Biodiversity and Riparian Assessment

West Schofields Precinct

Prepared for
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Contents

List of figures

List of tables

Abbreviations

ABBREVIATION	DESCRIPTION
AHCVV	Additional High Conservation Value Vegetation – vegetation meeting the requirements for ENV that was not mapped in the Growth Centres Conservation Plan
AW	Alluvial Woodland (also known as River-flat Eucalypt Forest)
BC Act	NSW Biodiversity Conservation Act 2016 (previously TSC Act)
CEEC	Critically Endangered Ecological Community
CPW	Cumberland Plain Woodland
DECCW	(Former) NSW Department of Environment, Climate Change and Water
DCP	Development Control Plan
DP&E	Department of Planning and Environment
DPI Water	NSW Department of Primary Industries - Water
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
ENV	Existing Native Vegetation, as defined in the Growth Centres Conservation Plan
EPA Act	NSW Environmental Planning and Assessment Act (1979)
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act (1999)
FM Act	NSW *Fisheries Management Act 1994*
MNES	Matters of National Environmental Significance
OEH	NSW Office of Environment and Heritage (formerly DECCW)
RC	Riparian Corridor
RFEF	River-flat Eucalypt Forest
SEPP	State Environmental Planning Policy
SEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now Commonwealth Department of Environment)
TSC Act	NSW Threatened Species Conservation Act (1995) (repealed)
VRZ	Vegetated Riparian Zone
WSUD	Water Sensitive Urban Design

Executive summary

The aim of this assessment is to identify the ecological and riparian values within the West Schofields Precinct, investigate the current and future constraints posed by ecological and riparian issues and provide recommendations for the future master planning, rezoning and urban development of the site.

Biodiversity Certification of the Growth Centres Conservation Plan contains a regional biodiversity offsets package, effectively enabling the loss of ecological values on certified lands at the development application stage, without triggering further assessment under the NSW Biodiversity Conservation Act 2016 (BC Act) (formally the *Threatened Species Conservation Act 1995)* . Similarly, the Strategic Assessment under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) exempts further assessment under Commonwealth legislation. The loss occurring on certified land is offset through the retention and management of areas of higher ecological value across the Growth Centres, and through a levy that will be used to protect and manage areas of high ecological value outside of the Growth Centres.

Within the West Schofields Precinct, less than half of the land is certified land. The certified land encompasses the bulk of the vegetation currently present. Non-certified land occurs along the eastern and western portions, coinciding with Bells Creek, Eastern Creek and floodplain areas. This land is subject to conditions 8 and 19 of the Biodiversity Certification Order, and any stands of Existing Native Vegetation (ENV) in the non-certified area must be protected (or offset if clearing is required for the provision of essential infrastructure).

A number of ecological values currently listed under State and Commonwealth legislation are present with the West Schofields Precinct: 122.35 ha of the listed vegetation communities Shale Plains Woodland (listed as Cumberland Plain Woodland under the BC Act and EPBC Act) and Alluvial Woodland (listed as River-flat Eucalypt Forest under the BC Act) were identified. This includes 80.57 ha of Shale Plains Woodland (49.77ha within certified land and 30.81 ha within non-certified land) and 40.13 ha of Alluvial Woodland (0.32 ha within certified land and 39.80 ha within non-certified land) and 1.65 ha of Cooks River / Castlereagh Ironbark Forest (1.08 ha within the certified land and 0.57 ha within non-certified land).

The threatened plants *Grevillea juniperina* subsp. *juniperina* (Juniper-leaved Grevillea) and *Dillwynia tenuifolia* both listed under the BC Act were identified within the West Schofields Precinct. These plants were found within Shale Plains Woodland and Cooks River / Castlereagh Ironbark Forest in the certified lands.

A total of 74.20 ha of ENV mapped in the draft Growth Centres Conservation Plan was validated within the West Schofield Precinct, 11.30 ha less than the originally mapped ENV on the Draft Conservation Plan. This is likely to be due to a combination of minor clearing and more accurate mapping.

To maintain parity with the 2000 hectare target of the Sydney Region Biodiversity Certification Order, a minimum of 52.55 ha of ENV must be protected the West Schofields Precinct. This figure is based on the amount of ENV mapped in the Draft Growth Centres Conservation Plan on non-certified lands. A total of 46.95 ha of ENV was validated in the non-certified lands, meaning that an additional 5.60 ha of ENV will need to be protected on certified lands. This report identifies priorities for protection of ENV.

Following preparation of the Precinct Plan, a Biodiversity Certification Consistency report will be prepared an exhibited to demonstrate the extent to which the Precinct Plan meets the requirements of the Sydney Region Growth Centres Biodiversity Certification.

1 Introduction

1.1 Description of Project

Eco Logical Australia Pty Ltd (ELA) was engaged by Department of Planning and Environment (DP&E) to undertake a biodiversity and riparian assessment of the West Schofields Precinct within the North West Growth Area (NWGA). The aim of this assessment is to identify key ecological and riparian features and constraints of the site to inform precinct planning and provide recommendations with respect to terrestrial and aquatic ecosystem management.

Specific objectives of this project are to:

- Undertake a biodiversity assessment to inform the precinct planning process and development of the Indicative Layout Plan (ILP). This will involve identifying and assessing the existing ecological constraints within the Precinct. This will involve analysis of ecological values particularly in regards to identifying areas of high, moderate and low ecological value.
- Ensure the statutory requirements for the protection, restoration and enhancement of threatened species, populations, ecological communities and their habitats will be met.
- Provide recommendations for achieving innovative and cost effective management frameworks for ecological and riparian issues, which enable long term conservation and management while facilitating development outcomes for the Precinct identified in the North West Structure Plan. This should be capable of implementation via the development approval process.
- Ensure protection of biodiversity values within the non-certified areas identified by the NSW *Biodiversity Conservation Act 1995* (BC Act), NSW *Fisheries Management Act 1994* (FM Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). If areas of ENV on non-certified areas are proposed to be cleared, the precinct planning process needs to ensure appropriate offsets are provided in accordance with the Biodiversity Certification.
- Ensure the precinct planning is consistent with the terms of the Biodiversity Certification granted under the Growth Centres SEPP, which includes the Relevant Biodiversity Measures outlined in the Biodiversity Certification Order.

1.2 Study Area

The West Schofields Precinct (**Figure 1**) contains an area south of Townson Road that has previously been assessed and zoned under a separate planning process. This area has therefore been excluded from this assessment.

The study area contains large parcels of remnant vegetation, parts of which are relatively intact while other areas are heavily cleared and disturbed. Bells Creek and Eastern Creek form the western and eastern boundaries, respectively. The two major creeks converge in the north of the Precinct boundary.

Bells Creek is in a moderate to low condition, with high levels of exotic vegetation cover interspersed with some relatively intact native vegetation. Eastern Creek forms the eastern site boundary and is also in moderate to low condition, primarily with high levels of exotic weed cover. The two watercourses have been modified by land owners with the construction of culverts and raised banks, and have been heavily impacted by grazing practises with expansive tree clearing, exotic groundcovers and unrestricted cattle

access. Inflows into Bells Creek and Eastern Creek (outside the study area) have been, and continue to be modified by land clearance activities in the surrounding area.

Less than half of the study area is currently biodiversity certified land which encompasses the bulk of remaining remnant vegetation in the south of the study area. The majority of the northern part of the study area is on non-certified lands. Non-certified land also occurs along the eastern and western portion of the precinct, corresponding with Bells Creek, Eastern Creek and related floodplain areas. This land is subject to conditions 8 and 19 of the Biodiversity Certification Order and any stands of ENV in the non-certified area must be protected (or offset if clearing is required for the provision of essential infrastructure and services).

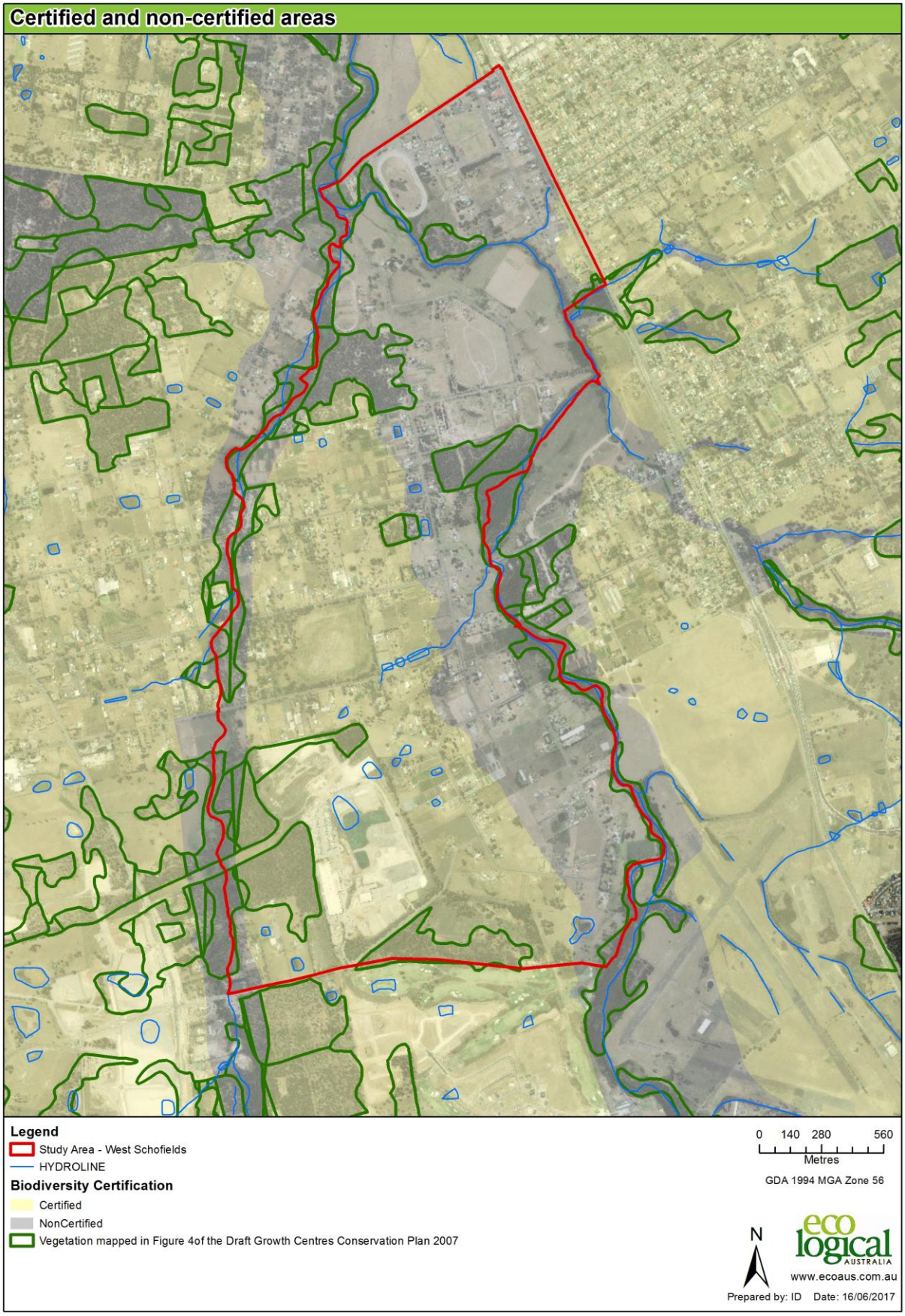

Figure 1: West Schofields Precinct

2 Statutory Framework

2.1 International, State and Local

A substantial array of legislation, policies and guidelines apply to the assessment, planning and management of biodiversity values within the study area. This information was reviewed and used to identify priority constraints and opportunities within the study area (Refer to **Appendix A**). Legislation and policies reviewed include:

International

- Japan – Australia Migratory Bird Agreement (JAMBA)
- China – Australia Migratory Bird Agreement (CAMBA)
- Republic of Korea – Australia Migratory Bird Agreement (ROKAMBA)

Commonwealth

- *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act)

State

- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Threatened Species Conservation Act 1995* (BC Act)
- *National Parks and Wildlife Act 1974*
- *Fisheries Management Act 1994* (FM Act)
- *Native Vegetation Act 2003*
- *Noxious Weeds Act 1993*
- State Environmental Planning Policy (Sydney Region Growth Centres) 2006
- Growth Centres Development Code 2006
- (Draft) Growth Centres Conservation Plan 2007
- Sydney Regional Environment Plan No 20 – Hawkesbury Nepean River (No 2 1997)

Local

- Blacktown Local Environmental Plan (2015)
- Blacktown Development Control Plan (2006)

2.2 Biodiversity Certification

Key to the assessment and protection of biodiversity values in the West Schofields Precinct is the Biodiversity Certification (under the BC Act 2016) of the Sydney Region Growth Centres State Environmental Planning Policy (SEPP) (referred to as the 'Growth Centres SEPP'). This process establishes outcomes for biodiversity that must be achieved.

The mechanism for achieving this is outlined in the (Draft) Growth Centres Conservation Plan (Eco Logical Australia, 2007) and the conditions for Biodiversity Certification are documented in the Ministers order for consent[1].

[1] http://www.environment.nsw.gov.au/resources/nature/biocertordwsgcentres.pdf

Section 8.4 of the BC Act 2016 describes the effect of Biodiversity Certification. For development and environmental assessment under Parts 4 and 5 of the EP&A Act 1979, an assessment of impacts to biodiversity value is not required for development on Biodiversity Certified land.

The (Draft) Growth Centres Conservation Plan (2007) assessed native vegetation across the entire Growth Centres area. The subsequent Biodiversity Certification Order provides for the protection of certain ENV within the Growth Centres. *ENV means areas of indigenous trees (including mature and saplings) that:*

a) had 10 % or greater over-storey canopy cover present,
b) were equal to or greater than 0.5 ha in area, and
c) were identified as "vegetation" on maps 4 and 5 of the (Draft) Growth Centres Conservation Plan, at the time the biodiversity certification order took effect, subject to condition 13.

Clause 13 of the biodiversity-certification details the ground-truthing requirements for ENV; namely, if new information becomes available after the biodiversity certification order took effect that demonstrates that the vegetation within an area does not otherwise meet the definition of ENV, then for the purposes of conditions 7-8 and 11-12 only the area of validated ENV shall be considered.

On 28th February 2012, the Commonwealth Minister for the Environment announced the program of development related activities within the Growth Centres that had been approved under the Growth Centres Strategic Assessment. (This was the second stage of the approval of the Strategic Assessment of the Growth Centres under the Commonwealth EPBC Act 1999). Specifically, "All actions associated with the development of the Western Sydney Growth Centres as described in the Sydney Region Growth Centres Strategic Assessment Program Report (Nov 2010) have been assessed at the strategic level and approved in regards to their impact on the following matters of national environmental significance (MNES):

- World Heritage Properties
- National Heritage Places,
- Wetlands of International Importance,
- Listed threatened species, populations and communities, and
- Listed migratory species."

This approval essentially means that the Commonwealth is satisfied that the conservation and development outcomes that will be achieved through development of the Growth Centres Precincts will satisfy their requirements for environmental protection under the EPBC Act. Therefore, provided development activity proceeds in accordance with the Growth Centres requirements (such as the Biodiversity Certification Order, the Growth Centres SEPP and Development Control Plans (DCPs), Growth Centres Development Code etc), then there is no requirement to assess the impact of development activities on MNES and hence no requirement for referral of activities to the Commonwealth Department of Environment. The requirement for assessment and approval of threatened species and endangered ecological communities and the other MNES issues listed above under the EPBC Act has now been "turned off" by the approval of the Strategic Assessment.

3 Terrestrial Biodiversity Assessment

The method used for the terrestrial biodiversity assessment are provided in the appendix of this report. This section of the report contains the results and interpretation of the terrestrial biodiversity survey and analysis.

3.1 Vegetation Communities & Condition

Validation of vegetation mapping was undertaken using NPWS (2002) vegetation mapping, aerial photography and field survey. The extent of vegetation shown in NPWS (2002) was updated using aerial photo interpretation at a scale of approximately 1:2000. Field validation of the community type was undertaken on foot where access was practical and granted by the landowner. Field validation of the bushland to the west of the CSR site was not undertaken as property access was not granted. Field validation did not occur in some of the smaller land holdings throughout the study area for the same reason. Additionally, some parcels of land did not require field validation as the area was void of native vegetation. This was assessed during the initial desktop analysis of aerial photography prior to field validation.

The study area has been substantially cleared and developed through agricultural and land management practices. However, the landscape is interspersed with several large remnants of native vegetation comprising of Shale Plains Woodland which is a sub-community of Cumberland Plain Woodland (CPW) within the central areas of the Precinct. The vegetation community transitions to Alluvial Woodland (AW; also known as River-flat Eucalypt Forest). In the north AW is continuous along Bells and Eastern Creek. Further south of Grange Avenue the distribution of AW along the creeks becomes patchy. In particular the remaining AW along Eastern Creek is highly fragmented with no connectivity to existing CPW remnants within the study area. A third vegetation community was recorded at one location on Grange Avenue, Cooks River/Castlereagh Ironbark Forest. This vegetation community contained a highly diverse assemblage of native species, although it was fragmented from other patches of intact vegetation.

