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## Appendix 6: Flora and fauna assessment (Biosis 2017c)

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# Lot 101 DP 785139 Crest Road, Albion Park: Flora and Fauna Assessment

FINAL REPORT V03

Prepared for MMJ Real Estate on behalf of Spinitu Pty Ltd

18 April 2017

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## Glossary

<b>AoS</b>	Assessment of Significance
<b>APZ</b>	Asset Protection Zone
<b>BA</b>	Birds Australia
<b>CAVs</b>	Census of Australian Vertebrates
<b>CBD</b>	Central Business District
<b>DA</b>	Development Application
<b>DBH</b>	Diameter at Breast Height
<b>DEE</b>	Department of the Environment and Energy (Commonwealth)
<b>DP&amp;E</b>	Department of Planning and Environment (NSW)
<b>EEC</b>	Endangered Ecological Community
<b>EP&amp;A Act</b>	<i>Environmental Planning and Assessment Act 1979</i> (NSW)
<b>EPBC Act</b>	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
<b>FM Act</b>	<i>NSW Fisheries Management Act 1994</i> (NSW)
<b>HBT</b>	Hollow Bearing Tree
<b>GIS</b>	Geographic Information System
<b>KTP</b>	Key Threatening Process
<b>LEP</b>	Local Environment Plan
<b>LGA</b>	Local Government Area
<b>MNES</b>	(Matter of) National Environmental Significance
<b>NSW</b>	New South Wales
<b>NV Act</b>	<i>Native Vegetation Act 2003</i> (NSW)
<b>NW Act</b>	<i>Noxious Weed Act 1993</i> (NSW)
<b>OEH</b>	NSW Office of Environment and Heritage
<b>SEPP</b>	State Environmental Planning Policy
<b>study area</b>	Lot 101 DP 785139, Crest Road, Albion Park
<b>subject site</b>	The area of impact for the proposed works within the study area
<b>TSC Act</b>	<i>Threatened Species Conservation Act 1995</i> (NSW)
<b>VMP</b>	Vegetation Management Plan

## Summary

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Biosis Pty Ltd was commissioned by MMJ Real Estate (MMJ), on behalf of Spinitu Pty Ltd, to undertake a flora and fauna assessment (FFA) for Lot 101 DP 785139, Crest Road, Albion Park (the study area).

MMJ previously submitted a Planning Proposal to rezone land in the study area to a mix of E3 Environmental Management and R2 Low Density Residential. To inform the rezoning application, Biosis has previously undertaken a BioBanking Assessment of the study area (Biosis 2012). Shellharbour City Council (Council) has since adopted the proposed rezoning outcome and is currently in the process of finalising the application with the NSW Department of Planning & Environment (DP&E). Landowners now wish to progress with the preparation of a land subdivision Development Application (DA) for the creation of approximately 72 housing lots within the study area for which Biosis has been requested to provide a FFA.

A number of previous ecological assessments of the study area have been undertaken by Biosis (2012), Kevin Mills (2007) and Eco Logical (2011) (Appendix 6). This FFA utilises the information from these previous ecological assessments to identify potential impacts to biodiversity values present within the study area.

### Ecological values

Key ecological values identified within the study area include:

- 8.36 hectares of Forest Red Gum – Thin-leaved Stringybark grassy woodland, including 5.76 hectares which is consistent with the TSC Act listed *Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion*, endangered ecological community (EEC) and the EPBC Act listed *Illawarra and south coast lowland forest and woodland ecological community*, critically endangered ecological community (CEEC) consistent with the moderate condition class\*.
- The presence of seven White-flowered Wax Plants *Cynanchum elegans*, listed under both the TSC Act and EPBC Act, at two locations.
- The presence of the one threatened bird species (Flame Robin *Petroica phoenicea*), four threatened mammal species (Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*, Little Bentwing-bat *Miniopterus australis*, Eastern False Pipistrelle *Falsistrellus tasmaniensis* and the Grey-headed Flying-fox *Pteropus poliocephalus*, listed under the TSC and EPBC Acts.
- Potential habitat for an additional threatened flora species (Illawarra Zieria *Zieria granulata*) and two threatened fauna species (Greater Broad-nosed Bat *Scoteanax rueppellii* and Varied Sitella *Daphoenositta chrysoptera*).
- 33 hollow bearing trees, 24 providing potential habitat for a number of general and threatened flora and fauna species, including roosting habitat for two threatened microchiropteran bats.

\*On 16 September 2016, *Illawarra and south coast lowland forest and woodland ecological community*, was newly listed as a Matter of National Environmental Significance (MNES) under the Environmental Protection and Biodiversity Protection Act 1999 (EPBC Act) as a Critically Endangered Ecological Community (CEEC). Assessments of the vegetation have been updated to take into account the Approved Conservation Advice (incorporating listing advice) for the Illawarra and South Coast Lowland Forest and Woodland Ecological Community (TSSC 2016).

### Government legislation and policy



An assessment of the project against key biodiversity legislation and policy is provided and summarised below

Legislation / Policy	Relevant ecological feature on site	Permit / Approval required
<b><i>Environment Protection and Biodiversity Conservation Act 1999</i></b>	White-flowered Wax Plant and Illawarra and south coast lowland forest and woodland ecological community are present within the study area.	Significant Impact Criteria assessments have been undertaken for White-flowered Wax Plant and Illawarra and south coast lowland forest and woodland ecological community. Referral for White-flowered Wax Plant is not required. Referral for the removal of moderate condition Illawarra and south coast lowland forest and woodland ecological community is recommended.
<b><i>Threatened Species Conservation Act 1995</i></b>	Threatened species and ecological communities including Illawarra Lowlands Grassy Woodland, White-flowered Wax Plant, Flame Robin, Eastern Bentwing-bat, Little Bentwing-bat, Eastern False Pipistrelle and the Grey-headed Flying-fox are present within the study area.	The proposed subdivision is unlikely to result in a significant effect to these species. A Species Impact Statement is not required.
<b><i>Environmental Planning &amp; Assessment Act 1979</i></b>	Threatened species and ecological communities	Assessment of Significance is required under S.5A of the EP&A Act were completed. Significant effect is unlikely to result from the proposed subdivision.
<b><i>State Environmental Planning Policy No 44</i></b>	SEPP44 does not apply to the Shellharbour City Council Local Government Area.	
<b><i>Noxious Weeds Act 1993</i></b>	<p>The following noxious weeds are present within the study area:</p> <ul style="list-style-type: none"> <li>• Lantana <i>Lantana camara</i></li> <li>• Blackberry <i>Rubus fruticosus</i></li> <li>• Fireweed <i>Senecio madagascariensis</i>.</li> <li>• Ground Asparagus <i>Asparagus aethiopus</i></li> <li>• Bridal creeper <i>Asparagus asparagoides</i>.</li> </ul>	<p>All five noxious weeds are listed as Class 4, meaning that "the growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold, propagated or knowingly distributed".</p> <p>Land owners within the study</p>

Legislation / Policy	Relevant ecological feature on site	Permit / Approval required
		area have an obligation under the Noxious Weeds Act 1993 to control all noxious weeds on their land according to the specified control class.

Note: Guidance provided in this report does not constitute legal advice.

Overall, the native vegetation to be removed supports a variable, but mostly degraded midstorey and groundcover within the study area. In its current form the development will result in the removal of 3.06 hectares of Illawarra Lowlands Grassy Woodland listed under the TSC Act and EPBC Act. This will include a further 1.10 hectares of permanent modification to Illawarra Lowlands Grassy Woodland CEEC for Asset Protection Zones (APZ). The project design includes 2.7 hectares of Illawarra Lowlands Grassy Woodland that will be retained and managed within an EMA (EMA) (Figure 6). An Assessment of Significance (AoS) did not find the removal of this vegetation significant as the reduction in area was unlikely to result in direct and indirect effects that would cause local extinction of the EEC (Appendix 3).

When considering the project impacts to the EPBC Act listed vegetation under the Approved Conservation Advice (TSSC 2016), the areas to be removed satisfy the moderate condition class for the CEEC. As such the vegetation and adjacent buffers are considered critical to the survival of the community (TSSC 2016). A Significant Impact Criteria (SIC) assessment (CoA 2013) found that the residual impacts to the CEEC are likely to have a significant impact.

The creation of the EMA will result in the entire known population of the White-flowered Wax Plant being retained within the study area, with the potential for a net positive effect for this species. The areas surrounding the White-flowered Wax Plant will be subject to management buffers with stringent controls. In addition, the EMA will result in the retention and improvement to 2.7 hectares of Illawarra Lowlands Grassy Woodland. A Vegetation Management Plan (VMP) for the EMA will also provide directions for weed removal and revegetation that will provide threat abatement from Lantana and Blackberry, as well as improvements in habitat condition for the White-flowered Wax Plant and Illawarra Lowlands Grassy Woodland in perpetuity.

The removal of hollow-bearing trees from the development footprint will be compensated with the provision of nest boxes at a 1:1 replacement rate (Table 11) to maintain limiting fauna habitat within the study area.

AoS (Appendix 3) and SIC assessments (Appendix 4) for White-flowered Wax Plant and hollow roosting microbats found that the proposed design is unlikely to cause a significant effect of impact.

## Recommendations

The primary measure for the development to minimise impacts to the ecological values identified within the subject site is to avoid and minimise the removal of native vegetation and habitat. In addition to the retention of 2.7 hectares of Illawarra Lowlands Grassy Woodland and White-flowered Wax Plant habitat within the EMA, the area has been rezoned as an E3 Environmental Management zone. This will provide additional development controls to maintain the site for environmental outcomes in the future.

Other measures to mitigate impacts to identified ecological features include:

- Retention of all hollow-bearing trees within the EMA.
- Retention of hollow-bearing trees within the development area, where not occurring within development envelopes, fence lines, soil cut areas, and if safe to do so.

- Installation of bushfire asset protection zones within the development and EMA area will prioritise retention of trees in the following sequence:
  - Hollow-bearing trees.
  - Canopy tree species (Forest Red Gum *Eucalyptus tereticornis* and Thin-leaved Stringybark *E. eugenoides*) over midstorey species of *Acacia*, *Melaleuca* and *Callistemon*
  - Largest to smallest DBH.
- Any hollow-bearing limbs, removed as a part of the subdivision, should be relocated into the EMA.
- Locating residential dwellings and the dwelling envelope within the EMA away from known locations of the White-flowered Wax Plant.
- Ensuring appropriate management of known locations for the White-flowered Wax Plant through strict adherence to the VMP.

The extent of clearing of Illawarra Lowlands Grassy Woodland CEEC listed under the EPBC Act for the proposed residential design is considered a significant impact and the preparation of a referral to the Commonwealth Minister for the Department of Environment and Energy for assessment of the project is recommended.

Under the EPBC Act Offsets Policy (Commonwealth of Australia 2012), any significant residual impact following the consideration of impact avoidance and minimisation measures will require offsets. This includes direct impacts arising from the removal of the CEEC, as well as indirect impacts within a 30 metre buffer.

# 1. Introduction

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## 1.1 Project background

Biosis Pty Ltd was commissioned by MMJ Real Estate (MMJ) on behalf of Spinutu Pty Ltd to undertake a flora and fauna assessment (FFA) of land at Lot 101 DP 785139 Crest Road, Albion Park (the study area; Figure 1). MMJ is currently preparing a Development Application (DA) for the subdivision of land into 71 residential lots, one environmental lot and one public reserve plus associated roads, infrastructure and asset protection zones (the subject site; Figure 2).

Biosis has previously undertaken a preliminary BioBanking Assessment of the study area (Biosis 2012) for the planning submission (MMJ 2011) which identified the biodiversity values present within the study area. The outcome of the Planning Proposal was to rezone land in the study area to a mix of R2 Low Density Residential, across the disturbed western portion, and E3 Environmental Management in areas supporting less disturbed native vegetation and threatened species.

The FFA identifies the impact of the proposed residential subdivision on existing biodiversity values and outlines measures to manage the E3 zoned area to ensure existing biodiversity values are appropriately protected and managed. The FFA has been compiled based on previous ecological assessments conducted within the study area and existing database records for threatened species, populations and communities known and expected to occur within the study area.

The FFA incorporates the listing for Illawarra Lowlands Grassy Woodland CEEC on 16 September 2016 and provides a summary of impacts and requirements that are required under the EPBC Act.

## 1.2 Scope of assessment

The objectives of this investigation are to:

- Update previous database searches relating to flora and terrestrial fauna issues relevant to the study area, including the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife and the Commonwealth Department of the Environment and Energy (DEE) Protected Matters Search Tool.
- Review previous assessment work undertaken by Biosis (2012), Ecological (2011) and Kevin Mills (2007).
- Preparation of a flora and fauna assessment report that will:
  - Discuss the ecological values present within the study area, including vegetation communities and the potential for threatened species and communities to occur.
  - Review the implications of relevant biodiversity legislation and policy.
  - Identify potential implications of the proposed development and provide recommendations to assist with development design.
  - Recommend any further assessments of the study area that may be required.

### **1.3 Location of the study area**

The study area is located at Albion Park in the Shellharbour Local Government Area (LGA) (Figure 1) and encompasses approximately 9.65 hectares of privately owned land at the end of Crest Rd, Albion Park (Figure 2). Following the support of the Planning Proposal (MMJ 2011) the study area is zoned R2 Low Density Residential and E3 Environmental Management under the Shellharbour Local Environment Plan (LEP) 2013.

The study area is within the:

- Illawarra Subregion of the Sydney Basin Bioregion.
- Lake Illawarra catchment.
- Southern Rivers Catchment Management Authority area.
- Shellharbour LGA.



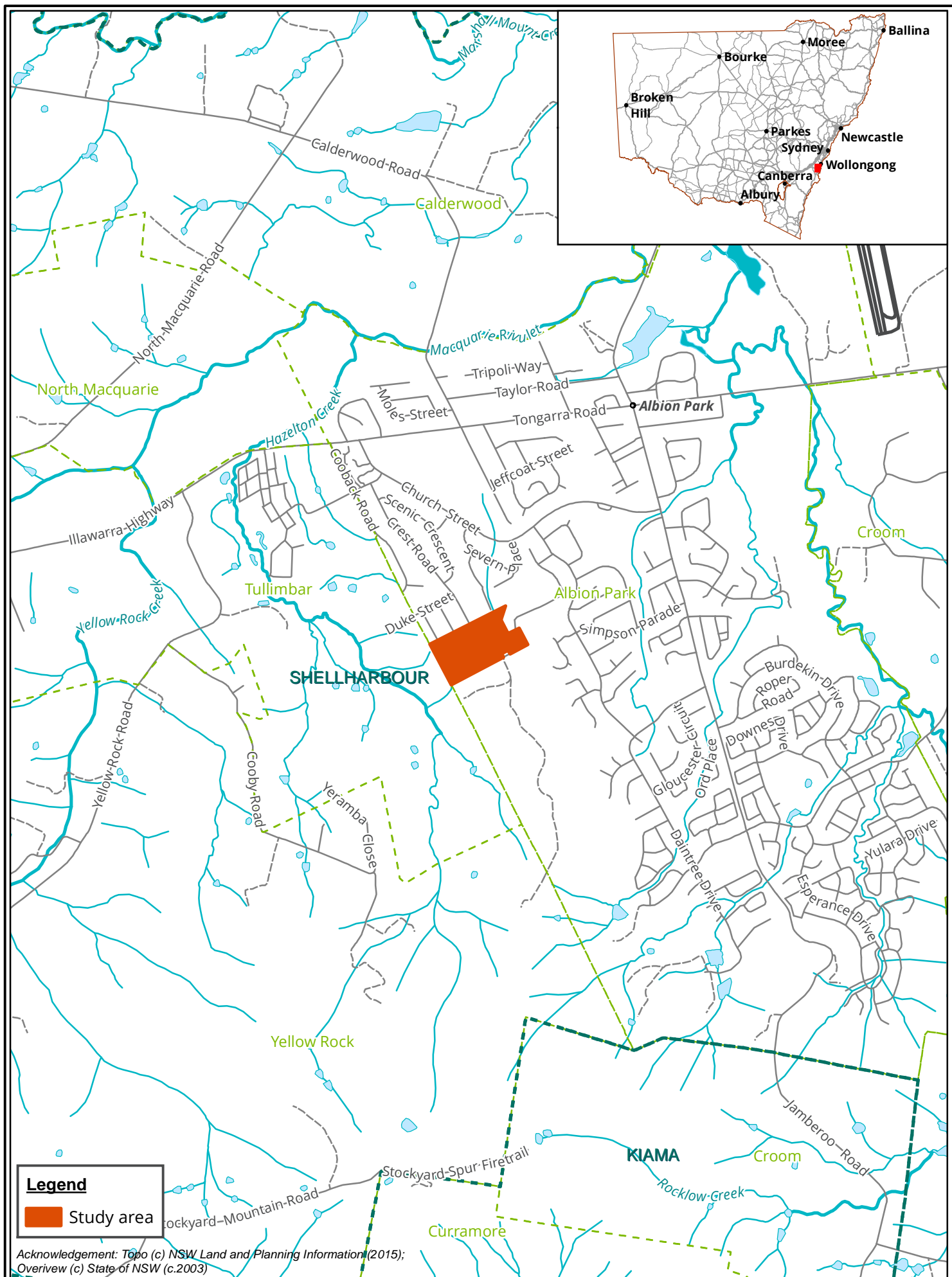


Figure 1: Location of the study area, Albion Park, NSW





#### Legend

- Study area
- Proposed subdivision**
  - Proposed lot boundary
  - APZ
  - Development - APZ
  - Development - Building envelope
  - Development - Lots
  - Development - Roads
  - Environmental management
  - Environmental management - Inner APZ
  - Environmental management - Outer APZ
- Zoning Boundaries**
  - E3 Environmental Management
  - R2 Low Density Residential

**Figure 2: Location of the subject site (proposed works) within the study area**

0 10 20 30 40 50  
Metres

Scale: 1:1,800 @ A3  
Coordinate System: GDA 1994 MGA Zone 56



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

Matter: 18852  
Date: 13 April 2017,  
Checked by: LH, Drawn by: NMG  
Location: P:\18800s\18852\Mapping\18852\_FFA\_F2\_StudyArea\_20170413



## 2. Methods

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### 2.1 Nomenclature

The flora taxonomy (classification) used in this report follows the most recent Flora of NSW (Harden 1992, Harden 1993, Harden 2000, Harden 2002). All doubtful species names were verified with the on-line Australian Plant Name Index (Australian National Botanic Gardens 2007). Flora species, including threatened species and introduced flora species, are referred to by both their common and then scientific names when first mentioned. Subsequent references to flora species cite the common names only, unless there is no common name, for which scientific name will be used. Common names, where available, have been included in threatened species tables and the complete flora list in Appendix 1.

Names of vertebrates follow the Census of Australian Vertebrates (CAVs) maintained by the Commonwealth Department of Environment and Energy (DEE) (Commonwealth of Australia 2009). In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only. Common and scientific names are included in the fauna list in Appendix 2.

