



Biodiversity Constraints Assessment

Hurlstone Development Project

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Abbreviations

Abbreviation	Description
BCAM	Biodiversity Certification Assessment Methodology
CBD	Central Business District
CEEC	Critically Endangered Ecological Community
CPW	Cumberland Plain Woodland in the Sydney Basin Bioregion
DCP	Development Control Plan
DECCW	NSW Department of Environment, Climate Change and Water (now OEH)
DotEE	Commonwealth Department of the Environment and Energy
DPI Water	Department of Primary Industries Water
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
FFIA	Flora and Fauna Impact Assessment
HAHS	Hurlstone Agricultural High School
IoM	Improve or Maintain
LEP	Local Environment Plan
LGA	Local Government Area
OEH	NSW Office of Environment and Heritage (formerly DECCW)
OSL	Office of Strategic Lands
PNSW	Property New South Wales
RFEF	River-Flat Eucalypt Forest
SPW	Shale Plains Woodland
ToB	Top of Bank
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>

Executive summary

Eco Logical Australia Pty Ltd (ELA) was commissioned on behalf of GPNSW to prepare a Biodiversity Assessment for the Hurlstone Development Project, Glenfield ('The Project'), within the Campbelltown Local Government Area. The Project is an integral component of the revitalisation of the Glenfield area and part of the Glenfield to Macarthur Urban Renewal Corridor.

This Biodiversity Assessment has been prepared to identify any ecological constraints present within the subject site, including threatened species, populations and Threatened Ecological Communities (TECs) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The study area was surveyed by ecologists Rebecca Dwyer and Alex Gorey on 8 August 2016 for a total period of 14 person hours. This assessment was to validate vegetation communities against the Sydney Metropolitan Catchment Management Authority mapping (OEH 2013) and ensure that all potential habitat niches were examined. Threatened flora and fauna species with potential to occur within the study area were identified in the literature and data review.

A review of the vegetation mapping (OEH 2013) identified six vegetation types within the study area. The field survey confirmed the presence of Cumberland Shale Plains Woodland, Cumberland Riverflat Forest and Weeds and Exotics. The Cumberland Swamp Oak Riparian Forest was found to be Cumberland Riverflat Forest due to the presence of *Eucalyptus tereticornis* (Forest Red Gum). It was also noted that Urban Exotic/Native and Plantations were very similar and have been amalgamated into Planted Native vegetation (**Figure 2**).

Cumberland Shale Plains Woodland (SPW) is a component of the Critically Endangered Ecological Community (CEEC) *Cumberland Plain Woodland in the Sydney Basin Bioregion* (CPW) listed under the TSC Act and EPBC Act. Cumberland Riverflat Forest is a component of the Endangered Ecological Community (EEC) *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* (RFEF), listed under the TSC Act.

Twenty threatened flora species, 45 threatened and/or migratory fauna species and five endangered populations, listed under either the TSC Act and/or EPBC Act were identified by the data review as known, or with the potential, to occur within a 5 km radius of the study area. The likelihood of these species occurring on site is presented in **Appendix A**. No threatened flora and/or fauna species were recorded within the study area during the survey, however one migratory species, *Ardea ibis* (Cattle Egret), listed under the EPBC Act was recorded. Potential breeding and foraging habitat was also recorded within the study area for nine threatened fauna species and one additional migratory species.

Twenty significant plantings were identified within the HAHS site during field surveys. These plantings hold various historical significance for HAHS. The significance of each planting is provided **Section 4.6** and mapped in **Figure 3**.

The riparian corridors within the study area have been assessed in relation to the Water Management Act. The three watercourses mapped within the study area were classified as 1st order streams. The two southern 1st order streams and the northern portion of the stream within the north-eastern corner of the study area, do not meet the definition of a 'river' under the WM Act, due to their lack of channel bed and bank and therefore do not require protection or enhancement of riparian zones. Substantial modification is likely to have occurred around the creeks with previous use of the site, including removal of vegetation and grading. Four farm dams were also recorded within the study area. All dams were found to contain

no vegetation. For the 1st order watercourse in the north-eastern corner the Department of Primary Industries Water (DPI Water) guidelines recommends a 10 m riparian buffer from the 'top of bank' on either side.

The ecological constraints at the subject site are provided in **Figure 5**, these constraints are ranked as, high, moderate or low. Areas marked as 'low' constraint are considered to have minimal ecological value and are most suitable for development. Areas marked as 'moderate' constraint may be used for development, however contains TECs and have the potential to provide habitat for threatened species, therefore would require further assessment prior to any future development. Areas marked as 'high' constraint are driven by the presence of remnant patches of the TEC's CPW and RFEF, listed under the TSC Act, and significant plantings. These areas of high constraint should be avoided where possible.

Prior to any future development, targeted surveys would be required to clarify the importance of the habitats within the site for threatened fauna, in particular, the Cumberland Plain Land Snail.

Mitigation measures and environmental safeguards will assist in minimising potential impacts during any construction phase and have been provided in **Chapter 7**.

The proposed development has the opportunity to seek approval with the preparation of a Development Application (DA), under Part 4 of the EP&A Act. This would require the preparation of a Flora and Fauna Impact Assessment. Depending on the size of the proposed impact, the impacts to TEC's may be significant and therefore a Species Impact Statement may be required. There may also be options to explore attaining a BioCertification Statement which may allow clearing of parts of the site, while the remainder of the site would be placed under a BioBanking Agreement.

1 Introduction

Eco Logical Australia Pty Ltd (ELA) was commissioned on behalf of Government Property New South Wales (GPNSW) to prepare a Biodiversity Assessment for the Hurlstone Development Project, Glenfield ('The Project'), within the Campbelltown Local Government Area.

This Biodiversity Assessment has been prepared to identify any ecological constraints present within the subject site, including threatened species, populations and Threatened Ecological Communities (TECs) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The scope of this report does not include a detailed flora and fauna impact assessment.

1.1 Project background

The Project relates to the Minister for Education's announcement on 18 November 2015 regarding the establishment of a new Hurlstone Agricultural High School at the Western Sydney University Hawkesbury campus with the subject site, considered surplus and to be divested at the highest best value. The Project proposes for 192 ha of surplus land being made available for a number of uses including housing and schooling.

1.2 Location of the subject site and study area

The subject site comprises 192 ha of land bound by Railway Parade, Campbelltown Road, South West Motorway and the South West Rail link in Glenfield. The subject site is comprised of two parcels of State Government owned land, including:

- Department of Education land, comprising the Hurlstone Agricultural High School (HAHS) site and three schools for specific purposes (Lot 1 DP175963, Lot 21 & 22 DP1035516, Lot 1 DP177010 and Lot 5 DP808118 Roy Watts Road, Glenfield)
- Office of Strategic Lands (OSL) site located at Railway Parade, Glenfield adjacent to the HAHS site to the north and south of the South West Rail link at Glenfield (Lot 11 & 12 DP1201109 Railway Parade, Glenfield)

The 'subject site' is the area directly impacted upon by the proposal. The 'study area' includes all areas surveyed as part of this assessment that may be directly or indirectly impacted by the proposal, as shown in **Figure 1**.



Figure 1: Location of the subject site

2 Statutory framework

Commonwealth and State legislation and policies, as well as local policies apply to the assessment, planning and management of ecological issues within the study area. A brief outline of the relevant Commonwealth and State Acts and Policies, and local policies, are provided below.

Table 1: Legislative context

Name	Relevance to the project	Section in this report
Commonwealth		
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	<p>The primary objective of the EPBC Act is to 'provide for the protection of the environment, especially those aspects of the environment that are Matters of National Environmental Significance.'</p> <p>Environmental approvals under the EPBC Act are required for an 'action' that is likely to have a significant impact on Matters of National Environmental Significance (known as 'MNES') including:</p> <ul style="list-style-type: none"> • World Heritage Areas • National Heritage Places • Ramsar wetlands of international importance • Nationally listed threatened species and ecological communities • Listed migratory species • Commonwealth marine areas • Nuclear actions • Great Barrier Reef Marine Park. <p>MNES relevant to the study area are nationally threatened species and ecological communities and listed migratory species. Matters of NES that were recorded or have the potential to occur within the study area are listed in Appendix A.</p>	Section 4 and 5, Appendix A
State		
<i>Environmental Planning and Assessment Act 1979</i>	The EP&A Act is the principal planning legislation for NSW. It provides a framework for land use control and assessment, determination and management of development. Various legislation and instruments, such as the TSC Act, are integrated with the EP&A Act and have been reviewed separately.	Section 5
<i>Threatened Species Conservation Act 1995</i>	The TSC Act aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The Act is integrated with the NSW EP&A Act and requires consideration of whether a development (Part 4 of the EP&A Act) or an activity (Part 5 of the EP&A Act), is likely to significantly affect threatened species, populations and ecological communities or their habitats.	Section 4 and 5
<i>Noxious Weeds Act 1993</i>	The <i>Noxious Weeds Act 1993</i> (NW Act) defines the roles of government, councils, private landholders and public authorities in the management of noxious weeds. The Act sets up categorisation and control actions for the various noxious weeds, according to their potential to cause harm to our local environment.	Section 4

Name	Relevance to the project	Section in this report
	<p>The objectives of the NW Act include:</p> <ul style="list-style-type: none"> • To identify noxious weeds in respect of which particular control measures need to be taken. • To specify those control measures. • To specify the duties of public and private landholders as to the control of those noxious weeds. • To provide a framework for the State-wide control of those noxious weeds by the Minister and local control authorities. <p>Under this Act, noxious weeds have been identified for Local Government Areas (LGAs) and assigned Control Classes. Part 3 provides that occupiers of land (this includes owners of land) have responsibility for controlling noxious weeds on the land they occupy.</p>	
<p><i>Draft Campbelltown Local Environmental Plan 2014</i></p>	<p>The Campbelltown Local Environmental Plan (LEP) 2014, determines minimum subdivision lot size, tree preservation requirements. The removal of native vegetation is authorised by a development consent.</p>	<p>Section 7</p>

3 Methodology

3.1 Literature and data review

The following information and databases were reviewed prior to field survey:

- OEH Atlas of NSW Wildlife Database (OEH 2016)
- EPBC Act Protected Matters Search Tool (DotEE 2016)
- The Native Vegetation of the Sydney Metropolitan Area (OEH 2013)
- Historical Features and History of Hurlstone Agricultural High School (Johanna Leglise *et. al.* undated)
- Aerial photographs
- Site plans.

A search of the Atlas of NSW Wildlife and the EPBC Protected Matters Search Tool was performed on 4 August 2016, using a radius of 5 km around the coordinates -33.969928, 150.886151 (Datum GDA94). Species from the data searches were combined to produce a list of threatened fauna and flora species that may potentially utilise the study area, with an assessment of the likelihood of occurrence for each species included in **Appendix A**. The likely occurrence of each species was determined by reviewing records in the area, considering the habitat available and using expert knowledge of the ecology of each species.

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

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

3.2 Field survey

The study area was surveyed by ecologists Rebecca Dwyer and Alex Gorey on 8 August 2016 and Rebecca Dwyer on 23 August 2016 for a total period of 18 person hours. Temperature ranged from 4.4 – 18.6°C during the survey period and conditions were fine with little cloud cover (BOM 2016).

3.2.1 Vegetation communities

The entire study area was traversed slowly on foot, with all visible flora species identified. Each traverse included an assessment of all vegetation communities and their condition, floristic structure, and various microhabitats on site (e.g. hollow bearing trees). This assessment was to validate vegetation communities against the mapped vegetation (OEH 2013) and ensure that all potential habitat niches were examined.

The vegetation classification system used in this report follows the NSW Vegetation Classification and Assessment database (Benson 2006 & 2008), which are correlated with the OEH (2013) mapping units and TEC listings (OEH 2016, DotEE 2016).