The level of weed infestation varies across the study area in response to the levels of previous and current site disturbance. Weed infestation is generally highest in the immediate surrounds of the watercourses and also in areas subject to regular disturbance (e.g., mowing, authorised/unauthorised access, dumping, recreation, edge effects, grazing etc.). The characteristics of these three native vegetation communities, their conservation significance and ecological condition are summarised in **Table 1**, discussed below and presented in **Figure 2**, **Figure 3** and **Figure 5**.

Vegetation community validation was based on all visible vegetative strata where possible including upper, mid-strata, and ground-layer. Where access was not available, percentage of canopy cover was based on aerial photography interpretation and groundcover was assumed based on the current landuse, adjacent landuse, and groundcover of adjacent patches. Where there was sufficient evidence based on the NSW Office and Heritage (OEH) profiles and BC Act community listing criteria, such as dominant canopy and ground cover species present, vegetation community types and boundaries were modified from the original NPWS (2002) mapping. Quadrat surveys were not undertaken as part of the surveys. However, the information collected from the vegetation assessments was sufficient for validation against the BC Act community listing criteria.

Access also affected the assessment of CPW listed under the EPBC Act. Condition criteria for this community are based on patch size and perennial understorey cover. While patch size can be determined remotely, an assessment of vegetation cover requires ground-truthing. A remote assessment was

undertaken for some polygons, with assessments of vegetation made from property boundaries and some assumptions made regarding the uniformity of vegetation ground cover across a patch. This assessment was based on land use, paddock size, visible portions of the polygon and NPWS (2002) conservation significance assessment (CSA) data. Wherever possible, dominant flora was noted to help confirm vegetation type and conservation significance.

A brief description of the three vegetation communities and their conservation significance is provided in the section below.

Shale Plains Woodland

The Shale Plains Woodland (SPW) is listed as one of the two sub-communities of the Cumberland Plain Woodland (CPW). It is listed as Critically Endangered Ecological Community (CEEC) under both the BC and EPBC Acts. The two sub-communities of CPW, are Shale Plains Woodland and Shale Hills Woodland. The species compositions of both sub-communities are generally identical on sites with some level of disturbance, and it is their position in landscape that predominantly determines whether an area is classified as Shale Plains or Shale Hills Woodland. Only one sub-community, Shale Plains Woodland was identified within the study area.

SPW is the most widely distributed community on the Cumberland Plain, predominantly occurring on soils derived from Wianamatta Shale. SPW present within the study area consists of a mixture of good, moderate and poor condition vegetation due to the varying levels of disturbance to the site. The vast majority of SPW across the study area is in good condition, particularly the stands within the private land parcels east of Bells Creek and to a lesser extend the large parcel located between Meadow Road and Townson Road on the southern boundary of the study area. In the northern part Precinct, a large tract of SPW in good condition was recorded between Carnarvon Road and Burfitt Road and a second patch bound by North Street, Carnarvon Road and Grange Avenue. These remnant areas exhibit good levels of recruitment and with evidence of relatively low levels of current or historical disturbance (**Figure 2** and **Figure 5**).

SPW was typically represented by a canopy of; *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus moluccana* (Grey Box), and Red Ironbark (*Eucalyptus fibrosa*).

The shrub layer over large parts of the study area has been and is currently subject to grazing and/or slashing. *Acacia decurrens* (*Black Wattle*), *Acacia parramattensis* (Parramatta Wattle), *Bursaria spinosa* (Native Blackthorn) and *Kunzea ambigua* (Tick Bush) are found commonly in upper and lower mid stratum throughout the study area, though depending on factors such as level of disturbance and clearing and time since fire, varies in abundance from sporadic to dominant. Other native shrubs in the upper and lower mid stratum present in reasonable abundance across the site include *Grevillea juniperina* (Juniper-leaf Grevillea), *Melaleuca nodosa* (Prickly-leaved Paperbark), *Melaleuca decora, Acacia falcata* (Hickory Wattle) and Rice Flower (*Ozothamnus diosmifolius*).

Groundcover vegetation is typically dominated by a mixture of native and exotic grasses and herbs. Native groundcover species include *Themeda australis* (Kangaroo Grass), *Aristida vagans* (Threeawn Speargrass), *Entolasia stricta* (Wiry Panic), *Microlaena stipoides* (Weeping Grass) *Commelina cyanea Glycine clandestine, Cheilanthes sieberi, Eragrostis brownii* (Brown's Lovegrass), *Lepidosperma laterale, Dichondra repens* (Kidney Weed), *Pratia purpurascens* (Whiteroot) and *Panicum simile* Two-colour Panic). Exotic groundcovers include *Cirsium vulgare* (Spear Thistle), *Solanum nigrum* (Black-berry Nightshade), *Sida rhombifolia* (Paddy's Lucerne), *Conyza* sp. (Fleabane) *Paspalum dilatatum* (Paspalum), *Tradescantia fluminensis* (Wandering Jew), *Eragrostis curvula* (African Lovegrass), *Asparagus asparagoides (*Bridal Creeper), *Opuntia* sp. (Prickly Pear), *Anredera cordifolia* (Madeira vine) *Sida rhombifolia* (Paddy's Lucerne) and *Senecio madagascariensis* (Fireweed).

In 2009 the Commonwealth and State Governments 'up-listed' Cumberland Plain Woodland to the status of CEEC under the EPBC and BC Acts respectively. The criterion that must be met to be captured by the new CEEC listing changed under both Acts. Under the EPBC Act, changes to both the vegetation characteristics and condition classes have been introduced. Smaller scale changes to vegetation characteristics, such as the inclusion of derived native grassland in areas of SPW, were made under the BC Act. The area of SPW that is likely to meet the EPBC Act definition is 48.62 ha, and corresponds to condition A Shale Plains Woodland (**Table 1** & **Figure 5**).

The patches of remnant SPW within the study area contain a number of hollow bearing trees, an important resource for native fauna such as micro-chiropteran bats and hollow-nesting woodland birds in the highly cleared and fragmented landscape of North- Western Sydney. Clearing of hollow bearing trees is listed as a Key Threatening Process under the BC Act.

Figure 2: Shale Plains Woodland, north-east of CSR land (bottom) and east of Bells Creek (top)

Alluvial Woodland

The Alluvial Woodland (AW) within the study area comprises the endangered ecological community *River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions* (River-Flat Eucalypt Forest), which is listed on Schedule 1 of the BC Act. AW or River-flat Eucalypt Forest is not listed under the EPBC Act.

AW was associated with the drainage lines within the study area and generally represented degraded vegetation. Most areas have been subject to historical clearing and grazing is present right up to the edge of the drainage line, contributing to high occurrences of exotic species and bank erosion.

AW occurs along Bells Creek running south to north at the western edge of the study area and along Eastern Creek at the eastern edge of the study area. The distribution of AW along the two creeks vary according to the leave of disturbance. In the northern part Precinct AW remains largely intact along both creeks until Grange Avenue. A small section of Bells Creek flattens out and is dominated by species which resemble SPW. The vegetation transitions again into AW south of South Street (**Figure 3** and **Figure 5**).

The most common canopy species found within AW are *Eucalyptus amplifolia* (Cabbage Gum), *Eucalyptus tereticornis* (Red Gum) and *Casuarina glauca* (Swamp Oak) while *Eucalyptus moluccana* (Grey Box) and *Angophora floribunda* (Rough-barked Apple) occurs less frequently. *Melaleuca styphelioides* (Prickly-leaved Paperbark) occurs with some frequency in the upper mid stratum with *Bursaria spinosa* (Native Blackthorn) commonly found in the shrub layer and *Ligustrum lucidum* (Broad-leaf Privet) and *Ligustrum sinense* (Small-leaf Privet) also occurring. *Cardiospermum grandiflorum* (Balloon Vine) was found to occur frequently in the mid stratum and extending into the canopy. This was particularly abundant along Eastern Creek.

Groundcover vegetation is typically dominated by a mixture of native and exotic grasses and herbs. Native groundcover species dominated by *Austrostipa* sp. (Speargrass), *Microlaena stipoides* (Weeping Grass), *Oplismenus aemulus* (Basket Grass). Exotic groundcovers are dominated by *Cynodon dactylon* (Couch), *Tradescantia fluminensis* (Wandering Jew), *Ehrharta erecta* (Panic Veldtgrass), *Plantago lanceolata* (Plantain), *Sida rhombifolia* (Paddy's Lucerne) and Blackberry (*Rubus fruticosus*).

Cooks River / Castlereagh Ironbark Forest

A small linear patch of Cooks River/Castlereagh Ironbark Forest was located along Grange Avenue. This vegetation community is listed as endangered is listed on Schedule 1 of the BC Act 2016. It is also listed CEEC under the EPBC Act. This vegetation community is restricted to western Sydney at the fridges where iron ore deposits occur. There are similarities between Cooks River/Castlereagh Ironbark Forest and adjacent vegetation communities and this community often intergrades with Cumberland Plain Woodland and Shale Gravel Transition Forest. The main distinguishing feature of this community are the clay soils on Tertiary alluvium or on shale soils on Winamatta Shale (NSW SC 2011).

Canopy species include; *Eucalyptus longifolia, E. fibrosa* and *E. moluccana* with a diverse shrub layer consisting of; *Daviesia ulicifolia, Bursaria spinosa* and *Acacia falcata*. The patch also contained two threatened shrubs, *Grevillea juniperina* subsp. *juniperina* and *Dillwynia tenuifolia*. The understorey was equally diverse including a number of different herbs, grasses and low shrubs. Species include *Goodenia hederacea*, *Entolasia stricta, Cheilanthes sieberi* subsp. *sieberi* and Glycine sp.

Area calculations of listed vegetation communities (Alluvial Woodland and Shale Plains Woodland) within the study area, including if any met the BC and EPBC Act criteria are provided in **Table 1** and **Figure 5**.

Figure 3: Alluvial Woodland (River-flat Eucalypt Forest); Bells Creek riparian corridor (top) and Eastern Creek riparian corridor (bottom)

Figure 4: Cooks River / Castlereagh Ironbark Forest

Table 1: A summary of area occupied by listed vegetation communities and their condition.

Vegetation community	Certified lands	Non-certified lands	Total
Shale Plains Woodland, ABC*	29.60	19.02	48.62
Shale Plains Woodland, TX/TXR	20.16	11.79	31.95
Cooks River/Castlereagh Ironbark Forest, A	1.08	0.57	1.65
Alluvial Woodland, ABC	0.31	36.94	37.25
Alluvial Woodland, TX/TXR	0.010	2.86	2.87
Other vegetation, TX/TXR	3.87	1.21	5.08
TOTAL	**55.04**	**72.39**	**127.43**

*EPBC Act listed CPW is represented by good condition (class A) stands of the vegetation community.

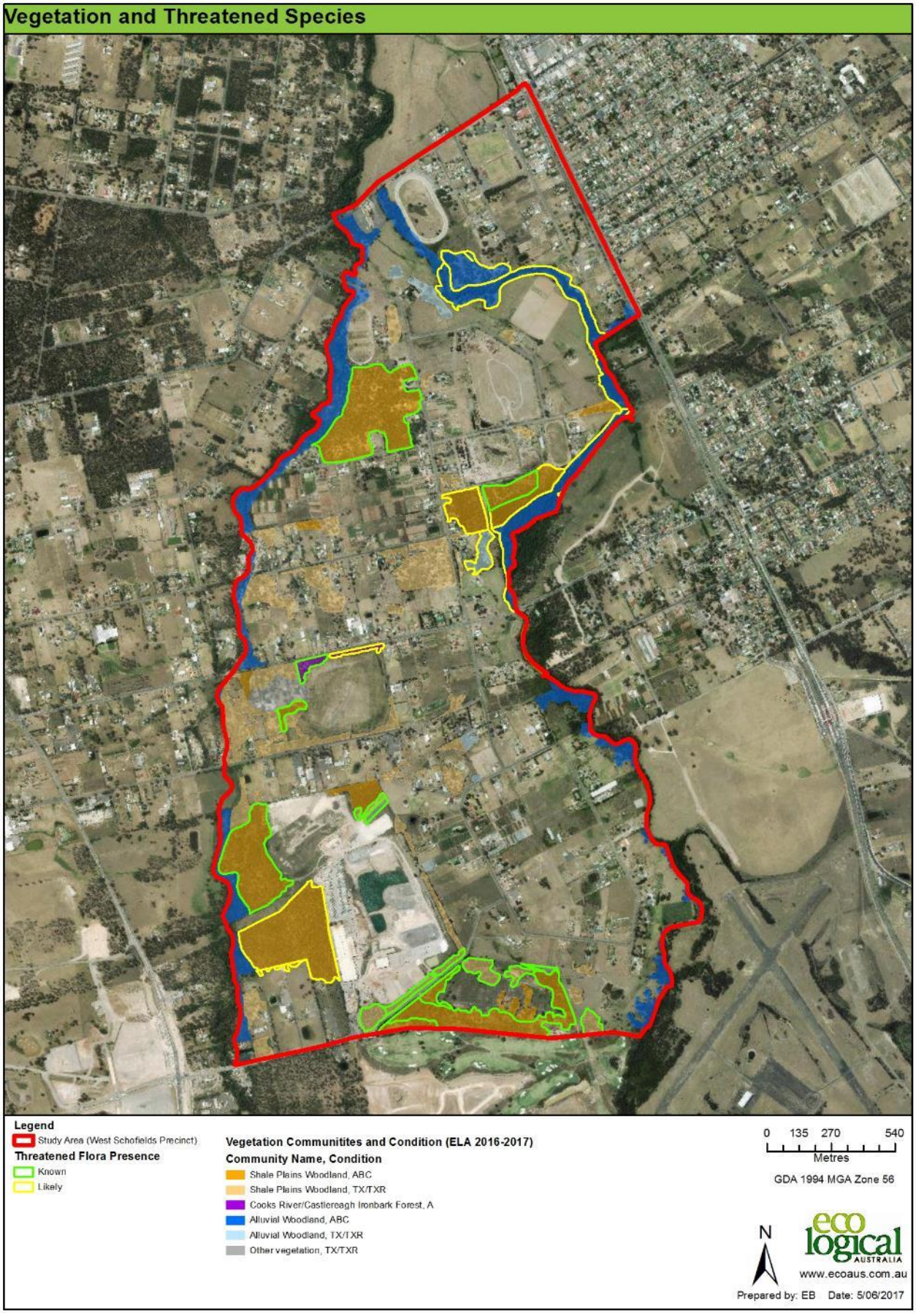

Figure 5: Validated vegetation communities and threatened flora within the study area

3.2 Existing Native Vegetation

A key element to the Biodiversity Certification of the Growth Centres is the protection of 2000 hectares of 'Existing Native Vegetation' (see the Statutory Framework section in this report). The 2000 hectares was based on the 'Existing Native Vegetation' located on non-certified lands.

Desktop aerial photo analysis and field survey was undertaken to validate the extent of the mapped 'Existing Native Vegetation'. This process resulted in the following classifications:

- Validated Existing Native Vegetation.
- Additional High Conservation Value Vegetation: Vegetation which meets criteria a) and b) of the definition of ENV (i.e. a 10% of greater canopy cover and a patch size of greater than 0.5 ha), but was not mapped in the original conservation plan.
- Cleared ENV.

Table 2 and **Figure 6** below show the results of the above assessment.

The Draft Growth Centres Conservation Plan mapped 85.51 ha of ENV within the entire precinct, with 52.55 ha located within non-certified areas and 32.96 ha within certified areas (**Table 2**).

Aerial photo interpretation and field survey validated the presence of 74.20 ha of ENV within the study area, which is comprised of 46.95 ha in the non-certified lands and 27.25 ha in the certified lands.

The area of validated ENV is 11.30 ha less than the original mapped ENV in the precinct, due to either the clearing of that ENV or the benefit of more accurate mapping. On the non-certified lands, there is 5.60 ha less than was mapped in the Draft Growth Centres Conservation Plan.

To maintain parity with the 2000 hectare target of the Sydney Region Biodiversity Certification Order, 52.55 ha of ENV must be protected in the West Schofields Precinct. The shortfall of 5.6 ha will need to be found on certified land.