### 2.2 Literature and database review

In order to provide a context for the subject site, information about flora and fauna from within 5 kilometres of the study area (the 'local area') was obtained from relevant public databases. Records from the following databases were collated and reviewed:

- DEE Protected Matters Search Tool for matters protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- NSW BioNet – the database for the Atlas of NSW Wildlife, OEH for threatened species, populations and communities listed under the *Threatened Species Conservation Act 1995* (TSC Act).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2013 (BA).

Other sources of biodiversity information:

- Relevant vegetation mapping, including:
  - Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands (SCIV) (Tozer et al. 2010).
  - Native Vegetation of the Illawarra Escarpment and Coastal Plain (NPWS 2002a).

The following reports were also reviewed:

- Illawarra Biodiversity Strategy. Volume 1 and Volume 2 (WCC et al. 2011a and 2011b).
- Draft Urban Fringe Local Environmental Plan. Additional Flora Assessment for the Urban Fringe Local Environmental Study (Mills 2007).
- Planning Submission. Draft Shellharbour Local Environmental Plan 2011. Lot 101 DP 785139, Crest Road, Albion Park. (MMJ 2011).
- Flora and Fauna Assessment. Lot 1011 DP 785139 Crest Road, Albion Park. (Ecological 2011) (Appendix 6).

- Lot 101 DP 785139, Crest Rd, Albion Park - BioBanking Assessment (Biosis 2012).

## 2.3 Site investigation

### 2.3.1 Flora and fauna assessment

Initial diurnal flora and fauna surveys were carried out over the study area on 11 December 2012 as part of the Biobanking Assessment prepared by Biosis (2012). A subsequent site investigation for vegetation condition was undertaken on 5 June 2015, and an updated fauna habitat assessment on 23 June 2016. Sections from Biosis (2012) relevant to the flora and fauna assessment have been reviewed and updated in this report. Flora surveys have included:

- Mapping of vegetation communities, including an assessment of floristic composition and condition.
- Review of collated data and condition assessment to confirm the presence of Illawarra Lowlands Grassy Woodland EEC and CEEC under the TSC Act and EPBC Act, respectively.
- Random meanders over the study area in the main landscape stratification units targeting threatened flora species and populations previously recorded in the locality and with potential to occur on the subject site. Species targeted included:
  - Eastern Flame Pea *Chorizema parviflorum* (threatened population)
  - White-flowered Wax Plant *Cynanchum elegans*
  - *Solanum celatum*
  - Illawarra Zieria *Zieria granulata*.
- Searches to locate and confirm the continued presence of threatened flora species recorded in previous surveys by Eco Logical (2011).

General fauna surveys focused on the types and qualities of habitat(s) present. All species of fauna observed during the assessment were noted and active searching for fauna was undertaken. This included direct observation, searching under rocks and logs, examination of tracks and scats and identifying calls. All trees on the site were inspected and the presence of hollow-bearing trees noted. Particular attention was given to searching for significant species recorded by Eco Logical (2011) or identified during database review and their habitats. Fauna species were recorded with a view to characterising the values of the site as the investigation was not intended to provide a comprehensive survey of all fauna that has potential to utilise the site over time.

During fauna surveys, a hollow bearing tree assessment was carried out in order to determine the habitat values present for hollow-dependent fauna species (11 December 2012 and 23 June 2016). All trees within the study area were visually inspected for hollows, and signs of fauna occupation. When a hollow-bearing tree was identified, a waypoint was taken and details of hollow size, height and suitability were recorded (Table 11).

A list of flora and fauna species was compiled and are presented in Appendix 1 (flora) and Appendix 2 (fauna). Records of all flora and fauna species will be submitted to OEH for incorporation into the Atlas of NSW Wildlife.

### 2.3.2 Permits and Licences

The flora and fauna assessment was conducted under the terms of Biosis' Scientific Licence issued by the Office of Environment and Heritage under the *National Parks and Wildlife Act 1973* (SL100758, expiry date 31

March 2017). Fauna survey was conducted under approval 11/355 from the NSW Animal Care and Ethics Committee (expiry date 31 January 2017).

## 2.4 Mapping

LandTeam Australia Pty Ltd has provided a subdivision plan. This subdivision plan is shown in Figure 2 and includes:

- Zone boundaries.
- The proposed lot layout, including lot boundaries, roads, soil cuts, and stormwater infrastructure.
- The location of asset protection zones (APZs).

The subdivision plan was digitised using a Geographic Information System (GIS).

Mapping was conducted using a combination of hand-held (uncorrected) GPS units (WGS84), aerial photo interpretation and a tablet computer with GPS capability. The accuracy of the hand held GPS mapping is subject to the accuracy of the GPS units (generally  $\pm 7$  metres) and dependent on the limitations of aerial photo rectification and registration. Mapping in the field using tablet (PC) provides a higher level of accuracy and has been used to map vegetation condition polygons, fauna habitat features and the extent of the Illawarra Lowlands Grassy Woodland EEC.

Mapping has been produced using a GIS including spatial data collected in the field and site information transposed from non-spatially referenced plans.

## 2.5 Limitations

Ecological surveys provide a sampling of flora and fauna at a given time and season. There are a number of reasons why not all species will be detected at a site during survey, such as species dormancy, seasonal conditions, ephemeral status of waterbodies and migration and breeding behaviours of some fauna. In many cases these factors do not present a significant limitation to assessing the overall biodiversity values of a site.

Biosis (2012) conducted initial survey effort for their Biobanking Assessment over one day in summer 2012. The survey effort was based on the nature of the proposal, the scope and the objectives of the BBAM. This inspection was updated in June 2015 and provided a seasonal comparison of condition of vegetation and re-assessment of hollow-bearing trees in June 2016.

In relation to the amount of survey effort and its timing, a reasonable sample of the spectrum of flora and fauna species and assessment of the ecological processes that are likely to occur in the study area have been made from desktop assessments, background research the 2012, 2015 and 2016 surveys and previous site inspections by Eco Logical (2011).

Tree counts for the site are based on Moore Trees (2016) that did not cover the entire site. Estimates of the number of trees present within the study area and EMA have been based on the number of trees per area found within the IPA area and extrapolated for the APZ Outer Protection Zone (104) and residual EMA areas (254).

Database searches, and associated conclusions on the likelihood of species to occur within the study area, are reliant upon external data sources and information managed by third parties.



## 3. Legislative context

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This section provides an overview of key biodiversity legislation and government policy considered in this assessment. Where available, links to further information are provided. This section does not describe the legislation and policy in detail and guidance provided here does not constitute legal advice.

### 3.1 Commonwealth

#### 3.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's key piece of environmental legislation. The EPBC Act applies to developments and associated activities that have the potential to significantly impact on Matters of National Environmental Significance (NES) protected under the Act.

Nine Matters of NES are identified under the EPBC Act:

- World heritage properties
- National heritage places
- Wetlands of international importance (also known as 'Ramsar' wetlands)
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development.

Under the EPBC Act, activities that have potential to result in significant impacts on Matters of NES must be referred to the Commonwealth Minister for the Environment for assessment.

Matters of NES relevant to the current project include nationally threatened species and ecological communities, migratory species and Ramsar wetlands. Threatened species and ecological communities protected by the EPBC Act are outlined in Section 4.4. An assessment of potential impacts to all Matters of NES under the provisions of the EPBC Act is provided in Section 5.4.1 with Significant Impact Criteria (SIC) assessments provided in Appendix 4.

### 3.2 State

#### 3.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) was enacted to encourage the proper consideration and management of impacts of proposed development or land-use changes on the environment (both natural and built) and the community. The EP&A Act is administered by the NSW Department of Planning and Environment (DP&E).

The EP&A Act provides the overarching structure for planning in NSW and is supported by other statutory environmental planning instruments. Sections of the EP&A Act of primary relevance to the natural environment are outlined further below.

### **Assessment of Significance (Part 1, Section 5A)**

Section 5A of the EP&A Act is an integral part of environmental impact assessment and requires proponents and consent authorities to consider if a development will have a significant effect on threatened species, populations or communities listed under the TSC Act and *Fisheries Management Act 1994* (FM Act). The objective of the Assessment of Significance (AoS) (also known as the “7-part test”) is to improve the standard of, and make transparent, the considerations given to threatened species, populations and ecological communities, and their habitats. Section 5A (and Section 94 of the TSC Act) outlines seven factors that must be taken into account. Typically, where any AoS determines that a development will result in a significant effect to a threatened species, population or community, a Species Impact Statement (SIS) is required.

Threatened species, populations and communities listed under the TSC Act are discussed in Section 4.4. An assessment of whether the project will result in a significant effect to these threatened species, populations and communities is summarised in Section 5.4.2, with AoS's provided in Appendix 3.

### **State Environmental Planning Policies (Part 3, Division 2)**

State Environmental Planning Policies (SEPPs) are environmental planning instruments under the EP&A Act that outline policy objectives relevant to State or regional environmental planning issues. There are over 65 SEPPs; however, only those relevant to the proposed development have been considered and are detailed below.

#### **SEPP No. 44 – Koala Habitat Protection**

SEPP No. 44 aims to encourage the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of koala-population decline. It applies to areas of native vegetation greater than one hectare and in councils listed in Schedule 1 to the SEPP.

The study area is located within the Shellharbour LGA, which is not listed within Schedule 1. Therefore SEPP No. 44 is not relevant to the current assessment.

### **Local Environment Plans (Part 3, Division 4)**

Local Environment Plans (LEP) are created by councils in consultation with their community and guide planning decisions for LGAs. They apply either to the whole or part of a LGA and make provision for the protection or utilisation of the environment through zoning of land and development controls.

The study area is subject to the Shellharbour LEP 2013 and is zoned R2 Low Density Residential and E3 Environmental Management. The objectives of R2 zoning are to:

- Provide for the housing needs of the community within a low density residential environment.
- Enable other land uses that provide facilities or services to meet the day to day needs of residents.

The objectives of E3 zoning are to:

- Protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.
- Provide for a limited range of development that does not have an adverse effect on those values.
- Retain and enhance the visual and scenic qualities of the Illawarra Escarpment.

The development application includes subdivision for the purposes of low density residential, including associated infrastructure. Low density residential development is located entirely within the R2 zone. Some development of roads and management of vegetation for asset protection zones (APZs) will occur within the E3 zone.

### **3.2.2 Threatened Species Conservation Act 1995**

The TSC Act is the key piece of legislation providing for the protection and conservation of biodiversity in NSW through the listing of threatened species, populations and communities, key threatening processes and critical habitat for threatened species, populations and communities. Impacts to threatened species, populations and communities are assessed under Section 5A of the EP&A Act (see above).

The potential for threatened species, populations and communities to occur within and be impacted by the proposed subdivision is assessed in Section 4.4. An assessment of whether the project will result in a significant effect to these threatened species, populations and communities is summarised in Section 5.4.3, with AoS's provided in Appendix 3.

### **3.2.3 Native Vegetation Act 2003**

The *Native Vegetation Act 2003* (NV Act) provides for, encourages and promotes the management of native vegetation on a regional basis and regulates the clearing of native vegetation on land in NSW. Under the NV Act no clearing of native vegetation is allowed except in accordance with prior development consent from the relevant Council or under a Property Vegetation Plan (PVP) approved by the relevant Catchment Management Authority.

The study area is zoned R2 Low Density Residential and E3 Environmental Management. Clearing of native vegetation in the R2 zone does not require approval under the NV Act as this zone is considered an 'urban area' under Schedule 1 of the NV Act. Some clearing of native vegetation within the E3 zone will be required for management of APZs. However, as this clearing will be carried out in accordance with a bush fire management plan under the *Rural Fires Act 1997*, approval under the NV Act is not required.

### **3.2.4 Noxious Weeds Act 1993**

The *Noxious Weeds Act 1993* (NW Act) was enacted to provide for the identification, classification and control of noxious weeds. The NW Act aims to reduce the negative impact of weeds on the economy, community and environment of NSW by:

- Establishing controls to prevent the establishment of significant new weeds in NSW.
- Preventing, eliminating or restricting the spread of particular significant weeds in NSW.
- Effectively managing widespread significant weeds in NSW.

Plants declared as noxious weeds are currently listed under *Noxious Weeds (Weed Control) Order 2014* published in the NSW Government Gazette No. 23. The NW Act is supported by a number of regulations and is administered by the DPI.

Noxious weeds are discussed further in Section 4.2 with recommendations for adhering to the NW Act provided in Section 5.4.4.

## 4. Results

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The key ecological features of the subject site and study area are described below and mapped in Figure 3. Species recorded during the flora and fauna assessment are listed in Appendix 1 (flora) and Appendix 2 (fauna). Unless of particular note, these species are not discussed further.

A list of significant species recorded or predicted to occur in the local area is also provided in those appendices, along with an assessment of the likelihood of the species occurring within the study area.

### 4.1 Landscape context

The study area has been partially cleared and subject to ongoing disturbance through the use of the site for horse agistment. Grazing and trampling of the flatter, low relief sections of the study area (western two thirds and south-eastern corner) by horses has resulted in a high degree of disturbance in these areas. These areas support mature trees over a low, grazed groundcover consisting of a mix of native and exotic species. The mid-storey in these areas is limited to scattered shrubs around the perimeter.

In the slopes associated with the gully in the north-eastern section of the study area, mature canopy trees occur over a dense mid-storey of Lantana *Lantana camara*. Groundcover is largely denuded, with native species scattered throughout.

A summary of the two previous ecological surveys and assessments that have been carried out on the subject site is provided below

#### 4.1.1 Draft Urban Fringe Local Environmental Plan. Additional Flora Assessment for the Urban Fringe Local Environmental Study, City of Shellharbour (Mills 2007)

The subject site was included as part of a Local Environmental Study by Mills (2007). The objective of this study was primarily to "*further investigate, identify the boundaries of and assess the importance of the Illawarra Lowlands Grassy Woodland on certain properties*" included in the Shellharbour Urban Fringe Local Environment Plan. The study area is referred to by Mills (2007) as 'Study Area 2'. The Mills (2007) investigation was restricted to flora surveys over only part of the study area.

In summary Mills (2007) states that of the approximate three hectares surveyed the "*eastern half of the study area is well treed and has a diverse native understorey . . . the area represents a relatively good quality stand of Illawarra Lowlands Grassy Woodland compared to other areas of the community in the vicinity . . . the western half of the study area is less well treed and most of the ground cover is exotic grassland, dominated by perennial exotic species*". A 'potential development area' is described and mapped by Mills (2007) for the western section of the study area.

#### 4.1.2 Flora and Fauna Assessment, Lot 1011 DP 785139 Crest Road, Albion Park (Eco Logical 2011)

Eco Logical (2011) undertook a more detailed terrestrial flora and fauna assessment and constraints analysis of the study area. The main constraints to future rezoning and development identified by Eco Logical included threatened biodiversity listed under the TSC and EPBC Acts including:

- Conformation of the presence of the Illawarra Lowlands Grassy Woodland EEC, listed under the TSC Act, within the study area.
- Records of the White-flowered Wax Plant *Cynanchum elegans*, listed under the TSC and EPBC Act, in the eastern portion of the study area.

- The potential for the Eastern False Pipistrelle *Falsistrellus tasmaniensis* and Gang-Gang Cockatoo *Callocephalon fimbriatum*, both listed under the TSC Act, to roost in hollow-bearing trees within the study area.

Eco Logical (2011) outlined that the condition of Illawarra Lowlands Grassy Woodland is variable and that this primarily reflects the level of past disturbance. The report recommended that any impacts to the ecological values of the study area through the rezoning be offset using the following measures:

- Restoration of Illawarra Lowlands Grassy Woodland EEC guided by a Vegetation Management Plan (VMP).
- Enhancement of habitat for threatened plant species White-flowered Wax Plant.
- Replacement or replication of hollows to compensate for the loss of hollow-bearing trees.

#### 4.1.3 Habitat connectivity

The study area forms part of vegetated corridor extending north and south of the study area, connecting to the Tongarra – Stockyard Mountain to Dunmore Hills regional biodiversity corridor (WCC et al. 2011). Within this corridor, the study area forms part of a partially cleared area along the upper crest, with cleared land extending further south. This land is also proposed for future residential development. On a local scale, the study area acts as a dispersal corridor for more mobile species including avifauna and arboreal mammals. It provides connectivity to interspersed remnant vegetation found among the adjacent rural development.

The surrounding landscape has been modified through clearing for agriculture to the south and west, and for residential development to the north and east.

These developments will not result in the fragmentation of this corridor, with native vegetation to the east and west remaining connected and being maintained.

## 4.2 Flora and fauna

Species recorded in the current and previous flora and fauna assessments are listed in Appendix 1 (flora) and Appendix 2 (fauna). Unless of particular note, these species are not discussed further. A list of threatened species and populations recorded or predicted to occur in the local area is also provided in those appendices, along with an assessment of the likelihood of the species occurring within the study area.

Hollow-bearing trees recorded within the study area are detailed in Appendix 2.4, Table 11. A total of 33 hollow-bearing trees were recorded within the study area. Nine trees were assessed as being unsuitable to provide habitat. The remaining 24 trees contained hollows suitable for fauna including:

- Hollow-roosting microbats.
- Hollow breeding small parrot species.
- Hollow breeding medium parrots or small possums.

Of these 24 trees, 16 are located within the residential development footprint, with 8 likely to be removed due to their occurrence within road, fence or building footprints. The trees that fall within these footprints contain a total of 12 hollows.

During the site investigation four noxious weeds as defined by DPI for the Shellharbour LGA were recorded. These noxious weeds include: Lantana, Blackberry *Rubus fruticosus* species aggregate, Fireweed *Senecio madagascariensis*, Ground Asparagus *Asparagus aethiopicus* and Bridal creeper *Asparagus asparagoides*. Management of these noxious weeds is discussed further in Section 5.4.4.



### 4.3 Vegetation communities and fauna habitat

The vegetation and fauna habitat throughout the majority of the study area has been modified by past disturbances, including clearing and horse agistment, resulting in significant grazing, nutrient loading, erosion and trampling by horses. The north-eastern section of the study area, associated with the gully slopes, supports a high degree of weed cover.

The study area supports a limited number of ecological features, including areas of native vegetation, the presence of the Illawarra Lowlands Grassy Woodland, the presence of the threatened White-flowered Wax Plant and hollow-bearing trees. The vegetation occurs as contiguous vegetation and scattered trees within modified pasture. In total, Moore Trees (Moore Trees 2016) mapped 747 trees consistent with the definitions within the Shellharbour City Council Tree Management Order, Biosis extrapolated that and additional 175 trees are estimated to occur within the Outer APZ and EMA based on the number of trees per mapped within the Inner APZ, making the total estimate of 922 trees within the study area.

The ecological features of the study area are outlined below (refer also to Figure 3).

