Tahmoor Planning Proposal –

Ecological and Riparian Assessment

Prepared for
Ingham Property Development Pty Ltd

October 2013

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Abbreviations

ABBREVIATION	DESCRIPTION
CA	Controlled action
CEEC	Critically Endangered Ecological Community
CPW	Cumberland Plain Woodland
DGPS	Differential Geographic Positioning System
EEC	Endangered Ecological Community
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW Environmental Planning and Assessment Act 1979
FM Act	NSW Fisheries Management Act 1994
GRSW	Georges River Sandstone Woodland
LEP	Local Environmental Plan
LGA	Local Government Area
NCA	Non-controlled action
NCA-PM	Non-controlled action – particular matter
NES	Matters of national environmental significance
NoW	New South Wales Office of Water
NSW	New South Wales
NV Act	NSW Native Vegetation Act 2003
OEH	Office of Environment and Heritage
SEPP 44	State Environmental Planning Policy No. 44 – Koala Habitat Protection
SEWPaC	Department of Sustainability, Environment, Water, Populations and Communities
SGF	Western Sydney Gully Forest
SIS	Species Impact Statement
SSTF	Shale Sandstone Transition Forest
TofB	Top of Bank
TSC Act	Threatened Species Conservation Act 1997
WM Act	NSW Water Management Act 2000
WoNS	Weeds of National Significance

Executive Summary

Rezoning is proposed for a portion of Ingham's landholdings at Tahmoor, incorporating Lots 1 to 6 DP1128745, Lot 255 DP10669 and Lot C DP374621 within the Wollondilly Local Government area. This land is currently zoned as RU4 Primary Production Small Holdings, with the proposed future land use zonings being a combination of R2 Low Density Residential, R5 Large Lot Residential, E2 Environmental Conservation and RE1 Recreation following the standard Local Environment Plan (LEP) zonings. Ingham Property Development have commissioned Eco Logical Australia Pty Ltd (ELA) to undertake an ecological assessment for this rezoning. The proposed area for rezoning covers an area of 165 ha.

The rezoning site is located east of Tahmoor township and is presently accessed via Cross Street, Tahmoor. Vegetation across the site consists of both exotic pasture grasslands and wooded areas. The site is bounded by the Bargo River Gorge in the south and contains several first order ephemeral streams.

Vegetation within the boundaries of the site consists of five vegetation communities:

- Cumberland Plain Woodland (CPW)
- Shale Sandstone Transition Forest (SSTF),
- Western Sandstone Gully Forest (SGF)
- Upper Georges River Sandstone Woodland (GRSW)
- Exotic Pastures.

CPW is listed as a critically endangered ecological community (CEEC) under both the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Threatened Species Conservation Act 1995* (TSC Act). SSTF is listed as an endangered ecological community (EEC) under both these acts.

The site also contains potential habitat for eight threatened flora species, 20 threatened fauna species (one fish, one frog, 11 birds, 3 terrestrial mammals and 4 bats species) and 13 migratory fauna species.

Literature review and database searches were undertaken and followed by preliminary field survey of the proposed rezoning site. Assessment of the vegetation structure and condition involved consideration of both species composition including exotic species and size of vegetation community parcels. CPW and SSTF areas were categorised using these assessments and mapped according to the condition classes – good condition, moderate condition or poor condition.

Riparian zones were defined in the field to the Top of Bank, with appropriate vegetated riparian zones (VRZ) mapped for first order and second order streams.

The proposed impact area i.e. the areas to be zoned R2 and R5, is primarily centred on those areas where the vegetation is of limited canopy trees and an understorey dominated by exotic pasture grasses, and on areas of SSTF in 'poor condition' where the understorey is also dominated by exotic species.

Of the 8.98 ha of Cumberland Plain Woodland listed under the NSW TSC Act on the site, approximately

4.76 ha (53%) will be retained and 4.22 ha (47%) will be impacted. It is important to note however that 76% of the good condition CPW will be retained.

Of the 94.15 ha of Shale Sandstone Transition Forest on the site, 39.36 ha (42%) will be impacted and 54.79% retained. Again it is important to note that the vast majority of the good condition SSTF (97%) and moderate condition SSTF (74%) will be retained while the development is focussed on the poor condition SSTF. Of the Upper Georges River Sandstone Woodland, 83% is to be retained and 96% of the Western Sandstone Gully Forest is to be retained.

Conservation outcomes for the retained woodland and vegetated riparian zone are to be secured through a combination of zoning (E2 Environmental Conservation and RE1 Recreation), preparation and implementation of a vegetation management plan, and long term security via either a legal agreement on title or transfer to a public authority if appropriate.

No threatened flora or fauna species were identified during preliminary field surveys undertaken in late 2012. Targeted surveys for species identified during database searches will be required at the detailed design and development application stage if areas of potential habitat are likely to be impacted by proposed development.

The study site contains potential Koala habitat. Whilst no koala have been recorded on the site or were observed during field work, a koala survey will be undertaken to determine whether any parts of the site meet the criteria of core koala habitat under SEPP 44. The greater proportion of trees within the study site are to be included in the E2 zone, so it is likely that areas of Core Koala Habitat if present would be conserved.

The proposed zoning of the site maintains the existing north-south and east-west habitat connectivity with the E2 zoning and VMP, securing this land for long term conservation outcomes.

The impact on the Riparian Zone of the proposed rezoning is limited to the crossing of a first order ephemeral stream in the north of the study site. Subsequent development will thus include a controlled activity, and will require application to the New South Wales Office of Water for a permit to carry out these works.

ELA assessed the development and conservation outcomes using the Biocertification Assessment Method (DECCW 2011). Three out of four ecosystem types exceeded their credit requirements. The Grey Box – Forest Red Gum grassy woodland (ie, CPW) had a credit shortfall of 5 credits. This shortfall can be overcome through very minor design changes as the project proceeds. Over-all, the development would result in a credit surplus of 98 credits.

Based on these findings, this report concludes that good conservation outcomes are achievable and that for the purposes of the planning gateway, ecological issues are adequately addressed.

1 Introduction

1.1 DESCRIPTION OF PROJECT

Ingham Enterprises has commissioned Eco Logical Australia Pty Ltd (ELA) to undertake an ecological assessment for the rezoning of a portion of Ingham's landholdings at Tahmoor. The proposed rezoning area incorporates Lots 1 to 6 DP1128745, Lot 255 DP10669 and LOT C DP374621 within the Wollondilly Local Government area. This land is currently zoned as RU4 Primary Production Small Holdings, with the proposed future land use zonings being a combination of R2 Low Density Residential, R5 Large Lot Residential and E2 Environmental Conservation and RE 1 Recreation following the standard Local Environment Plan (LEP) zonings. The proposed area for rezoning covers an area of 155.69 ha. The proposed rezoning site will be referred to as the 'study site' herewith.

Location of the proposed site is shown in **Figure 1.**

1.2 REPORT OBJECTIVES

This report includes the findings of a comprehensive database search and literature review of the relevant statutory considerations associated with the environmental constraints present at the site, field survey results and an assessment of how the proposal may impact upon the site's values.

The objectives of the report are:

- To identify and describe the vegetation communities and flora species present in the study area, and describe their conservation significance
- To assess the likelihood of threatened and migratory fauna species occurring within the study area, and their conservation significance
- To assess the impacts of the proposal on threatened ecological communities, populations, and species, and other environmental features pursuant to relevant statutory requirements
- To provide recommendations regarding any environmental management, impact mitigation/amelioration measures and rehabilitation actions, which can be implemented to limit the effects of the proposal on vegetation, fauna, habitats and other environmental features as necessary.

1.3 STUDY SITE

The study site is located east of Tahmoor Township and is presently accessed via Cross Street, Tahmoor. Vegetation across the site consists of both exotic pasture grasslands and wooded areas.

The Bargo River Gorge bounds the southern and south eastern portions of the study site. Myrtle Creek is near the northern boundary and the eastern boundary of the study site is four hundred metres west of the Nepean River. Smaller ephemeral streams flow from the site into both the Bargo and Nepean Rivers.

Rural residential and rural holdings border the subject site on the northern, eastern and western edges. Land use within the study site currently consists of intensive duck production and cattle grazing. A portion of the site is currently irrigated with waste water from the turkey processing plant which is located on the western boundary. The site has previously been used for free range turkey farming, with access tracks from this land use remaining across sections of the study site. South of the Bargo River Gorge the land is currently zoned E4 which is generally intended for land with special environmental or scenic values within which residential development can be accommodated (NSW Govt 2011).

1.4 PLANNING PROPOSAL

The planning proposal is to rezone the site to a combination of R2 - Low Density Residential, R5 - Large Lot Residential, RE1 - Recreation and E2 - Environmental Conservation (**Figure 2).** The proposed zoning of R5 land has targeted areas that are classified as exotic pasture or poor condition. Areas of good condition vegetation are generally proposed for an E2 zoning. Lot layouts and sizes have not yet been determined, but it is likely that the majority of lots will be between 1500 and 4000m^2 with larger lots (4000 – 6000m^2) in the south eastern corner of the site.

The E2 lands are designed to protect areas of moderate and good quality vegetation as well as maintain ecological links through the site n a north-south and east-west directions.

Vegetation in the E2 zone will be protected and managed via:

- An E2 – Environmental Conservation zone
- A Vegetation Management Plan that will lead to the improvement of the vegetation and habitat condition by addressing weeds, feral animals and uncontrolled access.
- A Conservation Agreement under the National Parks and Wildlife Act (or similar), transfer of land to a public authority, or managed under community title.

Vegetation in the RE1 Recreation zone is also to be retained, however low-impact development for recreational purposes will be permitted.