Table 2: Amount of ENV and AHCVV in study area

West Schofield Part Precinct	Certified Land (ha)	Non-Certified Land (ha)	Total (ha)
ENV original extent	32.96	52.55	85.51
Validated ENV	27.25	46.95	74.20
ENV – difference	-5.70	-5.60	-11.30
Additional Native Vegetation (AHCVV)	20.83	21.82	41.82

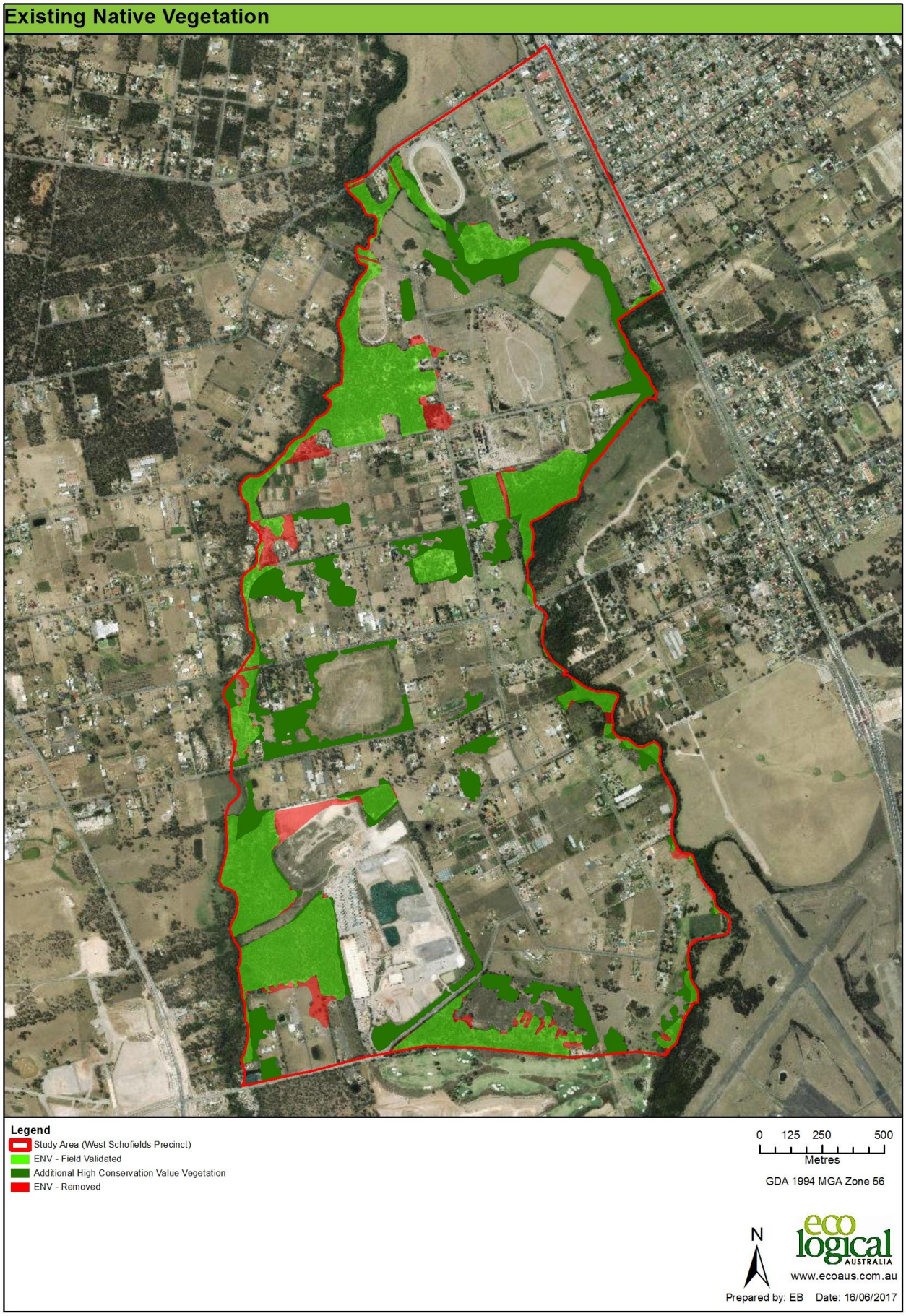

Figure 6: Existing Native Vegetation (ENV) as defined by Biodiversity Certification Order

3.3 Flora

The rapid site inspection undertaken within the study area identified 160 flora species, comprised of 85 native and 75 exotic species. A flora list for the study area is presented in **Appendix C**. Noxious weed species have been identified within the flora list. Note, this is not a comprehensive list of all flora species likely to be present within the study area.

A list of threatened flora species known to occur within a 5 km radius of the study area were identified through the database searches (DotE 2016a, OEH 2016a) and presented in **Appendix D**. During the field survey, two threatened flora species listed as vulnerable under the BC Act were recorded within the Precinct. The known locations of threatened flora species from ELA's 2016 survey results are shown in **Figure 5**. The survey involved targeted searches for the species in areas of likely habitat. Both surveyors undertook a random meander transect across the site.

Grevillea juniperina subsp. *juniperina*

Grevillea juniperina subsp. *juniperina* (Juniper-leaved Grevillea) is a broad spreading, erect shrub growing up to 2.5 m high. It has clustered prickly narrow bright green leaves, and 'spider-like' flowers up to 3.5 cm long, which range from green through pale orange, pink and red. It flowers sporadically during the year, but mainly between July and October. Individual plants are killed by fire, with replacement by germination of soil stored seed and consequently. Other threats include vegetation clearing and fragmentation, rubbish dumping, uncontrolled access, changes in drainage and weed invasion (OEH 2016a).

It grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary Alluvium with a shale influence. It has been recorded in CPW and Castlereagh Scribbly Gum Woodlands as well as Shale Gravel Transition Forest. It is endemic to Western Sydney and its distribution is centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor. *Grevillea juniperina* subsp. *juniperina* is listed Vulnerable under the NSW BC Act (OEH 2016a). It is not listed under the EPBC Act.

This species was found scattered widely through much of the remnant vegetation within the study area, with over 600 individuals observed during the field survey. The majority of individuals were in good condition and regeneration was apparent. Some dieback was noted for a patch of individuals located in a horse paddock near Carnarvon Road.

Dillwynia tenuifolia

Dillwynia tenuifolia is a low spreading pea flower growing up to 1 m high. It has small and narrow leaves and wide yellow / orange / red flowers. Flowering occurs between August and March dependant on the prevailing environmental conditions. Threats include vegetation clearance and fragmentation, inappropriate fire regimes, uncontrolled access, rubbish dumping and weed invasion (OEH 2016a).

Its core distribution is the Cumberland Plain with several distinct occurrences within which it may be locally abundant, particularly when it occurs within the scrubby / dry heath areas of Castlereagh Ironbark Forest and Shale Gravel Transition Forest (OEH 2016a). *Dillwynia tenuifolia* is listed as Vulnerable under the NSW BC Act and not listed under the Commonwealth EPBC Act.

Dillwynia tenuifolia was found growing within the large patches of Shale Plains Woodland in the southern portion of the precinct (**Figure 5**), with at least 50 individuals observed. This species was only found in the Cumberland Plain Woodland and approximately 10 individuals located in the Cooks River / Castlereagh Ironbark Forest vegetation community.

Other species

In addition to the species described above, other threatened flora species that have been previously recorded within close proximity to the study area include; *Marsdenia viridiflora* subsp. *viridiflora, Micromyrtus minutiflora, Pimelea curviflora* var*. curviflora, Pimelea spicata* and *Pultenaea parviflora.* These species were not identified during the field survey, however the survey effort was not exhaustive.

3.4 Fauna

The study area provides potential habitat for a wide range of threatened fauna species. Previous records of threatened fauna species within the study area were identified through the database searches (DotE 2016a, OEH 2016a) and can be found in **Appendix D** along with their likelihood of occurrence.

It should be noted that the majority of threatened fauna species that are likely to occur or that have potential to occur within the study area are highly mobile and utilise a large foraging habitat. Habitat for these highly mobile species is likely to extend outside of the study area.

The main habitats represented in the study area for species with a potential or likely occurrence are:

- *Wooded vegetation* – this is represented by the listed ecological communities outlined above (all except Freshwater Wetlands and exotic grasslands) and provides potential roosting, nesting and foraging habitat for microchiropteran bats, woodland birds, nocturnal birds and the Cumberland Land Snail (within the leaf litter of Cumberland Plain Woodland). It also provides potential foraging habitat for the Grey-headed Flying-fox. Higher quality habitat within the wooded vegetation is represented by:
    - An abundance of hollow-bearing trees and/or defoliating bark.
    - Vegetation containing all vegetation stratums and tree age classes.
    - Vegetation dominated by native species across stratums.
    - An abundance of leaf litter, fallen timber and rocky habitats.
    - Wildlife connectivity values.

- *Riparian*– this is represented by the:
    - potential foraging habitat for some migratory bird species and potential foraging and breeding habitat for some amphibian species.

The field survey identified 51 species of birds, 4 amphibians, one reptile and one fish and 3 introduced mammal species. A fauna list for the study area is presented in **Appendix C**.

The field survey identified two species, the Cattle Egret (*Ardea ibis*) and Eastern Great Egret (*Ardea modesta*) listed under the EPBC Act: The Cattle Egret and Eastern Great Egret are both widespread and common according to migration movements and breeding localities surveys (DotE 2016b).

In Australia the principal breeding sites for Cattle Egret are the central east coast from about Newcastle to Bundaberg as well as major inland wetlands in north NSW (notably the Macquarie Marshes). Non-breeding Cattle Egret may remain in breeding areas, but most migrate elsewhere. The total non-breeding range comprises east and South Australia from the far north-east of Queensland to Tasmania and the Eyre Peninsula and in inland regions it extends to the eastern parts of the Murray-Darling Basin (DotE 2016b).

The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has been seen in arid and semi-arid regions, however this is extremely rare. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass. The population estimate for Australia, New Guinea and New Zealand is 100 000 birds however there has been no systematic survey for the whole continent (DotE 2016b).

The Eastern Great Egret is usually solitarily, or in small groups when feeding. It has been reportedly found in a wide range of habitats, including swamps and marshes, damp or flooded grasslands, pastures and agricultural land and drainage channels. They roost in large flocks that may consist of hundreds of birds. The species usually nest in colonies and rarely in solitary pairs. Colonies may be mono-specific or commonly mixed with other egrets, herons, ibises, spoonbills and/or cormorants. Breeding colonies in south-eastern Australia typically comprise up to several hundred pairs (DotE 2016b).

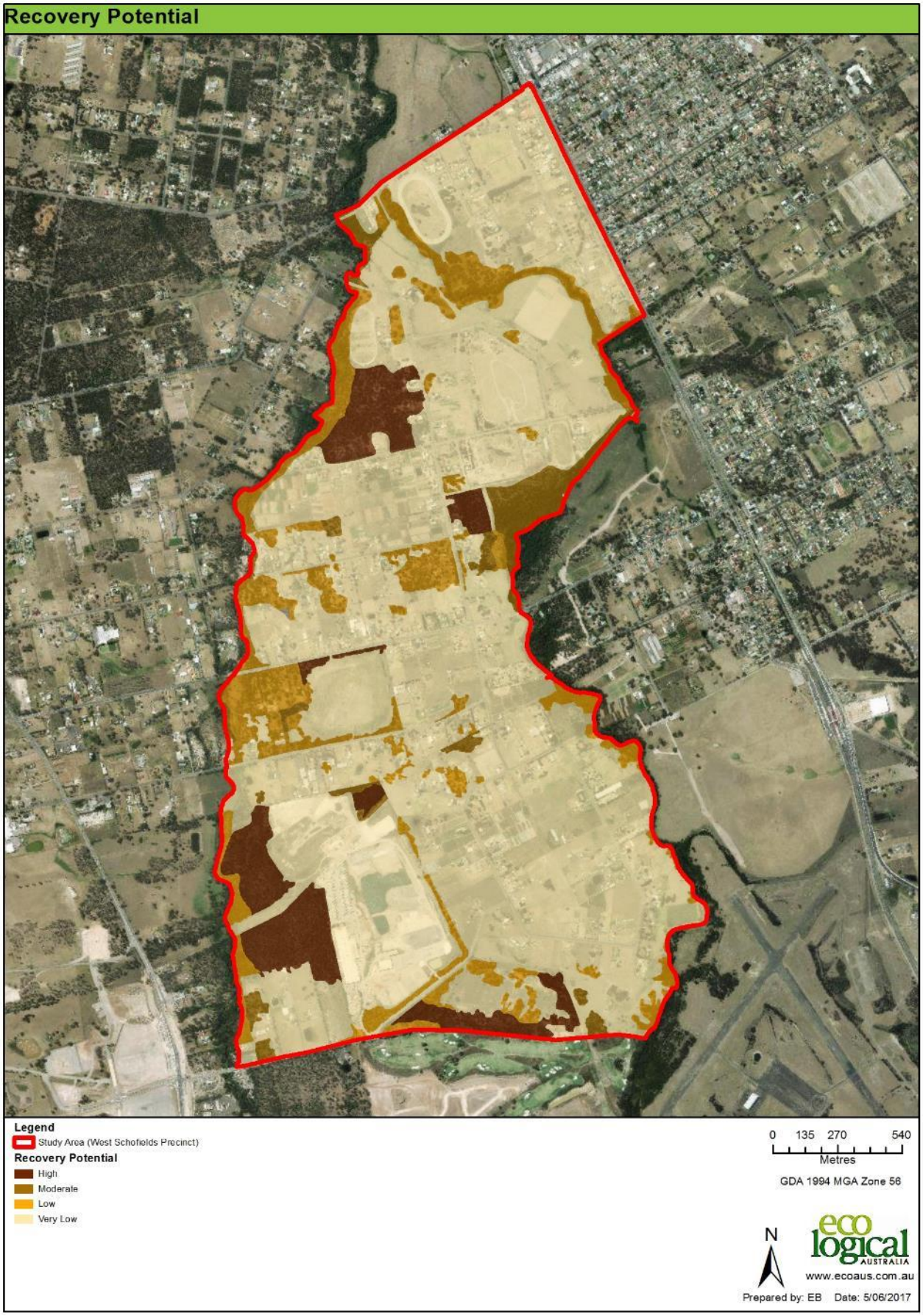

Figure 7: Recovery potential within the study area

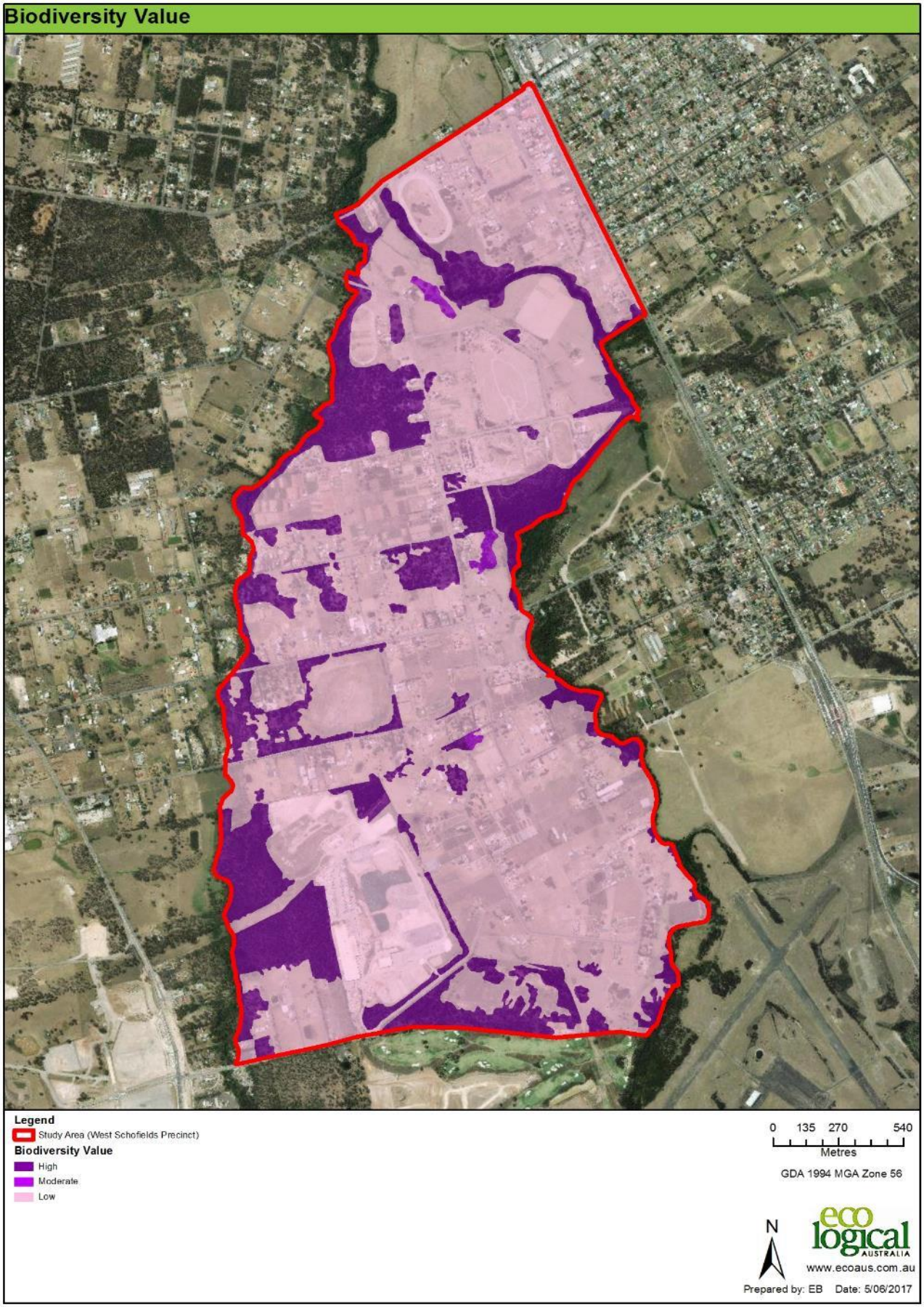

Figure 8: Biodiversity value within the study area

4 Riparian & Aquatic Assessment

4.1 Context

The study area lies within the Hawkesbury-Nepean Catchment. The Hawkesbury-Nepean is the second-largest in NSW and has its headwaters located within largely pristine regions including the Blue Mountains World Heritage Area and Sydney Catchment Authority's lands in the NSW Southern Highlands. These upper reaches provide over 90% of Sydney's drinking water. Once into flatter, floodplain country, the Hawkesbury River flows eastward towards the ocean through rural and semi-rural areas of western Sydney. The middle and lower reaches of the Nepean River system are highly impacted and degraded, both directly through waterway modifications and indirectly through adjacent land use practises. Hydrological and sediment regimes have been dramatically altered due to vegetation clearance and increasing urbanisation. Increasing impervious surfaces in the catchment are causing changes to hydrology which has greatly altered the geomorphology and ecology of the watercourses.