3.2.2 Threatened flora

Targeted flora survey was not undertaken, however, opportunistic observations of threatened flora were recorded whilst traversing the site. Threatened flora with potential to occur within the study area were identified in the literature and data review.

3.2.3 Threatened fauna

Target surveys for threatened fauna were not undertaken. However, opportunistic observations of threatened fauna were noted, including mapping of hollow bearing trees. Habitat suitable for threatened fauna species (TSC Act and EPBC Act), where observed, was recorded within the study area.

3.2.4 Significant plantings

One ELA ecologist undertook a half day survey of the HAHS site to identify and map the significant planting identified in the Historical Features and History of Hurlstone Agricultural High School, prepared by Johanna Leglise *et. al.* (undated). Each significant planting was photographed and mapped using a hand held Geographic Positions System (GPS).

3.2.5 Riparian zones

The watercourse was traversed on foot to undertake a rapid appraisal of hydrology, physical form and streamside vegetation. Top of Bank (ToB) mapping was not undertaken but was estimated using desktop methods.

3.2.6 Survey limitations

Field surveys were conducted in August, which is outside of the optimal survey period for some flora and fauna. A conservative approach was taken in assuming the presence of species that could potentially occur in the subject site (that is, species were assessed to have the potential to be present even if the potential for this was low).

4 Results

4.1 Data and literature review

A review of the *The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles* (OEH 2013) identified six vegetation types within the study area:

- Cumberland Shale Plains Woodland
- Cumberland Riverflat Forest
- Cumberland Swamp Oak Riparian Forest
- Plantations
- Urban Exotic/Native
- Weeds and exotics.

Twenty threatened flora species listed under either the TSC Act and/or EPBC Act were identified by the data audit as known, or with the potential, to occur within a 5 km radius of the study area. The likelihood of these species occurring on site is presented in **Appendix A**.

A total of 45 threatened and/or migratory fauna species and five endangered populations, listed under either the TSC Act and/or EPBC Act were identified by the data audit as known, or with the potential, to occur within a 5 km radius of the study area. The likelihood of these species occurring on site is presented in **Appendix A**.

4.2 Existing environment

The study area is located to the south of Glenfield railway station and is situated within the broader context of the HAHS site which includes the Department of Education Glenfield office, school buildings, boarding houses, sports oval, Memorial Forest and educational farming land. Other land uses surrounding the subject site include Glenfield Park School (School for Specific Purposes), commuter car park to the south and farming land.

4.2.1 Memorial Forest

The Memorial Forest was established in 1950 by the staff and students of HAHS. Within the Memorial Forest, two trees are dedicated to VC John Edmondson and the land was blessed by members of the clergy. In 2015, a lone Pine tree was also planted within the forest.

4.3 Field survey

4.3.1 Vegetation communities

The field survey confirmed the presence of Cumberland Shale Plains Woodland, Cumberland Riverflat Forest and Weeds and Exotics. The Cumberland Swamp Oak Riparian Forest was found to be Cumberland Riverflat Forest due to the presence of *Eucalyptus tereticornis* (Forest Red Gum). It was also noted that Urban Exotic/Native and Plantations were very similar and have been amalgamated into Planted Native vegetation (**Figure 2**).

Cumberland Shale Plains Woodland (SPW) is a component of the Critically Endangered Ecological Community (CEEC) Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW) listed under the TSC Act and EPBC Act.

Cumberland Riverflat Forest is a component of the Endangered Ecological Community (EEC) River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (RFEF), listed under the TSC Act.

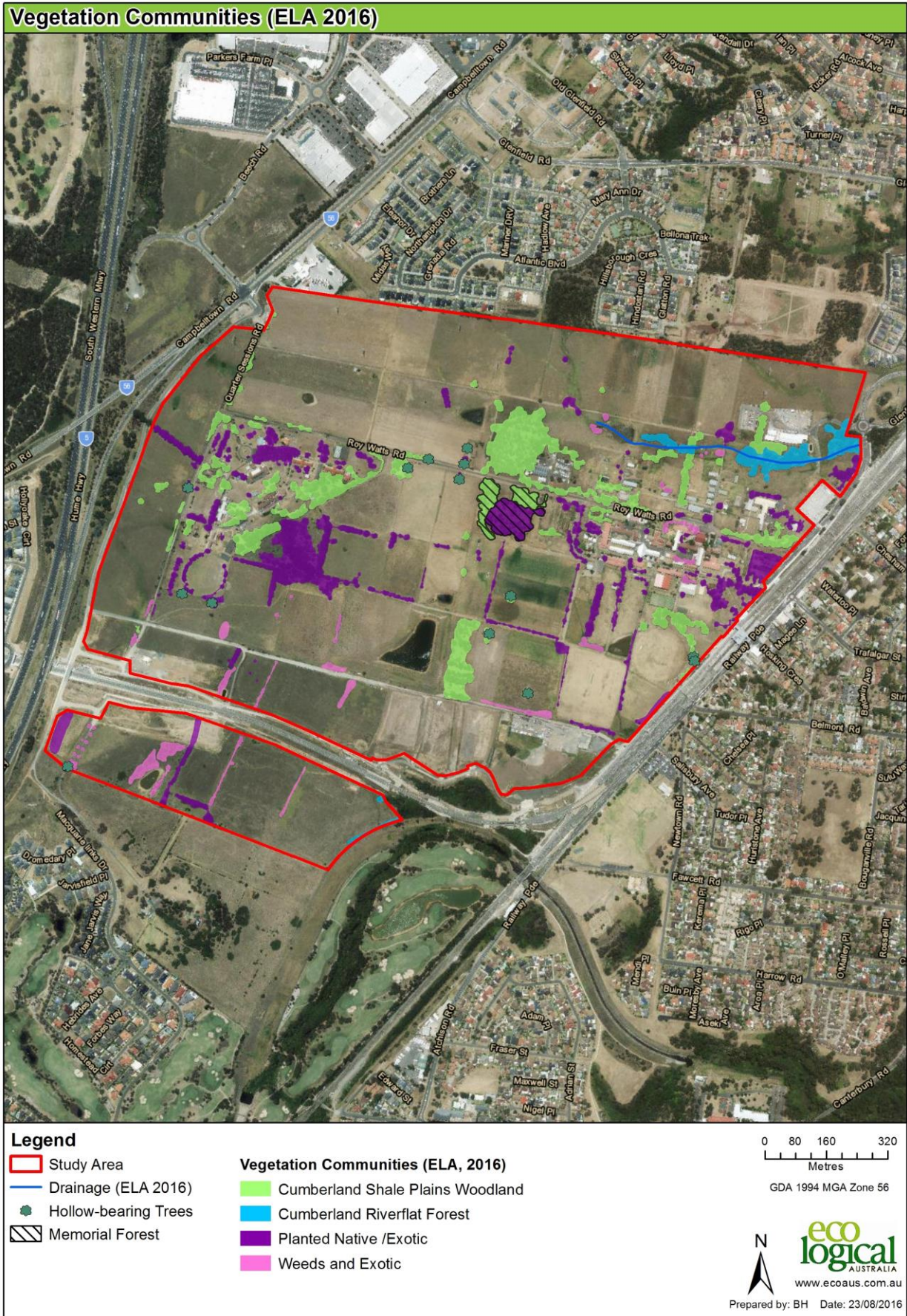


Figure 2: Vegetation mapping of the study area

Cumberland Shale Plains Woodland (SPW)

SPW is an open woodland dominated by a canopy of *Eucalyptus moluccana* (Grey Box) and *E. tereticornis* (Forest Red Gum), with *E. crebra* (Narrow-leaved Ironbark), *Corymbia maculata* (Spotted Gum) and *E. eugenioides* (Thin-leaved Stringybark) occurring less frequently. The shrub layer is dominated by *Bursaria spinosa* (Blackthorn), and it is common to find abundant grasses such as *Themeda triandra* (Kangaroo Grass) and *Microlaena stipoides* var. *stipoides* (Weeping Grass) (OEH 2016b).

The SPW identified within the study area was in two condition states, scattered paddock trees and remnant patches. The canopy consisted of *Eucalyptus tereticornis*, *E. moluccana*, *E. crebra* and *Corymbia maculata*. The mid-storey was sparse to absent consisting of *Bursaria spinosa*, *Acacia decurrens* (Black Wattle) and *Acacia falcata* (Hickory Wattle). The ground cover was <50% native consisting of sparse patches of *Themeda triandra*, *Microlaena stipoides* var. *stipoides*, *Chloris ventricosa* (Plump Windmill Grass), *Geranium solanderi* (Native Geranium), *Goodenia hederacea* (Forest Goodenia), *Dichondra repens* (Kidney Weed), *Einadia hastata* (Berry Saltbush) and *Glycine clandestina* (Twining Glycine) (**Plate 1** and **Plate 2**).

The dominant exotic species within the mid-storey included *Lycium ferocissimum* (African Boxthorn) and *Olea europaea* subsp. *cuspidata* (African Olive). Exotic grasses, forbs and creeper species dominated the groundcover including *Pennisetum clandestinum* (Kikuyu), *Paspalum dilatatum* (Paspalum), *Sida rhombifolia* (Arrowleaf Sida), *Senecio madagascariensis* (Fireweed) and *Verbena bonariensis* (Purple Top).

SPW is a component of the TEC Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW) listed as Critically Endangered under the TSC Act and the TEC Cumberland Plain Shale Woodlands and Shale-Gravel Forest listed as Critically Endangered under the EPBC Act. The majority of SPW remnant patches and scattered paddock trees recorded within the study area, were below the 0.5 ha threshold, therefore do not meet the EPBC condition thresholds for the CEEC. However, the patch of SPW to the north of Roy Watts Road is > 0.5 ha, but contains < 50% native grasses and forbs, and is also not contiguous with a native vegetation patch 5 ha or greater in size, therefore does not meet the EPBC condition thresholds for the CEEC (**Table 2**).

Table 2: Flowchart of key diagnostic features and condition thresholds to identify the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community (DEWHA 2010)

