ATTACHMENT C

ANNANGROVE ROAD LIGHT INDUSTRIAL AREA

Flora and Fauna Constraints Assessment

Prepared for
The Hills Shire Council

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Abbreviations

ABBREVIATION	DESCRIPTION
CPW	Cumberland Plain Woodland
EEC	Endangered Ecological Community
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
RFEF	River Flat Eucalypt Forest
ROTAP	Rare or Threatened Australian Plants
SEPP (SRGC) 2006	State Environmental Planning Policy (Sydney Region Growth Centres) 2006
SSGF	Sydney Sandstone Gully Forest
SSTF	Shale Sandstone Transition Forest
SSRW	Sydney Sandstone Ridgetop Woodland
TSC Act	*Threatened Species Conservation Act 1997*
WSGF	Western Sandstone Gully Forest

Executive Summary

Introduction

This Flora and Fauna Constraints Assessment for the Edwards Road Precinct has been prepared by Eco Logical Australia Pty Ltd (ELA) on behalf of The Hills Shire Council. The Hills Shire Council is seeking to develop a master plan that establishes a clear vision and concept for the Annangrove Road Light Industrial Area which includes the Edwards Road Precinct. This report documents the ecological values within the precinct, and ranks areas according to conservation value over the precinct.

The flora and fauna constraints assessment included a review of database records and relevant literature pertaining to the ecology of the study area and surrounding area, including previous flora and fauna assessments conducted by Hayes Environmental (2007) and Travers Environmental (2008). Existing vegetation mapping and other available GIS data were also reviewed. An assessment of the likely occurrence was made for threatened and migratory species identified from the database searches or considered to have the potential to occur within the locality.

Field surveys were undertaken by ELA ecologists on 10 and 13 April 2012. Surveys included vegetation community and condition mapping, and targeted searches for threatened flora considered likely to occur or with potential habitat in the study area. Targeted surveys for threatened fauna were not conducted, and habitat assessment was used to determine which threatened fauna species were likely to occur or that had potential to occur.

The flora and fauna constraints assessment of the study area was undertaken by GIS analysis, which assigned a high, moderate, low or very low ecological constraint to each mapped polygon within the study area. The analysis was based on the following input layers; the presence of endangered ecological communities (EECs) as listed under Commonwealth legislation; the presence of EECs as listed under State legislation; vegetation community condition as determined by the presence of weeds; vegetation community condition as determined by stratum characteristics; core vegetation and habitat connectivity; and habitat potentially supporting threatened or migratory species or Rare or Threatened Australian Plants (ROTAP). Ranked scores were assigned to polygons within each input layer. The analysis then overlaid the scores and polygon boundaries of each individual input layer to create a new single ecological constraints dataset.

Results

Three vegetation communities were mapped within the study area: Shale Sandstone Transition Forest (SSTF), River-Flat Eucalypt Forest (RFEF), and Cumberland Plain Woodland (CPW). CPW is listed as a critically endangered EEC under both the NSW *Threatened Species Conservation Act 1997* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), while SSTF is listed as an endangered EEC under both the TSC and EPBC Acts. RFEF is listed as an endangered EEC under the TSC Act. While CPW was mapped in the study area, it did not meet the listing criteria for CPW under the EPBC Act.

The condition of vegetation communities varied within the study area, both in terms of weed density and structure. Of the communities, CPW and RFEF were perhaps the most degraded; however, SSTF was

also degraded in parts, with the highest weed densities and modifications to the mid-storey occurring in the northern and eastern-most parts of the community.

No threatened flora species were recorded during the field survey, although Hayes Environmental (2007) recorded *Eucalyptus nicholii*, which was likely to have been planted. From the list of species previously recorded, 14 threatened flora species were considered as having the potential to occur within the study area. A total of 204 flora species were identified, which consisted of 143 native and 61 exotic species. . Additional exotic weeds and landscape plantings in the study area were observed but not recorded.

No threatened fauna species were recorded during the field survey, although *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Myotis macropus* (Large-footed Myotis), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat) and *Pteropus poliocephalus* (Grey-headed Flying-fox) have previously been recorded (Hayes Environmental 2007, Travers Environmental 2008). From the list of species previously recorded, 23 threatened and 6 migratory fauna species were considered as having the potential to occur within the study area. A total of 44 fauna species were recorded via direct observation, animal signs, and by their calls (33 birds, eight mammals and three frogs). Of the species recorded, eight were exotic species.

There were a number of habitat elements for flora and fauna species present within the study area. The habitat elements available across the study area provided sheltering, foraging, and roosting habitat for a range of fauna groups. Intact canopy and mid-storey layers provided foraging habitat for birds, bats and arboreal mammals, and tree canopies provided sheltering habitat for birds. Hollow-bearing trees, stags and trees with flaking bark provided roosting and/or breeding habitat for birds, bats, and arboreal mammals. Leaf litter, woody debris and exposed sandstone outcrops provided foraging and sheltering habitat for ground dwelling mammals, reptiles and some frog species. Standing fresh water provided foraging and breeding habitat for frog species, foraging habitat for bat species, and foraging and sheltering habitat for water birds and fish.

Constraints Assessment

The constraints assessment found that the majority of vegetated areas were of high or moderate ecological value, with some vegetated areas of low ecological value. Therefore, the majority of vegetated areas were identified as having some level of constraint in terms of development.

Of the vegetation communities, SSTF and CPW were the only communities assessed as having high ecological value. In relation to SSTF, this was mostly due to the community being in good condition, but the community is also listed as an EEC at the Commonwealth level, was classified as core vegetation, and had the highest threatened/migratory flora and fauna habitat value of all the communities in the study area. Both RFEF and CPW had experienced greater degrees of weed degradation and structural disturbances compared to SSTF; the only areas where CPW was assessed as having high ecological value were where weed degradation was low and/or where the community was structurally intact. Also, RFEF is not listed at the Commonwealth level, and CPW in the study area did not meet the listing criteria for the community under the EPBC Act. Both RFEF and CPW classified as Support for Core rather than Core vegetation. Areas where SSTF were assessed as having moderate ecological value were generally those which supported a high density of weeds or had experienced structural or other disturbances.

Conservation and Management Recommendations

Given that vegetated areas in the study area were generally those areas with the highest ecological value, vegetated areas within the study area had the highest level of constraint in terms of development for industrial use and/or subdivision, although existing disturbances to vegetated areas influenced the degree of ecological value/developmental constraint. Conversely, areas that have already been cleared or developed and lacked intact native vegetation (as represented by intact canopy, mid-storey and under-storey layers) were generally those areas with the lowest ecological value, representing the lowest areas of constraint to development.

Despite this, information at the lot level identifying areas suitable for development, areas of biodiversity value, and priority areas for restoration, regeneration or revegetation was provided.

In terms of measures to protect existing biodiversity values, recommended measures would include avoidance and ameliorative measures, with compensatory strategies considered for any significant impacts that cannot be avoided or mitigated. Avoidance and ameliorative measures have been recommended. Any offsetting measures should be developed in accordance with the "Principles for the use of Biodiversity Offsets in NSW"; the Biobanking Assessment methodology can be used to develop proposed offsetting measures.

1 Introduction

The Annangrove Road Light Industrial Area covers a 120 ha patch of land between Rouse Hill and Box Hill. It was established in 1991 and is zoned as Light Industrial 4(b) under *Baulkham Hills Local Environmental Plan 2005*, and IN2 Light Industrial under the *Draft The Hills Local Environmental Plan 2010*; it has not been biodiversity certified (bio-certified) in comparison to land in the surrounding area, which has been bio-certified. Since its establishment, the Annangrove industrial area has been unsuccessful in attracting new industrial businesses. However, there is a significant opportunity to provide employment growth within the industrial area, due in part to its location near Windsor Road, the Rouse Hill Town Centre and the proposed Box Hill precinct.

The Hills Shire Council is seeking to develop a master plan that establishes a clear vision and concept for the Annangrove Road Light Industrial Area. As part of the master plan preparation, technical studies including a Flora and Fauna Constraints Assessment are required for the Edwards Road Precinct. The Edwards Road Precinct extends south along Annangrove Road from approximately 600 m south of Joylyn Road to Withers Road in Rouse Hill, with Cattai and Second Ponds Creek forming the eastern boundary (**Figure 1**).

Previous Flora and Fauna Assessments for the north of the Edwards Road Precinct, prepared in association with previous development applications (Hayes Environmental 2007, Travers Environmental 2008), identified the presence of a number of threatened species and Endangered Ecological Communities (EECs). Council seeks information on the extent and significance of vegetation and EECs, and their significance as habitat for threatened flora and fauna species, for the entire Edwards Road Precinct. The presence of threatened species and EECs will directly impact on the future zoning, subdivision pattern, and road layout of the area. Further, Council seeks conservation and management recommendations to inform precinct planning, addressing:

- Areas suitable for development with no further ecological constraints
- Areas of biodiversity value that should be considered for retention
- Measures to protect biodiversity values
- Priority areas that could be considered for restoration, regeneration or revegetation
- Any proposed mechanisms for implementation of these recommendations, and
- Measures to control ecological impacts identified on the site.

This report is a Flora and Fauna Constraints Assessment for the Edwards Road Precinct. It reports on the ecological values within the precinct, and ranks areas according to conservation value over the precinct. It also provides conservation and management recommendations to inform precinct planning according to Council's requirements (outlined above).

1.1 STUDY AREA AND LOCALITY

The Edwards Road Precinct, also referred to as the study area in this assessment, is located in Rouse Hill, NSW, in the central western part of The Hills Shire Local Government Area (LGA). It is approximately 70.54 ha in area, and is comprised of 34 land parcels (**Table 1**). The precinct extends south along Annangrove Road from approximately 600 m south of Joylyn Road to Withers Road, with Cattai and Second Ponds Creek forming the eastern boundary (**Figure 1**).

The majority of the precinct is currently vegetated, although parts have been cleared for a transmission line easement and other uses. Much of the adjacent land to the east is also currently vegetated, particularly around the northern parts of the precinct, despite the Light Industrial 4(b) and Special Uses 5(a) zoning under the *Baulkham Hills Local Environmental Plan 2005* in these areas, and the adjacent North Kellyville Precinct, included under the *SEPP (Sydney Region Growth Centres) 2006* (SEPP (SRGC) 2006). Residential development lies further to the south east of the study area past the areas zoned as Light Industrial 4(b) and Special Uses 5(a). Rural residential properties, zoned as Rural 1(a) under the *Baulkham Hills Local Environmental Plan 2005*, lie along the northern boundary of the study area, to the west of Annangrove Road.

A number of vegetation communities have been mapped in the Edwards Road Precinct including Cumberland Plain Woodland (CPW), Shale Sandstone Transition Forest (SSTF), and Western Sandstone Gully Forest (WSGF) (NPWS 2002a). CPW is listed as a critically endangered EEC under both the NSW *Threatened Species Conservation Act 1997* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), while SSTF is listed as an endangered EEC under both the TSC and EPBC Acts. WSGF is not currently listed as an EEC.

The underlying geology of the study area is Hawkesbury Sandstone, although Liverpool Group Shale has been mapped for the southern parts of the study area. Three soil landscapes have been mapped for the study area: Hawkesbury Colluvial, Gymea Erosional and Blacktown Residual soil landscapes (map units ha, gy and bt, respectively) (Chapman and Murphy 1989). The characteristics of the soil landscapes are as follows:

- Hawkesbury: shallow (<50 cm) discontinuous lithosols/siliceous sands associated with rock outcrop, earthy sands, yellow earths, and locally deep sands on the inside of benches and along joints and fractures. It is also characterised by localised yellow and red podzolic soils associated with shale lenses, and siliceous sands on narrow valley flats. These soils are derived from the underlying Hawkesbury Sandstone geology
- Gymea: shallow to moderately deep (30-100 cm) tallow earths and earthy sands on crests and the inside of benches, localised gleyed podzolic soils and yellow podzolic soils on shale lenses, and shallow to moderately deep (<100 cm) siliceous sands and leached sands along drainage lines, and
- Blacktown: shallow to moderately deep (<100 cm) red and brown podzolic soils on crests, upper slopes and well drained areas, and deep (150-300 cm) yellow podzolic soils and soloths on lower slopes and in areas of poor drainage.

The study area is located close to several parcels of reserved land. The closest national parks, Scheyville and Cattai, lie approximately 5.2 km and 10 km to the north of the study area, respectively, while the closest nature reserves, Castlereagh and Windsor Downs, lie approximately 9 km and 12 km to the west of the study area, respectively. Some reserved land also occurs to the east, including Berowra Valley Regional Park which is approximately 11 km away.

The study area consists of land that is generally level, although some parts are slightly undulating and become steeper near creeks. Three creeks, Second Ponds, Caddies and Cattai Creeks, flow around the southern and eastern perimeters of the study area. An ephemeral tributary of Second Ponds Creek flows through Lot 26 DP 834050, Lot 12 DP 835727, and Lot 1 DP 835727. Other waterbodies of note which lie in proximity to the study area include farm dams. One dam is present on Lot 32 DP 834050.

The climate of the area is typical of the Sydney region, which can generally be described as temperate.

Table 1: Details of Lots and DPs comprising the study area

LAND PARCEL NO *	STREET ADDRESS	LOT	DP	AREA
1	278 Annangrove Road	2	879450	1.73
2	282 Annangrove Road	2	1032790	7.85
3	284 Annangrove Road	10	563695	2.02
4	286 Annangrove Road	2	838278	1.51
5	288 Annangrove Road	3	222080	2.12
6	20 Edwards Road	2	222080	3.53
7	31 Edwards Road	2	225401	2.06
8	290-312 Annangrove Road	26	834050	12.09
9	290-312 Annangrove Road	12	835727	7.71
10	314 Annangrove Road	27	834050	1.24
11	316 Annangrove Road	28	834050	1.67
12	318 Annangrove Road	29	834050	1.66
13	320 Annangrove Road	30	834050	1.66
14	322 Annangrove Road		78246	1.55
15	324 Annangrove Road	32	834050	1.95
16	326 Annangrove Road	33	834050	1.62
17	328 Annangrove Road	34	834050	1.68
18	330 Annangrove Road	12	833069	1.72
19	332-334 Annangrove Road	13	833069	2.71
20	NA (part of drainage corridor)	1	1032790	4.27
21	NA	1	133473	1.03
22	NA (part of drainage corridor)	1	835727	1.39
23	NA (part of drainage corridor)	1	879450	0.29
24	NA (part of drainage corridor)	14	833069	0.92
25	NA (part of drainage corridor)	15	833069	0.31
26	NA (part of drainage corridor)	17	834050	0.35
27	NA (part of drainage corridor)	18	834050	0.4
28	NA (part of drainage corridor)	19	834050	0.62
29	NA (part of drainage corridor)	20	834050	0.46
30	NA (part of drainage corridor)	21	834050	0.31
31	NA (part of drainage corridor)	22	834050	0.31
32	NA (part of drainage corridor)	23	834050	0.4
33	NA (part of drainage corridor)	24	834050	0.54
34	NA (part of drainage corridor)	25	834050	0.86
			Total	70.54

* Numbering has no relationship to Lot/DP numbers

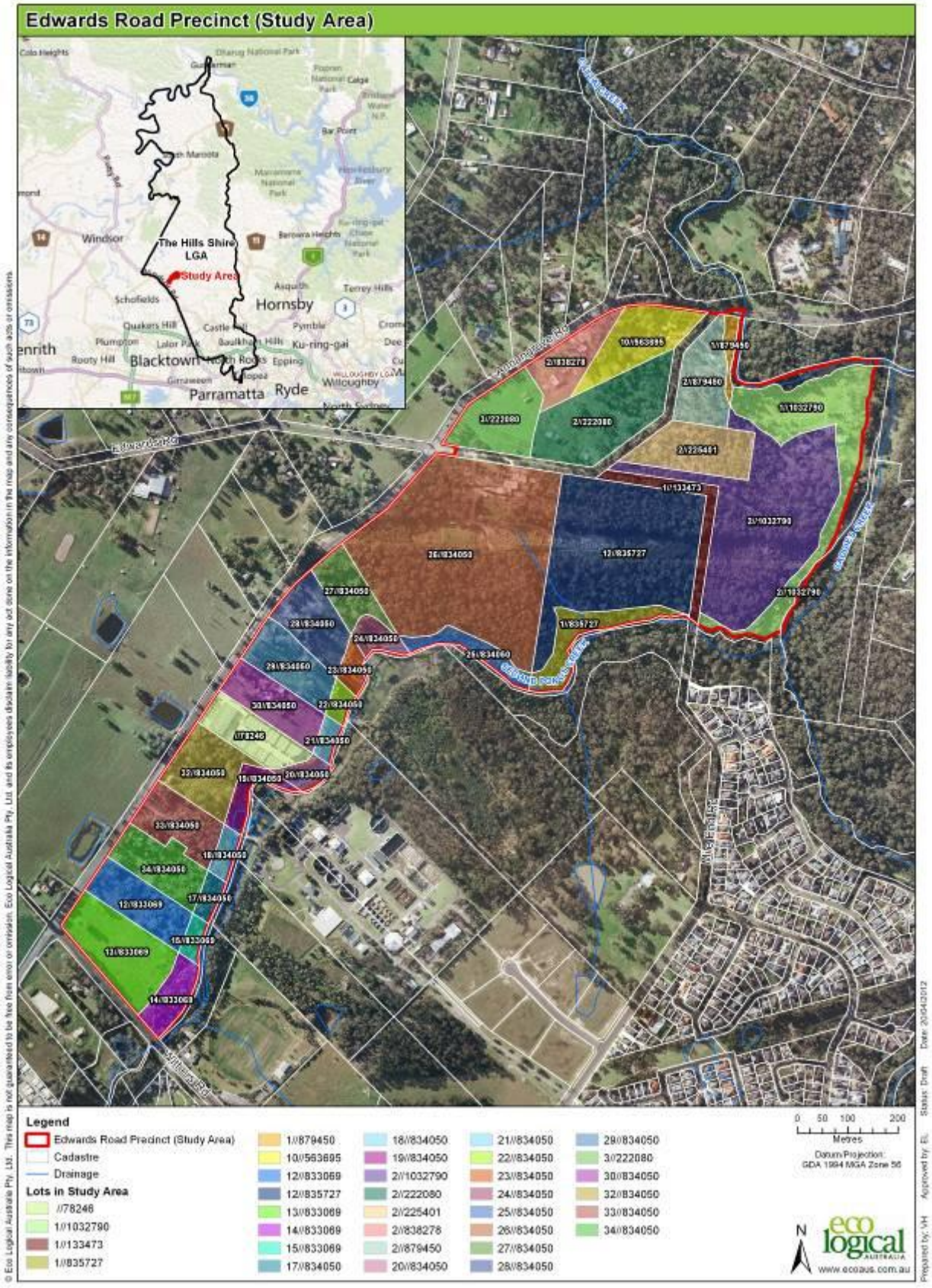

Figure 1: Location of the Edwards Road Precinct in Rouse Hill. Lot and DP numbers are shown

2 Methods

2.1 DATA AUDIT AND LITERATURE REVIEW

Database records and relevant literature pertaining to the ecology of the study area and surrounding area were reviewed. The material reviewed included:

- Office of Environment and Heritage (OEH) Atlas of NSW Wildlife. Search of data supplied September 2011, 10 km search radius) (OEH 2012)
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) Online search for Matters of National Environmental Significance (point search of coordinates with 10km buffer; see Appendix A) (Accessed 25 January 2011) (DSEWPAC 2012)
- The Hills Shire Council Vegetation Mapping (THSC 2005)
- DECC Vegetation of the Cumberland Plain, Final Edition – Vegetation and Core Habitat Mapping (DECC 2008);
- NPWS Vegetation of the Cumberland Plain – Vegetation and Core Habitat Mapping (NPWS 2002a)
- Native Vegetation Interpretation Guidelines for Western Sydney Vegetation (NPWS 2002b);
- Royal Botanic Garden (RBG) Online database, PlantNET (RBG 2012)
- *Flora and Fauna Assessment for the proposed industrial subdivision: Corner of Annangrove Road and Edwards Road, Rouse Hill* (Hayes Environmental 2007)
- *Flora and Fauna Constraints Analysis at Lot 2 and 4 DP 225401, Lot 2 DP 222080, Lot 10 DP 563695, and Lot 3 DP 879450 Crown Road, Rouse Hill* (Travers Environmental 2008), and
- Local plans including:
    - *Baulkham Hills Local Environmental Plan 2005* http://www.thehills.nsw.gov.au/Local-Environment-Plan.html
    - *Baulkham Hills Development Control Plan* http://www.thehills.nsw.gov.au/Development-Control-Plans.html
    - Draft *The Hills Local Environmental Plan 2010* http://www.thehills.nsw.gov.au/Draft-LEP-2010.html

High resolution aerial photographs (Virtual Earth and images provided by The Hills Shire Council) of the study area and surrounding area were also used to investigate the extent of vegetation cover, landscape features and land use in the area prior to field survey. In addition, relevant GIS datasets (soil, geology, drainage) were reviewed to guide the field survey component.

Species from both Atlas searches and searches for EPBC Act Matters of National Environmental Significance were combined to produce a list of threatened species that may occur within the study area ("subject species") (**Appendix A**). Likelihood of occurrences for threatened species, endangered populations and communities in the study area were then made based on location of database records, the likely presence or absence of suitable habitat on the subject site, and knowledge of the species' ecology. A list of potentially "affected species" was then identified (those that were defined as "yes", "likely" or having "potential" to occur in the study area – see overleaf).

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

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

Note that assessments for the likelihood of occurrence were made both prior to field survey and following field survey. The pre-survey assessments were performed to determine which species were "affected species", and hence determine which sorts of habitat to look for during field survey. The post-survey assessments to determine final "affected species" were made after observing the available habitat in the study area first hand.

2.2 SITE INSPECTION

Site inspection was conducted by two Eco Logical Australia (ELA) ecologists, Dr Enhua Lee and Jennie Powell, on 10 and 13 April 2012. Survey effort was approximately 32 person hours. Site inspection was conducted to validate vegetation mapping (as per THSC 2005, NPWS 2002a and DECC 2008), to determine the condition of vegetation communities, to determine the presence of threatened flora and fauna species, and to identify habitat features for threatened flora and fauna species within the study area.

Vegetation mapping was validated using a number of methods:

- Through comparisons of dominant canopy, mid-stratum and ground cover species present on the ground with those typical of the mapped vegetation communities (as provided in NPWS 2002b)
- Through assessments of similarities in the descriptions of vegetation communities and their occurrence in the landscape and on soils as provided in NPWS (2002b) with vegetation, landscape position and soils observed on the ground
- Using plot-based surveys (Biobanking plots: 20 x 20 m nested plots within 20m x 50 m plot). Four plot surveys were conducted (**Figure 2**), with one plot conducted per vegetation community less than 2 ha in area and two plots conducted per vegetation community between 2 and 50 ha in area. The exception was CPW where only one plot was conducted due to time constraints. However, CPW was also validated through traverses through the community. Information collected in Biobanking plots included quantitative data for native species richness (species were identified to the lowest taxonomic level possible and any unknown flora species were collected for later identification); native versus exotic species cover; the presence of hollow bearing trees and over-storey regeneration; and length of fallen logs in accordance with the Biobanking Assessment Methodology (Seidel and Briggs 2008), and
- Via traverses confirming the boundaries of vegetation communities and species assemblages. Where the boundaries of vegetation communities differed from existing vegetation mapping, these were modified on hard copy maps and marked with a hand-held GPS.

The condition of vegetation communities was determined by assigning a weed invasion category to each vegetation community (or part thereof where relevant) to indicate the level of weed invasion in the community. Invasion categories were assigned in accordance with the following criteria:

- Low weed invasion (< 5% foliage cover)
- Moderate weed invasion (6 - 25% foliage cover)
- High weed invasion (26 - 75% foliage cover), and
- Extreme weed invasion (> 75% foliage cover).

Also, the condition of vegetation communities was determined through the presence of structural layers within each vegetation community, with categories assigned as follows:

- Very High (intact canopy, mid-storey and ground layers present)
- High (intact canopy, mid-storey and ground layers present, but the patch is disturbed from paintball or minor under-scrubbing activities)
- Moderate (intact canopy present, but the patch has a depleted mid-storey layer and a highly modified ground layer)
- Moderate to Low (intact canopy present, but the patch lacks a mid-storey layer and has a highly compacted ground layer)
- Low (intact canopy present, but the patch lacks a mid-storey layer and has a highly modified/mown ground layer)
- Very Low (canopy absent, but mid-storey and ground layers present), and
- Extremely Low (canopy and mid-storey absent and the patch has a highly modified ground layer.

The boundaries of weed invasion and structural categories indicating condition were marked on hard copy maps and marked with a hand-held GPS.

The presence of threatened flora and fauna species identified as having the potential to occur in the study area (**Appendix A**) and the presence of their habitats was determined through targeted searches for those species and signs (scats, tracks, scratches, diggings) of those species and through notes made on habitat. The random meander method (Cropper 1993) was used to search for species, with meanders focussing on areas where threatened flora and fauna may be present. Where threatened species or important habitat features such as hollow-bearing trees, potential nesting or roosting sites, rock outcrops, winter-flowering eucalypts, and logs were observed along traverses, their locations were marked using a hand-held GPS for later mapping. However, the locations of all important habitat features observed were not recorded due to time constraints.

No active surveys were conducted for fauna. There was only limited habitat for *Meridolum corneovirens* (Cumberland Plain Land Snail) in CPW in the study area given the lack of a deep leaf litter layer at the base of trees.

During the survey, all fauna species and additional visible vascular flora encountered outside of plot surveys were recorded.

Temperatures were cool to mild on both field days, with the minimum and maximum temperatures for the 10 April recorded as 10.5°C and 18.1°C, respectively, and the minimum and maximum temperatures for the 13 April recorded as 9.4°C and 23.3°C, respectively (recordings taken from the nearest weather station to the subject site; BOM 2012). No rain fell during survey.

2.2.1 Survey Limitations

The survey was conducted in autumn, and no detailed fauna surveys targeting fauna groups were conducted due to the nature of the project (a constraints assessment rather than a study such as an impact assessment or biodiversity study). Thus, it is possible that flora and fauna species that may occur in the study area were not recorded due to the life cycle and behaviour of species and seasonal

considerations. Targeted surveys would need to be repeated over a number of seasons to more adequately capture the diversity of flora and fauna that could be present in the study area. Since this was not possible, habitat assessments were undertaken to predict the likely presence of species. A conservative approach was also taken in assuming the presence of species that could potentially occur in the study area (that is, species were assessed to have the potential to be present even if the potential for this was low).

