegetation within the subject site proposed to be removed does not include the area identified as habitat for the CPLS
- Targeted surveys within the vegetation that will be removed did not identify live or dead CPLS and the species is considered unlikely to occur within these areas.
- Proposed works will not increase the level of isolation for the populations

On the basis of the above considerations, it is unlikely that the proposal will constitute a significant impact on the CPLS and therefore, a SIS is not required.

Microbats (*Falsistrellus tasmaniensis*, *Myotis macropus*, *Saccolaimus flaviventris* and *Scoteanax rueppellii*)

(Eastern False Pipistrelle) is listed as vulnerable under Schedule 2 of the NSW *Threatened Species Conservation Act* 1995. The species is wide-ranging, occurring along the southeast coast of Australia with records from South East Queensland, New South Wales, Victoria and Tasmania.

The species occurs in sclerophyll forests from the Great Dividing Range to the coast, and generally prefers wet habitats where trees are more than 20 m high. Roosting occurs in hollow trunks of eucalypt trees, usually in single sex colonies, but the species has been recorded roosting in caves under loose bark and occasionally in old wooden buildings (Churchill 1998). Their flight pattern is high and fast and they forage within or just below the tree canopy. They feed on a variety of prey including moths, rove beetles, weevils, plant bugs, flies and ants.

This species is threatened by a number of processes including loss of trees for foraging and hollow-bearing trees for roosting, disturbance to winter roosting and breeding sites, and application of pesticides in or adjacent to foraging areas (DECC 2005).

The Eastern False Pipistrelle was recorded during the nocturnal field surveys using an Anabat detector. Previous records for the species include one record 5km northwest of the subject site from 2012. Suitable foraging habitat and potential roost sites (hollow-bearing trees) were observed within the subject site.

Myotis macropus (Large-footed Myotis) is listed as vulnerable under the TSC Act. This species has a primarily coastal distribution, rarely found more than 100 km inland, although it does occur further inland along major rivers (Churchill 1998). This species inhabits most habitat types as long as they are near water, where this species forages (Churchill 1998). The Large-footed Myotis forages along streams and pools, feeding on insects and small fish caught by raking their long feet across the water surface.

The Large-footed Myotis is a cave dweller but is also known to roost in tree hollows, under bridges, in clumps of vegetation, buildings, mine tunnels and stormwater drains (Churchill 1998). Roosts are usually in groups of 10-15, in close proximity to water over which the bats forage.

This species is threatened by a number of processes including the loss or disturbance of roosting sites, clearing adjacent to foraging areas and reduction in stream water quality affecting food resources (DECC 2005).

Large-footed Myotis was recorded during the field survey using an Anabat detector and was previously recorded at Prospect Dam in 2011. There is potential for the species to utilise the study area for roosting although and foraging over the water bodies including Bungarribee Creek, the unnamed drainage lines and the ponded water within the CPW and the irrigation dam.

Saccolaimus flaviventris (Yellow-bellied Sheath-tail-bat) roosts singly or in groups of up to six, in tree hollows and buildings. In treeless areas they are known to utilise mammal burrows. They forage in most habitats throughout their very wide range, including areas with and without trees and appear to defend an aerial territory DECC (2008). The species was recorded during the nocturnal field survey using an Anabat detector and but there were no previous records of the species within a 5km radius from the site. Foraging and potential roosting habitat for this species is present at the site.

Scoteanax rueppellii (Greater Broad-nosed Bat) is a large bat that feeds on moths and other large insects along edges of forest, cleared paddocks and tree-lined water courses (Churchill 1998). This species uses mostly tree hollows for roosting and they have been recorded in a variety of vegetation types from woodland to rainforest (Churchill 1998). Greater Broad-nosed Bat was recorded during the nocturnal field

survey using an Anabat detector and was previously recorded 3 km southwest of the subject site on Eastern Creek in 2006. The subject site contains foraging and roosting habitat for this species.