**Table 1: Vegetation communities and fauna habitat of the study area**

Illawarra Lowlands Grassy Woodland	
<b>Extent within study area</b>	<p>5.76 hectares of Illawarra Lowlands Grassy Woodland EEC and CEEC is mapped across the study area, as outlined below:</p> <ul style="list-style-type: none"> <li>• 3.06 hectares in the development site</li> <li>• 0.44 hectares in the inner APZ</li> <li>• 0.65 hectares in the outer APZ</li> <li>• 1.61 hectares in the EMA.</li> </ul>
<b>Description including fauna habitat</b>	<p>The canopy of this community is dominated by Forest Red Gum <i>Eucalyptus tereticornis</i> over both the flatter plateau area and north east slopes, with Thin-leaved Stringybark <i>Eucalyptus eugenioides</i> also present. Both areas have a very sparse midstorey of regenerating canopy species with occasional Hickory Wattle <i>Acacia implexa</i>, Maiden's Wattle <i>Acacia maidenii</i>, Red Ash <i>Alphitonia excelsa</i>, Sticky Hop-bush <i>Dodonaea viscosa</i> ssp. <i>angustifolia</i> and Muttonwood <i>Myrsine variabilis</i>. The understorey on the higher plateau is absent as a result of intensive grazing resulting from horse agistment (Plate 1), whilst the understorey on the north east slopes is entirely dominated by Lantana with occasional native shrubs on the higher slopes (Plate 2). The groundcover stratum on the higher plateau is in a moderate condition supporting a range of native grasses and herbs including Scurvy Weed <i>Commelina cyanea</i>, Slender Flat-sedge <i>Cyperus gracilis</i>, Slender Tick-trefoil <i>Desmodium varians</i>, Kidney Weed <i>Dichondra repens</i>, Weeping Grass <i>Microlaena stipoides</i> var. <i>stipoides</i> and Oplismenus <i>Oplismenus imbecillis</i>. Groundcover under the thickets of Lantana on the north-east slopes is virtually absent with sparse cover of native and exotic grasses, herbs and scramblers such as Asparagus Fern <i>Asparagus aethiopicus</i>, Indian Pennywort <i>Centella asiatica</i>, Scurvy Weed <i>Commelina cyanea</i>, Cape Ivy <i>Delairea odorata</i>, Panic Veldtgrass <i>Ehrharta erecta</i> and Wombat Berry <i>Eustrephus latifolius</i>.</p> <p>Fauna habitat within this vegetation community is largely dependent upon the understorey and presence of hollow-bearing trees. Areas dominated by Lantana provide foraging and sheltering habitat for a number of common woodland birds. 24 hollow-bearing trees were mapped as occurring within this community.</p>

Illawarra Lowlands Grassy Woodland	
	<p>These hollow-bearing trees generally support only small hollows between 5 and 20 cm in diameter. Other fauna habitat features, such as a complex understorey, hollow logs or leaf litter, are absent.</p>
<b>Condition</b>	<p>This community is generally in poor condition, with the higher plateau area impacted by grazing by horses and the north-east slopes dominated by Lantana. These areas are considered of low resilience without significant management.</p>
<b>Threatened ecological community</b>	<p>Commonwealth EPBC Act: Critically Endangered  <i>Justification:</i> Assessment against the TSSC (2016) concluded that the areas of vegetation equivalent to Illawarra Lowlands Grassy Woodland were consistent with the following category 'D. moderate condition class' because it satisfied the following attributes:</p> <ul style="list-style-type: none"> <li>• Patch size greater than 0.5 hectares</li> <li>• At least 30% of the total perennial understorey vegetation cover is composed of native species</li> <li>• The patch is contiguous with another patch of native vegetation (at least 1 hectare in area)</li> <li>• The patch has large locally indigenous trees with DBH at least 50 cm DBH and tree with hollows.</li> </ul> <p>NSW TSC Act: Endangered  <i>Justification:</i> The floristic composition and landscape position of this vegetation community is consistent with the Illawarra Lowlands Grassy Woodland EEC final determination.</p>
<b>Threatened species habitat</b>	<p>The White-flowered Wax Plant was recorded at five locations within the study area, with a total of seven plants recorded during targeted surveys. One additional flora species, Illawarra Zieria, is considered a medium likelihood of occurring within this vegetation community.</p> <p>Surveys undertaken by Eco Logical (2011) recorded three threatened microbat species within the study area (Eastern False Pipistrelle, Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i> and Little Bentwing-bat <i>Miniopterus australis</i>). The Grey-headed Flying-fox <i>Pteropus poliocephalus</i> was also recorded overflying the study area, while the Flame Robin <i>Petroica phoenicea</i> was recorded along the northern boundary. One additional micobat (Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>) is considered to have a medium likelihood of occurrence.</p>

## Illawarra Lowlands Grassy Woodland

### Plates

**Plate 1: Illawarra Lowlands Grassy Woodland, higher plateau area**



**Plate 2: Illawarra Lowlands Grassy Woodland, north east slopes**



Scattered trees	
<b>Extent within study area</b>	<p>2.60 hectares of scattered trees are mapped across the study area, as outlined below:</p> <ul style="list-style-type: none"> <li>• 2.59 hectares in the development site</li> <li>• 0.01 hectares in the inner APZ</li> </ul>
<b>Description including fauna habitat</b>	<p>This community supports a scattered canopy of Forest Red Gum and Thin-leaved Stringybark over a low groundcover of exotic pasture grasses and annual and perennial weeds. Exotic grasses such as <i>Paspalum dilatatum</i>, Kikuyu Grass <i>Pennisetum clandestinum</i> dominate with other common exotic herbs and grasses including Sorrel <i>Acetosella vulgaris</i>, Cobblers Pegs <i>Bidens pilosa</i>, Spear Thistle <i>Cirsium vulgare</i>, Fleabane <i>Conyza</i> sp., <i>Oxalis corniculata</i>, Fireweed <i>Senecio madagascariensis</i>, Petty Spurge <i>Euphorbia peplus</i> and Paddy's Lucerne <i>Sida rhombifolia</i>. Native grasses and herbs also occur mixed through the exotic groundcovers and common species include Common Cotula <i>Cotula australis</i>, Fishweed <i>Einadia trigonos</i> ssp. <i>trigonos</i>, Native Geranium <i>Geranium homeanum</i>, Weeping Grass and Tussock Grass <i>Poa labillardierei</i>.</p> <p>Fauna habitat within this vegetation community is limited to the presence of hollow-bearing trees. A total of 9 hollow-bearing trees were mapped as occurring within this community. These hollow-bearing trees generally support only small hollows between 5 and 20 cm in diameter. Other fauna habitat features, such as a complex understorey, hollow logs or leaf litter, are absent.</p>
<b>Condition</b>	This community is in poor condition, with a high cover of exotic species.
<b>Threatened ecological community</b>	<p>Commonwealth EPBC Act: Not listed</p> <p>NSW TSC Act: Not listed</p>
<b>Threatened species habitat</b>	None recorded. Low likelihood of occurrence for all species.



## Scattered trees

### Plates

#### Plate 3: Scattered trees



Other sections of the study area are mapped as cleared.

## 4.4 Threatened biota

Lists of threatened species, populations and communities recorded or predicted to occur within five kilometres of the study area are provided in Appendix 1 (flora) and Appendix 2 (fauna). Previous records of threatened biota within the locality are shown in Figure 4 (flora) and Figure 5 (fauna). An assessment of the likelihood of these species occurring in the study area, and an indication of where within the subject site (i.e. which habitats or features of relevance to the species), is included.

A summary of the threatened species recorded or with a medium or higher likelihood of occurring in the study area is provided in Table 2 below.

**Table 2: Summary of threatened biota likely to occur in the study area**

Species name	Area of value within the study area
<b>EPBC Act and TSC Act listed biota</b>	
<b>White-flowered Wax Plant</b>	The species was recorded in Illawarra Lowlands Grassy Woodland in the north-eastern section of the site, with seven plants recorded at two locations. The species occurs under a dense cover of Lantana (Figure 3). This species is discussed further below.



Species name	Area of value within the study area
<b>Illawarra Zieria</b>	The species was not recoded during targeted surveys, but may occur within Illawarra Lowlands Grassy Woodland seedbank on the upper rocky north east facing slopes. This area will form part of the vegetation management zone, with consequent improvement in habitat. This species is not discussed further.
<b>Grey-headed Flying-fox</b> <i>Pteropus poliocephalus</i>	This species was recorded by Eco Logical (2011) over-flying the subject site. Subject site does not support significant habitat. Some individuals may forage on flowering Forest Red Gum on occasion. This species is not discussed further.
<b>Illawarra and south coast lowland forest and woodland ecological community</b>	5.76 hectares of <i>Illawarra and south coast lowland forest and woodland ecological community</i> is mapped within the study area. Under the EPBC Act, this community is considered to be in moderate condition as assessed by TSSC (2016). Under the TSC Act however, this community is considered to be in poor condition as a result of past clearing, ongoing impacts from horse agistment and weed invasion. This community is discussed further below.
<b>TSC Act only listed biota</b>	
<b>Flame Robin</b> <i>Petroica phoenicea</i>	This species was recorded by Eco Logical (2011) along the northern boundary of the subject site. The species is highly mobile and although it may forage within the study area on occasion it is unlikely to be a resident species. This species is not discussed further.
<b>Hollow roosting microchiropteran bats:</b> <b>Greater Broad-nosed Bat</b> <b>Eastern False Pipistrelle</b> <i>Falsistrellus tasmaniensis</i>	The Eastern False Pipistrelle was recorded within the study area by Eco Logical (2011), while the Greater Broad-nosed bat is considered a medium likelihood of occurrence. These species are likely to forage within the study area. Additionally, There are 16 Hollow-bearing trees within the study area which may provide potential roosting habitat for these species; 6 of which (containing 8 hollows in total) are expected to be removed. These species are discussed further below.
<b>Cave roosting microchiropteran bats:</b> <b>Eastern bentwing-bat</b> <i>Miniopterus schreibersii oceanensis</i> <b>Little Bentwing-bat</b> <i>Miniopterus australis</i>	These species were recorded within the study area by Eco Logical (2011). The two species are likely to forage widely across the subject site. Suitable roosting habitat not present for these cave roosting species. These species are not discussed further.





#### Legend

- Hollow-bearing tree
  - ✱ Arborist mapped tree locations
  - Study area
- Vegetation community**
- Illawarra Lowlands Grassy
  - Woodland - Disturbed (EPBC Act/TSC Act)
  - Illawarra Lowlands Grassy
  - Woodland - Weedy (EPBC Act/TSC Act)
  - Scattered trees

**Figure 3: Ecological features of the study area**

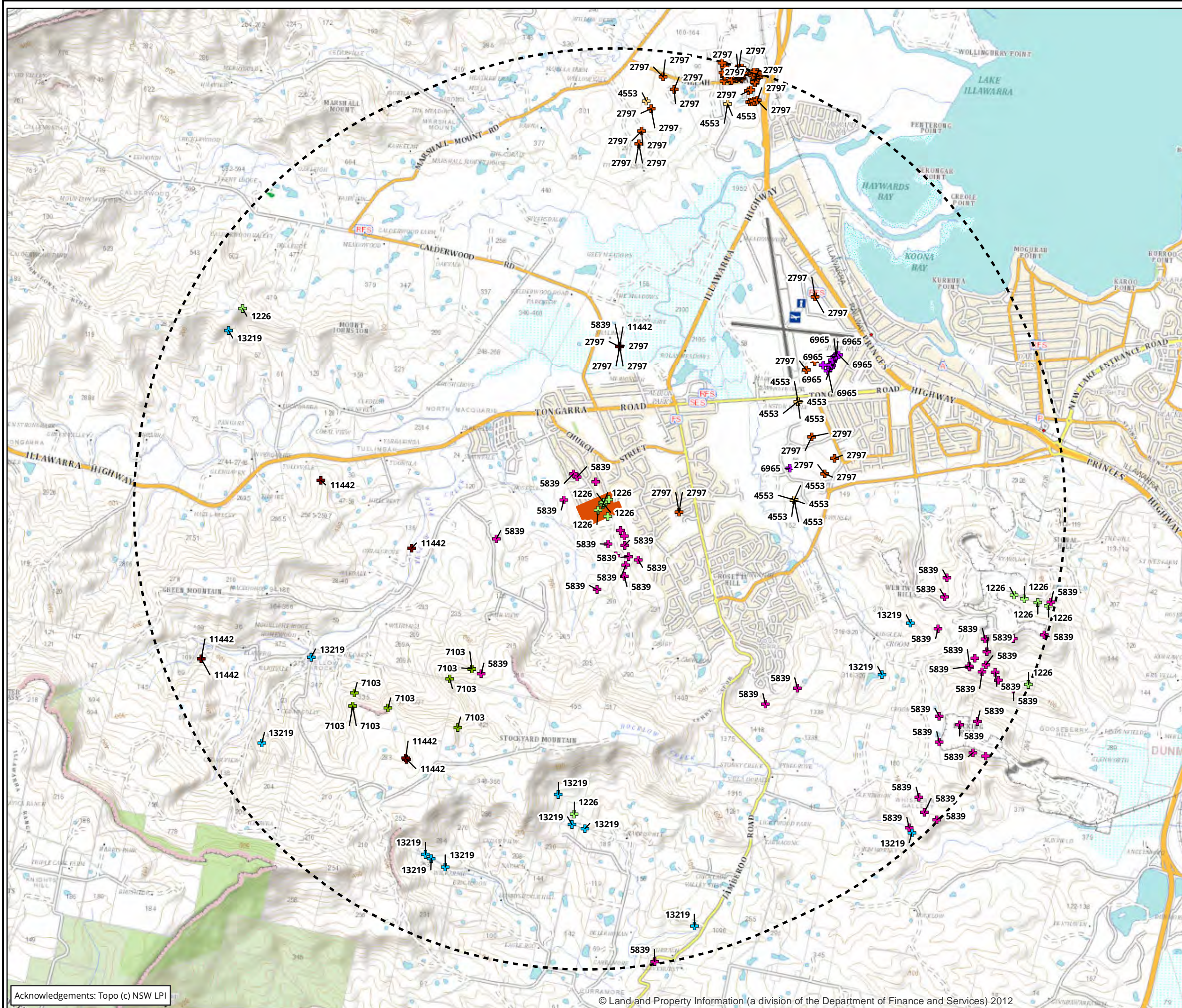
0 10 20 30 40 50  
Metres

Scale: 1:1,800 @ A3  
Coordinate System: GDA 1994 MGA Zone 56

**biosis**  
Biosis Pty Ltd  
Ballarat, Brisbane, Canberra, Melbourne,  
Sydney, Wangaratta & Wollongong

Matter: 18852  
Date: 18 April 2017  
Checked by: LH/ANP Drawn by: NMG  
Location: F:\18850s\18852\Wangaratta\18852\_FFA\_F3\_EcoFeaturesV4





**Legend**

Study area

Search area

**Threatened Flora**

- 11442 - *Solanum celatum*
- 1226 - *Cynanchum elegans*
- 13219 - *Daphnandra johnsonii*
- 2797 - *Chorizema parviflorum*
- 4553 - *Pterostylis gibbosa*
- 5839 - *Zieria granulata*
- 6965 - *Pimelea curviflora* var. *curviflora*
- 7103 - *Irenepharsus tryperus*

**Figure 4: Threatened flora species recorded within five kilometres of the study area**

0 400 800 1,200 1,600 2,000

Metres  
Scale: 1:40,000 @ A3  
Coordinate System: GDA 1994 MGA Zone 55



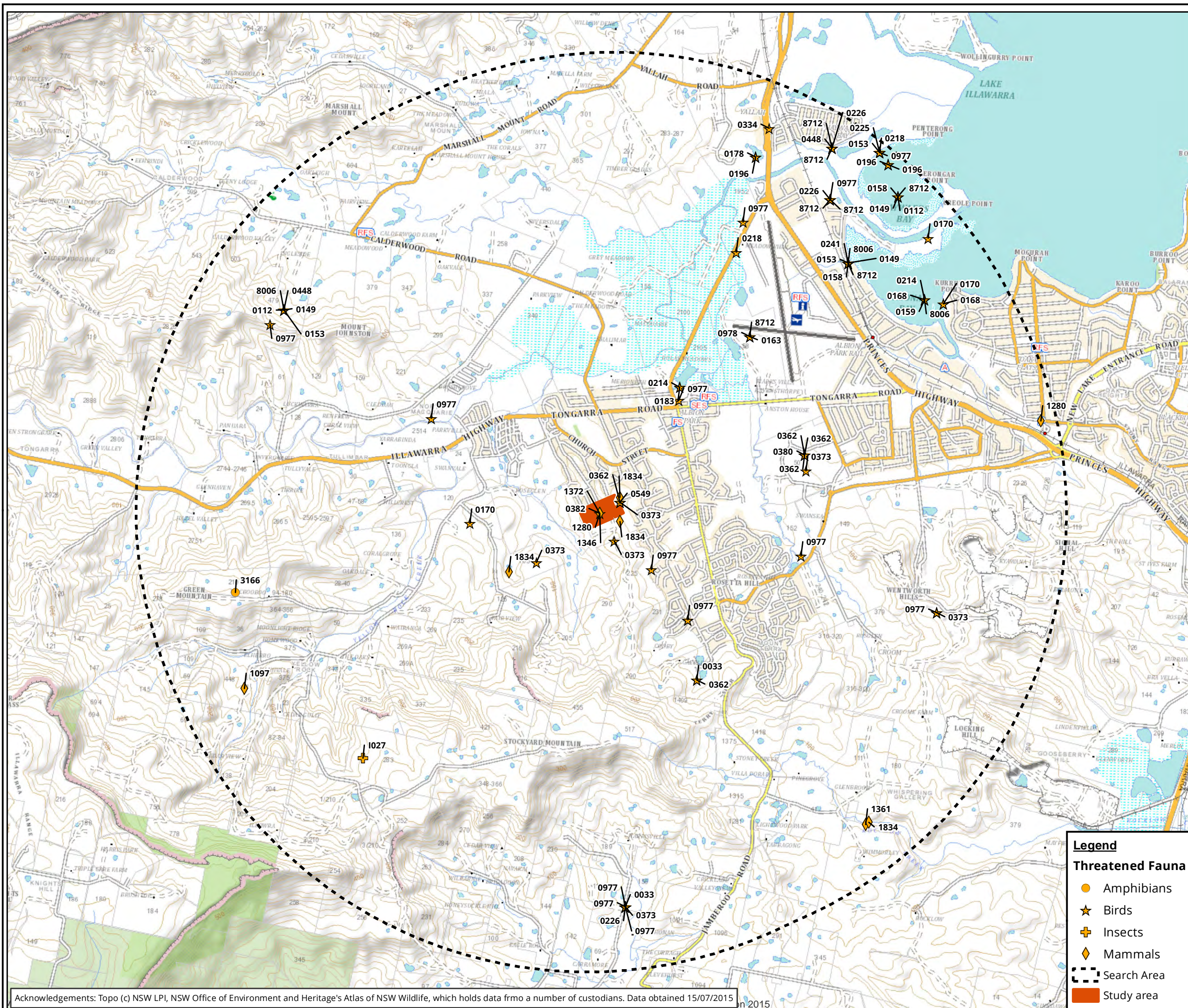
Biosis Pty Ltd  
Ballarat, Brisbane, Canberra, Melbourne,  
Sydney, Wangaratta & Wollongong

Matter:  
Date: 26 November 2015,  
Checked by: NMG, Drawn by: LH, Last edited by: lharley  
Location: P:\18800s\18852\mapping\18852\_FFA\_F4\_ThreatenedFlora

Acknowledgements: Topo (c) NSW LPI

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- Species list**
- Amphibians**
- 3166 - Green and Golden Bell Frog
- Birds**
- 0149 - Eastern Curlew  
0170 - Australian Painted Snipe  
0183 - Black-necked Stork  
0196 - Black Bittern  
0214 - Freckled Duck  
0218 - Spotted Harrier  
0225 - Little Eagle  
0241 - Osprey  
0248 - Powerful Owl\*  
0265 - Glossy Black-Cockatoo\*  
0380 - Scarlet Robin  
0382 - Flame Robin  
0448 - White-fronted Chat  
0549 - Varied Sittella
- Mammals**
- 1280 - Grey-headed Flying-fox  
1346 - Little Bentwing-bat  
1361 - Greater Broad-nosed Bat  
1372 - Eastern False Pipistrelle  
1834 - Eastern Bentwing-bat

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

**Figure 5: Threatened fauna species recorded within five kilometres of the study area**

0 400 800 1,200 1,600 2,000

Metres

Scale: 1:40,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55



Biosis Pty Ltd

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

Matter: 18852  
Date: 13 April 2017  
Checked by: NMG, Drawn by: LH, Last edited by: apritchard  
Location: P:\18800s\18852\Mapping\18852\_FFA\_F5\_ThreatenedFauna

Acknowledgements: Topo (c) NSW LPI, NSW Office of Environment and Heritage's Atlas of NSW Wildlife, which holds data from a number of custodians. Data obtained 15/07/2015



## 5. Ecological impacts and recommendations

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This section identifies the potential impacts of the proposed subdivision on the ecological values of the study area, and includes recommendations to assist MMJ and Spinitu Pty Ltd to design a development to avoid and minimise impacts on these values. It should be noted, that measures to avoid and minimise impacts to these values were discussed and implemented during the development of the Planning Proposal for the study area (MMJ 2011).

