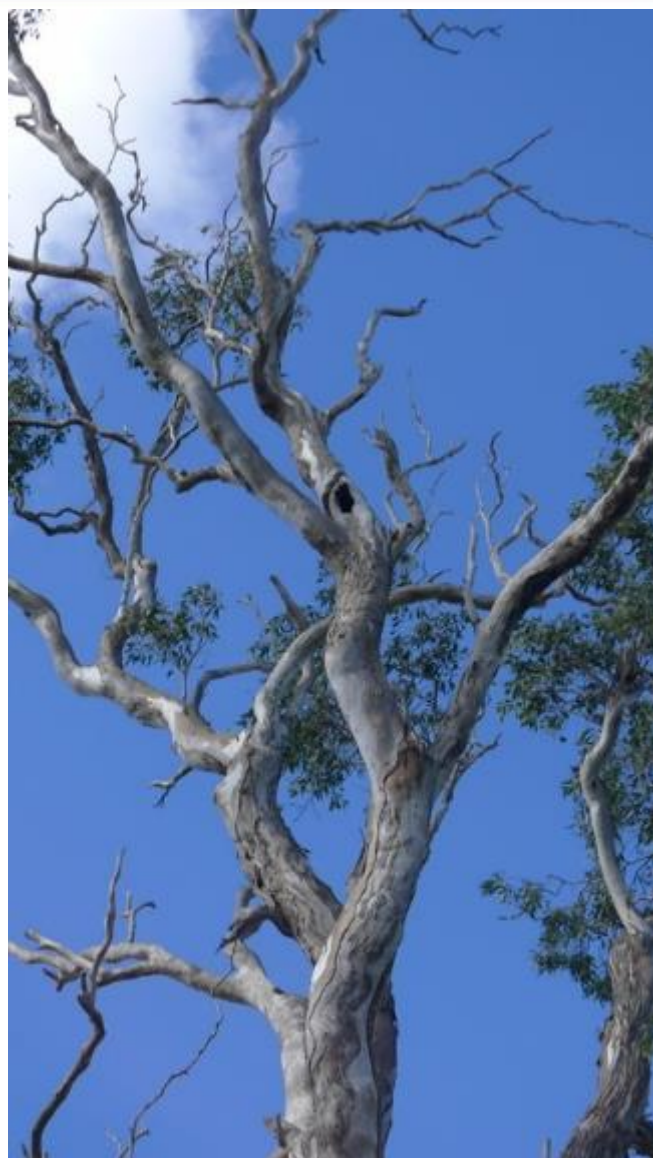




Ropes Creek Precinct – Biodiversity and Riparian Assessment

Prepared for NSW Department of Planning and Environment

October 2016



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Abbreviations

Abbreviation	Description
AoS	Assessment of Significance
CA	Controlled Action
CEEC	Critically Endangered Ecological Community
DotE	Department of the Environment
DP&I	Department of Planning and Infrastructure
DCP	Development Control Plan
EEC	Endangered Ecological Community
ELA	Eco Logical Australia
EPBC Act	<i>Environment Protection & Biodiversity Conservation Act 1999</i>
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
FM Act	<i>Fisheries Management Act 1994</i>
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NCA	Non-controlled Action
NCA-SA	Non-controlled action – Specified Manner
OSL	Office of Strategic Lands
SEPP	State Environmental Planning Policy
TSC Act	<i>Threatened Species Conservation Act 1995</i>

Executive summary

The Department of Planning and Environment (DP&E) owns a 138 hectare site within the Western Sydney Employment Area (WSEA), known as the Ropes Creek Precinct, which will become accessible upon completion of the Erskine Park Link Road. The Office of Strategic Lands (OSL) is seeking to undertake due diligence tasks prior to the sale of the land by tender.

Under the *State Environmental Planning Policy Western Sydney Employment Area 2009* no development can occur until such time as a Development Control Plan (DCP) has been produced. Eco Logical Australia (ELA) has been engaged by the DP&E to undertake an assessment of the biodiversity and riparian features of the Ropes Creek study area (Lot 10 DP 1157491) that will support the creation of a DCP for the Ropes Creek Precinct site (herein referred to as the subject site).

The assessment has determined that the site contains Critically Endangered Ecological Communities (CEEC) and habitat for threatened species listed under the NSW *Threatened Species Conservation Act 1995* and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*.

Areas of high conservation value are found along the major riparian corridor of Ropes Creek and a minor tributary running north-west – south east across the site. Whilst rehabilitation efforts will be required to reduce the impact of weeds, these areas currently provide connectivity through the site for fauna. These areas align reasonably well with the lands that are zoned E2 Environmental Conservation in the Western Sydney Employment Area SEPP. Protection and management of these areas is recommended via retaining such lands in a single public ownership if possible. Long term, it would be preferable that they be managed by a public authority with land management experience along with the other public lands to the west of the site.

The site also contains a number of riparian zones. Site survey revealed that whilst Ropes Creek and the main tributary provide reasonably good riparian habitat in parts, the other watercourses and dams on site offer little or no aquatic habitat of value. In particular the tributary with the large dam is in poor condition with the dam itself being extensively dominated by the noxious weed *Salvinia molesta*. Removal of this weed from the site will need to be undertaken with care – and in accordance with a Dam decommissioning Plan – to ensure the *Salvinia molesta* is not transported to Ropes Creek.

1 Introduction

Eco Logical Australia was engaged by the NSW Department of Planning and Environment to undertake a biodiversity and riparian assessment of the Ropes Creek Precinct (Lot 10 DP 1157491) as a technical input to the Ropes Creek Development Control Plan.

The subject site is located within the Western Sydney Employment Area (WSEA) which will become accessible upon completion of the Erskine Park Link Road.

1.1 Brief for the study

The objective of this report is to provide an overview of the ecological features of the site that will be used in the preparation of a Development Control Plan for the Ropes Creek Precinct. This will be achieved by undertaking the following:

- Literature review and desktop mapping
- Field surveys to:
 - validate vegetation communities on site
 - confirm whether vegetation meets the definition of threatened communities under *Threatened Species Conservation Act 1995* (TSC Act) and/or *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)
 - assess habitat for threatened fauna and targeted threatened flora searches
 - identify and assess any major ecological features of the site and any major ecological factors impacting the site such as erosion, feral animal populations, noxious weeds etc
- Conservation significance assessment mapping to identify key habitat features including:
 - current extent of native vegetation
 - key habitat features such as hollow bearing trees
 - Groundwater dependent ecosystems
 - Conservation significance areas grouped into high, moderate and low
 - Stream order classification, top of banks and riparian buffers
- Preparation of a biodiversity and riparian report including clear recommendations to inform precinct planning with regard to the following:
 - Areas of biodiversity value that should be considered for retention
 - Priorities for restoration, regeneration or revegetation
 - Measures to protect biodiversity values
 - Recommended development controls such as setbacks and tree preservation
 - Mechanisms to implement the recommendations
 - Measures to control ecological impacts on the site
 - Tenure and management

1.2 Location and overview of subject site

The subject site is Lot 10 DP 1157491 which forms part of the Ropes Creek Precinct (**Figure 1**). The site is approximately 138.14 hectares and comprises former grazing and farming lands and remnants from former farm operations. The site is bounded by a small amount of cleared paddocks to the north with the M4 Motorway beyond this, cleared paddocks and a waste facility to the east and north-east, cleared paddocks and Lenore Drive to the south and Ropes Creek to the west. The subject site is located within the Blacktown Local Government Area (LGA). A high voltage electricity easement and powerline is located within the subject site and runs along the eastern boundary.

The majority of the site is cleared, with a heavily vegetated riparian zone along the western boundary (Plate 1).

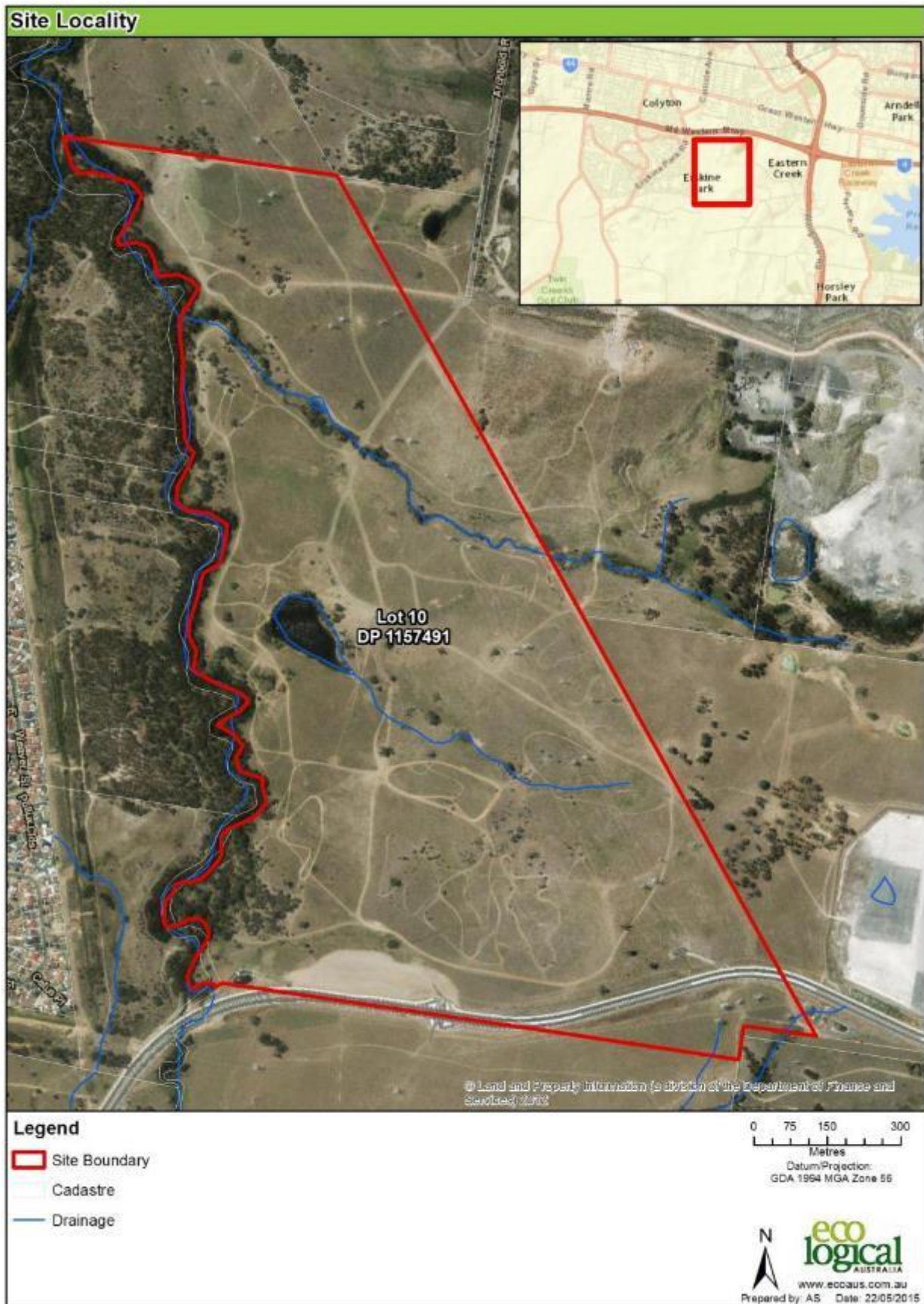


Figure 1: Ropes Creek Precinct

2 Planning and Legislation

Commonwealth and State legislation and policies, as well as local policies apply to the assessment, planning and management of ecological issues within the site. A brief outline of these is provided in the following table.

Table 1 Statutory Context

Act, Plan or Policy	Relevance to the project	Section in this report
Commonwealth		
<i>Environmental Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	The EPBC Act aims to protect Matters of National Environmental Significance (MNES). Where development may have a significant impact on MNES, approval from the Commonwealth Minister for the Environment may be required.	Chapter 4
State		
<i>Threatened Species Conservation Act 1995</i> (TSC Act)	The TSC Act aims to protect threatened species and endangered ecological communities. This report identifies threatened species, communities and populations and their habitats that are present or have the potential to be present on the subject site. The site is not biodiversity certified under s126 of the TSC Act. Impacts to threatened species and Endangered Ecological Communities (EEC) listed under the TSC Act will require assessment under s5A of the EP&A Act when a development application is prepared.	Chapter 4
<i>Fisheries Management Act 1994</i> (FM Act)	Among other things the FM Act aims to conserve threatened species, populations and ecological communities of fish and marine vegetation. The Act requires assessment of impacts to threatened species and also requires permits for certain works. Threatened species are considered in Chapter 5 of this report.	Chapter 5
<i>Native Vegetation Act 2003</i> (NV Act)	The development is proposed on land that is excluded from the operation of the Native Vegetation Act. No further assessment is required with regard to this Act.	NA
<i>Water Management Act 2000</i> (WM Act)	The objects of the WM Act are to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations. Among the object relating to biodiversity are (a) to apply the principles of ecologically sustainable development, and (b) to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality The precinct contains land within 40m of a watercourse and therefore meets	Chapter 5

	the definition of 'waterfront land' under the WM Act 2000. Development on waterfront land is likely to require a Controlled Activity Approval at the development stage. This report identifies the waterfront land and makes recommendations for the management of that land. .	
Planning Instruments		
SEPP 14 Coastal Wetlands	The site is located on land which is not subject to SEPP 14.	NA
SEPP 26 – Littoral Rainforests	The site is located on land which is not subject to SEPP 26.	NA
SEPP 44 Koala Habitat	The site is located within a local government area to which SEPP 44 does not apply.	NA
SEPP Western Sydney Employment Area	The SEPP WSEA has multiple aims relating to the development of the Western Sydney Employment Area. Among the aims of the SEPP are: <i>(e) to ensure that development occurs in a logical, environmentally sensitive and cost-effective manner and only after a development control plan (including specific development controls) has been prepared for the land concerned.</i> <i>(f) to conserve and rehabilitate areas that have a high biodiversity or heritage or cultural value, in particular areas of remnant vegetation.</i> The SEPP requires that the following in respect of DCPs be prepared in the WSEA: <i>(1) In making provision for or with respect to biodiversity, a development control plan must address the following:</i> <i>(a) the existing natural environment, including any remnant vegetation, threatened species, endangered ecological communities, critical habitat, wildlife corridors and riparian areas,</i> <i>(b) opportunities to offset the impact of any clearing of native vegetation,</i> <i>(c) species or kinds of trees or other vegetation to which clause 32 (of the Employment Lands SEPP) applies,</i> <i>(2) Where appropriate, the development control plan must provide for the preparation of management plans for the rehabilitation of any communities of flora and fauna so that the ecosystem diversity is maintained.</i>	Chapter 4, 5 and 6

3 Methods

3.1 Database review and Likelihood of occurrence assessment

A review of all readily available literature and database records pertaining to the ecology of the study locality and subject site were reviewed to provide important background information. A database search of both the BioNet Atlas of NSW Wildlife and EPBC Act Protected Matters Search Tool was carried out for the study area on the 18 May 2015 to determine the local occurrence of previously recorded threatened flora and fauna species, populations and EEC's in accordance with State and Federal statutory requirements.

A 10 x 10 km (100 km²) search of the BioNet Atlas of NSW Wildlife and a 5km radius search of the study site using the EPBC Act Protected Matters Search Tool was conducted. Both searches were centred on the subject site.

Following a review of fauna and flora databases and previous ecological surveys, a '*likelihood of occurrence*' assessment was undertaken for threatened and migratory species. This assessment was based on database or other records, presence or absence of suitable habitat, features of the study area and subject site, results of the field survey and professional judgement. Five terms for the likelihood of occurrence of species are used in this report. The terms for likelihood of occurrence are defined below:

“yes” = 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

A decision was then made as to whether an *Assessment of Significance* was required for the species based on the likelihood of being impacted by the proposal.

The results of these searches and the likelihood of occurrence assessment can be found in **Appendix A**

3.2 Literature Review

A significant amount of ecological study has been undertaken previously on the subject site, including regional scale vegetation mapping by the state government as well as site-specific surveys for previous development proposals. As part of this literature review, two reports have been analysed to identify the extent of previous survey and to provide an overview of the results and conclusions drawn from these reports.

3.2.1 Flora and Fauna Assessment. Biosis Research, May 2005.

A flora and fauna assessment was undertaken by Biosis Research in May of 2005. The aim of the study was to determine the potential options and constraints for future development and as such was designed as a brief and preliminary habitat assessment. The results of the assessment determined that the majority of the site was cleared paddocks with scattered trees and Cumberland Plain Woodland occurring in the south-west adjoining Ropes Creek and River-flat Eucalypt Forest occurring along

Ropes Creek. One threatened flora species, *Grevillea juniperina* ssp. *juniperina* (listed Vulnerable under the TSC Act) was recorded within the Cumberland Plain Woodland in the south-west of the subject site and on the banks of the large dam in the centre of the subject site. No threatened fauna species were recorded within the study area during the survey, however, based on habitat features and database searches Biosis considered the site to support potential habitat for twenty-one threatened and/or migratory species. The threatened species *Meridolum corneovirens* (Cumberland Plain Land Snail) had previously been recorded on site and Biosis considered there to be potential habitat for this species within the Cumberland Plain Woodland. A small dam located in the south-eastern part of the subject site was also considered potential habitat for *Litoria aurea* (Green and Golden Bell Frog).

3.2.2 Ropes Creek Environmental Constraints Assessment – Riparian Corridor Strategy. GHD. November 2009

As part of the Environmental Constraints Assessment GHD have reviewed an Ecological Values and Constraints Assessment for a site located off of Old Wallgrove Road, Eastern Creek which is located to the east of the current subject site. The field investigations for this assessment confirmed that the extent of remnant native vegetation was consistent with the previous mapping of the study area undertaken by National Parks and Wildlife Services (NPWS). Three remnant native plant communities were stated as occurring on site; Shale Hills Woodland (SHW), Shale Plains Woodland (SPW) and Alluvial Woodland (AW). This assessment concluded that the majority of the site has been cleared of native vegetation and is now dominated by exotic pastures, with the SHW degraded such that no significant floristics remain to confirm the presence of this community on site. SPW and AW do occur in varying degrees of health with the AW in close proximity to the creek edge and SPW located further away from the creek. The threatened species *Grevillea juniperina* ssp. *juniperina* (listed Vulnerable under the TSC Act) was recorded during the field assessment. This report lists three habitat types as being present on site being; native vegetation/woodland remnants, cleared pasture and remnant canopy trees and water bodies.