2.3 ECOLOGICAL CONSTRAINTS ASSESSMENT

The ecological constraints assessment of the study area was made through GIS analysis, which assigned areas with a high, moderate, low, or very low ecological constraint. The analysis was based on the presence of EECs as listed under Commonwealth legislation; the presence of EECs as listed under State legislation; vegetation community condition as determined by the presence of weeds; vegetation community condition as determined by stratum characteristics; core vegetation and habitat connectivity; and habitat potentially supporting threatened, migratory or ROTAP species. These formed the six data input layers used in the analysis (**Table 2**).

Table 2: Data inputs and their scores assigned per category/class

DATA INPUT	CLASS	SCORE
Vegetation Community (EPBC Act)	Critically Endangered	2
	Endangered	1
	Not listed	0
Vegetation Community (TSC Act)	Critically Endangered	2
	Endangered	1
	Not listed	0
Condition (weed invasion categories)	Low weed invasion (< 5% foliage cover)	4
	Moderate weed invasion (6 - 25% foliage cover)	3
	High weed invasion (26 - 75% foliage cover)	2
	Extreme weed invasion (> 75% foliage cover)	1
	Cleared	0
Condition (categories according to stratum characteristics)	Very High (intact canopy, mid-storey and ground layers present)	6
	High (intact canopy, mid-storey and ground layers present, but the patch is disturbed from paintball or minor under-scrubbing activities)	5
	Moderate (intact canopy present, but the patch has a depleted mid-storey layer and a highly modified ground layer)	4
	Moderate to Low (intact canopy present, but the patch lacks a mid-storey layer and has a highly compacted ground layer)	3
	Low (intact canopy present, but the patch lacks a mid-storey layer and has a highly modified/mown ground layer)	2
	Very Low (canopy absent, but mid-storey and ground layers present)	1
	Extremely Low (canopy and mid-storey absent and the patch has a highly modified ground layer	0

DATA INPUT	CLASS	SCORE
Core vegetation and habitat connectivity	Core (patch > 10 ha and projected foliage cover of the canopy > 10%)	2
	Support for Core (patch supports Core habitat, buffering from edge effects and providing corridor connections. Patch is < 10 ha and projected foliage cover of the canopy may be < 10% or > 10%)	1
	Limited to no connectivity	0
Threatened/migratory Flora and Fauna Habitat Value	High	4
	Moderate	3
	Moderate to Low	2
	Low (not a vegetation community, but habitat present)	1
	Extremely Low (not a vegetation community and limited to no habitat present)	0

The data input layers were mostly created from vegetation validation and observations made for vegetation condition during field investigation, although one layer, 'Core vegetation and habitat connectivity', was created based on a combination of patch size and projected foliage cover of the canopy (generally following the *Western Sydney Conservation Significance Assessment Mapping*, and the rules as set out in *Guidelines for the Conservation Significance Assessment Mapping*; NPWS 2002c and d, respectively).

Vegetation community mapping formed the basis of two of the data input layers: 'Vegetation Community (EPBC Act)', and 'Vegetation Community (TSC Act)'. The remaining data input layers, 'Condition (weed invasion categories)', 'Condition (categories according to stratum characteristics)', 'Core vegetation and habitat connectivity', and 'Threatened/migratory Flora and Fauna Habitat Value' had separate spatial layers to the vegetation community mapping and included areas within the study area that did not support vegetation communities.

Given the 'Core vegetation and habitat connectivity' layer included areas that did not support vegetation communities, this layer differed slightly from the *Western Sydney Conservation Significance Assessment Mapping* (NPWS 2002c) which was based on mapped vegetation communities, excluding sandstone communities (see NPWS 2002d). It was decided that areas not supporting recognised vegetation communities should be included to account for connectivity across the study area through modified vegetation lacking a canopy or planted vegetation, as was the case in parts of the riparian area e.g. within Lot 20 in DP 834050.

Scores were assigned to each input layer to reflect different levels of importance of classes/categories within the mapped areas. Higher scores were assigned to classes/categories that had higher legislative significance, were in better ecological condition (e.g. had lower weed densities or had more intact stratums), provided more threatened/migratory flora and fauna habitat value, or were larger patches of vegetation. For each data input layer, scores started from zero and increased incrementally to the highest class/category present in the input layer (**Table 2**). As such, scores in each data input layer related to the categories/classes within the specific data layer, and had no relation to scores in other data layers.

The determination of scores for the Threatened/migratory Flora and Fauna Habitat Value data input layer was more involved than the other layers as it was derived through a stepped process. The process was as follows:

1. The likelihood of occurrence of each threatened species, identified through 10 km radius database searches around the study area and literature review, was determined per vegetation community based on knowledge of each threatened fauna species' habitat requirements, and observations made of habitat elements present in vegetation types during field survey (see Section 2.1 for the terms used and **Appendix C**)

2. In each vegetation community, the number of species with the same likelihood of occurrence and conservation significance status was tallied (only the likelihood terms "yes", "likely", and "potential" were considered). For example, in SSTF, two species were recorded with a likelihood of "yes" and a conservation significance status of EPBC (Vulnerable)

3. The tallied numbers of species with the same likelihood and conservation significance status were multiplied by a weighting based on conservation significance status. These weightings are shown in **Table 3.** For example, in SSTF, two species were recorded with a likelihood of "yes" and a conservation significance status of EPBC (Vulnerable). Therefore, the number 2 was multiplied by the appropriate weighting of 3, which resulted in a score of 6 for that combination of likelihood and conservation significance status in SSTF

Table 3: Weightings of conservation significance status for threatened and ROTAP (Briggs and Leigh 1995) species

STATUS	MULTIPLIER
EPBC (Endangered)	4
EPBC (Vulnerable)	3
EPBC (Migratory)	1
TSC (Endangered)	3
TSC (Vulnerable)	2
ROTAP	1

4. The final score for each vegetation community was obtained by summing the scores for each combination of likelihood and conservation significance status that had been modified by the weighting of conservation significance status

5. The final scores for the vegetation communities were relatively evenly spread and so the following levels of Threatened/migratory Flora and Fauna Habitat Value were identified:

    - High (final score above 100)
    - Moderate (final score between 70 and 100), and
    - Moderate to Low (final score below 70).

6. Two additional levels were defined for areas that did not classify as a vegetation community. These were:

    - Low (not a vegetation community, but habitat present), and
    - Extremely Low (not a vegetation community and limited to no habitat present).

Once the scores were identified and assigned to polygons in each input layer, the ecological constraint analysis was conducted. It was undertaken as a GIS analysis which combined all the spatial datasets into a single dataset. The analysis overlaid the scores and boundaries from each of the six individual input layers on top of each other and these were combined into a new single constraints dataset. The

constraints dataset contained six scores from each of the input layers for every polygon present and were summed into final scores ranging between zero and 18.

A frequency distribution histogram of the final scores for each polygon was created and examined to convert scores into final constraint categories (**Figure 3**). Final constraints scores were placed in groups of High, Moderate, Low or Very Low ecological constraint based on the occurrence of natural breaks in the data and an understanding of the ecological values of the study area gained from the site inspection. While this involves a measure of subjectivity, it ensures that the constraints analysis properly reflects what was observed during the site inspection. It was also more precautionary, encapsulating more polygons within the higher categories of high and moderate.

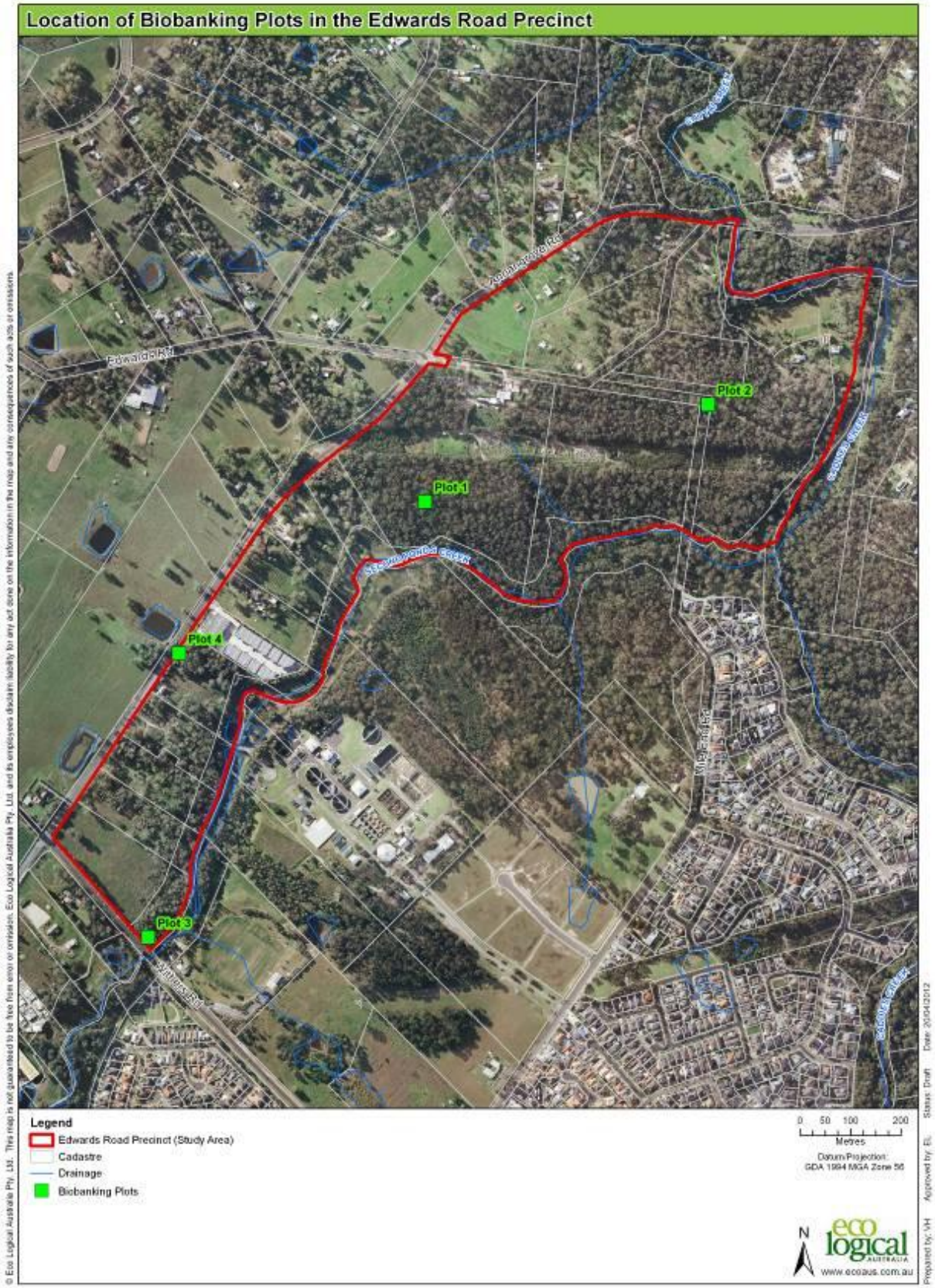

Figure 2: Location of Biobanking plots within the Edwards Road Precinct

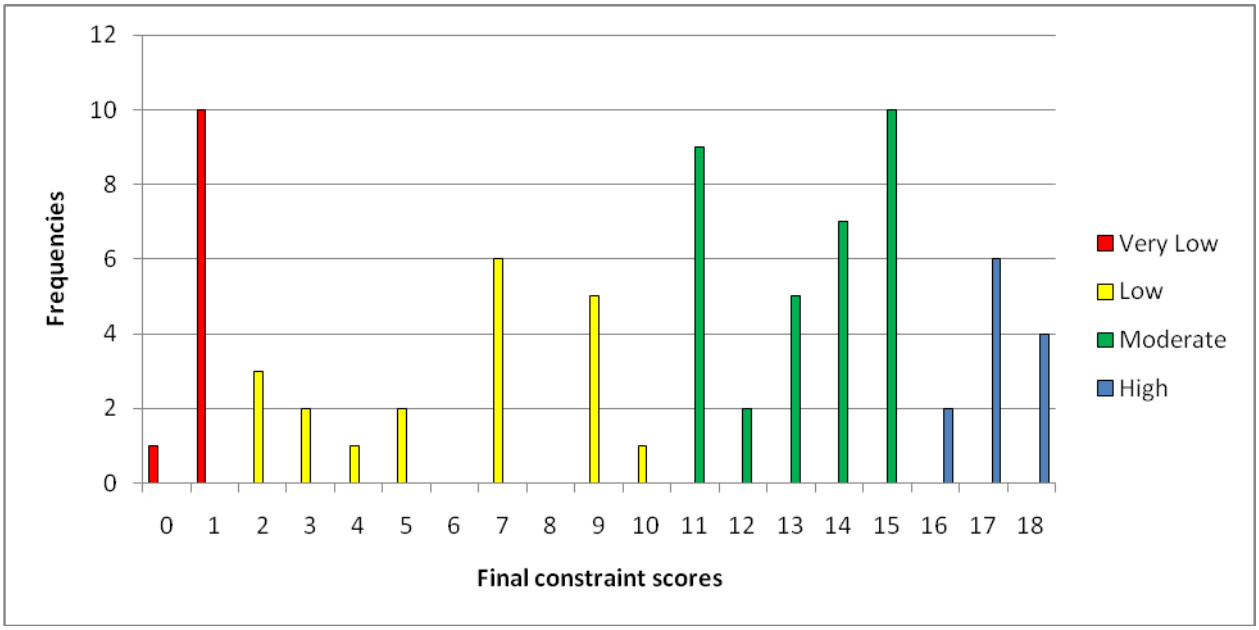

Figure 3: Frequency distribution of the final scores in the constraints layer

3 Results

3.1 VEGETATION COMMUNITIES

3.1.1 Data audit and literature review

The Vegetation of the Cumberland Plain, Western Sydney, was mapped in 2002 (NPWS 2002a) and updated in 2008 (DECC 2008). The updated 2008 mapping removed patches of vegetation which had a projected foliage cover of less than 10%. As such, vegetation mapping for the study area differed according to NPWS (2002a) and DECC (2008). According to the NPWS (2002a) mapping, the study area supported two EECs, CPW and SSTF, as well as WSGF and an unlisted vegetation community (**Figure 4**). According to the DECC (2008) mapping, the study area supported one EEC, SSTF, as well as WSGF and vegetation that had not been classified (**Figure 5**).

Vegetation mapping provided by The Hills Shire Council (THSC 2012) mapped three vegetation communities in the study area: CPW, SSTF, and Sydney Sandstone Gully Forest (SSGF). It also mapped vegetation that had not yet been classified (**Figure 6**).

Field validation by Hayes Environmental (2007) for Lot 26 in DP 834050, Lot 12 DP 835727, Lot 25 in DP 834050, and Lot 1 in DP 835727 in the north of the study area confirmed the presence of SSTF, but not the presence of WSGF which was mapped by NPWS (2002a) and DECC (2008) on these lots (**Figure 7**). Field validation by Travers Environmental (2008) for Lots 1 and 2 DP 1032790, Lot 2 DP 225401, Lot 2 DP 222080, Lot 2 DP 879450, Lot 1 DP 879450, and Lot 10 DP 563695 in the north east of the study area determined that SSTF and WSGF were not present as mapped by NPWS (2002a) and DECC (2008); rather, Sydney Sandstone Ridgetop Woodland (SSRW) was present over the majority of the lots. Further, Travers Environmental (2008) mapped disturbed open forest and disturbed gully forest on the lots, the latter of which was present in the south of Lot 1 in DP 1032790 and likely to once have been River Flat Eucalypt Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (RFEF) (**Figure 7**). RFEF is listed as an endangered EEC under the TSC Act.

3.1.2 Site inspection – presence and distribution of vegetation communities

Site inspection by ELA confirmed Hayes Environmental's (2007) assessment that SSTF was present in the north of the study area in Lot 26 in DP 834050, Lot 12 DP 835727, Lot 25 in DP 834050, and Lot 1 in DP 835727, and that WSGF mapped by NPWS (2002a) and DECC (2008), and CPW mapped by THSC (2012), were not present in these lots. Further, site inspection by ELA confirmed Travers Environmental's (2008) assessment that RFEF was present at the south of Lot 1 DP 1032790 (as opposed to WSGF mapped by NPWS (2002a) and DECC (2008)). However, ELA's site inspection found that SSTF was present within the majority of lots inspected by Travers Environmental (2008), and that SSRW did not occur in these lots. Further, ELA found that RFEF was present within the north east corner of Lot 1 DP 1032790, which was assessed by Travers Environmental's (2008) as supporting Disturbed Open Forest (*E. deanei/E. amplifolia*).

In the northern-most part of the study area, ELA validated unclassified vegetation (NPWS 2002a, DECC 2008) as SSTF. CPW, as listed under the TSC Act but not under the EPBC Act, was present in the southern parts of the study area, south from Lot 27 in DP 834050 to Lot 12 in DP 833069. RFEF was

present along the southern and south eastern boundaries of the study area within Lots 14 and 15 in DP 833069 and Lots 17 and 18 in DP834050.

The difference in the vegetation communities validated by ELA and Travers Environmental (2008) is based on the presence/absence of dominant tree species. Other parts of the vegetation validation of Travers Environmental (2008) and ELA were similar. Both validations used a combination of the underlying geology and the species assemblage. The assessment of the underlying geology based on mapping was the same (that the underlying geology and soils were transitional between shale and sandstone), with both Travers Environmental (2008) and ELA finding that the northern part of the study area had a strong sandstone influence. Further, the species assemblage recorded by Travers Environmental (2008) and ELA was similar (see Travers Environmental 2008 and section on SSTF below).

However, the final step of the vegetation validation was where Travers Environmental (2008) and ELA differed. ELA determined that the assemblage was more consistent with SSTF as described in NPWS (2002b). SSRW as described in NPWS (2002b) is dominated by *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus sclerophylla* (Hard-leaved Scribbly Gum) with *Banksia serrata* (Old Man Banksia) frequently present. Other trees such as *Eucalyptus punctata* (Grey Gum), *E. oblonga* (Narrow-leaved Stringybark) and *Angophora costata* (Smooth-barked Apple) also occur. None of the dominant species of SSRW, *Corymbia gummifera*, *Banksia serrata*, *E. oblonga* or *Angophora costata* were recorded during survey and therefore ELA determined that the vegetation was closer to SSTF than to SSRW.

The extent of vegetation communities, as validated in the field, is shown in **Figure 8**. Results from Biobanking plots are presented in **Appendix B**. Vegetation communities found in the study area are described in the following sections.

Shale Sandstone Transition Forest

Shale Sandstone Transition Forest was characterised by a canopy of *Eucalyptus punctata*, *E. tereticornis* (Forest Red Gum), and *Angophora bakeri* (Narrow-leaved Apple), with *E. eugenioides* (Thin-leaved Stringybark), *E. crebra* (Narrow-leaved Ironbark), *E. fibrosa* (Red/Broad-leaved Ironbark), and *E. sclerophylla* occurring in varying densities through the community. The understorey within this community was composed of shrubs including *Persoonia linearis* (Narrow-leaved Geebung), *Acacia floribunda* (White Sally), *Allocasuarina littoralis* (Black She-oak), *Leptospermum trinervium*, *Pimelea linifolia*, *Exocarpos cupressiformis* (Native Cherry), *Gahnia sieberana*, *Ozothamnus diosmifolius* (White Dogwood), *Kunzea ambigua* (Tick Bush), *Leucopogon juniperinum*, *Lepidosperma laterale*, and *Lomandra longifolia* (Spiny-headed Mat-rush). Some weeds including *Olea europaea* subsp. *cuspidata* (African Olive) and *Ligustrum* sp. (Privet species) were also present in low densities. The ground layer comprised of a mixture of grasses and forbs including *Pomax umbellata*, *Cheilanthes sieberi*, *Pratia purpurascens* (Whiteroot), *Microlaena stipoides* (Weeping Grass), *Trachymene incisor*, *Entolasia stricta* (Wiry Panic), *Paspalidium distans*, *Acianthus fornicatus* (Pixie Caps), *Panicum simile* (Two-colour Panic), *Glycine clandestina*, and *Hibbertia diffusa*.

River Flat Eucalypt Forest

River Flat Eucalypt Forest was characterised by a canopy of *E. tereticornis* and *E. amplifolia* (Cabbage Gum), although *E. deanei* (Mountain Blue Gum/Deane's Gum) and *E. moluccana* (Grey Box) were also present in the community. The understorey was mostly comprised of *Olea europaea* subsp. *cuspidata*, *Ligustrum* sp., *Acacia parramattensis* (Parramatta Wattle), *Acacia floribunda*, *Acacia decurrens* (Black Wattle), and *Melaleuca decora*, with some other species such as *Melaleuca linariifolia* and *Bursaria spinosa* (Native Blackthorn) also present. The ground layer comprised of species including *Hydrocotyle*

peduncularis, *Centella asiatica* (Pennywort), *Oplismenus imbecillis*, *Microlaena stipoides*, *Pratia purpurascens*, *Dichondra repens*, *Entolasia marginata*, *Oxalis perennans*, *Galium gaudichaudii*, and *Pellaea falcata* (Sickle Fern).

Cumberland Plain Woodland (as listed under the TSC Act only)

Cumberland Plain Woodland was characterised by a canopy of mostly *E. tereticornis*, although some *E. moluccana* was present in very low densities, and *Angophora floribunda* (Rough Barked Apple) occurred in parts of the community. The understorey was mostly comprised of *Acacia decurrens*, and *Acacia parramattensis*, although *Bursaria spinosa* was also present with *Ozothamnus diosmifolius* occurring less frequently. Weeds including *Olea europaea* subsp. *cuspidata* and *Ligustrum* sp. were present. The ground layer was dominated by the grass species, *Microlaena stipoides* in areas where weeds were absent, although other species including *Pratia purpurascens*, *Entolasia marginata* (Bordered Panic), *Paspalidium distans*, *Cheilanthes sieberi*, *Glycine clandestina*, *Glycine tabacina*, *Solanum prinophyllum*, *Centella asiatica*, and *Hydrocotyle peduncularis* were present in these areas. A large portion of the community was dominated by weeds, and as such, the community did not meet the EPBC Act criteria for the community whereby at least 30 % cover of the under storey is comprised of perennial native species.

3.1.3 Site inspection – condition of vegetation communities

The condition of vegetation communities varied within the study area, both in terms of weed densities and structurally. **Figure 9** and **Figure 10** show the condition of the vegetation communities in relation to weed density and structural characteristics, respectively.

Of the communities, CPW and RFEF were perhaps the most degraded, with the majority of the two communities displaying high weed infestations (although RFEF in the southern parts of the study area was less degraded by weeds). CPW was also degraded through disturbance to the mid-storey and ground layer, where the mid-storey had been removed and the ground layer maintained as a lawn.

SSTF was also degraded in parts, with the highest weed densities and modifications to the mid-storey occurring in the northern and eastern-most parts of the community. As well, the community experienced disturbance from paintball activities within Lot 26 DP 834050 and Lot 12 DP 835727, with the ground layer completely absent and the ground heavily compacted in some areas.