### 5.1 Potential impacts before avoidance, minimisation and offset considerations

This section discusses the potential impacts to the ecological values identified without any impact avoidance, minimisation or mitigation measures. Potential impacts arising from the project include:

- The permanent removal of 8.36 hectares of native vegetation, including:
  - 5.76 hectares of Illawarra Lowland Grassy Woodland EEC and CEEC.
  - 2.60 hectares of scattered trees.
- Removal of up to 922 trees.
- The ongoing deterioration of retained vegetation.
- The permanent removal of 8 hollow-bearing trees containing 12 hollows suitable for:
  - Hollow-roosting microbats.
  - Hollow breeding small parrot species.
  - Hollow breeding medium parrots or small possums.
- Impacts to threatened species and their habitats, including:
  - The permanent removal of seven White-flowered Wax Plants.
  - Permanent removal of potential habitat for the Illawarra Zieria.
  - The permanent removal of 8 hollow-bearing trees which may provide suitable roosting habitat for the Greater broad-nosed Bat and Eastern False Pipistrelle.
  - The permanent removal of potential foraging habitat for the Flame Robin, Grey-headed Flying-fox, Eastern Bentwing-bat, Little Bentwing-bat Greater broad-nosed Bat and Eastern False Pipistrelle.
- Erosion of steep slopes due to management of vegetation within APZs.

### 5.2 Impact avoidance and minimisation recommendations

During the development of the Planning Proposal (MMJ 2011) and subdivision plan MMJ, Spinitu Pty Ltd and Biosis have worked closely together to design a development that carefully considers the ecological values of the study area. Table 3 summarises the impact avoidance, minimisation and mitigation measures that have been and will be implemented.

**Table 3: Recommendations to avoid, minimise and mitigate impacts to identified ecological features**

Ecological feature	Recommendations
<p><b>Native vegetation, including Illawarra Lowlands Grassy Woodland EEC (TSC Act)/CEEC (EPBC Act)</b></p> <p><b>Ongoing deterioration of retained vegetation</b></p>	<ul style="list-style-type: none"> <li>• Rezoning of the eastern section of the site, supporting Illawarra Lowlands Grassy Woodland, to E3 Environmental Management.</li> <li>• Utilising roads as a part of APZs, where possible, to avoid removal of native vegetation.</li> <li>• Fencing of the boundary between the outer APZ and the remainder of the EMA to delineate management areas (see VMP).</li> <li>• Protection and management of retained vegetation through the development and implementation of a VMP (Appendix 5).</li> <li>• The VMP should outline plans for the removal of Lantana, and measures to improve the resilience of retained areas and revegetation of these areas if natural regeneration does not occur.</li> <li>• The VMP should include measures for the appropriate management of vegetation within APZs consistent with the recommendations of the bushfire assessment (Bushfire &amp; Evacuation Solutions 2015) whilst achieving a positive conservation outcome.</li> <li>• Management of fine fuels within the outer APZ should be limited to the raking or manual removal of fine fuels, with mowing limited to immediately prior to the fire season.</li> <li>• The VMP should have an operational period in perpetuity and be reviewed by the certifying authority on an annual basis.</li> </ul>
<p><b>Impacts to threatened species and their habitat</b></p> <p><b>Hollow-bearing trees</b></p>	<ul style="list-style-type: none"> <li>• Locating residential development away from known locations of the White-flowered Wax Plant.</li> <li>• Rezoning of the eastern section of the site, supporting the White-flowered Wax Plant, to E3 Environmental Management.</li> <li>• Ensuring appropriate management of known locations for the White-flowered Wax Plant within the VMP through the retention of a 20 metre buffer. Management of APZs within the buffer will be undertaken by a Bush Regenerator holding a Section 132 licence from the NSW OEH and subject to the specifications within the VMP.</li> <li>• Retention of hollow-bearing trees within the EMA, includes any thinning of trees to reduce tree canopy cover to less than 15 per cent in the inner APZ and 30 per cent in the outer APZ will avoid removal of hollow-bearing trees.</li> <li>• Where the removal of hollow-bearing trees cannot be avoided, compensatory hollow/nest boxes should be provided at a 1:1 ratio in areas of vegetation to be retained. These nest boxes will be designed to support the native species which would otherwise utilise the hollows to be removed as detailed in Appendix 2, Table 11.</li> <li>• Nest boxes will be installed by a suitably qualified ecologist one month prior to trees removal.</li> </ul>



Ecological feature	Recommendations
	<ul style="list-style-type: none"> <li>An ecologist should be present during the removal of hollow-bearing trees to salvage any fauna species from hollows.</li> <li>Any hollow-bearing limbs, removed as a part of the subdivision, should be relocated into the EMA. Hollow logs should be placed on the ground (outside of APZs) to provide supplementary habitat.</li> </ul>
<b>General fauna habitat removal</b>  <b>Tree removal protocols</b>	<ul style="list-style-type: none"> <li>Pre-clearing survey conducted by an ecologist to identify and clearly mark any significant habitat features present or relocate onsite if feasible.</li> <li>Remove all vegetation that is not marked in the pre-clearance survey as being significant habitat.</li> <li>Remove identified and marked areas of habitat 24 hours after the initial clearing to allow fauna to move from the disturbed area. This stage of habitat removal must be completed under the supervision of an ecologist.</li> </ul>
<b>Erosion of steep slopes due to management for APZs</b>	<ul style="list-style-type: none"> <li>Soil stabilisation using open weave jute-mesh and fire resistant native species indigenous to the local area and the Illawarra Lowlands Grassy Woodland.</li> </ul>

The principal means to reduce impacts on biodiversity values will be the retention and management of vegetation with the EMA. A VMP for this area has been developed, and is included at Appendix 5.

### 5.3 Residual impacts

Native vegetation within the study area will be subject to clearing within the R2 zone. The E3 Zone - EMA will retain vegetation for conservation, with some canopy reduction for APZs impacting this area. In total, the management of native vegetation within each of these areas will include:

- Subdivision – selected clearing of vegetation for roads, fencing and building envelopes.
- EMA: Inner APZ – thinning of canopy trees to achieve a tree canopy cover of less than 15 per cent, pruning of lower limbs of trees to 2 metres above the ground, removal of all fine fuels and maintenance of a low and green groundcover (where possible).
- EMA: Outer APZ – thinning of canopy trees to achieve a tree canopy cover of less than 30 per cent, removal of fine fuels and maintenance of a shrub cover of less than 20 per cent of the area.
- EMA – management of vegetation for conservation purposes (weed control and revegetation in selected areas).

Table 4 provides a breakdown of native vegetation within each area.

**Table 4: Vegetation removal within the subdivision**

Vegetation community	Subdivision (complete clearing)	EMA - Inner APZ (canopy thinning to 15% cover and slashing)	EMA - Outer APZ (canopy thinning to 30% cover and slashing)	EMA - Conservation (retention and improvement of vegetation)
<b>Illawarra Lowlands Grassy Woodland</b>	3.06	0.44	0.65	1.61
<b>Scattered trees</b>	2.59	0.01	0.00	0.00
<b>Grand Total</b>	<b>5.65</b>	<b>0.45</b>	<b>0.65</b>	<b>1.61</b>

Following on from the recommendations outlined above, the proposed subdivision will result in the following residual impacts to the ecological values of the study area:

- The permanent removal of 5.65 hectares of native vegetation, including:
  - 3.06 hectares of Illawarra Lowlands Grassy Woodland EEC (TSC Act)/CEEC (EPBC Act)
  - 2.59 hectares of scattered trees.
- Clearance of vegetation will involve the removal of up to 318 trees including removal of:
  - 278 trees with DBH less than or equal to 500 mm (~ 88%)
  - 26 trees with DBH less than or equal to 600 mm DBH (~8%)
  - 14 trees less than or equal to 1100 mm (~4%) for roads, fences and building envelopes.
- 1.10 hectares of Illawarra Lowlands Grassy Woodland EEC (TSC Act)/CEEC (EPBC Act) permanently modified for the management of APZs, including:
  - Clearance of up to a 60 trees for APZs based on estimates that 30% of the canopy will be removed.
- The permanent removal of 8 hollow-bearing trees (containing 12 hollows).

These residual impacts will be addressed by:

- The retention and management of 2.71 hectares of native vegetation within the EMA, including:
  - Management of 0.45 hectares of Illawarra Lowlands Grassy Woodland within the Inner APZ.
  - Management of 0.65 hectares of Illawarra Lowlands Grassy Woodland within the Outer APZ.
  - Management of 1.61 hectares of Illawarra Lowlands Grassy Woodland for conservation purposes.
- Retention of six hollow-bearing trees (containing 11 hollows) within the subdivision lots.
- Retention of 11 hollow-bearing trees (containing 20 hollows) within the EMA.
- Installation of 12 nest boxes within the EMA as per Appendix 2, Table 11.

- The retention and management of all individuals of the White-flowered Wax Plant within the EMA and subject to on-going management as per specifications within a VMP.

## 5.4 Based on these residual impacts to Illawarra Lowlands Grassy Woodland listed under the EPBC Act, the project will require suitable offsets that are consistent with the EPBC Act Environmental Offsets Policy (CoA 2012). Biodiversity legislation and government policy

This section provides an assessment of the residual impacts arising from the proposed subdivision against key biodiversity legislation and government policy outlined in Section 3.

### 5.4.1 Environment Protection and Biodiversity Conservation Act 1999

Matters of NES relevant to the project are summarised in Table 5 with Appendix 4 outlining Significant Impact Criteria assessments against the *Matters of National Environmental Significance - Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia 2013) for matters of NES likely to be impacted by the project.

**Table 5: Assessment of the project against the EPBC Act**

Matter of NES	Project specifics	Significant Impact Criteria assessment findings
<b>Threatened species(flora and fauna)</b>	One flora species, the White-flowered Wax Plant, and one fauna Grey-headed Flying-fox, were recorded in the study area. An additional 11 flora and 33 fauna species have been recorded or are predicted to occur in the locality. An assessment of the likelihood of these species occurring in the study area is provided in Appendix 1 (flora) and Appendix 2 (fauna).	Most of these species are not likely to occur and development unlikely to constitute a significant impact. A SIC assessment for impacts to the White-flowered Wax Plant is provided in Appendix 4. The retention of White-flowered Wax Plant in the EMA and protection via a VMP will result in negligible impact to this species.
<b>Threatened ecological communities</b>	<i>Illawarra and south coast lowland forest and woodland ecological community</i> CEEC was recorded within the study area.	3.06 ha of the CEEC will be removed and a further 1.10 ha of direct impact through permanent modification through management as an APZ. A SIC assessment for impacts the CEEC concluded a significant impact is likely to result due to the removal and permanent modification of 4.16 hectares of vegetation that is considered critical to the survival of the CEEC. A referral to the minister is strongly recommended.
<b>Migratory species</b>	24 migratory species have been recorded or are predicted to occur in the project search area (Appendix 2).	While some of these species would be expected to use the study area on occasions, some may do so regularly and others may be resident, the study area does not provide

Matter of NES	Project specifics	Significant Impact Criteria assessment findings
		important habitat for an ecologically significant proportion of any of these species.
<b>Wetlands of international importance (Ramsar sites)</b>	The study area is not identified as being within the catchment of any Ramsar sites.	N/A

On the basis of criteria outlined in the relevant Commonwealth of Australia (2013) it is considered likely that a significant impact on a MNES would result from the proposed action. Therefore a referral of the proposed subdivision to the Commonwealth Minister for the Environment is strongly recommended. Assessment of a referral to the minister is likely to require offsets for clearing of a CEEC as the current residual impacts are not adequate to satisfy the EPBC Act.

#### 5.4.2 Environmental Planning and Assessment Act 1979

Sections of the EP&A Act of primary relevance to the natural environment are considered further below in relation to the current proposal.

#### Assessment of Significance (Part 1, Section 5A)

Section 4.4 provides an assessment of the potential for threatened species, populations and communities to be impacted by the proposed development. Based on this, AoS have been prepared for the following species and community:

- White-flowered Wax Plant
- Illawarra Lowlands Grassy Woodland
- Hollow roosting microchiropteran bats, including the Greater Broad-nosed Bat and Eastern False Pipistrelle

Based on the project design the removal of Illawarra Lowlands Grassy Woodland was found unlikely to result in a significant effect as the proposal would not significantly reduce local connectivity, the vegetation to be removed was of low floristic diversity and its removal was unlikely to lead to local extinction of the EEC.

An AOS for White-flowered Wax Plant found that there will be no direct impact from the proposal as the population is to be retained within the EMA. A VMP for this area will provide for weed controls and safeguards for management of these plants which should have a positive effect.

An AOS for Hollow roosting microchiropteran bats found that the habitat to be removed was not limiting in extent or quality within the locality for these species, therefore will not result in a significant effect for this group.

The AoS demonstrate that a significant effect is not likely to result from the proposed subdivision, and SISs for these endangered biota are not required (Appendix 3 ).

#### SEPP No. 44 – Koala Habitat Protection

Forest Red Gum constitutes greater than 15 per cent of the total number of trees in the upper strata. Therefore, the study area constitutes potential Koala habitat as defined under SEPP No. 44. However, no evidence of occupation of the study area by Koalas was observed. No records of the Koala were returned

during database searches of the local area, and the Koala has rarely been recorded in the Illawarra floodplain and not in recent times.

The study area does not support Core Koala Habitat and a Plan of Management is not required.

#### **5.4.3 Threatened Species Conservation Act 1995**

Impacts to threatened species, populations and communities have been assessed to determine if a significant effect is likely to result from the proposed subdivision (see Section 5.4.2). This assessment indicates a significant effect is not likely to result from the proposed subdivision and an SIS is therefore not required.

The subject site does not contain declared 'critical habitat'.

A licence to harm/pick/damage habitat of a threatened species, population or community or damage critical habitat is not required.

#### **5.4.4 Noxious Weeds Act 1993**

Five declared noxious weeds listed under Noxious Weed (Control Order) 2014 for the Shellharbour LGA were recorded within the EMA.

Two Class 4 noxious weeds that require 'the growth of the plant to be suppressed in a manner that continuously inhibits the ability of the plant to spread':

- Lantana
- Blackberry *Rubus fruticosus* aggregate species.

Three additional Class 4 weeds, including Blackberry require that 'the plant must not be knowingly distributed':

- Bridal Creeper *Asparagus asparagoides*
- Ground Asparagus *Asparagus aethiopicus*
- Fireweed *Senecio madagascariensis*

Methods for control of these noxious and environmental weeds are included in the VMP (Appendix 5).





#### Legend

Study area

#### Environmental management

- Development - APZ
- Development - Building envelope
- Development - Lots
- Development - Roads
- Environmental management
- Environmental management - Inner APZ
- Environmental management - Outer APZ

**Figure 6: Management of native vegetation and fauna habitat within the study area**

0 10 20 30 40 50  
Metres

Scale: 1:1,800 @ A3  
Coordinate System: GDA 1994 MGA Zone 56



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

Matter: 18852  
Date: 13 April 2017  
Checked by: LH, Drawn by: NMG  
Location: P:\18800s\18852\Mapping\18852\_FFA\_F6\_Management\_20170413



## 6. Conclusion

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This report is an assessment of the potential impact of the proposed subdivision of land at Lot 101 DP 785139 Crest Road, Albion Park on ecological values within the study area in accordance with the provision of relevant biodiversity legislation outlined in Section 3.

One threatened flora species (White-flowered Wax Plant) and five threatened fauna species (Eastern False Pipistrelle, Eastern Bentwing-bat, Little Bentwing-bat, Grey-headed Flying-fox and Flame Robin) were recorded within the study area.

Native vegetation that is consistent with Illawarra Lowlands Grassy Woodland EEC and CEEC was also mapped within the study area.

One additional threatened flora species (Illawarra Zieria) has potential to exist within the soil seed bank within the EMA and one additional fauna species (Greater Broad-nosed Bat) were considered a medium of greater likelihood of occurrence.

Through the implementation of the recommendations outlined in Section 5.2, residual impacts arising from the project include:

- The permanent removal of 5.65 hectares of highly degraded native vegetation, including 3.06 hectares of Illawarra Lowlands Grassy Woodland EEC and CEEC in low condition and 2.59 hectares of scattered trees.
- Direct impact to 1.10 ha of Illawarra Lowlands Grassy Woodland CEEC through Installation of APZs.
- Clearance of vegetation will involve the removal of up to 378 (41% in the study area) trees including:
  - 318 trees from subdivision of the land
  - Up to 60 trees for APZ installation.
- The permanent removal of 8 hollow-bearing trees.