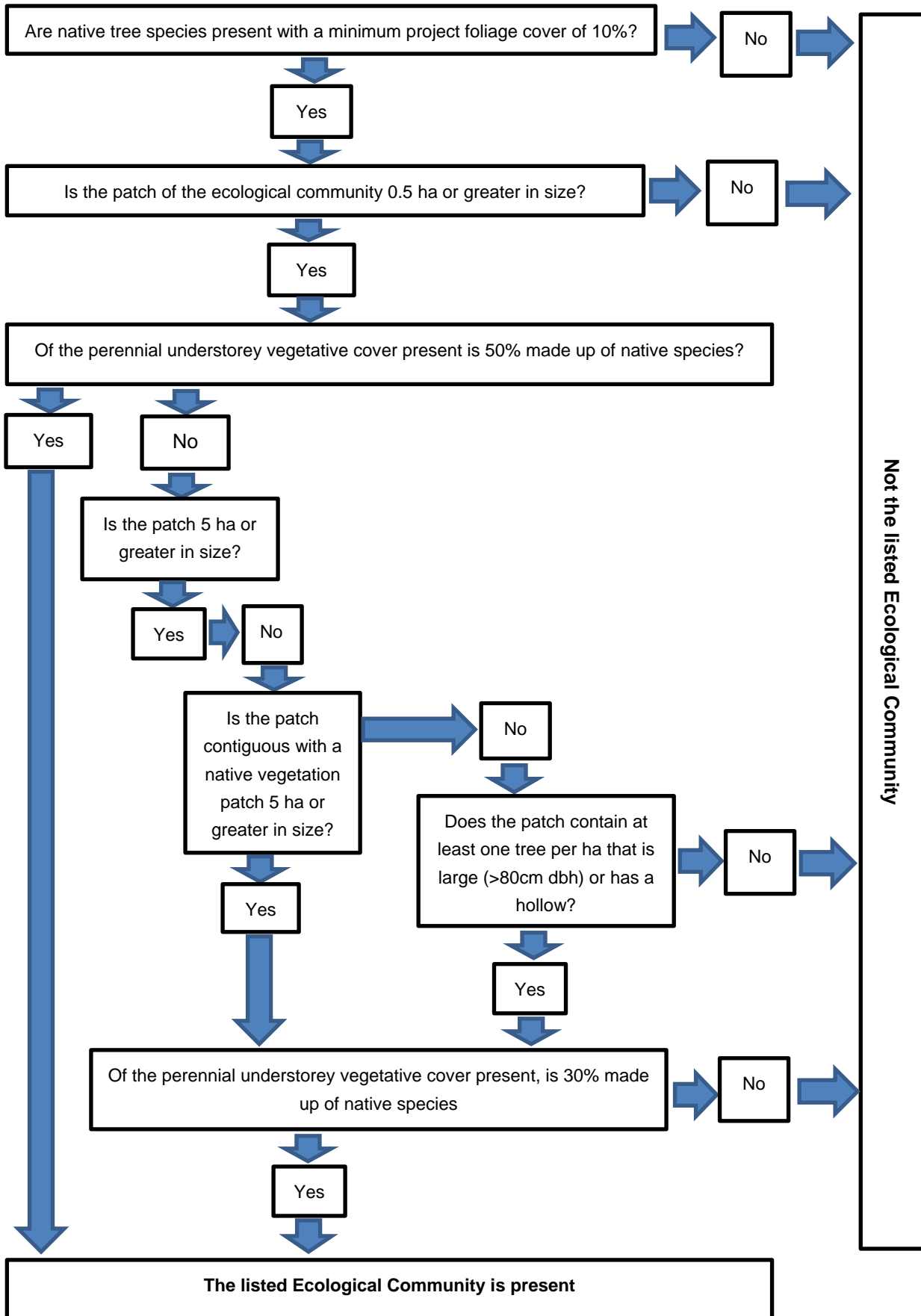




Plate 1: SPW scattered paddock trees recorded within the study area



Plate 2: Remnant SPW recorded within the study area

River-Flat Eucalypt Forest (RFEF)

RFEF is the name given to the ecological community associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. The composition of RFEF is primarily determined by the frequency and duration of waterlogging and the texture, nutrient and moisture content of the soil. The community is characterised by a canopy of *Casuarina cunninghamiana* subsp. *cunninghamiana* (River She-oak), *Casuarina glauca* (Swamp Oak), *Angophora floribunda* (Rough-barked Apple), *Eucalyptus amplifolia* (Cabbage Gum), *E. tereticornis* and *E. moluccana*. The midstorey consists of a small tree stratum of *Melaleuca decora* (White Feather Honeymyrtle), *Melaleuca styphelioides* (Prickly-leaved Paperbark), *Ozothamnus diosmifolius* (Rice Flower) and *Bursaria spinosa* (Sweet Bursaria). The ground cover is diverse consisting of native soft leaved herbs and grasses (OEH 2016b).

The RFEF identified within the study area consisted of a dense canopy of *Casuarina cunninghamiana* subsp. *cunninghamiana* with scattered occurrences of *Eucalyptus tereticornis* and *Angophora floribunda*. The mid-storey consisted of sparse patches of *Bursaria spinosa* (Sweet Bursaria). The ground cover contained < 50% native grasses and forbs including *Microlaena stipoides* var. *stipoides*, *Cynodon dactylon* (Couch), *Dichondra repens*, *Einadia hastata*, *Rumex brownii*, *Juncus usitatus* (Common Rush) and *Persicaria decipiens* (Slender Knotweed) (**Plate 3**).

The vegetation type was consistent with the EEC RFEF, listed under the TSC Act.

The dominant exotic species within the mid-storey included *Lycium ferocissimum* and *Olea europaea* subsp. *cuspidata*. Exotic grasses, forbs and creeper species dominated the groundcover including *Pennisetum clandestinum*, *Paspalum dilatatum*, *Tradescantia fluminensis* (Trad), *Sida rhombifolia*, *Senecio madagascariensis* and *Verbena bonariensis*.



Plate 3: RFEF recorded within the study area

Planted native vegetation

The planted native vegetation within the study area consisted of planted rows, with a canopy of *Eucalyptus tereticornis*, *E. moluccana*, *E. crebra*, *E. fibrosa* (Red Ironbark), *Corymbia maculata*, *Corymbia citriodora* (Lemon-scented Gum), *Eucalyptus microcorys* (Tallowood), *Eucalyptus leucoxylon* (Yellow Gum), *Melaleuca styphelioides* and *Grevillea robusta* (Silky Oak). The groundcover, consisted of mown exotic grasses and forbs including *Pennisetum clandestinum*, *Paspalum dilatatum*, *Sorghum* spp., *Lolium perenne*, *Sporobolus africanus*, *Briza minor*, *Senecio madagascariensis*, *Plantago lanceolata*, *Cirsium vulgare* and *Trifolium repens*. The vegetation type was not consistent with any threatened ecological community.



Plate 4: Planted native vegetation recorded within the study area

Weeds and exotics

The area of exotic vegetation across the study area is dominated by a mid-storey of *Olea europaea* subsp. *cuspidata*, *Lycium ferocissimum*, *Acacia baileyana* (Silver Wattle), and *Rubus fruticosus* spp. agg. (Blackberry), with a dense groundcover of *Pennisetum clandestinum*, *Paspalum dilatatum*, *Sida rhombifolia*, *Senecio madagascariensis* and *Verbena bonariensis* (**Plate 5**).

This vegetation community was not consistent with any threatened ecological community.



Plate 5: Weeds and exotics recorded within the study area

Cleared land

The area of cleared land across the study area was a mix of native and exotic species. The vegetation community was found to be heavily impacted by previous clearing and grazing activities and contained > 50% exotic cover including *Pennisetum clandestinum*, *Paspalum dilatatum*, *Sorghum* spp. (Sorghum), *Lolium perenne* (Perennial Rye-grass), *Chloris gayana* (Rhodes Grass), *Sporobolus africanus* (Parramatta Grass), *Briza minor* (Little Quaking Grass), *Senecio madagascariensis*, *Plantago lanceolata*, *Cirsium vulgare* (Spear Thistle), *Trifolium repens* (White Clover), *Sida rhombifolia* and *Verbena bonariensis*.

Microlaena stipoides var. *stipoides* was the most common native species in the pasture and is present throughout the site in varying densities. Other less common native species include *Chloris ventricosa*, *Cynodon dactylon*, *Geranium solanderi* and *Einadia hastata*.



Plate 6: Cleared land recorded within the study area

4.3.2 Flora

A total of 53 flora species were identified within the study area during field investigations, of which 24 were exotic species (**Appendix B**). Four noxious weeds, of which all were Weeds of National Significance (WoNS), were also recorded within the study area (**Appendix B**).

No threatened flora species were recorded within the study area during the survey.

4.3.3 Fauna

Opportunistic sightings of fauna were undertaken during the survey, with 19 fauna species recorded consisting of 14 indigenous bird species, one exotic birds, two amphibians and two exotic mammals (**Appendix C**).

4.3.4 Fauna habitat

A range of fauna habitat features were present throughout the study area:

- vegetated areas of tall open forest
- hollow bearing trees (HBT)
- dams
- pasture
- leaf litter/ woody debris.

Habitat within the study area provides potential foraging, breeding and nesting resources for a range of fauna. Fourteen HBT were recorded within the study area during field survey. The location of the HBT are shown in Error! Reference source not found.. The habitat features relevant to each fauna group are identified in **Table 3**.

Table 3: Key fauna habitat features present across the study area

Habitat features	Fauna species
Vegetated areas of tall open forest	Arboreal mammals, microchiropteran bats and owls
Hollow bearing trees	Habitat for birds, microchiropteran bats and marsupials
Dams	Amphibians, foraging for birds, microbats, reptiles and marsupials
Pasture	Birds, microchiropteran bats and reptiles
Leaf litter / woody debris	Foraging resources for birds, mammals, frogs and reptiles

4.4 Significant plantings

Twenty significant plantings were identified within the HAHS site during field surveys. The significance of each planting is described below and mapped in **Figure 3**.

4.4.1 The Railway Garden: Item 1

The Railway Garden is a sustainable garden, won in a competition held by Transport for NSW in 2012. The Glenfield sign was the original that lived at Glenfield station, and was given by Transport for NSW (Johanna Leglise *et. al.* undated) (**Plate 7**).



Plate 7: The Railway Garden

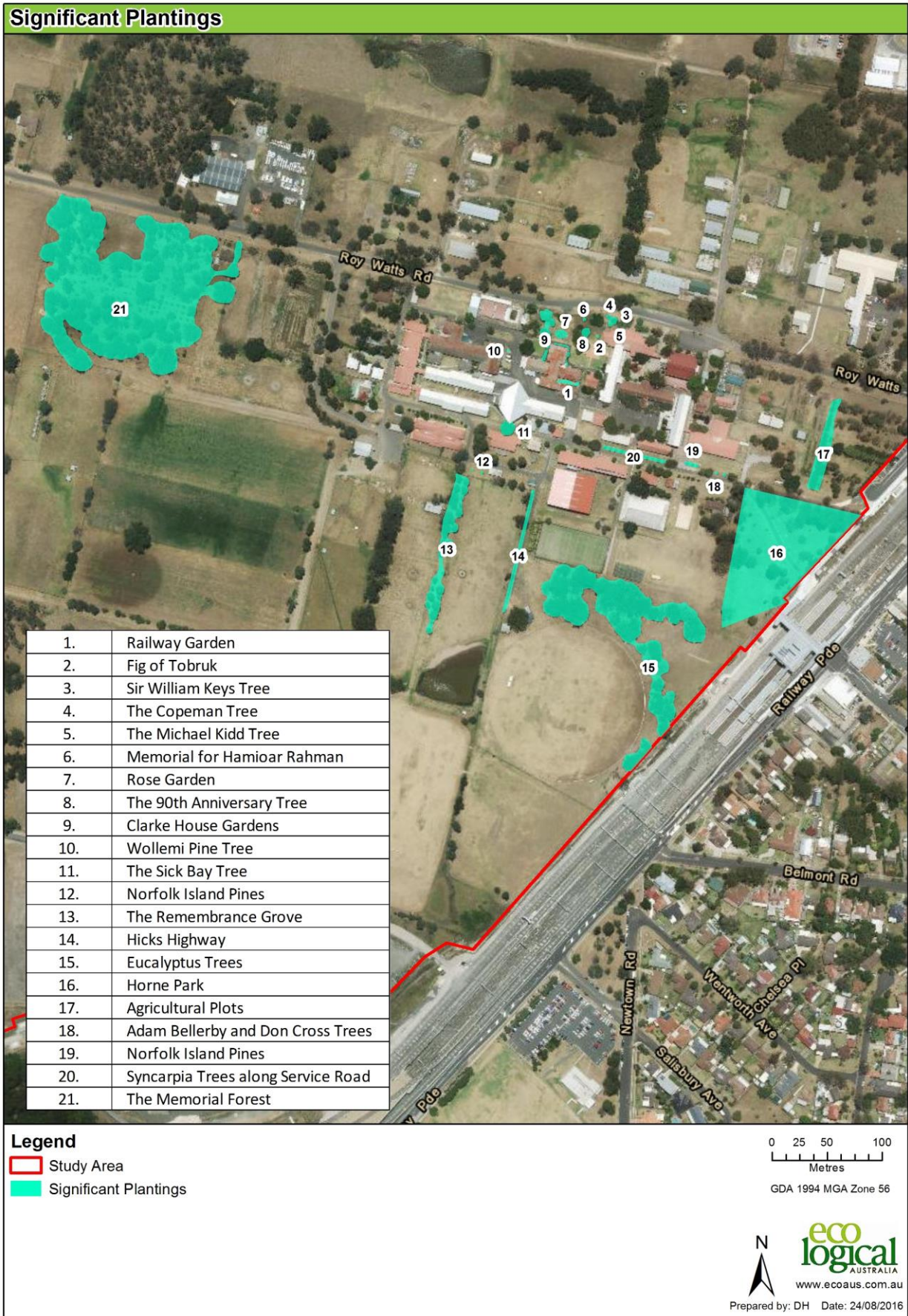


Figure 3: Significant plantings at HAHS

4.4.2 The Fig of Tobruk: Item 2

The Fig of Tobruk originated from Libya, symbolic of a great battle in WW2 that 'Old Boy' VC John Edmondson was involved in. Cuttings were taken from the fig, which resided in the middle of the battle field and planted on this site (Johanna Leglise *et. al.* undated) (**Plate 8**).