The study area is flanked by Bell's Creek to the west and Eastern Creek to the east. Both creeks flow northwards before joining at the northern extent of the precinct, and then flows a further 6 km to South Creek.

4.2 Aquatic and Riparian Habitat Condition Assessment

As required by statutory authorities, this riparian assessment follows the methodology outlined by the Department of Primary Industries – Water (DPI Water) (formally NSW Office of Water). This methodology is based on the Strahler Stream Order classification and associated Vegetated Riparian Zone (VRZ) widths as measured from the Top of Bank (TOB) on each side.

Top of bank mapping was undertaken through a combination of satellite imagery, LIDAR contours and on-ground survey with a Getac Windows tablet running ArcMap. Results of Top of Bank mapping are shown in **Figure 9**.

Rapid field surveys were conducted along the length of the watercourse. A number of key indicators were used to assess condition along the watercourse. The chosen indicators recognise key components of watercourse health and function, such as connectivity, catchment clearing, riparian clearing, riparian regeneration, weediness, large woody debris, bank stability, macrophytes and instream habitat variability. A final overall condition class was assigned to each reach of the watercourse, based on guidelines used by the NSW Department of Land and Water Conservation within the Hawkesbury Nepean Catchment (NSW DLWC 2000) as specified below:

- *Near Intact Condition*: Streams in a natural or near natural condition. Indicative characteristics are: intact range of native vegetation, slow rate of geomorphic change and hydrologic conditions unaltered.
- *Good Condition*: Streams with self-adjusting river forms and processes and relatively intact vegetation associations. Streams with character and behaviour that befit their setting with high potential for ecological diversity. Dams, reservoirs and weirs may alter hydrologic conditions.
- *Moderate Condition:* Streams with localised degradation of character and behaviour, typically marked by modified patterns of geomorphic units. Vegetation associations and coverage are poor and hydrologic conditions have been altered.
- *Degraded Condition:* These reaches have one or more of the following characteristics: abnormal or accelerated geomorphic instability (i.e. prone to planform change and / or bank or bed erosion),

excessively high volumes of coarse bedload which blankets the bed reducing habitat diversity, low levels of bank vegetation, heavy weed infestation and artificially modified channel.

The condition of each stream reach is summarised in **Table 3**, with representative photos of Bells Creek and Eastern Creek in **Figure 11**, and other tributaries in **Figure 10** and **Figure 12.**

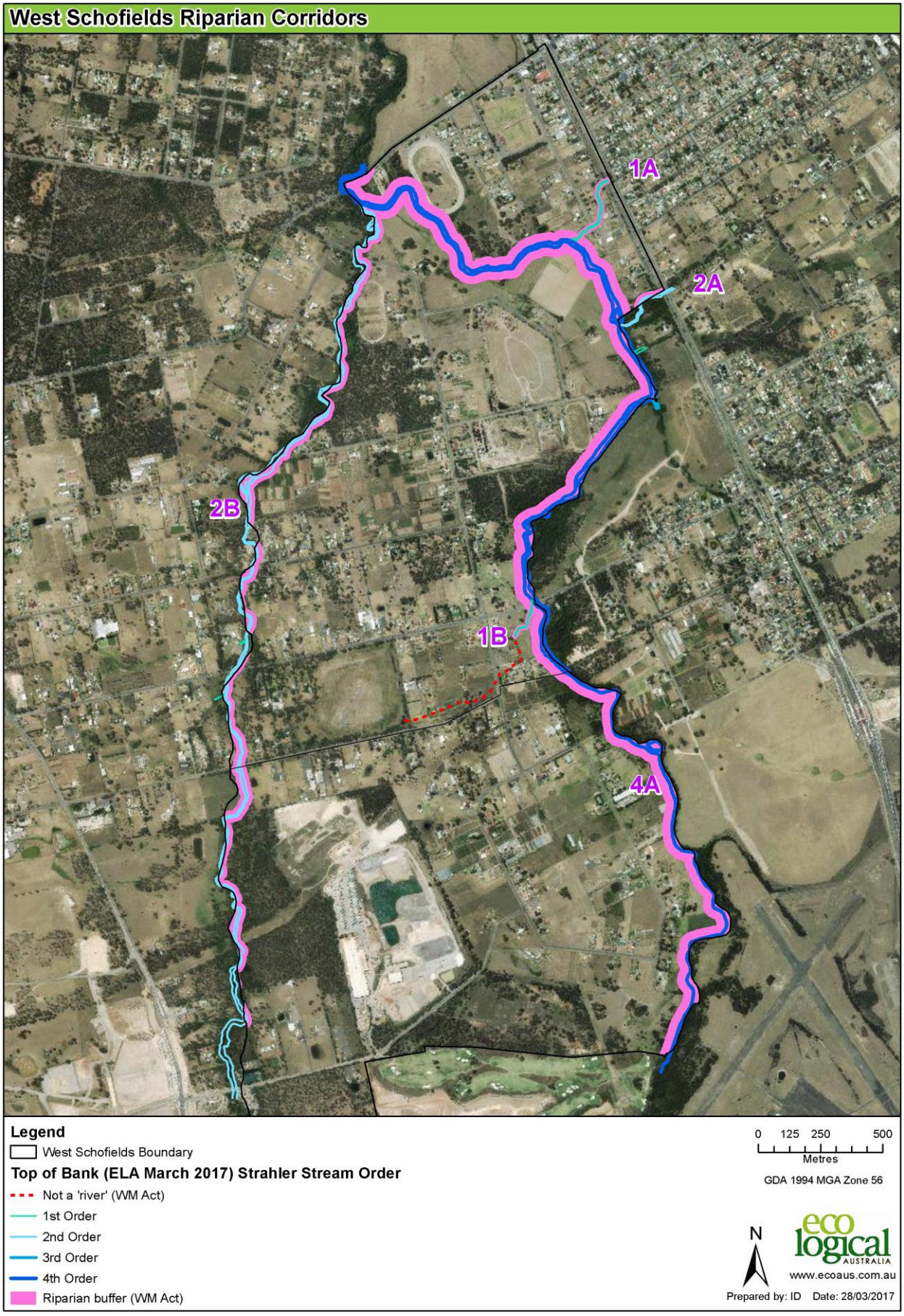

Figure 9: Watercourses and riparian corridors

Table 3 Waterway condition

Waterway	Hydrology	Streamside Vegetation	Physical Form	Aquatic Habitat	Overall Rating
1A (partially assessed from roads)	1st Order Stream (Strahler). Channel modified by road culverts, but generally7 follows a natural path. Inflows modified by cleared catchment.	Little remaining native vegetation Few native species remaining, cover dominated by exotic species. More than one stratum completely altered from reference (lost or <10% remaining). Reduced cover (<50%) of dominant strata, and only one age class present. Very small quantities of debris present.	Sand/clay banks with slope 30-70°. Approximately 50% of banks with slumping erosion and/or incised channel. Remainder of banks well stabilised by groundcovers and riparian trees (mostly in channel). Channel narrow, mostly <3 m with small banks.	Unable to be fully assessed dur to access restrictions. Not flowing at time of survey. Water in small shallow pools bunded at each road crossing. Reeds common (*Typha* sp.) at highest pool near railway. Minimal fish habitat.	Moderate
1B	1st Order Stream (Strahler). Channel heavily modified by online dams. Only the lower 200 m is a 'river' with defined bed and banks. The remainder is dams and overland flows. Inflows modified by a cleared catchment.	Only small patches of well-separated native vegetation remain. Few native species remaining, cover dominated by exotic species. Structure completely altered from reference. Dominant strata mostly absent. Very small quantities of debris present.	Sand/clay banks with slope 30-70°. Little evidence of erosion with banks well stabilised by groundcovers. Channel modified by online dam and culvert, otherwise mostly <3 m with small banks. No defined 'river' beyond 200 m.	Not flowing at time of survey. Water present in dam and channel, covered with dense macrophytes. Poorly connected to Eastern Creek due to elevated culvert under road. Minimal fish habitat.	Degraded

Waterway	Hydrology	Streamside Vegetation	Physical Form	Aquatic Habitat	Overall Rating
2A (restricted access to full length; observation from adjacent areas).	2nd Order Stream (Strahler).	About 50% of the native vegetation remains, either in strips or patches. Most strata dominated by exotic species, 'high threat' species abundant. More than one stratum completely altered from reference (lost or <10% remaining). Reduced cover (75-50%) of dominant strata, and/or only two age classes present.	Channel mostly unassessed due to dense weeds and property permissions. One online dam present. Two culverts upstream at road and railway.	Channel mostly unassessed due to dense weeds and property permissions. One online dam present. Culverts under road. Steep outlet to Eastern Creek across undefined channel (dam spills through vegetation).	Moderate
2B (Bells Creek)	2nd Order Stream (Strahler). Channel mostly unmodified, but with small culverts. Inflows modified due to regionally cleared land use.	Width reduced by up to 1/3 and/or some breaks in continuity. 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 (75-50%) of dominant strata, and/or only two age classes present. Some evidence of unnatural loss of debris (canopy clearing).	Sand/clay banks with slope 30-70°. Approximately 50% of banks with slumping erosion and/or incised channel. Remainder of banks well stabilised by groundcovers and riparian trees. Channel narrow, mostly <3 m with small banks.	Slowly flowing at time of survey. Water turbid and rubbish present. Mix of 2% riffle, 3% run and 95% pool. Depth mostly <50 cm. Macrophytes common (*Alisma plantago-aquatica* and *Eleocharis sphacelata*). Minimal fish habitat. Several Carp observed in pool upstream of South St.	Moderate

Waterway	Hydrology	Streamside Vegetation	Physical Form	Aquatic Habitat	Overall Rating
4A (Eastern Creek)	4th Order Stream (Strahler). Mostly unmodified channel, except: one informal culvert crossing; one major bridge under construction; and two existing bridges. Inflows modified due to regionally cleared land use.	About 50% of the native vegetation remains, either in strips or patches. One or more strata dominated by exotic species, high impact species present. One stratum missing or extra, cover within remaining strata 50% lower or higher than reference. Reduced cover (75-50%) of dominant strata, and/or only two age classes present. Some evidence of unnatural loss of debris (canopy clearing).	Sand/clay banks with slope 30-70°. Approximately 50% of banks with slumping erosion and/or incised channel. Remainder of banks well stabilised by groundcovers and riparian trees. Channel width mostly between 3-5 m. Several debris dams and log riffles.	Flowing steady at time of survey. Water turbid and rubbish deposited high up banks. Mix of 5% riffle, 20% run and 75% pool. Water depth mostly 30-100 cm. Moderately diverse aquatic habitat with large logs and submerged macrophytes (*Vallisneria australis*). Moderate fish habitat.	Moderate

Figure 10: Representative photos of reaches 2A (Bells Creek) and 4A (Eastern Creek)

Figure 11: Representative photos of reaches 1A and 2A

Figure 12: Representative photos of reach 1B

4.3 Threatened Species

Threatened species listed under the *Fisheries Management Act 1994* (FM Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) were considered for their potential to occur within the study area (**Table 4**). The following databases informed this process:

- EPBC Act Protected Matters Search (DotE 2016a).
- BC Act Threatened Species Search Tool (BioNet; OEH 2016a).
- FM Act listed protected and threatened species and populations, including species profiles, 'Primefact' publications and expected distribution maps.
- Online Zoological Collections of Australian Museums (OZCAM).

A review of those species revealed that no threatened species are likely to occur or be dependent on the available habitat in the study area. There are some areas of potential habitat for Green and Golden Bell Frog (*Litoria aurea*) such as existing dams with fringing emergent vegetation, however the vast majority of the site is considered to provide marginal or unlikely habitat for this species.

Table 4: Listed aquatic and amphibious species recorded in the region

Species	FM Act / BC Act status	EPBC Act status
Archaeophya adamsi (Adam's Emerald Dragonfly)	E	
Heleioporus australiacus (Giant Burrowing Frog)	V	V
Litoria aurea (Green and Golden Bell Frog)	E	V
Litoria littlejohni (Littlejohn's Tree Frog)	V	V
Macquaria australasica (Macquarie Perch)	E	E
Mixophyes iteratus (Giant Barred Frog)	E	E
Prototroctes maraena (Australian Grayling)	E	V

Whilst it is unlikely that any threatened aquatic species utilise the habitat on the site, there are a host of common aquatic species including eels, frogs and macroinvertebrates that rely on the health of aquatic habitat for their ongoing survival. Aquatic habitat is an important component of overall ecosystem health and contributes to the diversity of the catchment. It is highly recommended that future urban development considers the need to provide in-stream habitat, longitudinal connectivity (including removal of current barriers to fish passage) and fringing riparian vegetation. In addition, erosion and sediment control should be a key requirement during construction and Water Sensitive Urban Design (WSUD) structures should be constructed and maintained to improve the future quality of receiving waters

5 Recommendations

5.1 Protection of vegetation in the Indicative layout Plan

The following recommendations are made to assist in the drafting of the Indicative Layout Plan, Precinct Plan and Development Control Plan. The recommendations are made to ensure the Indicative Layout Plan and subsequent Precinct Plan are consistent with the Sydney Region Biodiversity Certification Order. To maintain parity with the Biodiversity Certification Order, the Precinct Plan should protect a minimum of 52.55 ha of ENV. The recommendations relate to areas shown on **Figure 13**.

Recommendation 1 – Protect all Existing Native Vegetation on non-certified lands

Rationale: Validated 'Existing Native Vegetation' on non-certified lands are the highest priority for conservation for the following reasons:

a) consistency with the original intent of the Draft Growth Centres Conservation Plan
b) vegetation in the non-certified lands are generally contiguous due to the vegetation being in the riparian corridor – and therefore provide habitat connectivity.

Recommendation 2: Protect at least 5.60 ha of ENV on certified land.

Rationale: As there is a shortfall of ENV on non-certified land, at least 5.60 ha of ENV on certified land must be protected in order to maintain parity with the Sydney Region Biodiversity Certification Order. The preferred areas for protection of ENV on certified land are shown in Figure 13. As only 5.60 ha is required to be protected, Figure 13 indicates the areas of high priority based on:

- Presence of Critically Endangered Ecological Community and threatened species
- Contiguous with riparian zone and other vegetation being protected

Protection above the minimum 5.60 ha is not necessary, but would enhance the biodiversity outcomes of the precinct.

Recommendation 3 – Protect riparian corridors with a minimum width in accordance with DPI-Water Guidelines

Rationale: In order to maintain and improve riparian zone integrity and connectivity, the riparian areas shown on Figure 13 are recommended for protection. Protection of the riparian corridors will be the main way in which ecological connectivity through the precinct is achieved in a north-south direction. The protection and management of these lands will provide watercourse stability, aquatic habitat and terrestrial fauna connectivity through the precinct. Development within these areas is to be avoided unless for essential infrastructure. Where development is proposed on land adjacent to these corridors, a Vegetation Management Plan should be prepared and implemented at the development phase of the precinct. Fragmentation via subdivision should be avoided where possible and public ownership is preferred. Riparian land for the watercourses rated 'low' do not have any particular conservation significance.