Measures to address the above residual impacts include:

- The retention and management for conservation of 2.71 hectares of native vegetation within the EMA, including 2.7 hectares of Illawarra Lowlands Grassy Woodland EEC, including up to 59 % of trees in the study area.
- Retention of 11 hollow-bearing trees within the EMA.
- The retention and management of all individuals of the White-flowered Wax Plant within the EMA.
- Management of the EMA according to a VMP.
- Installation of bushfire asset protection zones within the development EMA prioritising retained trees in the following sequence:
  - Hollow-bearing trees.
  - Large DBH canopy tree (Forest Red Gum *Eucalyptus tereticornis* and Thin-leaved Stringybark *E. eugenoides*) over midstorey species of *Acacia*, *Melaleuca* and *Callistemon*.
  - Largest to smallest DBH.

- Retention of hollow-bearing trees within the development area, where not occurring within development envelopes, roads, fence lines, stormwater infrastructure, and if safe to do so.
- Installation and management of 12 nest boxes within the EMA.

The implementation of these recommendations will result in the improvement of areas of retained Illawarra Lowlands Grassy Woodland through management in accordance with the VMP (Appendix 5). This management provides ongoing protection for the population of the White-flowered Wax Plant within the study area, with the potential for ongoing management and weed removal to result in net positive impact for this species. The retention of trees within the EMA will also result in the protection of 11 hollow-bearing trees, including 6 which may provide roosting habitat for threatened microchiropteran species. The protection and improvement of native vegetation and threatened species within the EMA will compensate for the removal of high degraded vegetation and fauna habitat.

While the project is not considered to have a significant impact on any TSC Act listed threatened species, populations or communities, a significant impact is likely to result from the removal and modification of 4.16 hectares of moderate condition Illawarra Lowlands Grassy Woodland CEEC listed under the EPBC. Therefore, a referral to the Commonwealth Minister of the Environment and Energy is strongly recommended and EPBC Act offsets are likely to be required based on the residual impacts of the current design.

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## Appendices

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## Appendix 1: Flora

### A1.1 Flora species recorded from the study area

#### Notes to tables:

<b>EPBC Act:</b> CR - Critically Endangered EN - Endangered VU - Vulnerable	<b>TSC Act:</b> C1 – critically endangered E1 – endangered (Part 1, Schedule 1) E2 – endangered (Part 2, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) V1 – vulnerable (Part 1, Schedule 2) <b>Bold</b> denotes characteristic flora species from Final Determinations for TEC's
<b>General status:</b> # - Native species outside natural range * - Exotic (not native to Australia) ** - Noxious weed species declared under the <i>Noxious Weeds Act 1993</i>	<b>Noxious weed status:</b> SP State prohibited species (Class 1) RP Regionally prohibited species (Class 2) RC Regionally controlled species (Class 3) RR Regionally restricted species (Class 4) R Restricted plant (Class 5)
<b>Modified Braun Blanquet Cover Abundance</b>	<b>Other Abundance</b>
1 <5% - 3 or less individuals	# Presence only
2 <5% - more than 3 sparsely scattered	
3 <5% - common throughout plot	
4 5% - 25%	
5 25% - 50%	
6 50% - 75%	
7 75% - 100%	

**Table 6: Flora species recorded from the study area**

Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
	<i>Acacia binervata</i>	Two-veined Hickory					1		#	#
	<i>Acacia fimbriata</i>	Fringed Wattle							#	
	<i>Acacia implexa</i>	Hickory Wattle							#	#
	<i>Acacia maidenii</i>	Maiden's Wattle	1						#	#
	<i>Acacia mearnsii</i>	Black Wattle							#	#
	<i>Acacia parramattensis</i>	Sydney Green Wattle							#	
*	<i>Acacia podalyriifolia</i>	Queensland Silver Wattle							#	
	<i>Acacia saliciformis</i>								#	
*	<i>Acetosella vulgaris</i>	Sorrel							#	
	<i>Acmena smithii</i>	Lilly Pilly							#	
	<i>Alectryon subcinereus</i>	Native Quince							#	
	<i>Alphitonia excelsa</i>	Red Ash			1				#	
	<i>Amyema pendulum ssp</i>								#	
*	<i>Anagallis arvensis</i>	Scarlet Pimpernel	2						#	

Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
	<i>Aneilema acuminatum</i>								#	
	<i>Aphanopetalum resinosum</i>	Gum Vine				1				
*	<i>Araujia sericifera</i>	Moth Vine	1						#	
**RR	<i>Asparagus aethiopicus</i>	Asparagus Fern	1	1					#	
**RR	<i>Asparagus asparagoides</i>	Bridal Creeper		1					#	
	<i>Austrostipa ramosissima</i>	Stout Bamboo Grass							#	
*	<i>Bidens pilosa</i>	Cobblers Pegs							#	
	<i>Bothriochloa macra</i>	Red Grass								#
	<i>Brachychiton populneus</i>	Kurrajong								#
	<i>Breynia oblongifolia</i>	Coffee Bush		1			1		#	#
*	<i>Briza subaristata</i>								#	
*	<i>Bromus catharticus</i>	Praire Grass	3				3	2	#	
	<i>Callistemon salignus</i>	Willow Bottlebrush							#	
	<i>Carex inversa</i>								#	#
	<i>Carex longibrachiata</i>								#	#

Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
	<i>Cayratia clematidea</i>	Native Grape		1					#	
	<i>Centella asiatica</i>	Indian Pennywort	1						#	#
*	<i>Chenopodium album</i>	Fat Hen	1				2		#	
	<i>Chenopodium pumilio</i>	Small Crumbweed								#
*	<i>Chloris gayana</i>	Rhodes Grass				2			#	
*	<i>Chlorophytum comosum</i>	Spider Plant							#	
	<i>Cissus hypoglauca</i>	Water Vine		2						
	<i>Clematis aristata</i>	Old Man's Beard							#	#
	<i>Clerodendrum tomentosum</i>	Hairy Clerodendrum	1	1					#	#
	<i>Commelina cyanea</i>	Scurvy Weed	2	2	2	2	3		#	#
*	<i>Conyza bonariensis</i>	Flaxleaf Fleabane	3							
*	<i>Crassula multicava</i>								#	
	<i>Cyathea australis</i>	Black Tree-fern							#	
	<i>Cyclophyllum longipetalum</i>	Coast Canthium							#	
<b>EN, E1</b>	<i>Cynanchum elegans</i>								#	



Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
	<i>Cynodon dactylon</i>	Couch						3	#	#
	<i>Cyperus gracilis</i>	Slender Flat-sedge	4				4	4		
	<i>Cyperus imbecillis</i>								#	
*	<i>Cyperus sp</i>		1							
*	<i>Delairea odorata</i>	Cape Ivy		3	3	2			#	
	<i>Desmodium varians</i>	Slender Tick-trefoil	2				2		#	#
	<i>Dianella revoluta ssp revoluta</i>	Blueberry Lily							#	
	<i>Dichelachne micrantha</i>	Shorthair Plumegrass							#	
	<i>Dichondra repens</i>	Kidney Weed	3	2			2		#	#
*	<i>Digitaria sanguinalis</i>	Summer Grass	2							
	<i>Dodonaea viscosa ssp angustifolia</i>	Sticky Hop-bush		1		1			#	#
*	<i>Echinochloa crus-galli</i>	Barnyard Grass							#	
	<i>Echinopogon caespitosus var caespitosus</i>	Tufted Hedgehog-grass							#	#
	<i>Echinopogon ovatus</i>	Forest Hedgehog Grass								#

Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
*	<i>Ehrharta erecta</i>	Panic Veldtgrass	1	2	2	2			#	
	<i>Einadia hastata</i>	Berry Saltbush	2				1		#	#
	<i>Einadia trigonos ssp trigonos</i>	Fishweed	3				3		#	#
	<i>Elaeodendron australe</i>									#
	<i>Entolasia marginata</i>	Bordered Panic							#	
	<i>Entolasia stricta</i>	Wiry Panic							#	
	<i>Eragrostis leptostachya</i>	Paddock Lovegrass							#	
	<i>Eucalyptus amplifolia ssp amplifolia</i>	Cabbage Gum							#	
	<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark	1			2	1		#	#
	<i>Eucalyptus quadrangulata</i>	White-topped Box							#	
	<i>Eucalyptus tereticornis</i>	Forest Red Gum	1	1	3	3	4	1	#	#
	<i>Euchiton involucratus</i>	Star Cudweed							#	
	<i>Euchiton sphaericus</i>									#
*	<i>Euphorbia peplus</i>	Petty Spurge							#	
	<i>Eustrephus latifolius</i>	Wombat Berry		2		2			#	

Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
	<i>Exocarpos cupressiformis</i>	Cherry Ballart							#	#
	<i>Ficus macrophylla</i>	Moreton Bay Fig							#	
*	<i>Fumaria bastardii</i>	Bastards Fumitory							#	
	<i>Gahnia aspera</i>	Rough Saw-sedge		1					#	
*	<i>Gamochaeta americana</i>	Cudweed	2					3		
*	<i>Gamochaeta</i> sp								#	
	<i>Geitonoplesium cymosum</i>	Scrambling Lily	1	2	2	2			#	#
	<i>Geranium homeanum</i>	Native Geranium							#	
	<i>Geranium solanderi</i> ssp <i>solanderi</i>	Native Geranium							#	#
	<i>Glyceria</i> sp								#	
	<i>Glycine clandestina</i>			2			2		#	#
	<i>Glycine microphylla</i>	Small-leaf glycine								#
	<i>Glycine tabacina</i>		2					2	#	#
*	<i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush							#	
	<i>Hardenbergia violacea</i>	Purple Coral Pea							#	#

Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
	<i>Hibbertia scandens</i>	Climbing Guinea Flower							#	#
	<i>Hibiscus heterophyllus</i> ssp <i>heterophyllus</i>	Native Rosella							#	
	<i>Hypericum japonicum</i>								#	
*	<i>Hypochaeris radicata</i>	Catsear					2		#	
*	<i>Hypochaeris</i> sp	White Flatweed							#	
	<i>Hypoxis hygrometrica</i>	Golden Weather-grass								#
*	<i>Impatiens walleriana</i>								#	
	<i>Indigofera australis</i>	Australian Indigo							#	#
	<i>Joycea pallida</i>	Silvertop Wallaby Grass							#	
	<i>Juncus usitatus</i>	Common Rush							#	
	<i>Kennedia rubicunda</i>	Dusky Coral Pea							#	
**RR	<i>Lantana camara</i>	Lantana		7	7	7			#	
	<i>Legnephora moorei</i>	Round-leaf Vine							#	
*	<i>Lepidium</i> sp		2				2			



Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
	<i>Leucopogon juniperinus</i>	Prickly Beard-heath							#	
*	<i>Ligustrum lucidum</i>	Large Leaved Privet							#	
	<i>Livistona australis</i>	Cabbage Fan-palm							#	
*	<i>Lolium perenne</i>	Perennial Ryegrass							#	
	<i>Maclura cochinchinensis</i>	Cockspur Thorn		1		1			#	
	<i>Marsdenia rostrata</i>	Milk Vine				1			#	
*	<i>Medicago lupulina</i>	Black Medic	1							
	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree							#	
	<i>Melia azedarach</i>	White Cedar							#	#
	<i>Melicytus dentatus</i>	Tree Violet							#	
	<i>Microlaena stipoides</i> var <i>stipoides</i>	Weeping Grass	3				6	4	#	#
*	<i>Modiola caroliniana</i>	Red-flowered Mallow	3				3	3		
	<i>Myrsine variabilis</i>		1	2					#	
	<i>Notelaea ovata</i>								#	
	<i>Notelaea venosa</i>	Veined Mock-olive							#	#

Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
	<i>Olearia viscidula</i>	Wallaby Weed							#	
	<i>Oplismenus aemulus</i>	Oplismenus	2						#	#
	<i>Oplismenus imbecillis</i>	Oplismenus		3						#
*	<i>Oxalis corniculata</i>		2				2	2	#	
	<i>Oxalis exilis</i>									#
	<i>Oxalis perennans</i>								#	
	<i>Pandorea pandorana</i>	Wonga Wonga Vine		2		2			#	#
*	<i>Paronychia brasiliiana</i>	Chilean Whitlow Wort							#	
	<i>Parsonsia straminea</i>	Common Silkpod				1			#	#
*	<i>Paspalum dilatatum</i>	Paspalum						3	#	
*	<i>Passiflora subpeltata</i>	White Passionflower		1		2			#	
*	<i>Pennisetum clandestinum</i>	Kikuyu Grass						3	#	
*	<i>Phytolacca octandra</i>	Inkweed							#	
*	<i>Pinus radiata</i>	Radiata Pine							#	
	<i>Pittosporum multiflorum</i>	Orange Thorn		1		1			#	#

Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
	<i>Pittosporum revolutum</i>	Wild Yellow Jasmine							#	#
	<i>Pittosporum undulatum</i>	Sweet Pittosporum							#	#
*	<i>Plantago lanceolata</i>	Lamb's Tongues	2				3		#	
	<i>Plectranthus parviflorus</i>	Cockspur Flower							#	
	<i>Poa affinis</i>	Poa						2		
	<i>Poa labillardierei</i>	Tussock Grass							#	
	<i>Poranthera microphylla</i>								#	
	<i>Portulaca oleracea</i>	Pigweed								#
	<i>Pratia purpurascens</i>	Whiteroot							#	
	<i>Pseuderanthemum variabile</i>	Pastel Flower	3	2		2		2	#	#
**RR	<i>Rubus fruticosus</i> aggregate species	Blackberry								
	<i>Rubus parvifolius</i>	Native Raspberry							#	
	<i>Santalum obtusifolium</i>	Blunt Sandalwood							#	
**RR	<i>Senecio madagascariensis</i>	Fireweed	3				3	2	#	
*	<i>Senna pendula</i> var <i>glabrata</i>				1				#	



Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
*	<i>Setaria gracilis</i>	Slender Pigeon Grass							#	
*	<i>Sida rhombifolia</i>	Paddy's Lucerne	4				4	3	#	
	<i>Sigesbeckia orientalis</i> ssp <i>orientalis</i>								#	#
*	<i>Solanum linnaeanum</i>								#	
*	<i>Solanum mauritianum</i>		1		1					
*	<i>Solanum nigrum</i>	Black-berry Nightshade							#	
*	<i>Sonchus oleraceus</i>	Common Sowthistle	2						#	
*	<i>Sporobolus africanus</i>	Parramatta Grass							#	
	<i>Sporobolus elongatus</i>	Slender Rat's Tail Grass								#
*	<i>Stellaria media</i>	Common Chickweed							#	
*	<i>Stenotaphrum secundatum</i>	Buffalo Grass							#	
	<i>Streblus brunonianus</i>	Whalebone Tree							#	
*	<i>Tagetes minuta</i>	Stinking Roger							#	
*	<i>Taraxacum officinale</i>	Dandelion					2		#	
*	<i>Tecoma capensis</i>	Cape Honeysuckle							#	

Status	Genus species	Common Name	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	ELA 2011	Mills 2007
	<i>Themeda australis</i>	Kangaroo Grass							#	
*	<i>Tradescantia fluminensis</i>	Wandering Jew							#	
*	<i>Trifolium repens</i>	White Clover							#	
	<i>Tylophora barbata</i>	Bearded Tylophora		2		2			#	
*	<i>Verbena bonariensis</i>	Purpletop	2						#	
	<i>Vernonia cinerea</i> ssp <i>cinerea</i>								#	
	<i>Veronica calycina</i>	Hairy Speedwell							#	
	<i>Veronica plebeia</i>	Trailing Speedwell	1				1		#	#
*	<i>Vulpia muralis</i>								#	
	<i>Wahlenbergia communis</i>	Tufted Bluebell								#
	<i>Wahlenbergia gracilis</i>	Sprawling Bluebell							#	#
*	<i>Xanthium occidentale</i>	Noogoora Burr							#	
	<i>Xerochrysum bracteatum</i>	Golden Everlasting							#	#
	<i>Zornia dyctiocarpa</i>	Zornia								#

## A1.2 Threatened flora species and ecological communities

The following table includes a list of the threatened flora species and ecological communities that have potential to occur within the study area. The list of species is sourced from the NSW BioNet Wildlife Atlas and the Protected Matters Search Tool (DoE; accessed on 15/07/2015).

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

Likelihood of occurrence	Potential criteria
<b>High</b>	<ul style="list-style-type: none"> <li>Species/ecological communities recorded in study area during current or previous assessment/s.</li> <li>Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s.</li> <li>Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species).</li> <li>Study area is within species natural distributional range (if known).</li> <li>Species has been recorded within five kilometres or from the relevant catchment/basin.</li> </ul>
<b>Medium</b>	<ul style="list-style-type: none"> <li>Records of terrestrial biota within five kilometres of the study area or of aquatic species in the relevant basin/neighbouring basin.</li> <li>Habitat limited in its capacity to support the species due to extent, quality, or isolation.</li> </ul>
<b>Low</b>	<ul style="list-style-type: none"> <li>No records within five kilometres of the study area or for aquatic species, the relevant basin/neighbouring basin.</li> <li>Marginal habitat present (low quality &amp; extent).</li> <li>Substantial loss of habitat since any previous record(s).</li> </ul>
<b>Negligible</b>	<ul style="list-style-type: none"> <li>Habitat not present in study area</li> <li>Habitat for aquatic species not present in connected waterbodies in close proximity to the study area.</li> <li>Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.</li> </ul>



**Table 7: Threatened flora species recorded / predicted to occur within five kilometres of the study area**

Scientific Name	Common Name	EPBC status	TSC status	Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Boronia deanei</i></b>	Deane's Boronia	VU	V	#		Negligible	Habitat not present on site	Occurs in Hawkesbury/Nepean and Southern Rivers Catchments. There are scattered populations of Deane's Boronia between the far south-east of NSW and the Blue Mountains. The species grows on the margins of high altitude swamps, in wet heath and in drier open forest on low nutrient, poorly drained peaty soils on sandstone or granite.
<b><i>Caladenia tessellata</i></b>	Thick Lip Spider Orchid	VU	E1	#		Low	Marginal habitat present (low quality & extent).	<i>Caladenia tessellata</i> is found in the following Catchment Management Regions Sydney Metropolitan, Southern Rivers, Hawkesbury/Nepean, and Hunter/Central Rivers. Currently known from three disjunct areas: Braidwood on southern tablelands, Ulladulla on the south coast and three populations in Wyong area on the Central Coast. It is generally found in grassy, dry sclerophyll forests/woodland, particularly those associated with clay loam, or sandy soils. However, there is one population at Braidwood in lowland on stony soil. This species only grows in very dense shrubbery in coastal areas. Flowers appear between September and November, but generally late September or early October in extant southern populations.