3.3 Site Survey

The subject site was surveyed by two ELA ecologists across two consecutive days on 13 - 14 May 2015. The general condition of the site was assessed and observations made of flora and fauna species and vegetation communities. During the surveys the weather was cool and sunny with no rain.

3.3.1 Flora Survey and Habitat Assessment

Species of plant growing in the study area were surveyed by undertaking a general habitat assessment as well as targeted searches for habitat of threatened species.

The condition of the vegetation was assessed according to the degree to which it resembled relatively natural, undisturbed vegetation using the following criteria:

- Species composition (species richness, degree of weed invasion)
- Vegetation structure (representation of each of the original layers of vegetation).

The three categories used to describe general habitat value were High, Moderate and Low as outlined below:

High: containing a high number of native species; little to no weeds present or weed invasion restricted to margins; vegetation community contains original layers of vegetation; vegetation layers (ground, shrub, mid-canopy, canopy) are intact.

Moderate: containing a moderate number of native species; moderate-high level of weed invasion or weeds occurring in isolated patches or scattered throughout. One or more of original layers of vegetation are modified; vegetation layers (if originally present) (ground, shrub, mid-canopy, canopy) are mostly intact.

Low: containing a low number of native species; high level of weed invasion; weeds occurring in dense patches or scattered throughout, one or more of the original layers of vegetation are highly modified; one or more original vegetation layers (ground, shrub, mid-canopy, canopy) are modified or absent.

3.3.2 Fauna Survey and Habitat Assessment

Fauna surveys occurred as part of the habitat assessment and involved incidental sightings of fauna only. For this report no trapping, call playback or spotlighting was undertaken. Targeted searches for *Meridolum corneovirens* (Cumberland Plain Land Snail) and its habitat were undertaken. Searches for habitat considered appropriate for the presence of *Litoria aurea* (Green and Golden Bell Frog) occurred, particularly around the large dam within the subject site. All hollow bearing trees and stag trees were recorded across the site.

Nocturnal fauna surveys

Nocturnal fauna surveys were undertaken by two ELA ecologists across two consecutive nights on 13 – 14 October 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**. Location of anabats and survey effort are shown in **Figure 2**.

Table 2: Nocturnal fauna survey methodology

GUILD/TARGET SPECIES	DEC (2004) RECOMMENDATIONS	ELA PROPOSED 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 Anabats programed 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 2: Location of anabats and nocturnal survey effort

3.3.3 Top of Bank Survey method

Riparian corridors were delineated from a combination of desktop and field-validated mapping. Desktop mapping used contour data and aerial imagery (Nearmap) to identify the likely top of bank for watercourses appearing on the 1:25,000 topographic map (Map Sheet 9030-2N Prospect). Field validation occurred on 25 May 2015 to confirm or adjust the top of bank mapping. Where access was available, creeks were walked and mapped with a GPS unit (<1 m accuracy). Accuracy decreased in dense vegetation cover (<5 m), and if necessary GPS points were adjusted post-field survey against the aerial mapping. Where creeks did not have a defined channel and were unlikely to meet the definition of a 'river' under the WM Act, the centreline of overland flow was mapped instead.

Waterways were assessed and rated as excellent to poor using aquatic, riparian and geomorphic indicators of stream health.

4 Results - Terrestrial Habitats

4.1 Vegetation Communities

The majority of the site has been cleared of native vegetation in the past for farming purposes and is now predominantly composed of exotic pasture species; however, there are areas of more resilient native grasses and herbs found throughout the subject site. The vegetation on site was considered to be grouped into four categories being Woodland Remnants, Riparian Forest, Cleared Paddocks with scattered remnant canopy trees, and one feature of the site being the man-made dam located in the centre of the subject site (**Figure 3**).

Vegetation within the subject site has previously been mapped by NSW National Parks and Wildlife Services (NPWS) as being Cumberland Plain Woodland (CPW) and River-Flat Eucalypt Forest. This mapping has been used in conjunction with field validation and aerial photo interpretation to create an accurate vegetation map of the subject site. CPW is currently listed as a CEEC under both Schedule 3 of the TSC Act and the EPBC Act. River-Flat Eucalypt Forest is listed under the TSC Act as being an EEC.

4.1.1 Woodland Remnants (CPW in the Sydney Basin Bioregion)

Across the site there are a number of small areas that support CPW in varying degrees of health. The south-western corner of the subject site contains CPW that in its current condition would meet the condition threshold definition of this community under both State and Federal legislation and is considered to be in good condition. There are three other areas across the subject site (southern end, surrounding the dam and northern end) that would meet the condition threshold definition of this community under State legislation only and are considered low-moderate condition.

The South-western portion of CPW has a dominant tree canopy consisting of *Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum) with *Casuarina glauca* (Swamp Oak) present on the boundary between CPW and the River-Flat Eucalypt Woodland and *Acacia parramattensis* (Parramatta Wattle) and *Melaleuca decora* (Honey Myrtle) in the mid-storey layer. The shrub layer consisted of *Bursaria spinosa* (Native Blackthorn), *Dillwynia sieberi* (Parrot-pea) and *Daviesia ulicifolia* (Bitter-pea).

A large number of the state listed vulnerable species *Grevillea juniperina* subsp. *juniperina* is also present within this community. The ground-layer consisted of numerous grasses and forbs including *Themeda australis* (Kangaroo Grass), *Cymbopogon refractus* (Barbed Wiregrass), *Microlaena stipoides* (Weeping Grass) and *Wahlenbergia* sp. (Sprawling Bluebell). Exotic species were also present in the ground-layer including *Senecio madagascariensis* (Fireweed), *Sida rhombifolia* (Paddy's Lucerne) and *Solanum nigrum* (Blackberry Nightshade).

The three other areas mapped as CPW consist of a dominant tree canopy of *Eucalyptus tereticornis* (Forest Red Gum) with occasional *Eucalyptus moluccana* (Grey Box). There is little native shrub layer, however, there is considerable Forest Red Gum juvenile recruitment occurring, most notably in the southern portion of CPW. A mixed grassy ground-layer consisting of native species including *Cymbopogon refractus* (Barbed Wiregrass), *Aristida ramosa* (Purple Wiregrass) occasional *Themeda australis* (Kangaroo Grass) and exotic grass species including *Paspalum dilatatum* (Paspalum), *Axonopus fissifolius* (Common Carpet grass) and *Eragrostis curvula* (African Lovegrass). Exotic species were also present in the ground-layer including *Senecio madagascariensis* (Fireweed) and *Lycium ferocissimum* (African Boxthorn).

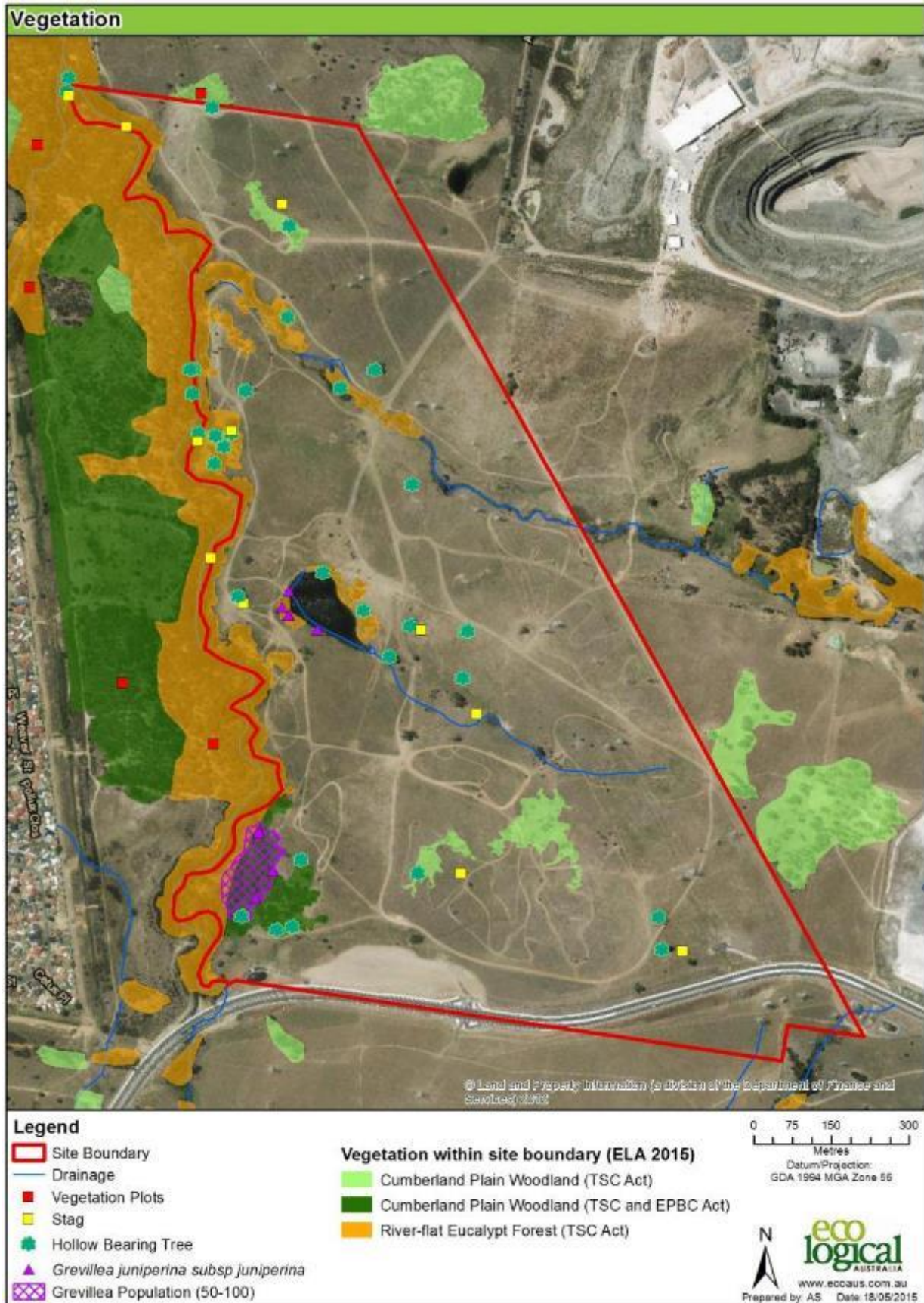


Figure 3: Mapped vegetation communities, Hollow bearing trees/stags and threatened species *Grevillea juniperina subsp. juniperina*



Plate 1: CPW in the south-west of the subject site (*Grevillea juniperina* subsp. *juniperina*)



Plate 2: Modified CPW regrowth

4.1.2 Riparian Forest (River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions)

The River-Flat Eucalypt Forest is located along the entire western boundary of the subject site and follows closely to the outline of Ropes Creek and extends to the east along a smaller drainage line in the northern portion of the subject site and partially surrounds the dam (**Figure 3**). The vegetation forms a thin strip along the creek edge and as such is subject to considerable edge effects and exotic species are common throughout, however, the vegetation is consistent with and meets the criteria of the state listed EEC.

The canopy tree species within the Riparian River-Flat Eucalypt Forest varied along the creek; however, the consistently dominant species was *Casuarina glauca* (Swamp Oak), with *Angophora floribunda* (Rough-barked Apple), *Angophora subvelutina* (Broad-leaved Apple), *Eucalyptus amplifolia* (Cabbage Gum), *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box) also present. The mid-storey layer consisted of *Melaleuca styphelioides* (Prickly-leaved Paperbark), *Acacia parramattensis* (Parramatta Wattle) and *Melaleuca decora* (Honey Myrtle). The noxious weed species *Ligustrum sinense* (Small-leaved Privet) and *Lycium ferocissimum* (African Box-thorn) also occupied the mid-storey and in some locations were quite dense. The shrub layer consisted of *Bursaria spinosa* (Native Blackthorn) and patches of both the threatened species *Grevillea juniperina* subsp. *juniperina* and the noxious weed *Rubus fruticosus* agg. (Blackberry). The ground-layer consisted of grasses and forbs including *Themeda australis* (Kangaroo Grass), *Microlaena stipoides* (Weeping Grass), *Rytidosperma bipartitum* (Wallaby Grass), *Pratia purpurascens* (Whiteroot), *Cheilanthes sieberi* (Narrow Rockfern). Numerous exotic species were also present in the ground-layer including *Senecio madagascariensis* (Fireweed), *Sida rhombifolia* (Paddy's Lucerne), *Solanum nigrum* (Blackberry Nightshade) and *Solanum pseudocapsicum* (Madeira Winter Cherry).



Plate 3: River-Flat Riparian Forest vegetation

The area of this community located along the drainage line has a slightly different composition and is dominated in the canopy by *Eucalyptus tereticornis* (Forest Red Gum), *Casuarina glauca* (Swamp Oak) and *Angophora floribunda* (Rough-barked Apple) with *Typha orientalis* (Cumbungi) and the exotic species *Juncus acutus* (Spiny rush) present along the drainage line.

The area of this community located around the dam is dominated in the canopy by *Eucalyptus tereticornis* (Forest Red Gum), *Casuarina glauca* (Swamp Oak) and *Eucalyptus moluccana* (Grey Box) with *Melaleuca styphelioides* (Prickly-leaved Paperbark) in the mid-storey and threatened *Grevillea juniperina* subsp. *juniperina* in the ground layer.

4.1.3 Cleared Paddocks with Scattered Remnant Canopy Trees

The vegetation across the subject site in these cleared paddock areas was in low condition with the canopy layer mostly removed and the mid-canopy/shrub layer highly modified. The paddocks were composed predominantly of exotic species including grasses and herbs including *Cynodon dactylon* (Common Couch), *Paspalum dilatatum* (Paspalum), *Eragrostis curvula* (African Lovegrass), *Chloris gayana* (Rhodes grass), *Axonopus fissifolius* (Common Carpetgrass), abundant *Senecio madagascariensis* (Fireweed) and *Bidens pilosa* (Cobblers Peg). Exotic shrubs include *Lycium ferocissimum* (African Box-thorn), *Olea europaea* subsp. *cuspidata* (African Olive) and *Rubus fruticosus* agg. (Blackberry). Scattered remnant tree canopy species that occur across the subject site are predominantly *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box). Occasional *Melaleuca styphelioides* (Prickly-leaved Paperbark) was also present in these cleared paddock areas.



Plate 4: Cleared paddocks with scattered remnant trees

4.2 Flora

A total of 104 flora species were recorded on the subject site and consisted of 50 native species (48%) and 54 exotic species (52%). A complete list of the flora species recorded on the subject site can be found in **Appendix B**.

4.2.1 Threatened flora

Twenty-seven threatened flora species listed under the TSC Act and twenty-one threatened flora species listed under both the TSC Act and EPBC Act have been recorded within a 10km radius of the site (**Figure 4**). A 'Likelihood of Occurrence' assessment (Appendix B) has been conducted for the flora species recorded in the 10km (TSC Act) and 5km (EPBC Act) searches. From this assessment a total of twelve (12) species have the potential to be found on site. Potential habitat for the remaining fifteen (15) species was not considered to be present on site.

One threatened flora species *Grevillea juniperina* subsp. *juniperina* has been identified as occurring on the subject site. **Figure 4** shows the locations of this species with the greatest proportion occurring in the south-western section of the site and also scattered around the dam.

4.2.2 Weeds

A total of nine (9) exotic species are listed under the Blacktown Local Government Area (LGA) noxious weeds list. Seven of these species are listed as being Class 4 (The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread) and include *Asparagus aethiopicus* (Asparagus Fern), *Asparagus asparagoides* (Bridal creeper), *Ligustrum sinense* (Small-leaved Privet), *Lycium ferocissimum* (African box-thorn), *Olea europaea* subsp. *cuspidata* (African Olive), *Rubus fruticosus* agg. (Blackberry) and *Senecio madagascariensis* (Fireweed). Two of these species are listed as Class 3 (The plant must be fully and continuously suppressed and destroyed) and include *Salvinia molesta* (Giant molesta) *Sporobolus fertilis* (Giant Parramatta Grass) (**Figure 5**).