In accordance with the NSW Office of Water Guidelines for Waterfront Land, development within the outer 50% of a Vegetated Riparian Zone (VRZ) may be possible if that impact is offset by protecting and managing an equivalent area along the watercourse.

Recommendation 4 – Consider other opportunities to protect native vegetation in parks

Rationale: Where native vegetation is located within open space and transition zones, Precinct Plans should promote the retention of the native vegetation. Whilst this is not required in order to meet the Biodiversity Certification Order conditions, it will enhance the biodiversity outcomes of the precinct. If retained, consideration will need to be given the need for bushfire asset protection zones on adjoining land.

5.2 Mechanisms for Protection of Biodiversity

5.2.1 Zoning

To ensure conservation areas are protected in the long term, the NSW Office of Environment and Heritage have recommended a planning hierarchy for protection as follows:

1st preference – E2 Environmental Conservation Zone in public ownership with permissible uses consistent with the conservation of biodiversity values.

2nd preference – E3 Environmental management Zone in public ownership with permissible uses consistent with the conservation of biodiversity values.

3rd preference – RE1 Public Recreation Zone with management of the conservation values of land as a primary objective

4th preference – SP2 Infrastructure zone with management of the conservation values of land as a primary objective

5th preference – E2 Environmental Conservation zone in private ownership with permissible uses consistent with the conservation of biodiversity values.

The OEH hierarchy is based on a combination of zoning and ownership. Where land is currently in private ownership it is difficult to provide certainty that the land can or will be bought into public ownership, particularly when no public authority has indicated a willingness to take ownership. Given the uncertainty regarding future ownership, it is recommended that the E2 Environmental Conservation zone is generally used to protect the ENV.

5.2.2 Development controls

To ensure the ENV and riparian zones are not cleared by development that is permissible without consent, it is recommended that the Precinct Plan apply clauses 6.3 and 6.4 in the Blacktown Precinct Plan (Growth Centres SEPP).

Clauses 6.5 and 6.6 should also be applied as these require preparation and implementation of a Vegetation Management Plan when development is proposed on or adjoining the E2 zone. This clause has been applied in the Blacktown and Schofield Precinct Plans. It is worth noting however, that there is likely to be a significance difference in the effectiveness of the clause on Bells Creek and Eastern Creek. Development is likely to occur on land adjoining Bells Creek which will trigger the clause. Eastern Creek however is located on a wider floodplain and therefore may not have development on land adjoining the riparian zone for much of its length in the Precinct. The improvement of the Eastern Creek riparian corridor within the Precinct is therefore unlikely unless other mechanisms can be found to trigger the restoration

of the riparian zone. If this outcome is pursued, a nexus between the requirement for restoration, development and the landholder would need to be clear and justified.

It is also recommended that the Growth Centres SEPP and its precinct plans ensure that minor clearing be allowed through ENV areas for the discharge of stormwater. This should not allow for vegetation clearing for detention basins, but should allow for the minimal amount of clear necessary to transfer stormwater from the site to the receiving waters.

5.3 Ownership and fragmentation

The recommended riparian zones and conservation areas are currently in multiple private ownership. Such patterns are not conducive to long term conservation management. Costs to manage are typically higher and co-ordination of weed management is rarely undertaken.

Where possible, conservation areas should be amalgamated and transferred to public ownership along with funds for their management. This should not be mandatory and would require a willing public authority to take ownership and management responsibility. If such an outcome is achieved, it would be conducive to environmental management and would also allow public access for recreation or potentially bike paths if they can be constructed in a manner that does not compromise the conservation outcomes.

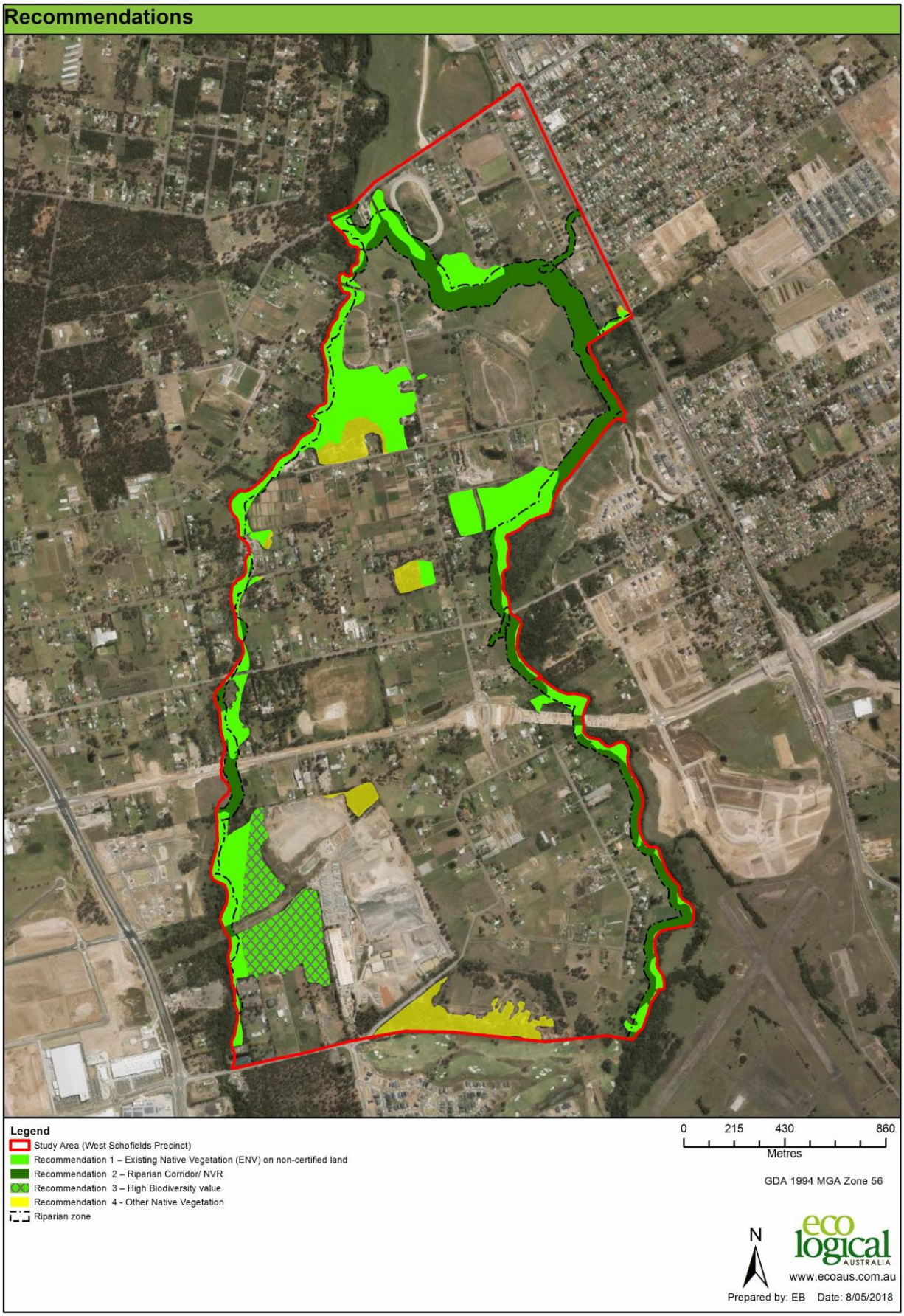

Figure 13 Recommendations for conservation

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Appendix A: Detailed Statutory Framework

Commonwealth

Environment Protection & Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) establishes a process for assessing the environmental impact of activities and developments where 'matters of national environmental significance' (MNES) may be affected. The *EPBC Act* lists endangered ecological communities, threatened and migratory species that have the potential to occur, or are known to occur on a site.

The approval of both stages of the strategic assessment occurred on the 28th February, 2012. This approval essentially means that the Commonwealth is satisfied that the conservation and development outcomes that will be achieved through development of the Growth Centres Precincts will satisfy their requirements for environmental protection under the EPBC Act. So that, provided development activity proceeds in accordance with the Growth Centres requirements (such as the Biodiversity Certification Order, the Growth Centres SEPP and DCPs, Growth Centres Development Code etc) then there is ***no requirement*** to assess the impact of development activities on matters of National Environmental Significance (NES) and hence ***no requirement*** for referral of activities to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC). The requirement for assessment and approval of threatened species and endangered ecological communities under the EPBC Act has now been "turned off" by the approval of the Strategic Assessment.

State

Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. Various legislative instruments, such as the NSW BC Act, are integrated with EP&A Act and have been reviewed separately.

In determining a development application, the consent authority is required to take into consideration the matters listed under Section 79C of the EP&A Act that are relevant to the application. Key considerations include:

- Any environmental planning instrument, including drafts
- The likely impacts of the development
- The suitability of the site for the development
- Any submissions made in accordance with the EP&A Act or regulations
- The public interest

Biodiversity Conservation Act 2016(BC Act)

In November 2016 the NSW parliament passed the *Biodiversity Conservation Act 2016* (BC Act). This new legislation replaced the *Threatened Species Conservation Act* 1995 (TSC Act) and took effect 25 August 2017. Among other things, the BC Act introduces new requirements for biodiversity assessment and requires proponents to offset significant biodiversity impacts through the purchase and retirement of

biodiversity credits. The government has recently exhibited regulations that provide further detail on the changes as well as establish the transitional arrangements.

Similarly to the TSC Act, the BC Act aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The BC Act is integrated with the EP&A Act and requires consideration of whether a development (Part 4 of the EP&A Act 1974) or an activity (Part 5 of the EP&A Act) is likely to significantly affect threatened species, populations and ecological communities or their habitat.

The schedules of the Act list species, populations and communities as endangered or vulnerable. New species, populations and communities are continually being added to the schedules of the BC Act. All developments, land use changes or activities need to be assessed to determine if they will have the potential to significantly impact on species, populations or communities listed under the Act.

Bio-certification was introduced under the TSC Act (s.126G) to confer certification on an environmental planning instrument if the Minister is satisfied that it will lead to the overall improvement or maintenance of biodiversity values – typically at a landscape scale. Under the new BC Act, existing biodiversity certified areas remain valid following the repealed TSC Act.

The effect of granting certification is that any development or activity requiring consent (Under Part 4 and 5 of the EP&A Act respectively) is automatically – development that is not likely to significantly affect threatened species. This certification removes the need to address threatened species considerations and the assessment of significance or seven part tests (s.5A of the EP&A Act), including the prepare species impact statements (SIS).

State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (Growth Centres SEPP)

The Growth Centres State Environmental Planning Policy (SEPP) (referred to as the 'Growth Centres SEPP') has been 'bio-certified' by order of the Minister for the Environment under s.126G of the ~~*TSB*~~*C Act*. The mechanism for achieving this is outlined in the *Growth Centres Conservation Plan* (Eco Logical Australia, 2007) and the conditions for bio-certification are documented in the Ministers order for consent[2]. Bio-certification negates the requirement for impact assessment under s.5A of the *Environmental Planning and Assessment Act, 1979* thus turning off the requirements for seven part tests or species impact statements.

Each precinct needs to be assessed against the conditions of the Biodiversity Conservation Order to ensure that the planned rezoning and subsequent development of the precinct complies. This is undertaken through the completion of a Biodiversity Certification Consistency Report.

Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. The FM Act defines 'fish' as any marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history. This includes insects, molluscs (eg. Oysters), crustaceans, echinoderms, and aquatic polychaetes (eg. Beachworms), but does not include whales, mammals, reptiles, birds, amphibians or species specifically excluded (eg.

[2] http://www.environment.nsw.gov.au/resources/nature/biocertordwsgcentres.pdf

Some dragonflies are protected under the BC Act instead of the FM Act). Under this act, if any activity occurs that will block fish passage, then a permit under this Act will be required.

Water Management Act 2000

The NSW *Water Management Act 2000* (WM Act) has replaced the provisions of the *Rivers and Foreshores Improvement Act 1948*. The *Water Management Act 2000* and *Water Act 1912* control the extraction of water, the use of water, the construction of works such as dams and weirs and the carrying out of activities in or near water sources in New South Wales. 'Water sources' are defined very broadly and include any river, lake, estuary, place where water occurs naturally on or below the surface of the ground and coastal waters.

If a 'controlled activity' is proposed on 'waterfront land', an approval is required under the Water Management Act (s91). 'Controlled activities' include:

- the construction of buildings or carrying out of works;
- the removal of material or vegetation from land by excavation or any other means;
- the deposition of material on land by landfill or otherwise; or
- any activity that affects the quantity or flow of water in a water source.

'Waterfront land' is defined as the bed of any river or lake, and any land lying between the river or lake and a line drawn parallel to and forty metres (40m) inland from either the highest bank or shore (in relation to non-tidal waters) or the mean high water mark (in relation to tidal waters). It is an offence to carry out a controlled activity on waterfront land except in accordance with an approval.

Biosecurity Act 2015

The *Noxious Weed Act 1993* was repealed and replaced with the *Biosecurity Act 2015*. Under the Biosecurity Act 2015 all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Specific legal requirements apply to State determined priorities under the Greater Sydney Regional Strategic Weed Management Plan 2017-2022. Weeds listed as 'other weeds of regional concern' warrant resources for local control or management programs and are a priority to keep out of the region. Inclusion in this list may assist Local Control Authorities and/or land managers to prioritise action in certain circumstances where it can be demonstrated the weed poses a threat to the environment, human health, agriculture etc.

State Environmental Planning Policy No.19 – Bushland in Urban Areas

This NSW State Environmental Planning Policy (SEPP) aims to protect and preserve bushland within selected local government areas. The policy recognises the recreational, educational and scientific significance of such bushland and aims to protect the flora, fauna, significant geological features, landforms and archaeological relics in such areas. It encourages management to protect and enhance the quality of the bushland and facilitate public enjoyment, compatible with its conservation. The policy states that a person shall not disturb bushland zoned or reserved for public open space purposes without the consent of the council.

Development Code

The Growth Centres Development Code was produced by the former Growth Centres Commission (GCC) in 2006. The Development Code was produced to guide the planning and urban design in the North West and South West Growth Centres.

The Development Code includes objectives and provisions that support the retention of as much native vegetation, habitat and riparian areas within the precinct through incorporation into land use planning outcomes such as lower density development in these areas, subdivision patterns, road design, local parks, and other areas required to be set aside for community uses without adversely affecting the development yield of areas.

As a requirement under the Development Code, the Townson Road precinct will need to demonstrate how the biodiversity and other values of areas identified by the SEPP will be protected, maintained and enhanced. Key issues will include boundary management (eg. Buffers to surrounding development), bush fire and water sensitive urban design (WSUD) (GCC 2006).

Growth Centres Conservation Plan

Under the GCC Conservation Plan (January 2007), the vegetation within Townson Road Precinct has been identified as 'Lower Long Term Management Viability (LMV)' and has already been considered for offset as part of the Improve or Maintain test (i.e. is not designated for conservation as part of the larger regional plan for Western Sydney). It should be noted however that while the Improve or Maintain test has already been considered, it can and should be supplemented by other relevant considerations as recommended by the Conservation Plan. By applying the precautionary principle, the Conservation Plan recommends that some residual areas identified as LMV should be further examined and addressed, for any potential for habitat conservation to contribute to the broader habitat values of the area at the planning stage.

Appendix B: Methodology

Terrestrial Biodiversity Assessment

Literature Review

A desktop literature review was undertaken by ELA to determine the location and extent of previous surveys, identify the representative spectrum of flora and fauna within the study area and identify the presence of any threatened species, populations and ecological communities listed under the BC Act and the Commonwealth EPBC Act that could potentially occur within the study area. To this end, the following documentation and mapping was reviewed:

- Topographic maps, digital elevation models and aerial photography of the study area.
- Database searches of NSW OEH Wildlife Atlas.
- EPBC online Protected Matters.
- (*Draft) Growth Centres Conservation Plan*' prepared by Eco Logical Australia (2007) for NSW Growth Centres Commission.
- Western Sydney Vegetation Mapping (NPWS 2002a).
- Western Sydney Condition and Conservation Significance Mapping (NPWS 2002b).
- 'Eco Logical Australia (2015) *Marsden Park North Precinct Biodiversity and Riparian Corridors Ecological Assessment.* Prepared for Marsden Park North Release Group.
- Ecological Australia (2014) *Flora, Fauna and Bushfire Assessment Meadow Road Planning Proposal*. Prepared for Brown Consulting.'
- Ecological Australia (2014) *Townson Road Precinct, Marsden Park Planning Study Biodiversity, Riparian Assessment*. Prepared for Mecone.

Likelihood of Occurrence

Appendix D identifies the threatened species returned by the NSW DECCW Wildlife Atlas database and EPBC online Protected Matters database searches (based on a 10km radius from the study area) together with an assessment of the likelihood of occurrence for each species. Each species likely occurrence was determined by records in the area, habitat availability and knowledge of the species' ecology.