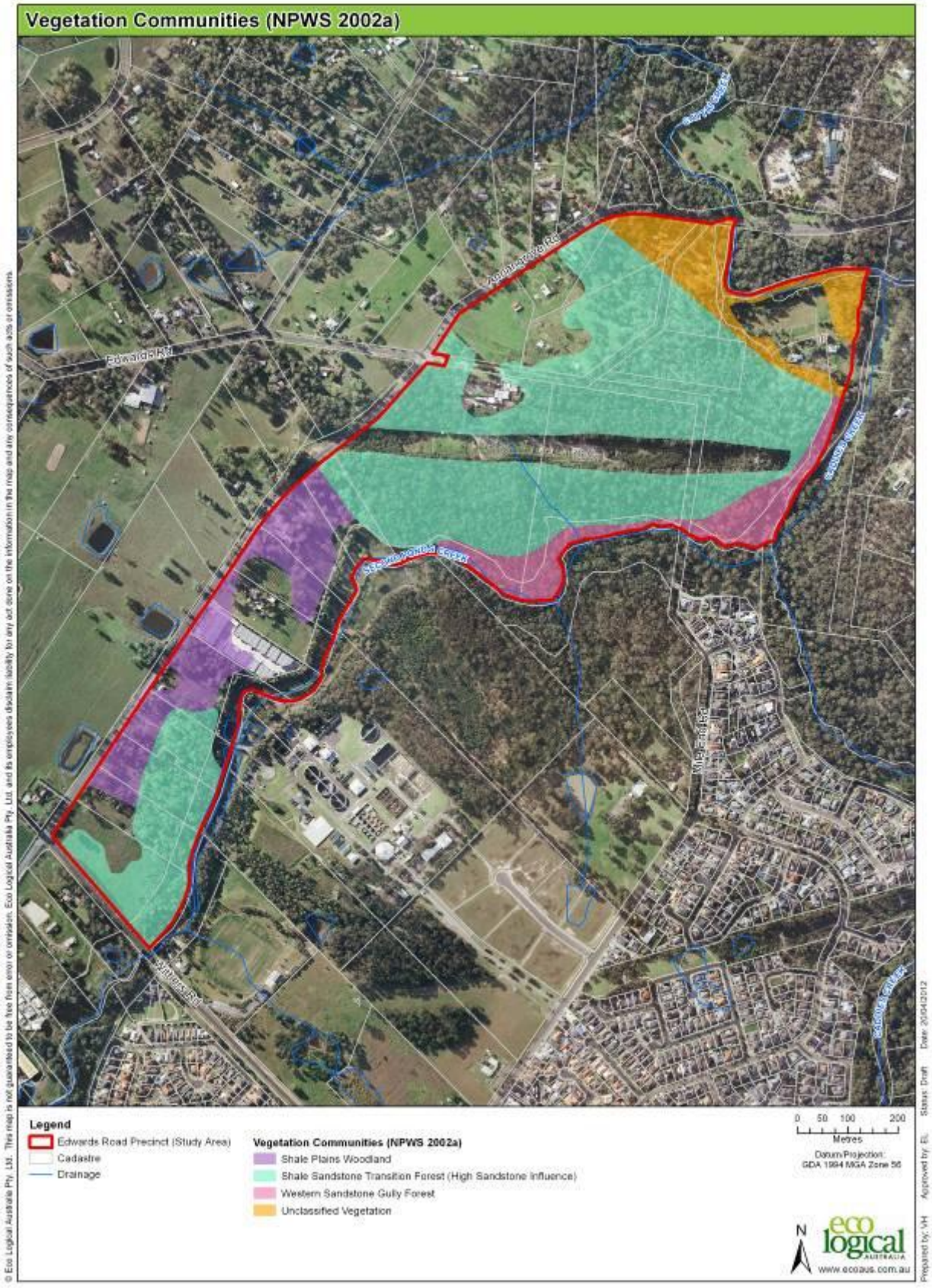

Figure 4: Vegetation communities (as per NPWS 2002a mapping) within the Edwards Road Precinct

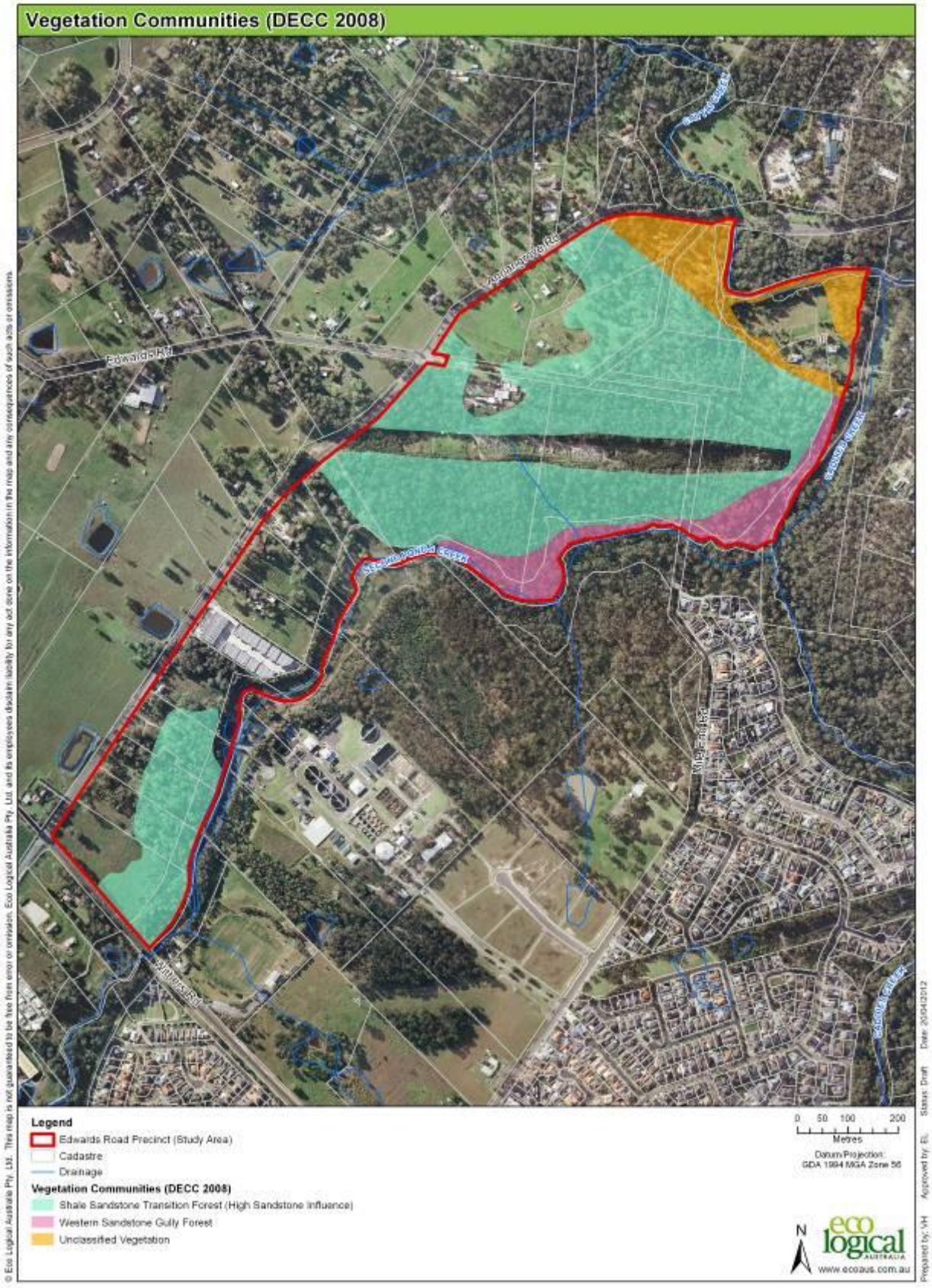

Figure 5: Vegetation communities (as per DECC 2008 mapping) within the Edwards Road Precinct

Figure 6: Vegetation communities (as per THSC 2012 mapping) within the Edwards Road Precinct

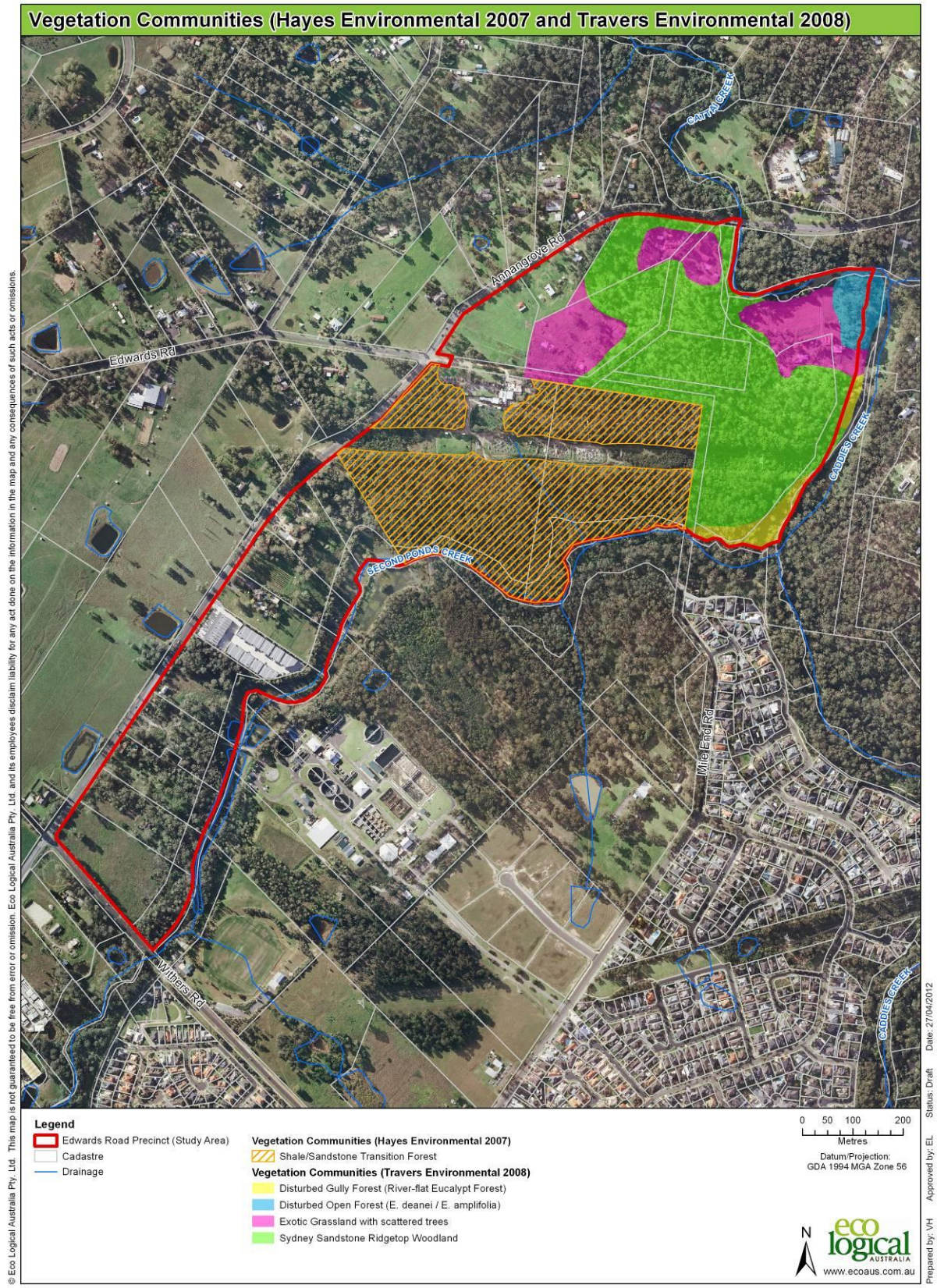

Figure 7: Vegetation communities as validated by Hayes Environmental (2007) and Travers Environmental (2008)

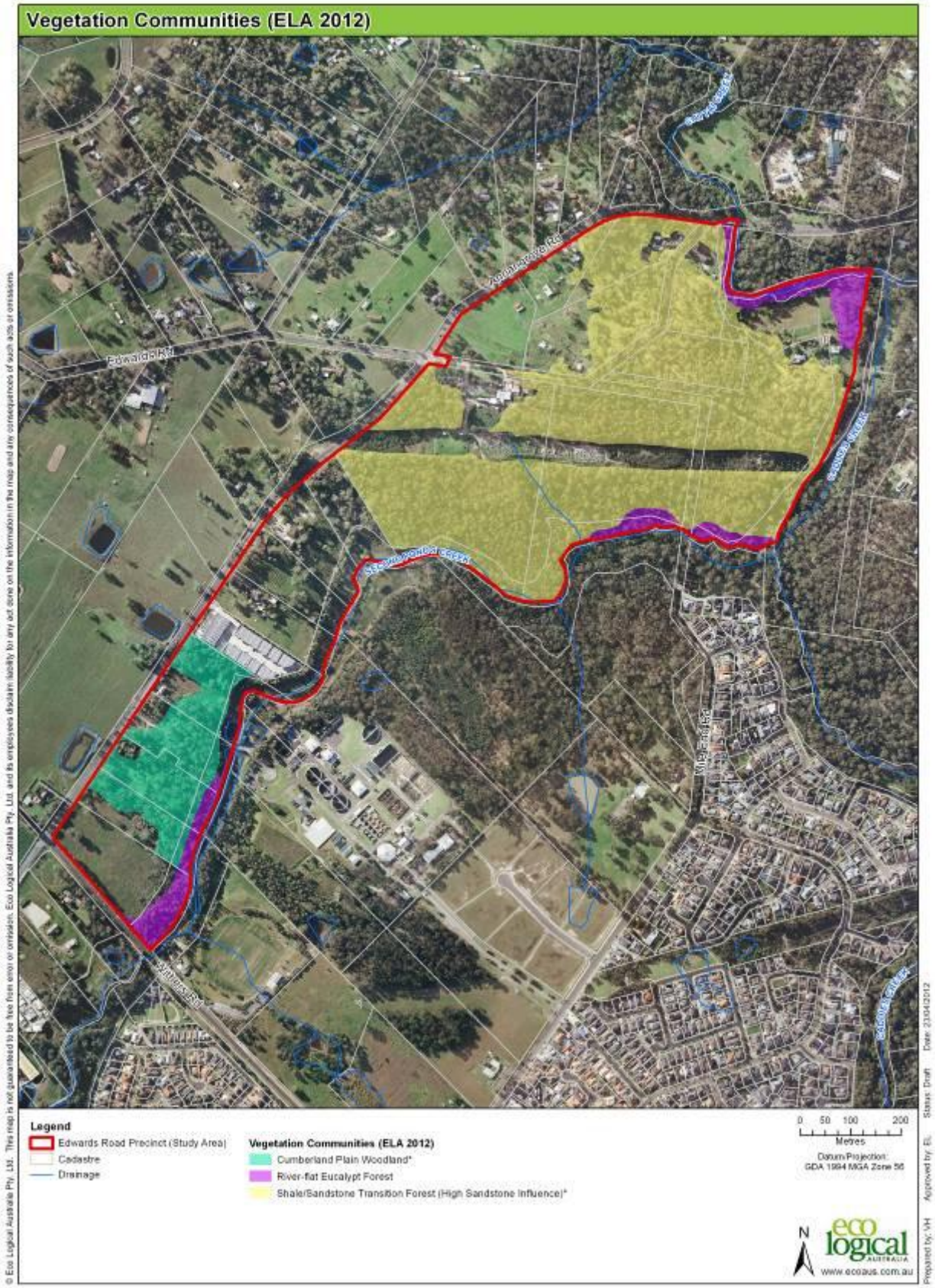

Figure 8: Vegetation communities as validated by ELA

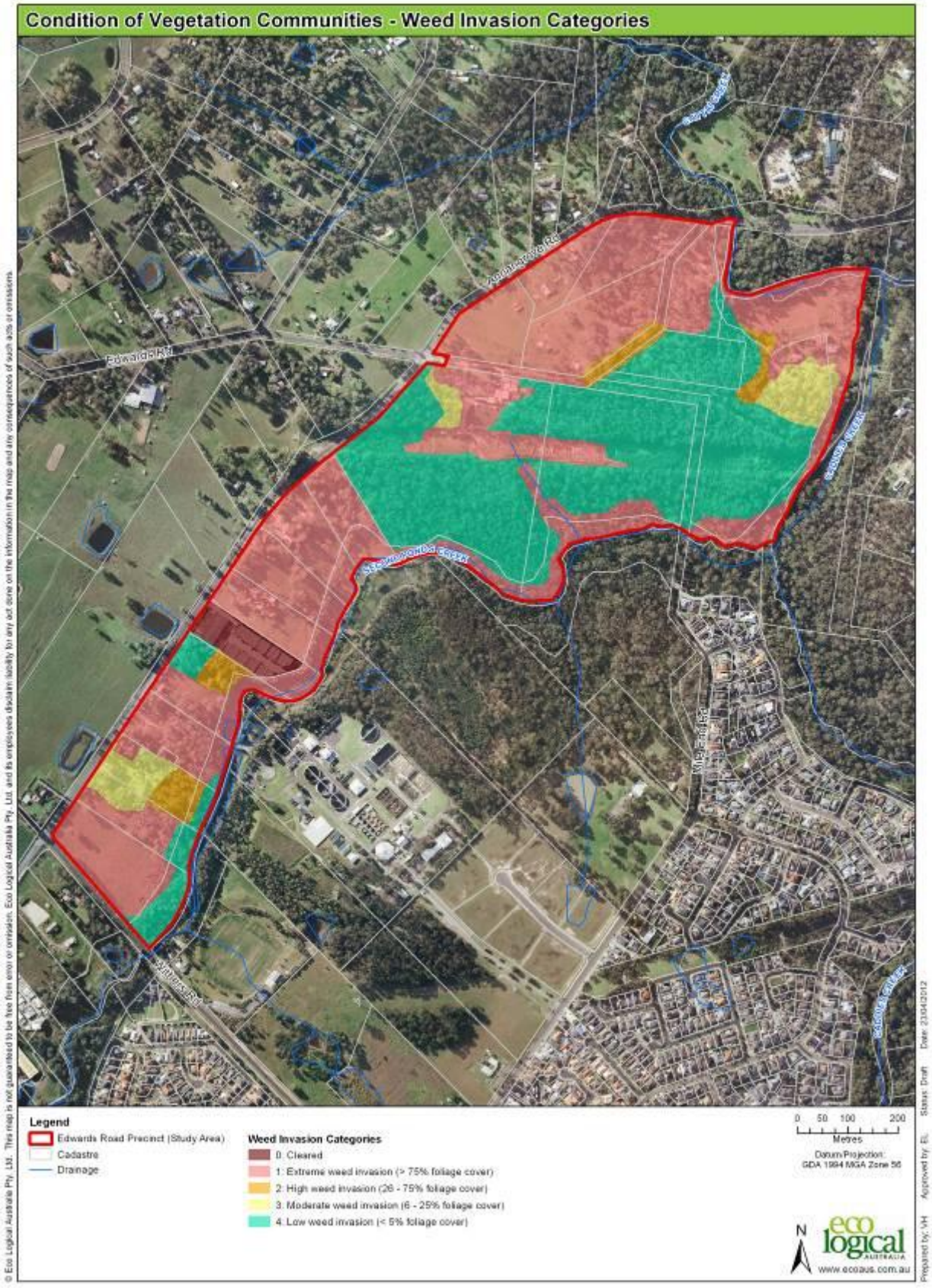

Figure 9: Condition of vegetation communities - weed invasion categories

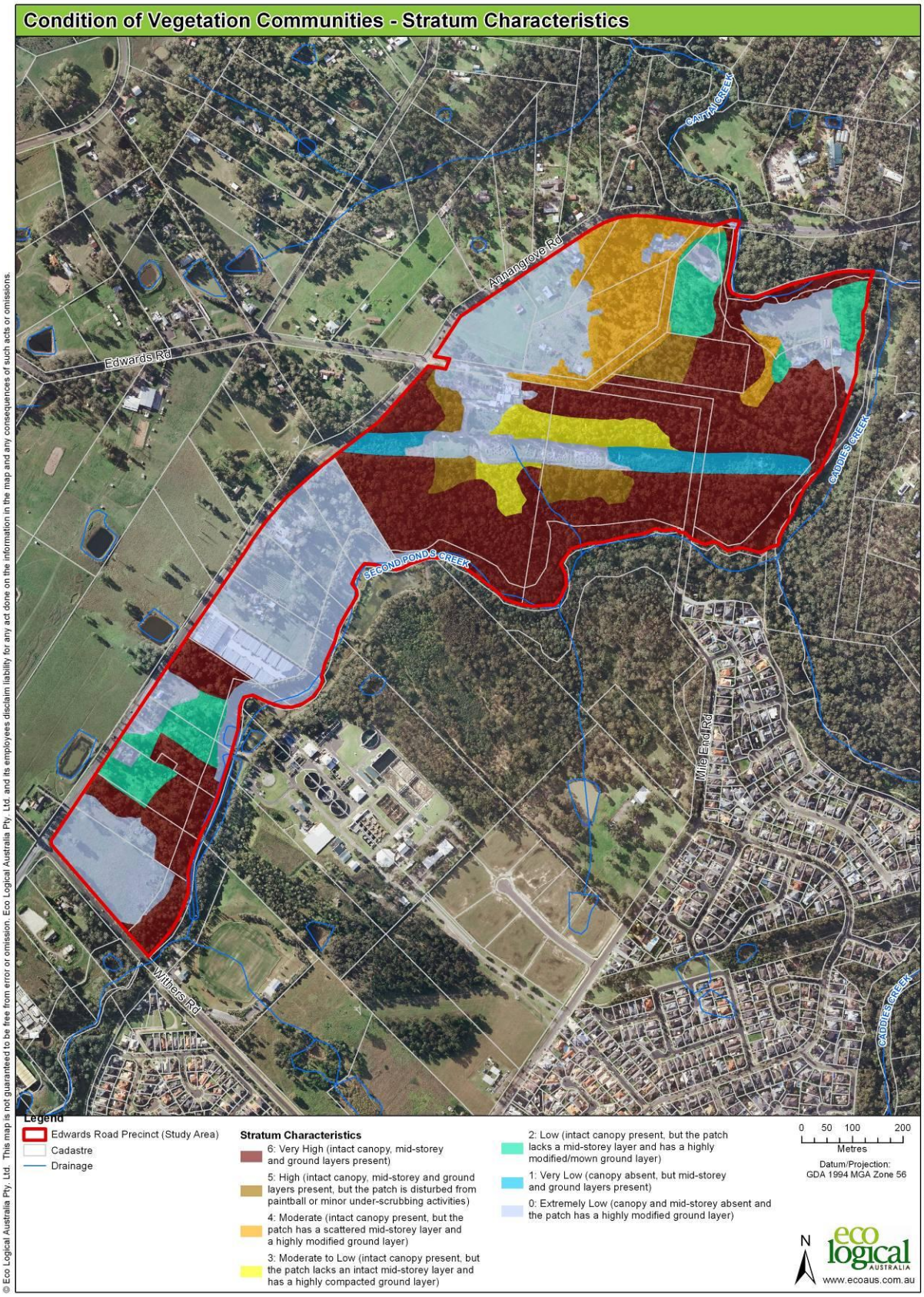

Figure 10: Condition of vegetation communities - categories according to stratum characteristics

3.2 FLORA

An assessment of the potential for threatened flora species to occur in the study area and a list of species previously recorded within the locality is included in **Appendix A**. **Figure 11** shows the locations of threatened flora species in the locality i.e. within a 10 km radius of the study area.

None of the flora species identified in **Appendix A** were recorded during the field survey, although Hayes Environmental (2007) recorded *Eucalyptus nicholii*, which was likely to have been planted. From the list of species previously recorded, 14 threatened flora species were considered as having the potential to occur within the study area:

- *Acacia bynoeana* (Bynoe's Wattle)
- *Acacia pubescens* (Downy Wattle)
- *Darwinia biflora*
- *Dillwynia tenuifolia*
- *Epacris purpurascens* var. *purpurascens*
- *Eucalyptus* sp. Cattai
- *Grevillea juniperina* subsp. *juniperina*
- *Hibbertia superans*
- *Lasiopetalum joyceae*
- *Leucopogon fletcheri* subsp. *fletcheri*
- *Persoonia hirsuta* (Hairy Geebung)
- *Pimelea curviflora* var. *curviflora*
- *Pimelea spicata* (Spiked Rice-flower), and
- *Tetratheca glandulosa.*

The potential for threatened flora to occur within the different vegetation communities (for the calculation of the flora and fauna habitat value input layer) is documented in **Appendix C**. A list of flora observed during the field survey is included in **Appendix D**. A total of 204 flora species comprised of 143 native and 61 exotic species were identified. Additional exotic weeds and landscape plantings in the study area were observed but not recorded.

Of the exotic species recorded, 11 are listed as noxious species for the Hawkesbury River County Council (which includes the Baulkham Hills LGA):

- *Salix spp.* (Willows): Class 5 noxious weed in the whole of NSW and in The Hills LGA
- *Rubus fruticosus* (Blackberry): Class 4 noxious weed in the whole of NSW and in The Hills Local Government Area (LGA)
- *Asparagus asparagoides* (Bridal Creeper): Class 4 noxious weed in The Hills LGA
- *Lantana camara* (Lantana): Class 4 noxious weed in The Hills LGA
- *Ligustrum lucidum* (Large-leaf Privet): Class 4 noxious weed in The Hills LGA
- *Ligustrum sinense* (Small-leafed Privet): Class 4 noxious weed in The Hills LGA
- *Olea europaea* subsp. *cuspidata* (African Olive): Class 4 noxious weed in The Hills LGA
- *Bryophyllum delagoense* (Mother-of-Millions): Class 3 noxious weed in The Hills LGA
- *Cestrum parqui* (Green Cestrum): Class 3 noxious weed in The Hills LGA
- *Ludwigia peruviana* (Ludwigia): Class 3 noxious weed in The Hills LGA, and
- *Salvinia molesta* (Salvinia): Class 3 noxious weed in The Hills LGA.

3.3 FAUNA

An assessment of the potential for threatened / migratory fauna species to occur in the study area and a list of species previously recorded within the locality has been included in **Appendix A**. **Figure 12** shows the locations of threatened/migratory fauna species in the locality.

None of the fauna species identified in **Appendix A** were recorded during the field survey, although *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) and *Myotis macropus* (Large-footed Myotis) were recorded by Hayes Environmental (2007) and Travers Environmental (2008), with *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat) recorded by Hayes Environmental (2007) and *Pteropus poliocephalus* (Grey-headed Flying-fox) recorded by Travers Environmental (2008). From the list of species previously recorded, 23 threatened and 6 migratory fauna species were considered as having the potential to occur within the study area:

Threatened

- *Litoria aurea* (Green and Golden Bell Frog)
- *Anthochaera phrygia* (Regent Honeyeater)
- *Callocephalon fimbriatum* (Callocephalon fimbriatum)
- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)
- *Circus assimilis* (Spotted Harrier)
- *Daphoenositta chrysoptera* (Varied Sittella)
- *Hieraaetus morphnoides* (Little Eagle)
- *Glossopsitta pusilla* (Little Lorikeet)
- *Lathamus discolor* (Swift Parrot)
- *Lophoictinia isura* (Square-tailed Kite)
- *Melanodryas cucullata cucullata* (Hooded Robin – south eastern subspecies)
- *Melithreptus gularis gularis* (Black-chinned Honeyeater - eastern subspecies)
- *Petroica boodang* (Scarlet Robin)
- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Tyto novaehollandiae* (Masked Owl)
- *Tyto tenebricosa* (Sooty Owl)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Miniopterus australis* (Little Bentwing-bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Mormopterus norfolkensis* (East Coast Freetail Bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat), and
- *Meridolum corneovirens* (Cumberland Land Snail).

Migratory

- *Apus pacificus* (Fork-tailed Swift)
- *Hirundapus caudacutus* (White-throated Needletail)
- *Merops ornatus* (Rainbow Bee-eater)
- *Monarcha melanopsis* (Black-faced Monarch)
- *Myiagra cyanoleuca* (Satin Flycatcher), and
- *Rhipidura rufifrons* (Rufous Fantail).

The potential for threatened and migratory fauna occur within the different vegetation communities (for the calculation of the flora and fauna habitat value input layer) is documented in **Appendix C**. A list of

fauna observed during the field survey is included in **Appendix E**. A total of 44 fauna species were recorded via direct observation, animal signs, and by their calls (33 birds, eight mammals and three frogs). Of the species recorded, eight were exotic species.