Plate 8: The Fig of Tobruk

4.4.3 Sir William Keys tree: Item 3

The Sir William Keys Tree was planted by Sir Will Keys (knighted for his Veteran Affairs and involvement in Korea/Malaysia War) in 1997 for the 90th anniversary of HAHS (Johanna Leglise *et. al.* undated) (**Plate 9**).



Plate 9: Sir William Keys Tree

4.4.4 The Copeman tree: Item 4

The Copeman Tree was planted on 21 June 2002, in honour of Trooper Russell James Copeman, 3 Special Service Air Squadron (SAS), who died on a Vietnamese tour of duty on 10 April 1967, aged 20. He was the only SAS serviceman to die in the Vietnam War from enemy action (Johanna Leglise *et. al.* undated) (**Plate 10**).



Plate 10: The Copeman Tree

4.4.5 The Michael Kidd tree: Item 5

The Michael Kidd tree was planted on 10 April 2003, in honour of the principal of HAHS from 1988- 2003 (Johanna Leglise *et. al.* undated) (**Plate 11**).



Plate 11: The Michael Kidd Tree

4.4.6 Memorial tree for Hamidar Rahman: Item 6

This tree was planted on 20 March 2002, by Year 9 students of the class of 2003, in memory of their classmate, Hamidar Rahman, who tragically passed away (Johanna Leglise *et. al.* undated) (**Plate 12**).



Plate 12: Memorial tree for Hamidar Rahman

4.4.7 The Rose Garden: Item 7

The Rose Garden located out the front of Clarke House contains a number of plaques to commemorate the HAHS staff who have passed away. Director General of Agriculture and 'Old Boy' Roy Watts and his wife, Alison, have been interred here (Johanna Leglise *et. al.* undated) (**Plate 13**).



Plate 13: The Rose Garden

4.4.8 The 90th Anniversary tree: Item 8

The 90th Anniversary Tree for HAHS was planted on 23 April 1997, by 'Old Boy' Tom Taylor. It has become practise for the oldest surviving 'Old Boy' and youngest Year 7 to plant the tree and cut a cake at each significant anniversary for HAHS (Johanna Leglise *et. al.* undated) (**Plate 14**).



Plate 14: the 90th Anniversary Tree

4.4.9 Clarke House Gardens: Item 9

The Clarke House Gardens have been established over time by the HAHS Environment Group, and are situated in various locations around the building (Johanna Leglise *et. al.* undated) (**Plate 15**).



Plate 15: One of the gardens surrounding Clarke House

4.4.10 Wollemi Pine tree: Item 10

The Wollemi Pine Tree was planted at the corner of A Block by the HAHS Environment Group. *Wollemia nobilis* (Wollemi Pine) is listed as critically endangered under the TSC Act and critically endangered under the EPBC Act (Johanna Leglise *et. al.* undated) (**Plate 16**).



Plate 16: Wollemi Pine at HAHS

4.4.11 The Sick Bay tree: Item 11

The Sick Bay tree is a Jacaranda (*Jacaranda mimosifolia*), planted next to the Sick Bay when it was being built. It is one of the biggest of its kind in Campbelltown (Johanna Leglise *et. al.* undated) (**Plate 17**).



Plate 17: The Sick Bay tree

4.4.12 The Norfolk Island Pines: Item 12

The Norfolk Island Pines (*Araucaria heterophylla*) are a group of two Norfolk Island Pines, planted in 2008 by the Norfolk Island Foote Foundation students attending at the time. There is a long and on-going history of Norfolk Islanders attending HAHS, dating back to pre- World War II (Johanna Leglise *et. al.* undated) (Plate 18).



Plate 18: Group of two Norfolk Island Pines

4.4.13 The Remembrance Grove: Item 13

The Remembrance Grove consists of planted *Corymbia maculata* (Spotted Gum) and were planted in the form of a cross and honour the 'Old Boys' who lost their lives during World Wars I and II (Johanna Leglise *et. al.* undated) (Plate 19).



Plate 19: Remembrance Grove**4.4.14 Hicks Highway: Item 14,**

The Hicks Highway was planted with 100 *Acmena smithii* (Lilly Pilly) shrubs in 2007, representing 100 years of HAHS (Johanna Leglise *et. al.* undated) (**Plate 20**).

**Plate 20: Hicks Highway****4.4.15 Eucalyptus trees: Item 15**

The Eucalyptus trees, surrounding Number One oval are planted *Corymbia maculata* (Spotted Gum), *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus microcorys* (Tallowwood). The trees, ranging from 100-200 years old, hold significance to the local Aboriginal groups. It is believed this area was a meeting place for Aboriginal women. Parts of the bark were used for medicinal healing for the Aboriginal communities (Johanna Leglise *et. al.* undated) (**Plate 21**).

**Plate 21: Eucalyptus trees surrounding Number One Oval**

4.4.16 Horne Park: Item 16

Horne Park was named after a former Head of Mathematics and Senior Resident master in the boarding school. Trees within this site are dedicated to various environmental groups and people (Johanna Leglise *et. al.* undated) (**Plate 22**).



Plate 22: Horne Park

4.4.17 The Agricultural Plots: Item 17

The Agricultural Plots were planted by the Agricultural Department in 1990, instructed by Head Teacher Rod Russel constructed to assist with the curriculum and utilised as learning tools for the HAHS students (Johanna Leglise *et. al.* undated) (**Plate 23**).



Plate 23: The Agricultural Plots

4.4.18 Adam Bellerby and Don Cross trees: Item 18

The Adam Bellerby and Don Cross trees were planted on 17 September 2004 by classmates to remember these friends who died at a young age (Johanna Leglise *et. al.* undated) (**Plate 24**).



Plate 24: Adam Bellerby & Don Cross trees:

4.4.19 The Norfolk Island Pines: Item 19

The Norfolk Island Pines (*Araucaria heterophylla*) are a group of three Norfolk Island Pines, planted in 2002 by the Norfolk Island Foote Foundation students attending at the time. There is a long and on-going history of Norfolk Islanders attending HAHS, dating back to pre- World War II (Johanna Leglise *et. al.* undated) (**Plate 25**).



Plate 25: Group of three Norfolk Island Pines

4.4.20 The *Syncarpia* trees: Item 20

The row of *Syncarpia glomulifera* (Turpentine) trees were planted by the Class of 1958. A plaque on the Music Block commemorates these plantings (Johanna Leglise *et. al.* undated) (**Plate 26**).



Plate 26: The *Syncarpia* trees

4.5 Riparian land

The riparian corridors within the study area were assessed in relation to the WM Act. The three watercourses mapped within the study area were classified as 1st order streams. The two southern 1st order streams and the northern portion of the watercourse within the north-eastern corner of the study area, do not meet the definition of a 'river' under the WM Act, due to their lack of channel bed and bank (Error! Reference source not found.). Substantial modification is likely to have occurred around the creeks with previous use of the site, including removal of vegetation and grading.

Four farm dams were also recorded within the study area. All dams were found to contain no vegetation (**Plate 27**).

DPI Water recommends riparian widths based on watercourse order under the Strahler method. The watercourse within the eastern corner of the study area was classified a 1st order stream, which requires a riparian corridor width of 10 m from the 'top of bank' on either side.

A desktop assessment of ToB was undertaken for the watercourse, within the study area using high resolution aerial photography and 2 m contour maps. Riparian corridor mapping, including desktop top of bank mapping is shown in **Figure 4**.



Plate 27: Farm dam recorded within the centre of the study area



Figure 4: Riparian mapping within the study area

5 Summary of biodiversity values

5.1 Threatened Ecological Communities

Two TECs were recorded within the study area during field survey:

- Cumberland Plain Woodland in the Sydney Basin Bioregion, listed as a CEEC under the TSC Act
- River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions, listed as an EEC under the TSC Act.

Removal of vegetation mapped as SPW or RFEF will require an assessment of significance consistent with s5A of the EP&A Act as part of a Development Application (DA).

5.2 Threatened flora

No threatened flora species were recorded within the study area during field survey, or predicted to occur.

5.3 Threatened and migratory fauna

No threatened fauna species were recorded within the subject site during field surveys, however one migratory species, *Ardea ibis* (Cattle Egret), listed under the EPBC Act was recorded.

Potential breeding and foraging habitat was recorded within the subject site for nine threatened fauna species and one additional migratory species:

- *Anthochaera phrygia* (Regent Honeyeater), listed as endangered under the TSC Act and EPBC Act
- *Apus pacificus* (Fork-tailed Swift), listed as migratory under the EPBC Act
- *Daphoenositta chrysoptera* (Varied Sittella), listed as vulnerable under the TSC Act
- *Glossopsitta pusilla* (Little Lorikeet), listed as vulnerable under the TSC Act
- *Meridolum corneovirens* (Cumberland Plain Land Snail), listed as endangered under the TSC Act
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat), listed as vulnerable under the TSC Act
- *Mormopterus norfolkensis* (Eastern Freetail-bat), listed as vulnerable under the TSC Act
- *Myotis macropus* (Southern Myotis), listed as vulnerable under the TSC Act
- *Phascolarctos cinereus* (Koala), listed as vulnerable under the TSC Act and EPBC Act
- *Pteropus poliocephalus* (Grey-headed Flying-fox), listed as vulnerable under the TSC Act and EPBC Act

The threatened/migratory fauna species listed above are known or likely to occur within a 5 km radius of the site.

5.4 Significant plantings

Twenty significant plantings were identified within the HAHS site during field surveys. These plantings hold various historical significance for HAHS. The significance of each planting is provided **Section 4.6** and mapped in Figure 3

6 Ecological constraints assessment

A constraint assessment was prepared to highlight any ecological constraints that any proposed development may encounter. A high, moderate and low ecological constraint ranking was identified for the site. The high constraints are driven by the presence of remnant patches of the TECs CPW and RFEF, listed under the TSC Act, riparian habitat under the WM Act and the significant plantings. These areas of high constraint should be avoided where feasibly possible.

Areas marked as 'moderate' constraint may be used for development, however contain EECs and have the potential to provide habitat for threatened species. Areas marked as 'low' constraint were considered to have minimal ecological significance and are most suitable for development.

The ecological constraints at the subject site are provided in **Figure 5** and discussed in **Table 4**.