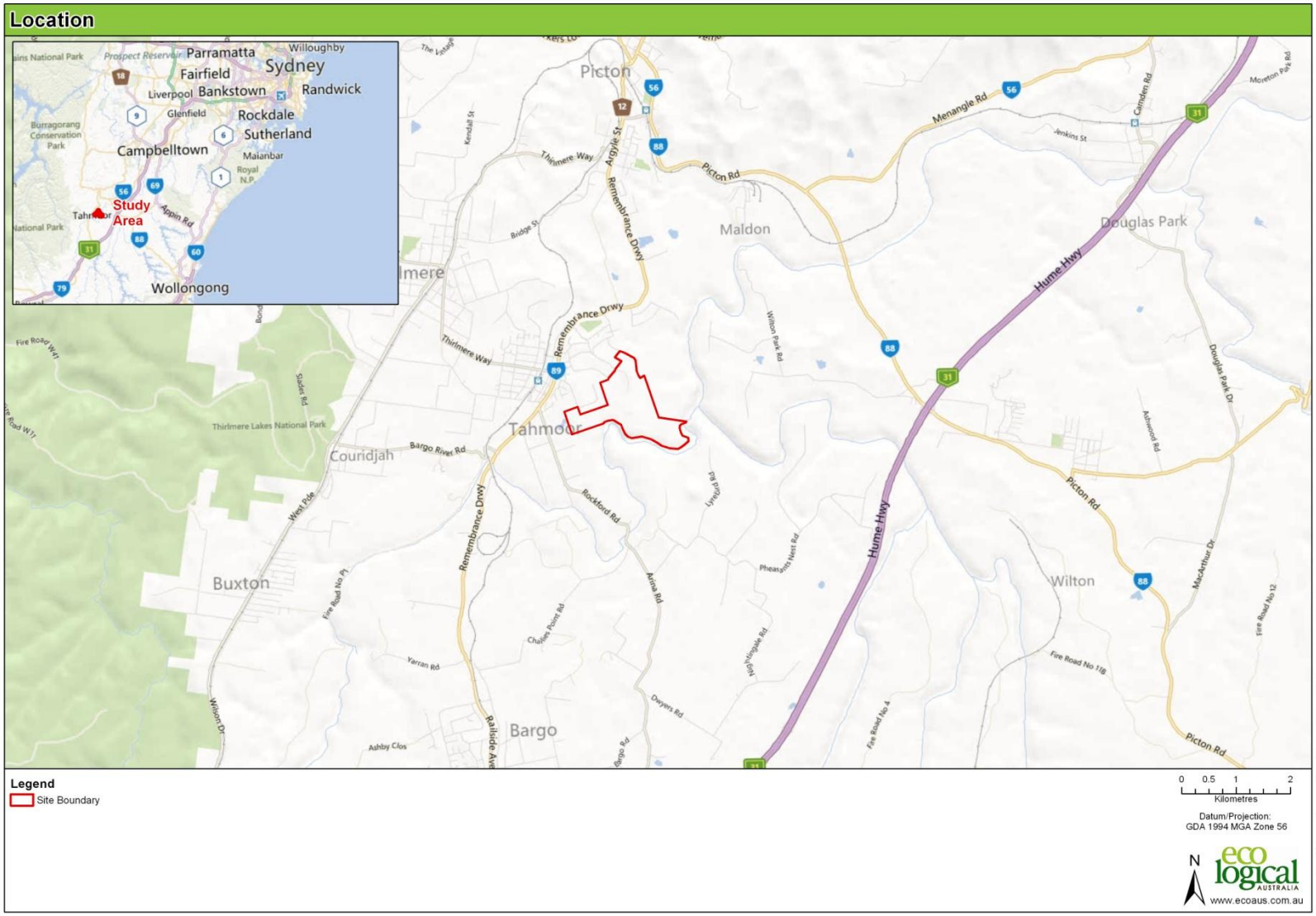

Figure 1 Location of Proposed Rezoning

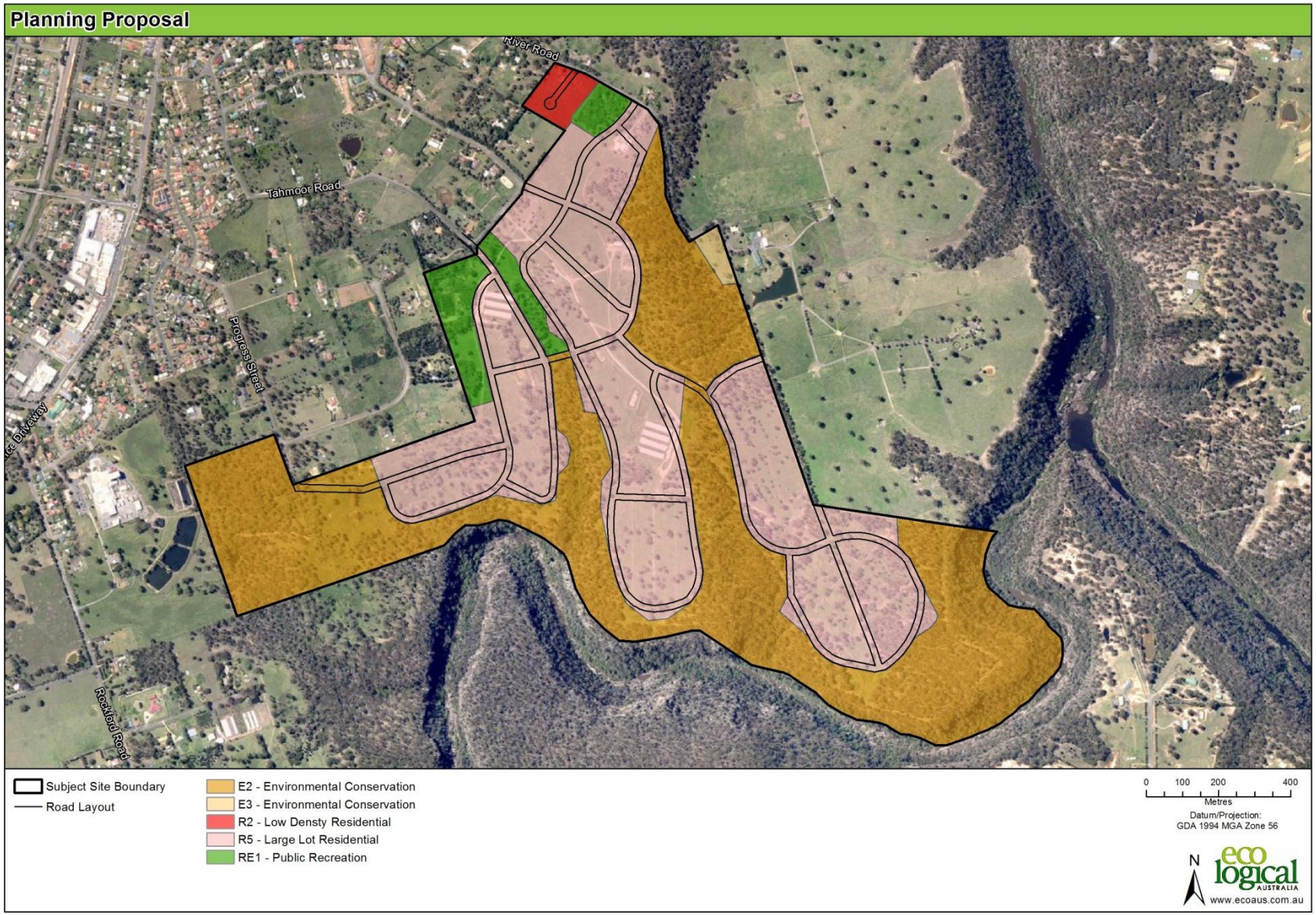

Figure 2 Planning Proposal (road alignment is indicative only)

2 Legislative Requirements

Commonwealth and State legislation and policies, as well as local policies apply to the assessment, planning and management of ecological issues within the study area at Tahmoor. A brief outline of the relevant Commonwealth and State Acts and Policies, and local policies, is provided below. The following are relevant to the proposed works:

- Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act)
- NSW *Environmental Planning and Assessment Act 1979* (EP&A Act)
- NSW *Threatened Species Conservation Act 1995* (TSC Act)
- NSW *Water Management Act 2000* (WM Act)
- NSW *Fisheries Management Act 1994* (FM Act)
- NSW *Native Vegetation Act 2003 (NV Act)*
- *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44)
- *Wollondilly Local Environmental Plan 2011*

2.1 STATE LEGISLATION AND POLICIES

2.1.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for NSW, providing a framework for the overall environmental planning and assessment of development proposals. It provides a framework for the overall environmental planning and assessment of proposals. Various pieces of environmental legislation, including the TSC Act, are linked to the EP&A Act for environmental assessment. The EP&A Act also provides for the making and implementation of environmental planning instruments i.e. State Environmental Planning Policies, Regional Environmental Plans and Local Environmental Plans.

Local Environmental Plans can be amended by the Minister under section 59 of the Act, following consideration of a Planning Proposal (s55), a gateway determination (s56) and Community Consultation (s57).

2.1.2 Threatened Species Conservation Act 1995

The NSW *Threatened Species Conservation Act* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The Act also aims to protect critical habitat, and eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities.

Whilst the rezoning of land does not trigger any particular mechanisms of the TSC Act, matters relating to threatened species, endangered populations and endangered ecological communities are typically considered in the plan-making (ie rezoning) stage to ensure subsequent development can be undertaken without having a significant impact on these matters. If a development is likely to have a significant impact on these matters, a Species Impact Statement (SIS) must be prepared and submitted with the Development Application.

2.1.3 Water Management Act 2000

A controlled activity approval under the Water Management Act 2000 (WM Act) is required for certain types of developments and activities that are carried out in or on waterfront land which is land within 40m of a river, lake or estuary. The NSW Office of Water (NoW) have prepared guidelines for riparian corridors on waterfront land, including guidance on vegetated riparian zones (VRZ) and infrastructure development within this area. Whilst a rezoning is not considered a controlled activity, the principles of the Act and the guidelines can be used to ensure land zoning is conducive to the protection of vegetated riparian zones during the subdivision stage of the site when a Controlled Activity approval is likely to be required.

2.1.4 Fisheries Management Act (1994)

The Fisheries Management Act (1994) lists threatened aquatic species which require consideration when addressing the potential impacts of a proposed development. If a proposed development is likely to significantly affect a threatened species, population, population or their habitats, SIS is required to be prepared.

2.1.5 Native Vegetation Act (2003)

The Native Vegetation Act 2003 regulates the clearing of all native vegetation in NSW except on land listed under Schedule 1 of the Act. The NV Act provides a framework for the conservation and sustainable management of native vegetation in NSW. Whilst mechanisms within the Act do not apply to the rezoning of land, the principles for the protection of native vegetation should be considered during the plan making stage.

2.1.6 State Environmental Planning Policy No. 44 – Koala Habitat Protection

SEPP 44 encourages the conservation and management of koala habitats in certain local government areas (LGAs). SEPP 44 aims to encourage the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range and reverse the current trend of koala population decline. SEPP 44 achieves this by:

- Requiring the preparation of plans of management before development consent can be granted in relation to areas of Core Koala Habitat
- Encouraging the identification of areas of Core Koala Habitat
- Encouraging the inclusion of areas of Core Koala Habitat in environment protection zones.

Whilst the mechanisms of SEPP 44 do not apply to rezoning of land, the principles and aims of the SEPP should be considered during the plan making stage.

2.1.7 Wollondilly Local Environmental Plan 2011

The subject site is currently zoned RU4 Primary Production Small Holdings with a minimum lot size of 2ha. The proposed future land use zonings for the study site are:

- R2 – Low Density Residential
- R5 - Large Lot Residential which allows for the inclusion of a residence on each lot
- E2 - Environmental Conservation.
- RE1 - Recreation

2.2 COMMONWEALTH LEGISLATION

2.2.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where matters of 'national environmental significance' (NES) may be affected. NES matters relevant to this study include threatened species, ecological communities and migratory species that are listed under the Act.

Under the Act, any action which "has, will have, or is likely to have a significant impact on a matter of national environmental significance" is defined as a "controlled action", and requires approval from the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) which is responsible for administering the EPBC Act.