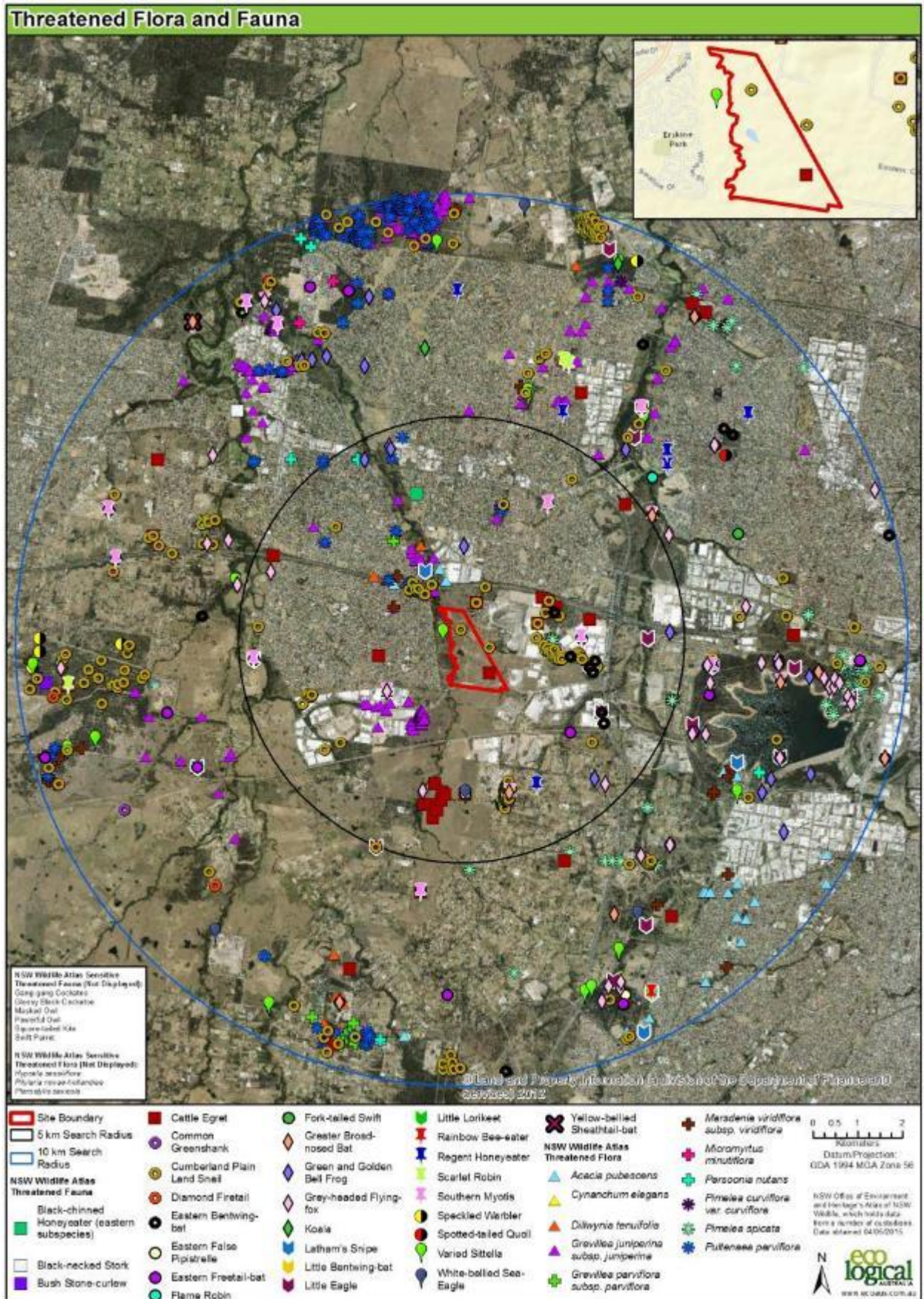


Figure 4: Threatened flora and fauna

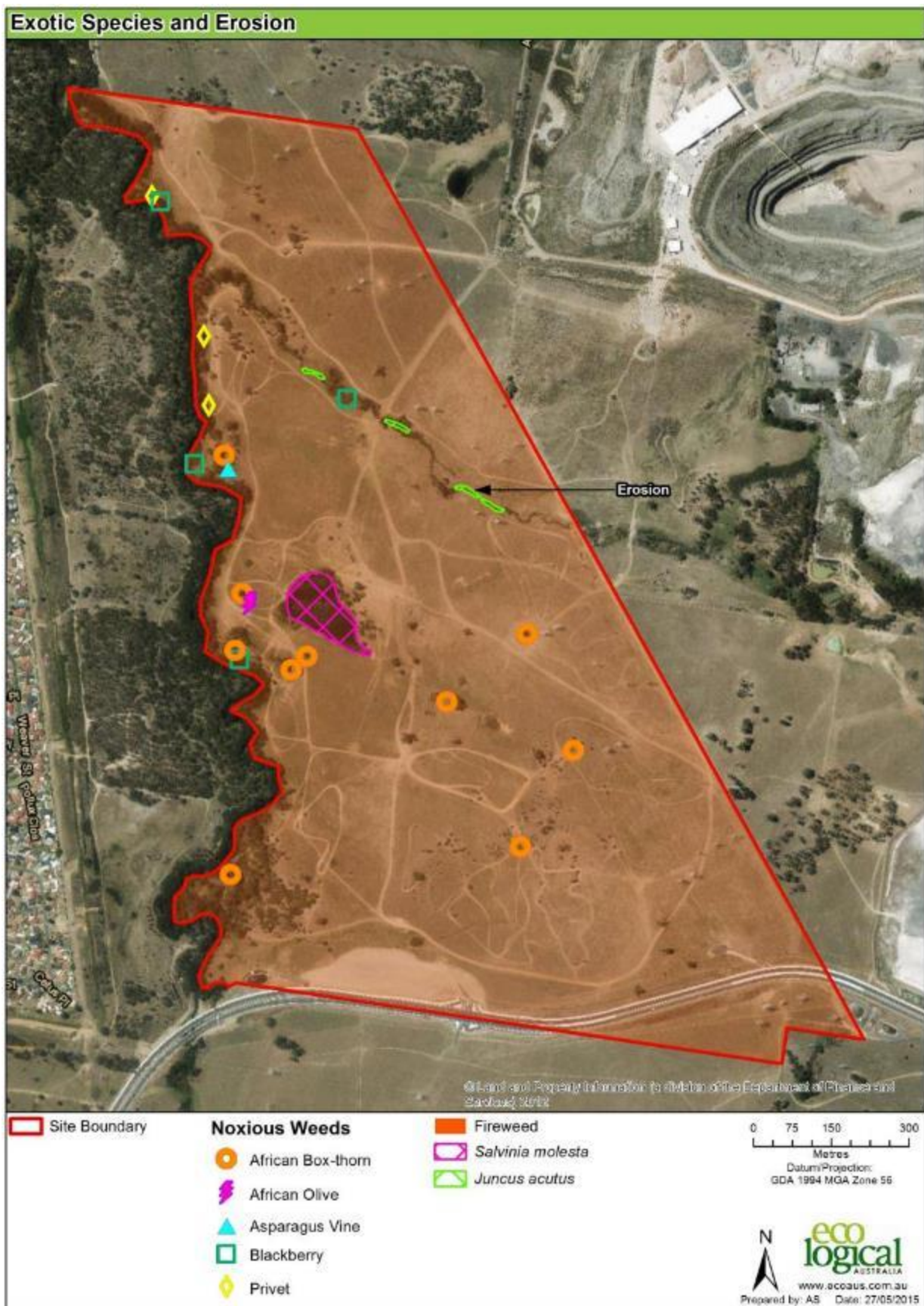


Figure 5: Noxious weeds and erosion on the subject site

4.1 Fauna habitat

Potential fauna habitat on site was considered to be grouped into four categories being Woodland Remnants in good condition and moderate condition, Riparian Forest, Cleared Paddocks with scattered remnant canopy trees (Error! Reference source not found.). **Table 3** provides a description of each.

4.2 Fauna species

A comprehensive fauna species list from observations made during the field survey is presented in **Appendix C**. A total of 38 fauna species were recorded on the subject site and consisted of 19 native birds, two exotic birds, two amphibians, 13 native mammals (including nine bat species), two exotic mammals,

Anabat analysis results are provided in **Appendix D**.

4.3 Threatened fauna

A total of forty-six threatened and/or migratory species have previously been recorded within a 10km radius of the site. Seventeen threatened fauna species listed under the TSC Act, eighteen threatened fauna species listed under the EPBC Act and/or TSC Act, 12 listed as migratory under the EPBC Act and one listed under the FM Act have been recorded (**Figure 4**).

A 'Likelihood of Occurrence' assessment (**Appendix A and B**) has been conducted for the fauna species recorded in the 10 km (TSC Act) and 5 km (EPBC Act) searches. From this assessment a total of 25 species are known or have the potential to occur within the study area.

Six threatened fauna species and one migratory species were recorded within the study area during field surveys, including:

- *Falsistrellus tasmaniensis* (Eastern Freetail-bat) listed as vulnerable under the TSC Act.
- *Miniopterus schreibersii oceanensis* (Eastern Bent-wing Bat), listed as vulnerable under the TSC Act.
- *Myotis macropus* (Large-footed Myotis), listed as vulnerable under the TSC Act.
- *Pteropus poliocephalus* (Grey-headed Flying Fox), listed as vulnerable under the TSC Act and EPBC Act.
- *Scoteanax rueppellii* (Greater Broad-nosed Bat), listed as vulnerable under the TSC Act
- *Hieraaetus morphnoides* (Little Eagle), listed as vulnerable under the TSC Act
- *Ardea ibis* (Cattle egret), listed under the EPBC Act

Table 3 Terrestrial habitats

Habitat	Value	Description
Woodland remnant good	High	The Cumberland Plain Woodland mapped as meeting TSC Act and EPBC Act thresholds (Error! Reference source not found.) is in relatively good condition and comprises good habitat for a range of species including a well-developed canopy of <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>Eucalyptus moluccana</i> (Grey Box), a mid-canopy and shrub layer and a grassy understorey. There are four (4) large hollow-bearing trees, some with multiple hollows present in this area. There is a small amount of fallen logs suitable for reptiles, small mammal and potentially amphibians; however there is limited leaf litter present. Targeted searches for the Threatened species <i>Meridolum corneovirens</i> (Cumberland Plain Land Snail), which has previously been recorded on site, were undertaken, however, the amount of leaf and debris cover required by this species was not present. Overall, it is considered that the vegetation in this area provides potential habitat for a number of threatened species.
Woodland moderate remnant	Moderate	The Cumberland Plain Woodland mapped as meeting TSC Act thresholds (Error! Reference source not found.) is relatively degraded regrowth vegetation that supports a scattered canopy of remnant trees including <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>Eucalyptus moluccana</i> (Grey Box). In these areas there is considerable eucalypt regeneration including many juvenile <i>E. tereticornis</i> . The majority of regrowth trees do not provide habitat for nesting or breeding, however <i>E. moluccana</i> may provide foraging resources for certain bird species. There is one significant hollow bearing tree located at the edge of the community and the presence of a small amount of fallen logs. There is very little to no ground leaf litter.
Riparian Forest	High	The riparian forest follows Ropes Creek along the western boundary of the subject site and its tributary extending to the east across the site. As this vegetation is fairly narrow it is subject to considerable edge effects and there is heavy weed invasion at numerous points along the creek. Apart from this, the structure of the riparian vegetation provides a good canopy layer of <i>Casuarina glauca</i> (Swamp Oak), numerous Eucalypts and Angophoras, a well-developed mid-canopy and shrub layer of Melaleucas and Acacias and a grassy ground layer providing shelter and protection to small mammals, reptiles and birds moving along the creek line. This vegetation is likely to provide important corridor habitat to the safe passage and movement of fauna into and off of the subject site. A large number of Grey-headed Flying Fox's were observed foraging in the trees during spotlighting surveys. Towards the north of the site, and along the drainage line a number of large hollow-bearing trees occur and may provide nesting/breeding habitat to a range of threatened fauna. Fallen logs and accumulations of debris

		(branches/logs/casuarina needles) were also present which may provide shelter to ground dwelling fauna.
Cleared Paddocks with scattered remnant canopy trees	Low	The cleared paddocks were dominated by exotic grasses with occasional remnant trees, consisting predominantly of <i>Eucalyptus tereticornis</i> (Forest Red Gum) and <i>Eucalyptus moluccana</i> (Grey Box). Approximately five (5) of these remnant trees were large hollow-bearing trees (HBT's) and six (6) were stag trees which may provide nesting/breeding habitat to a range of threatened fauna. Active nesting/breeding of <i>Eolophus roseicapilla</i> (Galah) and <i>Cacatua galerita</i> (Sulphur-crested Cockatoo) was observed in several HBT's within the study area, however no active microbat roosts were observed during stag watching surveys. A number of fallen logs were present across the paddocks and may potentially provide some habitat for small mammals and reptiles; however, there was very little leaf/debris litter suitable for use as shelter. The mix of tall exotic and to a lesser extent native grasses may provide suitable foraging and shelter for small mammals and birds.

4.4 Conservation Significance

Threatened flora, fauna habitat and ecological communities that have moderate or high conservation significance include:

The CPW mapped in the south-western portion of the site has been mapped as having a high level of conservation significance (**Figure 6**) as it meets both TSC Act and EPBC Act thresholds as well as containing a large patch of the threatened species *Grevillea juniperina* ssp. *Juniperina*.

The River-Flat Eucalypt Forest running along the western boundary of the site and along the drainage line to the south-east has been mapped as having a high level of conservation significance (**Figure 6**). This community does have some significant exotic weed invasion; however, this EEC meets the TSC Act criteria and forms part of a significant habitat corridor across the landscape that is likely to provide important shelter and safe passage to fauna species that may utilise the site. There are also a number of significant hollow-bearing and stag trees present which may provide important habitat to hollow dependent species.

The CPW that has been mapped as having a moderate level of conservation significance (**Figure 6**) is considered to meet the TSC Act threshold, however, is not as robust as the CPW mapped in the south western corner of the subject site. There is considerable weed invasion and certain elements of the stratum are missing, however, there is considerable juvenile recruitment occurring, which, if encouraged and properly managed, could improve the health of this community in these areas. Its isolation in what is likely to be a highly developed area mean that despite meeting the TSC Act definition it is unlikely to provide the same habitat for threatened species and has a lower long term viability.

The areas mapped as having a low level of conservation significance are the Cleared Paddocks with scattered remnant canopy trees (**Figure 6**). The cleared paddocks consist predominantly of exotic grasses and due to the exposed nature of these areas it is unlikely to provide significant habitat to any threatened species. It is also likely that the majority of the species that may have the potential to utilise these areas are highly mobile bird species and as such little direct impact will occur as a result of future development. Whilst the hollow bearing trees and stags (dead trees) can provide valuable habitat for fauna including threatened species such as arboreal mammals, bats and some birds, the isolated nature of these habitats is such that they are unlikely to provide important habitat resources compared to the nearby riparian areas of Ropes Creek.

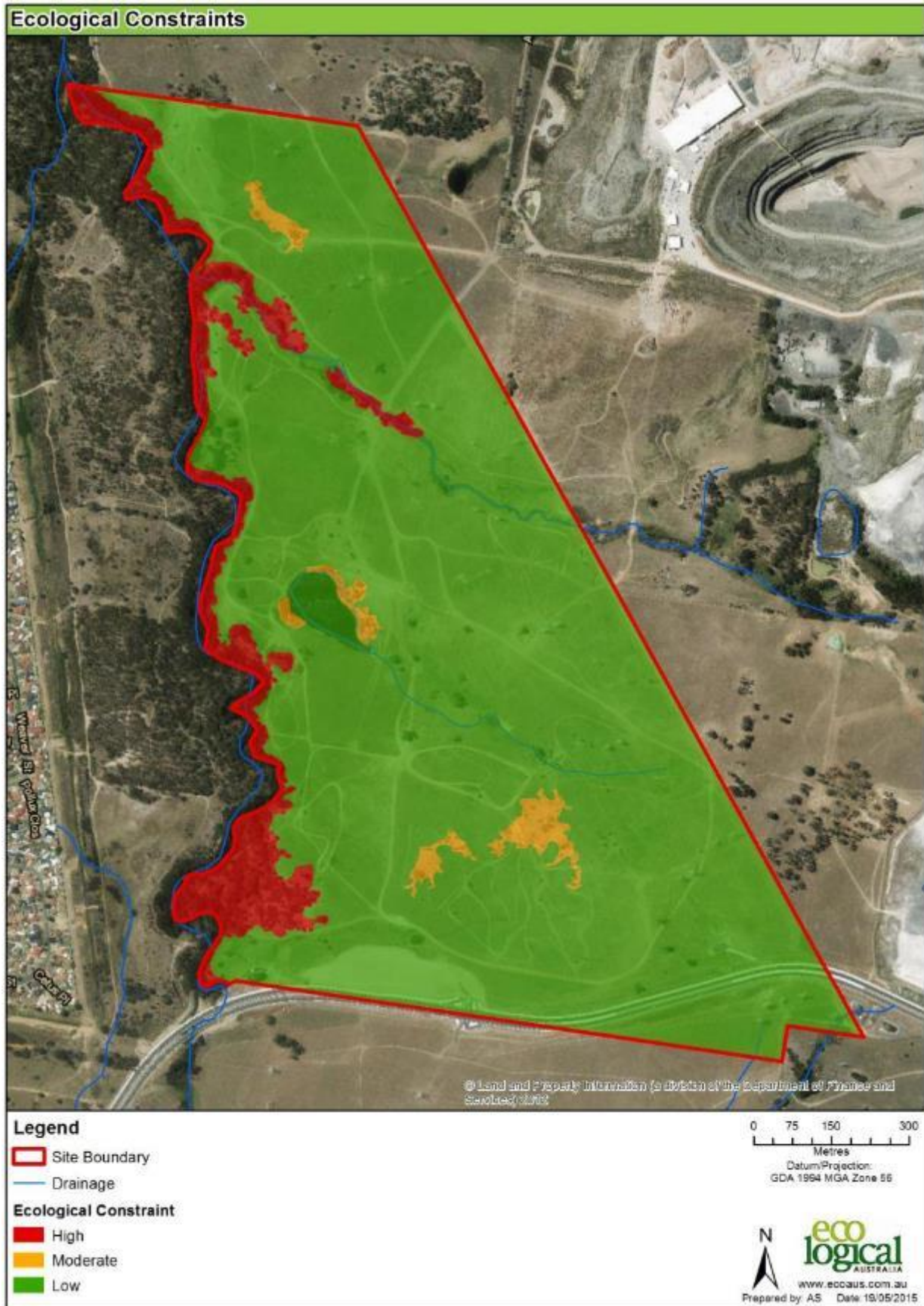


Figure 6: Terrestrial ecological constraints across the subject site

5 Results – Aquatic and Riparian Habitats

5.1 Top of bank mapping

Figure 7 shows the existing top of bank of creeks and dams, or the centre of drainage lines where no channel occurs. Each creek is classified using the Strahler stream order, which is a numerical measure of its branching complexity. Using this classification the smallest branches are 1st order. When a 1st order stream meets another 1st order stream it becomes a 2nd order stream. The stream only increments up when it joins a stream of equal order. For Ropes Creek only the eastern top of bank was mapped as the western bank is not relevant to the study area.

5.2 Aquatic habitats

Five creeks and a dam are mapped within the site on the 1:25,000 topographic map (**Figure 7**). Based on literature review and site assessment, **Table 4** provides information on their condition based on the literature review and site assessment. A photo of a representative section of each watercourse is provided.