Table 4: Constraint indicators

Ranking	Constraint ranking criteria	Presence of constraint on subject site
High	<ul style="list-style-type: none"> Remnant TECs listed under the TSC and/or EPBC Act Historical items Riparian habitat Threatened flora Threatened fauna breeding and/or foraging habitat previously recorded at the subject site 	<p>Yes - remnant patches of CPW and RFEF, listed under the TSC Act, present within the study area.</p> <p>The significant plantings for HAHS are present within the study area.</p> <p>Riparian corridor present within the eastern corner of the study area</p> <p>Potential habitat for threatened fauna species present within the remnant native vegetation community CPW.</p>
Moderate	<ul style="list-style-type: none"> Low condition Threatened Ecological Communities listed under the TSC and/or EPBC Act Habitat features present for common fauna species, such as hollow-bearing trees, fallen logs and rock outcrops 	<p>Yes - Low condition patches of CPW represented as scattered paddock trees, listed under the TSC Act, present within the study area.</p> <p>Hollow-bearing trees are also present within the study area</p>
Low	<ul style="list-style-type: none"> Exotic and/or planted vegetation 	<p>Yes - exotic and planted vegetation present within the study area.</p>

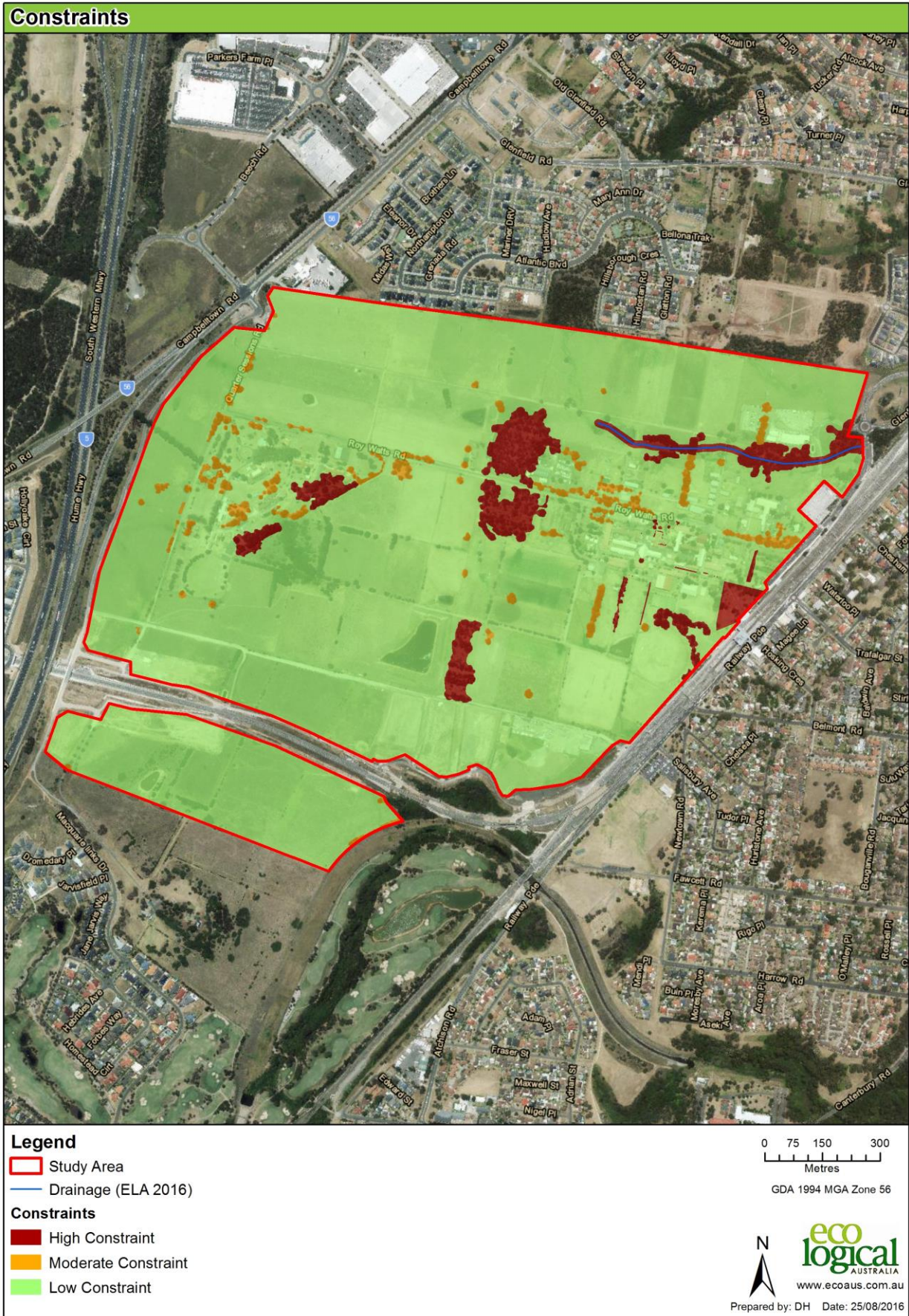


Figure 5: Ecological constraints within the study area

7 Recommendations

The constraints assessment determined that the study area contained high, moderate and low ecological values. The field survey confirmed the presence of remnant patches of the TECs CPW, listed as a CEEC under the TSC Act and EPBC Act, and RRFEF, listed as an EEC under the TSC Act. The historical Memorial Forest was also recorded within the study area.

The remnant patches of CPW and hollow bearing trees may also provide suitable habitat for threatened flora and/or fauna species.

Prior to any future development, targeted surveys would be required to clarify the importance of the habitats within the site for threatened fauna, in particular, the Cumberland Plain Land Snail.

A flora and fauna assessment should be undertaken to assess the potential impacts to the vegetation and threatened fauna habitats present and to recommend site specific mitigation measures. Depending on the size of the proposed impact, the impacts to TECs may be significant and therefore a Species Impact Statement (SIS) may be required.

7.1 Mitigation measures

The following measures and environmental safeguards may assist in minimising potential impacts during any construction phase. The measures would include:

- Clearly defined works zones to identify the locations of any 'no-go' areas within/adjacent to work site boundaries that are not to be in any way disturbed or damaged by the works. This would include retained vegetation and other habitat features.
- Sediment and erosion mitigation measures, such that any surface runoff is to be diverted away from areas of soil disturbance and to prevent tracking of soils/sediments from work sites to roadways, footpaths and drainage lines.
- Tree protection zones for trees that are to be retained.
- Trees to be removed are clearly marked and where possible, clearing of trees will be limited to trimming of branches rather than the removal of whole plants, such as those that over-hang the disturbance footprint.
- Materials, plant, equipment and stockpiles will be placed in a manner that prevents damage to any surrounding native vegetation.
- If any threatened species (flora or fauna) is discovered during the works, all work will stop immediately and the Project Manager will be notified. Work will only recommence once the impact on the species has been assessed and appropriate control measures provided.
- A weed control strategy to appropriately remove and dispose of any weeds requiring removal during the works program, and to prevent the spread of any noxious weeds as a result of undertaking the works.

7.2 Development opportunities

- The planning approvals pathways considered appropriate for development of the subject site include:
 - Planning proposal to rezone the land, and subsequent development application (DA) to Council, under Part 4 of the EP&A Act. This would require the following:

- Preparation of a Flora and Fauna Impact Assessment including the preparation of assessments of significance under the EP&A Act and/or EPBC Act for TECs and threatened species.
 - Depending on the size of the proposed impact, the impacts to the CEEC CPW may be significant and therefore a SIS may be required.
- There may be options to explore attaining a BioCertification which may allow clearing of parts of the site, while the remainder of the site would be placed under a BioBanking Agreement. This may satisfy local and State statutory requirements. BioCertification must be proposed by a planning authority, such as a local council, and can take a long time to reach agreement. There are risks associated with pursuing BioBanking agreements that may affect the development outcomes for this site:
 - The cost of administering the site may become prohibitive
 - The cost to manage the site may become prohibitive and therefore not economically viable for the landholder
 - The cost of attaining both a Statement and Agreement may not be economically viable for a development proponent.
- There are proposed changes to environmental legislation in NSW. There is a proposed Biodiversity Conservation Bill, which may alter some of the options currently available. It is unclear when this legislation would be enacted and what the implications might be for proposed larger scale developments seeking either certification or other offsetting arrangements.

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Appendix A : Likelihood of occurrence table

FLORA SPECIES

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	Ecology	Likelihood of occurrence
<i>Acacia bynoeana</i>	Bynoe's Wattle	E1	V	Found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains.	Heath or dry sclerophyll forest on sandy soils.	Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	Unlikely, lack of suitable habitat
<i>Acacia pubescens</i>	Downy Wattle	V	V	Restricted to the Sydney region around the Bankstown-Fairfield-Rookwood and Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon.	Open woodland and forest, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. Occurs on alluviums, shales and at the intergrade between shales and sandstones.	Flowers from August to October. The pods mature in October to December. Recruitment is more commonly from vegetative reproduction than from seedlings. The percentage of pod production and seed fall for this species appears to be low.	Unlikely, not recorded during field surveys
<i>Allocasuarina glareicola</i>		E1	E	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool.	Castlereagh woodland on lateritic soil. Found in open woodland with <i>Eucalyptus parramattensis</i> , <i>Eucalyptus fibrosa</i> , <i>Angophora bakeri</i> , <i>Eucalyptus sclerophylla</i> and <i>Melaleuca decora</i> .	Common associated understorey species include <i>Melaleuca nodosa</i> , <i>Hakea dactyloides</i> , <i>Hakea sericea</i> , <i>Dillwynia tenuifolia</i> , <i>Micromyrtus minutiflora</i> , <i>Acacia elongata</i> , <i>Acacia brownei</i> , <i>Themeda australis</i> and <i>Xanthorrhoea minor</i> . Not killed outright by fire but resprouts from the rootstock. Spreads by vegetative means, such that clumps of up to 100s of stems may be a single individual.	Unlikely, lack of suitable habitat
<i>Asterolasia elegans</i>		E1	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area.	Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys.	The canopy at known sites includes <i>Syncarpia glomulifera</i> subsp. <i>glomulifera</i> (Turpentine), <i>Angophora costata</i> (Smooth-barked Apple), <i>Eucalyptus piperita</i> (Sydney Peppermint), <i>Allocasuarina torulosa</i> (Forest Oak) and <i>Ceratopetalum gummiferum</i> (Christmas Bush). Ecological knowledge about this species is very limited. The species is considered to be fire sensitive and reliant on seed germination after disturbance to maintain populations. A soil seedbank appears to be established by this species, so for a number of years following fire or other disturbance the species may not be apparent, but be present only as seed in the soil.	Unlikely, lack of suitable habitat