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

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

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

Information provided in the habitat associations' column has primarily been extracted (and modified) from the Commonwealth Species Profile and Threats Database (DotE 2016b) and the NSW Threatened Species Profiles (OEH. 2016b)

Field survey

The field survey gathered information that was not achievable via the desktop analysis of aerial photos. This included:

- Validation of ENV as shown in the Draft Conservation Plan
- Identification of additional high conservation value vegetation (AHCVV) that met the definition (parts a and b) of ENV as per the Conservation Plan
- Validation of whether vegetation mapped as Cumberland Plain Woodland in the Strategic Assessment Program Report still meets that definition under the EPBC Act
- Assessment of habitat significance for threatened flora and fauna species
- Recording of incidental sightings of threatened flora and fauna.
- Collection of information in order to understand recovery potential.
- Collection of information to run the NPWS / OEH Conservation Significance Assessment,
- Identification of any major ecological factors impacting the site such as erosion, feral animal populations, fire regimes and noxious weed.

Field survey across the southern portion of the Precinct was conducted on the 2 and 3 June 2016 and 8 - 13 March for the northern Precinct area. See figure below.

Field survey consisted of validating ENV, vegetation communities and their condition, opportunistic fauna sightings and fauna habitat assessment. The field survey was undertaken by Matthew Dowle and Nicole McVicar of Eco Logical Australia. Approximately 64 person hours were utilised in completing the survey.

Matters of National Environmental Significance (MNES) listed under the Commonwealth EPBC Act were targeted during this survey period.

Weather conditions during field surveys

Date	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)
2 June 2016	6.3	19.4	0mm
3 June 2016	9.4	18.1	0mm
8 March 2017	16.3	24.8	0.2mm
13 March 2017	17.0	30.9	0 mm

Weather observations were taken from www.bom.gov.au Richmond Weather Station 067105)

The survey involved validating the mapped vegetation communities, delineating the boundaries of mapped vegetation and assessment of community condition, and searching for threatened flora and fauna. Three survey techniques were used during the field surveys. These techniques included:

- Vegetation community validation
- Random meander targeted flora searches
- Incidental fauna sightings

The survey techniques were based on those outlined within the Threatened *Biodiversity Survey and Assessment: Guidelines for Development and Activities (Working Draft)* by DEC (2004).

Targeted threatened plant searches were performed during vegetation survey for species deemed as potentially or likely to occur on the basis of suitable habitat.

Incidental observations of fauna and indirect evidence of fauna, such as scats, tracks and other traces, were recorded during survey. Habitat searches were undertaken for hollow bearing trees, coarse woody debris, defoliating bark and watercourses with potential to provide aquatic habitat.

Vegetation Community and Condition Assessment

Vegetation mapping was undertaken using aerial photography, ground-truthing of the NPWS Western Sydney Mapping Project (NPWS 2002) and traversing of cleared land surrounding currently mapped vegetation remnants. Vegetation community information, canopy density and understorey condition were assigned to each vegetation polygon.

Field surveys were carried out to assess the accuracy of the mapped boundaries and attributed information and where delineation of boundaries in the field was not obvious from the aerial photography, boundaries were marked using a Global Positioning System (GPS).

Field validation of vegetation remnants was undertaken to identify correlations with areas of Cumberland Plain Woodland that meet the criteria for the critically endangered ecological community listed under the EPBC Act, and areas of vegetation that have been cleared since aerial photos were taken.

NSW Cumberland Plain Condition Criteria

Table below outlines the classification rules used to determine canopy and understorey condition. This table is a modification of **Table 3** in the Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain, Western Sydney (NPWS 2002). Each area of remnant vegetation was given a condition rating according to the rule-set identified in the table below of canopy and condition codes.

CODE	CANOPY DENSITY	DESCRIPTION
A	>10%	Relatively intact native tree canopy
B	<10%	Larger areas of remnant vegetation with a low or discontinuous canopy. Often found on the disturbed edges of larger remnants.
C	<10%	Areas of native vegetation that do not have a Eucalypt canopy cover.
TX	<10%	Areas of native trees with very discontinuous canopy cover.
TXr	<10%	Areas of Tx (as above) located in areas where there is a combination of urban and rural activities such as rural residential development.
Txu	<10%	Areas of Tx (as above) located where the dominant land use is urban (residential/industrial etc).

Source: Table 4 in the Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain Western Sydney (NPWS 2002).

Commonwealth Cumberland Plain Woodland and Shale Gravel Transition Forest Condition Criteria

The condition assessment criteria under the EPBC Act differs from that of the BC Act. Condition is assigned based on patch size and perennial understorey cover. The table below outlines the EPBC Act condition criteria which were applied to vegetation within the study area to determine the condition code.

Condition Thresholds for Patches that meet the Description for the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community.

CATEGORY AND RATIONALE	THRESHOLDS
A. Core thresholds that apply under most circumstances: patches with an understorey dominated by Natives and a minimum size that is functional and consistent with the minimum mapping unit size applied in NSW.	Minimum patch[3] size is ≥0.5ha; **AND** ≥50% of the perennial understorey vegetation cover[4] is made up of native species.
OR	
B. Larger patches which are inherently valuable due to their rarity.	The patch size is ≥5ha; **AND** ≥30% of the perennial understorey vegetation cover is made up of native species.
OR	
C. Patches with connectivity to other large native vegetation remnants in the landscape.	The patch size is ≥0.5 ha; **AND** ≥30% of the perennial understorey vegetation cover is made up of native species; **AND** The patch is contiguous[5] with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) that is ≥5ha in area.
OR	
D. Patches that have large mature trees or trees with hollows (habitat) that are very scarce on the Cumberland Plain.	The patch size is ≥0.5 ha in size; **AND** ≥30% of the perennial understorey vegetation cover is made up of native species; **AND** The patch has at least one tree with hollows per hectare or at least one large tree (≥80 cm dbh) per hectare from the upper tree layer species outlined in the Description and .

[3] A *patch* is defined as a discrete and continuous area that comprises the ecological community, outlined in the Description. Patches should be assessed at a scale of 0.04 ha or equivalent (e.g. 20m x 20m plot). The number of plots (or quadrats or survey transects) per patch must take into consideration the size, shape and condition across the site. Permanent man-made structures, such as roads and buildings, are typically excluded from a patch but a patch may include small-scale disturbances, such as tracks or breaks or other small-scale variations in native vegetation that do not significantly alter the overall functionality of the ecological community, for instance the easy movement of wildlife or dispersal of spores, seeds and other plant propagules.

[4] Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers (as outlined in the Description and Appendix A) with a life-cycle of more than two growing seasons (Australian Biological Resources Study, 2007). Measurements of perennial understorey vegetation cover exclude annuals, cryptogams, leaf litter or exposed soil (although these are included in a patch of the ecological community when they do no alter functionality as per footnote 3 and the Description and Condition Thresholds are met).

[5] Contiguous means the woodland patch is continuous with, or in close proximity (within 100 m), of another patch of vegetation that is dominated by native species in each vegetation layer present.

Source: DEWHA (2009a) Advice to the Minister for the Environment, Heritage and the Arts from the Threatened Species Scientific Committee (the Committee) on an Amendment to the List of Threatened Ecological Communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Vegetation community validation

During field visits random meanders were undertaken to determine the community present and floristic lists were recorded and compared against the description of each community.

A rapid assessment was undertaken to determine if the patch was likely to meet the EPBC listing of CPSW & SGTF.

Threatened Flora Surveys

Random meander surveys were conducted within the vegetation communities located within the site, and other areas of potential habitat for threatened flora species. MNES flora species that were targeted during the field survey included:

- *Micromyrtus minutiflora*
- *Pimelea curviflora* var. *curviflora*
- *Pimelea spicata*
- *Pultenaea parviflora*

In addition, *Grevillea juniperina* and *Dillwynia tenuifolia,* listed under the BC Act was also targeted as it has previously been recorded within the locality.

Threatened Fauna Surveys

Habitat assessment for threatened fauna surveys were undertaken within the study area to determine whether any MNES species were likely to be found within the study area. Incidental fauna sightings were recorded.

Diurnal Birds

Survey for diurnal birds was opportunistic with observers moving through vegetation communities supporting potential habitat for diurnal birds over the entire survey period.

Nocturnal Birds

Nocturnal bird survey (habitat based) focused on identifying potential roosting / nesting trees during the survey period, through the incidence of large hollow bearing trees, owl wash and faecal pellets.

Ground dwelling and arboreal mammals

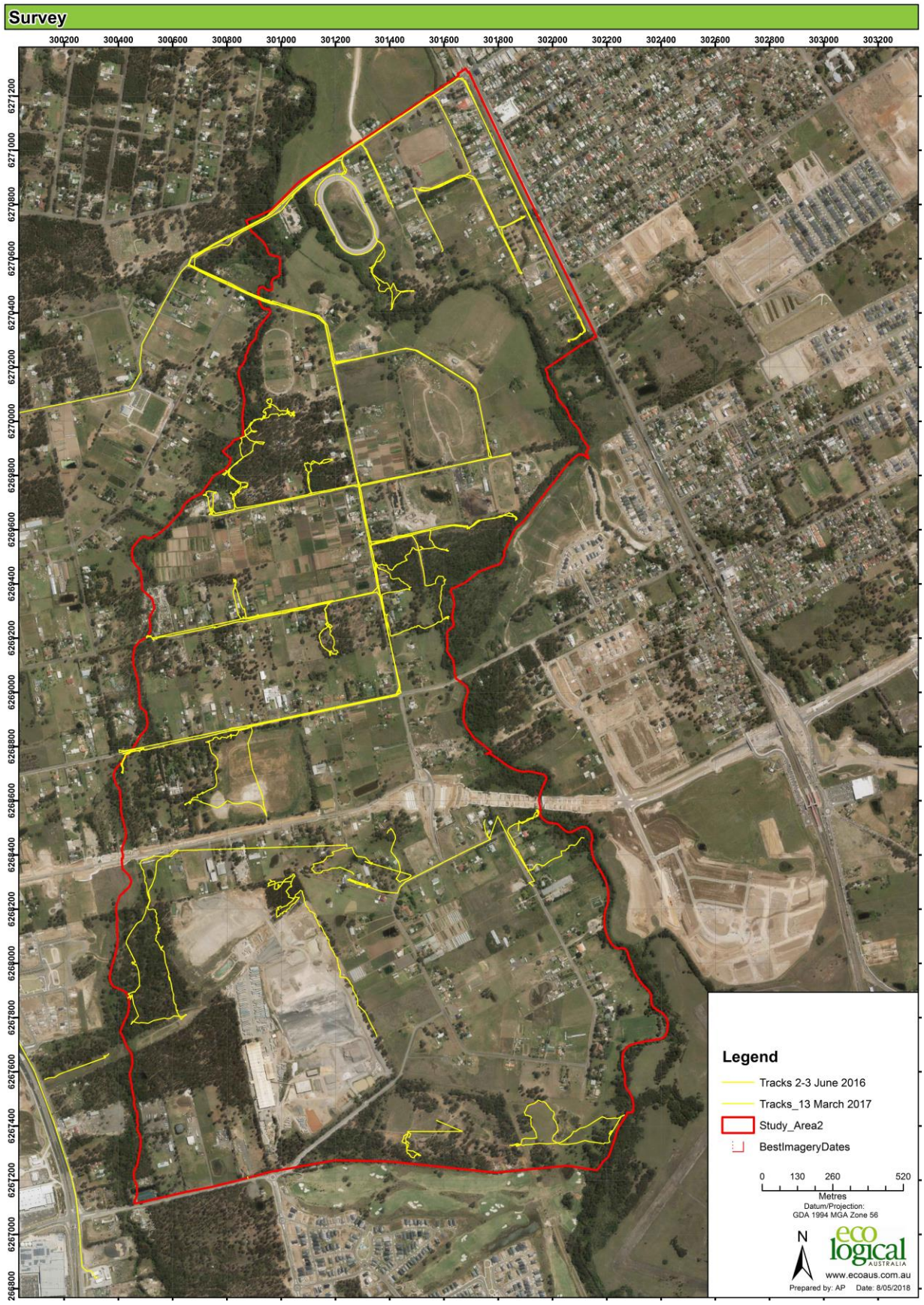
Habitat assessments and opportunistic surveys were undertaken continuously during daytime hours throughout the survey period whilst traversing suitable habitat within the study area. Any indirect evidence of fauna present was recorded including, fur, tracks, dens, scratches, and chew marks.

Reptiles and Amphibians

Opportunistic observations and habitat assessment for reptiles and amphibians were undertaken throughout the survey period.

Gastropods

Habitat assessments for *Meridolum corneovirens* (Cumberland Plain Land Snail) were undertaken throughout the survey period.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Prepared by: AP
Date: 8/05/2018

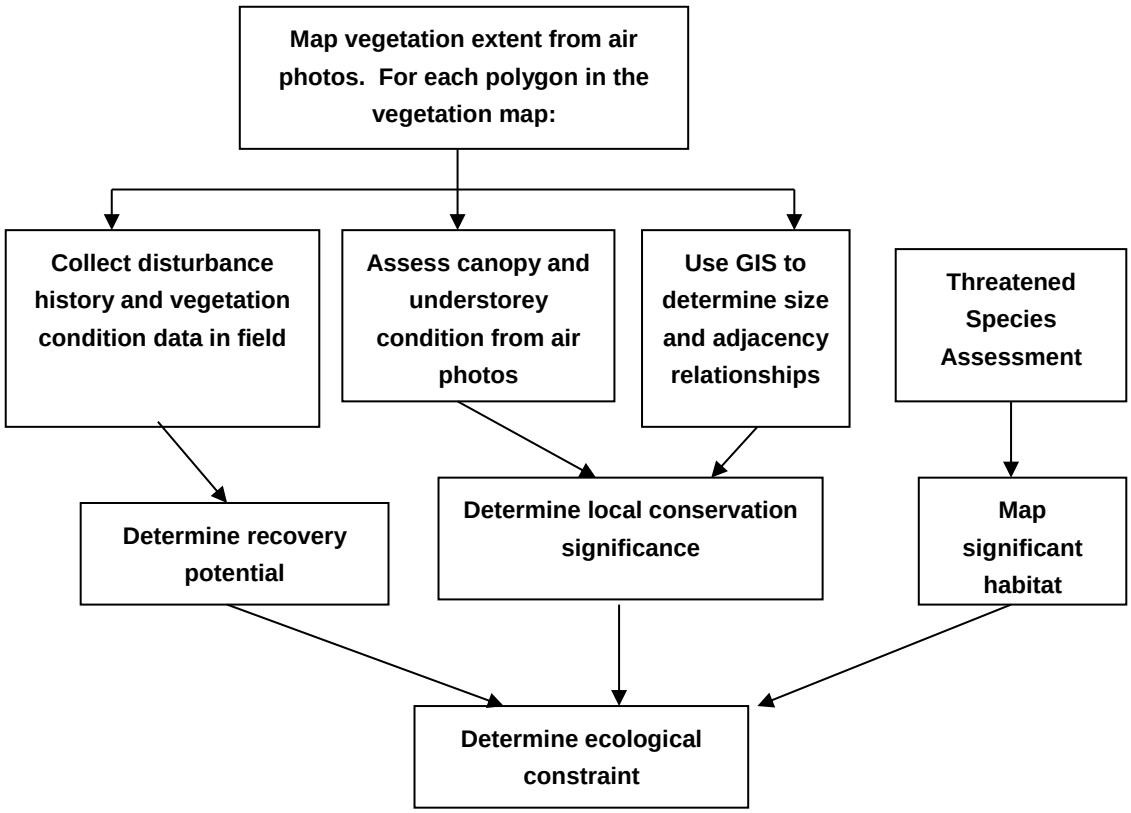
Ecological Constraints

An ecological constraints analysis, based on a methodology used elsewhere in Western Sydney (Eco Logical Australia 2003) was applied across the precinct. An ecological constraints analysis is a stepped analysis of the environmental values of an area. It provides a combined measure of ecological values, and is increasingly used as a basis for negotiations over locations, types and densities of land development. It includes measurement of:

- the conservation significance of vegetation communities (including legislative status);
- the structural condition of vegetation remnants;
- type and severity of disturbance and associated recovery potential;
- connectivity between remnants on and off site;
- the size of the vegetation remnant; and
- the value of the remnant as threatened species habitat.

The steps involved in this type of ecological constraints analysis are illustrated in the flowchart in the figure below. Vegetation mapping is combined with field survey work, threatened species assessment, recovery potential and the NPWS (2002) conservation significance assessment methodology to determine the relative level of ecological value or constraint across a site.