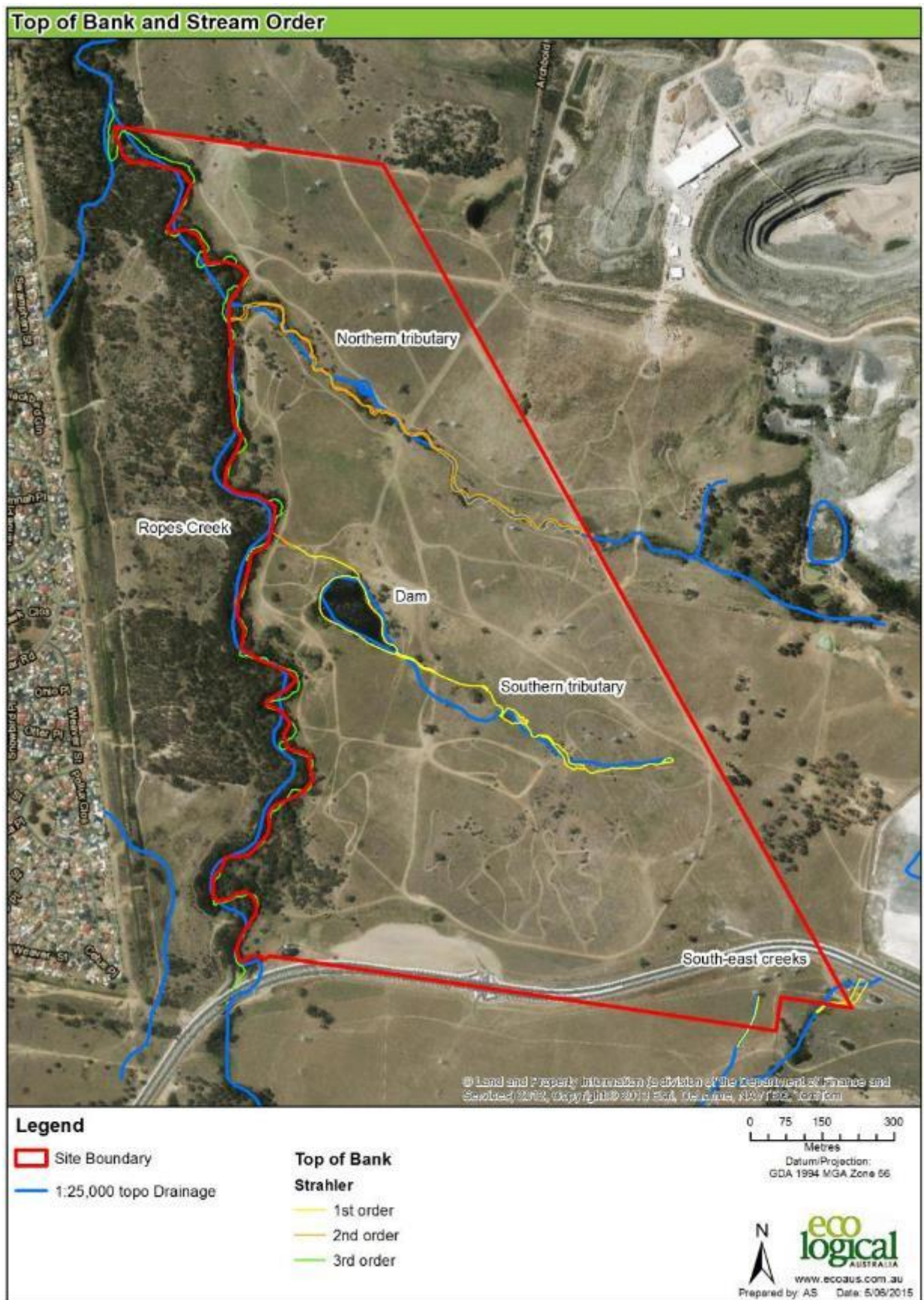


Figure 7 Top of Bank and Stream Order

Table 4 Aquatic and riparian habitat condition

Waterbody	Condition assessment	Representative section of watercourse
Ropes Creek	Whilst the majority of this watercourse is outside of the subject land, an assessment was made of its condition as the riparian zone of the watercourse extends into the subject site. This 3rd order stream is in moderate condition with mostly intact riparian vegetation and a variety of aquatic habitat. Understorey weeds are common, which may prevent natural recruitment of canopy species. Instream habitat consists of long sinuous pools connected by shallow runs and log jams. Water quality at the time of survey was very turbid. Only few macrophyte patches occur along the channel, likely shaded out by the dense canopy. Banks were mostly a gentle grade, but with occasional severe slumping on sharp bends, where trees have collapsed with the bank into the creek. Aquatic fauna is mostly likely common fish (e.g. eels) and pest species (e.g. carp). Native turtles and monitors would also cope with the disturbed aquatic habitat.	

Northern tributary	This 2nd order stream is in moderate-poor condition with large portions of riparian vegetation missing and shallow aquatic habitat. The creek is severely eroded in parts, especially beneath the power lines where tree management is likely implemented. Decades of fast runoff from the cleared catchment has incised the channel, collapsed banks and filled pools and riffle habitat with sediment. Cattle disturbance to the banks and channel is also evident. Other areas of this creek are in moderate condition, with only a thin strip of riparian vegetation, scattered macrophytes and woody debris. Aquatic fauna is likely limited to small fish and exploring turtles and eels. At a landscape scale, this creek appears to provide a fragmented connectivity to a patch of vegetation to the east of the study site, and therefore may facilitate terrestrial fauna movement.	
Southern tributary	This 1st order stream is in poor condition with large segments having no channel bed or bank. A small dam occurs midway upstream, along with occasional channel segments characterised by eroded banks (see photo) and scattered riparian vegetation.	

South-east creek (western branch).	This 1st order stream does not meet the definition of a 'river' under the WM Act, due to its lack of channel bed and bank.	
South-east creek (eastern branch).	This 1st order stream is a narrow creek beginning at the Lenore Drive box culverts and detention ponds. It is in poor condition with dense <i>Juncus acutus</i> weeds and no canopy (beneath power lines).	

Dam	The structure of the large dam consisted of high banks leading up to the wall surrounding the dam. <i>Casuarina glauca</i> (Swamp Oak) were present along the edge and slightly into the dam and a small amount of fringing vegetation including <i>Typha orientalis</i> (Typha) <i>Juncus usitatus</i> (Juncus) and the exotic <i>Juncus acutus</i> (Spiny rush). Four individuals of threatened species <i>Grevillea juniperina</i> subsp. <i>juniperina</i> are also present on the western side of the dam. <i>Salvinia molesta</i> (Giant molesta) covers 95% of the surface of the dam. This species is class 3 under the NSW Noxious Weeds Act and is a Weed of National Significance. The dense mat of this weed would produce a great deal of decaying organic matter beneath the surface. The bacteria consuming this organic matter would consume large amount of dissolved oxygen from the water, which the plants would replenish during diurnal (daytime) photosynthesis. However, the diel (24 hour) fluctuations of dissolved oxygen concentrations would be severe, likely ranging from 0 – 200% saturation. Most fish are unable to tolerate such extreme oxygen deficiencies. Only very hardy fish are likely to occur in this dam (e.g. native eels and pest gambusia). The extent of infestation makes it is unlikely that the dam is hospitable to any freshwater species. The presence of this species will affect most native plants, fish, birds or animals that use the infested water body. The thick floating mats of salvinia prevent light and oxygen from entering the water and shades out submerged native aquatic plants and creating unfavourable conditions for other aquatic organisms (DPI 2006). There is potential for the dam to provide some habitat for highly mobile threatened and migratory species. A targeted search of the dam and habitat surrounding the dam	
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	occurred for <i>Litoria aurea</i> (Green and Golden Bell Frog). This search determined that there was not enough suitable vegetation surrounding the dam to provide shelter and breeding habitat for this species.	
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5.3 Riparian buffer requirements

In accordance with the NSW Office of Water's (NOW) *Guidelines for Riparian Corridors on Waterfront Land*, vegetated riparian buffers 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.

The Guidelines recommend that, a 1st order watercourse requires a 10 m riparian buffer on each side measured from top of bank; 2nd order = 20 m; 3rd order = 30 m; 4th order and greater = 40 m. In the case of online dams, riparian buffers are taken from the bank of the dam, but if dams were to be removed this riparian corridor would realign with the reconstructed creek.

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. Consultation with NOW is required if there is a desire to modify a creek or reduce its riparian width, including complete removal. Consultation with NOW would need to demonstrate that a balance of riparian lands is possible and appropriate by investing more riparian land into to more valuable creeks within the property. In this case, we recommend consultation with NOW should consider the removal of the southern tributary and dams, and the south-east creek (western branch). NOW would advise if the loss of riparian land should be offset into the northern tributary or Ropes Creek. Without offset, our recommended riparian corridors are shown in **Table 5** and **Figure 8**.

Table 5 Riparian buffer recommendations

Waterbody	Conservation significance	Office of Water Guidelines – buffer	ELA Recommended buffer
Ropes Creek	High: This creek has a functioning riparian zone containing endangered ecological communities.	30m	30m
Northern tributary	Moderate: whilst the watercourse and riparian zone are degraded in parts, this watercourse provides a link through the site which provides moderate habitat values that could be enhanced with restoration.	20m	20m
Southern tributary	Low: Whilst a riparian zone could be rehabilitated, the catchment for this creek is small and will not provide an important link to other aquatic habitats.	10m	Nil
South-east creek (western branch).	Nil: No evidence of channel.	10m	Nil
South-east creek (eastern branch).	Low: Highly weed infested	10m	10m

Dam	Low: Extensive infestation by Class 3 weed (<i>Salvinia molesta</i>). The dam is unlikely to contain native fish and have low conservation significance. If it is proposed to remove the dam, dewatering of the dam will need to be undertaken in a manner that avoids discharge of water and weeds off site or to Ropes Creek.	10m	Nil
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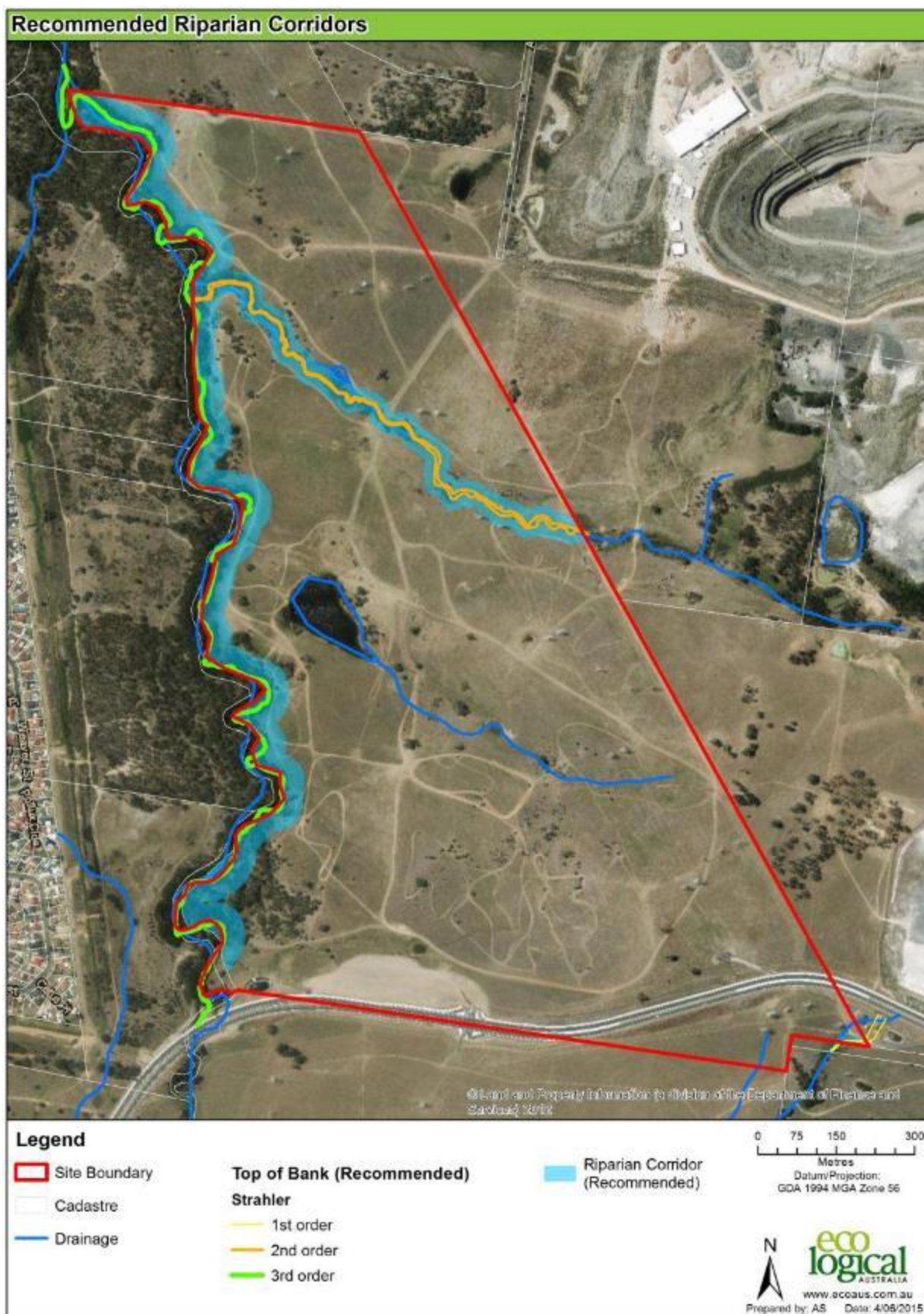


Figure 8 Recommended riparian buffers

6 Recommendations

This chapter provides recommendations for the protection of ecological values on the site, in accordance with Schedule 4 of the SEPP (Western Sydney Employment Area) 2009.

Requirement from the study brief.	Recommendation
Identify areas of biodiversity value that should be considered for retention, restoration, regeneration or revegetation.	1. Areas mapped as 'Protected and managed' on Figure 9 are recommended for retention 2. Areas mapped as 'Revegetation' on Figure 9 are recommended for restoration, regeneration or revegetation.
Recommend measures to protect biodiversity values, including development controls, setbacks, tenure and management.	3. Include the following objective in the DCP: • To conserve and improve the condition of riparian corridors and areas of high conservation value. 4. Avoid development on land shown in Figure 9 as 'Protection and Management / Revegetation' other than necessary infrastructure crossings 5. Avoid fragmentation of riparian corridors by retaining corridors in a single ownership if possible. 6. Prepare a Vegetation Management Plan for the riparian corridors in accordance with the <i>NSW Office of Water Guidelines for Development on Waterfront Land</i>. 7. Establish a funding source (such as a contribution scheme or Planning Agreements) to generate funds for the management of the riparian corridors. 8. Dedicate riparian corridors to a public authority or organisation with land management capabilities. This action would preferably be part of an over-all strategy for the management of lands to the west of Ropes Creek which are also in public ownership. 9. Apply clause 32 <i>Preservation of Trees</i> to all trees on the site. 10. If riparian corridors cannot be retained in public ownership, a Vegetation Management Plan should be prepared and submitted with each development application for development of the adjoining employment lands. Implementation of each plan would be the responsibility of the land owner of the adjacent employment lands.

	11. Removal of hollow bearing trees (if granted consent) is to be in accordance with best practice to minimise risk of injury to animals. A qualified ecologist should be onsite during felling of the hollow bearing trees. 12. Removal of the dam containing <i>Salvinia molesta</i> is to be under-taken in accordance with a dam decommissioning plan which ensures the weed is not transmitted to any drainage lines on the site.
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Figure 9 Recommendations

References

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Appendix A Likelihood of Occurrence : Threatened Species TSC Act 1995 and EPBC Act 1999

Endangered Ecological Communities

Community Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	EPBC listing equivalent	TSC listing equivalent	Distribution overlaps (yes/no)	Habitat present (good, marginal, none)	Community known to occur in region (yes/no)	Community known to occur on site (yes/no)	Likelihood of occurrence	Habitat on site directly or indirectly impacted (Yes/No)	Impact Assessment Required
Agnes Banks Woodland in the Sydney Basin Bioregion	E		Occurs in western Sydney, now mostly near Agnes Banks on the east bank of the Hawkesbury River, in the Penrith local government area.	Areas of wind-blown sand which overlay Tertiary Alluvium deposits from ancient river systems.			Yes	Marginal	Yes	No	Potential	No	No
Blue Gum High Forest in the Sydney Basin Bioregion	CE	CE	Remnants mainly occur in the Lane Cove, Willoughby, Ku-ring-gai, Hornsby, Baulkham Hills, Ryde and Parramatta local government areas.	On ridgelines in areas where rainfall is high (above 1100 mm per year) and the soils are relatively fertile and derived from Wianamatta shale. Also occurs on soils associated with localised volcanic intrusions.	Blue Gum High Forest of the Sydney Basin Bioregion		Yes	None	Yes	No	No	No	No
Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	E	CE	Blue Mountains and Wollemi areas, within the Blue Mountains and Hawkesbury LGAs, both within the Sydney Basin Bioregion. It may occur elsewhere in the Bioregion, and communities within Wollondilly LGA show similarities to this community.	Deep fertile soils formed on Wianamatta Shale, on moist sheltered sites at lower to middle altitudes.	Turpentine-Ironbark Forest in the Sydney Basin Bioregion.		No	None	Yes	No	No	No	No
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	V		Occurs within the local government areas of Bankstown, Blacktown, Campbelltown, Hawkesbury, Liverpool and Penrith. Mainly found in the Castlereagh area of the Cumberland Plain, with small patches occurring at Kemps Creek and Longneck Lagoon; also present around Holsworthy.	Occurs almost exclusively on soils derived from Tertiary alluvium, or on sites located on adjoining shale or Holocene alluvium. Often adjacent to and on slightly higher ground than Castlereagh Ironbark Forest or Shale Gravel Transition Forest in the Sydney Basin Bioregion.			Yes	None	Yes	No	No	No	No

Castlereagh Swamp Woodland Community	E		Western Sydney in the Castlereagh and Holsworthy areas, mainly in the Hawkesbury, Liverpool and Penrith local government areas.	Deposits from ancient river systems along today's intermittent creeklines, often in poorly drained depressions.			Yes	None	Yes	No	No	No	No
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	E		Occurs in western Sydney, with the most extensive stands occurring in the Castlereagh and Holsworthy areas. Smaller remnants occur in the Kemps Creek area and in the eastern section of the Cumberland Plain.	Mainly occurs on clay soils derived from the deposits of ancient river systems (alluvium), or on shale soils of the Wianamatta Shales.			Yes	Marginal	Yes	No	Potential	No	No
Cumberland Plain Woodland in the Sydney Basin Bioregion	CE	CE	Remnants scattered widely across the Cumberland Plain in western Sydney.	Typically occurs on heavy clay soils derived from Wianamatta Shale.	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.		Yes	Marginal	Yes	Yes	Yes	Yes	Yes
Eastern Suburbs Banksia Scrub of the Sydney Region	E	E	Eastern and south eastern suburbs of Sydney.	Nutrient-poor sand deposits.		Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion	No	None	Yes	No	No	No	No
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		Known from along the majority of the NSW coast.	Coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains.			No	None	Yes	No	No	No	No