<i>Callistemon linearifolius</i>	Netted Bottle Brush	V		Georges River to Hawkesbury River in the Sydney area (limited to the Hornsby Plateau area), and north to the Nelson Bay area of NSW. Also Coalcliff in the northern Illawarra.	Dry sclerophyll forest.	Flowers spring – summer.	Unlikely, lack of suitable habitat
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V	In NSW, recorded mainly on coastal and near coastal ranges north from Victoria to near Forster, with two isolated occurrences inland north-west of Grafton.	Coastal heathlands, margins of coastal swamps and sedgeland, coastal forest, dry woodland, and lowland forest.	The larger populations typically occur in woodland dominated by <i>Eucalyptus sclerophylla</i> (Scribbly Gum), <i>E. sieberi</i> (Silvertop Ash), <i>Corymbia gummifera</i> (Red Bloodwood) and <i>Allocasuarina littoralis</i> (Black Sheoak); appears to prefer open areas in the understorey of this community. Being leafless it is expected to have limited photosynthetic capability and probably depends upon a fungal associate to meet its nutritional requirements from either living or dead organic material. In addition to reproducing from seed, it is also capable of vegetative reproduction and thus forms colonies which can become more or less permanent at a site.	Unlikely, lack of suitable habitat
<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E1	E	Has been recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens.	Dry sclerophyll forest and moss gardens over sandstone.	Flowers February to March.	Unlikely, lack of suitable habitat
<i>Gyrostemon thesioides</i>		E1		Within NSW, only ever recorded at three sites to the west of Sydney, near the Colo, Georges and Nepean Rivers.	Hillsides and riverbanks; may be restricted to fine sandy soils.	A fire-opportunist, with recruitment occurring from a soil stored seed bank following fire. Adult plants are killed by fire. Plants reach maturity in less than a year and plants are presumably short-lived.	Unlikely, lack of suitable habitat
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	E2		Razorback Range, also recorded at Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys.	Vine thickets and open shale woodland.		Unlikely, lack of suitable habitat
<i>Melaleuca deanei</i>	Deane's Paperbark	V	V	Ku-ring-gai/Berowra area, Holsworthy/Wedderburn area, Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas.	Heath on sandstone.	Flowers appear in summer but seed production appears to be small and consequently the species exhibits a limited capacity to regenerate.	Unlikely, lack of suitable habitat
<i>Persoonia hirsuta</i>	Hairy Geebung	E1	E	Scattered distribution around Sydney, from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west.	Sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	It is usually present as isolated individuals or very small populations. It is probably killed by fire (as other Persoonia species are) but will regenerate from seed.	Unlikely, lack of suitable habitat
<i>Persoonia nutans</i>	Nodding Geebung	E1	E	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south.	Northern populations: sclerophyll forest and woodland (Agnes Banks Woodland, Castlereagh Scribbly Gum Woodland and Cooks River / Castlereagh Ironbark Forest) on aeolian and alluvial sediments. Southern populations: tertiary alluvium, shale sandstone transition communities and Cooks River / Castlereagh Ironbark Forest.	Peak flowering is from November to March with sporadic flowering all year round. An obligate seed regenerator. Seed germination is promoted by fire and also by physical disturbance. Although listed as a short-lived species much of the ecology is poorly known. Maturity is expected in about 10 years.	Unlikely, not recorded during field surveys

<i>Pimelea curviflora</i> var. <i>curviflora</i>		V	V	Confined to the coastal area of the Sydney and Illawarra regions between northern Sydney and Maroota in the north-west and Croom Reserve near Albion Park in the south.	Woodland, mostly on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes.	Flowers October to May. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots. Likely to be fire tolerant species capable of resprouting following fire due to the presence of a tap root. Seedlings have been observed following fire.	Unlikely, lack of suitable habitat
<i>Pimelea spicata</i>	Spiked Rice-flower	E1	E	Two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama).	Well-structured clay soils. <i>Eucalyptus moluccana</i> (Grey Box) communities and in areas of ironbark on the Cumberland Plain. Coast Banksia open woodland or coastal grassland in the Illawarra.	Mature plants spread over short distances through underground rhizomes. Flowers may be self-pollinating, although fruit production is variable. A soil seedbank develops and is maintained in the presence of a suitable disturbance regime.	Unlikely, lack of suitable habitat
<i>Pomaderris brunnea</i>	Brown Pomaderris	E	V	In NSW, found around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands.	Moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Flowers appear in September and October. The species has been found in association with <i>Eucalyptus amplifolia</i> , <i>Angophora floribunda</i> , <i>Acacia parramattensis</i> , <i>Bursaria spinosa</i> and <i>Kunzea ambigua</i> .	Unlikely, lack of suitable habitat
<i>Pterostylis gibbosa</i>	Illawarra Greenhood	E1	E	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra).	Open forest or woodland, on flat or gently sloping land with poor drainage.	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. After a spring flowering, the plant begins to die back and seed capsules form (if pollination has taken place).	Unlikely, lack of suitable habitat
<i>Pterostylis nigricans</i>	Dark Greenhood	V		North-east NSW north from Evans Head, and in Qld.	Coastal heathland with <i>Banksia ericifolia</i> (Heath Banksia), and lower-growing heath with lichen-encrusted soil surfaces, on sandy soils.		Unlikely, lack of suitable habitat
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E1	E	Restricted to western Sydney between Freemans Reach in the north and Picton in the south.	Small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines, adjacent to sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	All species of <i>Pterostylis</i> are deciduous and die back to fleshy, rounded underground tuberoids. The time of emergence and withering has not been recorded for this species, however flowering occurs from October to December and may vary due to climatic conditions. The above ground parts of the plant wither and die following seed dispersal and the plant persists as a tuberoid until the next year. Typically occurs as scattered individuals or in small groups.	Unlikely, lack of suitable habitat
<i>Pultenaea pedunculata</i>	Matted Bush-pea	E1		In NSW it is represented by just three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn.	Woodland, sclerophyll forest, road batters and coastal cliffs.	Flowers appear in spring (August to December), with fruit maturing from October to January but sometimes persistent on the plant until April-May. Few young plants have been seen (no seedlings) and the suggestion is that there will be germination after disturbance as well as after fire, although the fire response is unknown.	Unlikely, not recorded during field surveys
<i>Thesium australe</i>	Austral Toadflax	V	V	In eastern NSW it is found in very small populations scattered along the coast, and from the Northern to Southern Tablelands.	Grassland on coastal headlands or grassland and grassy woodland away from the coast.	Often found in association with <i>Themeda australis</i> (Kangaroo Grass). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass. Flowers in spring.	Unlikely, lack of suitable habitat

FAUNA SPECIES

Class	Family	Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Distribution	Habitat	Ecology	Likelihood of occurrence
Aves	Meliphagidae	<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A	E	Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North-West Plains, North-West and South-West Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions; also recorded in the Central Coast and Hunter Valley regions.	Eucalypt woodland and open forest, wooded farmland and urban areas with mature eucalypts, and riparian forests of <i>Casuarina cunninghamiana</i> (River Oak).	Two of three known key breeding areas are in NSW: the Capertee Valley and Bundarra-Barraba region. The species breeds between July and January and usually nests in horizontal branches or forks in tall mature eucalypts and Sheoaks. The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes.	Potential
Aves	Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift	P	C,J,K, Mar	Recorded in all regions of NSW.	Riparian woodland, swamps, low scrub, heathland, saltmarsh, grassland, Spinifex sandplains, open farmland and inland and coastal sand-dunes.	Non-breeding visitor to all states and territories of Australia, arriving from its breeding grounds in Siberia around October, and departing in April. The species is thought to be highly mobile within Australia, moving across the country in search of food. They probably roost aerially.	Potential
Aves	Ardeidae	<i>Ardea ibis</i>	Cattle Egret	P	C,J, Mar	Recorded in all regions of NSW.	Grasslands, wooded lands and terrestrial wetlands.	Uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. The Cattle Egret often forages away from water on low lying grasslands, improved pastures and croplands. It is commonly found amongst livestock.	Known
Aves	Ardeidae	<i>Ardea alba</i>	Great Egret	P	C, J, Mar	Widespread, occurring across all states/territories. Also a vagrant on Lord Howe and Norfolk Island.	Swamps and marshes, grasslands, margins of rivers and lakes, salt pans, estuarine mudflats and other wetland habitats.	Mostly forages in shallow to moderately deep water for fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammals. In NSW, most breeding colonies are located in the Darling Riverine Plains region and the Riverina region. Breeding sites are located in wooded and shrubby swamp. The breeding season generally extends from November to April.	Unlikely, lack of suitable habitat
Aves	Ardeidae	<i>Botaurus poiciloptilus</i>	Australasian Bittern	E1	E	Found over most of NSW except for the far north-west.	Permanent freshwater wetlands with tall, dense vegetation, particularly <i>Typha</i> spp. (bullrushes) and <i>Eleocharis</i> spp. (spikerushes).	Feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds.	Unlikely, lack of suitable habitat
Aves	Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-curlew	E1		In NSW, found sporadically in coastal areas, and west of the divide throughout the sheep-wheat belt.	In NSW, it occurs in lowland grassy woodland and open forest.	It forages nocturnally in irrigated paddocks, grasslands, woodlands, domestic gardens, saltmarsh, mangroves, and playing fields. Feeds on a wide variety of invertebrates, seeds, small fruit, crustaceans, molluscs, frogs, lizards, snakes and mice. It roosts during the day in or near woodland remnants amongst fallen timber or ground litter. The nest site is typically in or near the edge of open grassy woodland or within a cleared paddock, and the breeding season is between spring and early summer.	Unlikely, lack of suitable habitat

Aves	Cacatuidae	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo population in the Hornsby and Kuring-gai Local Government Areas	E2,V		The population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east.	Forest and woodland, urban fringes.	Old growth attributes required for nesting and roosting purposes. Also utilises less heavily timbered woodlands and urban fringe areas to forage, but appears to favour well-timbered country. Individuals are likely to move outside the 'defined' population boundary in the general area and should still be considered of this population. Last known breeding population in the Sydney Metropolitan area, of between 18 - 40 pairs.	No, outside of population distribution
Aves	Cacatuidae	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V		In NSW, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. Isolated records known from as far north as Coffs Harbour and as far west as Mudgee.	Tall mountain forests and woodlands in summer; in winter, may occur at lower altitudes in open eucalypt forests and woodlands, and urban areas.	Favours old growth attributes for nesting and roosting.	Unlikely, lack of suitable habitat
Aves	Cacatuidae	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo, Riverina population	E2,V		Within the Narrandera Range and to the north-west in the Brobenah Hills, McPhersons Range, Cocoparra Range, Lachlan Range and Jimberoo State Forests, and the Naradhan Range.	Largely restricted to hills and low ridges where suitable stands of its food plant <i>Allocasuarina verticillata</i> (Drooping Sheoak) remain.	Requires large tree-hollows for breeding. Areas adjacent to drainage lines may be preferred for nesting. The diet consists almost exclusively of sheoak seeds, especially Drooping Sheoak for the Riverina population.	No, outside of population distribution
Aves	Cacatuidae	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V		In NSW, widespread along coast and inland to the southern tablelands and central western plains, with a small population in the Riverina.	Open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur.	Feeds almost exclusively on the seeds of several species of she-oak (<i>Casuarina</i> and <i>Allocasuarina</i> species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.	Unlikely, lack of suitable habitat
Mammalia	Vespertilionidae	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Recorded from Rockhampton in Qld south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney basin and the NSW north-west slopes.	Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country.	Roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces. It also possibly roosts in the hollows of trees. The species is thought to require roosting habitat that is adjacent to higher fertility sites which are used for foraging. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.	Potential, foraging habitat only
Aves	Accipitridae	<i>Circus assimilis</i>	Spotted Harrier	V		Found throughout the Australian mainland, except in densely forested or wooded habitats, and rarely in Tasmania.	Grassy open woodland, inland riparian woodland, grassland, shrub steppe, agricultural land and edges of inland wetlands.	Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Preys on terrestrial mammals (e.g. bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion.	Unlikely, lack of suitable habitat
Aves	Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		Distribution in NSW is nearly continuous from the coast to the far west.	Inhabits eucalypt forests and woodlands, mallee and <i>Acacia</i> woodland.	Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Potential
Aves	Dasyornithidae	<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E1	E	There are three main populations: Northern - southern Qld/northern NSW, Central - Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern - Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border.	Central and southern populations inhabit heath and open woodland with a heathy understorey. In northern NSW, habitat comprises open forest with dense tussocky grass understorey.	Feeds on a variety of insects, particularly ants. Nests are elliptical domes constructed on or near the ground amongst dense vegetation. Two eggs are laid during August to February.	Unlikely, lack of suitable habitat