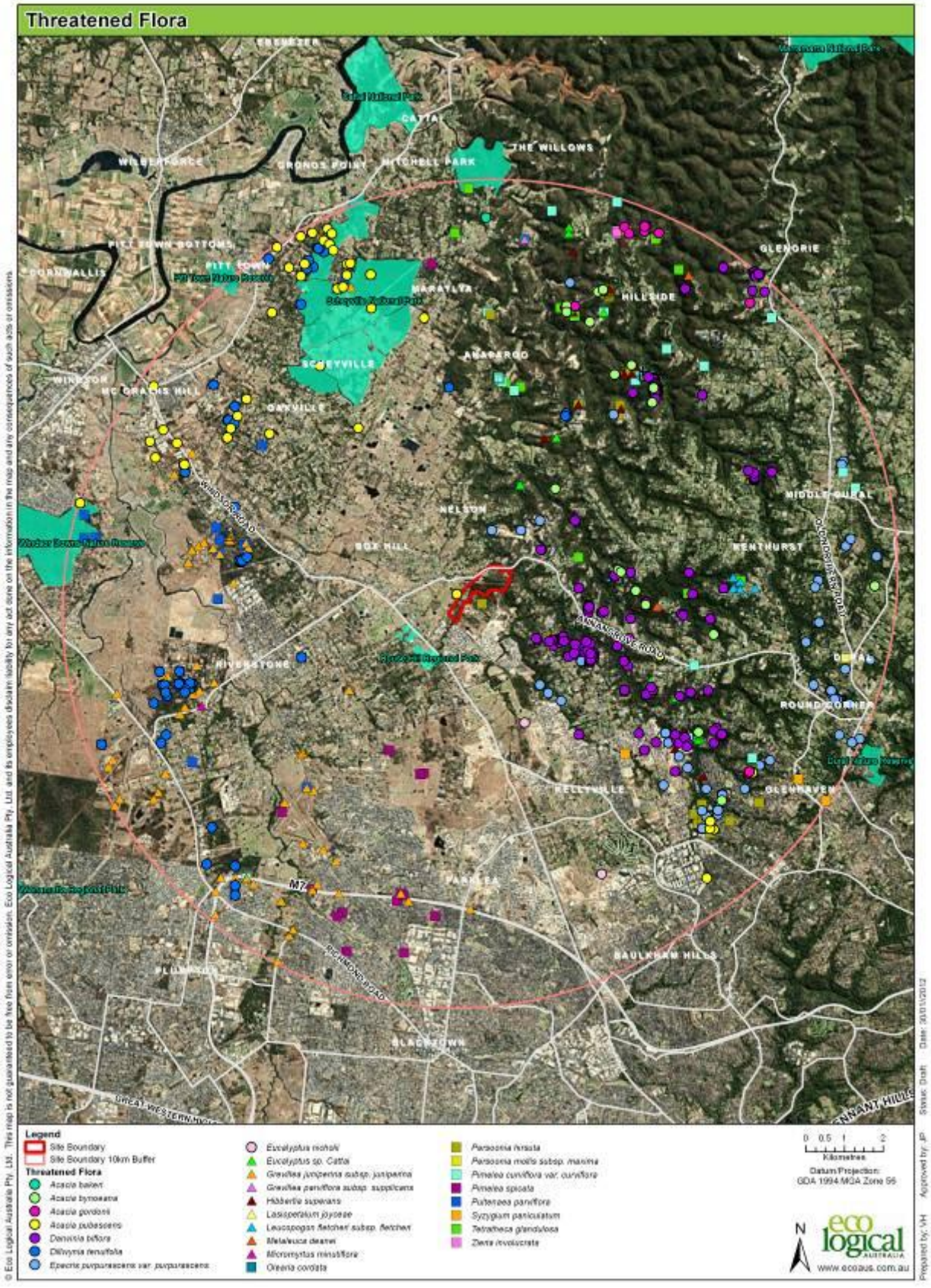

Figure 11: Threatened flora records in the locality (10 km radius)

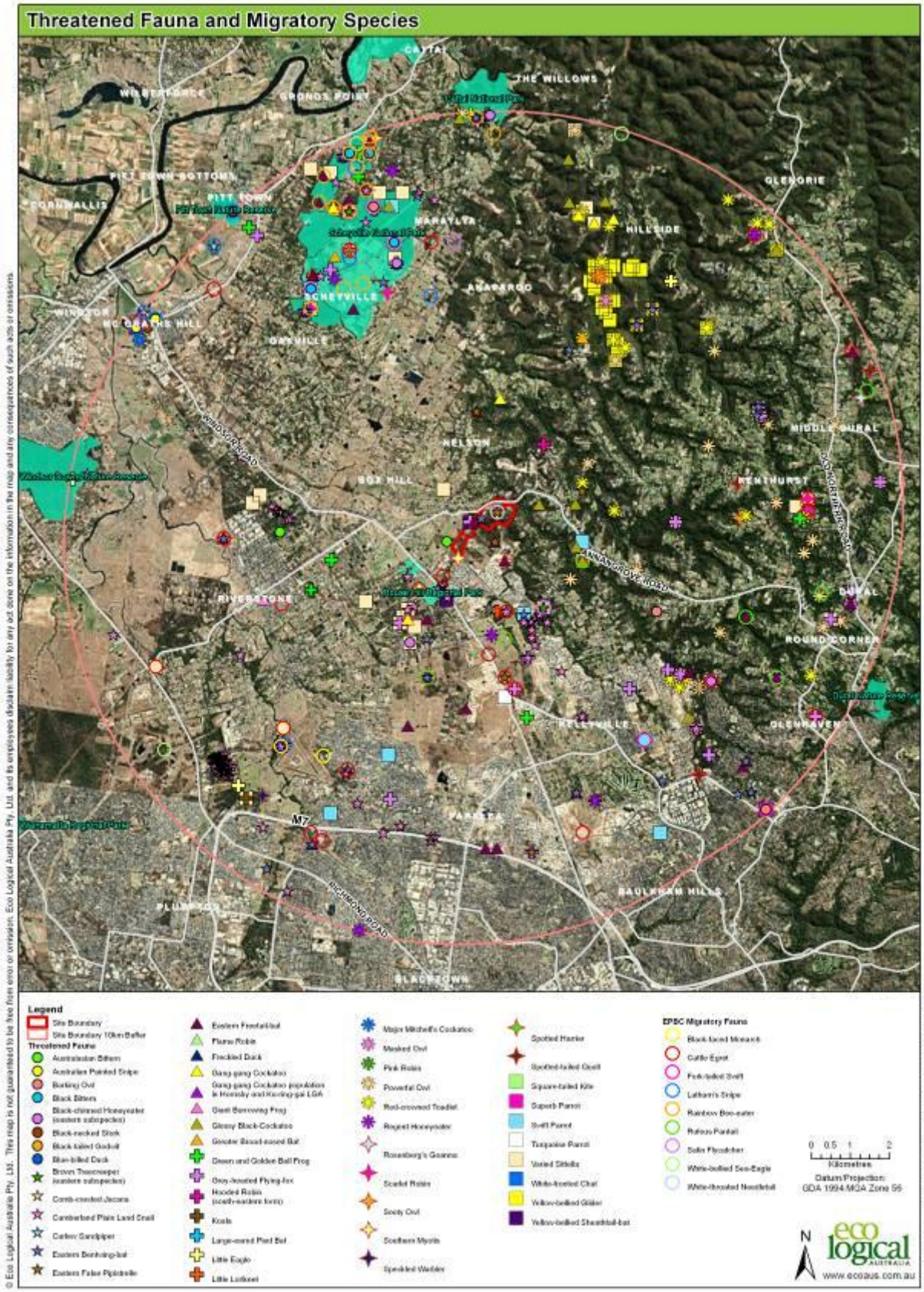

Figure 12: Threatened and migratory fauna records in the locality (10 km radius)

3.4 HABITAT ELEMENTS

There were a number of habitat elements present within the study area for flora and fauna species. Habitat elements in the study area included:

- Intact canopy layers within vegetation communities
- Intact and semi-intact shrub-layers within vegetation communities
- Stags supporting hollows
- Hollow-bearing trees
- Trees with flaking bark
- Leaf litter
- Woody debris (fallen logs and braches);
- Exposed sandstone outcrops, and
- Standing fresh water (within creeks).

The habitat elements available across the study area provided sheltering, foraging, and roosting habitat for a range of fauna groups. Intact canopy and mid-storey layers provided foraging habitat for birds, bats and arboreal mammals, with tree canopies providing sheltering habitat for birds. Hollow-bearing trees, stags and trees with flaking bark provided roosting and/or breeding habitat for birds, bats, and arboreal mammals. Leaf litter, woody debris and exposed sandstone outcrops provided foraging and sheltering habitat for ground dwelling mammals, reptiles and some frog species. Standing fresh water provided foraging and breeding habitat for frog species, foraging habitat for bat species, and foraging and sheltering habitat for water birds and fish.

With regards to threatened fauna species, canopy trees and shrubs may provide foraging habitat for woodland bird species, diurnal and nocturnal birds of prey, and bat species (see Section 3.3 for species with the potential to occur). Standing water may also provide foraging habitat for threatened microbat species. Fallen logs within CPW may provide habitat for Cumberland Land Snail.

3.5 THREATENED/MIGRATORY FLORA AND FAUNA HABITAT VALUE INPUT LAYER

The results of the species tallies per vegetation community (tallied from the assessment provided in **Appendix C**) multiplied by weightings to reflect their conservation significance and determine scores and final scores for the threatened/migratory flora and fauna habitat value input layer are shown in **Table 4**, **Table 5**, and **Table 6**.

Figure 13 shows the areas of high, moderate and low threatened/migratory flora and fauna habitat value.

Table 4: Results of score calculations for Shale Sandstone Transition Forest

LIKELIHOOD	STATUS	COUNTS OF SPECIES	MULTIPLIER	SCORE
Yes	EPBC (E)	0	4	0
	EPBC (V)	2	3	6
	EPBC (M)	0	1	0
	TSC (E)	0	3	0
	TSC (V)	5	2	10
	ROTAP	0	1	0
Likely	EPBC (E)	0	4	0
	EPBC (V)	0	3	0
	EPBC (M)	0	1	0
	TSC (E)	0	3	0
	TSC (V)	5	2	10
	ROTAP	0	1	0
Potential	EPBC (E)	3	4	12
	EPBC (V)	6	3	18
	EPBC (M)	5	1	5
	TSC (E)	7	3	21
	TSC (V)	19	2	38
	ROTAP	7	1	7
			FINAL SCORE	**127**

Table 5: Results of score calculations for Cumberland Plain Woodland

LIKELIHOOD	STATUS	COUNTS OF SPECIES	MULTIPLIER	SCORE
Yes	EPBC (E)	0	4	0
	EPBC (V)	1	3	3
	EPBC (M)	0	1	0
	TSC (E)	0	3	0
	TSC (V)	4	2	8
	ROTAP	0	1	0
Likely	EPBC (E)	0	4	0
	EPBC (V)	0	3	0
	EPBC (M)	0	1	0
	TSC (E)	0	3	0
	TSC (V)	5	2	10
	ROTAP	0	1	0
Potential	EPBC (E)	3	4	12
	EPBC (V)	2	3	6
	EPBC (M)	5	1	5
	TSC (E)	4	3	12
	TSC (V)	17	2	34
	ROTAP	4	1	4
			FINAL SCORE	**94**

Table 6: Results of score calculations for River Flat Eucalypt Forest

LIKELIHOOD	STATUS	COUNTS OF SPECIES	MULTIPLIER	SCORE
Yes	EPBC (E)	0	4	0
	EPBC (V)	1	3	3
	EPBC (M)	0	1	0
	TSC (E)	0	3	0
	TSC (V)	4	2	8
	ROTAP	0	1	0
Likely	EPBC (E)	0	4	0
	EPBC (V)	0	3	0
	EPBC (M)	0	1	0
	TSC (E)	0	3	0
	TSC (V)	5	2	10
	ROTAP	0	1	0
Potential	EPBC (E)	2	4	8
	EPBC (V)	1	3	3
	EPBC (M)	7	1	7
	TSC (E)	3	3	9
	TSC (V)	10	2	20
	ROTAP	0	1	0
			FINAL SCORE	**68**

3.6 CORE VEGETATION AND HABITAT CONNECTIVITY INPUT LAYER

The result of the analysis for core vegetation and habitat connectivity is shown in **Figure 14**. They are based on the categories shown in **Table 2**.

Core Habitat and Support for Core areas shown in **Figure 14** include areas mapped by NPWS (2002c) as well as sandstone vegetation that was not mapped by NPWS (2002c) but was mapped as part of this report.

Within the study area Core Habitat includes areas of better quality vegetation, including endangered ecological communities. Areas of Support for Core provide connectivity between areas of Core habitat.

In a wider context, the Core Habitat and areas of Support for Core within the study area provide connectivity between areas of habitat that have been mapped in the local area. **Figure 15** shows the study area within this local context. It shows a composite of 3 mapping data sets. The mapping within the study area consists of the Core Habitat and Support for Core habitat mapped for this report. The remainder of the vegetation consist of the habitat mapping by NPWS (2002c) and the more broad-scale mapping of the Sydney Region by the Benson (1992).

In terms of connectivity with habitat outside of the study area, the Core Habitat in the north of the site forms part of a broad north/south corridor. The Core habitat and Support for Core areas within the study area also provide connectivity in an east-west direction.

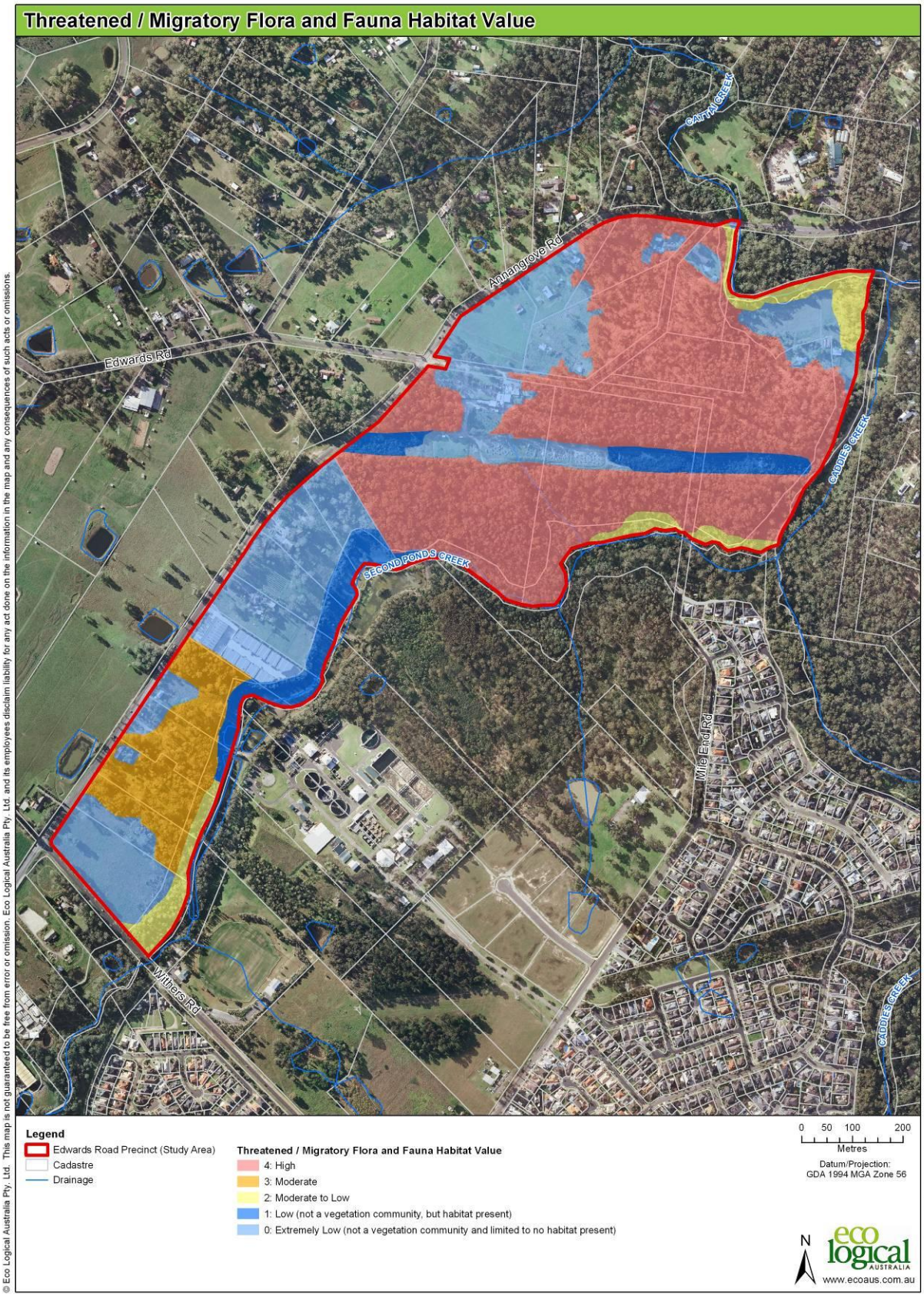

Figure 13: Areas of high, moderate and low threatened/migratory flora and fauna habitat value

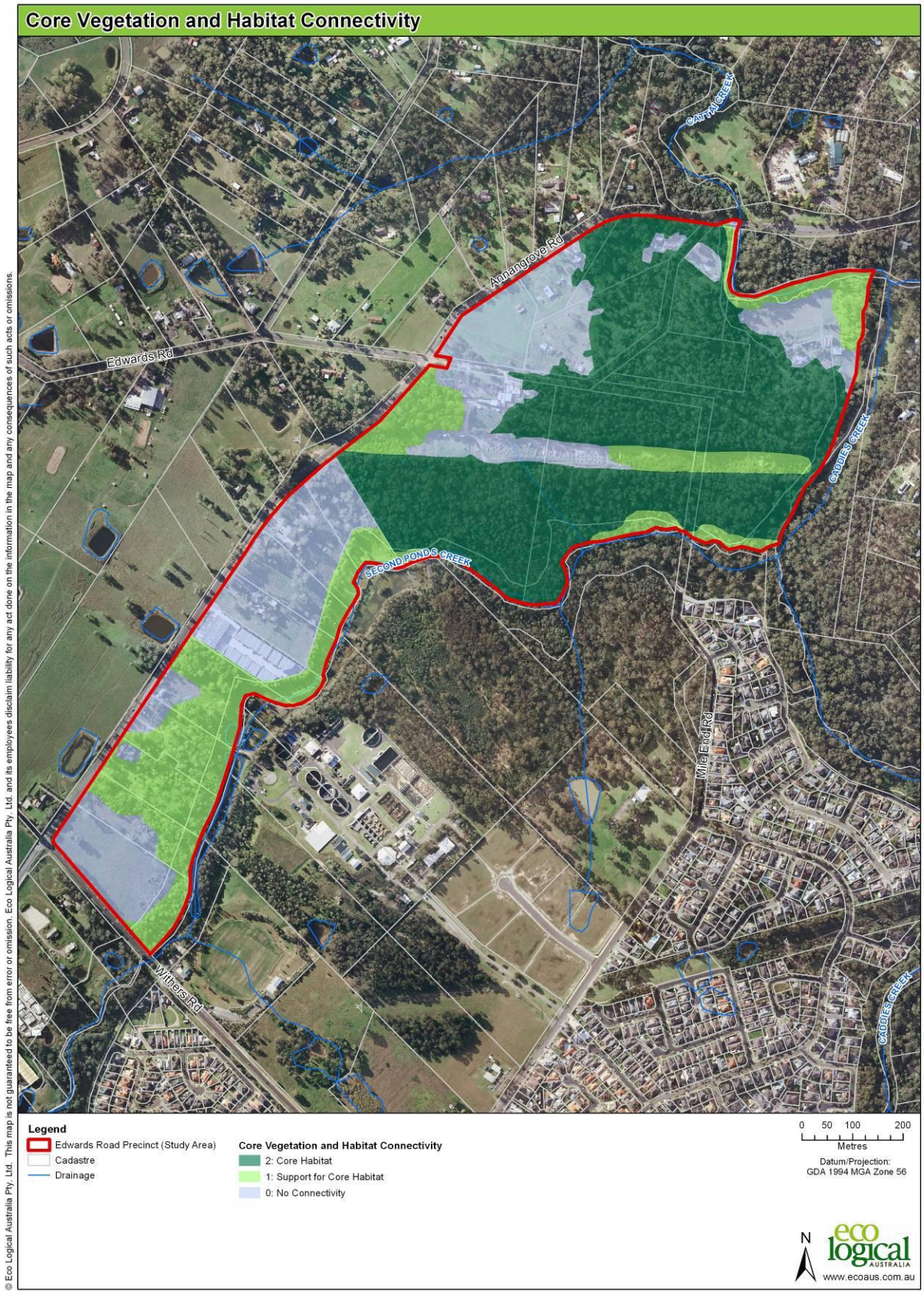

Figure 14: Core vegetation and habitat connectivity across the study area

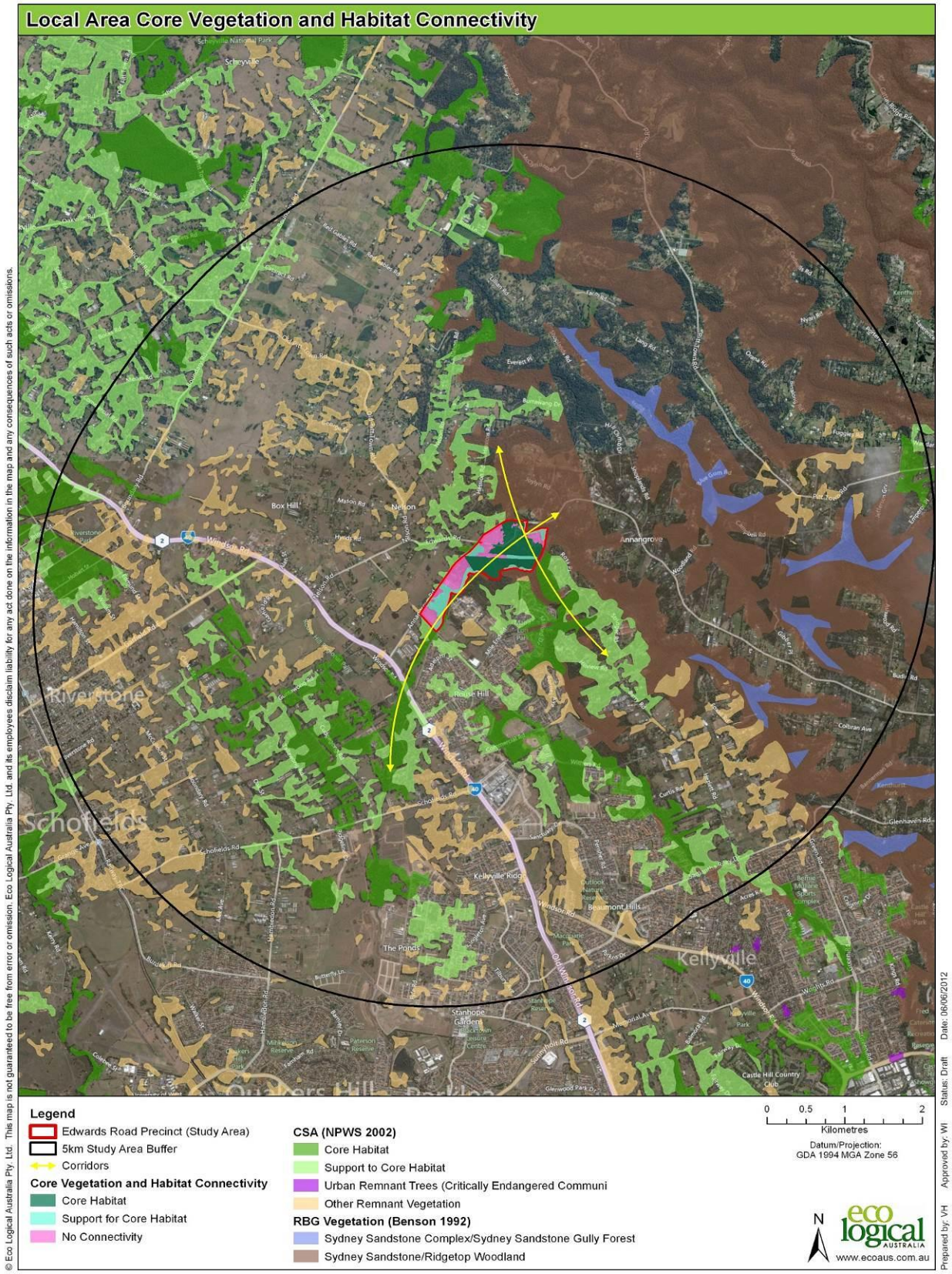

Figure 15: Core vegetation and habitat connectivity across the local area.

3.7 CONSTRAINTS ASSESSMENT

The result from the constraints assessment is shown in **Figure 16**. The constraints assessment found that the majority of vegetated areas were of high or moderate ecological value, with some vegetated areas of low ecological value. Therefore, the majority of vegetated areas were identified as having some level of constraint in terms of development.

Of the vegetation communities, SSTF and CPW were the only communities assessed as having high ecological value. In relation to SSTF, this was mostly due to the community being in good condition, but the community is also listed as an EEC at the Commonwealth level, was classified as core vegetation, and had the highest threatened/migratory flora and fauna habitat value of all the communities in the study area. Both RFEF and CPW had experienced greater degrees of weed degradation and structural disturbances compared to SSTF; the only areas where CPW was assessed as having high ecological value were where weed degradation was low and/or where the community was structurally intact. Also, RFEF is not listed at the Commonwealth level, and CPW in the study area did not meet the listing criteria for the community under the EPBC Act. Both RFEF and CPW classified as Support for Core rather than Core vegetation. Areas where SSTF were assessed as having moderate ecological value were generally those which supported a high density of weeds or had experienced structural or other disturbances.

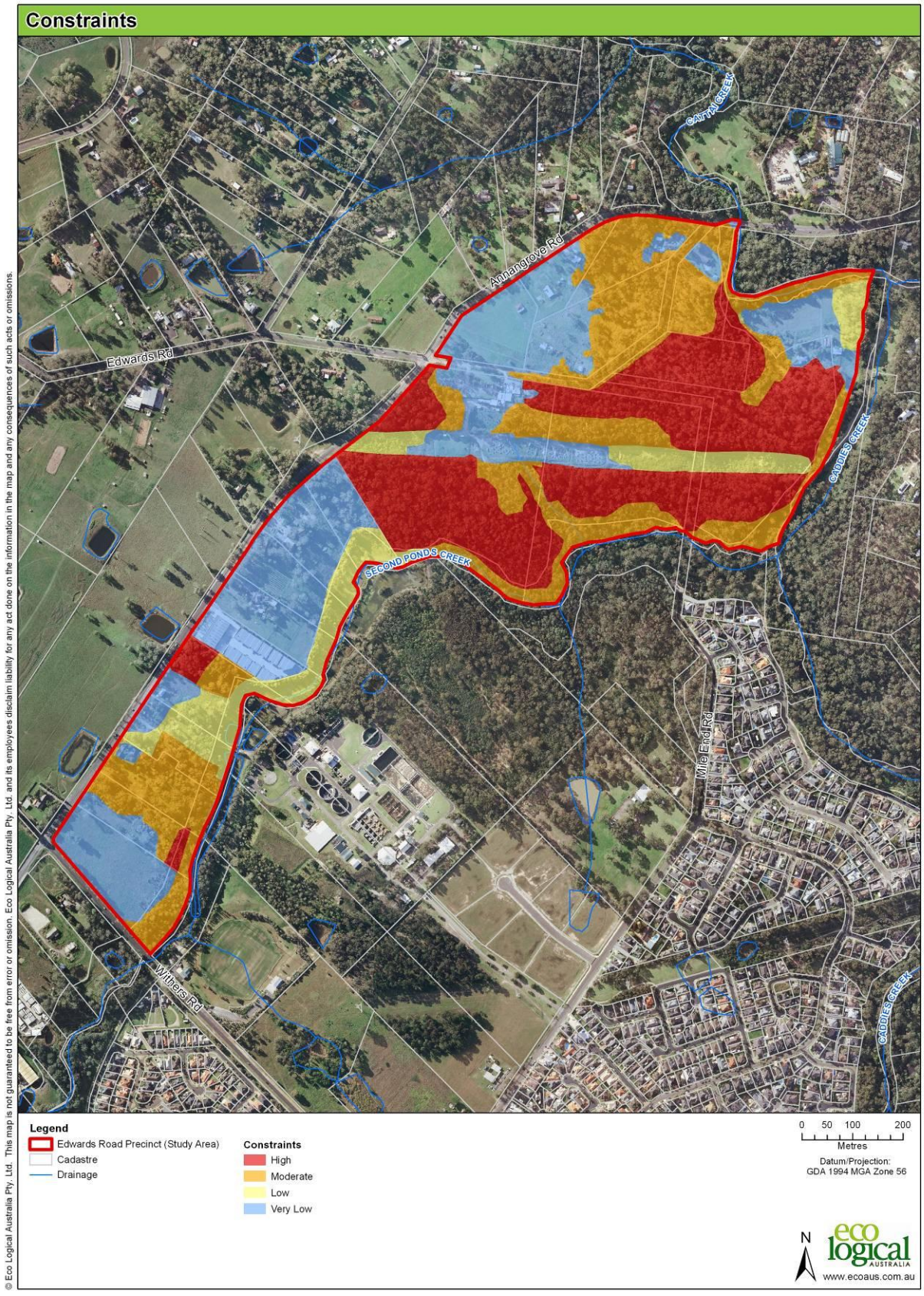

Figure 16: Results from the constraints analysis

4 Conservation and Management Recommendations

Given that vegetated areas in the study area were generally those areas with the highest ecological value, vegetated areas within the study area had the highest level of constraint in terms of development for industrial use and/or subdivision, although existing disturbances to vegetated areas influenced the degree of ecological value/developmental constraint. Conversely, areas that have already been cleared or developed and lacked intact native vegetation (as represented by intact canopy, mid-storey and under-storey layers) were generally those areas with the lowest ecological value, representing the lowest areas of constraint to development.