River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		Found on the river flats of the coastal floodplains. Known from parts of 28 Local Government Areas. . In The Sydney area these include: Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool and Bankstown	Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains.			Yes	Good	Yes	Yes	Yes	Yes	Yes
Shale Gravel Transition Forest in the Sydney Basin Bioregion	E	CE	Mainly found in the northern section of the Cumberland Plain, western Sydney, in the Richmond, Marsden Park and Windsor districts. Also appears in the Liverpool/ Holsworthy area, and there are small occurrences at Bankstown, Yennora and Villawood and the Kemps Creek area.	Occurs primarily where shallow deposits from ancient river systems overlay shale soils, but also associated with localised concentrations of iron-hardened gravel.	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.		Yes	Marginal	Yes	No	Potential	No	No
Shale/Sandstone Transition Forest	E	E	Occurs at the edges of the Cumberland Plain in western Sydney, most now occurs in the Hawkesbury, Baulkham Hills, Liverpool, Parramatta, Penrith, Campbelltown and Wollondilly local government areas.	Intergrade between clay soils from the shale rock and earthy and sandy soils from sandstone, or where shale caps overlay sandstone.	Shale/Sandstone Transition Forest		Yes	Marginal	Yes	No	Potential	No	No
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	E		Range bounded approximately by Hurstville, Carss Park, Bundeena, Otford, Stanwell Tops, Darkes Forest, Punchbowl Creek and Menai.	Primarily gentle terrain, typically associated with sheltered heads and upper slopes of gullies on transitional zones where sandstone outcrops may exist, but where soils are influenced by lateral movement of moisture, nutrients and sediment from more fertile substrates.			No	None	Yes	No	No	No	No

Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		Coastal floodplains of NSW. Known from parts of the Local Government Areas of 46 LGA. In The Sydney area these include: Hawkesbury, Baulkham Hills, Hornsby, Lane Cove, Blacktown, Auburn, Parramatta, Penrith, Fairfield, Liverpool and Bankstown	Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains Generally occurs below 20 m elevation.			Yes	Marginal	Yes	No	Potential	No	No
Temperate Highland Peat Swamps on Sandstone		E	Components of the community include the Blue Mountains Swamps, Butler's Swamp, Jackson's Bog (Mila Swamp), Newnes Plateau Swamps, Paddy's River Swamps - Hanging Rock, Long, Mundego and Stingray Swamps, Wildes Meadow Swamp and Wingecarribee Swamp.	In Blue Mountains and Newnes Plateau areas, swamps associated with Triassic sandstone plateaux (Narrabeen Sandstone) in shallow, low-sloping, often narrow headwater valleys, on long gentle open drainage lines in the lowest footslopes, low-lying broad valley floors and alluvial flats, and in gully heads, open depressions on ridgetops and steep valley sides associated with semi-permanent water seepage.		Blue Mountains Swamps in the Sydney Basin Bioregion Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion Montane peatlands and swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	No	None	Yes	No	No	No	No
Turpentine-Ironbark Forest in the Sydney Basin Bioregion	E	CE	Cumberland Lowlands, with remnants also occurring to the west on shale-capped ridges in the Blue Mountains.	Restricted to areas with clay soil derived from Wianamatta Shale in an area that generally has an annual rainfall of more than 950 mm.		Sydney Turpentine-Ironbark Forest Blue Mountains Shale Cap Forest in the Sydney Bioregion	No	Marginal	Yes	No	Unlikely	No	No

Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion		E	Generally confined to the Sydney Basin bioregion, including the Moss Vale, Ettrema, Burragorang, Sydney Cataract, and Wollemi IBRA sub-regions. However, some patches may extend into in the Kanangra and Oberon IBRA sub-regions of the South Eastern Highlands bioregion.	Found on igneous rock (predominately Tertiary basalt and microsyenite). Typically occurs at elevations between 650 and 1050 m above sea level.		Robertson Basalt Tall Open Forest in the Sydney Basin Bioregion Mount Gibraltar Forest in the Sydney Basin Bioregion	No	Marginal	Yes	No	Unlikely	No	No
Western Sydney Dry Rainforest and Moist Woodland on Shale	E	CE	Cumberland Plain Sub-region of the Sydney Basin Bioregion.	It generally occurs in rugged terrain and other patches may occur on undulating terrain, with dry rainforest patches typically occupying steep lower slopes and gullies, and moist woodland patches typically occupying upper sections of the slope Occurs almost exclusively on clay soils derived from Wiannamatta Group shales.		Western Sydney dry rainforest in the Sydney Basin Bioregion Moist Shale Woodland in the Sydney Basin Bioregion.	No	None	Yes	No	No	No	No
Western Sydney Dry Rainforest in the Sydney Basin Bioregion	E	CE	Very restricted; occurs most commonly in the far southern section of the Cumberland Plain, in the Razorback Range near Picton. Outlying occurrences have been recorded at Grose Vale and Cattai.	Restricted to hilly country where it occurs on the sheltered lower slopes and in gullies. Occurs on clay soils derived from Wianamatta shale.	Western Sydney Dry Rainforest and Moist Woodland on Shale	Western Sydney Dry Rainforest in the Sydney Basin Bioregion	No	None	Yes	No	No	No	No
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	E	CE	Occurs in an arc along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria.	Areas where rainfall is between 400 and 1200 mm per annum, on moderate to highly fertile soils at altitudes of 170 m to 1200 m.		White Box Yellow Box Blakely's Red Gum Woodland	No	Marginal	Yes	No	Unlikely	No	No

Threatened Fauna

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Ecology	Distribution overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence	Habitat on site directly or indirectly impacted (Yes/No)	Impact Assessment Required
<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A	E	Two of three known key breeding areas are in NSW: the Capertee Valley and Bundarra-Barraba region. The species breeds between July and January and usually nests in horizontal branches or forks in tall mature eucalypts and Sheoaks. The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Apus pacificus</i>	Fork-tailed Swift	P	C,J,K, Mar	Non-breeding visitor to all states and territories of Australia, arriving from its breeding grounds in Siberia around October, and departing in April. The species is thought to be highly mobile within Australia, moving across the country in search of food. They probably roost aerially.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Ardea alba</i>	Great Egret	P	C, J, Mar	Mostly forages in shallow to moderately deep water for fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammals. In NSW, most breeding colonies are located in the Darling Riverine Plains region and the Riverina region. Breeding sites are located in wooded and shrubby swamp. The breeding season generally extends from November to April.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Ardea ibis</i>	Cattle Egret	P	C,J, Mar	Uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. The Cattle Egret often forages away from water on low lying grasslands, improved pastures and croplands. It is commonly found amongst livestock.	Yes	Marginal	Yes	Yes	Yes	Yes	Yes

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<i>Botaurus poiciloptilus</i>	Australasian Bittern	E1	E	Feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds.	Yes	None	Yes	No	No	Yes	No
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces. It also possibly roosts in the hollows of trees. The species is thought to require roosting habitat that is adjacent to higher fertility sites which are used for foraging. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.	Yes	None	Yes	No	No	Yes	No
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		Feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E1	E	Feeds on a variety of insects, particularly ants. Nests are elliptical domes constructed on or near the ground amongst dense vegetation. Two eggs are laid during August to February.	Yes	None	Yes	No	No	Yes	No
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E1		Usually forage in water 5-30cm deep for vertebrate and invertebrate prey (eels, fish, frogs and invertebrates). Black-necked Storks build large nests high in tall trees close to water. In NSW, breeding activity occurs May - January; incubation May - October; nestlings July - January; fledging from September.	Yes	Marginal	Yes	No	Potential	Yes	Yes

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<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		Predominately roosts in Eucalypt tree hollows. It has also been found to roost under loose bark on trees and in man-made structures. It hunts beetles, moths, weevils and other flying insects above or just below the tree canopy, in open forests. Hibernates in winter. Females are pregnant in late spring to early summer.	Yes	Marginal	Yes	No	Known	Yes	Yes
<i>Gallinago hardwickii</i>	Latham's Snipe	P	C,J,R, Mar	Non-breeding migrant to Australia, arriving between July-November from its breeding grounds in Japan and far-eastern Russia, and departing by late February. It feeds in mud or in very shallow water with low, dense vegetation. Roosting occurs on the ground near or in foraging areas beside or under clumps of vegetation, among dense tea-tree, in forests, in drainage ditches or plough marks, among boulders, or in shallow water if cover is unavailable.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	P	C	The breeding season extends from June to January (or sometimes February) in southern Australia. Breeding habitat is usually close to water, but may occur up to a kilometre away. Nests are mainly located in tall open forest or woodland, but sometimes in other habitats such as dense forest, closed scrub or in remnant trees on cleared land. The White-bellied Sea-Eagle feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion and offal.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water. This species breeds mainly in autumn, but has been recorded calling throughout the year. Egg masses are foamy with an average of approximately 500-800 eggs and are laid in burrows or under vegetation in small pools. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter.	Yes	None	Yes	No	No	No	No
<i>Hieraaetus morphnoides</i>	Little Eagle	V		Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	Yes	Marginal	Yes	Yes	Yes	Yes	Yes

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<i>Hirundapus caudacutus</i>	White-throated Needletail	P	C,J,K	Breeds in eastern Siberia, north-eastern China and Japan. The species arrives in Australia in September–October, and most depart by April. It almost always forages aerially. Recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E1	V	Nocturnal. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer. Feeds mostly on geckos and small skinks; will also eat frogs and small mammals occasionally. Females produce four to 12 live young from January to March.	Yes	None	Yes	No	No	Yes	No
<i>Lathamus discolor</i>	Swift Parrot	E1	E	Favoured feed trees include winter flowering species such as <i>Eucalyptus robusta</i> (Swamp Mahogany), <i>Corymbia maculata</i> (Spotted Gum), <i>C. gummifera</i> (Red Bloodwood), <i>E. sideroxylon</i> (Mugga Ironbark), and <i>E. albens</i> (White Box). Commonly used lerp infested trees include <i>E. microcarpa</i> (Inland Grey Box), <i>E. moluccana</i> (Grey Box) and <i>E. pilularis</i> (Blackbutt). Following winter they return to Tasmania where they breed from September to January.	Yes	None	Yes	No	No	Yes	No
<i>Litoria aurea</i>	Green and Golden Bell Frog	E1	V	The species is active by day and usually breeds in summer when conditions are warm and wet. Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation. Tadpoles feed on algae and other plant-matter; adults eat mainly insects, but also other frogs.	Yes	None	Yes	No	No	Yes	No
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V	V	Breeding is triggered by heavy rain and can potentially occur all year, but is usually from late summer to early spring. Males call from low vegetation close to slow flowing pools. Eggs are laid in loose gelatinous masses attached to small submerged twigs. Eggs and tadpoles are mostly found in still or slow flowing pools that receive extended exposure to sunlight. Shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground.	Yes	None	Yes	No	No	Yes	No

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<i>Lophoictinia isura</i>	Square-tailed Kite	V		It is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Appears to occupy large hunting ranges of more than 100km ² . Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V		Nectar is taken from flowers, and honeydew is gleaned from foliage. Breeds solitarily or co-operatively, with up to five or six adults, from June to December. The nest is placed high in the crown of a tree, in the uppermost lateral branches, hidden by foliage. It is a compact, suspended, cup-shaped nest.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E1		Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Can dig several centimetres into soil to escape drought. It is a fungus specialist and is generally active at night. Little is known of its breeding biology. It is known to be hermaphroditic, laying clutches of 20-25 small, round, white eggs in moist, dark areas (such as under logs)..	Yes	None	Yes	Yes	Yes	Yes	Yes
<i>Merops ornatus</i>	Rainbow Bee-eater	P	J	The breeding season extends from August to January. The nest is constructed in an enlarged chamber at the end of long burrow that is excavated by both sexes. Populations that breed in southern Australia are migratory, birds moving north to northern Australia, Papua New Guinea and eastern Indonesia after breeding, and remaining there for the duration of the Australian winter. Its diet mainly consists of bees and wasps.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Miniopterus australis</i>	Little Bentwing-bat	V		Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat. Maternity colonies form in spring. Males and juveniles disperse in summer.	Yes	None	Yes	No	No	Yes	No

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<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V		It forages above and below the tree canopy on small insects, especially moths. The bats congregate at the same maternity roosts each year to give birth and rear young. In the southern part of the species' range this occurs during spring. Maternity roosts may be located in caves, abandoned mines, concrete bunkers and lava tubes. Over-wintering roosts used outside the breeding period include cooler caves, old mines, and stormwater channels, under bridges and occasionally buildings.	Yes	Marginal	Yes	No	Known	Yes	Yes
<i>Mixophyes balbus</i>	Stuttering Frog	E1	V	Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Feed on insects and smaller frogs. Breed in streams during summer after heavy rain. Eggs are laid on rock shelves or shallow riffles in small, flowing streams. As the tadpoles grow they move to deep permanent pools and take approximately 12 months to metamorphose.	No	None	Yes	No	No	No	No
<i>Monarcha melanopsis</i>	Black-faced Monarch	P	Bonn, Mar	The species spends summer and autumn in eastern Australia, and winters in southern and eastern Papua New Guinea from March to August. Breeds from October to March, in rainforest habitat.	Yes	None	Yes	No	No	Yes	No
<i>Monarcha trivirgatus</i>	Spectacled Monarch	P	Bonn, Mar	Summer breeding migrant to north-east NSW and south-east QLD from September/October to May. Nests in a tree fork or in hanging vines, 1 m - 6 m above the ground, often near water.	Yes	None	Yes	No	No	Yes	No
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.	Yes	Marginal	Yes	No	Potential	Yes	Yes

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<i>Myiagra cyanoleuca</i>	Satin Flycatcher	P	Bonn, Mar	Satin Flycatchers move north in autumn to spend winter in northern Australia and New Guinea and returning south in spring. In NSW, they depart between February and March and return between September and October. In NSW, breeding occurs between November and March, with a nest usually built in the high, exposed outer branches of a tree.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Myotis macropus</i>	Southern Myotis	V		Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Ninox strenua</i>	Powerful Owl	V		It roosts by day in dense vegetation comprising species such as <i>Syncarpia glomulifera</i> (Turpentine), <i>Allocasuarina littoralis</i> (Black She-oak), <i>Acacia melanoxylon</i> (Blackwood), <i>Angophora floribunda</i> (Rough-barked Apple), <i>Exocarpus cupressiformis</i> (Cherry Ballart) and eucalypt species. The main prey items are medium-sized arboreal marsupials. Powerful Owls nest in large tree hollows in large eucalypts that are at least 150 years old. Nesting occurs from late autumn to mid-winter.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Pandion cristatus</i>	Eastern Osprey	V		Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Yes	None	Yes	No	No	Yes	No
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E1	V	Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. Highly territorial and have strong site fidelity with an average home range size of about 15 ha. Breeding is likely to be continuous, at least in the southern populations, with no apparent seasonal trends in births.	Yes	None	Yes	No	No	No	No

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<i>Petroica boodang</i>	Scarlet Robin	V		Feed on small insects and other invertebrates which are taken from the ground, or off tree trunks and logs; they sometimes forage in the shrub or canopy layer. Mainly breed between July and January. This species' nest is an open cup made of plant fibres and cobwebs and is built in the fork of tree usually more than 2 metres above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Petroica phoenicea</i>	Flame Robin	V		Feeds on small invertebrates which they take from the ground or off tree trunks, logs and other coarse woody debris. Breeds in spring to late summer. Nests are often near the ground and are built in sheltered sites, such as shallow cavities in trees, stumps or banks. Builds an open cup nest made of plant materials and spider webs.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Phascolarctos cinereus</i>	Koala, Hawks Nest and Tea Gardens population	E2,V	V	Swamp Mahogany and Tallowwood are of primary importance to this Koala population. Other local native tree species used by Koalas include Broad-leaved Paperbark, Blackbutt, Red Bloodwood, Flooded Gum and Smooth-barked Apple	No	Marginal	No	No	No	No	No
<i>Phascolarctos cinereus</i>	Koala in the Pittwater Local Government Area	E2,V	V	The Grey Gum (<i>Eucalyptus punctata</i>) is the most important food tree for this species in Pittwater. Other favoured food trees are <i>E. haemastoma</i> (Scribbly Gum), <i>E. robusta</i> (Swamp Mahogany) and <i>E. racemosa</i> (Snappy Gum). Generally koalas can be expected to feed to a limited extent on all species of <i>Eucalyptus</i> , <i>Corymbia</i> and <i>Angophora</i> that they encounter in Pittwater.	No	Marginal	No	No	No	No	No
<i>Phascolarctos cinereus</i>	Koala	V	V	Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Females breed at two years of age, with mating occurring between September and February.	Yes	Marginal	Yes	No	Potential	Yes	Yes

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<i>Pseudomys novaehollandiae</i>	New Holland Mouse	P	V	It is a social animal, living predominantly in burrows shared with other individuals. Distribution is patchy in time and space, with peaks in abundance during early to mid stages of vegetation succession typically induced by fire.	Yes	None	Yes	No	No	No	No
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Annual mating commences in January and a single young is born in October or November. Can travel up to 50 km from the camp to forage. Feed on the nectar and pollen of <i>Eucalyptus</i> , <i>Melaleuca</i> and <i>Banksia</i> species, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.	Yes	None	Yes	No	No	No	No
<i>Rhipidura rufifrons</i>	Rufous Fantail	P	Bonn, Mar	The southern subspecies <i>Rhipidura rufifrons rufifrons</i> is migratory, being virtually absent from south-east Australia in winter. Departure from the breeding areas is usually March to early April, most moving to coastal lowlands and off-shore islands in south-east Queensland, north to Cape York Peninsula and Torres Strait Island. Birds arrive back in south-east Australia mostly in September to November, and breed September to February.	Yes	Marginal	Yes	No	Potential	Yes	Yes
<i>Rostratula australis</i>	Australian Painted Snipe	E1	E, Mar	Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. The nest consists of a scrape in the ground, lined with grasses and leaves. Breeding is often in response to local conditions; generally occurs from September to December. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter.	Yes	None	Yes	No	No	No	No
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		Usually roosts in tree hollows, but has also been found in buildings. Forages after sunset along creek and river corridors for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees.	Yes	Marginal	Yes	No	Known	Yes	Yes

Threatened flora

Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Ecology	Distribution overlaps (yes/no)	Habitat quality present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence	Habitat or species on site directly or indirectly impacted (Yes/No)	Impact Assessment Required
Fabaceae (Mimosoideae)	<i>Acacia bynoeana</i>	Bynoe's Wattle	E1	V	Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	Yes	No	Yes	No	No	No	No
Fabaceae (Mimosoideae)	<i>Acacia gordonii</i>		E1	E	Flowers August to September and produces fruit October to February. Fire promotes germination of the soil stored seedbank and seed germination will not occur in the absence of fire.	Yes	None	Yes	No	No	No	No
Fabaceae (Mimosoideae)	<i>Acacia pubescens</i>	Downy Wattle	V	V	Flowers from August to October. The pods mature in October to December. Recruitment is more commonly from vegetative reproduction than from seedlings. The percentage of pod production and seed fall for this species appears to be low.	Yes	Marginal	Yes	No	Potential	Yes	Yes
Rutaceae	<i>Asterolasia elegans</i>		E1	E	The canopy at known sites includes <i>Syncarpia glomulifera subsp. glomulifera</i> (Turpentine), <i>Angophora costata</i> (Smooth-barked Apple), <i>Eucalyptus piperita</i> (Sydney Peppermint), <i>Allocasuarina torulosa</i> (Forest Oak) and <i>Ceratopetalum gummiiferum</i> (Christmas Bush). Ecological knowledge about this species is very limited. The species is considered to be fire sensitive and reliant on seed germination after disturbance to maintain populations. A soil seedbank appears to be established by this species, so for a number of years following fire or other disturbance the species may not be apparent, but be present only as seed in the soil.	No	None	Yes	No	No	No	No