Actions that may have a significant impact on one or more matters of NES need to be referred to the Department under the EPBC Act. The EPBC Act referrals process can produce one of three outcomes:

> Non-controlled action (NCA): Assessment and approval under the EPBC Act is **not required**. The project may proceed without further approval under the EPBC Act.
>
> Non-controlled action – particular manner (NCA-PM): Assessment and approval under the EPBC Act is **not required** provided the action is undertaken in a specific way (similar to conditions).
>
> Controlled Action (CA): (The project will or is likely to have a significant impact on one or more matters of national environmental significance.) The project will require full assessment and approval before it can proceed.

This report highlights any EPBC Act matters of NES. The nationally threatened ecological communities and threatened and migratory species occurring or having the potential to occur in the assessment area are outlined in **Appendix A.**

Whilst amendments to the LEP are not considered an 'action' under the EPBC Act, consideration of matters of National Environmental Significance at the plan making stage can reduce the risk that subsequent development will have a significant impact on these matters.

3 Methodology

3.1 LITERATURE REVIEW AND DATABASE SEARCH

Searches of the Atlas of NSW Wildlife and the EPBC Protected Matters Search Tool for threatened flora and fauna which have either been previously recorded within the region or are likely to occur due to the presence of suitable habitat were performed on 8th November 2011. A search of a 10 km radius around the study site was undertaken. Species from these searches were combined to produce a list of threatened fauna and flora species that may occur within the study site.

Appendix A of this report lists the threatened flora and fauna species identified by the database searches as potentially occurring within a 10 km radius of the study site.

A review of literature relating to this study site was undertaken prior to field survey and the assessment of potential impacts of the proposed rezoning. The distribution of vegetation communities was considered with review of both NSW National Parks and Wildlife vegetation maps of the Cumberland Plain (NSW NPWS 2002) and the vegetation maps given in Conacher Travers (2007).

The underlying geology of the study site is of the Mittagong formation which is relatively shallow and overlies deeper Hawkesbury Sandstone strata. Soils resulting from the Mittagong Formation are generally sandy clays and sandy loams with poor soil structure and low fertility. The site is characterised by low, lying gently undulating plains with a plateau parallel to a deep river gorge. (Conacher Travers 2007).

3.2 FIELD SURVEY - VEGETATION

Field surveys were designed to validate mapping of two vegetation communities, Cumberland Plain Woodland (CPW) and Shale Sandstone Transition Forest (SSTF), as determined from the desktop studies and literature review. CPW is listed as a Critically Endangered Ecological Community (CEEC) and SSTF is listed as an Endangered Ecological Community (EEC) under both the EPBC Act and the TSC Act.

Field survey was undertaken on 7th and 21st November 2012 with all mapped vegetation communities traversed and assessed with consideration given to floristic, structure and condition of vegetation. Assessment of condition of the vegetation communities was based on dominance of native or exotic species in the canopy and groundcover strata. Within areas of 'Poor condition' SSTF plot based assessment was undertaken to determine the dominance of exotic species within the understorey. A summary of the criteria used to determine the condition of the vegetation communities is provided in **Table 1**.

Table 1: Condition Parameters for Vegetation Assessment

CONDITION	CONDITION PARAMETERS
Good	Dominated by native species in all stratum
Moderate	Dominated by native species in the canopy with understorey a mix of native and exotic species
Poor	Dominated by native species in a scattered canopy with understorey dominated by exotic species

3.3 BIOMETRIC PLOTS

A second field survey was undertaken in April 2013 to collect biometric data for use in the Biocertification Assessment Method (BCAM). The site was stratified using the vegetation community and condition categories to create each vegetation zone. Eleven biometric plots were undertaken, with at least one plot in each vegetation zone. Given their broader distribution, 2 plots were undertaken in the SSTF – Good and the SSTF – Moderate vegetation zones.

3.4 FIELD SURVEY - HABITAT VALUES

During the vegetation field surveys undertaken in November 2012, opportunistic observations regarding fauna habitat values were made. No detailed fauna surveys have been undertaken to date.

3.5 FIELD SURVEY - RIPARIAN ZONES

Within the study site, the Top of Bank (TofB) for all riparian zones was mapped in the field using a differential GPS (DGPS). Rapid assessment of watercourses was undertaken with observations made on hydrology, riparian vegetation, physical form, and visual assessment of water quality and aquatic habitat. This survey was undertaken in late September, 2012.

The Office of Water (NoW) guidelines for vegetated riparian zones (VRZ) and riparian corridors (RC) are listed in **Table 2**.

Table 2. Recommended Riparian Corridor Widths

WATERCOURSE TYPE	VRZ WIDTH (each side of watercourse)	TOTAL RC WIDTH
1st order	10 m	20m + channel width
2nd order	20m	40m + channel width
3rd order	30m	60m + channel width
4th order or greater	40m	80m + channel width

(NoW, 2012)

4 Results

4.1 LITERATURE REVIEW AND DATABASE SEARCH (10KM RADIUS)

Database searches and literature review were conducted using 10 km search radius from the Tahmoor study site. **Figure 5** shows the locations of threatened flora species in the locality i.e. within a 10 km radius of the study area and **Figure 6** shows the locations of threatened fauna species in the locality.

These database searches revealed the likely occurrence of four endangered ecological communities, 9 threatened flora species, 20 threatened fauna species (one fish, one frog, 12 birds, 3 terrestrial mammals and 4 bats species) and 3 migratory fauna species within the locality.

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

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

Appendix A contains an assessment of likely occurrence within the study site of each threatened flora and fauna species. The likelihood of occurrence was determined by reviewing the recent species records from the region, amount of available habitat present at the study site and surrounding region as well as applying expert knowledge of each species' ecology and biology.

4.2 VEGETATION COMMUNITIES

Following field survey at the study site, the following vegetation communities have been mapped for the site: **Table 3**.

Table 3 Vegetation Community Terminology

Vegetation Community	Corresponding Biometric Vegetation Type	Corresponding Endangered Ecological Community
Cumberland Plain Woodland(CPW)	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Cumberland Plain Woodland in the Sydney Basin Bioregion
Shale Sandstone Transition Forest (SSTF)	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	Shale / Sandstone Transition Forest
Western Sandstone Gully Forest (SGF)	Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest in sandstone gullies of western Sydney, Sydney Basin	NA
Upper Georges River Sandstone Woodland	Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain,	NA

(GRSW)	Sydney Basin	
Exotic Pasture	Cleared	NA

Examples of these vegetation communities and condition classes are illustrated in **Figure 7** to **Figure 10**. Distribution of the vegetation including condition classes is mapped in **Figure 3** and **Figure 4 .**

4.2.1 Cumberland Plain Woodland

CPW is listed as a critically endangered ecological community under both the TSC Act and the EPBC Act. The full name for this community under the EPBC Act is Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. Cumberland Plain Woodland vegetation has different condition thresholds under the NSW and Commonwealth legislations, and is mapped accordingly in **Figure 3**.

Cumberland Plain Woodland is distinct groupings of plants that occur on the clay soils derived from shale on the undulating Cumberland Plain. The dominant canopy trees include *Eucalyptus moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum)*, E. crebra* (Narrow-Leaved Ironbark), and *Corymbia maculata* (Spotted Gum). A variety of other lesser-known eucalypts as well as shrubs, grasses and herbs are also found. The shrub layer may be dominated by *Bursaria spinosa* (Blackthorn) and other shrubs such as *Acacia implexa* (Hickory Wattle)*, Indigofera australis* (Duwabili) and *Dodonaea viscosa* ssp. *cuneata* (Wedge-leaf Hop-bush).

It is common to find grasses, such as *Themeda australis* (Kangaroo Grass), *Microlaena stipoides var stipoides* (Weeping Meadow Grass) and herbs, such as *Dichondra repens* (Kidney Weed), *Brunoniella australis* (Blue Trumpet) and *Desmodium varians* (NPWS 2004a).

4.2.2 Shale Sandstone Transition Forest (SSTF)

Shale-Sandstone Transition Forest occurs at the edges of the Cumberland Plain at the interface between shale rock/ clay soils and sandstone. The main tree species are *Eucalyptus tereticornis, E. punctata* (Grey Gum), *E. globoidea* (White Stringybark), *E. eugenioides* (Thin-leaved Stringybark), *E. fibrosa* (Red Ironbark) and *E. crebra*.

The high sandstone influence form of SSTF includes sandstone species, such as *Kunzea ambigua* (Tick Bush) and *Persoonia linearis* (Narrow Leaved Geebung), and is most widespread in the southern section of the Cumberland Plain. The low sandstone influence form has an understorey layer that is closer to CPW and includes shrub layer dominated by *Bursaria spinosa* with grasses, such as *Themeda australis* and other herbs such as *Dichondra repens.* (NPWS 2004b).

The definition of SSTF is the same under both the TSC Act and the EPBC Act, and this community is mapped in **Figure 3** based on condition classes.

4.2.3 Western Sandstone Gully Forest

Western Sandstone Gully Forest occurs on the lower slopes of sandstone gullies on the western side of the Woronora Plateau and is often associated with soils derived from the Mittagong formation, with sandstone outcrops frequently evident.

The canopy of Western Sandstone Gully Forest is dominated by *Angophora costata* (Sydney Red Gum), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus pilularis (Blackbutt),* with scattered *E. punctata* occurring on mid-slopes. A sparse layer of smaller trees is often present, and may be

dominated by *Allocasuarina littoralis* (Black She-Oak). The shrub and ground strata are also sparse. Shrub species include *Acacia terminalis* (Sunshine Wattle), *Leptospermum trinervium* (Slender Tea-tree), *Persoonia linearis* and *Banksia spinulosa var. spinulosa* (Hairpin Banksia). In the understorey, the fern species *Pteridium esculentum* (Bracken Fern) is invariably present, along with the climber *Smilax glycyphylla* (Sweet Sarsaparilla). Other species frequently recorded in the ground stratum include *Entolasia stricta* (Wiry Panic), *Dianella caerulea*, *Lomandra obliqua*, *L. longifolia* (Spiny-headed Mat-rush), *L. gracilis*, *Lepidosperma laterale* and *Gonocarpus teucriodes* (Raspwort). (NPWS 2002).

4.2.4 Upper Georges River Sandstone Woodland

Upper Georges River Sandstone Woodland is typically found on upper slopes and ridges, and is dominated by *Eucalyptus punctata* and *Corymbia gummifera*, with *E. oblonga* (Narrow-leaved Stringybark) occurring at lower abundance. *Allocasuarina littoralis* is frequently present forming a small tree layer on the upper slopes of gullies.

Diverse shrub and ground strata are always present. Typical shrub species include *Acacia ulicifolia* (Prickly Moses)*, A. terminalis, A. linifolia* (White Wattle)*, Persoonia linearis, Leptospermun trinervium* and *Exocarpos strictus* (Pale-fruit Ballart). The ground stratum is often dominated by grass species such as *Entolasia stricta, Themeda australis, Austrostipa pubescens, Aristida vagans* (Threeawn Speargrass) and *Rytidosperma fulvum* (Wallaby Grass). Other species frequently recorded in the ground stratum include *Dianella revoluta* (Blue Flax-Lily)*, Pomax umbellata, Lepidosperma laterale, Cyathochaeta diandra, Lomandra multiflora* (Many-flowered Mat-rush) and *L. cylindrical* (Needle Mat-Rush).