Despite the generalities that can be applied to the study area in terms of ecological value/developmental constraint, Council seeks specific conservation and management recommendations to inform precinct planning at the Lot level, addressing:

- Areas suitable for development with no further ecological constraints
- Areas of biodiversity value that should be considered for retention
- Measures to protect biodiversity values
- Priority areas that could be considered for restoration, regeneration or revegetation
- Any proposed mechanisms for implementation of these recommendations, and
- Measures to control ecological impacts identified on the site.

Information at the lot level identifying areas suitable for development, areas of biodiversity value, and priority areas for restoration, regeneration or revegetation is provided in **Table 7**. Areas suitable for development, areas of biodiversity value, and priority areas for restoration, regeneration or revegetation are illustrated in **Figure 17**, **Figure 18**, and **Figure 19**, respectively.

Table 7: Areas suitable for development, areas of biodiversity level, and priority areas for restoration, regeneration or revegetation

STREET ADDRESS	LOT	DP	SUITABLE FOR DEVELOPMENT	AREA OF BIODIVERSITY VALUE (CONSIDER RETENTION)	PRIORITY AREA (CONSIDER FOR RESTORATION, REGENERATION, REVEGETATION)
278 Annangrove Road	2	879450	Potentially ^	Yes, but area is degraded	Yes, if area not developed
282 Annangrove Road	2	1032790	No	Yes	Yes
284 Annangrove Road	10	563695	Potentially ^	Yes, but area is degraded	Yes, if area not developed
286 Annangrove Road	2	838278	Potentially ^	Yes, but area is degraded	Yes, if area not developed
288 Annangrove Road	3	222080	Yes	No	No
20 Edwards Road	2	222080	Potentially ^	Yes, but area is degraded	Yes, if area not developed
31 Edwards Road	2	225401	No	Yes	Not currently high priority #
290-312 Annangrove Road	26	834050	Parts	Yes	Yes
290-312 Annangrove Road	12	835727	Parts	Yes	Yes

STREET ADDRESS	LOT	DP	SUITABLE FOR DEVELOPMENT	AREA OF BIODIVERSITY VALUE (CONSIDER RETENTION)	PRIORITY AREA (CONSIDER FOR RESTORATION, REGENERATION, REVEGETATION)
314 Annangrove Road *	27	834050	Yes	No	No
316 Annangrove Road *	28	834050	Yes	No	No
318 Annangrove Road	29	834050	Yes	No	No
320 Annangrove Road	30	834050	Yes	No	No
322 Annangrove Road		78246	Yes	No	No
324 Annangrove Road	32	834050	Potentially ^	Yes, but area is degraded	Yes, if area not developed
326 Annangrove Road	33	834050	Potentially ^	Yes, but area is degraded	Yes, if area not developed
328 Annangrove Road	34	834050	Potentially ^	Yes, but area is degraded	Yes, if area not developed
330 Annangrove Road	12	833069	Potentially ^	Yes, but area is degraded	Yes, if area not developed
332-334 Annangrove Road	13	833069	Yes	No	No
NA (part of drainage corridor)	1	1032790	Parts	Parts	Yes
NA	1	133473	No	Yes	Not currently high priority #
NA (part of drainage corridor)	1	835727	No	Yes	Yes
NA (part of drainage corridor)	1	879450	No	Yes	Yes
NA (part of drainage corridor)	14	833069	No	Yes	Not currently high priority #
NA (part of drainage corridor)	15	833069	No	Yes	Not currently high priority #
NA (part of drainage corridor)	17	834050	No	Yes	Not currently high priority #
NA (part of drainage corridor)	18	834050	No	Yes	Yes
NA (part of drainage corridor)	19	834050	No	Yes	Yes
NA (part of drainage corridor)	20	834050	No	Yes	Yes
NA (part of drainage corridor)	21	834050	No	Yes	Yes
NA (part of drainage corridor)	22	834050	No	Yes	Yes
NA (part of drainage corridor)	23	834050	No	Yes	Yes
NA (part of drainage corridor)	24	834050	No	Yes	Yes
NA (part of drainage corridor)	25	834050	No	Yes	Yes

* vegetation on these lots was observed during the site inspection as cleared, despite available aerial imagery
^ if offsets are committed to and meet the improve or maintain test
# weed density is currently low, but needs to be maintained to this low level

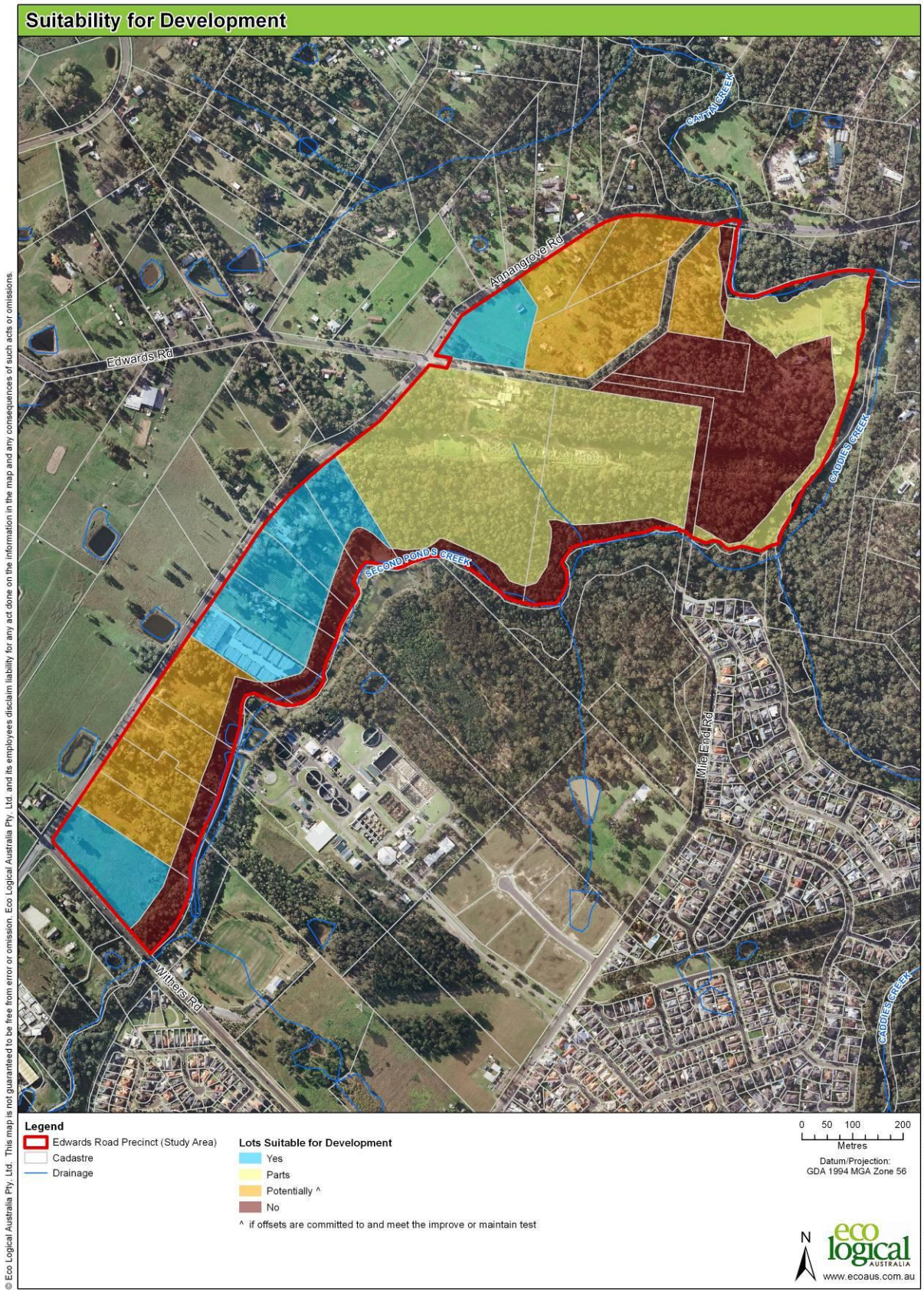

Figure 17: Areas suitable for development

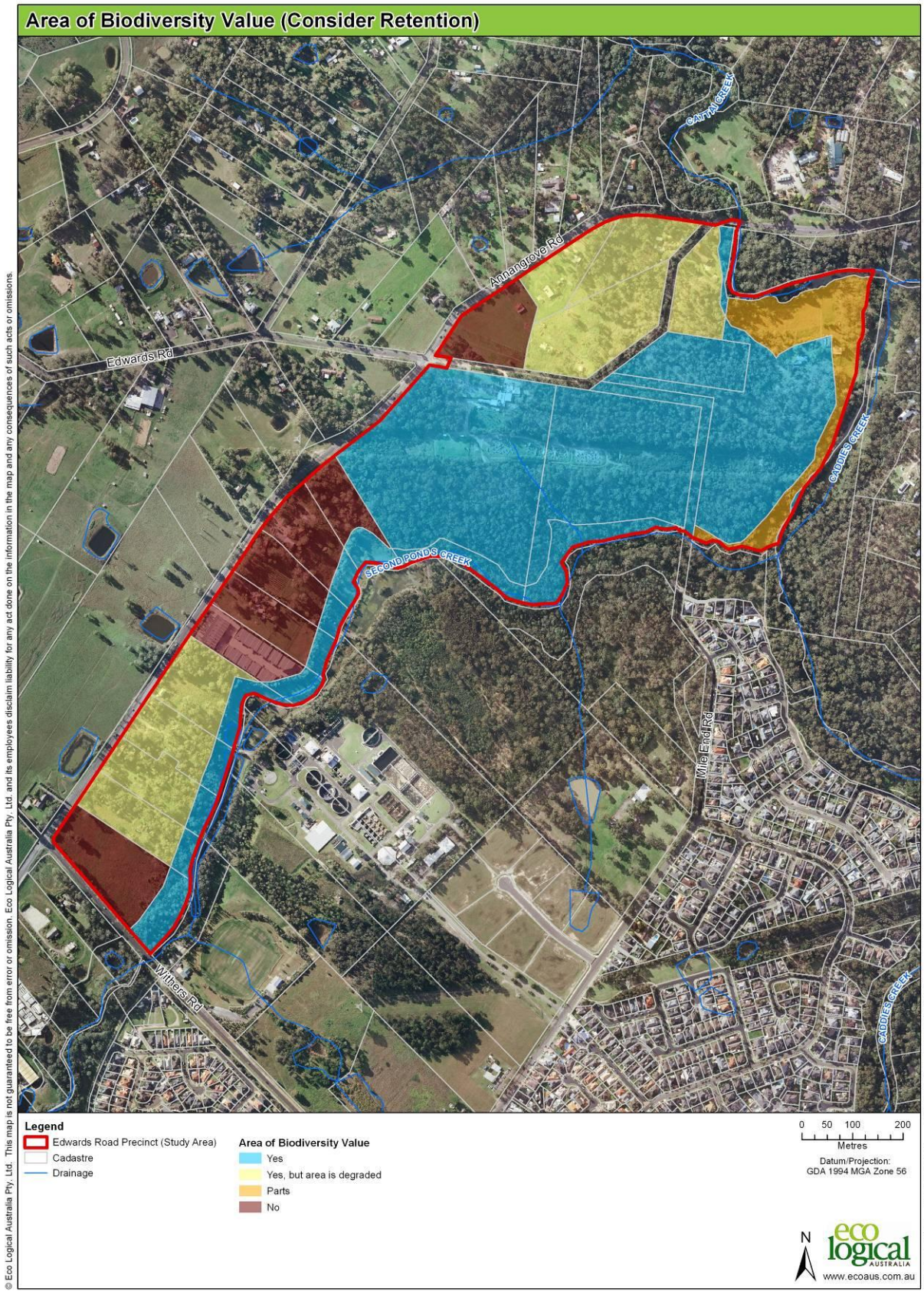

Figure 18: Areas of biodiversity value to be considered for retention

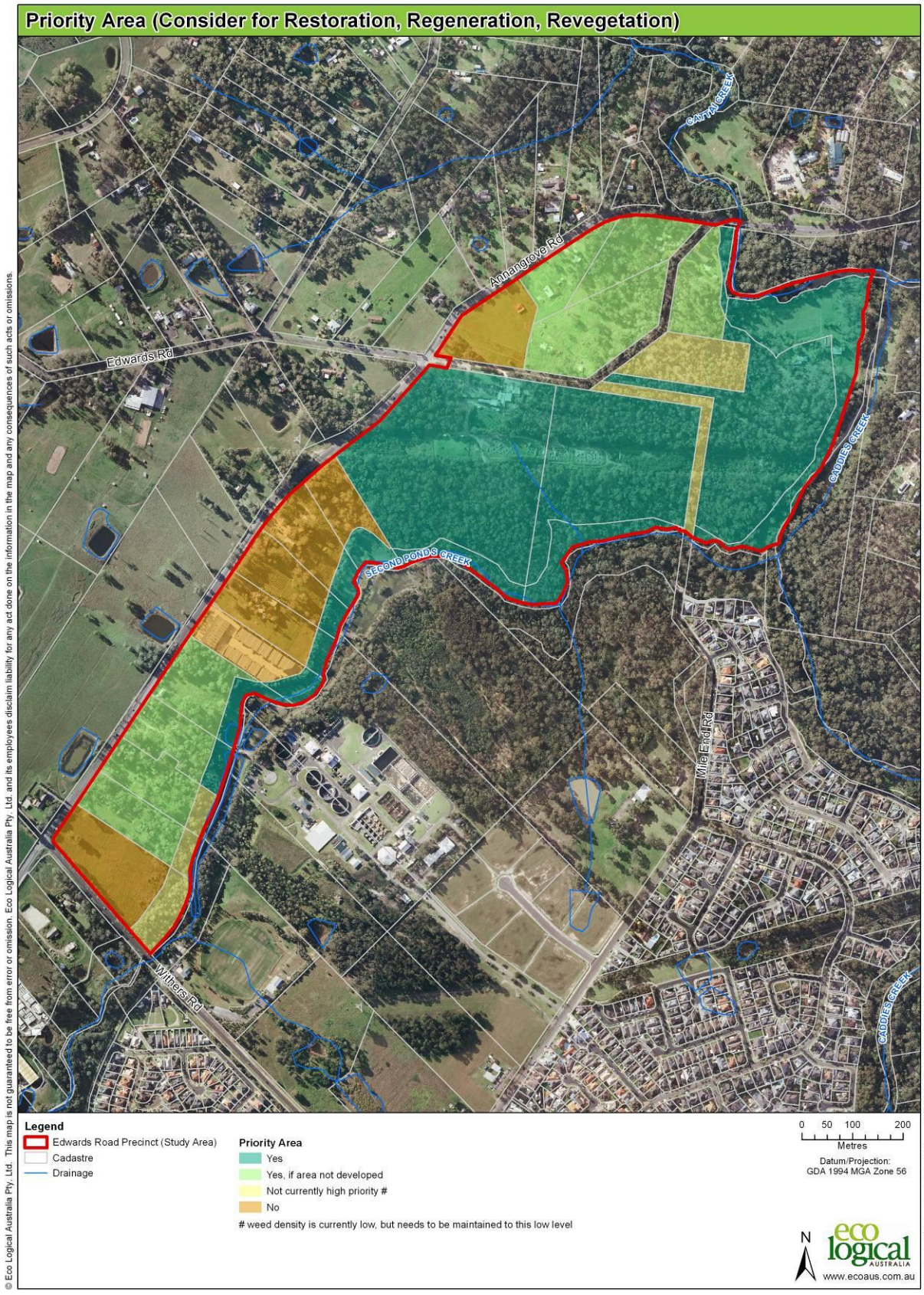

Figure 19: Priority areas for restoration, regeneration or revegetation

In terms of measures to protect existing biodiversity values, recommended measures would include:

Avoidance measures

- Avoid any additional clearing of native vegetation (see **Figure 8** for areas of native vegetation), and
- Limit the impacts of any additional disturbances to the study area and the extent of existing disturbances e.g. paintball activities.

Ameliorative measures

- Manage any pre- and post-development activities through a Conservation Area Management Plan (CAMP) that aims to ensure that the ecological values of the study area are maintained through:
    - Weed control: the density of weeds should be reduced and weeds should be controlled to prevent the spread of weeds within and between native vegetation communities (see **Figure 9** for the levels of weed invasion in vegetation communities)
    - Controls on access and allowable activities: the collection of fire wood and bush rock should be prohibited, and rubbish dumping prevented
    - An adaptive management approach that will respond to any post-development ecological changes. The adaptive management approach places an emphasis on encouraging natural resilience and integrating natural processes to retain the ecological values of the site. In this manner, actions to maintain the condition and integrity of the ecological values of the study area, such as weed control, minimising vegetation disturbance and reducing stormwater and sediment run off, are priorities for on-ground works;
    - The establishment of a framework for ongoing site management
    - Recommendations for ongoing monitoring such that required changes to the management approach can be identified
    - The establishment of areas that will amongst other matters cover:
        - Erosion and sediment management pre- during and post-construction;
        - Construction fencing pre- and during construction to ensure that construction related impacts are contained within the construction areas

Compensatory strategies

- Any development should avoid, minimise and ameliorate any impacts to the maximum extent possible. Compensatory (or offset) measures should be considered for any significant impacts that cannot be avoided or mitigated. These offsetting measures should be developed in accordance with the “Principles for the use of Biodiversity Offsets in NSW”; the Biobanking Assessment methodology can be used to develop proposed offsetting measures.

References

Allison, F. R. and Hoye, G. A. 1998. 'Eastern Freetail-bat', In: Strahan, R. (Ed.) *The Mammals of Australia*, pp. 484-485, Australian Museum/ Reed Publications, Sydney.

Australian Museum Business Services (AMBS) 1995. *Fauna impact statement for proposed forestry activities in the Urbenville Management Area*. Report prepared for State Forests of New South Wales. Australian Museum Business Services, Sydney.

Bell, S. 2001. 'Notes on population size and habitat of the vulnerable *Cryptostylis hunteriana* (Orchidaceae) from the Central Coast of New South Wales', *Cunninghamia* **7(2)**: 195-204.

Benson, D.H. (1992) The natural vegetation of the Penrith 1:100 000 map sheet. *Cunninghamia* 2(4): 541–596.

Benson, D. and McDougall, L. 1994. 'Ecology of Sydney plants 2', *Cunninghamia* **3(4)**: 709- 1004.

Benson, D. and McDougall, L. 1998. 'Ecology of Sydney plant species Part 6: Dicotyledon family Myrtaceae', *Cunninghamia* **5(4)**: 808-987.

Blakers, M., Davies, S., and Reilly, P.N 1984. *The Atlas of Australian Birds*. RAOU Melbourne University Press.

Braithwaite, L.W. 1984. 'The identification of conservation areas for possums and gliders within the Eden woodpulp concession district', In: Smith, A. P and Hume, I. D. (Eds.) *Possums and Gliders,* Australian Mammal Society, Sydney.

Briggs, J. D. And Leigh, J. H. 1995. *Rare or Threatened Australian Plants*. CSIRO. Canberra.

Bureau of Meteorology (BOM) 2012. Daily Weather Observations from Prospect Reservoir, Station 067019, April 2012. Available: http://www.bom.gov.au/climate/dwo/201204/html/IDCJDW2116.201204.shtml. Accessed April 2012.

Chapman, G. A. and Murphy, C. L.. 1989. *Soil Landscapes of the Sydney 1:100 000 Sheet*. Soil Conservation Service of NSW, Sydney.

Churchill, S. 1998. *Australian Bats*, Reed New Holland, Sydney.

Cropper, S.C. 1993. *Management of Endangered Plants*. CSIRO, East Melbourne, Victoria.

Davey, S.M. 1984. 'Habitat preference of arboreal marsupials within a coastal forest in southern New South Wales'. Pp. 509-516 In: Smith, A.P. and Hume, I.D. (Eds.) *Possums and Gliders*. Australian Mammal Society, Sydney.

Debus, S. J. S. 1994. 'The Sooty Owl *Tyto tenebricosa* in New South Wales', *Australian Birds*, 28:s4-s19.

Debus, S. J. S. 1997. 'The Barking Owl in New South Wales', *Australian Birds* **30(3)**.

Debus, S. J. S. and Chafer, C. J. 1994. 'The Powerful Owl *Ninox strenua* in New South Wales', *Australian Birds*. **28:**s21-s38.

Department of Environment and Climate Change (DECC) (2008). *Native vegetation of the Cumberland Plain, Final Edition – Vegetation and Core Habitat Mapping*. NSW National Parks and Wildlife Services, Hurstville.

Department of Environment and Conservation NSW (DEC) 2004. *Draft NSW and National Recovery Plan for* Pimelea spicata, Department of Environment and Conservation, Hurstville NSW.

Department of Environment and Conservation (DEC) 2007. *Threatened Species Profiles* *http://www.threatenedspecies.environment.nsw.gov.au/index.aspx*

Department of Sustainability, Environment, Water, Populations and Communities (DSEWPAC). 2012. *Protected Matters Search Tool* [online]. Available: http://www.environment.gov.au/epbc/protect/index.html (Accessed: January 2012).

Dwyer, P. D. 1981. 'Common Bent-wing Bat, *Miniopterus schreibersii'*, *ANH* **20(6)**:187-190.

Dwyer, P. D. 1995 'Common Bent-wing Bat (Miniopterus schreibersii)', In: R. Strahan (Ed.) *The Australian Museum Complete Book of Australian Mammals*, pp494-495, Angus and Robertson Publishers, Sydney.

Eby, P. 1998. 'An analysis of the diet specialisation in frugivorous *Pteropus_poliocephalus* in Australian subtropical rainforest', *Austral Ecology* **23**:443-456

Ehmann, E. 1997. *Threatened Frogs of New South Wales: Habitats, status and conservation*, Frog and Tadpole Study Group, Sydney.

Environment Australia 2000. *Comprehensive and Regional Assessments for North-East NSW*. Report to National Parks and Wildlife Service.

Fielding, P. 1979. 'Avifauna of Tasmanian orchards.' *Tasmanian Naturalist*. 56:7-8.

Frith, H. J., Crome, F. H. J. and Brown, B.K. 1977. 'Aspects of the Biology of the Japanese Snipe *Gallinago hardwickii*.' *Australian Journal of Ecology* **2**:341-368.

Garnett, S. (Ed) 1993. *Threatened and extinct birds of Australia. Royal Australian Ornithologists Union and Australian NPWS*, Royal Australian Ornithologists Union Report, No. 82.

Hayes Environmental 2007. *Flora and Fauna Assessment for the proposed industrial subdivision: Corner of Annangrove Road and Edwards Road, Rouse Hill*. Unpublished report prepared as part of a development application (Applicant unknown).

Henry, S. R. and Craig, S. A. 1984. 'Diet, ranging behaviour and social organisation of the Yellow-bellied Glider (*Petaurus australis* Shaw) in Victoria, in Smith, A.P. and Hume, I.D. (eds) *Possums and Gliders,* Pp. 331-341, Australian Mammal Society, Sydney.

Higgins, P. J. and Davies, S. J. 1996. *Handbook of Australian, New Zealand and Antartic Birds, Volume 3: Snipe to Pigeons*, Oxford University Press, Melbourne.

Hoye, G. and Richards, G. 1998. 'Greater Broad-nosed Bat', In: Strahan, R. (ed.) *The Australian Museum Complete Book of Australian Mammals*, Angus and Robertson Publishers, Sydney.

Hyem, E.L. 1979. 'Observation on Owls in the Upper Manning River District, New South Wales', *Corella* **3(2)**:17-25.

Kavanagh, R. P. 1984 'Seasonal changes in habitat use by gliders and possums in southeastern New South Wales', Pp. 527-543 in A.P. Smith and I.D. Hume (eds) *Possums and Gliders*. Australian Mammal Society, Sydney.

Kavanagh, R.P. and Peake, P. 1993. 'Distribution and habitats of nocturnal forest birds in south-eastern New South Wales', In: Olsen, P. (Ed.). *Proceedings of the 10th Anniversary Conference*, Canberra, pp 86-100, Australian Raptor Association, Royal Ornithologists Union, Sydney.

Kushlan, J. A. and Hancock, J. 2005. *Herons*. Oxford, United Kingdom: Oxford University Press.

Lane, B. A. and Jessop, A. E. 1985. *National Wader Count - Report to Participants*. Unpublished report for Royal Australasian Ornithologists Union, Melbourne.

Mahony, M. 1999. 'Review of the declines and disappearances in the Bell frog species group (Litoria aurea species group) in Australia', In: Campbell, A. (Ed.) *Declines and Disappearances of Australian Frogs*, pp 81-93, Biodiversity Group Environment Australia, Canberra.

Mansergh, I. M. 1984. 'The status, distribution and abundance of *Dasyurus maculatus* (Tiger Quoll) in Australia with particular reference to Victoria', *Australian Zoology* **21(2)**:109-22.

Marchant and Higgins 1993. *Handbook of Australian, New Zealand and Antarctic Birds*. Oxford University Press, Melbourne.

Martínez-Vilalta, A. and Motis, A. 1992. 'Family Ardeidae (Herons).' In: del Hoyo J., A. Elliott and J. Sargatal, eds. *Handbook of the Birds of the World*. Page(s) 376-42. Barcelona: Lynx Edicions.