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

Factors likely to have an adverse effect on the life cycle of the four microbats listed above would include a substantial loss and/or fragmentation of foraging habitat, loss of hollow bearing trees, pesticide/herbicide usage and disturbance to roosting and breeding sites.

The proposal will result in the removal of the following foraging habitat - approximately 0.66 ha of CPW, 0.11 ha of RFEF (which will be offset through plantings), and 0.24 ha of planted Eucalypts and Casuarinas. Nine hollow-bearing trees were identified on the site and seven will be removed to allow for construction of the masterplan. While these hollows offer potential roosting habitat for these microbats, the nocturnal survey did not observe any microbats emerging from the hollow-bearing trees. It is likely that the site is utilised by the microbats for foraging.

The proposed impacts to habitat for the microbats are unlikely to cause the extinction of a viable local population, as none were observed emerging from the potential roosting hollows and important foraging habitat including the vegetation along Bungarribee Creek and along the drainage lines will be retained. It is also likely that the lights installed on the playing fields will attract insects, which will in turn attract foraging by these microbats.

Given, the small area of potential habitat to be removed, that potential habitat will remain on site and in adjacent areas and that this species is highly mobile, it is unlikely that the proposal would place the local population of this species 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**

None of the above species are listed as an endangered population.

- c. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

- i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable to microbats (threatened fauna).

- 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**

Seven of the nine hollow-bearing trees representing potential microbat roosting habitat will be removed. In addition, approximately 1 ha of native and planted vegetation, mostly consisting of mature trees will be removed. Two hollow-bearing trees (potential roosting habitat) and vegetation along Bungarribee Creek and the unnamed drainage lines will be retained and provide foraging habitat within the subject site.

Foraging habitat for the Large-footed Myotis will be retained along the creek and drainage line and within the irrigation dam. There will be a minor loss of habitat for this species as the ponded water within the CPW will be filled and made into sporting fields.

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

All four microbat species are highly mobile. The removal of vegetation within the subject site will not fragment or isolate habitat for these species.

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

The proposed habitat to be removed is unlikely to be important habitat for the long-term survival of the four species. The potential roosting habitat did not appear to be used by the microbats, as none were observed emerging from the hollow-bearing trees during the nocturnal survey. While there will be some loss of foraging habitat, vegetation will be retained along the creek and drainage lines and around the irrigation dam. There is high quality foraging habitat at Prospect Dam, within CPW to the immediate north of the subject site and along the vegetated corridor of Bungarribee Creek.

e. Whether the action proposed is likely to have an adverse effect on critical habitat.

No critical habitat has been declared for these four microbat species.

f. 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 prepared for these species of microbats.

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.

A number of Key Threatening Processes (KTP) are relevant to this proposal with respect to the four species of microbats. These include:

- Clearing of native vegetation / Land clearance.
- Removal of dead wood and dead trees.
- Loss of hollow-bearing trees.

Conclusions

The proposal is unlikely to constitute a significant impact on any of the four microbats *Falsistrellus tasmaniensis*, *Myotis macropus*, *Saccolaimus flaviventris* and *Scoteanax rueppellii* given that:

- The proposed works would constitute a minor disturbance to an area of foraging habitat within the study area. While 1 ha of vegetation will be removed (including native and planted vegetation), approximately 1.69 ha will be retained. In addition, 11 ha of RFEF will be revegetated with the riparian zone.
- Larger areas of suitable foraging habitat are present within the surrounding landscape, including the 8.68 ha patch of CPW to immediate north of the site and Prospect Reservoir to the south.

- The proposal would not isolate or fragment any currently connecting areas of habitat in terms of use by highly mobile species.

On the basis of the above considerations, it is unlikely that the proposal will constitute a significant impact on *Falsistrellus tasmaniensis*, *Myotis macropus*, *Saccolaimus flaviventris* and *Scoteanax rueppellii* and therefore, a SIS is not required.

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