4.2.5 Exotic Pastures

This vegetation category is applied to areas within the study site where the dominant species are exotic pasture grasses including *Pennisetum clandestinum* (Kikuyu Grass) and *Paspalum dilatatum* (Paspalum), and the shrub and canopy strata are limited to exotic species with very low occurrence.

4.2.6 Extent of Vegetation Communities

The distribution of CPW and SSTF and the associated condition classes, incorporating data from the literature review, field surveys and assessment under EPBC condition thresholds, is shown **Figure 3.** A summary of the extent of these communities within the study site is listed in **Table 4**.

Table 4. Vegetation Community Areas within the Study Site

VEGETATION COMMUNITY	CONDITION CLASS	TSC LISTED AREA (HA) (includes EPBC listed areas)	EPBC LISTED AREA (HA)
Cumberland Plain Woodland	Moderate	4.56	2.6
	Poor	4.42	-
Total Cumberland Plain Woodland		8.98	2.6
Shale Sandstone Transition Forest	Good	30.81	
	Moderate	20.97	
	Poor	42.37	
Total Shale Sandstone Transition Forest		94.15	
Western Sandstone Gully Forest	Good	4.65	
Upper Georges River Sandstone Woodland	Good	19.83	
Cleared		*38.36*	
Total		**165**	

4.3 THREATENED FLORA SPECIES

Database searches revealed the likely occurrence of 8 threatened flora species in the study site. Those species identified as having the 'potential' or 'likely' possibility of occurring in the study site are

- *Darwinia peduncularis*
- *Epacris purpurescens var. purpurescens*
- *Grevillea parviflora subsp. parviflora* (Small-flower Grevillea)
- *Persoonia bargoensis*
- *Persoonia glaucescens*
- *Persoonia hirsuta* (Hairy Geebung)
- *Pimelea spicata*
- *Pomaderris brunnea* (Rufous Pomaderris)

Both *Grevillea parviflora* subsp. *parviflora* and *Persoonia bargoensis* are known to colonise areas of disturbance and limited groundcover, and may be found adjacent to tracks or in areas of regrowth. Whilst ELAs field work did not include targeted searches for these two species, the field work did occur in November which is the flowering period for these species. No incidental sightings of these species were made during the field work. Targeted searches will be required at the detailed design and development application stage if areas of potential habitat are likely to be impacted by proposed development.

4.4 THREATENED FAUNA SPECIES

A 10km database search revealed the occurrence 20 threatened fauna species (one fish, one frog, 11 birds, 3 terrestrial mammals and 4 bats species) and 13 migratory fauna species that could occur in the locality, based on habitat suitability.

Those threatened fauna species assessed as having the potential to occur within the study site are listed below:

- Red-crowned Toadlet
- Regent Honeyeater
- Glossy Black Cockatoo
- Brown Treecreeper
- Varied Sittella
- Little Lorikeet
- Swift Parrot
- Black-chinned Honeyeater
- Barking Owl
- Powerful Owl
- Scarlet Robin
- Speckled Warbler
- Diamond Firetail
- Eastern Pygmy-possum
- Spotted-tailed Quoll
- Koala
- Large-eared Pied Bat
- Eastern Bent-wing Bat
- Large-footed Myotis
- Grey-headed Flying Fox
- Macquarie Perch – potential habitat in Bargo River

Migratory Marine Species

- Rufous Fantail
- Great Egret
- Cattle Egret

Fauna habitat values vary across the study site and include:

- Aquatic habitats including small dams, ephemeral streams and degraded drainage lines
- Vegetated areas with varying canopy, shrub and groundcover densities
- Mature eucalypts and other species with flowering potential
- Tree hollows and stags
- Leaf litter
- Fallen timber
- Small rocky areas.

Conacher Travers (2007) identified the highest quality fauna habitats within the study site as the gullies which drain into the Bargo River. These gullies provide foraging and refuge habitat for most locally occurring fauna species. The woodland areas between the gullies and the cleared pasture areas contain large mature trees which provide an important nectar resource for nomadic bird species such as the endangered Regent Honeyeater and Swift Parrot. These trees also contain a significant representation of hollows found within the study site. The cleared pasture areas provide the lowest level of fauna habitat.

No threatened fauna species were observed during the site vegetation survey, however further targeted surveys will be required at the detailed design and development application stage if potential suitable habitat areas for particular threatened species are to be impacted by proposed development.

4.5 NOXIOUS WEEDS

Of the exotic species recorded, 3 are listed as noxious species for the Wollondilly LGA, and are listed in **Table 5**. These weeds are also listed as Weeds of National Significance (WoNS).

Table 5: Noxious Weeds within Study Site

SCIENTIFIC NAME	COMMON NAME	WoNS	CONTROL CLASS	LEGAL REQUIREMENTS
Lantana camara	Lantana	√	Class 4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Lycium ferocissimum	African boxthorn	√	Class 4	
Rubus fruticosus aggregate species	Blackberry	√	Class 4	

4.6 KOALA HABITAT

Koala food tree species have been identified throughout most of the site except for the patch of good condition SSTF in the far western part of the site (within the odour buffer). These species include *Eucalyptus tereticornis*, *Eucalyptus moluccana* and *Eucalyptus punctata* at a density which indicated potential koala habitat. Whilst targeted koala searches were not undertaken, no koala or koala pellets or scratch marks were observed during the vegetation community surveys. A detailed flora and fauna survey according to OEH guidelines will be undertaken at the detailed design and development application stage to identify and locate any areas of core koala habitat which may be present within the study site. If core koala habitat is present, a Comprehensive Koala Plan of Management will be prepared.