Aves	Falconidae	<i>Falco subniger</i>	Black Falcon	V		Sparsely distributed in NSW, occurring mostly in inland regions.	Woodland, shrubland and grassland, especially riparian woodland and agricultural land. Often associated with streams or wetlands.	Black Falcons nest in winter to late spring in the old stick nests of corvids or sometimes other raptor species. These tend to be located at the top of emergent trees in woodland, particularly riparian woodland. Feeds mostly on other birds, especially ground-feeding granivores such as pigeons and parrots, but also small mammals, large insects and occasionally carrion.	Unlikely, lack of suitable habitat
Mammalia	Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range.	Tall (greater than 20m) moist habitats.	Predominately roosts in Eucalypt tree hollows. It has also been found to roost under loose bark on trees and in man-made structures. It hunts beetles, moths, weevils and other flying insects above or just below the tree canopy, in open forests. Hibernates in winter. Females are pregnant in late spring to early summer.	Unlikely, lack of suitable habitat
Aves	Scolopacidae	<i>Gallinago hardwickii</i>	Latham's Snipe	P	C,J,R, Mar	Migrant to east coast of Australia, extending inland west of the Great Dividing Range in NSW.	Freshwater, saline or brackish wetlands up to 2000 m above sea-level; usually freshwater swamps, flooded grasslands or heathlands.	Non-breeding migrant to Australia, arriving between July-November from its breeding grounds in Japan and far-eastern Russia, and departing by late February. It feeds in mud or in very shallow water with low, dense vegetation. Roosting occurs on the ground near or in foraging areas beside or under clumps of vegetation, among dense tea-tree, in forests, in drainage ditches or plough marks, among boulders, or in shallow water if cover is unavailable.	Unlikely, lack of suitable habitat
Aves	Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet	V		In NSW, found from the coast westward as far as Dubbo and Albury.	Dry, open eucalypt forests and woodlands, including remnant woodland patches and roadside vegetation.	Nomadic movements are common, influenced by season and food availability. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts. Nesting season extends from May to September.	Potential
Aves	Meliphagidae	<i>Grantiella picta</i>	Painted Honeyeater	V		Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas.	Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.	A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> . Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.	Unlikely, lack of suitable habitat
Aves	Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	P	C	Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia.	Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas.	The breeding season extends from June to January (or sometimes February) in southern Australia. Breeding habitat is usually close to water, but may occur up to a kilometre away. Nests are mainly located in tall open forest or woodland, but sometimes in other habitats such as dense forest, closed scrub or in remnant trees on cleared land. The White-bellied Sea-Eagle feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion and offal.	Unlikely, lack of suitable habitat
Amphibia	Myobatrachidae	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	South eastern NSW and Victoria, in two distinct populations: a northern population in the sandstone geology of the Sydney Basin as far south as Ulladulla, and a southern population	Heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water. This species breeds mainly in autumn, but has been	Unlikely, lack of suitable habitat

						occurring from north of Narooma through to Walhalla, Victoria.		recorded calling throughout the year. Egg masses are foamy with an average of approximately 500-800 eggs and are laid in burrows or under vegetation in small pools. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter.	
Aves	Accipitridae	<i>Hieraaetus morphnoides</i>	Little Eagle	V		Throughout the Australian mainland, with the exception of the most densely-forested parts of the Dividing Range escarpment.	Open eucalypt forest, woodland or open woodland, including sheoak or <i>Acacia</i> woodlands and riparian woodlands of interior NSW.	Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	Unlikely, lack of suitable habitat
Aves	Apodidae	<i>Hirundapus caudacutus</i>	White-throated Needletail	P	C,J,K	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide.	Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland.	Breeds in eastern Siberia, north-eastern China and Japan. The species arrives in Australia in September–October, and most depart by April. It almost always forages aerially. Recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows.	Unlikely, lack of suitable habitat
Reptilia	Elapidae	<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E1	V	Largely confined to Triassic and Permian sandstones within the coast and ranges in an area within approximately 250 km of Sydney.	Dry and wet sclerophyll forests, riverine forests, coastal heath swamps, rocky outcrops, heaths, grassy woodlands.	Nocturnal. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer. Feeds mostly on geckos and small skinks; will also eat frogs and small mammals occasionally. Females produce four to 12 live young from January to March.	No, lack of suitable habitat
Amphibia	Hylidae	<i>Litoria aurea</i>	Green and Golden Bell Frog	E1	V	Since 1990, recorded from ~50 scattered sites within its former range in NSW, from the north coast near Brunswick Heads, south along the coast to Victoria. Records exist west to Bathurst, Tumut and the ACT region.	Marshes, dams and stream-sides, particularly those containing <i>Typha</i> spp. (bullrushes) or <i>Eleocharis</i> spp. (spikerushes). Some populations occur in highly disturbed areas.	The species is active by day and usually breeds in summer when conditions are warm and wet. Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation. Tadpoles feed on algae and other plant-matter; adults eat mainly insects, but also other frogs.	No, lack of suitable habitat
Amphibia	Hylidae	<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V	V	Plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest south to Buchan in Victoria. The species has not been recorded in southern NSW within the last decade.	Breeding habitat is the upper reaches of permanent streams and perched swamps. Non-breeding habitat is heath-based forests and woodlands	Breeding is triggered by heavy rain and can potentially occur all year, but is usually from late summer to early spring. Males call from low vegetation close to slow flowing pools. Eggs are laid in loose gelatinous masses attached to small submerged twigs. Eggs and tadpoles are mostly found in still or slow flowing pools that receive extended exposure to sunlight. Shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground.	No, lack of suitable habitat
Amphibia	Hylidae	<i>Litoria raniformis</i>	Southern Bell Frog	E1	V	In NSW, only known to exist in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. A few recent unconfirmed records have also been made in the Murray Irrigation Area.	Permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/ <i>Typha</i> swamps and River Red Gum swamps or billabongs along floodplains and river valleys. Also found in irrigated rice crops.	Breeding occurs during the warmer months and is triggered by flooding or a significant rise in water levels. The species has been known to breed anytime from early spring through to late summer/early autumn. Outside the breeding season animals disperse away from the water and take shelter beneath ground debris such as fallen timber and bark, rocks, grass clumps and in deep soil cracks. Prey includes a variety of invertebrates as well as other small frogs, including young of their own species.	No, lack of suitable habitat

Aves	Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite	V		In NSW, it is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast.	Timbered habitats including dry woodlands and open forests, particularly timbered watercourses.	It is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Appears to occupy large hunting ranges of more than 100km ² . Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	Unlikely, lack of suitable habitat
Gastropoda	Camaenidae	<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E1		Areas of the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool, west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains.	Primarily inhabits Cumberland Plain Woodland. Also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest.	Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Can dig several centimetres into soil to escape drought. It is a fungus specialist and is generally active at night. Little is known of its breeding biology. It is known to be hermaphroditic, laying clutches of 20-25 small, round, white eggs in moist, dark areas (such as under logs).	Potential
Aves	Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	P	J	Distributed across much of mainland Australia, including NSW.	Open forests and woodlands, shrublands, farmland, areas of human habitation, inland and coastal sand dune systems, heathland, sedgeland, vine forest and vine thicket.	The breeding season extends from August to January. The nest is constructed in an enlarged chamber at the end of long burrow that is excavated by both sexes. Populations that breed in southern Australia are migratory, birds moving north to northern Australia, Papua New Guinea and eastern Indonesia after breeding, and remaining there for the duration of the Australian winter. Its diet mainly consists of bees and wasps.	Unlikely, lack of suitable habitat
Mammalia	Vespertilionidae	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V		In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga.	Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland.	It forages above and below the tree canopy on small insects, especially moths. The bats congregate at the same maternity roosts each year to give birth and rear young. In the southern part of the species' range this occurs during spring. Maternity roosts may be located in caves, abandoned mines, concrete bunkers and lava tubes. Over-wintering roosts used outside the breeding period include cooler caves, old mines, and stormwater channels, under bridges and occasionally buildings.	Potential, foraging habitat only
Aves	Dicruridae	<i>Monarcha melanopsis</i>	Black-faced Monarch	P	Bonn, Mar	In NSW, occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Widden Valley, Wollemi National Park and Wombeyan Caves. It is rarely recorded farther inland.	Rainforest, open eucalypt forests, dry sclerophyll forests and woodlands, gullies in mountain areas or coastal foothills, Brigalow scrub, coastal scrub, mangroves, parks and gardens.	The species spends summer and autumn in eastern Australia, and winters in southern and eastern Papua New Guinea from March to August. Breeds from October to March, in rainforest habitat.	Unlikely, lack of suitable habitat
Mammalia	Molossidae	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		Found along the east coast from south Qld to southern NSW.	Dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.	Potential
Aves	Motacillidae	<i>Motacilla flava</i>	Yellow Wagtail	P	C,J,K	Regular summer migrant to mostly coastal Australia. In NSW recorded Sydney to Newcastle, the Hawkesbury and inland in the Bogan LGA.	Swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land, lawns.	Breeds Europe to Siberia and west Alaska. Regular summer migrant to Australia (November-April).	Unlikely, lack of suitable habitat
Aves	Dicruridae	<i>Myiagra cyanoleuca</i>	Satin Flycatcher	P	Bonn, Mar	In NSW, widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains.	Eucalypt-dominated forests, especially near wetlands, watercourses, and heavily-vegetated gullies.	Satin Flycatchers move north in autumn to spend winter in northern Australia and New Guinea and returning south in spring. In NSW, they depart between February and March and return between September and October. In NSW, breeding occurs between November and March, with a nest usually built in the high, exposed outer branches of a tree.	Unlikely, lack of suitable habitat
Mammalia	Vespertilionidae	<i>Myotis macropus</i>	Southern Myotis	V		In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers.	Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation up to 20m.	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, and storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects	Potential

								and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.	
Aves	Strigidae	<i>Ninox strenua</i>	Powerful Owl	V		In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains.	Woodland, open sclerophyll forest, tall open wet forest and rainforest.	It roosts by day in dense vegetation comprising species such as <i>Syncarpia glomulifera</i> (Turpentine), <i>Allocasuarina littoralis</i> (Black She-oak), <i>Acacia melanoxylon</i> (Blackwood), <i>Angophora floribunda</i> (Rough-barked Apple), <i>Exocarpus cupressiformis</i> (Cherry Ballart) and eucalypt species. The main prey items are medium-sized arboreal marsupials. Powerful Owls nest in large tree hollows in large eucalypts that are at least 150 years old. Nesting occurs from late autumn to mid-winter.	Unlikely, lack of suitable habitat
Mammalia	Pseudocheiridae	<i>Petauroides volans</i>	Greater Glider population in the Eurobodalla local government area	E2		This population on the south coast of NSW is bounded by the Moruya River to the north, Coila Lake to the south and the Princes Highway and cleared land exceeding 700 m in width to the west.	Eucalypt forests and woodlands.	Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Shelter during the day in tree hollows and will use up to 18 hollows in their home range. Occupy a relatively small home range with an average size of 1 to 3 ha. Give birth to a single young in late autumn or early winter.	No, outside of population distribution
Mammalia	Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider in the Wagga Wagga Local Government Area	E2,V		The extent of the endangered population is legally defined by the boundaries of the Wagga Wagga LGA.	Open forest, woodland and riverine forest habitats.	Live in family groups and require abundant tree hollows for refuge and nest sites, so are more likely to inhabit mature or old growth forest. Nests are bowl-shaped and leaf lined. Two young are born between May and December. The diet consists primarily of nectar, pollen, plant exudates and invertebrates. Eucalypt species known to provide suitable denning and foraging resources include (but are not restricted to): <i>Eucalyptus blakelyi</i> (Blakely's Red Gum), <i>E. microcarpa</i> (Grey Box), <i>E. polyanthemos</i> (Red Box), <i>E. sideroxylon</i> (Mugga Ironbark), <i>E. camaldulensis</i> (River Red Gum), <i>E. albens</i> (White Box) and <i>E. melliodora</i> (Yellow Box).	No, outside of population distribution
Mammalia	Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	E2,V		The endangered population is within the Pittwater Local Government Area on the Barrenjoey Peninsula, north of Bushrangers Hill.	In NSW, occurs in a range of coastal habitats from low scrubby eucalypt woodlands and banksia thickets to tall, wet eucalypt forests bordering on rainforest.	The diet consists primarily of nectar, pollen, plant exudates and invertebrates. In Pittwater, important food sources are likely to be the winter flowering <i>Banksia integrifolia</i> (Coast Banksia) and <i>Corymbia maculata</i> (Spotted Gum) and the summer flowering <i>B. serrata</i> (Old Man Banksia) and <i>Eucalyptus paniculata</i> (Grey Ironbark). Other likely food sources include <i>Angophora costata</i> , <i>Banksia spinulosa</i> , <i>Corymbia gummifera</i> , <i>Eucalyptus botryoides</i> , <i>E. punctata</i> , <i>E. robusta</i> , <i>Melaleuca quinquenervia</i> , mistletoes and <i>Xanthorrhoea</i> species. Tree hollows are an important habitat feature providing den sites for raising young. Births may occur throughout the year, usually with peak in winter.	No, outside of population distribution
Mammalia	Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider	V		Widely though sparsely distributed on both sides of the Great Dividing Range in eastern Australia, from northern Qld to western Victoria.	Mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	Live in family groups of a single adult male one or more adult females and offspring. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of <i>Acacia</i> gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	No, lack of suitable habitat
Mammalia	Macropodidae	<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E1	V	In NSW they occur from the Qld border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit.	Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges.	Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. Highly territorial and have strong site fidelity with an average home range size of	No, lack of suitable habitat