McKilligan, N. 2005. *Herons, Egrets and Bitterns*, CSIRO Publishing.

Menkhorst, P. and Knight, F. 2004. *A Field Guide to the Mammals of Australia*, 2nd Edn., Oxford University Press, South Melbourne.

Menkhorst, P. and Seebeck, J. 1990 'Distribution and Conservation Status of Bandicoots in Victoria', In: Seebeck, J., Brown, P., Wallis, R. and Kemper, C. (Eds.) *Bandicoots and Bilbies*, Surrey Beatty and Sons, Sydney.

Morcombe, M. 2004. *Field Guide to Australian Birds*, Steve Parish Publishing.

Naarding, J.A. 1982. 'Latham's Snipe *(Gallinago hardwickii)* in Tasmania.' *Wildlife Division Technical Report*. 82/1. Tasmania: National Parks and Wildlife Service.

Naarding, J.A. 1983. 'Latham's Snipe *(Gallinago hardwickii)* in Southern Australia.' *Wildlife Division Technical Report*. 83/01. Tasmania: National Parks and Wildlife Service.

NSW National Parks and Wildlife Service (NPWS) 1997. *Urban Bushland Biodiversity Study - Western Sydney,* National Parks and Wildlife Service.

NSW National Parks and Wildlife Service (NPWS) 1995. *Endangered Fauna of Western New South Wales*, NSW National Parks and Wildlife Service, Hurstville.

National Parks and Wildlife Service (NPWS) 2002a. *Native vegetation of the Cumberland Plain*. NSW National Parks and Wildlife Services, Hurstville.

National Parks and Wildlife Service (NPWS) 2002b. *Native vegetation maps of the Cumberland Plain Western Sydney: Interpretive Guidelines*. NSW National Parks and Wildlife Services, Hurstville.

National Parks and Wildlife Service (NPWS) 2002c. *Conservation Significance Assessment Mapping*. NSW National Parks and Wildlife Services, Hurstville.

National Parks and Wildlife Service (NPWS) 2002d. *Guideline for the Conservation Significance Assessment of the Native Vegetation of the Cumberland Plain, Western Sydney*. NSW National Parks and Wildlife Services, Hurstville.

NSW Scientific Committee (1999, 2000, 2001, 2004). *Final Determinations* http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Final+determinations

Office of Environment and Heritage (OEH). 2012. *Threatened Species Database* (10 km radius search). OEH Sydney, NSW. (Data supplied September 2011).

Payne, R. 1997. *The Distribution and Reproductive Ecology of* Syzygium paniculatum *and* Syzygium australe *(Myrtaceae) in the Gosford-Wyong Region*. Unpublished Thesis prepared for the award of Masters of Natural Resources, University of New England, Armidale NSW.

Pizzey, G. and Knight, F. 1997. *Field Guide to the Birds of Australia*, Harper Collins Publishers, Sydney.

Pyke, G. H and White, A. W. 1996. 'Habitat requirements for the Green and Golden Bell Frog *Litoria aurea* (Anura:Hylidae), *Australian Zoologist* **30(2)**:177-189.

Reed, P. C., Lunney, D. and Walker, P. 1990. 'A 1986-7 survey of the Koala Phascolarctos cinereus in NSW and an ecological interpretation of its distribution', In: *Biology of the Koala*, pp: 55-74.

Richards, G. C. 1998. 'Large-footed Mouse-eared Bat (*Myotis adversus*)', In: Strahan, R (Ed.) *The Australian Museum Complete Book of Australian Mammals*, Angus and Robertson Publishers, Sydney.

Robinson, M. 1993. *A Field Guide to Frogs of Australia: from Port Augusta to Fraser Island including Tasmania*, Australian Museum/Reed New Holland, Chatswood.

Royal Botanic Garden (RBG) 2012. *NSW FloraOnline database* (PlantNET). Available online: http://plantnet.rbgsyd.nsw.gov.au/search/spatial.htm

Schodde, R. and Tidemann, S. (Eds) 1986. *Readers Digest complete book of Australian Birds*, 2nd Edn., Reader's Digest Services Pty Ltd, Sydney.

Sheilds, J. and Chrome, F. 1992. *Parrots and Pigeons of Australia*, Angus and Robinson, Sydney.

Seidel, J. and Briggs, S. 2008. *Biobanking Operation Manual*. NSW Department of Environment and Climate Change, Sydney.

Simpson, K. and Day, N. 1999. *Field guide to the birds of Australia 6th edn.,* Penguin Books Australia Ltd, Ringwood Victoria.

Simpson, K. and Day, N. 2004. *Field guide to the birds of Australia 7th edn.,* Penguin Books Australia Ltd, Ringwood Victoria.

Strahan, R. (Ed.) 1998. *The Australian Museum Complete Book of Australian Mammals*, Angus and Robertson Publishers, Sydney.

The Hills Shire Council (THSC) 2005. *Vegetation Mapping*. Supplied to ELA April 2012.

Travers Environmental 2008. *Flora and Fauna Constraints Analysis at Lot 2 and 4 DP 225401, Lot 2 DP 222080, Lot 10 DP 563695, and Lot 3 DP 879450 Crown Road, Rouse Hill*. Unpublished report prepared for Jack Taylor Architechs.

Webb J.K. and Shine R. 1998. 'Ecological characteristics of a threatened snake species *Hoplocephalus bungaroides* (Serpentes: Elapidae)', *Animal Conservation* **1**: 185-193.

Appendix A: Likelihood of Occurrence Table

Searches of the Atlas of NSW Wildlife and EPBC Protected Matters search tool were performed for the study area in January 2012, buffered for 10 km around -33.6584 150.9153, -33.6584 150.9334, -33.6717 150.9334, -33.6717 150.9153, and-33.6584 150.9153. Marine species (including whales, seabirds, turtles and seals) have been removed from the list as these species were not considered relevant to the current proposal.

The likelihood of occurrence was considered for all listed species, and is provided for each species under the 'likely' column. The terms for likelihood of occurrence are defined below:

Y yes: the species was observed on the site during previous or current surveys or has been previously observed (NSW Atlas data)
L likely: a medium to high probability that a species uses the site
P potential: suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
U unlikely: a very low to low probability that a species uses the site
N no: habitat on site and in the vicinity is unsuitable for the species.

Those species considered as potentially, likely or known to occur (likelihood of potential, likely or yes) are considered subject species for this project and are highlighted in blue.

TSC Status	Listing under the NSW Threatened Species Conservation Act 1995
EPBC Status	Listing under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999
CE	Critically Endangered
E	Endangered
E2	Endangered Population
V	Vulnerable
M	Migratory

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
FISH					
Macquarie australasica	Macquarie Perch	E (under FM Act)	E	Habitat for the Macquarie perch is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods.	U
Prototroctes maraena	Australian Grayling	-	V	Historically, this species occurred in coastal streams from the Grose River southwards through NSW, VIC and TAS. On mainland Australia, this species has been recorded from rivers flowing east and south of the main dividing ranges. This species spends only part of its lifecycle in freshwater, mainly inhabiting clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops but has also been found in muddy-bottomed, heavily silted habitat. Grayling migrate between freshwater streams and the ocean and as such it is generally accepted to be a diadromous (migratory between fresh and salt waters) species.	U
FROGS					
Heleioporus australiacus	Giant Burrowing Frog	V	V	Forages in woodlands, wet heath, dry and wet sclerophyll forest (Ehmann 1997). Associated with semi-permanent to ephemeral sand or rock based streams (Ehmann 1997), where the soil is soft and sandy so that burrows can be constructed (Environment Australia 2000).	U

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Litoria aurea	Green and Golden Bell Frog	E	V	This species has been observed utilising a variety of natural and man-made waterbodies (Pyke and White 1996) such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water (DEC 2007). Fast flowing streams are not utilised for breeding purposes by this species (Mahony 1999). Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading (DEC 2007). Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes–*Typha* sp. and spikerushes–*Eleocharis* sp.) adjacent to open grassland areas for foraging are preferable (Ehmann 1997; Robinson 1993). Ponds that are typically inhabited tend to be free from predatory fish such as *Gambusia holbrooki* (Mosquito Fish) (DEC 2007).	P
Litoria littlejohni	Littlejohn's Tree Frog, Heath Frog	V	V	Littlejohn's Tree Frog has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria (DEC 2007). It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It appears to be restricted to sandstone woodland and heath communities at mid to high altitude (NSW Scientific Committee 2000). It forages both in the tree canopy and on the ground, and it has been observed sheltering under rocks on high exposed ridges during summer (NSW Scientific Committee 2000). It hunts either in shrubs or on the ground. Breeding is triggered by heavy rain and can occur from late winter to autumn, but is most likely to occur in spring when conditions are favourable. Males call from low vegetation close to slow flowing pools. Eggs and tadpoles are mostly found in slow flowing pools that receive extended exposure to sunlight, but will also use temporary isolated pools (DEC 2007).	U

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Mixophyes balbus	Stuttering Frog	E	V	A variety of forest habitats from rainforest through wet and moist sclerophyll forest to riparian habitat in dry sclerophyll forest (DEC 2007) that are generally characterised by deep leaf litter or thick cover from understorey vegetation (Ehmann 1997). Breeding habitats are streams and occasionally springs. Not known from streams disturbed by humans (Ehmann 1997) or still water environments (NSW Scientific Committee 2002).	N
Mixophyes iteratus	Giant Barred Frog	E	E	Found on forested slopes of the escarpment and adjacent ranges in riparian vegetation, subtropical and dry rainforest, wet sclerophyll forests and swamp sclerophyll forest (DEC 2007; Ehmann 1997). This species is associated with flowing streams with high water quality, though habitats may contain weed species (Ehmann 1997). This species is not known from riparian vegetation disturbed by humans (NSW Scientific Committee 1999). During breeding eggs are kicked up onto an overhanging bank or the streams edge (DEC 2007).	N
Pseudophryne australis	Red-crowned Toadlet	V	-	Red-crowned Toadlets are found in steep escarpment areas and plateaus, as well as low undulating ranges with benched outcroppings on Triassic sandstones of the Sydney Basin (DEC 2007). Within these geological formations, this species mainly occupies the upper parts of ridges, usually being restricted to within about 100 metres of the ridgetop. However they may also occur on plateaus or more level rock platforms along the ridgetop (DEC 2007). Associated with open forest to coastal heath (Ehmann 1997). Utilises small ephemeral drainage lines which feed water from the top of the ridge to the perennial creeks below for breeding, and are not usually found in the vicinity of permanent water (Ehmann 1997). Breeding sites are often characterised by clay-derived soils and generally found below the first sandstone escarpment in the talus slope (NPWS 1997).	U
REPTILES					

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Typical sites consist of exposed sandstone outcrops and benching where the vegetation is predominantly woodland, open woodland and/or heath on Triassic sandstone of the Sydney Basin (DEC 2007). They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (Webb and Shine 1998). Some of the canopy tree species found to regularly co-occur at known sites include *Corymbia eximia, C. gummifera, Eucalyptus sieberi, E. punctata* and *E.piperita* (DEC 2007).	N
Varanus rosenbergi	Heath Monitor	V	-	Associated with Sydney sandstone woodland and heath land. Rocks, hollow logs and burrows are utilised for shelter (Environment Australia 2000). Terrestrial termitaria are required for reproduction.	U
DIURNAL BIRDS					
Anthochaera Phrygia (aka Xanthomyza phrygia)	Regent Honeyeater	E	E and M	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*) (Garnett 1993). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have been observed to be utilised (NPWS 1997). The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (Environment Australia 2000).	P
Botaurus poiciloptilus	Australasian Bittern	V	-	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats (Marchant and Higgins 1993). Reedbeds, swamps, streams, estuaries (Simpson and Day 1999).	U
Cacatua leadbeateri	Major Mitchell's Cockatoo	V	-	Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water.	U
Callocephalon fimbriatum	Gang-gang Cockatoo (population in Hornsby and Ku-ring-gai LGAs)	V-E2	-	During summer in dense, tall, wet forests of mountains and gullies, alpine woodlands (Morcombe 2004). In winter they occur at lower altitudes in drier more open forests and woodlands, particularly box-ironbark assemblages (Shields and Chrome 1992). They sometimes inhabit woodland, farms and suburbs in autumn/winter (Simpson and Day 2004).	P

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Associated with a variety of forest types containing Allocasuarina species, usually reflecting the poor nutrient status of underlying soils (Environment Australia 2000; NPWS 1997; DEC 2007). Intact drier forest types with less rugged landscapes are preferred (DEC 2007). Nests in large trees with large hollows (Environment Australia 2000).	P
Circus assimilis	Spotted Harrier	V	-	Occurs mostly commonly in native grassland, but also in grassy open woodland including acacia and mallee remnants, inland riparian woodland, and foraging at the edges of inland wetlands, Can also forage over agricultural land for prey such as rabbits, but most native prey require ground cover. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn).	P
Daphoenositta chrysoptera	Varied Sittella	V	-	Distribution includes most of mainland Australia except deserts and open grasslands. Prefers eucalypt forests and woodlands with rough-barked species, or mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods from bark, dead branches, or small branches and twigs.	P
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	- -	Distributed through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys. The Brown Treecreeper occupies eucalypt woodlands, particularly open woodland lacking a dense understorey. It is sedentary and nests in tree hollows within permanent territories. (NSW Scientific Committee 2001).	U
Dasyornis brachypterus	Eastern Bristlebird	E	E	Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW occurs in open forest with tussocky grass understorey; all of these vegetation types are fire prone. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously.	N

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Epthianura albifrons	White-fronted Chat	V		Regularly observed in the saltmarsh of Newington Nature Reserve (with occasional sightings from other parts of Sydney Olympic Park and in grassland on the northern bank of the Parramatta River). Current estimates suggest this population consists of 8 individuals. Regularly observed in the saltmarsh and on the sandy shoreline of a small island of Towra Point Nature Reserve. This population is estimated to comprise 19-50 individuals. Have been observed breeding from late July through to early March, with 'open-cup' nests built in low vegetation. Nests in the Sydney region have also been seen in low isolated mangroves. Gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground (DEC 2007).	N
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Associated with tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats, and occasionally woodlands and grasslands floodplains (Marchant and Higgins 1993). Forages in fresh or saline waters up to 0.5m deep, mainly in open fresh waters, extensive sheets of shallow water over grasslands or sedgeland, mangroves, mudflats, shallow swamps with short emergent vegetation and permanent billabongs and pools on floodplains (Marchant and Higgins 1993; DEC 2007).	U
Hieraaetus morphnoides	Little Eagle	V	-	Utilises open eucalypt, sheoak and acacia forest, woodland or open woodland. Uses tall trees for nesting, with a large stick nest being built. Lays eggs in spring, and young fledge in early summer. Preys on birds, reptiles and mammals, and occasionally feeds on large insects or carrion.	P

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Glossopsitta pusilla	Little Lorikeet	V	-	In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands White Box *Eucalyptus albens* and Yellow Box *E. melliodora* are particularly important food sources for pollen and nectar respectively.	P
Irediparra gallinacea	Comb-crested Jacana	V	-	Freshwater wetlands, such as lagoons, billabongs, swamps, lakes and reservoirs, generally with abundant floating aquatic vegetation (Marchant and Higgins 1993).	U
Ixobrychus flavicollis	Black Bittern	V	-	Occurs in both terrestrial and estuarine wetlands generally in areas of permanent water and dense vegetation (DEC 2007). In areas with permanent water it may occur in flooded grassland, forest, woodland, rainforest and mangroves (DEC 2007).	U
Lathamus discolor	Swift Parrot	E	E	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts (Blakers *et al*. 1984; Schodde and Tidemann 1986). Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*) (DEC 2007).	P
Limosa limosa	Black-tailed Godwit	V	-	Primarily found along the coast on sandspits, lagoons and mudflats (DEC 2007). The species has also been found to occur inland on mudflats or shallow receding waters of portions of large muddy swamps or lakes (Pizzey and Knight 1997; Higgins and Davies 1996).	U

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Lophoictinia isura	Square-tailed Kite	V	-	In coastal areas associated tropical and temperate forests and woodlands on fertile soils with an abundance of passerine birds (Marchant and Higgins 1993, DEC 2007). May be recorded inland along timbered watercourses (DEC 2007). In NSW it is commonly associated with ridge or gully forests dominated by Woollybutt (*Eucalyptus longiflora*), Spotted Gum (*E. maculata*), or Peppermint Gum (*E. elata, E. smithii*) (DEC 2007).	P
Melanodryas cucullata *Melanodryas cucullata cucullata*	Hooded Robin Hooded Robin (southeastern subspecies)	V	-	Associated with a wide range of Eucalypt woodlands, Acacia shrubland and open forests (Blakers *et al*. 1984). In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover (NSW Scientific Committee 2001). Hooded Robin home ranges are relatively large, averaging 18ha for birds from the New England Tableland (NSW Scientific Committee 2001).	P
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Predominantly associated with box-ironbark association woodlands and River Red Gum (NSW Scientific Committee 2001). Also associated with drier coastal woodlands of the Cumberland Plain and the Hunter, Richmond and Clarence Valleys (NSW Scientific Committee 2001).	P
Neophema pulchella	Turquoise Parrot	V	-	Steep rocky ridges and gullies, rolling hills, valleys and river flats and the plains of the Great Dividing Range compromise the topography inhabited by this species (Marchant and Higgins 1993). Spends much of the time on the ground foraging on seed and grasses (DEC 2007). It is associated with coastal scrubland, open forest and timbered grassland, especially low shrub ecotones between dry hardwood forests and grasslands with high proportion of native grasses and forbs (Environment Australia 2000).	U
Oxyura australis	Blue-billed Duck	V	-	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation (DEC 2007). The species is completely aquatic, swimming low in the water along the edge of dense cover (DEC 2007). It will fly if disturbed, but prefers to dive if approached (DEC 2007). Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and over-wintering lakes with some long-distance dispersal to breed during spring and early summer (DEC 2007). Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes (DEC 2007).	U

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Petroica boodang	Scarlet Robin	V	-	Occurs from the coast to the inland slopes in NSW. After breeding (July-Jan), some disperse to the lower valleys and plains of the tablelands and slopes, and may appear as far west as the eastern edges of the inland plains in autumn and winter. Primarily resides in dry eucalypt forests and woodlands, with usually open and grassy understorey, with scattered shrubs. Abundant logs and fallen timber are important habitat components. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees, and may join mixed flocks of other small insectivorous birds.	P
Petroica phoenicea	Flame Robin	V	-	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes, often on ridges and slopes, in NSW. Prefers clearings or areas with open understoreys, and grassy groundlayer for breeding habitat. Will often occur in recently burnt areas. Shrub density does not appear to be an important habitat factor. Many birds move to the inland slopes and plains in winter, or to drier more open habitats in the lowlands.	U
Petroica rodinogaster	Pink Robin	V	-	The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. Breeds between October and January and can produce two clutches in a season.	U
Polytelis swainsonii	Superb Parrot	V	V	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. Inhabit box-gum woodland and Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest foraging at or near the ground. Nest in hollows.	U

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Pyrrholaemus sagittatus	Speckled Warbler	V	-	Occupies a wide range of eucalypt dominated communities with a grassy understorey, often on rocky ridges or in gullies (DEC 2007). Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy (DEC 2007). Large, relatively undisturbed remnants are required for the species to persist in an area (DEC 2007). Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding (DEC 2007).	U
Rostratula australis (a.k.a. R. benghalensis)	Painted Snipe (Australian subspecies)	E	V	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (DEC 2007). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (ibid.). Breeding is often in response to local conditions; generally occurs from September to December (DEC 2007). Roosts during the day in dense vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (DEC 2007). Feeds on worms, molluscs, insects and some plant-matter (ibid.).	U
Stictonetta naevosa	Freckled Duck	V	-	Associated with a variety of plankton-rich wetlands, such as heavily vegetated, large open lakes and their shores, creeks, farm dams, sewerage ponds and floodwaters (DEC 2007).	U
NOCTURNAL BIRDS					
Ninox connivens	Barking Owl	V	-	Associated with a variety of habitats such as savanna woodland, open eucalypt forests, wetland and riverine forest. The habitat is typically dominated by Eucalypts (often Redgum species), however often dominated by Melaleuca species in the tropics (DEC 2007). It usually roosts in dense foliage in large trees such as River She-oak (*Allocasuarina cunninghamiana*), other Casuarina and Allocasuarina, eucalypts, Angophora, Acacia and rainforest species from streamside gallery forests. It usually nests near watercourses or wetlands in large tree hollows with entrances averaging 2-29 metres above ground, depending on the forest or woodland structure and the canopy height (Debus 1997).	P

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Ninox strenua	Powerful Owl	V	-	Powerful Owls are associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus and Chafer 1994). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000).	P
Tyto novaehollandiae	Masked Owl	V	-	Associated with forest with sparse, open, understorey, typically dry sclerophyll forest and woodland (DEC 2007) and especially the ecotone between wet and dry forest, and non forest habitat (Environment Australia 2000). Known to utilise forest margins and isolated stands of trees within agricultural land (Hyem 1979) and heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained (Kavanagh and Peake 1993).	P
Tyto tenebricosa	Sooty Owl	V	-	Sooty Owls are associated with tall wet old growth forest on fertile soil with a dense understorey and emergent tall Eucalyptus species (Environment Australia 2000, Debus 1994). Pairs roost in the daytime amongst dense vegetation, in tree hollows and sometimes in caves. The Sooty Owl is typically associated with an abundant and diverse supply of prey items and a selection of large tree hollows (Debus 1994, Garnett 1993, Hyem 1979).	P
MAMMALS (EXCLUDING BATS)					
Dasyurus maculatus *Dasyurus maculatus maculatus*	Spotted-tailed Quoll Spotted-tailed Quoll (SE Mainland Population)	V -	- E	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests (Mansergh 1984; DEC 2007), more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in (DEC 2007). Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (Environment Australia 2000).	U
Isoodon obesulus	Southern Brown Bandicoot	E	E	This species is associated with heath, coastal scrub, heathy forests (Menkhorst and Knight 2004), shrubland and woodland on well drained soils. This species is thought to display a preference for newly regenerating heathland and other areas prone to fire (Menkhorst and Seebeck 1990).	U

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Petaurus australis	Yellow-bellied Glider	V	-	This species is restricted to tall mature forests, preferring productive tall open sclerophyll forests with a mosaic of tree species including some that flower in winter (Environment Australia 2000, Braithwaite 1984, Davey 1984, Kavanagh 1984; DEC 2007). Large hollows within mature trees are required for shelter, nesting and breeding (Henry and Craig 1984; DEC 2007).	U
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (Strahan 1998).	N
Phascolarctos cinereus	Koala	V-E2	-	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70% (Reed *et al.* 1990), with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: *Eucalyptus tereticornis*, *E. punctata*, *E. cypellocarpa*, *E. viminalis*	U
Potorous tridactylus *Potorous tridactylus tridactylus*	Long-nosed Potoroo Long-nosed Potoroo (SE Mainland Population)	V -	- V	Associated with dry coastal heath and dry and wet sclerophyll forests (Strahan 1998) with dense cover for shelter and adjacent more open areas for foraging (Menkhorst and Knight 2004).	N
Pseudomys novaehollandiae	New Holland Mouse	-	V	A small burrowing native rodent with a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid stages of vegetation succession typically induced by fire	N
MAMMALS (BATS)					
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests (Churchill 1998; DEC 2007). This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces (Churchill 1998; DEC 2007).	L

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Prefers moist habitats with trees taller than 20m (DEC 2007). Roosts in tree hollows but has also been found roosting in buildings or under loose bark (DEC 2007).	Y. Recorded by Travers Environmental (2008) and Hayes Environmental (2007)
Miniopterus australis	Little Bent-wing Bat	V	-	Prefers well-timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests (Churchill 1998). This species shelter in a range of structures including culverts, drains, mines and caves (Environment Australia 2000). Relatively large areas of dense vegetation of either wet sclerophyll forest, rainforest or dense coastal banksia scrub are usually found adjacent to caves in which this species is found (DEC 2007). Breeding occurs in caves, usually in association with M. schreibersii (Environment Australia 2000, DEC 2007).	L
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	-	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). It forages above and below the tree canopy on small insects (AMBS 1995, Dwyer 1981, 1995). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995).	L
Mormopterus norfolkensis	East Coast Freetail Bat	V	-	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range (Churchill 1998). Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges (Environment Australia 2000; Allison and Hoye 1998). Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (Environment Australia 2000; Allison and Hoye 1998).	L

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Myotis macropus (formerly *M. adversus*)	Southern Myotis, Large-footed Myotis	V	-	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Will occupy most habitat types such as mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River Red Gum woodland, as long as they are close to water (Churchill 1998). While roosting (in groups of 10-15) is most commonly associated with caves, this species has been observed to roost in tree hollows, amongst vegetation, in clumps of Pandanus, under bridges, in mines, tunnels and stormwater drains (Churchill 1998). However the species apparently has specific roost requirements, and only a small percentage of available caves, mines, tunnels and culverts are used (Richards 1998). Forages over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December (DEC 2007)	Recorded by Travers Environmental (2008) and Hayes Environmental (2007)
Pteropus poliocephalus	Grey-headed Flying-Fox	V	V	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998).	Recorded by Travers Environmental (2008)
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Found in almost all habitats, from wet and dry sclerophyll forest, open woodland (Churchill 1998), open country, mallee, rainforests, heathland and waterbodies. Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock (Environment Australia 2000) and in abandoned sugar glider nests (Churchill 1998). The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (Environment Australia 2000).	Recorded by Hayes Environmental (2007)
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill 1998), tending to be more frequently located in more productive forests (Hoye and Richards 1998). Within denser vegetation types use is made of natural and man-made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye and Richards 1998).	L
INVERTEBRATES					

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Meridolum corneovirens	Cumberland (Large) Land Snail	E	-	Associated with open eucalypt forests, particularly Cumberland Plain Woodland. Found under fallen logs, debris and in bark and leaf litter around the trunk of gum trees or burrowing in loose soil around clumps of grass (NPWS 1997). Urban waste may also form suitable habitat (NSW NPWS 1997).	P
MIGRATORY TERRESTRIAL SPECIES LISTED UNDER EPBC ACT					
Apus pacificus	Fork-tailed Swift	-	M	Sometimes travels with Needletails. Varied habitat with a possible tendency to more arid areas but also over coasts and urban areas (Simpson and Day 1999).	P
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas (Marchant and Higgins 1993, Simpson and Day 1999). Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away (Marchant and Higgins 1993).	U
Hirundapus caudacutus	White-throated Needletail	-	M	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant and Higgins 1993; Simpson and Day 1999). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather (Marchant and Higgins 1993).	P
Merops ornatus	Rainbow Bee-eater	-	M	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May. Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs (ibid). Nest is a chamber a the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting.	P
Monarcha melanopsis	Black-faced Monarch	-	M	Rainforest and eucalypt forests, feeding in tangled understorey (Blakers *et al.* 1984).	P
Myiagra cyanoleuca	Satin Flycatcher	-	M	Wetter, denser forest, often at high elevations (Simpson and Day 2004).	P