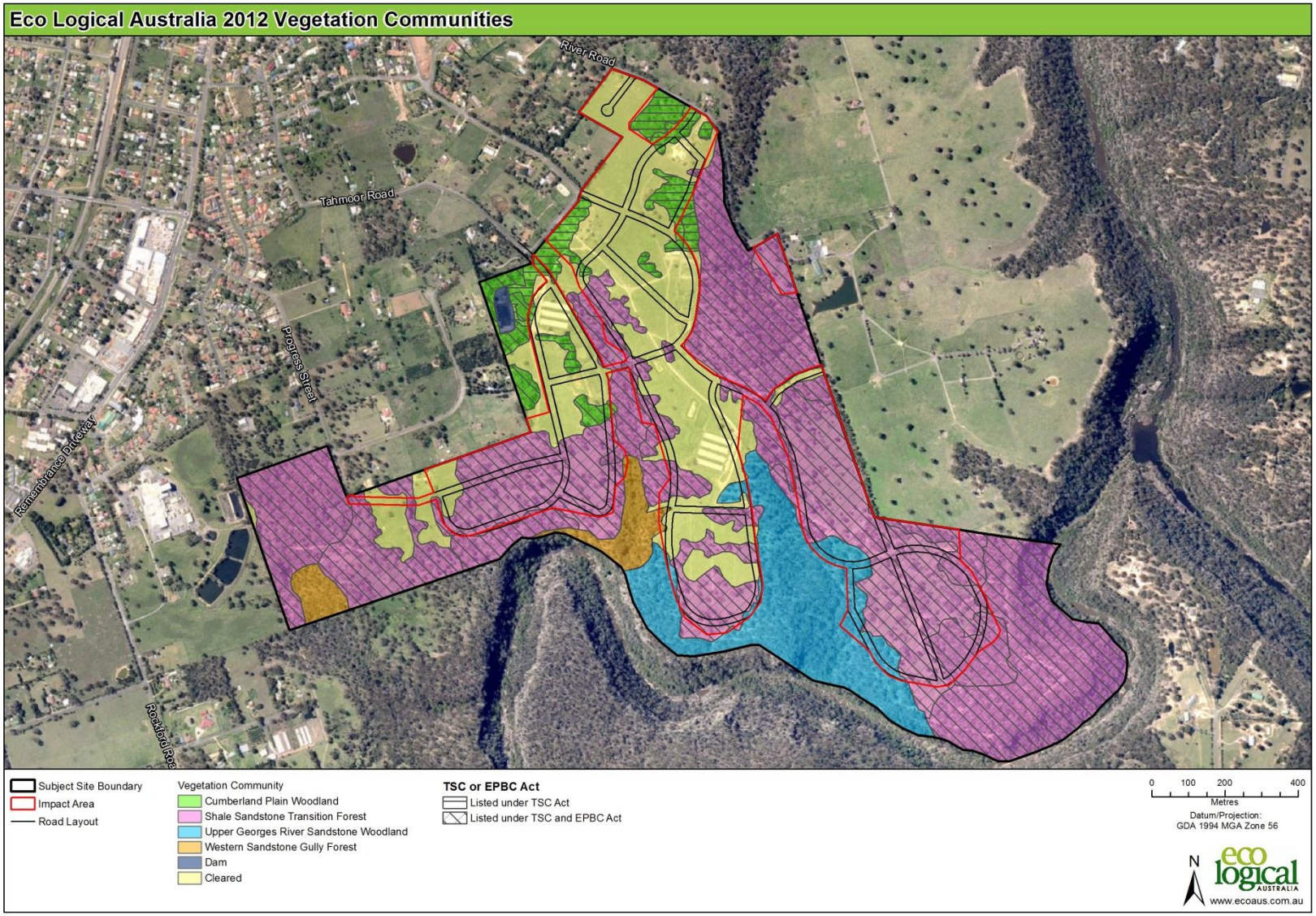

Figure 3. Vegetation Communities and legal status

Figure 4 Vegetation condition

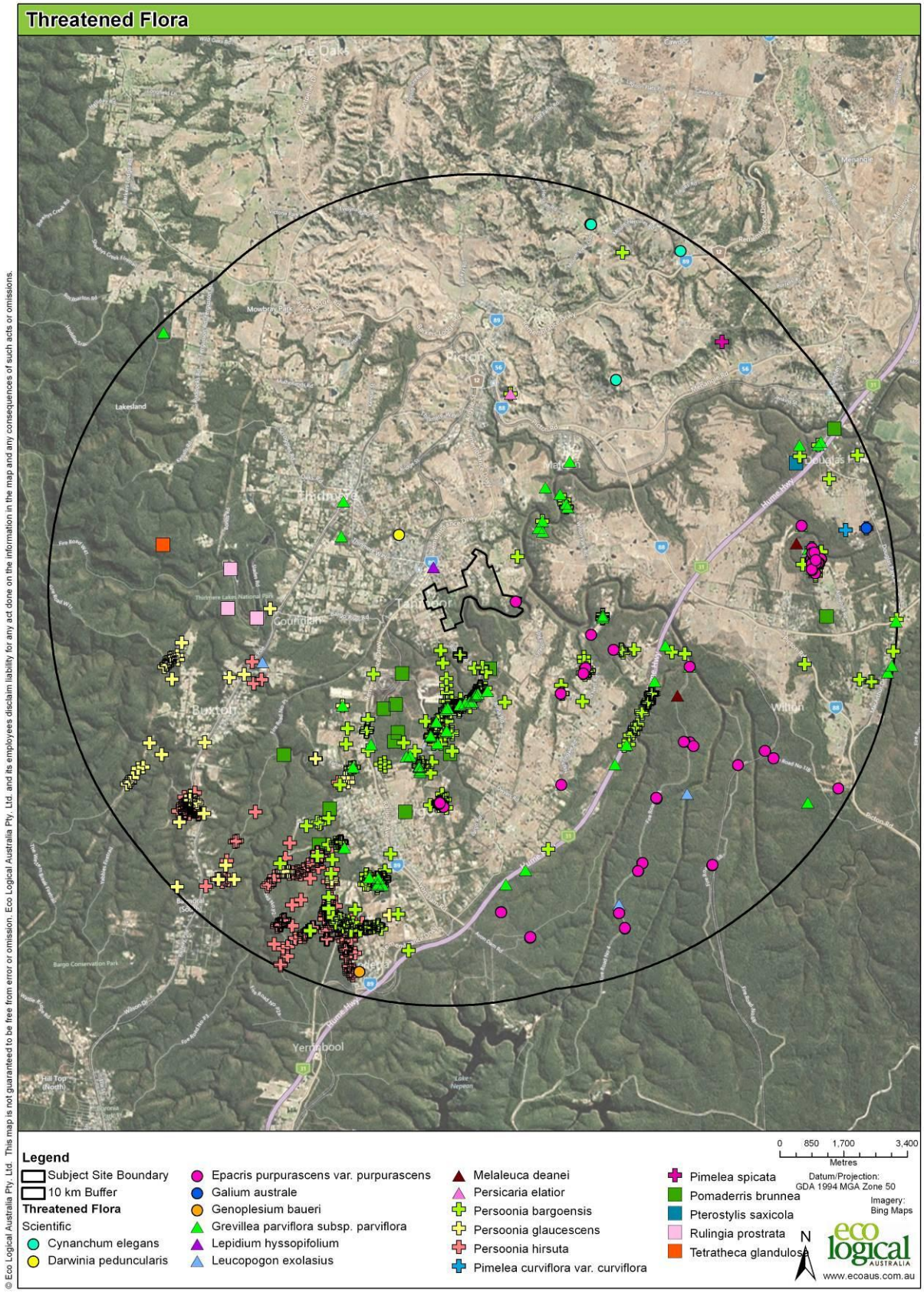

Figure 5. Threatened Flora Species

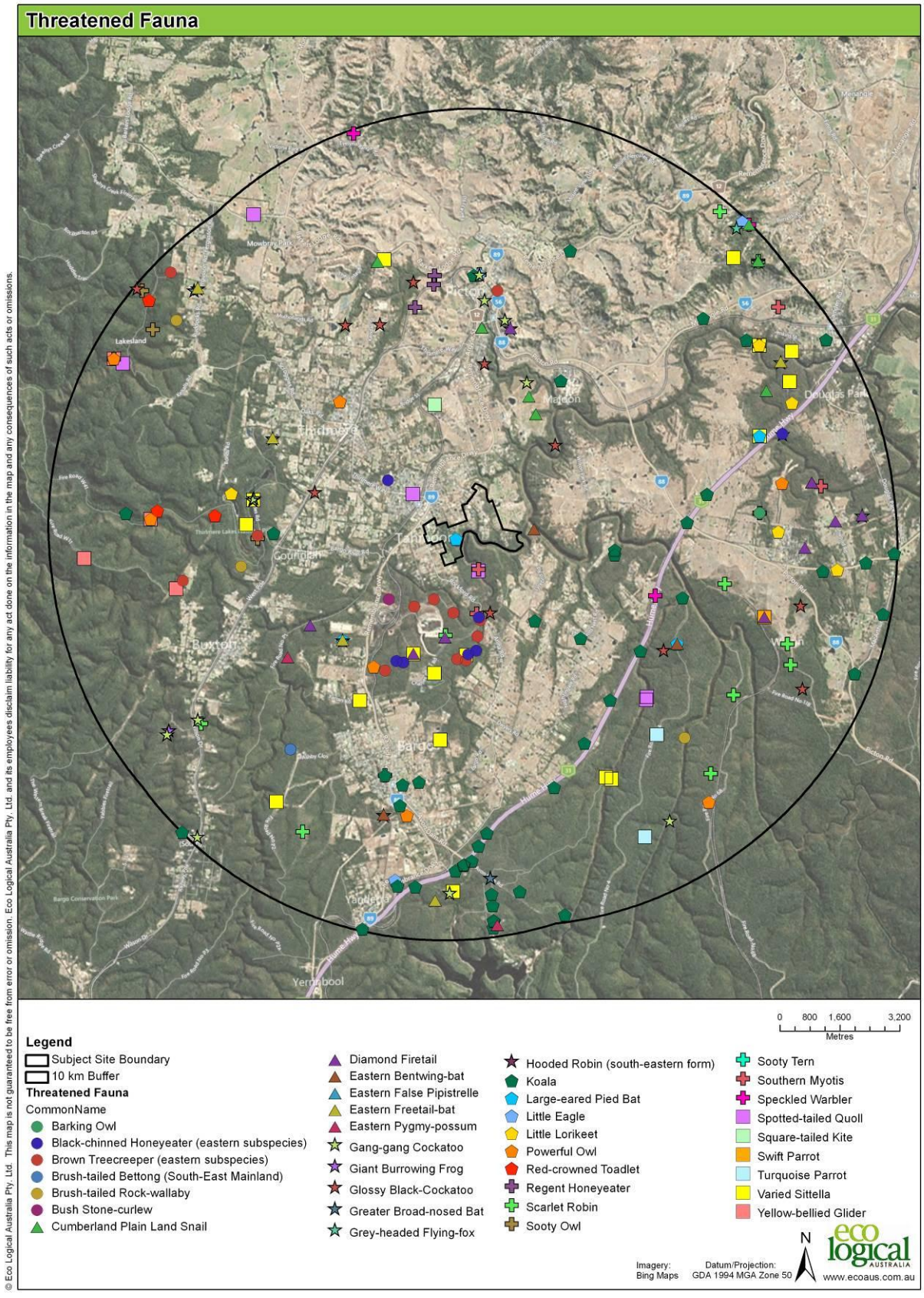

Figure 6. Threatened Fauna Species

Figure 7. Cumberland Plain Woodland - Poor Condition

Figure 8. Shale Sandstone Transition Forest - Moderate Condition

Figure 9. Shale Sandstone Transition Forest - Poor Condition (Understorey is dominated by *Lantana camara*)

Figure 10. Cleared Area with Exotic Pasture Grasses

4.7 RIPARIAN ZONES

All watercourses (represented by blue lines on the 1:25,000 topographic map series) were mapped to the top of bank (TofB). Several first order ephemeral streams pass through the study site, and one second order ephemeral stream flows a short distance across the south of the study site before entering the Bargo Gorge. **Figure 11** presents mapping of both the TofB and the required VRZ based on NoW Guidelines**.** This figure also includes an overlay illustrating the proposed development footprint.

As the proposed rezoning includes a road crossing over a RZ, subsequent development will include controlled activities, and thus require application to the NoW for a permit to carry out these works.

The results of the rapid assessment of aquatic and riparian habitat are provided in **Table 6** which describes the condition of each reach as shown in Figure 11. Representative photos of watercourses are provided as **Figure 12 to Figure 15**. In general the watercourses were in moderate condition.