Ecological Constraints Flowchart



Recovery Potential

Using information collected in the field 'recovery potential' is determined for each area of vegetation. This is defined as *"...the anticipated capacity of (an) area to recover to a state representative of its condition prior to the most recent disturbance event"* (IPC & AES, 2002).

The table over the page outlines the decision rules used in this step, resulting in a ranking of High, Moderate, Low or Very Low recovery potential for each vegetation remnant.

Conservation Significance

As part of the recovery planning process for Cumberland Plain vegetation communities, NPWS (2002) have classified remnant vegetation across the Plain into significance categories to assist Councils and other land use planners in making decisions about land use. Remnant woodland and forest vegetation has been ranked as one of four categories:

- 'Core Habitat'; defined as "areas that constitute the backbone of a viable conservation network across the landscape; or areas where the endangered ecological communities are at imminent risk of extinction".
- 'Support for Core Habitat'; "areas that provide a range of support values to the Core Habitat, including increasing remnant size, buffering from edge effects, and providing corridor connections".
- 'Other Remnant Vegetation'; "all native vegetation that does not fall within the above significance categories".

These decision criteria are outlined in the tables over the page.

NPWS (2002) conservation significance attribute information was assigned to the vegetation polygons mapped within Area 20. Where the classification no longer matched, changes were made.

Threatened Species Assessment

Threatened species information and field observations of habitat value were then collated for the study area and used to determine significant threatened species habitat. Each remnant vegetation patch is classed as having either Known, Likely or Nil chance of supporting threatened species.

The following criteria were adopted for categorisation;

Known/High

- Known occurrence of threatened flora or fauna

Likely/Moderate

- Likely occurrence of threatened flora or fauna
- Known to contain hollow-bearing trees

Nil/Low

- Foraging habitat only, for wide ranging species (e.g. bats and birds with large home ranges)

Ecological Constraint

Information derived from the recovery potential, conservation significance and threatened species calculations are combined to determine ecological constraint. The tables on the following pages show the process for combining this information.

Recovery potential matrix

Source: Eco Logical Australia (2003).

Current condition and land use	Past land use and disturbance	Soil Condition	Vegetation	Recovery Potential
Cleared (no woodland canopy). Includes *Bursaria* thickets in grassland	Recently cleared (<2 years)	Unmodified or largely natural. Uncultivated.	Native dominated	High
			Exotic dominated	Moderate
		Modified. Heavily cultivated and/or pasture improved. Imported material.	Either	Low
	Historically cleared (>2 years) and consistently managed as cleared.	Unmodified or largely natural. Uncultivated.	Native dominated	Moderate
			Exotic dominated	Low
		Modified. Heavily cultivated and/or pasture improved. Imported material.	Either	Very Low
Wooded/Native Canopy present or regenerating	No recent clearing of understorey	Unmodified or largely natural. Uncultivated.	Native understorey relatively intact or in advanced state of regeneration. Native dominated.	High
			Native understorey significantly structurally modified, absent or largely absent. Includes areas dominated by African Olive.	Moderate
			Exotic dominated	*Low*
		Moderately modified by long term grazing or mowing.	*Native dominated*	*Low*
		Modified. Heavily cultivated and/or pasture improved. Imported material.	Native understorey significantly structurally modified, absent or largely absent. Includes areas dominated by African Olive.	Very Low
			Native understorey present. Heavily weed invaded.	Low
	Understorey patchily intact	*Disturbed*	*Native dominated*	*Moderate*
			Exotic dominated	*Low*
	Recent clearing of understorey and or native understorey significantly structurally modified due to existing land use (eg. Mowing, grazing)	Unmodified or largely natural. Uncultivated.	Native dominated. If no vegetation present, assume native dominated.	High
			Exotic dominated	Moderate
		Modified. Heavily cultivated and/or pasture improved. Imported material.	Native dominated	Low
			Exotic dominated	Very Low

Conservation significance matrix

Source: NSW NPWS (2002)

Community type	Condition Code	Patch Size^	Connectivity	Code	Conservation Significance
Endangered Ecological Community (Critically endangered) ("CEEC")	ABC, TX or Txr	Any	Any	C3	Core
	Txu	Any	Any	URT	Urban remnant trees (critically endangered communities)
Endangered Ecological Community ("EEC")	ABC (with Understorey in good or moderate condition)	> 10 ha	Any	C1	Core
		< 10 ha	Adjacent to C1 or CEEC	C2	Core
			Adjacent to S1	S2	Support for core
			None	O	Other remnant vegetation
	TX or Txr, ABC (with poor Understorey condition)	Any	Adjacent to any Core	S1	Support for core
			None	O	Other remnant vegetation
	Txu	Any	Any	O	Other remnant vegetation

^ Patch size is based on a 15m adjacency analysis

Decision matrix step 1:

This step combines the recovery potential and conservation significance maps (ELA 2003).

	Recovery Potential				
Conservation Significance		**High**	**Moderate**	**Low**	**Very Low**
	Core	High	High	High	High
	Support for core	High	Moderate	Moderate	Low
	Other	Moderate	Moderate	Low	Low

Decision matrix step 2:

This step combines results from the above table with the threatened species layer to determine overall ecological value (ELA 2003).

	Combined Recovery Potential and Conservation Significance (result of Table above)			
Threatened Species Assessment		**High**	**Moderate**	**Low**
	Known (High)	High	High	High
	Likely (Moderate)	High	Moderate	Moderate
	Nil (Low)	High	Moderate	Low

Appendix C: Flora and Fauna Lists

FLORA LIST

FAMILY NAME	*SCIENTIFIC NAME*	COMMON NAME
Fabaceae	*Acacia decurrens*	Sydney Wattle
Fabaceae	*Acacia falcata*	Hickory Wattle
Fabaceae	*Acacia parramattensis*	Parramatta Wattle
Polygonaceae	*Acetosa sagittata**	Turkey Rhubarb
Agavaceae	*Agave americana**	Century Plant
Alismataceae	*Alisma plantago-aquatica*	European Water-plantain
Amaranthaceae	*Amaranthus* sp.*	
Myrtaceae	*Angophora floribunda*	Rough-barked Apple
Basellaceae	*Anredera cordifolia***	Madeira-vine
Aizoaceae	*Aptenia cordifolia**	
Asclepiadaceae	*Araujia sericifera**	Moth Vine
Poaceae	*Aristida vagans*	Threeawn Speargrass
Poaceae	*Arundo donax***	Giant Reed
Asparagaceae	*Asparagus aethiopicus***	Sprenger's Asparagus Fern
Asparagaceae	*Asparagus asparagoides***	Bridal Creeper
Asparagaceae	*Asparagus virgatus***	Asparagus Fern
Poaceae	*Austrostipa ramosissima.*	Stout Bamboo Grass
Poaceae	*Avena barbata**	Slender Wild Oat
Poaceae	*Axonopus fissifolius**	Carpetgrass
Asteraceae	*Bidens bipinnata**	Bipinnate Beggar's Ticks
Asteraceae	*Bidens pilosa**	Cobblers Pegs
Pittosporaceae	*Billardiera scandens*	Apple Berry
Poaceae	*Bothriochloa decipiens*	Red Grass
Brassicaceae	*Brassica* sp.*	
Brassicaceae	*Brassicaceae* sp. *	-
Crassulaceae	*Bryophyllum delagoense***	Mother-of-millions
Pittosporaceae	*Bursaria spinosa*	Blackthorn
Asteraceae	*Calotis cuneifolia*	
Brassicaceae	*Capsella bursa-pastoris**	Shepherd's Purse
Sapindaceae	*Cardiospermum grandiflorum**	Balloon Vine
Cyperaceae	*Carex appressa*	Tall Sedge
Lauraceae	*Cassytha glabella*	Slender Devil's Twine
Casuarinaceae	*Casuarina cunninghamiana*	River Oak
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Poaceae	*Cenchrus clandestinus**	Kikuyu

FAMILY NAME	*SCIENTIFIC NAME*	COMMON NAME
Apiaceae	*Centella asiatica*	Indian Pennywort
Solanaceae	*Cestrum parqui***	Green Cestrum
Pteridaceae	*Cheilanthes sieberi*	Poison Rock Fern
Chenopodiaceae	*Chenopodium album**	Fat Hen
Poaceae	*Chloris gayana**	Rhodes Grass
Poaceae	*Chloris truncata*	Windmill Grass
Asteraceae	*Chrysanthemoides monilifera***	Boneseed
Asteraceae	Cirsium vulgare*	Spear Thistle
Ranunculaceae	*Clematis glycinoides*	Headache Vine
Commelinaceae	*Commelina cyanea*	Scurvy Weed
Asteraceae	*Conyza bonariensis**	Fleabane
Poaceae	*Cortaderia selloana***	Pampas Grass
Poaceae	*Cynodon dactylon**	Couch
Cyperaceae	*Cyperus eragrostis**	Tall Flatsedge
Poaceae	*Cyperus gracilis*	Slender Flat-sedge
Cyperaceae	*Cyperus polystachyos*	
Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea
Asteraceae	*Delairea odorata**	Cape Ivy
Phormiaceae	*Dianella longifolia*	Blueberry Lily
Convolvulaceae	*Dichondra repens*	Kidney Weed
Fabaceae	*Dillwynia sieberi*	Sieber's Parrot-pea
Fabaceae	*Dillwynia tenuifolia*	-
Sapindaceae	*Dodonaea viscosa*	Hopbush
Poaceae	*Echinopogon sp.*	-
Poaceae	*Ehrharta erecta**	Panic Veldtgrass
Chenopodiaceae	*Einadia hastata*	Berry Saltbush
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush
Cyperaceae	*Eleocharis spaculata*	
Poaceae	Eleusine indica*	
Poaceae	*Entolasia stricta*	Wiry panic
Poaceae	*Eragrostis brownii*	Brown's Lovegrass
Poaceae	*Eragrostis curvula**	African Lovegrass
Poaceae	*Eragrostis leptostachya*	Paddock Love grass
Scrophulariaceae	*Eremophila debilis*	Winter Apple
Fabaceae	*Erythrina x sykesii***	Coral Tree
Myrtaceae	*Eucalyptus amplifolia*	Cabbage Gum
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark
Myrtaceae	*Eucalyptus eugenioides*	Narrow-leaved Stringybark
Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark

FAMILY NAME	*SCIENTIFIC NAME*	COMMON NAME
Myrtaceae	*Eucalyptus longifolia*	Wollybutt
Myrtaceae	*Eucalyptus moluccana*	Grey Box
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart
Apiaceae	*Foeniculum vulgare**	Fennel
Fabaceae	*Glycine clandestina*	Twining Glycine
Fabaceae	*Glycine tabacina*	Variable Glycine
Goodeniaceae	*Goodenia hederacea*	Forest Goodenia
Proteaceae	*Grevillea juniperina* subsp. *juniperina*	Juniper-leaf Grevillea
Proteaceae	*Grevillea robusta**	Silky Oak
Fabaceae	*Hardenbergia violacea*	Purple Coral Pea
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern
Clusiaceae	*Hypericum gramineum*	Small St. Johns-wort
Clusiaceae	*Hypericum perforatum**	St Johns Wort
Asteraceae	*Hypochaeris radicata**	Catears
Fabaceae	*Indigofera australis*	Australian Indigo
Convolvulaceae	*Ipomoea purpurea**	Purple Morning Glory
Juncaceae	*Juncus* sp.	-
Juncaceae	*Juncus subsecundus*	Finger Rush
Juncaceae	*Juncus usitatus*	Common Rush
Myrtaceae	*Kunzea ambigua*	Tick Bush
Verbenaceae	*Lantana camara***	Lantana
Cyperaceae	*Lepidosperma laterale*	Variable Swordsedge
Myrtaceae	*Leptospermum parvifolium*	
Myrtaceae	*Leptospermum trinervium*	Paperbark Teatree
Oleaceae	*Ligustrum lucidum***	Large-leaved Privet
Oleaceae	*Ligustrum sinense***	Small-leaved Privet
Ericaceae	*Lissanthe strigosa*	Peach Heath
Ericaceae	*Lissanthe strigosa* subsp. *strigosa*	Native Peach
Lomandraceae	*Lomandra filiformis*	Wattle Mat-rush
Lomandraceae	*Lomandra glauca*	Pale Mat-rush
Lomandraceae	*Lomandra longiflora*	Spiny-head Matt-rush
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle
Solanaceae	*Lycium ferocissimum***	African Boxthorn
Myrtaceae	*Melaleuca decora*	White Feather Honeymyrtle-
Myrtaceae	*Melaleuca nodosa*	Prickly-leaved Paperbark
Myrtaceae	*Melaleuca sieberi*	Sieber's Paperbark
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Paperbark

FAMILY NAME	*SCIENTIFIC NAME*	COMMON NAME
Meliaceae	*Melia azedarach*	White Cedar
Poaceae	*Microlaena stipoides*	Weeping Grass
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow
Moraceae	*Morus alba**	White Mulberry
Oleaceae	*Olea europaea* subsp. *cuspidata***	African Olive
Poaceae	*Oplismenus aemulus*	Basket Grass
Cactaceae	*Opuntia* sp.*	-
Cactaceae	*Opuntia stricta***	Prickly Pear
Oxalidaceae	*Oxalis perennans*	-
Poaceae	*Panicum simile*	Hairy panic
Poaceae	*Paspalidium distans*	-
Poaceae	*Paspalum dilatatum**	Paspalum
Passifloraceae	*Passiflora sp.**	
Malvaceae	*Pavonia hastata**	Pink Pavonia
Polygonaceae	*Persicaria* sp.	-
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme Spurge
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues
Portulacaceae	*Portulaca oleracea**	Pigsweed
Campanulaceae	*Pratia purpurascens*	White Root
Fabaceae	*Pultenaea microphylla*	-
Euphorbiaceae	*Ricinus communis**	Castor-oil-plant
Rosaceae	*Rubus fruticosus***	Blackberry
Polygonaceae	*Rumex crispus**	Wild Dock
Polygonaceae	*Rumex obtusifolius **	Broad-leaved Dock
Salicaceae	*Salix sp.***	
Anacardiaceae	*Schinus areira**	Pepper Tree
Asteraceae	*Senecio madagascariensis***	Fireweed
Fabaceae Caesalpinioideae	*Senna pendula* var. *glabrata**	
Poaceae	*Setaria parviflora**	-
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Solanaceae	*Solanum mauritianum**	Wild Tobacco
Solanaceae	*Solanum pseudocapsicum**	Madeira Winter Cherry
Solanaceae	*Solanum seaforthianum**	Brazilian Nightshade
Asteraceae	*Sonchus* sp.*	
Poaceae	*Sorghum halepense**	Johnson grass
Poaceae	*Sporobolus africanus**	Parramatta Grass
Poaceae	*Themeda australis*	Kangaroo Grass
Commelinaceae	*Tradescantia fluminensis**	Wandering Jew
Euphorbiaceae	*Triadica sebifera**	Chinese Tallowood

FAMILY NAME	*SCIENTIFIC NAME*	COMMON NAME
Anthericaceae	*Tricoryne elatior*	Yellow Autumn-lily
Fabaceae	*Trifolium fragiferum**	Strawberry Clover
Typhaceae	*Typha* sp.	-
Hydrocharitaceae	*Vallisneria australis*	Ribbonweed
Verbenaceae	*Verbena bonariensis**	Purpletop
Asteraceae	*Vernonia cinerea*	
Apocynaceae	*Vinca major**	Blue Periwinkle
Asphodelaceae	*Xanthorrhoea* sp.	-

* exotic

** Noxious or Weed of National Significance

FAUNA LIST

SCIENTIFIC NAME	COMMON NAME	STATUS
Aves		
Acanthorhynchus tenuirostris	Eastern Spinebill	N
Acridotheres tristis	Common Myna	E
Anas superciliosa	Pacific Black Duck	N
Anthochaera chrysoptera	Little Wattlebird	N
Ardea ibis	Cattle Egret	N, Mi
Ardea modesta	Eastern Great Egret	N; Ma
Ardea pacifica	White-necked Heron	N
Aviceda subcristata	Pacific Baza	N
Cacatua galerita	Sulphur-crested Cockatoo	N
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	N
Chenonetta jubata	Australian Wood Duck	N
Cisticola exilis	Golden-headed cisticola	N
Columba leucomela	White –headed pigeon	N
Columba livia	Rock Dove	E
Corvus coronoides	Australian Raven	N
Cracticus nigrogularis	Pied Butcherbird	N
Dacelo novaeguineae	Kookaburra	N
Egretta novaehollandiae	White-faced Heron	N
Eolophus roseicapilla	Galah	N
Falco berigora	Brown Falcon	N
Gallinula tenebrosa	Dusky Moorhen	N
Geopelia striata	Peaceful Dove	N
Glossopsitta concinna	Musk Lorikeet	N
Grallina cyanoleuca	Magpie-lark	N
Gymnorhina tibicen	Australian Magpie	N
Hirundo neoxena	Welcome Swallow	N
Malurus cyaneus	Superb Fairy-wren	N
Manorina melanocephala	Noisy Miner	N
Manorina melanophrys	Bell Miner	N
Microcarbo melanoleucos	Little Pied Cormorant	N
Myiagra inquieta	Restless Flycatcher	N
Neochmia temporalis	Red-browed Finch	N
Ocyphaps lophotes	Crested Pigeon	N
Oriolus sagittatus	Olive-backed Oriole	N