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Rhipidura rufifrons	Rufous Fantail	-	M	The Rufous Fantail is a summer breeding migrant to southeastern Australia (Morcombe 2004). The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation (Morcombe 2004). Open country may be used by the Rufous Fantail during migration (Morcombe 2004).	P
Xanthomyza phrygia	Regent Honeyeater	E	E, M	SEE DIURNAL BIRDS ABOVE	SEE DIURNAL BIRDS ABOVE
MIGRATORY WETLAND SPECIES LISTED UNDER EPBC ACT					
Ardea alba	Great Egret	-	M	The Great Egret is common and widespread in Australia (McKilligan 2005). The Eastern Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs (Kushlan and Hancock 2005; Marchant and Higgins 1993; Martínez-Vilalta and Motis 1992). The species usually frequents shallow waters. It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats (McKilligan 2005).	U
Ardea ibis	Cattle Egret	-	M	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments (McKilligan 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan 2005).	U
Calidris ferruginea	Curlew Sandpiper	E	M	Intertidal mudflats of estuaries, lagoons, mangrove channels; around lakes, dams, floodwaters, flooded saltbush surrounds of inland lakes (Morcombe 2004).	U

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Gallinago hardwickii	Latham's Snipe	-	M	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover (Marchant and Higgins 1993). Occupies a variety of vegetation around wetlands (Marchant and Higgins 1993) including wetland grasses and open wooded swamps (Simpson and Day 1999). Latham's Snipe sometimes occur in habitats that have saline or brackish water, such as saltmarsh, mangrove creeks, around bays and beaches, and at tidal rivers (Frith *et al.* 1977; Naarding 1983; Patterson 1991). These habitats are most commonly used when the birds are on migration (Frith *et al*. 1977). They are regularly recorded in or around modified or artificial habitats including pasture, ploughed paddocks, irrigation channels and drainage ditches, ricefields, orchards, saltworks, and sewage and dairy farms (Fielding 1979; Frith *et al*. 1977; Lane and Jessop 1985; Naarding 1982, 1983). They can also occur in various sites close to humans or human activity (e.g. near roads, railways, airfields, commercial or industrial complexes) (Frith *et al.* 1977; Naarding 1983).	U
Rostratula benghalensis (a.k.a. R. australis)	Painted Snipe	-	M	See: *Rostratula australis*	U
FLORA SPECIES					
Acacia bakeri	Marblewood	V		In NSW *Acacia bakeri* is restricted to far North Coast north from near Mullumbimby. It occurs In or near lowland subtropical rainforest, in adjacent eucalypt forest and in regrowth of both. Usually occurs in the understorey but may occur as a large canopy tree (DEC 2007).	N
Acacia bynoeana	Bynoe's Wattle	E	V	*Acacia bynoeana* is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains, and has recently been found in the Colymea and Parma Creek areas west of Nowra. It is found in heath and dry sclerophyll forest, typically on a sand or sandy clay substrate, often with ironstone gravels (DEC 2007).	P

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Acacia gordonii		E	E	*Acacia gordonii* is restricted to the north-west of Sydney, occurring in the lower Blue Mountains in the west, and in the Maroota/Glenorie area in the east, within the Hawkesbury, Blue Mountains and Baulkham Hills local government areas. Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops (DEC 2007).	U
Acacia pubescens	Downy Wattle	V	V	*Acacia pubescens* occurs on the NSW Central Coast in Western Sydney, mainly in the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. It is associated with Cumberland Plains Woodlands, Shale / Gravel Forest and Shale / Sandstone Transition Forest growing on clay soils, often with ironstone gravel (NPWS 1997; Benson and McDougall 1994).	P
Asterolasia elegans	*Asterolasia elegans*	E	E	*Asterolasia elegans* is restricted to a few localities on the NSW Central Coast north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs. It is found in sheltered forests on mid- to lower slopes and valleys, in or adjacent to gullies (DEC 2007).	U
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	*Cryptostylis hunteriana* is known from a range of vegetation communities including swamp-heath and woodland (DEC 2007). The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); where it appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*) (DEC 2007). Bell (2001) has identified Coastal Plains Scribbly Gum Woodland and Coastal Plains Smoothed-barked Apple Woodland as potential habitat on the Central Coast. Flowers between November and February, although may not flower regularly (DEC 2007; Bell 2001).	U
Darwinia biflora	*Darwinia biflora*	V	V	*Darwinia biflora* is an erect or spreading shrub to 80cm high associated with habitats where weathered shale capped ridges intergrade with Hawkesbury Sandstone, where soils have a high clay content (NPWS 1997).	P

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Dillwynia tenuifolia	*Dillwynia tenuifolia*	V	V	*Dillwynia tenuifolia* has a core distribution within the Cumberland Plain, where it may be locally abundant within scrubby, dry heath areas within Castlereagh Ironbark Forest and Shale/Gravel Transition Forest on tertiary alluvium or laterised clays (DEC 2007). It may also be common in the ecotone between these areas and Castlereagh Scribbly Gum Woodland (DEC 2007).	P
Epacris purpurascens var. *purpurascens*	*Epacris purpurascens* var. *purpurascens*	V		*Epacris purpurascens* var. *purpurascens* has been recorded between Gosford in the north to Avon Dam in the south, in a range of habitats, but most have a strong shale soil influence (DEC 2007).	P
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	*Eucalyptus nicholii* naturally occurs in the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield. Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite (DEC 2007). This species is widely planted as an urban street tree and in gardens but is quite rare in the wild (DEC 2007). Plantings undertaken for horticultural and aesthetic purposes are not considered threatened species under the TSC Act.	Recorded by Hayes Environmental (2007)
Eucalyptus sp. Cattai	*Eucalyptus* sp. Cattai	E		*Eucalyptus* sp. Cattai occurs in the area between Colo Heights and Castle Hill, north western Sydney. It occurs as a rare emergent in scrub, heath and low woodland on sandy soils, usually as isolated individuals or occasionally in small groups. The sites at which it occurs are generally flat and on ridge tops and associated soils are laterised clays overlying sandstone (DEC 2007).	P
Grevillea juniperina subsp. *juniperina*	Juniper-leaved Grevillea	V		*Grevillea juniperina* subsp. *juniperina* is endemic to Western Sydney, centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town. It grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium, typically containing lateritic gravels (DEC 2007).	P
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	*Grevillea parviflora* subsp. *parviflora* is sporadically distributed throughout the Sydney Basin mainly around Picton, Appin and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie and Cessnock and Kurri Kurri. It grows in sandy or light clay soils over thin shales, often with lateritic ironstone gravels. It often occurs in open, slightly disturbed sites such as tracks (DEC 2007).	U

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Grevillea parviflora subsp. *supplicans*	*Grevillea parviflora* subsp. *supplicans*	E		Grevillea parviflora subsp. supplicans occurs in heathy woodland associations in skeletal sandy soils over massive sandstones (NSW Scientific Committee1999). The species is confined to the north-west of Sydney near Arcadia and the Maroota–Marramarra Creek area, in Hornsby and Baulkham Hills local government areas, where it has a preference for yellow clays with periodically impeded drainage (DEC 2007).	U
Hibbertia superans	*Hibbertia superans*	E		*Hibbertia superans* mainly occurs in the north west Sydney region between Baulkham Hills and Wisemans Ferry, with a disjunct occurrence near Mt Boss (inland from Kempsey) on the Mid North Coast of NSW. In the Sydney region it occurs in dry sclerophyll forest on sandstone ridgetops while the northern occurrence is on granite (DEC 2007).	P
Lasiopetalum joyceae	*Lasiopetalum joyceae*	V	V	*Lasiopetalum joyceae* grows in ridgetop woodland, heath, woodland or open scrub, often with a clay influence (NPWS 1997).	P
Leucopogon fletcheri subsp. *fletcheri*	*Leucopogon fletcheri* subsp*. fletcheri*	E		*Leucopogon fletcheri* subsp. *fletcheri* is restricted to north-western Sydney between St Albans in the north and Annangrove in the south, within the local government areas of Hawkesbury, Baulkham Hills and Blue Mountains. It occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs (DEC 2007).	P
Melaleuca deanei	Deane's Paperbark	V	V	Found in heath on sandstone (DEC 2007), and also associated with woodland on broad ridge tops and slopes on sandy loam and lateritic soils (Benson and McDougall 1998).	U
Micromyrtus minutiflora	*Micromyrtus minutiflora*	E		*Micromyrtus minutiflora* is restricted to the area between Richmond and Penrith in western Sydney on the Central Coast. It grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, and open forest on tertiary alluvium and consolidated river sediments (DEC 2007).	U

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Olearia cordata	*Olearia cordata*	V	V	The species' habitat is woodland on exposed Hawkesbury Sandstone ridges (DEC 2007). Soils are shallow or skeletal and are usually neutral to slightly acidic (DEC 2007). Shale-influence may be a habitat attribute (Benson and McDougall 1994). Associated soil landscapes are Gymea and Hawkesbury. The species tends to prefer the more sheltered easterly aspects (DEC 2007). Associated flora includes *Angophora costata*, *A. bakeri*, *Eucalyptus punctata* and *Corymbia eximia* with understorey species including *Allocasuarina torulosa*, *Acacia linifolia*, *Persoonia linearis* and *Leucopogon muticus* along with various grasses (Maryott-Brown & Wilks 1993). There have also been listings of *E. eugenioides* as an associate; and *E. oblonga*, *E. notabilis* and *Leptospermum trinervium* as dominant species near Wollombi. Recent observation have noted *C. gummifera* and in northern areas, *Angophora euryphylla* as common canopy species (DEC 2007).	U
Persoonia hirsuta	Hairy Geebung	E	E	*Persoonia hirsuta* occurs from Singleton in the north, south to Bargo and the Blue Mountains to the west (DEC 2007). It grows in dry sclerophyll eucalypt woodland and forest on sandstone	P
Persoonia mollis subsp. *maxima*	*Persoonia mollis* subsp. *maxima*	E	E	Deep gullies or on the steep upper hillsides of narrow gullies incised from Hawkesbury Sandstone, characterised by steep sideslopes, rocky benches and broken scarps, with creeks fed by small streams and intermittent drainage depressions. Occurrences of this plant have been recorded on the dry upper-hillsides of gullies and in more exposed aspects (Scribbly Gum *E. haemastoma*, Grey Gum (*E. punctata*).	U
Pimelea curviflora var. *curviflora*	*Pimelea curviflora* var. *curviflora*	V	V	*Pimelea curviflora* var. *curviflora* is confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. It grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands (DEC 2007). Associated with the Duffys Forest Community, shale lenses on ridges in Hawkesbury sandstone geology.	P

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Pimelea spicata	Spiked Rice-flower	E	E	In western Sydney, *Pimelea spicata* occurs on an undulating topography of well-structured clay soils, derived from Wianamatta shale (DEC 2004). It is associated with Cumberland Plains Woodland (CPW), in open woodland and grassland often in moist depressions or near creek lines (Ibid.). Has been located in disturbed areas that would have previously supported CPW (Ibid.).	P
Pterostylis gibbosa	Illawarra Greenhood	E	E	Known from a small number of populations in the upper Hunter Valley (Milbrodale), the Illawarra region (Albion Park and Yallah) and near Nowra (DEC 2007). Plants grow in a variety of woodland and open forest communities with shallow rocky soils.	U
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Terrestrial orchid predominantly found in Hawkesbury Sandstone Gully Forest growing in small pockets of soil that have formed in depressions in sandstone rock shelves (NPWS 1997). Known from Georges River National Park, Ingleburn, Holsworthy, Peter Meadows Creek, St Marys Tower (NSW Scientific Committee 1999).	U
Pultenaea parviflora	*Pultenaea parviflora*	E	V	May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays (DEC 2007). May also be common in ecotone between these communities and Castlereagh Scribbly Gum Woodland (ibid.). *Eucalyptus fibrosa* is usually the dominant canopy species (ibid.). *E. globoidea*, *E. longifolia*, *E. parramattensis*, *E. sclerophylla* and *E. sideroxylon* may also be present or co-dominant, with Melaleuca decora frequently forming a secondary canopy layer (ibid.). Associated species may include *Allocasuarina littoralis*, *Angophora bakeri*, *Aristida* spp. *Banksia spinulosa*, *Cryptandra* spp., *Daviesia ulicifolia*, *Entolasia stricta*, *Hakea sericea*, *Lissanthe strigosa*, *M. nodosa*, *Ozothamnus diosmifolius* and *Themeda australis* (ibid.). Often found in association with other threatened species such as *Dillwynia tenuifolia*, *Dodonaea falcata*, *Grevillea juniperina*, *Micromyrtus minutiflora*, *Persoonia nutans* and *Styphelia laeta* (ibid.). Flowering may occur between August and November (ibid.).	U

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	HABITAT ASSOCIATIONS	LIKELIHOOD OF OCCURRENCE
Syzygium paniculatum	Magenta Lilly Pilly	V	V	This species occupies a narrow coastal area between Bulahdelah and Conjola State Forests in NSW. On the Central Coast, it occurs on Quaternary gravels, sands, silts and clays, in riparian gallery rainforests and remnant littoral rainforest communities (Payne 1997). In the Ourimbah Creek valley, *S. paniculatum* occurs within gallery rainforest with *Alphitonia excelsa*, *Acmena smithii*, *Cryptocarya glaucescens*, *Toona ciliata*, *Syzygium oleosum* with emergent *Eucalyptus saligna*. At Wyrrabalong NP, S. paniculatum occurs in littoral rainforest as a co-dominant with *Ficus fraseri*, *Syzygium oleosum*, *Acmena smithii*, *Cassine australe*, and *Endiandra sieberi*. Payne (1991) reports that the species appears absent from Terrigal formation shales, on which the gully rainforests occur. *S. paniculatum* is summer flowering (November-February), with the fruits maturing in May (DEC 2007).	U
Tetratheca glandulosa	*Tetratheca glandulosa*	V	V	Associated with ridgetop woodland habits on yellow earths, also in sandy or rocky heath and scrub (NPWS 1997). Often associated with sandstone / shale interface where soils have a stronger clay influence (NPWS 1997). Flowers July to November.	P
Zieria involucrata	*Zieria involucrata*	E	V	*Zieria involucrata* has a disjunct distribution north and west of Sydney, in the Baulkham Hills, Hawkesbury, Hornsby and Blue Mountains local government areas (DEC 2007). Associated with Sydney Sandstone Gully Forest on sheltered slopes and among gullies (NPWS 1997).	U

Disclaimer: Data extracted from the Atlas of NSW Wildlife and EPBC Protected Matters Report are only indicative and cannot be considered a comprehensive inventory. 'Migratory marine species' and 'listed marine species' listed on the EPBC Act (and listed on the protected matters report) have not been included in this table, since they are considered unlikely to occur within the study area due to the absence of marine habitat.

Appendix B: BioBanking plot datasheets

Plot 1

Eco Logical Australia - Biobank plot data sheet
Star: a new sheet for each plot

Site Sheet No.

photos 130-132

Ref Site ID	Plot 1	Recorders	JP & EL	Date	10/4/12
GPS datum	WP009	Easting *	0307478	Northing*	6273201

* Record from Easting and Northing from the end of the 50m transect which also has the 20m quadrat (NW corner). 50m towards the east.

Vegetation Zone Identification

Biometric Vegetation Type (Create a standard short version)	Shale Sandstone Transition Forest		
Ancillary Code (Usually condition description)			
Condition (Low or Mod-Good)		Habitat Features (rocks etc)	

20m x 20m Quadrat	Number of native plant species	Use species list over page (full Id is not required) Write no. natives here: 40		
50m Transect – 10 Points	Native over-storey cover (%)	10, 5, 0, 40, 30, 30, 40, 30, 50	Sum / 10	25.5%
	Native mid-storey cover (%)	5, 30, 20, 0, 40, 0, 0, 5, 10	Sum / 10	11.0 %
50m Transect – 50 Points	Native ground cover (hits/50 points) – Grasses	𝍸 𝍸 ||||	Double score out of 50 to get %	28 %
	Native ground cover (hits/50 points) – shrubs	1	Double score out of 50 to get %	2 %
	Native ground cover (hits/50 points) – other	𝍸 𝍸 𝍸 𝍸 ||	Double score out of 50 to get %	49 %
50m Transect – 10 points + 50 points	Exotic plant cover - Sum exotic cover (%) from (a) overstorey + (b) midstorey + (c) ground cover	Overstory (10 points)	Sum / 10	Sum exotic 0 % cover
		Midstorey (10 points)	Sum / 10	0
		Ground (50 points)	Double score	0 %
20m x 50m Quadrat	Number of trees with hollows	||| ie (3)		
	Total length fallen logs >10cm width (m)	36		
Whole Veg. Zone	Over-storey regeneration	Species	Regenerating (ie. saplings)?	Proportion

Litter 𝍸 𝍸 𝍸 \|\|\|
Rock 𝍸

	Natives (20m Quadrat)	Exotics (20m Quadrat)
1	E. punctata	African Olive
2	E. tereticornis	Small leaved privet
3	Angophora floribunda	
4	Hakea sp.	
5	Syncarpia glomulifera (sclerophylla?) ✓	
6	Euc. (Maiden?)	
7	Quatrechista dimidiata	
8	Acacia floribunda	
9	Dodonaea longifolia	
10	Pittosporum undulatum	
11	Allocasuarina littoralis	
12	Leptospermum trinervium	
13	Leptospermum polygalifolium	
14	Pimelea linifolia	
15	Commandra longifolia	
16	Gahnia sieberiana	
17	Eucalyptus eximia/tenuis	
18	Dodonaea viscosa	
19	~~Lissanthe strigosa~~ Leucopogon juniperinum	
20	Lepidosperma laterale	
21	Persoonia linearis	
22	Melaleuca sieberi	
23	Prostanthera purpurascens	
24	Billardiera scandens	
25	Macrozamia spiralis	
26	Hypericum gramineum	
27	Tetratheca juncea	
28	Entolasia marginata	
29	Glycine clandestina	
30	Aristida [illegible] vagans	
31	Panicum [illegible] simile	
32	Hibbertia [illegible] diffusa	
33	[illegible] Acianthus fornicatus	
34	[illegible]	
35	Commandra glaucus	
36	Dichondra repens	
37	Clematis aristata	
38	Veronica plebia	
39	Chiloglottis sp?	
40	Acacia sp. (5)	Proteaceae family
41	Persoonia [illegible] (5)	sp. 1 sonis
42	Pomaderris [illegible]	Paspalidium distans
43	~~Sedge~~ Ozothamnus [illegible] (5)	
44	~~Unknown grass~~ Panicum simile	
45		
46		
47		
48		
49		
50		
51		
52		

Plot 2

Eco Logical Australia - Biobank plot data sheet

Start a new sheet for each plot

Site Sheet No.

Ref Site ID	Plot 2	Recorders	EL & SP	Date	13/4/12
GPS datum	WGS 019	Easting *	0308035	Northing*	6273397

* Record from Easting and Northing from the end of the 50m transect which also his the 20m quadrat

Vegetation Zone Identification

Biometric Vegetation Type (Create a standard short version)	SSTF		
Ancillary Code (Usually condition description)			
Condition (Low or Mod-Good)		Habitat Features (rocks etc)	

20m x 20m Quadrat	Number of native plant species	Use species list over page (full Id is not required) Write no. natives here: 46		
50m Transect – 10 Points	Native over-storey cover (%)	30, 10, 10, 10, 10, 5, 30, 40, 30, 5.	Sum / 10	18 %
	Native mid-storey cover (%)	0, 30, 30, 0, 50, 50, 40, 0, 20, 0	Sum / 10	22 %
50m Transect – 50 Points	Native ground cover (hits/50 points) – Grasses	IIII IIII	Double score out of 50 to get %	20 %
	Native ground cover (hits/50 points) – shrubs		Double score out of 50 to get %	0 %
	Native ground cover (hits/50 points) – other	IIII IIII III	Double score out of 50 to get %	28 %
50m Transect – 10 points + 50 points	Exotic plant cover - Sum exotic cover (%) from (a) overstorey + (b) midstorey + (c) ground cover	Overstory (10 points)	Sum / 10	Sum exotic 0 % cover
		Midstorey (10 points) 5, 50	Sum / 10	5.5
		Ground (50 points)	Double score	0 %
20m x 50m Quadrat	Number of trees with hollows	9		
	Total length fallen logs >10cm width (m)	60		
Whole Veg. Zone	Over-storey regeneration	Species	Regenerating (ie. saplings)?	Proportion

Litter IIII IIII IIII IIII IIII IIII
Log/stump III
Rock III

	Natives (20m Quadrat)	Exotics (20m Quadrat)
1	E. punctata	Olea europea subsp cuspidata
2	~~[illegible]~~	Ligustrum sinense
3	C. crebra	Conyza sp.
4	Angophora bakeri	Ochna
5	E. eugenioide	Jacaranda
6	Kunzea ambigua	Lantana camara
7	Leucopogon muticus	Hypochaeris radicata
8	Ozothamnus diosm	
9	Allocasuarina littoralis	
10	Exocarpos cupressiformis	
11	Notelea longifolia	
12	Persoonia linearis	
13	Stypandra glauca	
14	Lomandra long.	
15	Cheilanthes sieberi	
16	Astroloma humifusum	
17	Entolasia stricta	
18	Microlaena stipoides	
19	Pomax umbellata	
20	Trachymene incisa	
21	Leucopogon juniperinus	
22	Imperata cylindrica	
23	Acianthus fornicatus	
24	Desmodium varians	
25	Lepidosperma laterale	
26	Glycine clandestina	
27	[illegible] purpurascens	
28	[illegible] sp. sieberiana	
29	Aristida vagans	
30	Themeda australis	
31	Daviesia ulicifolia	
32	Breynia oblongifolia	
33	Lomandra filiformis	
34	Veronica plebeia	
35	Acaena sp.	
36	Solanum pinnatifolium	
37	[illegible] distans	
38	Panicum simile	
39	Hibbertia diffusa	
40	Poranthera microphylla	
41	Dichondra repens	
42	Stiff leaves not Ozothamnus (s) ?	
43	Asteraceae, spatulate leaves (s) Epaltes	australis
44	Grass – Digitaria like (s) ? Poaceae	
45	~~Frond-like~~ (s) Orchid	
46	Commelina cyanea	
47	Clematis glycinoides	
48		
49		
50		
51		
52		

Plot 3

Eco Logical Australia - Biobank plot data sheet Start a new sheet for each plot	Site Sheet No.

Ref Site ID	Plot 3	Recorders	EL & JP	Date	13/9/12
GPS datum	020	Easting *	306921	Northing*	6272391

* Record from Easting and Northing from the end of the 50m transect which also has the 20m quadrat

Vegetation Zone Identification

Biometric Vegetation Type (Create a standard short version)	RFEF		
Ancilary Code (Usually condition description)			
Condition (Low or Mod-Good)		Habitat Features (rocks etc)	

20m x 20m Quadrat	Number of native plant species	Use species list over page (full Id is not required) Write no. natives here: 44		
50m Transect – 10 Points	Native over-storey cover (%)	40, 30, 20, 10, 20, 5, 0, 0, 0, 5	Sum / 10	13 %
	Native mid-storey cover (%)	80, 80, 90, 1, 40, 50, 20, 40, 50, 90	Sum / 10	49.1 %
50m Transect – 50 Points	Native ground cover (hits/50 points) – Grasses	𝍸 𝍸 𝍸 𝍸	Double score out of 50 to get %	37 %
	Native ground cover (hits/50 points) – shrubs	4	Double score out of 50 to get %	9 %
	Native ground cover (hits/50 points) – other	𝍸 𝍸 𝍸	Double score out of 50 to get %	38 %
50m Transect – 10 points + 50 points	Exotic plant cover - Sum exotic cover (%) from (a) overstorey + (b) midstorey + (c) ground cover	Overstorey (10 points)	Sum / 10	Sum exotic 0 % cover
		Midstorey (10 points)	Sum / 10	0
		Ground (50 points) 𝍸	Double score	12 %
20m x 50m Quadrat	Number of trees with hollows	0		
	Total length fallen logs >10cm width (m)	15m		
Whole Veg. Zone	Over-storey regeneration	Species	Regenerating (ie. saplings)?	Proportion

Litter 𝍸 𝍸 𝍸 IV

B. Hardenbergia scandens
E. punctata
Cas. cunninghamiana
L. laxiflorus

	Natives (20m Quadrat)	Exotics (20m Quadrat)
1	E. moluccana	Blackberry
2	E. tereticornis	Setaria sp
3	E. amplifolia	Verbena bon
4	Melaleuca decora	Conyza
5	Acacia floribunda	Plantago lanceolata
6	Acacia decurrens	Cyperus eragrostis
7	Exocarpos cupressiformis	Asparagus aspergoides
8	Imperata cylindrica	Moth vine
9	Hydrocotyle pedunculosa	Paspalum dilatatum
10	Centella asiatica	Senecio sp
11	Oplismenus imbecillis	Bidens pilosa
12	Glycine tabacina	Ligustrum sinense
13	Pratia purpurascens	Ligustrum lucidum
14	Dichondra repens	Cirsium vulgare
15	Dianella longifolia	
16	Alternanthera denticulata	
17	Desmodium brachypodum	
18	Cynodon dactylon	
19	Goodenia ovata	
20	Lomandra longifolia	
21	Clematis glycinoides	
22	Entolasia marginata	
23	Cheilanthes sieberi	
24	Galium sp Sieberiana	
25	Solanum prinophyllum	
26	Desmodium varians	
27	Kunzea ambigua	
28	Hakea dactyloides	
29	Daviesia ulicifolia	
30	Aristida vagans	
31	Glycine clandestina	
32	Adiantum aethiopicum	
33	Pellaea falcata	
34	Leucopogon juniperinus	
35	Eucalyptus ? (5) Hypoxis hygrometrica var hygrometrica	
36	Oxalis sp (5) Pennisetum	
37	Angophora floribunda	
38	Persoonia pinifolia	
39	Themeda australis	
40	Persicaria sp.	
41	Fern-leaf forb (5) Galium gaudichaudii	
42	Lilly (purple unformed) (5) Cassia pauciflora var pauciflora	
43	Echinopogon caespitosus	
44	Melaleuca linariifolia	
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Plot 4

Eco Logical Australia - Biobank plot data sheet Start a new sheet for each plot	Site Sheet No.