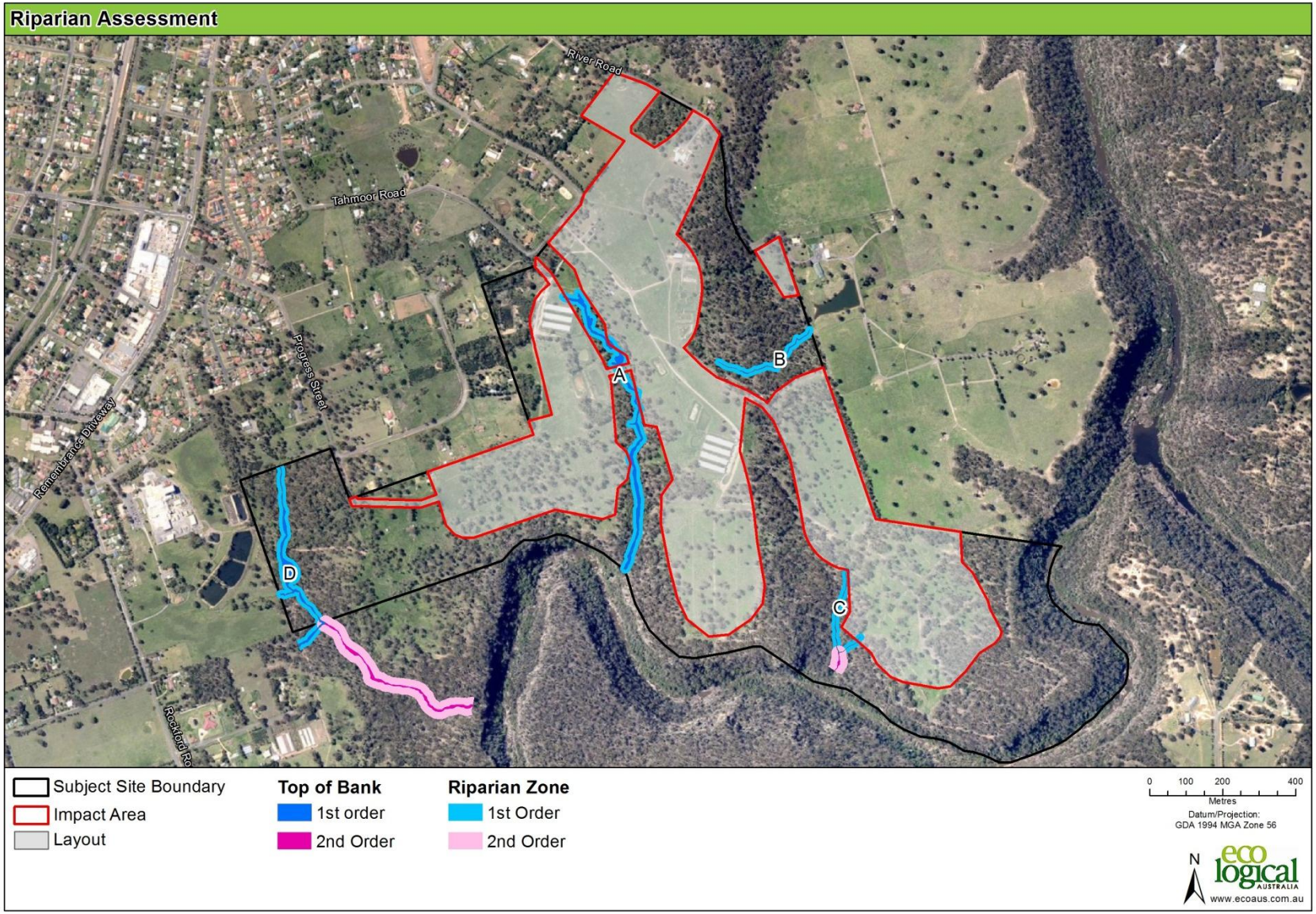

Figure 11. Top of Bank, Vegetated Riparian Zones and Reach number

Table 6 Aquatic and Riparian Assessment

REACH NO.	HYDROLOGY	STREAMSIDE VEGETATION	PHYSICAL FORM	WATER QUALITY AND AQUATIC HABITAT	OVERALL RATING
A	1st Order Stream (Strahler). Inflows modified due to regionally cleared land use.	Upstream is substantially modified. Downstream is largely unmodified. Upstream section has only small patches of well-separated native vegetation remaining. Downstream has little evidence of broad-scale loss of native vegetation. Upstream section has one or more strata dominated by exotic species, with 'high threat' species present. Downstream vegetation is predominantly native, with few weeds and no 'high threat' species. Upstream section has midstorey stratum missing and greater groundcover than reference. Downstream has number of strata and cover similar to reference. Upstream section has reduced cover (<50%) of dominant strata, and only one age class present. Downstream has dominant strata with reference level of cover and at least three age classes present (juveniles, sub-adults and adults). Upstream section has very small quantities of debris present. Downstream has quantities and cover of debris similar to reference.	Upstream section has clay banks with slope 30-70°. Downstream mostly large boulders and bedrock. Upstream section has approximately 20% of banks slumped and 5% with minor gully erosion. Remainder of banks well stabilised by groundcover and riparian trees.	Aquatic habitat limited to small pools with some exotic macrophytes present. No native aquatic plants present Average 0.75m wetted width of channel with mostly shallow (10-20cm), stagnant, turbid water. Large woody debris common. Overall, limited fish and frog habitat. One common frog species observed (*Crinia signifera*).	Moderate-degraded condition
B	1st Order Stream (Strahler). Inflows modified due to small upstream dam.	Slightly modified No or little evidence of broad-scale loss of native vegetation. One or more strata dominated by exotic species, 'high threat' species present. Cover within one stratum up to 50% lower or higher than reference. Reduced cover (<50%) of dominant strata, and only one age class present.	Steep gradient with small clay and cobble banks. Relatively stable banks with minimal erosion.	Poor aquatic habitat due to steep gradient and lack of pools. Channel dry at time of survey. Minor frog habitat near rushes. Large woody debris abundant.	Moderate condition

REACH NO.	HYDROLOGY	STREAMSIDE VEGETATION	PHYSICAL FORM	WATER QUALITY AND AQUATIC HABITAT	OVERALL RATING
		Quantities and cover of debris similar to reference.			
C	1st Order Stream upstream and 2nd Order Stream downstream of tributary (Strahler). Inflows modified due to some cleared land use and small dams.	Largely unmodified. No or little evidence of broad-scale loss of native vegetation. Exotic species present but not dominating any strata, 'high threat' species rare. Number of strata and cover within each similar to reference. Dominant strata with reference level of cover and at least three age classes present (juveniles, sub-adults and adults). Quantities and cover of debris similar to reference.	Steep gradient with small bedrock and cobble banks. Relatively stable creek with minimal erosion.	Poor aquatic habitat due to steep gradient and lack of pools. Channel stagnant at time of survey. Good frog habitat around large boulders downstream. One frog species observed (*Litoria fallax*). No native macrophytes present. Large woody debris abundant.	Good condition
D	1st Order Stream upstream and 2nd Order Stream downstream of tributary (Strahler). Channel modified to include one small farm dams. Inflows modified due to regionally cleared land use and other dams.	Upstream is slightly modified. Downstream is largely unmodified. No or little evidence of broad-scale loss of native vegetation. Exotic species present but not dominating any strata, 'high threat' species restricted to upstream section. Number of strata and cover within each similar to reference, except in upstream section. Dominant strata with reference level of cover and at least three age classes present (juveniles, sub-adults and adults), except in upstream section. Some evidence of unnatural loss of debris (trampling of leaf litter by stock).	Clay banks with gentle slope <30° upstream with steep cobble/bedrock banks downstream. Approximately 20% of upstream banks slumped. Downstream sections stable rock banks. .	Aquatic habitat limited to one instream dam with several native macrophytes present. Remainder of channel stagnant at time of survey. Large woody debris abundant. Overall, limited native fish habitat, but some frog habitat for disturbance-tolerant species.	Moderate condition

Figure 12 Reach System A

Figure 13 Reach System B

Figure 14 Reach System C

Figure 15 Reach System D

5 Impact Assessment

5.1 VEGETATION COMMUNITIES

The impact on vegetation within the site of the proposed rezoning and subsequent development is centred on exotic pasture areas with limited canopy cover and areas where the existing vegetation has been identified as 'poor condition'. Both these vegetation classes are characterised by an understorey dominated by exotic species.

The impact on Shale Sandstone Transition Forest and Cumberland Plain Woodland as defined under the TSC Act is given in **Table 7**. Development of the proposed R2 and R5 land will impact up to 39.36 ha of SSTF. However it is likely that this is an over-estimate as the lot size (typically 1500m2 – 4000m2) will allow for retention of native vegetation outside of the building footprint and Asset Protection Zone. Of the 39.36 ha being impacted, 32.92 ha is in poor condition, meaning only 0.96 ha of good condition and 5.48 ha of moderate condition is being impacted. Of the 54.79 ha being retained, 29.85 ha is in good condition – meaning that 97% of the good condition and 74% of the moderate condition SSTF is being protected.

The impact on Cumberland Plain Woodland (CPW) within the study site follows a similar pattern with a greater impact (3.14 ha) on the 'poor condition' CPW compared to 1.08 ha of good condition CPW. This protects 76% of the good condition CPW. Much of the protection of the CPW does however fall within lands to be zoned RE1. It will therefore be important for the land manager (presumably Council) to ensure recreational activities are conducive to the retention and conservation of CPW in these areas.

A vegetation management plan for the E2 conservation zones is proposed to be prepared with long term conservation outcomes secured via legally binding obligations (Conservation Agreement under the NP&W Act) or via dedication to a public authority.

Table 7. Impact and Retention of Native Vegetation Communities including listing under NSW TSC Act

Vegetation Community	Condition	Indicative Area (ha)		% Retained	WSYD 2002 mapped extent (ha)
		Impact	Retained		
Cumberland Plain Woodland (CEEC)	Moderate	1.08	3.48	76%	28174
	Poor	3.14	1.28	29%	28174
	Total CPW	**4.22**	**4.76**	**53%**	28174
Shale-Sandstone Transition Forest (EEC)	Good	0.96	29.85	97%	19352
	Moderate	5.48	15.49	74%	19352
	Poor	32.92	9.45	22%	19352
	Total SSTF	**39.36**	**54.79**	**58%**	19352
Upper Georges River Sandstone Woodland	Good	3.31	16.52	83%	6782

Western Sandstone Gully Forest	Good	0.17	4.48	96%	5881
Total Vegetation		**47.06**	**80.55**	**63%**	

* = Listed as a Critically Endangered Ecological Community under both the TSC Act

5.2 CONNECTIVITY

The proposed zoning of the site maintains the existing north-south, between Myrtle Creek in the north and the Bargo River Gorge in the south, and east-west habitat connectivity with the E2 zoning and VMP, securing this land for long term conservation outcomes. A minimum 50m wide corridor along the top of the escarpment above Bargo Gorge will provide adequate movement corridor for fauna. In effect the corridor is much wider than this as the vegetation within the gorge itself will also be used as core habitat and movement.

5.3 THREATENED FLORA

The potential presence of threatened flora species within the study site will require the undertaking of targeted surveys at the detailed design and development application stage to determine if populations or individual plants are contained within the impact zone. With the proposed R5 Large Lot Residential occurring largely on areas with high exotic species populations in the understorey, it less likely that the suitable habitat for the potential threatened species exists within the impact zone for this proposal.

5.4 FAUNA

Good fauna habitat is provided by the gully areas within the study site (Conacher Travers 2007). These areas are outside the proposed impact zone for future development and will be protected as part of the E2 and riparian zone.

The retention of mature trees with hollows across the site will be considered at the detailed design and development application stage. These trees provide significant fauna habitat. Mature trees are present in the proposed E2 conservation zone and in the proposed impact area, although in lesser numbers.

Preparation of a vegetation management plan for both the riparian zone and additional areas within the E2 conservation zones and the subsequent management of these areas to retain and improve the habitat value for both fauna and flora are to be undertaken.

5.5 KOALA HABITAT

Tree clearing within this site is likely to lead to the loss of some potential Koala habitat. The proposed rezoning which is provided in **Figure 2** potentially impacts on those areas with lower canopy density and much of those areas with the greater proportion of potential Koala habitat is proposed to be conserved within E2 environmental conservation areas.

Further detailed investigation in accordance with OEH guidelines is required at the detailed design and development application stage to determine the extent of Core Koala Habitat within the study site.

5.6 RIPARIAN ZONES

Wherever possible development and subsequent asset protection zones (APZ) should not occur in areas mapped as Riparian Zone or within 40m of the Top of Bank of the Bargo or Nepean Rivers.

Where this is unavoidable a Vegetation Management Plan is required for submission at the detailed design and development application stage.

The majority of the riparian zones mapped within the study site are potentially outside any development footprint associated with the proposed rezoning. A section of a first order ephemeral stream in the north of the study site where vegetation has been cleared and replaced by pasture may be impacted directly by a road crossing.

The construction of a road across this ephemeral stream impacting on the Riparian Zone is a controlled activity under the WM Act and an approval will be required under Section 91 (2) of the WM Act. The preparation of a vegetation management plan is also required.

5.7 ASSESSMENT USING BIODIVERSITY CERTIFICATION ASSESSMENT METHOD

To quantify the development and conservation outcome, ELA utilised the Biodiversity Certification Assessment Methodology (DECCW 2011). Whilst the Methodology was designed for use under Part 7AA of the Threatened Species Conservation Act 1995 to confer certification on land where an 'improve or maintain' outcome had been achieved, it is also a useful tool for assessing ecological outcomes for other strategic planning projects.

The BCAM calculates the impact (described in terms of Biobanking credits required) and the conservation benefits (described as Biobanking credits generated) for each ecosystem type in the subject site. If more credits are generated than are required for each ecosystem type, a proposal can clearly demonstrate that a positive ecological outcome is being achieved.

There are three points that are acknowledged when using the BCAM for this project. Firstly, the project is not being proposed for Biodiversity Certification. The BCAM is being used to give a broad indication of the conservation impacts and benefits of the planning proposal only so that impacts to threatened species and EECs can be assessed at an early stage in the planning process. Secondly, the development footprint will impact on endangered ecological communities which are 'red flagged' under the BCAM which means an 'improve or maintain' outcome is not possible unless a red-flag variation is obtained from OEH. As the proposal is not being submitted for bio-certification, a red-flag variation is not being sought. Thirdly, BCAM was run for ecosystem credits only. BCAM can also be run for 'species credits' however at this gateway phase ecosystem credits are appropriate since ecosystem credits cover EECs, many threatened fauna (birds, bats, koala and other mammals) and do not require counts of individual threatened flora which will be undertaken before lodging a development application for the project.