Scientific Name	Common Name	EPBC status	TSC status	Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Chorizema parviflorum</i></b>	Eastern Flame Pea		E2	2007		Low	Marginal habitat present (low quality & extent).	Heath and sclerophyll woodland and forest on heavy soils. The endangered population has been recorded from between Austinmer and Albion Park in the local government areas of Wollongong and Shellharbour. All known sites (excluding the site at Austinmer) occupy woodland or forest dominated by Forest Red Gum <i>Eucalyptus tereticornis</i> and/or Woollybutt <i>E. longifolia</i> . At Austinmer, the species is recorded from a coastal headland.
<b><i>Cryptostylis hunteriana</i></b>	Leafless Tongue Orchid	VU	V	#		Low	Marginal habitat present (low quality & extent).	<p>This species typically grows in swamp-heath on sandy soils chiefly in coastal districts but has also been recorded on steep bare hillsides. Within the Central Coast bioregion, this species has been recorded within Coastal Plains Smooth-barked Apple Woodland and Coastal Plains Scribbly Gum Woodland. This species does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by <i>E.sclerophylla</i>, <i>E. sieberi</i>, <i>Corymbia gummifera</i> and <i>Allocasuarina littoralis</i>; appears to prefer open areas in the understorey of this community and is often found in association with the <i>Cryptostylus subulata</i>.</p> <p>It occurs in the following Catchment Management Regions Hawkesbury/Nepean, Hunter/Central Rivers, Northern Rivers and Southern Rivers. Inconsistent flowering times Dec-February; Jan-February (in Victoria)</p>

Scientific Name	Common Name	EPBC status	TSC status	Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Cynanchum elegans</i></b>	White-flowered Wax Plant	EN	E1	2005/#		Recorded	Species recorded on site in the current and previous surveys	Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. The species has been recorded as far west as Merriwa in the upper Hunter River valley. Catchment Management Regions include Hawkesbury/Nepean, Hunter/Central Rivers, Northern Rivers, Southern Rivers and Sydney Metropolitan. <i>Cynanchum elegans</i> usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; <i>Leptospermum laevigatum</i> , <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> ; <i>E. tereticornis</i> open forest and woodland; <i>E. maculata</i> open forest and woodland; and <i>Melaleuca armillaris</i> scrub to open scrub. Flowering occurs between August and May, with a peak in November. Flower abundance on individual plants varies from sparse to prolific.
<b><i>Daphnandra johnsonii</i></b>		EN		2001/#		Low	Marginal habitat present (low quality & extent).	Occupies the rocky hillsides and gullies of the Illawarra lowlands, occasionally extending onto the upper escarpment slopes. Associated vegetation includes rainforest and moist eucalypt forest.



Scientific Name	Common Name	EPBC status	TSC status	Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Irenepharsus trypherus</i></b>	Illawarra Irene	EN	E1	2001/#		Negligible	Habitat not present on site	Occurs on coast and escarpment between Wollongong and the Shoalhaven River. Typically inhabits steep rocky slopes near cliff lines and ridge tops. The species is less typically found growing out of rock crevices or on narrow benches along cliff lines. The vast majority of sites are recorded from the upper slopes of the ridge systems that extend south and east of the Illawarra escarpment, although the species has also been recorded from the deep sandstone gorges of the Shoalhaven River. Associated vegetation includes moist sclerophyll forest, Ironwood <i>Backhousia myrtifolia</i> thicket, and rainforest.
<b><i>Melaleuca biconvexa</i></b>	Biconvex Paperbark	VU	V	#		Negligible	Habitat not present on site	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Catchment regions include: Hunter/Central Rivers, Hawkesbury/Nepean, Southern Rivers, and Northern River Catchments. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October.

Scientific Name	Common Name	EPBC status	TSC status	Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Pimelea spicata</i></b>	Spiked Rice-flower	EN	E1	#		Negligible	Habitat not present on site	<p>Once widespread on the Cumberland Plain, <i>Pimelea spicata</i> occurs in two disjunct areas, the Cumberland Plain and the Illawarra. Catchment areas are Hawkesbury/Nepean, Southern Rivers, and Sydney Metropolitan Catchment.</p> <p>In western Sydney, <i>P. spicata</i> occurs on an undulating topography of substrates derived from Wianamatta Shale in areas supporting, or that previously supported, the Cumberland Plain Woodland Vegetation Community. Associated species include: <i>E. moluccana</i>, <i>E. tereticornis</i>, <i>E. crebra</i>, <i>Bursaria spinosa</i>, and <i>Themeda australis</i>.</p> <p>In the Illawarra region, <i>P. spicata</i> is found in open woodland and also in coastal grassland communities with emergent shrubs. Dominant species within the woodland habitat include <i>E. tereticornis</i>, <i>E. eugenioides</i>, <i>Themeda australis</i>, and <i>Lomandra longifolia</i>. In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a more well developed shrub and grass understorey.</p> <p><i>Pimelea spicata</i> flowers sporadically throughout the year, with flowering likely to depend upon climatic conditions, particularly rainfall. Flowering times recorded for <i>P. spicata</i> vary. Rye (1990) noted flowering period as May - January; Benson and McDougall (2001) noted peak flowering period as March/ April.</p>

Scientific Name	Common Name	EPBC status	TSC status	Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Pterostylis gibbosa</i></b>	Illawarra Greenhood	EN	E1	2007/#		Low	Marginal habitat present (low quality & extent).	<p>Known from a small number of populations in the Hunter region, the Illawarra region and the Shoalhaven region. It is apparently extinct in western Sydney which is the area where it was first collected (1803).</p> <p>All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by <i>Eucal</i> White-flowered Wax Plant <i>yptus tereticornis</i>, <i>E. longifolia</i> and <i>Melaleuca decora</i>. Near Nowra, the species grows in an open forest of <i>Corymbia maculata</i>, <i>E.tereticornis</i> and <i>E. paniculata</i>. In the Hunter region, the species grows in open woodland dominated by <i>E. crebra</i>, Forest Red Gum and <i>Callitris endlicherii</i>.</p> <p>The Illawarra Greenhood is a deciduous orchid that is only visible above the ground between late summer and spring, and only when soil moisture levels can sustain its growth. The leaf rosette grows from an underground tuber in late summer, followed by the flower stem in winter. The Illawarra Greenhood can survive occasional burning and grazing because of its capacity to reshoot from an underground tuber.</p>
<b><i>Solanum celatum</i></b>			E1	2010		Low	Marginal habitat present (low	<p>Restricted to an area from Wollongong to just south of Nowra, and west to Bungonia. Majority of records are prior to 1960 and the majority of populations are likely to have been lost to clearing. Grows in rainforest clearings, or in wet sclerophyll forest</p>

Scientific Name	Common Name	EPBC status	TSC status	Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
							quality & extent).	
<b><i>Streblus pendulinus</i></b>	Sia's Backbone	EN		#		Negligible	Habitat not present on site.	Sia's Backbone occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island. Occurs In warmer rainforest, chiefly along watercourses.
<b><i>Thesium australe</i></b>	Austral Toadflax	VU	V	#		Low	Marginal habitat present (low quality & extent).	Found in very small to large populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. <i>Thesium australe</i> is a root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass. It is often found in damp sites in association with <i>Themeda australe</i> , but also found on other grass species at inland sites. Occurs on clay soils in grassy woodlands or coastal headlands.



Scientific Name	Common Name	EPBC status	TSC status	Most recent record	Other sources	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Zieria granulata</i></b>	Illawarra Zieria	EN	E1	2010/#		Medium	Records of species adjacent to the site.  Habitat present on site.	Occurs in the Kiama district where it grows on dry rocky ridges in sclerophyll forest to rainforest margins. The species primarily occupies the coastal lowlands between Oak Flats and Toolijooa, in the local government areas of Shellharbour and Kiama. The typical habitat is dry ridge tops and rocky outcrops on shallow volcanic soils. Less frequently found on the moist slopes of the Illawarra escarpment and in low-lying areas on Quaternary sediments. Associated vegetation includes <i>Melaleuca armillaris</i> scrub, <i>E. tereticornis</i> woodland and rainforest margins, although the species has been recorded from a number of other vegetation types

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

## Appendix 2: Fauna

Fauna species in these tables are listed in alphabetical order within their taxonomic group.

### Appendix 2.1 Fauna species recorded from the study area

Below is a list of fauna species recorded from the study area during the present assessment and a list of significant fauna species recorded or predicted to occur within five kilometres of the study area.

#### Notes to table:

<b>TSC Act:</b>	<b>EPBC Act:</b>
C1 – critically endangered	EX - Extinct
E1 – endangered species (Part 1, Schedule 1)	CR - Critically Endangered
E2 – endangered population (Part 2, Schedule 1)	EN - Endangered
E4 – presumed extinct (Part 4, Schedule 1)	VU - Vulnerable
V1 – vulnerable (Part 1, Schedule 2)	CD - Conservation dependent
* - introduced species	

**Table 8: Vertebrate fauna recorded from the study area (current assessment)**

EPBC status	TSC status	Scientific Name	Common Name	Biosis 2012	ELA 2011
		<i>Alisterus scapularis</i>	Australian King-parrot		#
		<i>Cracticus tibicen</i>	Australian Magpie	#	
		<i>Corvus coronoides</i>	Australian Raven	#	#
		<i>Ceyx azureus</i>	Azure Kingfisher	#	
		<i>Elanus axillaris</i>	Black-shouldered Kite		#
		<i>Acanthiza pusilla</i>	Brown Thornbill	#	
		<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	#	#
		<i>Sturnus tristis</i>	Common Myna *	#	#
		<i>Ocyphaps lophotes</i>	Crested Pigeon	#	#
		<i>Platycercus elegans</i>	Crimson Rosella		#
		<i>Eudynamys orientalis</i>	Eastern Koel	#	
		<i>Platycercus eximius</i>	Eastern Rosella		#
		<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	#	
		<i>Psophodes olivaceus</i>	Eastern Whipbird	#	
	V	<i>Petroica phoenicea</i>	Flame Robin		#
		<i>Eolophus roseicapillus</i>	Galah	#	#
		<i>Cracticus torquatus</i>	Grey Butcherbird	#	#

EPBC status	TSC status	Scientific Name	Common Name	Biosis 2012	ELA 2011
		<i>Rhipidura albiscapa</i>	Grey Fantail	#	#
		<i>Dacelo novaeguineae</i>	Laughing Kookaburra	#	#
		<i>Grallina cyanoleuca</i>	Magpie-lark	#	#
		<i>Vanellus miles</i>	Masked Lapwing		#
		<i>Philemon corniculatus</i>	Noisy Friarbird		#
		<i>Manorina melanocephala</i>	Noisy Miner	#	#
		<i>Strepera graculina</i>	Pied Currawong		#
		<i>Trichoglossus haematodus</i>	Rainbow Lorikeet		#
		<i>Anthochaera carunculata</i>	Red Wattlebird		#
		<i>Todiramphus sanctus</i>	Sacred Kingfisher		#
		<i>Zosterops lateralis</i>	Silvereye	#	
		<i>Pardalotus punctatus</i>	Spotted Pardalote		#
		<i>Streptopelia chinensis</i>	Spotted Turtle-Dove *	#	#
		<i>Pardalotus striatus</i>	Striated Pardalote		#
		<i>Acanthiza lineata</i>	Striated Thornbill	#	#
		<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	#	#
		<i>Malurus cyaneus</i>	Superb Fairy-wren	#	
		<i>Rhipidura leucophrys</i>	Willie Wagtail		#
		<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	#	
		<i>Calyptorhynchus funereus</i>	Yellow-tailed Black-Cockatoo	#	#
		<i>Felis catus</i>	Cat *		#
		<i>Chalinolobus morio</i>	Chocolate Wattled Bat		#
		<i>Trichosurus vulpecula</i>	Common Brushtail Possum		#
	V	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat		#
	V	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle		#
		<i>Macropus giganteus</i>	Eastern Grey Kangaroo		#
		<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat		#
		<i>Vulpes vulpes</i>	Fox *		#
		<i>Mormopterus</i> sp. 2	Freetail Bat		#
VU	V	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox		#
		<i>Equus caballus</i>	Horse *	#	#

EPBC status	TSC status	Scientific Name	Common Name	Biosis 2012	ELA 2011
		<i>Vespadelus darlingtoni</i>	Large Forest Bat		#
		<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat		#
	V	<i>Miniopterus australis</i>	Little Bentwing-bat		#
		<i>Vespadelus vulturnus</i>	Little Forest Bat		#
		<i>Oryctolagus cuniculus</i>	Rabbit *	#	#
		<i>Wallabia bicolor</i>	Swamp Wallaby	#	
		<i>Tadarida australis</i>	White-striped Freetail-bat		#
		<i>Litoria dentata</i>	Bleating Tree Frog		#
		<i>Crinia signifera</i>	Common Eastern Froglet		#
		<i>Lampropholis delicata</i>	Dark-flecked Garden Sunskink	#	
		<i>Amphibolurus muricatus</i>	Jacky Lizard		#



## A2.2 Threatened fauna species

The following table includes a list of the significant fauna species that have potential to occur within the study area. The list of species is sourced from the NSW BioNet Wildlife Atlas, BirdLife Australia data search and the Protected Matters Search Tool (DoE; accessed on 15/07/2015).

### Notes to table:

#	species predicted to occur by the DoE database (not recorded on other databases)
##	species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched
Year	recorded on databases listed above
2015	recorded during current survey

Likelihood of occurrence	Potential criteria
<b>High</b>	<ul style="list-style-type: none"> <li>Species recorded in study area during current or previous assessment/s.</li> <li>Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s.</li> <li>Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species).</li> <li>Study area is within species natural distributional range (if known).</li> <li>Species has been recorded within &lt;five or ten kilometres&gt; or from the relevant catchment/basin.</li> </ul>
<b>Medium</b>	<ul style="list-style-type: none"> <li>Records of terrestrial species within five kilometres of the study area or of aquatic species in the relevant basin/neighbouring basin.</li> <li>Habitat limited in its capacity to support the species due to extent, quality, or isolation.</li> </ul>
<b>Low</b>	<ul style="list-style-type: none"> <li>No records within five kilometres of the study area or for aquatic species, the relevant basin/neighbouring basin.</li> <li>Marginal habitat present (low quality &amp; extent).</li> <li>Substantial loss of habitat since any previous record(s).</li> </ul>
<b>Negligible</b>	<ul style="list-style-type: none"> <li>Habitat not present in study area</li> <li>Habitat for aquatic species not present in connected waterbodies in close proximity to the study area.</li> <li>Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.</li> </ul>

**Table 9: Threatened fauna species recorded, or predicted to occur, within five kilometres of the study area**

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b>Birds</b>							
<i><b>Botaurus poiciloptilus</b></i>	Australasian Bittern	EN	E1	#	Negligible	Suitable habitat not present.	The Australasian Bittern is distributed across south-eastern Australia. Often found in terrestrial and estuarine wetlands, generally where there is permanent water with tall, dense vegetation including <i>Typha</i> spp. and <i>Eleocharis</i> spp.. Typically this bird forages at night on frogs, fish and invertebrates, and remains inconspicuous during the day. The breeding season extends from October to January with nests being built amongst dense vegetation on a flattened platform of reeds.
<i><b>Rostratula australis</b></i>	Australian Painted Snipe	VU	E1	1970/#	Negligible	Suitable habitat not present.	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. They prefer freshwater wetlands, ephemeral or permanent, although they have been recorded in brackish waters.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Ninox connivens</i>	Barking Owl		V	1988	Low	The Barking owl may forage within the study area on occasion. Suitable breeding habitat, in the form of large hollows, not present.	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country. Territories are typically 2000 ha in NSW habitats.
<i>Ixobrychus flavicollis</i>	Black Bittern		V	1983	Negligible	Suitable habitat not present.	The Black Bittern is found along the coastal plains within NSW, although individuals have rarely being recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation. The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates. The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork		E1	1962	Negligible	Suitable habitat not present.	Found in swamps, mangroves and mudflats. Can also occur in dry floodplains and irrigated lands and occasionally forages in open grassy woodland. Nests in live or dead trees usually near water.
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	EN	E1	#	Negligible	Suitable habitat not present.	Found in coastal woodlands, dense scrub and heathlands, particularly where it borders taller woodlands.
<i>Sternula nereis nereis</i>	Fairy Tern	VU		#	Negligible	Suitable habitat not present.	A small piscivorous (fish-eating) bird, the Fairy Tern is approximately 22–27 cm in length, 70 g in weight and has a wingspan of 44–53 cm. The Fairy Tern is bulky and round bodied. Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The subspecies has been known from New South Wales (NSW) in the past, but it is unknown if it persists there.



Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Petroica phoenicea</i>	Flame Robin		V	2011	Recorded	This species was recorded by ELA (2011) along the northern boundary of the site. Unlikely to be resident.	Flame Robins are found in a broad coastal band from southern Queensland to just west of the South Australian border. The species is also found in Tasmania. The preferred habitat in summer includes moist eucalyptus forests and open woodlands, whilst in winter prefers open woodlands and farmlands. It is considered migratory. The Flame Robin breeds from about August to January.
<i>Stictonetta naevosa</i>	Freckled Duck		V	2003	Negligible	Suitable habitat not present.	The Freckled Duck breeds in permanent fresh swamps that are heavily vegetated. Found in fresh or salty permanent open lakes, especially during drought. Often seen in groups on fallen trees and sand spits.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo		V	##	Low	Ecological (2011a) predicted that this species may forage within the study area on occasion. Hollows unsuitable for roosting or breeding.	The Gang-gang Cockatoo occurs from Victoria to central, south and eastern NSW (Hunter region, Central Tablelands and south-west slopes). It favours old growth nesting and roosting, inhabiting mountain forests and mature wet sclerophyll forests in spring and summer, moving to lower altitudes and drier, more open eucalypt forests and woodlands (e.g. box-gum and box-ironbark assemblages) in autumn and winter. It occasionally occurs in sub-alpine Snow Gum Eucalyptus pauciflora woodland and temperate rainforests.
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo		V, E2	1999	Low	Although individuals may overfly the study area on occasion significant habitat features, including breeding habitat and foraging resources, not present	Inhabits forest with low nutrients, characteristically with key <i>Allocasuarina</i> species. Tends to prefer drier forest types. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Neophema chrysogaster</i>	Orange-bellied Parrot	CE	E4A	#	Negligible	Suitable habitat not present.	A single breeding population of fewer than 200 individuals occurs in a narrow coastal strip of south-west Tasmania. Adult birds depart Tasmania for the mainland in February. The first adults begin leaving the mainland for Tasmania in September with the last birds having departed by November. It is a coastal species inhabiting saltmarshes, sedgeplains, coastal dunes, pastures, shrublands and moorlands, generally within 10 km of the coast. Critical winter habitat for the species includes natural saltmarshes dominated by <i>Sarcocornia quinqueflora</i> Beaded Glasswort and <i>Sclerostegia arbuscula</i> Shrubby Glasswort, as well as the associated grassy or weedy pastures. Historical records indicate that the Orange-bellied Parrot was formerly more abundant and widespread in NSW than it is now, however the species' distribution continues to extend into south-eastern NSW where suitable habitat is still available.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Erythrotriorchis radiatus</i></b>	Red Goshawk	VU	E4A	#	Negligible	Suitable habitat not present.	Occur in forest and woodland habitat near permanent water. In NSW prefer <i>Melaleuca</i> swamp forest and open eucalypt woodland. Require greater than 20 m tall trees for nesting.
<b><i>Anthochaera phrygia</i></b>	Regent Honeyeater	EN	E4A	#	Low	Whilst the species may forage within the study area on occasion it is considered vagrant in this area.	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises: <i>E. microcarpa</i> , <i>E. punctata</i> , <i>E. polyanthemus</i> , <i>E. mollucana</i> , <i>Corymbia robusta</i> , <i>E. crebra</i> , <i>E. caleyi</i> , <i>C. maculata</i> , <i>E. mckieana</i> , <i>E. macrorhyncha</i> , <i>E. laevopinea</i> and <i>Angophora floribunda</i> . Nectar and fruit from the mistletoes <i>A. miquelii</i> , <i>A. pendula</i> , <i>A. cambagei</i> are also eaten during the breeding season. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and sheoaks. Also nest in mistletoe. An open cup-shaped nest is constructed of bark, grass, twigs and wool by the female.



Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Lathamus discolor</i></b>	Swift Parrot	EN	E1	#	Low	Whilst the species may forage within the study area on occasion it is considered vagrant in this area.	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>E. robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> , and White Box <i>E. albens</i> . Commonly used lerp infested trees include Grey Box <i>E. microcarpa</i> , Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i> . This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Daphoenositta chrysoptera</i>	Varied Sittella		V	2009	Low	Study area largely lacks rough-barked eucalypt species which provide foraging habitat. Disturbance further makes the study area unsuitable.	The Varied Sittella is a sedentary species which inhabits a wide variety of dry eucalypt forests and woodlands, usually with either shrubby understorey or grassy ground cover or both, in all climatic zones of Australia. Usually inhabit areas with rough-barked trees, such as stringybarks or ironbarks, but also in mallee and acacia woodlands, paperbarks or mature Eucalypts. The Varied Sittella feeds on arthropods gleaned from bark, small branches and twigs. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.
<b>Reptiles</b>							
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	VU	E1	#	Negligible	Suitable habitat not present.	Mainly occurs in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they generally use rock crevices and exfoliating rock during the cooler months and tree hollows during summer.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b>Amphibians</b>							
<i>Mixophyes iteratus</i>	Giant Barred Frog	EN	E1	#	Negligible	Suitable habitat not present.	Occurs along coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW. Found in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m, often hiding in leaf litter near permanent fast-flowing streams. Females lay eggs onto moist creek banks or rocks above water level, from where tadpoles drop into the water when hatched. When not breeding the frogs disperse hundreds of metres away from streams.
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	VU	V	#	Negligible	Suitable habitat not present.	Prefers hanging swamps on sandstone shelves adjacent to perennial non-flooding creeks. Can also occur within shale outcrops within sandstone formations. Known from wet and dry forests and montane woodland in the southern part range. Individuals can be found around sandy creek banks or foraging along ridge-tops during or directly after heavy rain. Males often call from burrows located in sandy banks next to water. Spends the majority of its time in non-breeding habitat 20-250m from breeding sites.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Litoria aurea</i>	Green and Golden Bell Frog	VU	E1	1971/#	Negligible	Suitable habitat not present.	Most existing locations for the species occur as small, coastal, or near coastal populations, with records occurring between south of Grafton and northern VIC. The species is found in marshes, dams and stream sides, particularly those containing bullrushes or spikerushes. Preferred habitat contains water bodies that are unshaded, are free of predatory fish, have a grassy area nearby and have diurnal sheltering sites nearby such as vegetation or rocks, although the species has also been recorded from highly disturbed areas including disused industrial sites, brick pits, landfill areas and cleared land. Breeding usually occurs in summer. Tadpoles, which take approximately 10-12 weeks to develop, feed on algae and other vegetative matter. Adults eat insects as well as other frogs, including juveniles of their own species.



Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	VU	V	#	Negligible	Suitable habitat not present.	The species is distributed along the eastern slopes of the Great Dividing Range from Watagan State Forest near Wyong, south to Buchan in north-eastern VIC. It is not known from coastal habitats. Occurs in wet and dry sclerophyll forests and heath communities associated with sandstone outcrops between 280 and 1000 m. Littlejohn's Tree Frog prefers permanent and semi-permanent rock flowing streams, but individuals have also been collected from semi-permanent dams with some emergent vegetation. Forages both in the tree canopy and on the ground, and has been observed sheltering under rocks on high exposed ridges during summer. The species breeds in autumn but will also breed after heavy rainfall in spring and summer. The species has been recorded calling in all seasons with variously reported peak calling periods. Eggs are laid in loose gelatinous masses attached to submerged twigs; eggs and tadpoles are most often recorded in slow-flowing pools that receive extended exposure to sunlight.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Mixophyes balbus</i>	Stuttering Frog	VU	E1	#	Negligible	Suitable habitat not present.	This species is usually associated with mountain streams, wet mountain forests and rainforests. It rarely moves very far from the banks of permanent forest streams, although it will forage on nearby forest floors. Eggs are deposited in leaf litter on the banks of streams and are washed into the water during heavy rains.
<b>Mammals</b>							
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	VU	E1	#	Negligible	Suitable habitat not present.	Occurs along the Great Dividing Range south to the Shoalhaven, and also occurs in the Warrumbungles and Mt Kaputar. Habitats range from rainforest to open woodland. It is found in areas with numerous ledges, caves and crevices, particularly where these have a northerly aspect. Individuals defend a specific rock shelter, emerging in the evening to forage on grasses and forbs, as well as browse in drier months. Home sizes range from 2-30 ha.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Miniopterus schreibersii oceanensis</i></b>	Eastern Bentwing-bat		V	2015	Recorded	This species was recorded by Ecological (2011) within the study area. Study area provides foraging habitat. Breeding or roosting habitat not present.	Occurs from Victoria to Queensland, on both sides of the Great Dividing Range. Forms large maternity roosts (up to 100,000 individuals) in caves and mines in spring and summer. Individuals may fly several hundred kilometres to their wintering sites, where they roost in caves, culverts, buildings, and bridges. They occur in a broad range of habitats including rainforest, wet and dry sclerophyll forest, paperbark forest and open grasslands. Has a fast, direct flight and forages for flying insects (particularly moths) above the tree canopy and along waterways.



Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Falsistrellus tasmaniensis</i></b>	Eastern False Pipistrelle		V	2015	Recorded	This species occurs in a wide range of habitats. The study area does not support preferred wet sclerophyll habitat but may forage within the study area on occasion. Hollow bearing trees which may provide roosting habitat for the species also occur within the study area.	Distribution extending east of the Great Dividing Range throughout the coastal regions of NSW, from the Queensland border to the Victorian border. Prefers wet high-altitude sclerophyll and coastal mallee habitat, preferring wet forests with a dense understorey but being found in open forests at lower altitudes. Apparently hibernates in winter. Roosts in tree hollows and sometimes in buildings in colonies of between 3 and 80 individuals. Often change roosts every night. Forages for beetles, bugs and moths below or near the canopy in forests with an open structure, or along trails. Has a large foraging range, up to 136 ha. Records show movements of up to 12 km between roosting and foraging sites.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat		V	2015	Moderate	Species is likely to forage within the study area. Species may also roost within tree hollows within the study area.	Distribution extends east of the Great Dividing Range from southern Queensland to south of Sydney. Most records are from dry eucalypt forests and woodland. Individuals tend to forage in natural and artificial openings in forests, although it has also been caught foraging low over a rocky river within rainforest and wet sclerophyll forest habitats. The species generally roosts in hollow spouts of large mature eucalypts (including paddock trees), although individuals have been recorded roosting in the roof of a hut, in wall cavities, and under metal caps of telegraph poles. Foraging generally occurs within a few kilometres of roosting sites.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat		V	2015	Medium	This species has been recorded a number of times recently in the local area. The study area does not provide significant habitat but may forage within the study area on occasion. Hollow bearing trees which may provide roosting habitat for the species also occur within the study area.	Occurs along the Great Dividing Range, generally at 500 m but up to 1200 m, and in coastal areas. Occurs in woodland and rainforest, but prefers open habitats or natural or human-made openings in wetter forests. Often hunts along creeks or river corridors. Flies slowly and directly at a height of 30 m or so to catch beetles and other large, flying insects. Also known to eat other bats and spiders. Roosts in hollow tree trunks and branches.



Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Pteropus poliocephalus</i></b>	Grey-headed Flying-fox	VU	V	#	Recorded	This species was recorded by Ecological (2011a) overlying the study area. The study area does not support significant breeding or roosting habitat.	Occurs along the NSW coast, extending further inland in the north. This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Roosts in large colonies (camps), commonly in dense riparian vegetation. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.
<b><i>Phascolarctos cinereus</i> (combined populations of Qld, NSW and the ACT)</b>	Koala	VU	V	#	Low	There are few records of the Koala from the Illawarra floodplain and the species is considered unlikely to occur.	Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. Primary feed trees include <i>E. robusta</i> , <i>E. tereticornis</i> , <i>E. punctata</i> , <i>E. haemostoma</i> and <i>E. signata</i> . They are solitary with varying home ranges. In high quality habitat home ranges may be 1-2 ha and overlap, while in semi-arid country they are usually discrete and around 100 ha.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	VU	V	#	Low	Whilst individuals may forage over the study area on occasion the study area does not provide roosting habitat.	Occurs from the Queensland border to Ulladulla, with largest numbers from the sandstone escarpment country in the Sydney Basin and Hunter Valley. Primarily found in dry sclerophyll forests and woodlands, but also found in rainforest fringes and subalpine woodlands. Forages on small, flying insects below the forest canopy. Roosts in colonies of between three and 80 in caves, Fairy Martin nests and mines, and beneath rock overhangs, but usually less than 10 individuals. Likely that it hibernates during the cooler months. The only known existing maternity roost is in a sandstone cave near Coonabarabran.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Miniopterus australis</i>	Little Bentwing-bat		V	2011	Recorded	This species was recorded by Ecological (2011a) within the study area.	Occurs from Northern Queensland to the Hawkesbury River near Sydney. Roost sites encompass a range of structures including caves, tunnels and stormwater drains. Young are raised by the females in large maternity colonies in caves in summer. Shows a preference for well timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. The Little Bentwing bat forages for small insects (such as moths, wasps and ants) beneath the canopy of densely vegetated habitats.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<b><i>Potorous tridactylus tridactylus</i></b>	Long-nosed Potoroo	VU	V, E2	#	Negligible	Suitable habitat not present.	Cobaki Lakes and Tweed Heads West population: Occurs from Queensland to Victoria, normally within 50 km of the coast. Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy. Known to eat fungi, arthropods, fleshy fruit, seeds and plant tissue. It is solitary and sedentary, but tends to aggregate in small groups. It has two breeding seasons, one in late winter-early spring and the other in late summer. This species appears to benefit from a lack of recent disturbance.



Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	VU		#	Negligible	Suitable habitat not present.	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes. The home range of the New Holland Mouse can range from 0.44 ha to 1.4 ha. The New Holland Mouse is a social animal, living predominantly in burrows shared with other individuals. The species is nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal. It is likely that the species spends considerable time foraging above-ground for food, predisposing it to predation by native predators and introduced species. Breeding typically occurs between August and January, but can extend into autumn.
<i>Pseudomys fumeus</i>	Smoky Mouse	EN	E4A	#	Negligible	Suitable habitat not present.	Appears to prefer heathy ridgetops and slopes within sclerophyll forests, heathland and open forest from the coast to sub-alpine regions of up to 1800 m.

Scientific Name	Common Name	EPBC Status	TSC Status	Most recent record	Likely occurrence in study area	Rationale for likelihood ranking	Habitat description
<i>Isoodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern)	EN	E1	#	Negligible	Suitable habitat not present.	This species prefers sandy soils with scrubby vegetation and/or areas with low ground cover that are burn from time to time. A mosaic of post fire vegetation is important for this species.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	EN	V	#	Low	There is only a few records from the Illawarra floodplain for this species. The study area does not contribute to a significant movement corridor for this species and is unlikely to support significant habitat for this species.	Occurs along the east coast of Australia and the Great Dividing Range. Uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests. Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas (NPWS 1999k). Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage. Seventy per cent of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require large areas of relatively intact vegetation through which to forage. The home range of a female is between 180 and 1000 ha, while males have larger home ranges of between 2000 and 5000 ha. Breeding occurs from May to August.

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

## Appendix 2.3 Migratory species (EPBC Act listed)

Includes records from the following sources:

- NSW BioNet Wildlife Atlas (refer to Section 2.1)
- DoE database (accessed on 15/07/2015)
- BirdLife Australia data search
- Current survey

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

**Table 10: Migratory fauna species recorded or predicted to occur within five of the study area**

Scientific Name	Common Name	Conservation Status		Most recent record
		EPBC	TSC	
<i>Anthochaera phrygia</i>	Regent Honeyeater	EN	E4A	#
<i>Apus pacificus</i>	Fork-tailed Swift			#
<i>Ardea ibis</i>	Cattle Egret			2015/#
<i>Ardea modesta</i>	Eastern Great Egret			2014/#
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper			2007
<i>Calidris melanotos</i>	Pectoral Sandpiper			2007
<i>Calidris ruficollis</i>	Red-necked Stint			2014
<i>Chalcophaps indica</i>	Emerald Dove			2000
<i>Danaus plexippus</i>	Monarch Butterfly			2009
<i>Gallinago hardwickii</i>	Latham's Snipe			2011/#
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle			2014/#
<i>Hirundapus caudacutus</i>	White-throated Needletail			2010/#
<i>Hydroprogne caspia</i>	Caspian Tern			2012
<i>Lamna nasus</i>	Porbeagle, mackerel shark			#
<i>Limosa lapponica</i>	Bar-tailed Godwit			2011
<i>Merops ornatus</i>	Rainbow Bee-eater			#
<i>Monarcha melanopsis</i>	Black-faced Monarch			2013/#




Scientific Name	Common Name	Conservation Status		Most recent record
		EPBC	TSC	
<i>Myiagra cyanoleuca</i>	Satin Flycatcher			#
<i>Neophema chrysogaster</i>	Orange-bellied Parrot	CE	E4A	#
<i>Numenius madagascariensis</i>	Eastern Curlew	CE		2002
<i>Pandion haliaetus</i>	Osprey		V	2014/#
<i>Plegadis falcinellus</i>	Glossy Ibis			1985
<i>Pluvialis fulva</i>	Pacific Golden Plover			1999
<i>Rhipidura rufifrons</i>	Rufous Fantail			2012/#
<i>Rostratula australis</i>	Australian Painted Snipe	EN	E1	2011/#
<i>Symposiachrus trivirgatus</i>	Spectacled Monarch			#
<i>Tringa nebularia</i>	Common Greenshank			2011
<i>Tringa stagnatilis</i>	Marsh Sandpiper			1987



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

## Appendix 2.4 Hollow-bearing tree and nest box replacement inventory



**Table 11: Hollow bearing trees recorded within the study area**



HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
1	5cm branch hollow	Microbat species	Yes, road	<ul style="list-style-type: none"> <li>– Eastern False Pipistrelle</li> <li>– Greater Broad-nosed Bat</li> <li>– Other non-threatened microbat species</li> </ul>	Microbat box	
2	5cm branch hollow	Microbat species	Yes, building envelope.	<ul style="list-style-type: none"> <li>– Eastern False Pipistrelle</li> <li>– Greater Broad-nosed Bat</li> <li>– Other non-threatened microbat species</li> </ul>	Microbat box	



HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
	5cm branch hollow			<ul style="list-style-type: none"> <li>– Eastern False Pipistrelle</li> <li>– Greater Broad-nosed Bat</li> <li>– Other non-threatened microbat species</li> </ul>	Microbat box	
3	Large opening on dead branch	Microbat species	Yes, building envelope	<ul style="list-style-type: none"> <li>– Eastern False Pipistrelle</li> <li>– Greater Broad-nosed Bat</li> <li>– Other non-threatened microbat species</li> </ul>	Microbat box	
4	Small vertical fissure one 15cm trunk hollow	Microbat species	Yes, building envelope	<ul style="list-style-type: none"> <li>– Eastern False Pipistrelle</li> <li>– Greater Broad-nosed Bat</li> <li>– Other non-threatened microbat species</li> </ul>	Microbat box	


HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
	Small vertical fissure	Microbat species		<ul style="list-style-type: none"> <li>– Eastern False Pipistrelle</li> <li>– Greater Broad-nosed Bat</li> <li>– Other non-threatened microbat species</li> </ul>	Microbat box	
	15cm trunk hollow	Medium sized parrots and small possums		<ul style="list-style-type: none"> <li>– Galah</li> <li>– Little Corella</li> <li>– King Parrot</li> <li>– Ringtailed Possum</li> </ul>	Medium opening vertical nest box.	
5	5cm trunk hollow, low to the ground	Unsuitable habitat	Yes, not Applicable	Not Applicable	Not Applicable	




HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
6	15 cm branch hollow, very shallow	Unsuitable habitat	No, not Applicable	Not Applicable	Not Applicable	
7	10cm branch hollow	Small parrot species	No, retained within Lot 73	Not required		

HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
8	10cm trunk hollow, rubble filled.	Unsuitable habitat.	Not Applicable	Not Applicable	Not Applicable	
9	5cm, dead branch	Microbat species	No, retained within Lot 73	Not required	Not required	

HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
10	10 cm trunk hollow	Small parrot species	No, retained within Lot 73	Not required		
11	10cm trunk hollow	Small parrot species	No, retained within Lot 73	Not required	Not required	
	10cm trunk hollow	Small parrot species		Not required	Not required	
	10cm trunk hollow	Small parrot species		Not required	Not required	



HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
	10cm trunk hollow	Small parrot species		Not required	Not required	
	20 cm trunk hollow	Medium sized parrots and small possums		Not required	Not required	
12	5cm trunk hollow	Microbat species	No, retained within Lot 73	Not required	Not required	





HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
13	5cm tube hollow in branch	Microbat species	No, retained within Lot 73	Not required	Not required	
14	5cm branch hollow	Microbat species	No, retained within Lot 73	Not required	Not required	
	10cm trunk hollow	Small parrot species		Not required	Not required	
	20cm trunk hollow	Medium sized parrots and small possums		Not required	Not required	



HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
	30 cm trunk hollow	Medium sized parrots and small possums		Not required	Not required	
15	15cm tube hollow in branch	Medium sized parrots and small possums	No, retained within Lot 73	Not required	Not required	
16	5cm branch hollow	Microbat species	No, retained within Lot 73	Not required	Not required	
	10 cm branch hollow	Microbat species		Not required	Not required	

HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
	10 cm trunk hollow	Small parrot species		Not required	Not required	
	25 cm trunk hollow	Medium sized parrots and small possums		Not required	Not required	
	30 cm trunk hollow	Medium sized parrots and small possums		Not required	Not required	
17	5cm branch hollow	Microbat species	No, retained within Lot 73	Not required	Not required	
	5cm branch hollow	Microbat species		Not required	Not required	



HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
18	15cm trunk hollow, obstructed	Unsuitable habitat	Not Applicable	Not Applicable	Not Applicable	
19	15cm hollow in dead branch	Unsuitable habitat	Not Applicable	Not Applicable	Not Applicable	





HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
20	10cm fissure in trunk	Small parrot species	No, retained within Lot	Not required	Not required	
	5cm branch tube hollow	Microbat species		Not required	Not required	
21	10cm vertical fissure	Small parrot	Yes, road	<ul style="list-style-type: none"> <li>– Eastern rosella</li> <li>– Crimson rosella</li> <li>– Rainbow Lorikeet</li> <li>– Red-rumped Parrot</li> </ul>	Small opening, vertical nest box	

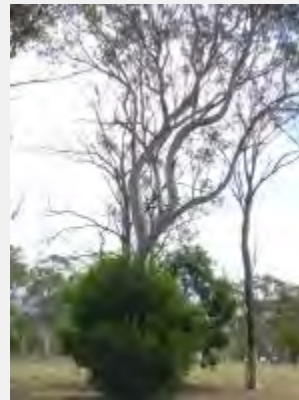

HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
22	Fissure in dead branch	Threatened microbat species	Yes, unsafe stag tree.	<ul style="list-style-type: none"> <li>– Eastern False Pipistrelle</li> <li>– Greater Broad-nosed Bat</li> <li>– Other non-threatened microbat species</li> </ul>	Microbat box	
	Fissure in dead branch	Threatened microbat species		<ul style="list-style-type: none"> <li>– Eastern False Pipistrelle</li> <li>– Greater Broad-nosed Bat</li> <li>– Other non-threatened microbat species</li> </ul>	Microbat box	
23	Shallow fissure on trunk, 10 x 50cm	Unsuitable habitat	Not Applicable	Not Applicable	Not Applicable	

HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
24	15 cm trunk hollow	Medium sized parrots and small possums	No, retained within Lot	Not required	Not required	
25	Cracked trunk with vertical fissure	Threatened microbat species	No, retained within Lot	Not required	Not required	
	10 cm branch hollow	Small parrot species		Not required	Not required	
	10 cm trunk hollow	Small parrot species		Not required	Not required	

HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
26	10 cm trunk hollow	Small parrot species	Yes, building envelope	<ul style="list-style-type: none"> <li>– Eastern rosella</li> <li>– Crimson rosella</li> <li>– Rainbow Lorikeet</li> <li>– Red-rumped Parrot</li> </ul>	Small opening, vertical nest box	
27	20cm trunk hollow with woody rubble	Unsuitable habitat	Yes, fence line - Not Applicable	Not Applicable	Not Applicable	



HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
28	Small crack on branch	Unsuitable habitat	Yes, road - Not Applicable	Not Applicable	Not Applicable	
29	15cm bowl shaped hollow on trunk	Medium sized parrots and small possums	Yes, building envelope	Galah Little Corella King Parrot Ringtailed Possum	Medium opening vertical nest box.	

HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
30	5 cm tube hollow	Threatened microbat species	No, retained within Lot	Not required	Not required	
31	5cm tube hollow	Threatened microbat species	No, retained within Lot	Not required	Not required	

HBT label	Hollow size/ features	Suitability for fauna occupancy	Removal predicted	Species Targeted	Type of compensatory habitat	Photo
32	Large fissure in trunk	Threatened microbat species	No, retained within Lot	Not required	Not required	
	15cm branch hollow	Medium sized parrots and small possums				
	15cm branch hollow	Medium sized parrots and small possums				
33	10 – 20 cm open fissure in trunk	Unsuitable habitat	Not applicable	Not required	Not required	





## Appendix 3: Assessments of Significance

The following section provides for Assessments of Significance according to the seven factors outlined in Section 5A of the EP&A Act for all species listed as a medium likelihood or greater in Appendix 1 and Appendix 2.

### Illawarra Lowlands Grassy Woodland

*Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion* is an endangered ecological community listed under the TSC Act.

5.76 hectares was identified within the study area. There are 3.06 hectares of this community proposed for removal in the study area; however it has been highly modified due to past clearing and use of the study area for horse agistment. 2.7 hectares will be retained and managed for conservation.

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

Not applicable.

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

Not applicable.

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

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

Illawarra Lowlands Grassy Woodland within the study area forms part of a habitat corridor extending to the south and east, with extensive stands of the community to the south. This is defined as the local occurrence. The proposed subdivision will result in the permanent removal of 3.06 hectares of the community in a degraded condition. 2.7 hectares will be retained and managed for conservation in the EMA, resulting in the improvement of retained vegetation.

Illawarra Lowlands Grassy Woodland within the study area is in a degraded condition due to past clearing and ongoing impacts from horse agistment. Within the study area, the community is represented by an overstorey of mature trees over a low, grazed groundcover with high levels of weeds. No midstorey is present. The extent of the community within the study area shows a low level of ecological functioning and low resilience.

The proposed subdivision will not have an adverse effect on the extent of the community or modify the community to such an extent that the community will be placed at an increased risk of extinction.

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

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

- (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

The proposed subdivision will result in the permanent removal of 3.06 hectares and the retention and management for conservation of 2.7 hectares of Illawarra Lowlands Grassy Woodland.

The proposed subdivision will not result in the fragmentation or isolation of any areas, with vegetated corridors to be retained within the EMAs and to the east and west of the study area.

Illawarra Lowlands Grassy Woodland within the study area shows a high degree of disturbance and, as a result, has a low level of ecological functioning and low resilience. Impacts from horse agistment have significantly degraded the community over time. In comparison to other stands within the locality this vegetation is considered of low importance due to the low structural and species diversity.

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

There is no critical habitat declared for this community.

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

There is no recovery plan for this community.

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

The proposed residential subdivision is likely to result in the operation of, or increase the impact of, the following key threatening processes relevant to the community:

- Clearing of native vegetation.

The VMP has been developed to mitigate the impacts of these key threatening processes on this community.

## **Conclusion**

The proposal is unlikely to result in a significant effect on *Illawarra Lowlands Grassy Woodland in the Sydney Basin Bioregion* as:

- 2.7 hectares will be retained and managed for conservation, resulting in improvement in the quality of retained areas.
- Habitat to be removed within the study area is already highly degraded and of poor structural condition and low species diversity.
- The extent of habitat to be removed is considered of low importance in the locality.

Based on the above assessment, an SIS is not considered necessary.

## White-flowered Wax Plant *Cynanchum elegans*

The White-flowered Wax Plant is listed as endangered under the TSC Act.

Targeted surveys have been undertaken throughout native vegetation within the study area. Seven plants were recorded at two locations within the study area. This is defined as the 'local population'. Habitat is substantially degraded due to a dense cover of Lantana.

The proposed subdivision will not result in the removal of any plants. There is potential for indirect impacts to five plants at one location, including modification of habitat, through the management of vegetation within the outer APZ. No negative impacts to remaining plants will occur.

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

The species was recorded within the EMA, at two locations. One location is within the conservation area and will be managed purely for conservation, resulting in beneficial impacts. One location, supporting the majority of plants is located within the outer APZ.

The management of vegetation within the outer APZ has the potential to result in impacts to life cycle of this species, resulting in the prevention of suckering by adult plants and preventing the spread of seeds. Provided the measures outlined in Section 5.2 are implemented, including retention of a 20 metre buffer and fencing of this population, the life cycle of this species will not be adversely affected. Any works undertaken within APZ areas will be completed by a s 132 licenced bush regenerator.

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

Not applicable.

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

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

Not applicable.

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

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

No plants will be permanently removed as a result of the proposed subdivision. There is some potential for modification to the habitat for this species within the inner and outer APZs. However, the majority of habitat for this species will be retained within the EMA and managed for conservation purposes.

No areas of habitat will become isolated or fragmented as a result of the proposed subdivision.

The habitat to be removed is considered of low importance for the species due to significant ongoing degradation due to horse agistment.

Provided the measures outlined in Section 5.2 are implemented, including protection of 2.7 hectares of habitat within the EMA, and management of retained vegetation in accordance with the VMP there is potential for beneficial impact for this species.

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

Critical habitat has not been declared for this species.

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

There is no recovery plan for this species.

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

The proposed residential subdivision is likely to result in the operation of, or increase the impact of, the following key threatening processes relevant to the community:

- Clearing of native vegetation.

The VMP has been developed to mitigate the impacts of these key threatening processes on this community.

## **Conclusion**

The proposal is unlikely to result in a significant effect on the White-flowered Wax Plant as:

- No plants will be removed.
- Although habitat will be removed within the study area, it is already highly degraded.
- Provided the recommendations outlined in Section 5.2 are implemented indirect impacts to retained plants can be effectively managed.
- There is potential for beneficial impacts to this species due to the retention and management of habitat within the EMA.

Based on the above assessment, an SIS is not considered necessary.



## **Hollow roosting microchiropteran bats (Greater Broad-nosed Bat *Scoteanax rueppellii* and Eastern False Pipistrelle *Falsistrellus tasmaniensis*)**

Both species are listed as vulnerable under the TSC Act.

The Eastern False Pipistrelle was recorded within the study area by Ecological (2011) while the Greater Broad-nosed Bat is considered a medium likelihood of occurrence. The species are likely to forage within the study area and there is potential for these species to roost within hollow-bearing trees within the study area.

The 'local population' of these species is defined as all individuals that may forage within the study area on occasion. Given the mobility and nightly foraging range of these species, this would conservatively be estimated as all individuals within the locality.

The proposed subdivision will result in the 5.65 hectares of foraging habitat as well as the removal of 21 hollow-bearing trees which may provide roosting habitat for these species. 2.71 hectares of foraging habitat and 12 hollow-bearing trees will be retained within the EMA.

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

Both species are likely to utilise the study area for foraging on occasion, with hollow-bearing trees providing potential roosting habitat. The proposed residential subdivision will result in the removal of 5.65 hectares of foraging habitat and 21 hollow-bearing trees which may provide roosting habitat for these species.

Foraging and roosting habitat within the subject site is not considered limiting within the locality, with abundant foraging habitat and potential roosting habitat present. In addition, 2.71 hectares of foraging habitat and 12 hollow-bearing trees will be retained within the EMA.

Given the small amount of habitat proposed to be removed, the retention of habitat within the EMA, the high mobility of the species and abundance of habitat within the locality it is considered unlikely that the proposed subdivision would result in an adverse effect on the life cycle of these two microbat species to such an extent that it would place the local populations at risk of extinction.

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

Not applicable.

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

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

Not applicable.

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

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*

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

The proposed subdivision will result in the removal of 5.65 hectares of foraging habitat and 21 hollow-bearing trees which may provide roosting habitat for these species. 2.71 hectares of foraging habitat and 12 hollow-bearing trees will be retained within the EMA.

No fragmentation or isolation of habitat will result from the proposed subdivision, with maintenance of habitat corridors to the east, south and west.

Habitat to be removed is not considered limiting in the locality. Although hollow-bearing trees provide potential roosting habitat for these species, there was no evidence of occupation. In addition, both species tend to prefer moist environments for roosting, with the study area located on a ridge top.

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

Critical habitat has not been declared for these species.

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

There is no recovery plan for these species.

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

The proposed residential subdivision is likely to result in the operation of, or increase the impact of, the following key threatening processes relevant to the community:

- Clearing of native vegetation.
- Loss of hollow-bearing trees.
- Predation by the feral cat *Felis catus*.
- Removal of dead wood and dead trees.

The proposed subdivision may result in the operation of the above three key threatening processes. However, only a small area of degraded habitat and a small number of potential roosting trees would be removed. Whilst there may be some detrimental impacts to these species, these impacts are unlikely to be significant given the abundance of habitat within the locality and lack of evidence of occupation of the subject site by these species.

## Conclusion

The proposal is unlikely to result in a significant effect on these species as:

- Habitat within the study area is degraded and not considered limited within the locality.
- Habitat will be retained within the EMA.

Based on the above assessment, an SIS is not considered necessary.

## Appendix 4: Significant Impact Criteria assessments

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### White-flowered Wax Plant *Cynanchum elegans*

The White-flowered Wax Plant is listed as endangered under the EPBC Act.

Targeted surveys have been undertaken throughout native vegetation within the study area. Seven plants were recorded at two locations within the study area. This is defined as the 'local population'. Habitat is substantially degraded due to a dense cover of Lantana.

The proposed subdivision will not result in the removal of any plants. There is potential for indirect impacts to five plants at one location, including modification of habitat, through the management of vegetation within the outer APZ. No negative impacts to remaining plants will occur.

*An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:*

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

No plants will be removed as a result of the proposed subdivision. Retained plants will be managed to minimize and mitigate impacts. Suitable habitat will be managed within the EMA, resulting in the potential for an increase in the size of the population within the site.

*reduce the area of occupancy of the species*

Some degraded habitat will be removed as a result of the proposed subdivision. However, all occupied habitat will be retained and managed, resulting in beneficial impacts for the species.

*fragment an existing population into two or more populations;*

No areas of habitat will become isolated or fragmented as a result of the proposed subdivision.

*adversely affect habitat critical to the survival of a species;*

No habitat critical to the survival of the species has been identified. Habitat within the study area is not likely to be considered critical to the survival of the species.

*disrupt the breeding cycle of a population;*

The species was recorded within the EMA, at two locations. One location is within the conservation area and will be managed purely for conservation, resulting in beneficial impacts. One location, supporting the majority of plants, is located within the outer APZ.

The management of vegetation within the outer APZ has the potential to result in impacts to the life cycle of this species, resulting in the prevention of suckering by adult plants and preventing the spread of seeds. Provided the measures outlined in Section 5.2 are implemented, including retention of a 20 metre buffer, works undertaken within APZ areas to be completed by a s 132 licenced bush regenerator and fencing of this population, the life cycle of this species will not be adversely affected.

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

No plants will be permanently removed as a result of the proposed subdivision. There is some potential for modification to the habitat for this species within the inner and outer APZs. However, the majority of habitat for this species will be retained within the EMA and managed for conservation purposes. Any works undertaken within APZ areas will be completed by a s 132 licenced bush regenerator.

The habitat to be removed is considered of low importance for the species due to significant ongoing degradation due to horse agistment.

Provided the measures outlined in Section 5.2 are implemented, including protection of 2.7 hectares of habitat within the EMA, and management of retained vegetation in accordance with the VMP there is potential for beneficial impact for this species.

*result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;*

Areas of retained habitat for this species are currently being impacted by significant invasion by weed species. Management of these areas will result in removal of invasive species harmful to this species.

*introduce disease that may cause the species to decline, or;*

Introduction of diseases are unlikely to result from the proposed subdivision.

*interfere with the recovery of the species.*

The VMP will incorporate many of the recovery actions identified for this species, including fencing, weed control, and habitat restoration and ecotone maintenance.

## **Conclusion**

The proposal is unlikely to result in a significant impact on the White-flowered Wax Plant as:

- No plants will be removed.
- Although habitat will be removed within the study area, it is already highly degraded.
- Provided the recommendations outlined in Section 5.2 are implemented indirect impacts to retained plants can be effectively managed.
- There is potential for beneficial impacts to this species due to the retention and management of habitat within the EMA.

Based on the above assessment, a referral to the Commonwealth Minister for the Environment is not considered necessary.



## **Illawarra and south coast lowland forest and woodland ecological community**

The Illawarra and south coast lowland forest and woodland ecological community is listed as critically endangered under the EPBC Act.

An action is likely to have a significant impact on critically endangered and endangered ecological community if there is a real chance or possibility that it will:

### *Reduce the extent of an ecological community*

The study area contains 5.76 hectares of CEEC. The project in its current form will result in a reduction of extent of 4.16 hectares of the CEEC to provide for residential subdivision within the study area. This includes the installation of an APZ which will modify 1.10 hectares of the CEEC to be retained. The APZ will impact the CEEC and provide a buffer wider than 30 metres between the development and retained and surrounding vegetation.

The remaining 1.6 hectares of CEEC will be retained and managed under a VMP in perpetuity.

### *Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*

The proposed subdivision occurs within a corridor of vegetation that is orientated north to south and contiguous with the Tongarra – Stockyard Mountain to Dunmore Hills regional biodiversity corridor (WCC et al. 2011). The vegetation to be removed as part of the proposed action will reduce the area of the corridor, but will not result in a discrete break in the corridors length. The CEEC to be retained within the east of the study area will retain connectivity to the south. The proposed action will have a minimal impact to the vegetation to the west of the study area which adjoins native vegetation further to the north. This may include the installation of a piped stormwater easement up to 10 metres wide.

### *Adversely affect habitat critical to the survival of an ecological community*

The approved conservation advice considers all Illawarra Lowlands Grassy Woodland that is moderate condition or above as critical to the survival of the community. The proposed subdivision will adversely affect habitat critical to the survival of the CEEC.

### *Modify or destroy abiotic (non-living) factors (such as water, nutrients or soil) necessary for an ecological communities survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*

The proposed subdivision footprint will result in the permanent modification of the habitat within the development area. Trees will be retained within the development footprint in areas where not occurring within dwelling footprints, fence lines, proposed roads or soil cuts. The retained CEEC vegetation to the east and west will be buffered by APZs at a distance of 30 metres or greater. Management of the APZs will contribute to providing a buffer from the development and provide for infiltration of water uphill from the the retained CEEC. This will contribute to minimising drying of vadose zone hydrology that may impact the CEEC. The majority of runoff from residential hard surfaces and stormwater flows is proposed to be re-directed through stormwater infrastructure to a rock lined ephemeral gully to the west. This will reduce any increased flows into areas of the CEEC and avoid localised changes in hydrology that will result in a wetter environment.

### *Causes a substantial change in the species composition of an occurrence of an ecological community, including causing a decline of functionally important species, for example through regular burning or flora or fauna harvesting*

The removal of CEEC vegetation will cause a substantial change within the development footprint. Installation of APZs will also result in permanent modification of the CEEC through canopy thinning and slashing of midstorey species and groundcovers on a regular basis.

The CEEC area to be retained within the study area will be managed for conservation under a VMP and include: removal of man-made structures, fencing, control of noxious weeds, and revegetation of low condition groundcover areas. No burning is planned within the VMP management actions.

*Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community including, but not limited to:*

*Assisting invasive species, that are harmful to the listed ecological community, to become established, or*

*Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community*

The study area is currently managed for horse agistment with minimum input for weed control. The retained CEEC and its APZs will be managed under a VMP in perpetuity which will result in a reduction of noxious woody weeds and improvement of condition for the retained vegetation. The application of herbicides will be limited to spot application or via manual control methods as per the VMP.

There is potential for garden escapes to become new weed pressures that threaten the CEEC as development occurs within the study area. These threats will be managed through a VMP for the retained vegetation within the EMA..

Broad scale use or application of fertilisers will not be undertaken as part of the proposed development, and sediment fencing will be installed to reduce the potential for downstream impacts into the retained areas via soil erosion.

*Interfering with the recovery of an ecological community*

A recovery plan for the CEEC has not been prepared. The proposal is contributing to the clearing and fragmentation of the CEEC, which are considered the highest threat to its survival (TSSC 2016).

## **Conclusion**

Based on the SIC guidelines (CoA 2013) and approved conservation advice for the CEEC (TSSC 2016) the proposed action is likely to result in a significant impact on Illawarra Lowlands Grassy Woodland due to the removal and permanent modification of 4.16 hectares of vegetation that is considered critical to the survival of the CEEC.

Based on the above assessment, a referral to the Commonwealth Minister for the Environment is strongly recommended.