Ref Site ID	Plot 4	Recorders	EL & JP	Date	13/4/12
GPS datum	0?5	Easting *	0306991	Northing*	6272907

* Record from Easting and Northing from the end of the 50m transect which also has the 20m quadrat

Vegetation Zone Identification

Biometric Vegetation Type (Create a standard short version)	CPW		
Ancillary Code (Usually condition description)			
Condition (Low or Mod-Good)		Habitat Features (rocks etc)	

20m x 20m Quadrat	Number of native plant species	Use species list over page (full Id is not required) Write no. natives here: 25		
50m Transect – 10 Points	Native over-storey cover (%)	10, 10, 20, 30, 46, 20, 10, 5, 5, 20	Sum / 10	19 %
	Native mid-storey cover (%)	5, 5, 50, 40, 1, 50, 10, 0, 0, 40	Sum / 10	20.1 %
50m Transect – 50 Points	Native ground cover (hits/50 points) – Grasses	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ||||	Double score out of 50 to get %	98 %
	Native ground cover (hits/50 points) – shrubs		Double score out of 50 to get %	0 %
	Native ground cover (hits/50 points) – other	~~||||~~ ||	Double score out of 50 to get %	14 %
50m Transect – 10 points + 50 points	Exotic plant cover - Sum exotic cover (%) from (a) overstorey + (b) midstorey + (c) ground cover	Overstory (10 points)	Sum / 10	Sum exotic % cover: 0
		Midstorey (10 points) 5, 80	Sum / 10	8.5 %
		Ground (50 points) ||	Double score	4
20m x 50m Quadrat	Number of trees with hollows	0		
	Total length fallen logs >10cm width (m)	39		
Whole Veg. Zone	Over-storey regeneration	Species	Regenerating (ie. saplings)?	Proportion

log 1

	Natives (20m Quadrat)	Exotics (20m Quadrat)
1	E. tereticornis	Olea europea subsp cuspida
2	A. floribunda	Setaria sp.
3	Acacia decurrens	Asparagus asparagoides
4	Acacia parramattensis	Cayratia sp.
5	Rubus parviflorus	Sida rhombifolia
6	Micrantheum hexandrum	Dovea mediterranicum
7	Amaranthus sp.	Ligustrum sinense
8	Chrysocephalum apiculatum	Cyperus eragrostis
9	Entolasia marginata	Eleusine
10	Paspalidium distans	Bidens pilosa
11	Goodenia heterophylla	Malva sp.
12	Solanum prinophyllum	Solanum sp.
13	Glycine tabacina	Blackberry
14	Bursaria spinosa	
15	Centella asiatica	
16	Oxalis corniculata	
17	Grevillea sericea	
18	Hydrocotyle pedunculata	
19	Arthropodium milleflorum	
20	Poa sp. (S) – Entolasia marginata (already recorded)	
21	Eragrostis (S) brownei	
22	Echinopogon sp.	
23	Commelina cyanea	
24	Hydrocotyle sp. (S) – Alisma plantago-aquatica	
25	Persicaria sp.	
26	Oplismenus (Poaceae)	
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Appendix C: Likelihood of threatened and migratory flora and fauna occurrence within vegetation communities

SCIENTIFIC NAME	COMMON NAME	ROTAP	TSC ACT	EPBC ACT	LIKELIHOOD OF OCCURRENCE	SHALE SANDSTONE TRANSITION FOREST	CUMBERLAND PLAIN WOODLAND	RIVER FLAT EUCALYPT FOREST
Macquarie australasica	Macquarie Perch		E (under FM Act)	E	U			
Prototroctes maraena	Australian Grayling		-	V	U			
Heleioporus australiacus	Giant Burrowing Frog		V	V	U			
Litoria aurea	Green and Golden Bell Frog		E	V	P			x
Litoria littlejohni	Littlejohn's Tree Frog, Heath Frog		V	V	U			
Mixophyes balbus	Stuttering Frog		E	V	N			
Mixophyes iteratus	Giant Barred Frog		E	E	N			
Pseudophryne australis	Red-crowned Toadlet		V	-	U			
Hoplocephalus bungaroides	Broad-headed Snake		E	V	N			
Varanus rosenbergi	Heath Monitor		V	-	U			
Anthochaera Phrygia	Regent Honeyeater		E	E and M	P	x	x	x
Botaurus poiciloptilus	Australasian Bittern		V	-	U			
Cacatua leadbeateri	Major Mitchell's Cockatoo		V	-	U			
Callocephalon fimbriatum	Gang-gang Cockatoo (population in Hornsby and Ku-ring-gai LGAs)		V-E2	-	P	x	x	x
Calyptorhynchus lathami	Glossy Black-Cockatoo		V	-	P	x	x	x

SCIENTIFIC NAME	COMMON NAME	ROTAP	TSC ACT	EPBC ACT	LIKELIHOOD OF OCCURRENCE	SHALE SANDSTONE TRANSITION FOREST	CUMBERLAND PLAIN WOODLAND	RIVER FLAT EUCALYPT FOREST
Circus assimilis	Spotted Harrier		V	-	P	x	x	x
Daphoenositta chrysoptera	Varied Sittella		V	-	P	x	x	
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)		V	-	U			
Dasyornis brachypterus	Eastern Bristlebird		E	E	N			
Epthianura albifrons	White-fronted Chat		V		N			
Ephippiorhynchus asiaticus	Black-necked Stork		E	-	U			
Hieraaetus morphnoides	Little Eagle		V	-	P	x	x	x
Glossopsitta pusilla	Little Lorikeet		V	-	P	x	x	x
Irediparra gallinacea	Comb-crested Jacana		V	-	U			
Ixobrychus flavicollis	Black Bittern		V	-	U			
Lathamus discolor	Swift Parrot		E	E	P	x	x	x
Limosa limosa	Black-tailed Godwit		V	-	U			
Lophoictinia isura	Square-tailed Kite		V	-	P	x	x	x
Melanodryas cucullata cucullata	Hooded Robin (southeastern subspecies)		V	-	P	x	x	
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)		V	-	P		x	
Neophema pulchella	Turquoise Parrot		V	-	U			
Oxyura australis	Blue-billed Duck		V	-	U			
Petroica boodang	Scarlet Robin		V	-	P	x	x	
Petroica phoenicea	Flame Robin		V	-	U			
Petroica rodinogaster	Pink Robin		V	-	U			
Polytelis swainsonii	Superb Parrot		V	V	U			
Pyrrholaemus sagittatus	Speckled Warbler		V	-	U			
Rostratula australis (a.k.a. R. benghalensis)	Painted Snipe (Australian subspecies)		E	V	U			

SCIENTIFIC NAME	COMMON NAME	ROTAP	TSC ACT	EPBC ACT	LIKELIHOOD OF OCCURRENCE	SHALE SANDSTONE TRANSITION FOREST	CUMBERLAND PLAIN WOODLAND	RIVER FLAT EUCALYPT FOREST
Stictonetta naevosa	Freckled Duck		V	-	U			
Ninox connivens	Barking Owl		V	-	P	x	x	x
Ninox strenua	Powerful Owl		V	-	P	x	x	x
Tyto novaehollandiae	Masked Owl		V	-	P	x	x	x
Tyto tenebricosa	Sooty Owl		V	-	P	x	x	x
Dasyurus maculatus	Spotted-tailed Quoll		V	E	U			
Isoodon obesulus	Southern Brown Bandicoot		E	E	U			
Petaurus australis	Yellow-bellied Glider		V	-	U			
Petrogale penicillata	Brush-tailed Rock-wallaby		E	V	N			
Phascolarctos cinereus	Koala		V-E2	-	U			
Potorous tridactylus tridactylus	Long-nosed Potoroo (SE Mainland Population)		V	V	N			
Pseudomys novaehollandiae	New Holland Mouse		-	V	N			
Chalinolobus dwyeri	Large-eared Pied Bat		V	V	L	x	x	x
Falsistrellus tasmaniensis	Eastern False Pipistrelle		V	-	Y	x	x	x
Miniopterus australis	Little Bent-wing Bat		V	-	L	x	x	x
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat		V	-	L	x	x	x
Mormopterus norfolkensis	East Coast Freetail Bat		V	-	L	x	x	x
Myotis macropus (formerly M. adversus)	Southern Myotis, Large-footed Myotis		V	-	Y	x	x	x
Pteropus poliocephalus	Grey-headed Flying-Fox		V	V	Y	x	x	x
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat		V	-	Y	x	x	x
Scoteanax rueppellii	Greater Broad-nosed Bat		V	-	L	x	x	x
Meridolum corneovirens	Cumberland (Large) Land Snail		E	-	P		x	
Apus pacificus	Fork-tailed Swift		-	M	P	x	x	x

SCIENTIFIC NAME	COMMON NAME	ROTAP	TSC ACT	EPBC ACT	LIKELIHOOD OF OCCURRENCE	SHALE SANDSTONE TRANSITION FOREST	CUMBERLAND PLAIN WOODLAND	RIVER FLAT EUCALYPT FOREST
Haliaeetus leucogaster	White-bellied Sea-Eagle		-	M	U			
Hirundapus caudacutus	White-throated Needletail		-	M	P	x	x	x
Merops ornatus	Rainbow Bee-eater		-	M	P	x	x	x
Monarcha melanopsis	Black-faced Monarch		-	M	P	x	x	x
Myiagra cyanoleuca	Satin Flycatcher		-	M	P			x
Rhipidura rufifrons	Rufous Fantail		-	M	P			x
Ardea alba	Great Egret		-	M	U			
Ardea ibis	Cattle Egret		-	M	U			
Calidris ferruginea	Curlew Sandpiper		E	M	U			
Gallinago hardwickii	Latham's Snipe		-	M	U			
Rostratula benghalensis (a.k.a. R. australis)	Painted Snipe		-	M	U			
Acacia bakeri	Marblewood		V	-	N			
Acacia bynoeana	Bynoe's Wattle	yes	E	V	P	x		
Acacia gordonii		yes	E	E	U			
Acacia pubescens	Downy Wattle	yes	V	V	P	x	x	
Asterolasia elegans	*Asterolasia elegans*	yes	E	E	U			
Cryptostylis hunteriana	Leafless Tongue Orchid		V	V	U			
Darwinia biflora	*Darwinia biflora*	yes	V	V	P	x		
Dillwynia tenuifolia	*Dillwynia tenuifolia*	yes	V	V	P		x	
Epacris purpurascens var. purpurascens	*Epacris purpurascens* var. *purpurascens*		V	-	P	x		
Eucalyptus nicholii	Narrow-leaved Black Peppermint		V	V	Y	x		
Eucalyptus sp. Cattai	*Eucalyptus* sp. Cattai		E		P	x		
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea		V	-	P		x	

SCIENTIFIC NAME	COMMON NAME	ROTAP	TSC ACT	EPBC ACT	LIKELIHOOD OF OCCURRENCE	SHALE SANDSTONE TRANSITION FOREST	CUMBERLAND PLAIN WOODLAND	RIVER FLAT EUCALYPT FOREST
Grevillea parviflora subsp. parviflora	Small-flower Grevillea		V	V	U			
Grevillea parviflora subsp. supplicans	*Grevillea parviflora* subsp. *supplicans*		E	-	U			
Hibbertia superans	*Hibbertia superans*		E	-	P	x		
Lasiopetalum joyceae	*Lasiopetalum joyceae*		V	V	P	x		
Leucopogon fletcheri subsp. fletcheri	*Leucopogon fletcheri* subsp. *fletcheri*	yes	E	-	P	x		
Melaleuca deanei	Deane's Paperbark	yes	V	V	U			
Micromyrtus minutiflora	*Micromyrtus minutiflora*		E	-	U			
Olearia cordata	Olearia cordata	yes	V	V	U			
Persoonia hirsuta	Hairy Geebung		E	E	P	x		
Persoonia mollis subsp. maxima	Persoonia mollis subsp. maxima		E	E	U			
Pimelea curviflora var. curviflora	Pimelea curviflora var. curviflora		V	V	P	x		
Pimelea spicata	Spiked Rice-flower	yes	E	E	P		x	
Pterostylis gibbosa	Illawarra Greenhood		E	E	U			
Pterostylis saxicola	Sydney Plains Greenhood	yes	E	E	U			
Pultenaea parviflora	Pultenaea parviflora		E	V	U			
Syzygium paniculatum	Magenta Lilly Pilly		V	V	U			
Tetratheca glandulosa	*Tetratheca glandulosa*	yes	V	V	P	x		
Zieria involucrata	*Zieria involucrata*	yes	E	V	U			
Brasenia schreberi		yes			U			
Amperea xiphoclada var. papillata		yes			U			
Lomandra brevis		yes			U			
Myoporum floribundum		yes			P	x		
Callistemon shiressii		yes			P	x	x	

SCIENTIFIC NAME	COMMON NAME	ROTAP	TSC ACT	EPBC ACT	LIKELIHOOD OF OCCURRENCE	SHALE SANDSTONE TRANSITION FOREST	CUMBERLAND PLAIN WOODLAND	RIVER FLAT EUCALYPT FOREST
Kerandrenia corollata var. denticulata		yes			U			

Appendix D: Flora species recorded in the study area

SCIENTIFIC NAME	COMMON NAME	PLOT 1	PLOT 2	PLOT 3	PLOT 4	TRANSECT 1	TRANSMISSION LINE	RFEF	OPPORTUNISTIC
Acacia binervia	Coast Myall					x			
Acacia decurrens	Black Wattle			x	x	x			
Acacia falcata						x	x		
Acacia floribunda	White Sally	x		x	x	x			
Acacia longifolia									x
Acacia parramattensis	Parramatta Wattle				x	x	x	x	
Acacia podalyriifolia	Queensland Silver Wattle								x
Acacia sp.			x						
Acacia terminalis	Sunshine Wattle								x
Acacia ulicifolia	Prickly Moses								x
Acer pseudoplatanus *	Sycamore Maple								x
Acetosa sagittata *	Rambling Dock					x			
Acianthus fornicatus	Pixie Caps	x	x						
Adiantum aethiopicum	Common Maidenhair			x					x
Agapanthus praecox *	Agapanthus								x
Alisma plantago-aquatica	Water Plantain				x				
Allocasuarina littoralis	Black Sheoak	x	x						x
Alternanthera denticulata	Lesser Joyweed			x					
Andropogon virginicus *	Whisky Grass						x		
Angophora bakeri	Narrow-leaved Apple	x	x			x	x		
Angophora floribunda	Rough-barked Apple	x		x	x				x
Araujia sericifera *	Moth Vine			x	x				x
Aristida vagans	Threeawn Speargrass	x	x						
Asparagus asparagoides *				x	x	x	x		
Astroloma humifusum	Native Cranberry		x						
Banksia ericifolia							x		

SCIENTIFIC NAME	COMMON NAME	PLOT 1	PLOT 2	PLOT 3	PLOT 4	TRANSECT 1	TRANSMISSION LINE	RFEF	OPPORTUNISTIC
Banksia spinulosa									x
Bidens pilosa *	Cobbler's Pegs			x	x			x	x
Billardiera scandens	Appleberry	x							
Breynia oblongifolia	Coffee Bush		x			x		x	
Bryophyllum delagoense *	Mother of millions								x
Bursaria spinosa	Native Blackthorn			x	x	x	x		
Caesia parviflora var. parviflora	Pale Grass-lilly			x					
Callistemon sp.									x
Calochlaena dubia	Common Ground Fern								x
Canna indica *	Indian Shot								x
Cardamine hirsuta *	Common Bittercress					x			
Casuarina cunninghamiana	River Oak								x
Centella asiatica	Pennywort			x	x	x		x	
Cestrum parqui *	Green Cestrum								x
Cheilanthes sieberi		x	x	x	x	x			
Chiloglottis sp.		x							
Chloris gayana *	Rhodes Grass					x	x		
Cirsium vulgare *	Spear Thistle			x		x			
Cissus hypoglauca	Giant Water Vine								x
Clematis aristata		x				x			
Clematis glycinoides	Headache Vine		x	x		x	x		
Commelina cyanea	Native Wandering Jew		x		x			x	x
Conyza bonariensis *	Flaxleaf Fleabane			x		x		x	
Conyza sp. *			x		x				
Cortaderia selloana *	Pampas Grass								x
Corymbia maculata									x
Cyathochaeta diandra		x							
Cynodon dactylon	Common Couch			x					x
Cyperus eragrostis *	Umbrella Sedge			x	x				x
Daviesia ulicifolia	Gorse Bitter Pea		x	x					x
Desmodium varians	Slender Tick-trefoil		x						
Dianella caerulea						x			

SCIENTIFIC NAME	COMMON NAME	PLOT 1	PLOT 2	PLOT 3	PLOT 4	TRANSECT 1	TRANSMISSION LINE	RFEF	OPPORTUNISTIC
Dianella longifolia				x					
Dichelachne sp.									x
Dichondra repens	Kidney Weed	x	x	x		x		x	
Dodonaea triquetra									x
Echinopogon caespitosus				x					x
Echinopogon sp.					x				
Ehrharta erecta *	Panic Veldtgrass					x			
Einadia hastata	Berry Saltbush							x	
Entolasia marginata	Bordered Panic	x		x	x	x			
Entolasia stricta	Wiry Panic		x						x
Epaltes australis			x						
Eragrostis brownii					x				x
Eragrostis curvula *	African Lovegrass					x	x		
Eucalyptus amplifolia	Cabbage Gum			x				x	
Eucalyptus crebra	Narrow-leaved Ironbark		x			x			
Eucalyptus deanei	Mountain Blue Gum							x	
Eucalyptus eugenioides	Thin-leaved Stringybark		x			x			
Eucalyptus fibrosa	Red Ironbark					x			
Eucalyptus moluccana	Grey Box			x					
Eucalyptus punctata	Grey Gum	x	x			x			
Eucalyptus resinifera	Red Mahogany	x							
Eucalyptus sclerophylla	Hard-leaved Scribbly Gum	x							x
Eucalyptus tereticornis	Forest Red Gum	x		x	x	x		x	
Euphorbia peplus *	Petty Spurge					x			
Exocarpos cupressiformis	Native Cherry	x	x	x		x			
Ficus rubiginosa	Port Jackson Fig, Rusty Fig								x
Gahnia sieberiana		x	x	x	x	x			
Gahnia sp.						x			
Galium gaudichaudii				x					
Geranium solanderi	Native Geranium							x	
Glycine clandestina		x	x	x	x	x		x	

SCIENTIFIC NAME	COMMON NAME	PLOT 1	PLOT 2	PLOT 3	PLOT 4	TRANSECT 1	TRANSMISSION LINE	RFEF	OPPORTUNISTIC
Glycine tabacina					x				
Goodenia ovata				x					
Grevillea robusta	Silky Oak				x				x
Hakea dactyloides				x					
Hakea sericea							x		
Hardenbergia violacea	False Sarsaparilla								x
Hibbertia diffusa		x	x						
Hydrocotyle peduncularis				x	x				
Hydrocotyle sp.						x			
Hypochaeris radicata *	Catsear	x	x				x		
Hypoxis hygrometrica var. *hygrometrica*	Yellow Stars			x					
Imperata cylindrica			x	x		x	x		
Ipomoea indica *	Blue Morning Glory								x
Isopogon anemonifolius							x		
Jacaranda mimosifolia *	Jacaranda		x						
Jacksonia scoparia	Dogwood					x			
Juncus usitatus				x					
Kennedia rubicunda	Red Kennedy Pea								x
Kunzea ambigua	Tick Bush		x	x		x	x		
Lantana camara *	Lantana		x			x		x	
Lepidosperma laterale		x	x			x			
Leptospermum polygalifolium		x							
Leptospermum trinervium		x							
Leucopogon juniperinus		x	x	x		x			x
Leucopogon lanceolatus var. *lanceolatus*									x
Leucopogon muticus			x						x
Ligustrum lucidum *	Large-leaved Privet			x		x			
Ligustrum sinense *		x	x	x	x	x	x	x	
Lindsaea linearis	Screw Fern								x
Liquidambar styraciflua *	Liquidambar								x
Lomandra filiformis		x	x						
Lomandra longifolia	Spiny-headed Mat-rush	x	x	x		x	x		

SCIENTIFIC NAME	COMMON NAME	PLOT 1	PLOT 2	PLOT 3	PLOT 4	TRANSECT 1	TRANSMISSION LINE	RFEF	OPPORTUNISTIC
Lomandra multiflora									x
Ludwigia peruviana *									x
Macrozamia communis									x
Maytenus silvestris	Narrow-leaved Orangebark								x
Melaleuca decora				x			x		
Melaleuca linariifolia				x					
Melaleuca nodosa									x
Microlaena stipoides		x	x	x	x	x			
Modiola caroliniana *	Red-flowered Mallow					x			
Nerium oleander *	Oleander								x
Notelaea longifolia	Large Mock-olive	x	x				x		
Ochna serrulata *	Mickey Mouse Plant		x			x			
Olea europaea subsp. *cuspidata* *		x	x		x	x	x		
Oplismenus aemulus						x			
Oplismenus imbecillis				x	x				
Oxalis perennans				x					
Oxalis sp.									x
Ozothamnus diosmifolius	White Dogwood	x	x	x	x	x			
Pandorea pandorana	Wonga Wonga Vine								x
Panicum maximum *	Guinea Grass					x			
Panicum simile	Two-colour Panic	x	x						
Parsonsia straminea	Common Silkpod								x
Paspalidium distans		x	x	x	x				
Paspalum dilatatum *	Paspalum			x				x	
Paspalum urvillei *	Vasey Grass								x
Passiflora sp. *									x
Pellaea falcata	Sickle Fern			x					x
Pennisetum clandestinum *	Kikuyu Grass				x			x	x
Persicaria sp.				x	x			x	x
Persoonia linearis	Narrow-leaved Geebung	x	x			x			
Phoenix canariensis *	Phoenix Palm								x

SCIENTIFIC NAME	COMMON NAME	PLOT 1	PLOT 2	PLOT 3	PLOT 4	TRANSECT 1	TRANSMISSION LINE	RFEF	OPPORTUNISTIC
Pimelea linifolia		x							
Pittosporum revolutum	Rough Fruit Pittosporum								x
Pittosporum undulatum	Sweet Pittosporum								x
Plantago lanceolata *	Lamb's Tongues			x					x
Polyscias sambucifolia	Elderberry Panax								x
Pomax umbellata		x	x						
Poranthera microphylla			x	x					
Portulaca oleracea	Pigweed								x
Pratia purpurascens	Whiteroot	x	x	x	x	x		x	
Pteridium esculentum	Bracken						x	x	x
Pterostylis sp.			x						
Pultenaea flexilis									x
Ricinus communis *	Castor Oil Plant								x
Rubus fruiticosus *	Blackberry complex			x	x				x
Rumex brownii	Swamp Dock								x
Rumex obtusifolius									x
Salix spp. *									x
Salvinia molesta *									x
Senecio madagascariensis *	Fireweed				x			x	x
Senecio sp. *				x					
Senna pendula *						x			
Setaria sp. *				x	x	x			
Sida rhombifolia *	Paddy's Lucerne				x	x		x	
Sigesbeckia orientalis									x
Solanum mauritianum *	Wild Tobacco Bush								x
Solanum nigrum *	Black-berry Nightshade					x		x	
Solanum prinophyllum	Forest Nightshade		x	x	x	x			
Solanum sp.					x				
Soliva sessilis *	Bindii					x			
Sonchus oleraceus *	Common Sowthistle								x
Sporobolus sp. *									x
Stenotaphrum secundatum *	Buffalo Grass								x

SCIENTIFIC NAME	COMMON NAME	PLOT 1	PLOT 2	PLOT 3	PLOT 4	TRANSECT 1	TRANSMISSION LINE	RFEF	OPPORTUNISTIC
Stypandra glauca	Nodding Blue Lily		x				x		x
Themeda australis	Kangaroo Grass		x			x			
Trachymene incisa		x	x						
Tradescantia fluminensis *	Trad							x	
Trema aspera	Native Peach						x		x
Trifolium sp. *									x
Typha orientalis	Broad-leaved Cumbungi								x
Ulmus parvifolia *									x
Unidentified forb			x						
Unidentified Poacaea			x						
Unidentified Proteacaea species		x							
Urtica incisa *	Stinging Nettle							x	x
Verbena bonariensis *	Purpletop			x		x		x	
Veronica plebeia	Trailing Speedwell	x	x						
Vicia sativa *									x
Viola hederacea									x
Wahlenbergia sp.									x
Xanthorrhoea sp.									x
Yucca aloifolia *									x
Zieria smithii	Sandfly Zieria								x

* Denotes exotic species

Appendix E: Fauna species recorded in and directly adjacent to the study area

SCIENTIFIC NAME	COMMON NAME
BIRDS	
Acridotheres tristis *	Common Myna
Alisterus scapularis	Australian King-Parrot
Anas platyrhynchos *	Mallard
Anas superciliosa	Pacific Black Duck
Artamus cyanopterus	Dusky Woodswallow
Cacatua galerita	Sulphur-crested Cockatoo
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo
Cisticola exilis ?	Golden-headed Cisticola
Colluricincla harmonica	Grey Shrike-thrush
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Cracticus torquatus	Grey Butcherbird
Dacelo novaeguineae	Laughing Kookaburra
Gallinula tenebrosa	Dusky Moorhen
Grallina cyanoleuca	Magpie-lark
Gymnorhina tibicen	Australian Magpie
Malurus cyaneus	Superb Fairy-wren
Manorina melanocephala	Noisy Miner
Manorina melanophrys	Bell Miner
Meliphaga lewinii	Lewin's Honeyeater
Pardalotus punctatus	Spotted Pardalote
Phalacrocorax sp.	Cormorant species
Phaps chalcoptera	Common Bronzewing
Platalea regia	Royal Spoonbill
Platycercus adscitus eximius	Eastern Rosella
Platycercus elegans	Crimson Rosella
Psophodes olivaceus	Eastern Whipbird
Ptilonorhynchus violaceus	Satin Bowerbird
Pycnonotus jocosus *	Red-whiskered Bulbul
Rhipidura albiscapa	Grey Fantail
Rhipidura leucophrys	Willie Wagtail
Strepera graculina	Pied Currawong
Streptopelia chinensis *	Spotted Turtle-Dove
Trichoglossus haematodus	Rainbow Lorikeet
MAMMALS	
Canis lupus familiaris *	Dog

Lepus capensis *	Brown Hare
Oryctolagus cuniculus *	Rabbit
Petaurus breviceps	Sugar Glider
Pseudocheirus peregrinus	Common Ringtail Possum
Tachyglossus aculeatus	Short-beaked Echidna
Vulpes vulpes *	Fox
Wallabia bicolor	Swamp Wallaby
FROGS	
Crinia signifera	Common Eastern Froglet
Limnodynastes tasmaniensis	Spotted Marsh Frog
Litoria latopalmata	Broad-palmed Frog

* Denotes exotic species, ? denotes species not positively identified

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