The assessment made the following assumptions regarding development and conservation outcomes:

- That all vegetation within the areas proposed to be zoned R2 and R5 would be cleared of vegetation. In reality, many of these trees would remain – especially in the larger lots, however for the purposes of BCAM they were assumed to be lost.
- Vegetation within the conservation lands would be protected via either:
    - Permanently managed and funded conservation measures – such as transfer to NPWS or Council; or
    - Permanently managed conservation measures – including appropriate zoning, secured under a legal agreement such as a Conservation Agreement, and implementation of a Vegetation Management Plan

Discussions with Council and NSW OEH regarding these mechanisms will be undertaken following gateway determination, however the proponent is committed to the long term security and management of the conservation areas.

BCAM requires assessment to be undertaken using Biometric Vegetation Types (BVT). ELA has converted the vegetation communities to the closest BVT match. The results of the assessment are provided in **Table 8.** The credit requirement is met for three out of the four BVTs. Only the Grey Box – Forest Red Gum grassy woodland BVT (ie, the Cumberland Plain Woodland) is in deficit by 5 credits. This is a relatively minor shortfall and can be addressed post-gateway through minor changes to the development footprint of < 0.5 ha.

Table 8 BCAM Results

Vegetation Community	Biometric Vegetation Type	Credits Required	Credits Generated	Difference
Cumberland Plain Woodland	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	39	34	-5
Shale sandstone Transition Forest	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin	394	449	55
Upper Georges River Sandstone Woodland	Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin	81	92	11
Western Sandstone Gully Forest	Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest in sandstone gullies of western Sydney, Sydney Basin	3	40	37
		517	615	98

5.8 EPBC ACT

Vegetation communities listed under the EPBC Act 1999 are considered Matters of National Environmental Significance (MNES). Where an action may have a significant impact on MNES, the Commonwealth recommends referral of the action for consideration of whether it should be considered a Controlled Action under the EPBC Act.

Planning proposals do not constitute an 'action' under the EPBC Act and therefore referral of the planning proposal to the Commonwealth is not required. However, future subdivision and earthworks for development will be considered an 'action' and therefore may require referral is there is likely to be a significant impact to MNES. This sectio0n provides a preliminary review of the impacts to MNES.

The MNES relevant to the study site include Cumberland Plain Woodland, Shale Sandstone Transition Forest and species identified in Appendix A.

The Commonwealth definition of Cumberland Plain Woodland / Shale Gravel Transition Forest differs to that of NSW. The statistics in the **Table 9** below relate only to the CPW/SGTF which met the Commonwealth definition. The definition for SSTF is the same under both Commonwealth and State definitions.

Impacts of 0.6 ha are unlikely to have a significant impact to CPW/SGTF and therefore are unlikely to be considered a Controlled Action under the EPBC Act. Impacts of 39.36 ha to SSTF are clearly more significant in terms of hectares, however there is a reasonable basis for concluding that this will not have a significant impact (and therefore should not be a Controlled Action) given the impact is largely restricted to the poor condition vegetation. The same logic is likely to apply to the species listed under the EPBC Act such as the Regent honeyeater, Swift parrot and bats which are more likely to be utilising the intact forested habitat. However, given the extent of impact to EPBC listed communities, a referral to the Commonwealth is recommended.

Table 9 EPBC Threatened Ecological Community Impacts

Vegetation Community	Condition	Indicative Area (ha)***		% retained
		Impact	Retained	
EPBC Cumberland Plain Woodland (CEEC)	Moderate	0.6	2.0	**77%**
EPBC Shale-Sandstone Transition Forest (EEC)	Good	0.96	29.84	**97%**
	Moderate	5.48	15.49	**74%**
	Poor	32.92	9.45	**22%**
	Total SSTF	**39.36**	**54.79**	**58%**

6 Conclusion

The proposed rezoning of a section of Inghams Property Development landholding in south east Tahmoor, has been designed to focus future subdivision and development in areas with lower habitat value, lower condition of vegetation and higher exotic species density. The proposed layout of the R5 Large Lot Residential, RE1 Recreation and E2 Environmental Conservation zones results in impact areas being primarily in those areas classified as 'Exotic Pastures', i.e. areas with a limited canopy of native species and an understorey dominated by exotic species and areas of 'poor condition' woodland.

Both CPW and SSTF communities are represented within the proposed R5 areas however only a small proportion of 'good to moderate condition' woodland will be impacted.

The majority of the retained woodland is proposed to be zoned E2 – Environmental Conservation, and would be protected from further impact and managed for conservation outcomes. This retained woodland includes 77% of the EPBC listed CPW, 97% of the good condition SSTF and 74% of the moderate condition SSTF.

With the protection of significant areas of woodland within the E2 zone, the protection of habitat for both threatened flora and fauna is supported, however further investigation will be required at the detailed design and development application stage.

The inclusion of 85 ha of the site in E2 Environmental Conservation zone with the implementation of a VMP will provide a mechanism for the improved long term conservation outcomes for the immediate and surrounding areas.

Riparian systems within the study area are generally in moderate condition with however all riparian areas are to be retained (other than one road crossing) and managed under a Vegetation Management Plan.

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Appendix A: Threatened Species Likelihood of Occurrence

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

An assessment of likelihood of occurrence was made for threatened and migratory species identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

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

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
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 (OEH 2012).	Unlikely
Acacia flocktoniae	Flockton Wattle	V	V	*Acacia flocktoniae* is entirely limited to dry sclerophyll forest growing on sandstone within the Southern Blue Mountains (Mt. Victoria, Megalong Valley and Yerranderie).(OEH 2012).	Unlikely
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 (OEH 2012).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Caladenia tessellata	Thick Lip Spider Orchid	E	V	*Caladenia tessellata* occurs in grassy sclerophyll woodland, often growing in well-structured clay loams or sandy soils south from Swansea, usually in sheltered moist places and in areas of increased sunlight (OEH 2012). It flowers from September to November (OEH 2012).	Unlikely
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	*Cryptostylis hunteriana* is known from a range of vegetation communities including swamp-heath and woodland (OEH 2012). 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*) (OEH 2012). 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 (OEH 2012; Bell 2001).	Unlikely
Cynanchum elegans	White-flowered Wax Plant	E	E	*Cynanchum elegans* is a climber or twiner with a variable form, and flowers between August and May, peaking in November (OEH 2012). It occurs in dry rainforest gullies, scrub and scree slopes, and prefers the ecotone between dry subtropical rainforest and sclerophyll woodland/forest (NPWS 1997). The species has also been found in littoral rainforest; *Leptospermum laevigatum – Banksia integrifolia* subsp. *integrifolia* coastal scrub; *Eucalyptus tereticornis* open forest/ woodland; *Corymbia maculata* open forest/woodland; and *Melaleuca armillaris* scrub to open scrub (OEH 2012).	Unlikely
Darwinia peduncularis		V	-	*Darwinia peduncularis* occurs as local disjunct populations in coastal NSW in the Blue Mountains, Brooklyn, Berowra, Galston Gorge, Hornsby, Bargo River, Glen Davis, Mount Boonbourwa and Kings Tableland, and usually grows on or near rocky outcrops on sandy, well drained, low nutrient soil over sandstone (OEH 2012).	Potential habitat present on the slope to the Nepean and Bargo Rivers.
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 (OEH 2012).	Likely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Galium australe	Tangled Bedstraw	E	-	*Galium australe* is known from the Towamba Valley near Bega, Lake Yarrunga near Kangaroo Valley, Cullendulla Creek Nature Reserve near Batemans Bay, Conjola National Park, Swan Lake near Swanhaven, and the Big Hole in Deua National Park. Tangled Bedstraw was recorded historically from the Clyde River near Batemans Bay and the Mongarlowe area near Braidwood (OEH 2012). The species also occurs beside Lake Windemere in Jervis Bay, is widespread in Victoria and is also found in South Australia and Tasmania (OEH 2012). In NSW *Galium australe* has been found in moist gullies of tall forest, *Eucalyptus tereticornis* forest, coastal Banksia shrubland, and *Allocasuarina nana* heathland, while in other states the species is found in a range of near-coastal habitats, including sand dunes, sand spits, shrubland and woodland.	Unlikely
Genoplesium baueri	Bauer's Midge Orchid	V	-	Known from coastal areas from northern Sydney south to the Nowra district. Previous records from the Hunter Valley and Nelson Bay are now thought to be erroneous. Grows in shrubby woodland in open forest on shallow sandy soils (OEH 2012).	Unlikely
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 (OEH 2012).	Potential
Lepidium hyssopifolium	Aromatic Peppercress	E	E	*Lepidium hyssopifolium* occurs near Bathurst, near Bungendore, near Crookwell and near Armidale, occurring in a variety of habitats including woodland with a grassy understorey and grassland (OEH 2012).	Unlikely
Leucopogon exolasius	Woronora Beard-heath	V	V	*Leucopogon* exolasius is found along the upper Georges River area and in Heathcote National Park (OEH 2012). It is associated with Sydney Sandstone Gully Forest on rocky hillsides and creek banks (NPWS 1997).	Unlikely
Melaleuca deanei	Deane's Paperbark	V	V	Found in heath on sandstone (OEH 2012), and also associated with woodland on broad ridge tops and slopes on sandy loam and lateritic soils (Benson and McDougall 1998).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Pelargonium sp. Striatellum	Omeo's Stork's Bill	E	E	The species is known to occur in habitat usually located just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is known to colonise exposed lake beds. It is not known if the species' rhizomes and/or soil seedbank persist through prolonged inundation or drought (SEWPaC 2012).	Unlikely
Persicaria elatior	Tall Knotweed	V	V	*Persicaria elatior* has been recorded from a number of localities along the NSW coast. It normally grows in damp places, especially beside streams and lakes or occasionally in swamp forest or associated with disturbance (OEH 2012).	Unlikely
Persoonia acerosa	Mossy Geebung	V	V	*Persoonia acerosa* occurs in dry sclerophyll forest, scrubby low-woodland and heath, principally on clayey sandstone and laterites of the Narrabeen Group as well as the Hawkesbury Group where soils are very infertile and stony (OEH 2012). It prefers ridge-tops and plateaux with sandy topsoil over clayey subsoil (ibid.). Typical associates are *Eucalyptus sieberi, E. piperita, E. sclerophylla*, occasionally *E. stricta* and *E. ligustrina, Lambertia formosa, Leptospermum trinervium, Hakea dactyloides, Platysace linearifolia, Petrophile pulchella, A. terminalis,* and *Acacia obtusifolia* (ibid.).	Unlikely
Persoonia bargoensis	Bargo Geebung	E	V	Associated with woodland to dry sclerophyll forest, on sandstone and clayey laterite on heavier, well-drained, loamy, gravelly soils of the Hawkesbury Sandstone and Wianamatta Shale in the catchments of the Cataract, Cordeaux and Bargo Rivers (NSW Scientific Committee 2000).	Likely
Persoonia glaucescens	Mittagong Geebung	E	V	*Persoonia glaucescens* occurs on the south eastern part of the NSW Central Tablelands from near Berrima north to near Buxton. It grows in woodland to dry sclerophyll forest on clayey and gravely laterite, usually on ridge-tops, plateaux and upper slopes (OEH 2012).	Potential – at northern limit for this species
Persoonia hirsuta	Hairy Geebung	E	E	*Persoonia hirsuta* occurs from Singleton in the north, south to Bargo and the Blue Mountains to the west (OEH 2012). It grows in dry sclerophyll eucalypt woodland and forest on sandstone (PlantNet 2012).	Potential