								about 15 ha. Breeding is likely to be continuous, at least in the southern populations, with no apparent seasonal trends in births.	
Aves	Petroicidae	<i>Petroica boodang</i>	Scarlet Robin	V		In NSW, it occurs from the coast to the inland slopes.	Dry eucalypt forests and woodlands, and occasionally in mallee, wet forest, wetlands and tea-tree swamps.	Feed on small insects and other invertebrates which are taken from the ground, or off tree trunks and logs; they sometimes forage in the shrub or canopy layer. Mainly breed between July and January. This species' nest is an open cup made of plant fibres and cobwebs and is built in the fork of tree usually more than 2 metres above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	Unlikely, lack of suitable habitat
Aves	Petroicidae	<i>Petroica phoenicea</i>	Flame Robin	V		In NSW, breeds in upland areas, and in winter many birds move to the inland slopes and plains, or occasionally to coastal areas. Likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands.	Breeds in upland tall moist eucalypt forests and woodlands. In winter uses dry forests, open woodlands, heathlands, pastures and native grasslands. Occasionally occurs in temperate rainforest, herbfields, heathlands, shrublands and sedgeland at high altitudes.	Feeds on small invertebrates which they take from the ground or off tree trunks, logs and other coarse woody debris. Breeds in spring to late summer. Nests are often near the ground and are built in sheltered sites, such as shallow cavities in trees, stumps or banks. Builds an open cup nest made of plant materials and spider webs.	Unlikely, lack of suitable habitat
Mammalia	Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala, Hawks Nest and Tea Gardens population	E2,V	V	Known from, and in the immediate vicinity of, the towns of Hawks Nest and Tea Gardens in the Great Lakes Local Government Area.	Eucalypt forest and woodland communities, including coastal forests, rainforest, riparian areas, swamp sclerophyll forests, heathland and shrubland.	Swamp Mahogany and Tallowwood are of primary importance to this Koala population. Other local native tree species used by Koalas include Broad-leaved Paperbark, Blackbutt, Red Bloodwood, Flooded Gum and Smooth-barked Apple	No, outside of population distribution
Mammalia	Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala in the Pittwater Local Government Area	E2,V	V	The endangered population occurs within the Pittwater Local Government Area, with most recent records occurring on the Barrenjoey Peninsula.	Eucalypt forests and woodlands. Key likely habitats within Pittwater Council are: Swamp Mahogany Forest, ecotone between Spotted Gum Forest & Hawkesbury Sandstone Open-Forest, Northern form of Coastal Sandstone Woodland at Whale Beach, Red Bloodwood - Scribbly Gum Woodland, Bilgola Plateau Forest and the Grey Ironbark - Grey Gum form of the Newport Bangalay Woodland.	The Grey Gum (<i>Eucalyptus punctata</i>) is the most important food tree for this species in Pittwater. Other favoured food trees are <i>E. haemastoma</i> (Scribbly Gum), <i>E. robusta</i> (Swamp Mahogany) and <i>E. racemosa</i> (Snappy Gum). Generally koalas can be expected to feed to a limited extent on all species of <i>Eucalyptus</i> , <i>Corymbia</i> and <i>Angophora</i> that they encounter in Pittwater.	No, outside of population distribution
Mammalia	Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands.	Eucalypt woodlands and forests.	Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Females breed at two years of age, with mating occurring between September and February.	Potential
Mammalia	Muridae	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	P	V	Fragmented distribution across eastern NSW.	Open heathlands, woodlands and forests with a heathland understorey, vegetated sand dunes.	It is a social animal, living predominantly in burrows shared with other individuals. Distribution is patchy in time and space, with peaks in abundance during early to mid-stages of vegetation succession typically induced by fire.	No, lack of suitable habitat
Mammalia	Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Along the eastern coast of Australia, from Bundaberg in Qld to Melbourne in Victoria.	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Annual mating commences in January and a single young is born in October or November. Can travel up to 50 km from the camp to forage. Feed on the nectar and pollen of <i>Eucalyptus</i> , <i>Melaleuca</i> and <i>Banksia</i> species, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.	Potential

Aves	Dicruridae	<i>Rhipidura rufifrons</i>	Rufous Fantail	P	Bonn, Mar	Coastal and near coastal districts of northern and eastern Australia, including on and east of the Great Divide in NSW.	Wet sclerophyll forests, subtropical and temperate rainforests. Sometimes drier sclerophyll forests and woodlands.	The southern subspecies <i>Rhipidura rufifrons</i> is migratory, being virtually absent from south-east Australia in winter. Departure from the breeding areas is usually March to early April, most moving to coastal lowlands and off-shore islands in south-east Queensland, north to Cape York Peninsula and Torres Strait Island. Birds arrive back in south-east Australia mostly in September to November, and breed September to February.
Aves	Rostratulidae	<i>Rostratula australis</i>	Australian Painted Snipe	E1	E, Mar	In NSW most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys.	Swamps, dams and nearby marshy areas.	Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. The nest consists of a scrape in the ground, lined with grasses and leaves. Breeding is often in response to local conditions; generally occurs from September to December. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter.
Mammalia	Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V		There are scattered records of this species across the New England Tablelands and North West Slopes. Rare visitor in late summer and autumn to south-western NSW.	Almost all habitats, including wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies.	It forages for insects above the canopy in eucalypt forests, and closer to the ground in more open country. It is dependent on suitable hollow-bearing trees to provide roost sites. The species has also been recorded using caves and abandoned sugar glider nests as roost sites. Breeding occurs between December and mid-march.
Mammalia	Vespertilionidae	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		Both sides of the great divide, from the Atherton Tableland in Qld to north-eastern Victoria, mainly along river systems and gullies. In NSW it is widespread on the New England Tablelands.	Woodland, moist and dry eucalypt forest and rainforest.	Usually roosts in tree hollows, but has also been found in buildings. Forages after sunset along creek and river corridors for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees.

Appendix B : Flora and Fauna species lists

Table 5: Flora species list

Family Name	Species Name	Common Name
Anacardiaceae	<i>Schinus areira</i> *	Pepper Tree
Asparagaceae	<i>Asparagus asparagoides</i> ** #	Bridal Creeper
Asteraceae	<i>Conyza bonariensis</i> *	Flax-leaf Fleabane
	<i>Cirsium vulgare</i> *	Spear Thistle
	<i>Hypochaeris radicata</i> *	Cat's Ear
	<i>Senecio madagascariensis</i> ** #	Fireweed
Casuarinaceae	<i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i>	River She-oak
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush
Commelinaceae	<i>Tradescantia fluminensis</i> *	Wandering Jew
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed
Fabaceae Subf. Faboideae	<i>Glycine clandestina</i>	Twining Glycine
	<i>Trifolium repens</i> *	White Clover
Fabaceae subf. Mimosoideae	<i>Acacia baileyana</i> *	Silver Wattle
	<i>Acacia decurrens</i>	Black Wattle
	<i>Acacia falcata</i>	Hickory Wattle
Geraniaceae	<i>Geranium solanderi</i>	Native Geranium
Goodeniaceae	<i>Goodenia hederacea</i>	Forest Goodenia
Juncaceae	<i>Juncus usitatus</i>	Common Rush
Malvaceae	<i>Brachychiton populneus</i>	Kurrajong
	<i>Sida rhombifolia</i> *	Arrow-leaf Sida
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple
	<i>Corymbia citriodora</i> +	Lemon-scented Gum
	<i>Corymbia maculata</i>	Spotted Gum
	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark
	<i>Eucalyptus fibrosa</i>	Red Ironbark
	<i>Eucalyptus leucoxydon</i> +	Yellow Gum
	<i>Eucalyptus microcorys</i> +	Tallowood
	<i>Eucalyptus moluccana</i>	Grey Box

	<i>Eucalyptus tereticornis</i>	Forest Red Gum
	<i>Melaleuca styphelioides</i>	Prickly-leaved Paperbark
Oleaceae	<i>Olea europaea</i> **	African Olive
Pittosporaceae	<i>Bursaria spinosa</i>	Blackthorn
Plantaginaceae	<i>Plantago lanceolata</i> *	Plantain
Polygonaceae	<i>Persicaria decipiens</i>	Slender Knotweed
Poaceae	<i>Briza minor</i> *	Little Quaking Grass
	<i>Cymbopogon refractus</i>	Barbed-wire Grass
	<i>Cynodon dactylon</i>	Couch
	<i>Chloris gayana</i> *	Rhodes Grass
	<i>Chloris ventricosa</i>	Plump Windmill Grass
	<i>Lolium perenne</i> *	Perennial Rye-grass
	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
	<i>Paspalum dilatatum</i> *	Paspalum
	<i>Pennisetum clandestinum</i> *	Kikuyu
	<i>Phalaris aquatica</i> *	Canary Grass
	<i>Setaria gracilis</i> *	Slender Pigeon Grass
	<i>Sorghum</i> spp.*	Sorghum
	<i>Sporobolus africanus</i> *	Parramatta Grass
<i>Themeda triandra</i>	Kangaroo Grass	
Proteaceae	<i>Grevillea robusta</i> +	Silky Oak
Pteridaceae	<i>Cheilanthes sieberi</i>	Mulga Fern
Rosaceae	<i>Rubus fruticosus aggregate</i> **#	Blackberry
Solanaceae	<i>Lycium ferocissimum</i> ** #	African Boxthorn
Verbenaceae	<i>Verbena bonariensis</i> *	Purpletop

Key: * exotic species, + Non indigenous, ** noxious weed, # WoNS

Table 6: Fauna species list

Class	Family	Scientific name	Common name
Aves	Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra
	Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck
	Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron
		<i>Ardea ibis</i>	Cattle Egret+
	Artamidae	<i>Cracticus tibicen</i>	Australian Magpie
	Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
	Charadriidae	<i>Vanellus miles</i>	Masked Lapwing
	Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon
	Corvidae	<i>Corvus coronoides</i>	Australian Raven
	Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner
		<i>Manorina melanophrys</i>	Bell Miner
	Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe
	Psittacidae	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet
	Rhipidurae	<i>Rhipidura leucophrys</i>	Willie Wagtail
Sturnidae	<i>Sturnus vulgaris</i> *	Common Starling	
Amphibia	Hylidae	<i>Litoria nasuta</i>	Striped Rocket Frog
	Myobatrachidae	<i>Crinia signifera</i>	Common Froglet
Mammalia	Bovidae	<i>Bos taurus</i> *	Cattle
		<i>Ovis aries</i> *	Sheep

Key: * Exotic species, + migratory species under the EPBC Act

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