Orchidaceae	<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V	The larger populations typically occur in woodland dominated by <i>Eucalyptus sclerophylla</i> (Scribbly Gum), <i>E. sieberi</i> (Silvertop Ash), <i>Corymbia gummifera</i> (Red Bloodwood) and <i>Allocasuarina littoralis</i> (Black Sheoak); appears to prefer open areas in the understorey of this community. Being leafless it is expected to have limited photosynthetic capability and probably depends upon a fungal associate to meet its nutritional requirements from either living or dead organic material. In addition to reproducing from seed, it is also capable of vegetative reproduction and thus forms colonies which can become more or less permanent at a site.	Yes	None	Yes	No	No	No	No
Fabaceae (Faboideae)	<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia, Kemps Creek	E2,V		Flowering occurs sporadically from August to March depending on environmental conditions. Pollinators are unknown. The lifespan is estimated to be 20-30 years. It is thought a minimum of 3-4 years is required before seed is produced. Seeds are hard coated and are persistent in the soil seed bank. Dispersal is likely to be localised and ants are the probable vectors. Killed by fire and re-establishes from soil-stored seed.	Yes	Marginal	Yes	No	Potential	Yes	Yes
Fabaceae (Faboideae)	<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia Sieber ex D.C. in the Baulkham Hills local government area	E2,V		Flowering occurs sporadically from August to March depending on environmental conditions. Pollinators are unknown. The lifespan is estimated to be 20-30 years. It is thought a minimum of 3-4 years is required before seed is produced. Seeds are hard coated and are persistent in the soil seed bank. Dispersal is likely to be localised and ants are the probable vectors. Killed by fire and re-establishes from soil-stored seed.	Yes	Marginal	Yes	No	Potential	Yes	Yes
Fabaceae (Faboideae)	<i>Dillwynia tenuifolia</i>		V		<i>Eucalyptus fibrosa</i> is usually the dominant canopy species. <i>Eucalyptus globoidea</i> , <i>E. longifolia</i> , <i>E. parramattensis</i> , <i>E. sclerophylla</i> and <i>E. sideroxylon</i> may also be present or codominant, with <i>Melaleuca decora</i> frequently forming a secondary canopy layer. Flowering occurs sporadically from August to March depending on environmental conditions. Pollinators are unknown. The lifespan is estimated to be 20-30 years. It is thought a minimum of 3-4 years is required before seed is produced. Seeds are hard coated and are persistent in the soil seed bank. Dispersal is likely to be localised and ants are the probable vectors. Killed by fire and re-establishes from soil-stored seed.	Yes	None	Yes	No	No	No	No

Scrophulariaceae	<i>Euphrasia arguta</i>		E4A	CE	Annual habit and has been observed to die off over the winter months, with active growth and flowering occurring between January and April. As with other species of <i>Euphrasia</i> , this species is semi-parasitic and attaches to the roots of other associated plants.	No	None	Yes	No	No	No	No
Orchidaceae	<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E1	E	Flowers February to March.	No	Marginal	Yes	No	Unlikely	No	No
Proteaceae	<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	V		Associated canopy species within Cumberland Plain Woodland and Shale/Gravel Transition Forest include <i>Eucalyptus tereticornis</i> , <i>E. moluccana</i> , <i>E. crebra</i> , <i>E. fibrosa</i> and <i>E. eugenioides</i> . In Castlereagh Woodland on more sandy soils the dominant canopy species are <i>Eucalyptus fibrosa</i> , <i>E. sclerophylla</i> , <i>Angophora bakeri</i> and <i>Melaleuca decora</i> . Flowering may occur sporadically throughout the year, but particularly between July and October. Plants are killed by fire with regeneration solely from soil-stored seed. Fire leads to a sudden increase in the recruitment of seedlings. Physical disturbance of the soil appears to result in an increase in seedling recruitment. Has a tendency to colonise mechanically disturbed areas	Yes	Good	Yes	Yes	Yes	Yes	Yes
Proteaceae	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	V	V	Plants are capable of suckering from a rootstock and most populations demonstrate a degree of vegetative spread, particularly after disturbance such as fire. Flowering has been recorded between July to December as well as April-May. Flowers are insect-pollinated and seed dispersal is limited. Seedling recruitment after fire is uncommon, and most recovery after disturbance appears to be gesprouting from rhizomes.	Yes	Marginal	Yes	No	Potential	Yes	Yes
Haloragaceae	<i>Haloragis exalata</i> subsp. <i>exalata</i>	Square Raspwort	V	V	Flowering specimens in NSW are recorded from November to January.	No	Marginal	Yes	No	Unlikely	No	No
Haloragaceae	<i>Haloragodenron lucasii</i>		E1	E	Highly clonal, which implies the true population size may be considerably smaller than expected. Flowering occurs from August to November with fruits appearing from October to December. Has demonstrated an ability to resprout from its rootstock.	No	Marginal	Yes	No	Unlikely	No	No

Lobeliaceae	<i>Hypsela sessiliflora</i>		E1	X	May be an early successional species that benefits from some disturbance.	Yes	Marginal	Yes	No	Potential	Yes	Yes
Apocynaceae	<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			Yes	Marginal	Yes	No	Potential	Yes	Yes
Myrtaceae	<i>Micromyrtus minutiflora</i>		E1	V	Sporadic flowering, June to March Response to fire and mechanical disturbance is uncertain. Regeneration may be due to resprouting or germination of soil-stored seed	Yes	Marginal	Yes	No	Potential	Yes	Yes
Asteraceae	<i>Olearia cordata</i>		V	V	Flowers November to May, with seed released from February to May. Adults are capable of resprouting following fire. Abundant seedlings have been observed following fire, but seeds are also capable of germinating in the absence of fire as there is no seed dormancy with this species and germination should occur with any significant rains soon after seed release. Seedlings reach maturity in 1-2 years.	No	None	Yes	No	No	No	No
Proteaceae	<i>Persoonia acerosa</i>	Needle Geebung	V	V	Plants are likely to be killed by fire and recruitment is solely from seed. This species seems to benefit from the reduced competition and increased light available on disturbance margins including roadsides.	No	Marginal	Yes	No	Unlikely	No	No
Proteaceae	<i>Persoonia hirsuta</i>	Hairy Geebung	E1	E	It is usually present as isolated individuals or very small populations. It is probably killed by fire (as other Persoonia species are) but will regenerate from seed.	Yes	Marginal	Yes	No	Potential	Yes	Yes
Proteaceae	<i>Persoonia nutans</i>	Nodding Geebung	E1	E	Peak flowering is from November to March with sporadic flowering all year round. An obligate seed regenerator. Seed germination is promoted by fire and also by physical disturbance. Although listed as a short-lived species much of the ecology is poorly known. Maturity is expected in about 10 years.	Yes	Marginal	Yes	No	Potential	Yes	Yes
Marsileaceae	<i>Pilularia novae-hollandiae</i>	Austral Pillwort	E1		This species is probably ephemeral (especially in the drier parts of its range), appearing when soils are moistened by rain.	Yes	Marginal	Yes	No	Potential	Yes	Yes

Thymelaeaceae	<i>Pimelea spicata</i>	Spiked Rice-flower	E1	E	Mature plants spread over short distances through underground rhizomes. Flowers may be self-pollinating, although fruit production is variable. A soil seedbank develops and is maintained in the presence of a suitable disturbance regime.	Yes	Marginal	Yes	No	Potential	Yes	Yes
Fabaceae (Faboideae)	<i>Pultenaea glabra</i>	Smooth Bush-Pea	V	V	Flowers September to November, fruit matures October to December. Fire sensitive, with adults killed by fire and recruitment occurring from a persistent soil stored seed bank. Seed germination will not occur in the absence of fire as the hard-coated seed requires heat to break seed dormancy.	No	None	Yes	No	No	No	No
Fabaceae (Faboideae)	<i>Pultenaea parviflora</i>		E1	V	<i>Eucalyptus fibrosa</i> is usually the dominant canopy species. <i>Eucalyptus globoidea</i> , <i>E. longifolia</i> , <i>E. parramattensis</i> , <i>E. sclerophylla</i> and <i>E. sideroxylon</i> may also be present or co-dominant, with <i>Melaleuca decora</i> frequently forming a secondary canopy layer. Flowering may occur between August and November depending on environmental conditions. Killed by fire and re-establishes from soil-stored seed. There is no evidence of vegetative spread. Germination can be prolific after a moderate to high intensity fire.	Yes	Marginal	Yes	No	Potential	Yes	Yes
Moraceae	<i>Streblus pendulinus</i>	Siah's Backbone, Sia's Backbone, Isaac Wood	P	E	In 2003, Siah's Backbone was thought to occur at one location (Norfolk Island). In 2012, a taxonomic change occurred and the species now includes mainland populations that were previously included with <i>Streblus brunonianus</i> . Dioecious, fruit ripen in January–April.	No	None	Yes	No	No	No	No
Santalaceae	<i>Thesium australe</i>	Austral Toadflax	V	V	Often found in association with <i>Themeda australis</i> (Kangaroo Grass). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass. Flowers in spring.	Yes	Marginal	Yes	No	Potential	Yes	Yes

Class	Family	Scientific Name	Common Name	FM Act Status	EPBC Act Status	Distribution	Habitat	Ecology	Distribution overlaps (yes/no)	Habitat present (good, marginal, none)	Species known to occur in region (yes/no)	Species known to occur on site (yes/no)	Likelihood of occurrence	Habitat on site directly or indirectly impacted (Yes/No)	Impact Assessment Required
Actinopterygii	Percichthyidae	<i>Macquaria australasica</i>	Macquarie Perch	E1	E	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.	River and lake habitats, especially the upper reaches of rivers and their tributaries.	Feed on aquatic insects, crustaceans and molluscs. Sexual maturity occurs at two years for males and three years for females. Macquarie perch spawn in spring or summer in shallow upland streams or flowing parts of rivers. Females produce around 50,000-100,000 eggs which settle among stones and gravel of the stream or river bed.	Yes	None	Yes	No	No	Yes	No
Actinopterygii	Retropinnidae	<i>Prototroctes maraena</i>	Australian Grayling		V	Streams and rivers on the eastern and southern flanks of the Great Dividing Range; in NSW, it occurs south from the Shoalhaven River.	Coastal rivers and streams, fresh and brackish coastal lagoons.	Spawning occurs in freshwater from late summer to winter, with exact timing being dependant on location and annual conditions. Omnivorous, feeding on a variety of small aquatic organisms, including crustaceans (such as cladocerans), insects and their larvae and algae.	Yes	None	Yes	No	No	Yes	No

Likelihood of occurrence – threatened species – Fisheries Management Act

Scientific Name	Common Name	FM Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Archaeophya adamsi</i>	Adam's Emerald Dragonfly	E	-	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).	Unlikley - no suitable habitat
<i>Austrocordulia leonardi</i>	Sydney Hawk Dragonfly	E	-	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).	Unlikley - no suitable habitat
<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 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.	Unlikley - distibution is limited and generally recorded in forested catchments
<i>Maccullochella macquariensis</i>	Trout cod	E	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.	Unlikley - distibution is limited and generally recorded in forested catchments
<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.	Unlikley - distibution is limited and generally recorded in forested catchments
<i>Macquarie australasica</i>	Macquarie Perch	E	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 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.	Unlikley - distibution is limited and generally recorded in forested catchments
<i>Prototroctes maraena</i>	Australian grayling	P	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.	Unlikley - distibution is limited and generally recorded in forested catchments

CE = Critically Endangered; E = Endangered; Mi = Migratory; P = Protected; PE = Presumed Extinct; V = Vulnerable

Appendix B Flora List

Species Name	Common name	TSC Act	Noxious weed**
<i>Acacia falcata</i>	Sickle Wattle		
<i>Acacia parramenttensis</i>	Parramatta Wattle		
<i>Angophora floribunda</i>	Rough-barked Apple		
<i>Angphora subvelutina</i>	Broad-leaved Apple		
<i>Anisopogon avenaceus</i>	Oats Speargrass		
<i>Aristida ramosa</i>	Purple Wiregrass		
<i>Asperula conferta</i>	Common Woodruff		
<i>Bothriochloa macra</i>	Red Grass		
<i>Bursaria spinosa</i>	Native Blackthorn		
<i>Callistemon sp. (planted)</i>	Bottlebrush		
<i>Callitris rhomboidea</i>	Oyster Bay Pine		
<i>Carex appressa</i>	Tall Sedge		
<i>Casuarina glauca</i>	Swamp She-oak		
<i>Centalla asiatica</i>	Indian Pennywort		
<i>Cheilanthes sieberi</i>	Narrow Rockfern		
<i>Chloris ventricosa</i>	Plump windmill grass		
<i>Clematis aristata</i>	Old mans Beard		
<i>Cymbopogon refractus</i>	Barbed Wiregrass		
<i>Daviesia ulicifolia</i>	Bitter Pea		
<i>Dianella longifolia</i>	Blue Flax-lily		
<i>Dichondra repens</i>	Kidney Weed		
<i>Dillwynia sieberi</i>	Parrot-pea		
<i>Eragrostis leptostachya</i>	Paddock Lovegrass		
<i>Eucalyptus amplifolia</i>	Cabbage Gum		
<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark		

Species Name	Common name	TSC Act	Noxious weed**
<i>Eucalyptus moluccana</i>	Grey Box		
<i>Eucalyptus</i> sp.	Eucalyptus		
<i>Eucalyptus</i> spp. (regenerating)	Eucalyptus		
<i>Eucalyptus tereticornis</i>	Forest Red Gum		
<i>Geranium</i> sp.	Geranium		
<i>Glycine tabacina</i>	Variable Glycine		
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	V	
<i>Imperata cylindrica</i>	Bladey Grass		
<i>Juncus usitatus</i>	Juncus		
<i>Leptospermum squarrosum</i>	Pink Tea Tree		
<i>Lomandra filiformis</i>	Wattle Mat-rush		
<i>Lomandra longifolia</i>	Spiny-head mat-rush		
<i>Luzula</i> sp.			
<i>Melaleuca decora</i>	Honey Myrtle		
<i>Melaleuca linariifolia</i>	Snow-in-summer		
<i>Melaleuca stypheloides</i>	Prickly-leaved Paperbark		
<i>Microlaena stipoides</i>	Weeping Grass		
<i>Oxalis perennans</i>	Grassland Wood-sorrel		
<i>Plantago varia</i>	Variable Plantain		
<i>Pratia purpurascens</i>	Whiteroot		
<i>Pteridium esculatum</i>	Austral Bracken		
<i>Rytidosperma bipartitum</i>	Wallaby Grass		
<i>Solanum prinophyllum</i>	Blackberry Nightshade		
<i>Themeda australis</i>	Kangaroo Grass		
<i>Typha orientalis</i>	Cumbungi		
<i>Wahlenbergia</i> sp.	Sprawling Bluebell		
* <i>Andropogon virginicus</i>	Whiskey Grass		

Species Name	Common name	TSC Act	Noxious weed**
* <i>Araujia sericifera</i>	Moth Plant		
* <i>Asparagus aethiopicus</i>	Asparagus Fern		Yes Class 4
* <i>Asparagus asparagoides</i>	Bridal Creeper		Yes Class 4
* <i>Axonopus fissifolius</i>	Common Carpetgrass		
* <i>Bidens pilosa</i>	Cobblers Peg		
* <i>Briza subaristata</i>	Quaking Grass		
* <i>Brome hordeaceus</i>	Soft Brome		
* <i>Calystegia silvatica</i>			
* <i>Centaureum erythraea</i>	Centaury		
* <i>Chloris gayana</i>	Rhodes Grass		
* <i>Cirsium vulgare</i>	Spear Thistle		
* <i>Conyza bonariensis</i>	Fuzzweed		
* <i>Cynodon dactylon</i>	Common Couch		
* <i>Cynosurus echinatus</i>	Rough Dog's Tail		
* <i>Cyperus eragrostis</i>	Umbrella Sedge		
* <i>Ehrharta erecta</i>	Panic Veltgrass		
* <i>Eragrostis curvula</i>	African Love Grass		
* <i>Foeniculum vulgare</i>	Fennel		
* <i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush		
* <i>Hypochaeris radicata</i>	Catsear		
* <i>Juncus acutus</i>	Spiny Rush		
* <i>Ilex aquafolium</i>	English Holly		
* <i>Lepidium</i>			
* <i>Ligustrum sinense</i>	Small-leaved Privet		Yes Class 4
* <i>Lolium sp.</i>	Rye Grass		
* <i>Lotus sp.</i>			

Species Name	Common name	TSC Act	Noxious weed**
<i>*Lycium ferocissium</i>	African Box-thorn		Yes Class 4
<i>*Malva sp.</i>	Mallow		
<i>*Olea europaea subsp. cuspidata</i>	African Olive		Yes Class 4
<i>*Oxalis sp.</i>			
<i>*Paspalum dilatatum</i>	Paspalum		
<i>*Pennisetum villosum</i>	Feathertop Grass		
<i>*Phyllanthus tenellus?</i>	Scrubby Spurge		
<i>*Plantago lanceolata</i>	Ribwort		
<i>*Plectranthus sp.</i>			
<i>*Ranunculus sp.</i>	Buttercup		
<i>*Rubus fruticosus agg.</i>	Blackberry		Yes Class 4
<i>*Rumex crispus</i>	Dock		
<i>*Salvinia molesta</i>	Giant Molesta		Yes Class 3
<i>*Schinus molle</i>	Peppertree		
<i>*Senecio madagascariensis</i>	Fireweed		Yes Class 4
<i>*Senecio sp.</i>			
<i>*Setaria gracilis</i>	Pigeon Grass		
<i>*Setaria sp.</i>	Pigeon Grass		
<i>*Sida rhombifolia</i>	Paddy's Lucerne		
<i>*Solanum linnaeanum</i>	Nightshade		
<i>*Solanum pseudocapsicum</i>	Madeira Winter Cherry		
<i>*Solanum sp.</i>			
<i>*Sporobolus fertilis</i>	Giant Parramatta Grass		Yes Class 3
<i>*Tradescantia fluminensis</i>	Wandering Jew		