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
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 (OEH 2012).	Unlikely
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 (OEH 2012). 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.).	Potential
Pomaderris brunnea	Rufous Pomaderris	V	V	*Pomaderris brunnea* occurs in a limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands and in far eastern Gippsland in Victoria It grows in moist woodland or forest on clay or alluvial soils of floodplains and creek lines (OEH 2012).	Potential
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated (OEH 2012).	Unlikely
Pultenaea glabra	Smooth Bush-pea	V	V	*Pultenaea glabra* is restricted to the higher Blue Mountains in the Katoomba-Hazelbrook and Mount Victoria areas, with unconfirmed sightings in the Mount Wilson and Mount Irvine areas It grows on swamp margins, hillslopes, gullies and creekbanks and occurs within dry sclerophyll forest and tall damp heath on sandstone (OEH 2012).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Rulingia prostrata	Dwarf Kerrawang	E	E	Occurs on sandy, sometimes peaty, soils in a wide variety of habitats: Snow Gum (*Eucalyptus pauciflora*) woodland at Rose Lagoon; Blue leaved Stringybark (*E. agglomerata*) open forest at Tallong; and in Brittle Gum (*E. mannifera*) low open woodland at Penrose; Scribbly Gum (*E. haemastoma*)/ Swamp Mahogany (*E. robusta*) ecotonal forest at Tomago (OEH 2012). Associated native species may *include Imperata cylindrica, Empodisma minus* and *Leptospermum continentale* (ibid).	Unlikely
Streblus pendulinus	Siah's backbone	-	E	On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest (SEWPaC 2012).	Unlikely
Tetratheca glandulosa		V	V	Associated with ridgetop heaths and scrub to woodlands/open woodlands, and open forest (OEH, 2012). Restricted to the following Local Government Areas: Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong. Often associated with sandstone / shale interface where soils have a stronger clay influence (NPWS 1997). Flowers July to November.	Unlikely
Thelymitra sp. *Kangaloon*	Kangaloon Sun-orchid	CE	CE	*Thelymitra sp.* Kangaloon is only known to occur on the southern tablelands of NSW in the Robertson / Kangaloon / Fitzroy Falls area at 550-700 m above sea level. It is thought to be a short-lived perennial, flowering in late October and early November. It is found in swamps in sedgelands over grey silty grey loam soils (OEH 2012). It is known to occur at three swamps that are above the Kangaloon Aquifer, and that are a part of the ecological community "Temperate Highland Peat Swamps on Sandstone" which is listed under the Environment Protection and Biodiversity Conservation Act 1999.	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
INVERTEBRATES					
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	Associated with open eucalypt forests, particularly Cumberland Plain Woodland described in Benson (1992). 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; Rudman 1998). Urban waste may also form suitable habitat (NSW NPWS 1997; Rudman 1998).	Unlikely
FISH					
Macquarie australasica	Macquarie Perch	E (under FM Act 1994)	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.	Potential habitat in Bargo River
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).	Unlikely

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 & 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 (DECC 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 (DECC 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 Mosquito Fish (Gambusia holbrooki) (DECC 2007).	Unlikely
Litoria littlejohnii	Littlejohn's Tree Frog			Littlejohn's Tree Frog 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).	Unlikely
Mixophyes balbus	Stuttering Frog	E	V	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range (OEH 2012) 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).	Unlikely
Pseudophryne australis	Red-crowned Toadlet	V	-	Red-crowned Toadlets are found in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Outside the breeding season this species disperses to sandstone ridges where forages amongst leaf litter (OEH 2012). 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).	Potential

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
REPTILES					
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 (OEH 2012). They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (Webb & Shine 1998)	Unlikely
BIRDS					
Anthochaera phrygia	Regent Honeyeater	E	E & 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).	Potential
Botaurus poiciloptilus	Australasian Bittern	V	-	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats (Marchant & Higgins 1993). Reedbeds, swamps, streams, estuaries (Simpson & Day 1999).	Unlikely
Burhinus grallarius	Bush Stone-curlew	E	-	Associated with dry open woodland with grassy areas, dune scrubs, in savanna areas, the fringes of mangroves, golf courses and open forest / farmland (Pittwater Council 2000; Marchant & Higgins 1993). Forages in areas with fallen timber, leaf litter, little undergrowth and where the grass is short and patchy (Environment Australia 2000; Marchant & Higgins 1993). Is thought to require large tracts of habitat to support breeding, in which there is a preference for relatively undisturbed in lightly disturbed.	Unlikely
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	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 & Chrome 1992). They sometimes inhabit woodland, farms and suburbs in autumn/winter (Simpson & Day 2004).	Unlikely

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; OEH 2012). Intact drier forest types with less rugged landscapes are preferred (OEH 2012). Nests in large trees with large hollows (Environment Australia 2000).	Potential
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).	Likely
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.	Potential
Erythrotriochis radiatus	Red Goshawk	E4A	V	Associated with forests and woodlands with a mosaic of vegetation types, an abundance of birds and permanent water. In NSW, this species is thought to favour mixed subtropical rainforest, Melaleuca Swamp Forest, and open eucalypt forest along rivers, often in rugged terrain (Marchant & Higgins 1993; OEH 2012). Across northern Australian south through eastern Queensland to far north-east NSW. The species is very rare in NSW. Most records are from the Clarence River Catchment, with a few about the lower Richmond and Tweed Rivers. (OEH 2012)	Unlikely

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.	Potential
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.	Likely
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; Forshaw and Cooper 1981). 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*) (OEH 2012)	Potential
Leipoa ocellata	Malleefowl	E	V	Dry inland scrub, mallee. Males tend large sand nest-mound (Simpson & Day 1999).	Unlikely
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 & Higgins 1993, OEH 2012). Shows a particular preference for timbered watercourses (OEH 2012).	Unlikely
Melanodryas cucullata cucullata	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).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*) (OEH 2012). Also associated with drier coastal woodlands of the Cumberland Plain and the Hunter, Richmond and Clarence Valleys (NSW Scientific Committee, 2001). Tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares (OEH 2012)	Unlikely
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 & Higgins 1993). Spends much of the time on the ground foraging on seed and grasses (OEH 2012). 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).	Unlikely
Ninox connivens	Barking Owl	V	-	Associated with a woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use with hunting extending to closed forest and more open areas (OEH 2012). It usually roosts in dense foliage in large trees from streamside gallery forests and nests near watercourses or wetlands (NPWS 2003) in large tree hollows with entrances averaging 2-29m above ground (Debus 1997).	Potential
Ninox strenua	Powerful Owl	V	-	The Powerful Owl is 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 & Chafer 1994). Large trees with hollows at least 0.5m deep are required for shelter and breeding (Environment Australia 2000).	Potential

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. 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.	Potential
Pyrrholaemus sagittatus	Speckled Warbler	V	-	Occupies a wide range of eucalypt dominated communities with a grassy understorey, often on rocky ridges or in gullies (OEH 2012). Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy (OEH 2012). Large, relatively undisturbed remnants are required for the species to persist in an area (OEH 2012). Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding (OEH 2012).	Potential
Stagonopleura guttata	Diamond Firetail	V	-	Typically found in grassy eucalypt woodlands, but also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities (OEH 2012). It is often found in riparian areas and sometimes in lightly wooded farmland (OEH 2012). Appears to be sedentary, though some populations move locally, especially those in the south (OEH 2012).	Potential
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).	Unlikely
MAMMALS (EXCLUDING BATS)					

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Cercartetus nanus	Eastern Pygmy-possum	V	-	Found in wet and dry eucalypt forest, subalpine woodland, coastal banksia woodland and wet heath (Menkhorst & Knight 2004). Pygmy-Possums feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit (Turner & Ward 1995). Small tree hollows are favoured as day nesting sites, but nests have also been found under bark, in old birds nests and in the branch forks of tea-trees (Turner & Ward 1995).	Potential
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; OEH 2012), more frequently recorded near the ecotones of closed and open forest. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (OEH 2012). Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (Environment Australia 2000).	Potential
Isoodon obesulus	Southern Brown Bandicoot	E	E	This species is associated with heath, coastal scrub, heathy forests (Menkhorst & 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 & Seebeck 1990).	Unlikely
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 1995).	Unlikely
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). Large hollows within mature trees are required for shelter, nesting and breeding (Henry and Craig 1984).	Unlikely
Phascolarctos cinereus	Koala	V	V	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	Likely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
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 & Knight 2004).	Unlikely
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 (SEWPaC 2012)	Unlikely
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; OEH 2012). 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). Found in well-timbered areas containing gullies (OEH 2012).	Likely
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Prefers moist habitats with trees taller than 20m (OEH 2012). Roosts in tree hollows but has also been found roosting in buildings or under loose bark (OEH 2012).	Unlikely
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 1995). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995).	Likely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Mormopterus norfolkensis	Eastern 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 & 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 & Hoye 1998).	Unlikely
Myotis macropus	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. 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, 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 with specific roost requirements (Richards 1998). Forages over streams and pools catching insects and small fish. In NSW females have one young each year usually in November or December (OEH 2012)	Potential
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).	Potential
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 & 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 & Richards 1998).	Unlikely
MIGRATORY MARINE 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 & Day 1999).	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
MIGRATORY TERRESTRIAL SPECIES LISTED UNDER EPBC ACT					
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas (Marchant & Higgins 1993, Simpson & 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 & Higgins 1993).	Unlikely
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 & Higgins 1993; Simpson & Day 1999). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather (Marchant & Higgins 1993).	Unlikely
Leipoa ocellata	Malleefowl	E	V	SEE BIRDS ABOVE	Unlikely
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 . 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.	Unlikely
Monarcha melanopsis	Black-faced Monarch	-	M	Rainforest and eucalypt forests, feeding in tangled understorey (Blakers et al. 1984).	Unlikely
Myiagra cyanoleuca	Satin Flycatcher	-	M	Wetter, denser forest, often at high elevations (Simpson & Day 2004).	Unlikely
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).	Potential
Xanthomyza phrygia	Regent Honeyeater	E	E, M	SEE BIRDS ABOVE	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
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. 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 & Hancock 2005; Marchant & Higgins 1993; Martínez-Vilalta & 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).	Potential
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).	Potential
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 & Jessop 1985; Naarding 1982, 1983)	Unlikely

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
Rostratula australis	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 (OEH 2012). 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 (OEH 2012). Forages nocturnally on mud-flats and in shallow water (OEH 2012). Feeds on worms, molluscs, insects and some plant-matter (ibid.).	Unlikely

E = Endangered; E2 = Endangered Population; V = Vulnerable; M = Migratory.

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