SCIENTIFIC NAME	COMMON NAME	STATUS
Pardalotus punctatus	Spotted Pardalote	N
Phalacrocorax sulcirostris	Black Cormorant	N
Platycercus eximius	Eastern Rosella	N
Porphyrio porphyrio	Purple Swamphen	N
Psephotus haematonotus	Red-rumped Parrot	N
Rhipidura albiscapa	Grey Fantail	N
Rhipidura leucophrys	Willie Wagtail	N
Strepera graculina	Pied Currawong	N
Streptopelia chinensis	Spotted Dove	E
Sturnus vulgaris	Common Starling	E
Taeniopygia guttata	Zebra Finch	N
Threskiornis moluccus	Australian White Ibis	N
Threskiornis spinicollis	Straw necked Ibis	N
Trichoglossus haematodus	Rainbow Lorikeet	N
Turdus merula	Common Blackbird	E
Vanellus miles	Masked Lapwing	N
Zosterops lateralis	Silvereye	N
Fish		
Cyprinus carpio	Carp	E
Reptiles		
Eulamprus quoyii	Eastern Water Skink	N
Amphibians		
Crinia signifera	Eastern Common Froglet	N
Limnodynastes peronii	Striped Marsh Frog	N
Litoria dentata	Bleating Tree Frog	N
Litoria fallax	Eastern Dwarf Tree Frog	N
Mammals		
Deer sp.	Deer scats	E
Oryctolagus cuniculus	European Rabbit	E
Vulpes vulpes	European Fox	E

E=Exotic, N=Native, Mi=Migratory under EPBC Act, Ma=Marine under EPBC Act

Appendix D: Likelihood of Occurrence Table

FLORA

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Recorded in field survey
Dillwynia tenuifolia		V	-	Dillwynia tenuifolia has a core distribution within the Cumberland Plain, where it may be locally abundant within scrubby, dry heath areas within Castlereagh Ironbark Forest and Shale/Gravel Transition Forest on tertiary alluvium or laterised clays. It may also be common in the ecotone between these areas and Castlereagh Scribbly Gum Woodland.	Likely	**Yes**
Grevillea juniperina subsp. *juniperina*		V	-	Restricted to red sandy to clay soils – often lateritic on Wianamatta Shale and Tertiary alluvium in Cumberland Plain Woodland and Castlereagh Woodland. Confined to Western Sydney and known within the area bounded approximately by St Marys, Londonderry and Prospect (*ibid.*).	Likely	**Yes**
Marsdenia viridiflora var. *viridiflora*	*Marsdenia viridiflora* R. Br. subsp. *viridiflora* endangered population	E2	-	A twining climber to 4 m high. Grows in vine thickets and open shale woodland. Recorded from western Sydney (Prospect, Bankstown, Smithfield, Cabramatta Creek, St Marys), and Razorback Range. Known from the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	Potential – nearby records	No
Micromyrtus minutiflora		E	V	Micromyrtus minutiflora is restricted to the area between Richmond and Penrith in western Sydney on the Central Coast. It grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, and open forest on tertiary alluvium and consolidated river sediments.	Potential – nearby records	No
Pimelea curviflora var *curviflora*		V	V	Occurs in woodlands on ridgetops and slopes, on shale/lateritic soils over sandstone or shale/sandstone transition soils. Previous records are concentrated around the Parramatta River and Illawarra coastal plains. Inconspicuous, fire-tolerant species that flowers October to May.	Unlikely – site does not support associated vegetation community	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Recorded in field survey
Pimelea spicata		E	E	In western Sydney, it occurs on an undulating topography of well structured clay soils, derived from Wianamatta shale. Associated with 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.*). Recorded from open woodlands and grasslands dominated by *Eucalyptus moluccana*, *E. crebra, E. tereticornis, Bursaria spinosa* and *Themeda triandra* and in the Illawarra occurs on clay soils on coastal headland in *Themeda triandra* grassland with low native shrubs present.	Potential	No
Pterostylis gibbosa	Illawarra Greenhood	E	E	All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. Existing populations are known from the Hunter, Illawarra and Shoalhaven regions. The Illawarra Greenhood is a deciduous orchid that is only visible above the ground between late summer and spring, and only when soil moisture levels can sustain its growth. The leaf rosette grows from an underground tuber in late summer, followed by the flower stem in winter and flowers in spring.	Unlikely – likely locally extinct on Cumberland Plain.	No
Pterostylis saxicola		E	E	Terrestrial orchid predominantly found in Hawkesbury Sandstone Gully Forest growing in small pockets of soil that have formed in depressions in sandstone rock shelves. Known from Georges River National Park, Ingleburn, Holsworthy, Peter Meadows Creek, St Marys Tower.	Unlikely – site does not support typical geology	No
Pultenaea parviflora		E	V	May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest, Shale Gravel Transition Forest on tertiary alluvium or laterised clays and Castlereagh Scribbly Gum Woodland (DEC 2005). .Often found in association with other threatened species such as *Dillwynia tenuifolia, Dodonaea falcata, Grevillea juniperina, Micromyrtus minutiflora, Persoonia nutans* and *Styphelia laeta* (*ibid.*). Flowering may occur between August and November (*ibid.*).	Potential – nearby records	No
Streblus pendulinus	Siah's Backbone	-	E	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	Unlikely – site does not support habitat	No
Tetratheca glandulosa	Glandular Pink-bell	V	V	Associated with ridgetop woodland habits on yellow earths also in sandy or rocky heath and scrub. Often associated with sandstone / shale interface where soils have a stronger clay influence. Flowers July to November.	Unlikely – site does not support typical soils/geology	No

FAUNA

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Recorded in field survey
FISH						
Archaeophya adamsi	Adam's Emerald Dragonfly	E (FM Act)	-	Adam's emerald dragonflies are one of Australia's rarest dragonflies. The species is only known from a few sites in the greater Sydney region. Larvae have been found in small creeks with gravel or sandy bottoms, in narrow, shaded riffle zones with moss and rich riparian vegetation (NSW Department of Primary Industries, 2016).	None – no suitable habitat	No
Macquarie australasica	Macquarie Perch	E (listed in NSW under FM Act)	E	Habitat for the Macquarie perch is bottom or mid-water in slow-flowing rivers with deep rocky 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.	None – no suitable habitat	No
Prototroctes maraena	Australian Grayling	E (listed in NSW under FM Act)	V	Historically, this species occurred in coastal streams from the Grose River southwards through NSW, Vic. and Tas. On mainland Australia, this species has been recorded from rivers flowing east and south of the main dividing ranges. This species spends only part of its lifecycle in freshwater, mainly inhabiting clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops but has also been found in muddy-bottomed, heavily silted habitat. Grayling migrate between freshwater streams and the ocean and as such it is generally accepted to be a diadromous (migratory between fresh and salt waters) species.	None – no suitable habitat	No
FROGS						
Heleioporus australiacus	Giant Burrowing Frog	V	V	Forages in woodlands, wet heath, dry and wet sclerophyll forest. Associated with semi-permanent to ephemeral sand or rock based streams, where the soil is soft and sandy so that burrows can be constructed.	None – no suitable habitat	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Recorded in field survey
Litoria aurea	Green and Golden Bell Frog	E	V	Uses a variety of natural and man-made waterbodies 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. Fast flowing streams are not used for breeding. Preferable habitat includes shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading. Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes and spikerushes) adjacent to open grassland areas for foraging are preferable. Typically requires ponds free from predatory fish such as Mosquito Fish (*Gambusia holbrooki*).	Potential	No – however, potential habitat available within dams and creeklines
Litoria littlejohni	Littlejohn's Tree Frog	V	V	Plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest south to Buchan in Victoria. The species has not been recorded in southern NSW within the last decade. "Breeding habitat is the upper reaches of permanent streams and perched swamps. Non-breeding habitat is heath-based forests and woodlands	No	No
Litoria raniformis	Southern Bell Frog	E	V	In NSW, only exists in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. A few recent unconfirmed records have also been made in the Murray Irrigation Area.	No	No
Mixophyes iteratus	Giant Barred Frog	E	E	Coast and ranges from Eumundi in south-east Qld to Warrimoo in the Blue Mountains. "Freshwater permanent/semi-permanent streams, generally at lower elevation. Riparian rainforest or wet sclerophyll forest is favoured. "	No	No
REPTILES						
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200m of escarpments in summer.	None – no suitable habitat	No
BIRDS						
Anthochaera phrygia (aka *Xanthomyza phrygia)*	Regent Honeyeater	CE	E & M	Inhabits temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts (such as *E. fibrosa*, *E. albens* and *E. melliodora*) and mistletoes, and riparian forests of *Casuarina cunninghamiana* and *E. robusta* in coastal areas.	Potential – could feed on lerp-affected Eucalypts	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Recorded in field survey
Botaurus poiciloptilus	Australasian Bittern	V	E	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats. Reedbeds, swamps, streams, estuaries .	Unlikely – site does not support required habitat	No
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. Intact drier forest types with less rugged landscapes are preferred. Nests in large trees with large hollows.	Potential	No Limited habitat available
Chthonicola sagittatus	Speckled Warbler	V	-	Occupies a wide range of eucalypt dominated communities with a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding.	Potential	No
Cirsus assimilis	Spotted Harrier	V	-	It occurs throughout the Australian mainland, except in densly forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands .	Potential – may forage along the river	No
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	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Recorded in field survey
Glossopsitta pusilla	Little Lorikeet	V	-	In NSW 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 *melaleuca* and mistletoes. On the western slopes and tablelands *Eucalyptus albens* and *E*. *melliodora* are particularly important food sources for pollen and nectar respectively.	Potential recorded recently within 1km	No
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. 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*).	Potential – four records within 5km	No – forgaging habitat recorded
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Predominantly associated with box-ironbark association woodlands and River Red Gum. Also associated with drier coastal woodlands of the Cumberland Plain and the Hunter, Richmond and Clarence Valleys.	Potential	No
Oxyura australis	Blue-billed Duck	V	-	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached. Blue-billed Ducks are partly migratory, with short-distance movements between breeding swamps and over-wintering lakes with some long-distance dispersal to breed during spring and early summer. Young birds disperse in April-May from their breeding swamps in inland NSW to non-breeding areas on the Murray River system and coastal lakes .	Potential	No – potential habitat was found within the study area

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Recorded in field survey
Pyrrholaemus sagittatus	Speckled Warbler	V	-	Occupies a wide range of eucalypt dominated communities with a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding.	Potential – 4 records within 5km	No – required habitat not available on site
Rostratula australis (a.k.a. R. benghalensis)	Painted Snipe (Australian subspecies)	E	V	Utilises wet areas with grasses, lignum, low scrub or open timber, including shallow terrestrial wetlands, lakes, swamps, claypans, waterlogged grassland or saltmarsh, dams, rice crops, sewage farms etc. Builds sparse ground nest, in shallow wetlands with areas of bare wet mud with shrubs and trees nearby, Breeding can occur year-round, and is often in response to local conditions; most often between August and February. Roosts during the day in dense vegetation. Forages nocturnally on mud-flats and in shallow water on vegetation, seeds, insects, worms, molluscs, crustaceans and other invertebrates.	Unlikely	No – required habitat not available on site
MAMMALS (EXCLUDING BATS)						
Dasyurus maculatus *Dasyurus maculatus maculatus*	Spotted-tailed Quoll Spotted-tailed Quoll (SE Mainland Population)	V -	- E	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests, more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in. Maternal den sites are logs with cryptic entrances, rock outcrops,burrows & tree hollows.	Unlikely	No – required habitat not available on site
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.	Unlikely	No – required habitat not on site
Phascolarctos cinereus	Koala	V-E2	-	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70%, with acceptable Eucalypt food trees. *Eucalyptus tereticornis* is one of the Koala's preferred browsing species.	Unlikely – despite nearby recordings	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Recorded in field survey
Potorous tridactylus *Potorous tridactylus tridactylus*	Long-nosed Potoroo Long-nosed Potoroo (SE Mainland Population)	V -	- V	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	Unlikely	No – required habitat not available on site
Pseudomys novaehollandiae	New Holland Mouse	-	V	Recorded as disjunct populations from Queensland to Tasmania,. Habitat include heathland, open woodland with heathy understorey, and vegetated sand dunes, and the home range varies from 0.44 ha to 1.4 ha. This nocturnal species is social and usually shares a burrow with other individuals. Relatively little is known about habitat preferences, and many vegetation types appear to provide habitat, but soil conditions do need to be suitable for burrowing and growth of hypogeal fungi is likely to be a key diet component.	Unlikely	No – required habitat not available on site
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. This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces.	Potential – known to occur within 1km	No
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Prefers moist habitats with trees taller than 20m. Roosts in tree hollows but has also been found roosting in buildings or under loose bark.	Potential – known to occur within 1 km.	No
Miniopterus australis	Little Bent-wing Bat	V	-	Prefers well-timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. This species shelter in a range of structures including culverts, drains, mines and caves. Relatively large areas of dense vegetation of either wet sclerophyll forest, rainforest or dense coastal banksia scrub are usually found adjacent to caves in which this species is found. Breeding occurs in caves, usually in association with *M. schreibersii*.	Potential	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Recorded in field survey
Mormopterus norfolkensis	Eastern Freetail Bat	V	-	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range. Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges. Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut.	Potential – known to occur within 1km	No
Myotis macropus	Southern Myotis, Large-footed Myotis	V	-	Rarely recorded more than 100 km inland, this species forages over streams and pools and utilises a range of habitats from small creeks to large lakes and mangrove lined estuaries. Generally roosts close to waterbodies in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.	Potential – known to occur within 1km	No
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. Camps are often located in gullies, typically close to water, in vegetation with a dense canopy.	Potential – known to occur within 1km	No
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Found in almost all habitats, from wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies. Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock and in abandoned sugar glider nests. The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats.	Potential – known to occur within 1km	No
INVERTEBRATES						
Meridolum corneovirens	Cumberland (Large) Land Snail	E	-	Associated with open eucalypt forests, particularly Cumberland Plain Woodland. Found under fallen logs, debris and in bark and leaf litter around the trunk of gum trees or burrowing in loose soil around clumps of grass. Urban waste may also form suitable habitat.	Potential – known to occur within 1km	No
MIGRATORY TERRESTRIAL SPECIES LISTED UNDER EPBC ACT						
Apus pacificus	Fork-tailed Swift	-	M	Aerial species, recorded over open country, from semi-deserts to coasts, sometimes forests and cities.	Potential	No –may fly over the site

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Recorded in field survey
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas. 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.	Unlikely	No – required habitat not available on site
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.	Potential	No – may fly over the site
Merops ornatus	Rainbow Bee-eater	-	M	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May. Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs (*ibid*). Nest is a chamber a the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting (*ibid*).	Unlikely	No – required habitat not available on site
Monarcha melanopsis	Black-faced Monarch	-	M	Rainforest and eucalypt forests, feeding in tangled understorey (Blakers et al. 1984). May also be found in coastal scrub or damp gullies, and during migration, more open woodland habitats. Breeding migrant that arrives in coastal south-eastern Australia in September and returns north in March.	Unlikely	No – required habitat not available on site
Myiagra cyanoleuca	Satin Flycatcher	-	M	Associated with eucalypt forests, often near wetlands or watercourses but absent from rainforests; occurs in open forests, often at height. Breed above 600m asl during Nov-Jan, and migrate north for winter.	Unlikely	No – required habitat not available on site
Rhipidura rufifrons	Rufous Fantail	-	M	The Rufous Fantail is a summer breeding migrant to southeastern Australia. The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation. Open country may be used by the Rufous Fantail during migration.	Unlikely	No – required habitat not available on site

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Recorded in field survey
MIGRATORY WETLAND SPECIES LISTED UNDER EPBC ACT						
Ardea alba	Great Egret	-	M	The Great Egret is common and widespread in Australia. It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats.	Potential	**Yes**
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. 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.	Known	**Yes**
Gallinago hardwickii	Latham's Snipe	-	M	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover. Occupies a variety of vegetation around wetlands including wetland grasses and open wooded swamps.	Unlikely	No – required habitat not available on site
Rostratula benghalensis (a.k.a. R. australis)	Painted Snipe	-	M	See: *Rostratula australis*	-	-

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ISO 14001 Environmental Management

AS/NZS 4801:2001 Occupational Health and Safety Management

ISO 9001 Quality Management

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