Species Name	Common name	TSC Act	Noxious weed**
* <i>Trifolium repens</i>	White clover		
* <i>Trifolium sp.</i>	Clover		
* <i>Verbena bonariensis</i>	Purple Tops		

*Exotic species

**As listed under the Blacktown Local Government Area (LGA) (DPI 2015).

Appendix C - Fauna List

		Conservation Status		
Scientific	Common name	TSC Act	EPBC Act	Exotic
Aves				
<i>Acanthiza pusilla</i>	Brown Thornbill			
<i>Anas superciliosa</i>	Pacific Black Duck			
<i>Ardea ibis</i>	Cattle Egret		Migratory	
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			
<i>Corvus sp.</i>	Raven			
<i>Cracticus torquatus</i>	Grey Butcherbird			
<i>Dacelo novaeguineae</i>	Laughing Kookaburra			
<i>Egretta novaehollandiae</i>	White-faced Heron			
<i>Eolophus roseicapillus</i>	Galah			
<i>Grallina cyanoleuca</i>	Magpie-lark			
<i>Gymnorhina tibicen</i>	Australian Magpie			
<i>Hieraaetus morphnoides</i>	Little Eagle	V		
<i>Hirundo neoxena</i>	Welcome Swallow			
<i>Malurus cyaneus</i>	Superb Fairy-wren			
<i>Manorina melanocephala</i>	Noisy Miner			
<i>Pelecanus conspicillatus</i>	Pelican			
<i>Pycnonotus jocosus</i>	Red Whiskered Bulbul			Yes
<i>Rhipidura albiscapa</i>	Grey Fantail			
<i>Rhipidura leucophrys</i>	Willie Wagtail			
<i>Sturnus tristis</i>	Common/Indian Myna			Yes
Amphibians				
<i>Crinia signifera</i>	Common Eastern Froglet			
<i>Limnodynastes tasmaniensis</i>	Spotted Marsh Frog			

		Conservation Status		
Scientific	Common name	TSC Act	EPBC Act	Exotic
Mammals				
<i>Bos taurus</i>	Cow			Yes
<i>Chalinolobus gouldi</i>	Goulds Wattled Bat			
<i>Chalinolobus morio</i>	Chocolate Wattled Bat			
<i>Falsistrellus tasmaniensis</i>	Eastern Freetail-bat	V		
<i>Macropus giganteus</i>	Eastern Grey Kangaroo			
<i>Miniopterus schreibersii</i> <i>oceanensis</i>	Eastern Bent-wing Bat	V		
<i>Myotis macropus</i>	Large-footed Myotis	V		
<i>Pseudocheirus peregrinus</i>	Ringtail Possum			
<i>Pteropus poliocephalus</i>	Grey-headed Flying Fox	V		
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		
<i>Tadarida australis</i>	White-striped Freetail-bat			
<i>Trichosurus vulpecula</i>	Brush-tail Possum			
<i>Vespadelus vulturnus</i>	Little Forest Bat			
<i>Vulpes vulpes</i>	European Fox			Yes
<i>Wallabia bicolor</i>	Swamp Wallaby			

Appendix D : Anabat Analysis Results

Anabat Results – Eastern Creek 15SYD-1670.
4 Anabat nights 12 – 13 October 2015

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 409 passes recorded from Anabat detectors placed at four sites east of Ropes Creek in Eastern Creek between 12 and 14 August 2015. Approximately 88% 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 (**Tables 1 – 4, Figures 1 – 10**).

Site 1 was located next to a dam and general microbat activity was high with calls on average every five 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 and/or source of water resource for microbats at the time of the survey.

Chalinolobus gouldi (Goulds Wattled Bat) and *Tadarida australis* (White-striped Freetail-bat) was the most commonly recorded species. The remaining species identified were represented by 23 calls in total.

Site 2 was located to the north of the study area on the edge of riparian vegetation of Ropes Creek. General microbat activity was high with calls recorded on average every three 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 resource for microbats at the time of the survey. *Chalinolobus gouldi* (Goulds Wattled Bat) was the most commonly recorded species followed by *Tadarida australis* (White-striped Freetail-bat).

Site 3 was located south of the study area on the edge of riparian vegetation of Ropes Creek. General microbat activity was low due to the openness of the site with a total of 16 calls recorded. *Chalinolobus gouldi* (Goulds Wattled Bat) and *Tadarida australis* (White-striped Freetail-bat) with a total of five calls for each species recorded.

Site 4 microbat activity was low due to the openness of the site with a total of 21 calls recorded. *Chalinolobus gouldi* (Goulds Wattled Bat) and *Tadarida australis* (White-striped Freetail-bat) was the most commonly recorded species. The remaining species identified were represented by three calls.

The calls of the **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 the **Eastern Bentwing-bat** can often display very similar characteristics to other species such as Large Forest Bat. Calls of the **Eastern Bentwing-bat** were distinguished by the irregular pulse shape and time between calls, lack of an up-sweeping tail and drop in frequency of the pre-characteristic section of more than 2kHz.

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 6: Site 1 (Anabat01) results from one Anabat night 12 October 2015, Eastern Creek.

SCIENTIFIC NAME	COMMON NAME	DEFINITE	PROBABLE	POSSIBLE	TOTAL
<i>Chalinolobus gouldi</i>	Goulds Wattled Bat	49			49
<i>Chalinolobus gouldi</i> / <i>Mormopterus Ozimops ridei</i> (species 2)	Goulds Wattled Bat / Eastern Freetail Bat			9	9
<i>Chalinolobus gouldi</i> / <i>Scoteanax rueppellii</i> *	Goulds Wattled Bat / Greater Broad-nosed Bat			5	5
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	1			1
<i>Falsistrellus tasmaniensis</i> * / <i>Scoteanax rueppellii</i> * / <i>Scotorepens orion</i>	Eastern False Pipistrelle / Greater Broad-nosed Bat / Eastern Broad-nosed Bat			1	1
<i>Falsistrellus tasmaniensis</i> * / <i>Scotorepens orion</i>	Eastern False Pipistrelle / Eastern Broad-nosed Bat			1	1
<i>Falsistrellus tasmaniensis</i> * / <i>Scoteanax rueppellii</i> *	Eastern False Pipistrelle / Greater Broad-nosed Bat /			4	4
<i>Myotis macropus</i> * / <i>Nyctophilus</i> sp.	Large-footed Myotis / Long-eared Bat			2	2
<i>Tadarida australis</i>	White-striped Freetail-bat	45			45
<i>Vespadelus vulturnus</i>	Little Forest Bat	1			1
Low					1
Short					20
TOTAL		96		22	139

Table 7: Site 2 (Anabat02) results from one Anabat night 12 October 2015, Eastern Creek.

SCIENTIFIC NAME	COMMON NAME	DEFINITE	PROBABLE	POSSIBLE	TOTAL
<i>Chalinolobus gouldi</i>	Goulds Wattled Bat	89			89

<i>Chalinolobus gouldi</i> / <i>Mormopterus Ozimops ridei</i> (species 2)	Goulds Wattled Bat / Eastern Freetail Bat	6	6
<i>Chalinolobus gouldi</i> / <i>Scoteanax rueppellii</i>*	Goulds Wattled Bat / Greater Broad-nosed Bat	26	26
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	3	3
<i>Falsistrellus tasmaniensis</i>*	Eastern False Pipistrelle	4	4
<i>Falsistrellus tasmaniensis</i>* / <i>Scotorepens orion</i>	Eastern False Pipistrelle / Eastern Broad-nosed Bat	11	11
<i>Falsistrellus tasmaniensis</i>* / <i>Scoteanax rueppellii</i>*	Eastern False Pipistrelle / Greater Broad-nosed Bat	5	5
<i>Falsistrellus tasmaniensis</i>* / <i>Scoteanax rueppellii</i>* / <i>Scotorepens orion</i>	Eastern False Pipistrelle / Greater Broad-nosed Bat / Eastern Broad-nosed Bat	8	8
<i>Miniopterus schreibersii</i> <i>oceanensis</i>*	Eastern Bentwing-bat	1	1
<i>Myotis macropus</i>* / <i>Nyctophilus sp.</i>	Large-footed Myotis / Long-eared Bat	4	4
<i>Scoteanax rueppellii</i>*	Greater Broad-nosed Bat	1	1
<i>Tadarida australis</i>	White-striped Freetail-bat	51	51
<i>Vespadelus vulturnus</i>	Little Forest Bat	5	5
Low			2
Short			17
TOTAL			233
* Threatened species			

Table 8: Site 3 (Anabat02) results from one Anabat night 13 October 2015, Eastern Creek.

SCIENTIFIC NAME	COMMON NAME	DEFINITE	PROBABLE	POSSIBLE	TOTAL
<i>Chalinolobus gouldi</i>	Goulds Wattled Bat	5			5
<i>Tadarida australis</i>	White-striped Freetail-bat	5			5
Low					1
Short					5
TOTAL					16
* Threatened species					

Table 9: Site 4 (Anabat01) results from one Anabat night 13 October 2015, Eastern Creek.

SCIENTIFIC NAME	COMMON NAME	DEFINITE	PROBABLE	POSSIBLE	TOTAL
<i>Chalinolobus gouldi</i>	Goulds Wattled Bat	6		1	6
<i>Chalinolobus gouldi</i> / <i>Mormopterus Ozimops ridei</i> (species 2)	Goulds Wattled Bat / Eastern Freetail Bat			2	2
<i>Chalinolobus morio</i>	Chocolate Wattled Bat			1	1
<i>Tadarida australis</i>	White-striped Freetail-bat	7			7
Low					1
Short					3
TOTAL					21
* Threatened species					

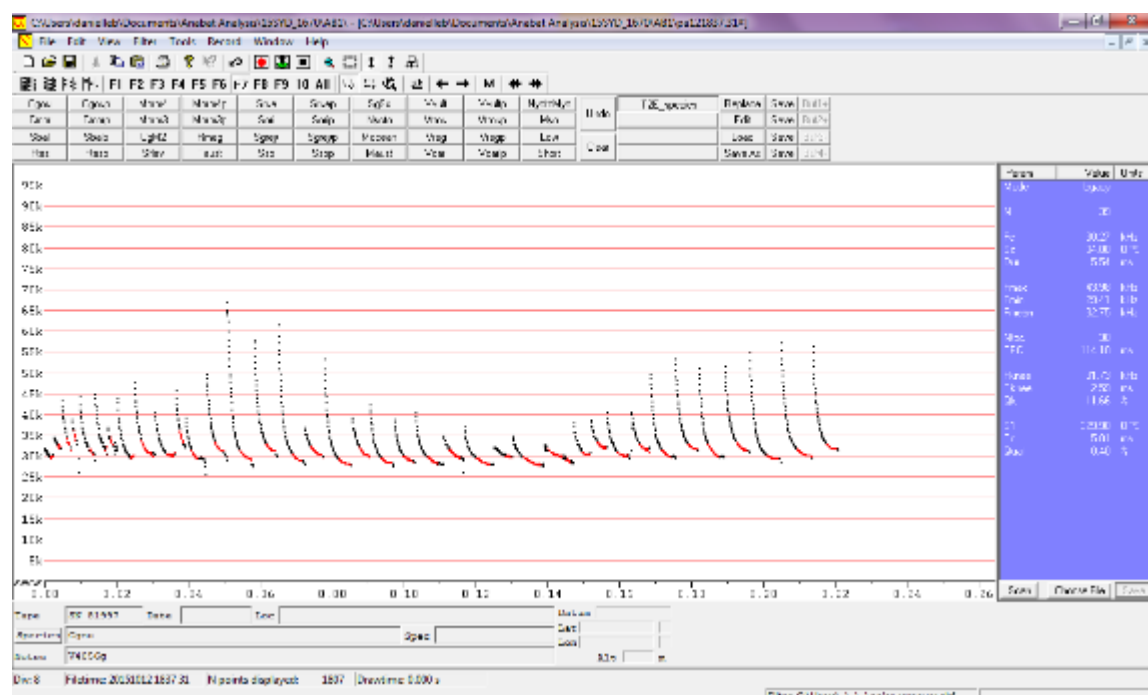


Figure 1: Call profile for *Chalinolobus gouldii* at Site 1, Eastern Creek at 1837 on 12 October 2015.

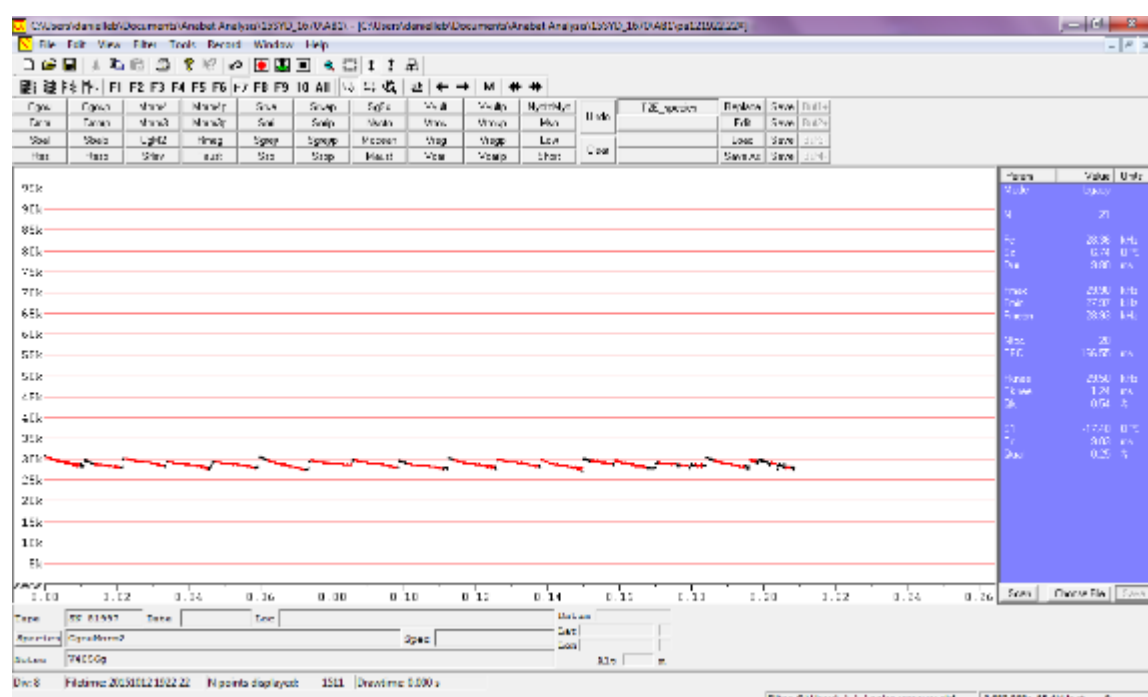


Figure 2: Possible call profile for *Chalinolobus gouldii* / *Mormopterus Ozimops ridei* (species 2) recorded at Site 1, Eastern Creek at 1922 on 12 October 2015

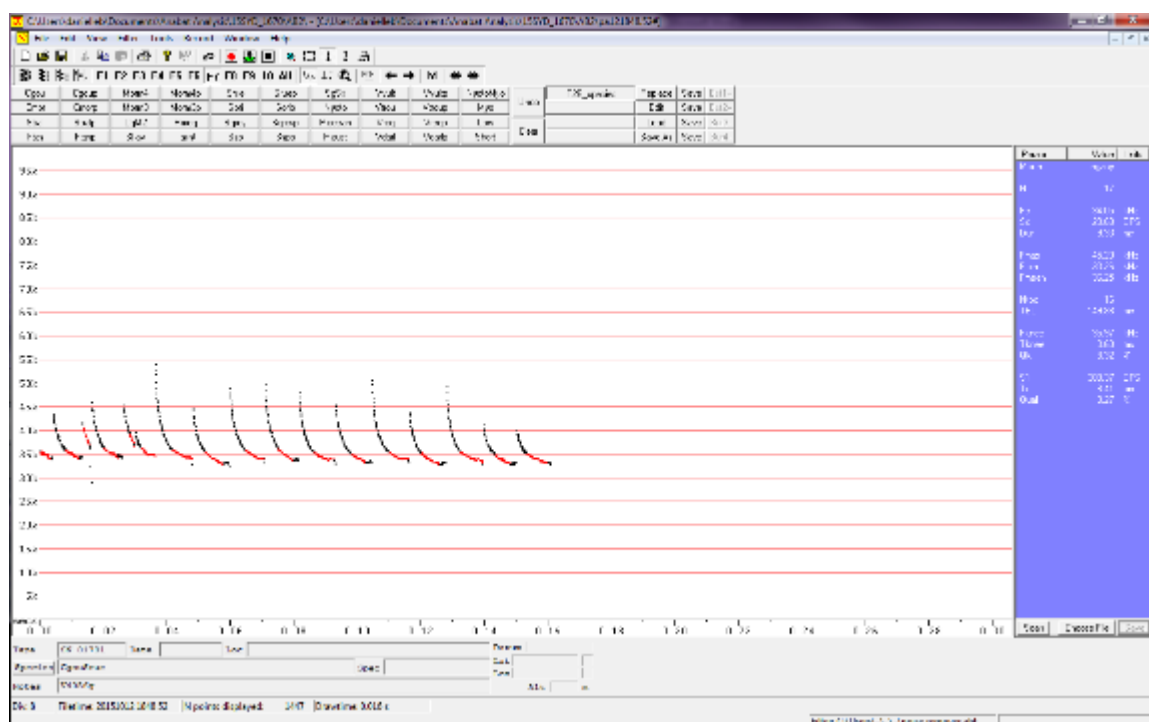


Figure 3: Call profile for *Chalinolobus gouldii* / *Scoteanax rueppellii* recorded at Site 2, Eastern Creek at 1848 on 12 October 2015.

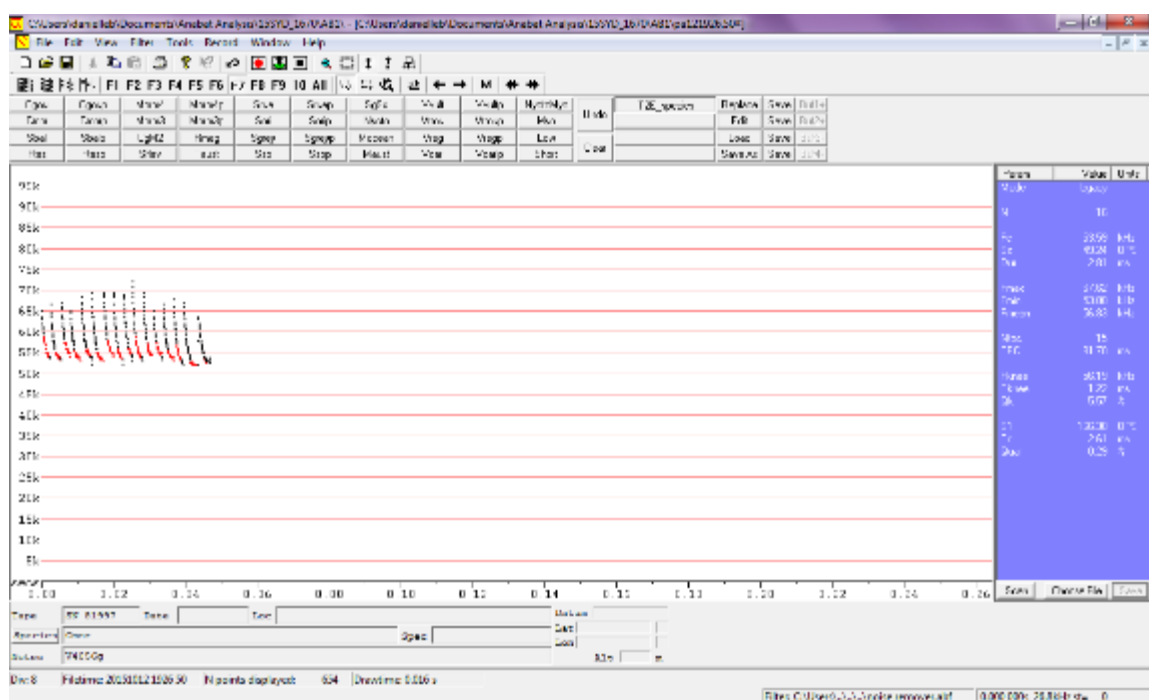


Figure 4: Call profile for *Chalinolobus morio* recorded at Site 1, Eastern Creek at 1926 on 12 October 2015

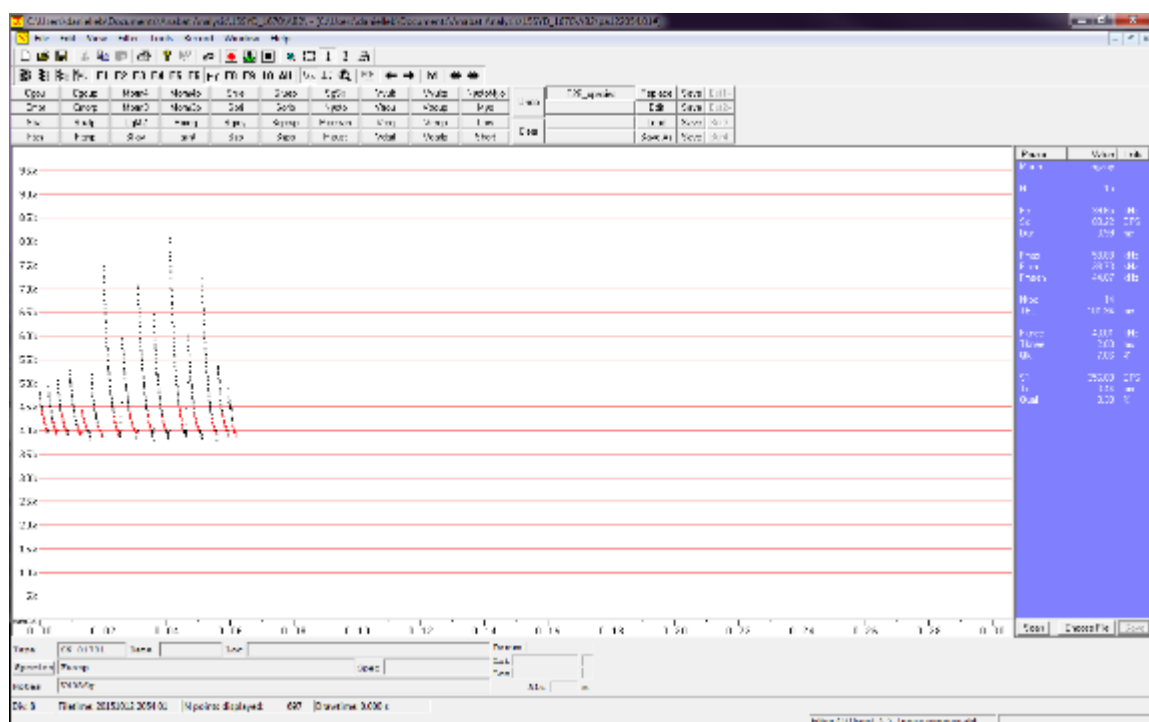


Figure 5: Possible call profile for *Falsistrellus tasmaniensis* recorded at Site 2, Eastern Creek at 2054 on 12 October 2015.

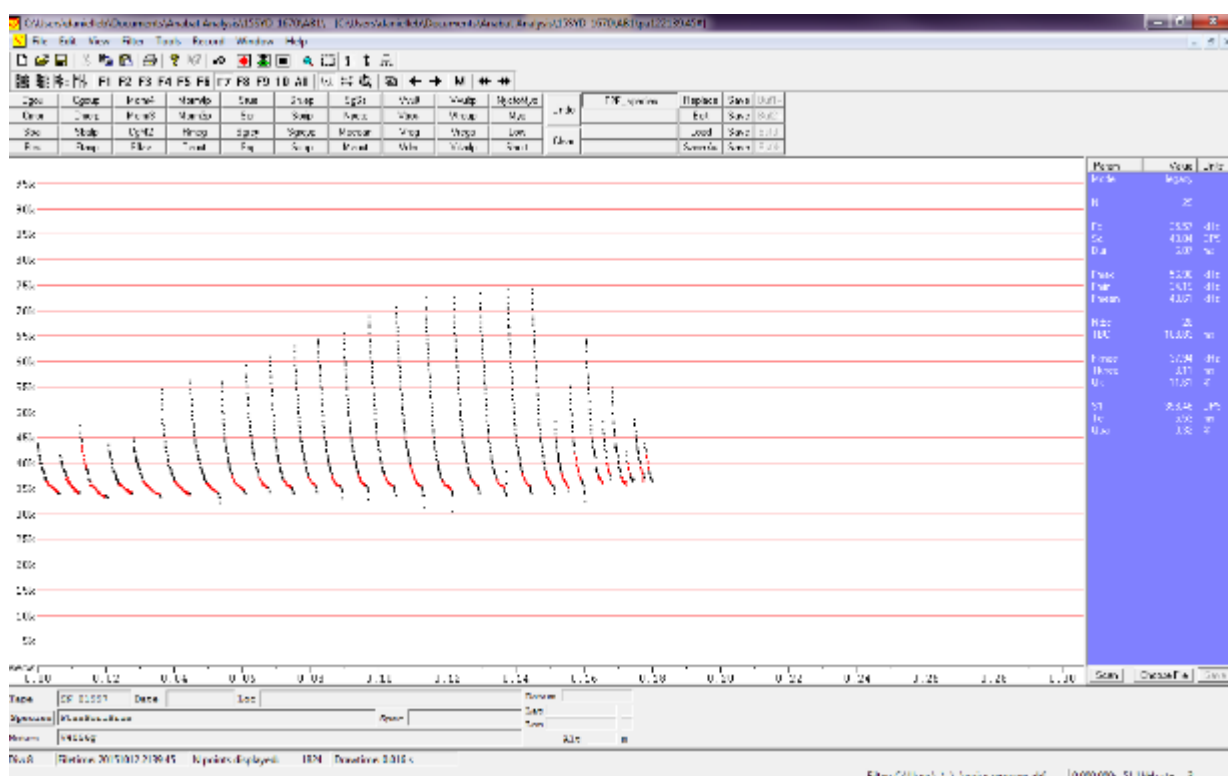


Figure 6: Probable profile call for *Falsistrellus tasmaniensis* / *Scotenax rueppellii* / *Scotorepens orion* at Site 1, Eastern Creek at 2139 on 12 October 2015

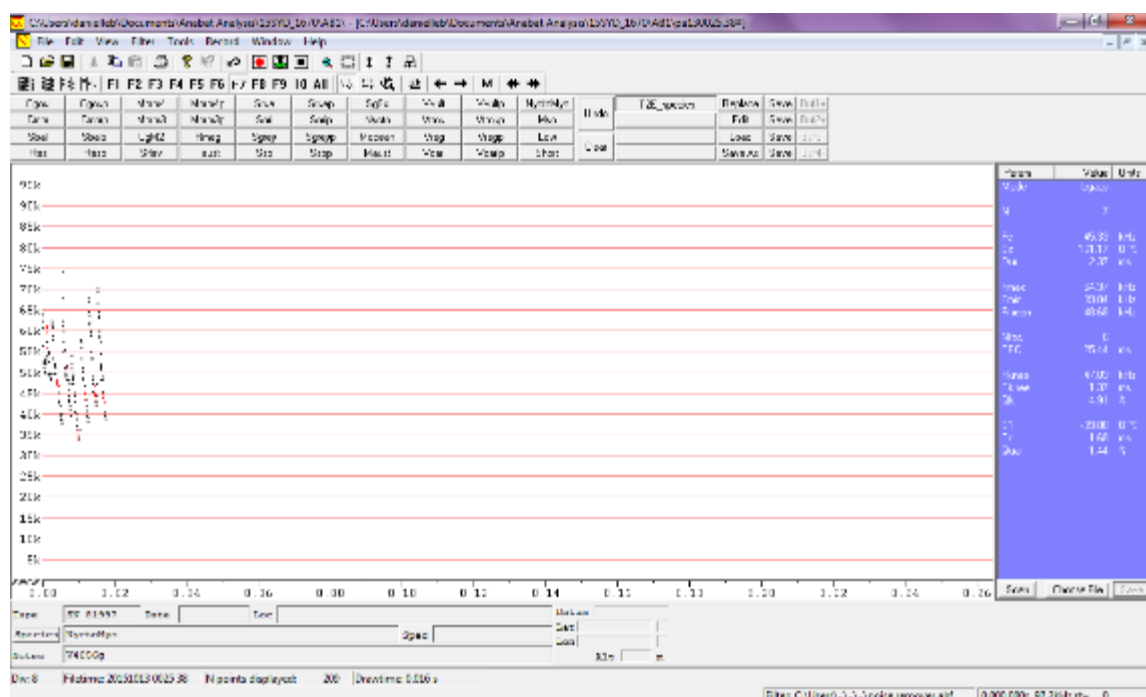


Figure 7: Call profile for *Myotis macropus* / *Nyctophilus* spp. recorded at Site 1, Eastern Creek at 0025 on 12 October 2015

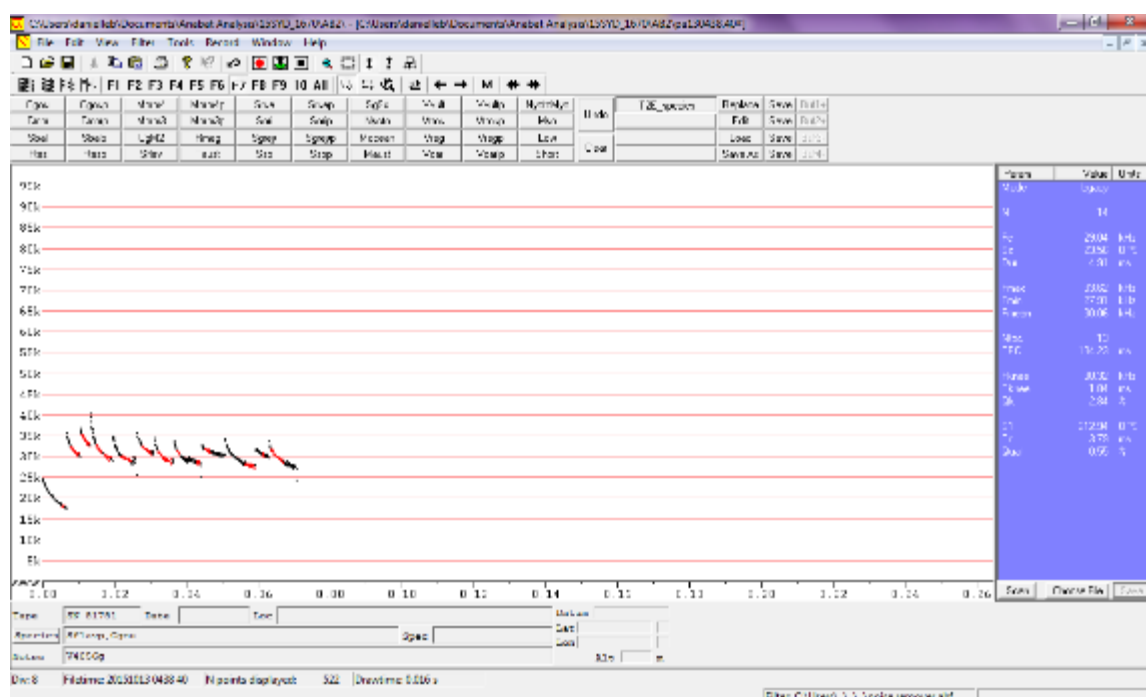


Figure 8: Possible call profile for *Saccolaimus flaviventris* also showing call for *Chalinolobus gouldii* recorded at Site 2, Eastern Creek at 0438 on 12 October 2015.

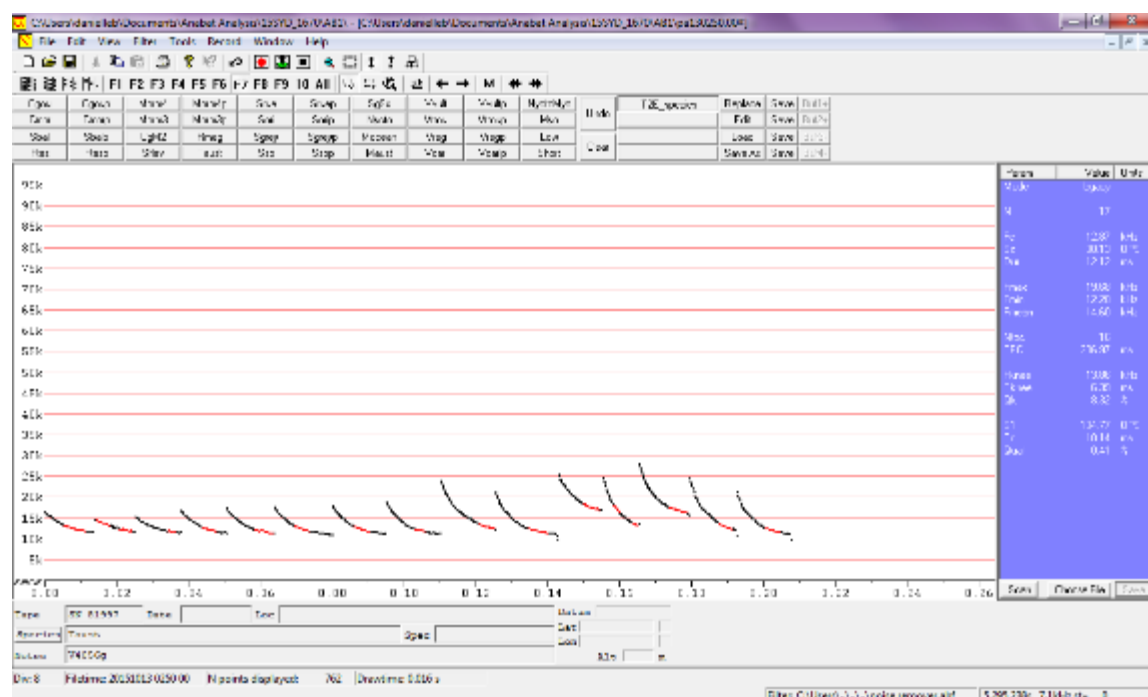


Figure 9: Call profile for *Tadaria australis* recorded at Site 1, Eastern Creek at 0250 on 12 October 2015.

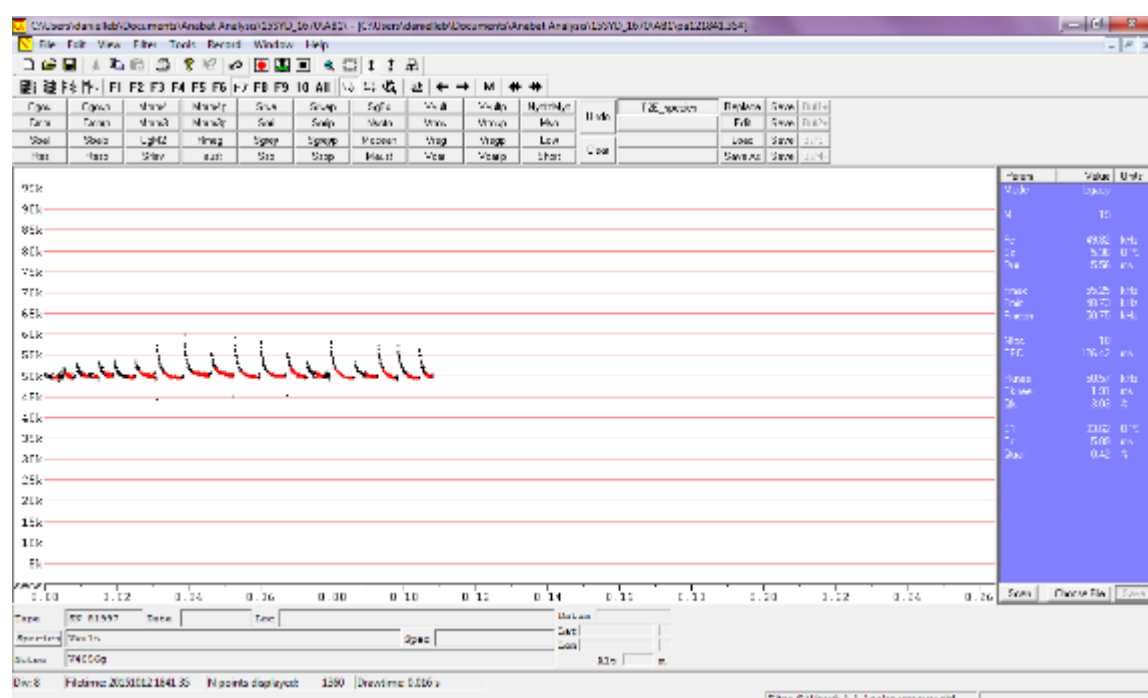


Figure 10: Call profile for *Vespadelus vulturinus* recorded at Site 1, Eastern Creek at 1841 on 12 October 2015.

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