EXHIBITION DRAFT

BROADER WESTERN SYDNEY EMPLOYMENT AREA

Biodiversity and Riparian Assessment

Prepared for
NSW Department of Planning and Infrastructure

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Abbreviations

ABBREVIATION	DESCRIPTION
BWSEA	Broader Western Sydney Employment Area
CEEC	Critically Endangered Ecological Community
CPW	Cumberland Plain Woodland
DoPI	Department of Planning and Infrastructure
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
EEC	Endangered Ecological Community
ELA	Eco Logical Australia
ENV	Existing Native Vegetation
EPBC	Environment Protection and Biodiversity Conservation Act
NES	Matters of National Environmental Significance
OEH	Office of Environment and Heritage
RC	Riparian Corridor
SEPP	State Environmental Planning Policy
TSC	Threatened Species Conservation Act
VRZ	Vegetated Riparian Zone

1 Introduction

1.1 DESCRIPTION OF PROJECT

Eco Logical Australia Pty Ltd (ELA) was engaged by (DoPI) to undertake a desktop biodiversity and riparian corridors assessment of approximately 10,800 ha that forms the Broader Western Sydney Employment Area (BWSEA). The aim of this assessment is to identify key ecological and riparian constraints to assist in the preparation of a Structure Plan for the area.

The desktop biodiversity assessment and baseline situation was to cover:

- An audit of existing ecological databases;
- Review background information, previous studies and GIS documentation;
- Document the extent of survey work undertaken, any site specific surveys undertaken for threatened species and endangered ecological communities, mapping of remnant Existing Native Vegetation on and adjacent to the site to the site, the classification of these assemblages and possible vegetation links;
- Identify any species, populations or ecological communities listed under the Threatened Species Conservation Act 1995. The Commonwealth Environmental Protection and Biodiversity Conservation Act 1999, or the Fisheries Management Act 1994;
- Identify local and regional habitat linkages through analysis of aerial photographs; identify any areas within the study area targeted for further investigation through field survey.

The desktop riparian assessment was to cover:

- Obtain the location of hydrolines from NSW Office of Water
- Allocate Strahler stream order to individual reaches to determine their value; and
- Using NSW Office of Water Guidelines determine appropriate buffers around streams

1.2 STUDY AREA

The BWSEA is shown in Figure 1 and includes parts of four Local Government Areas: Liverpool, Penrith, Fairfield and Blacktown.

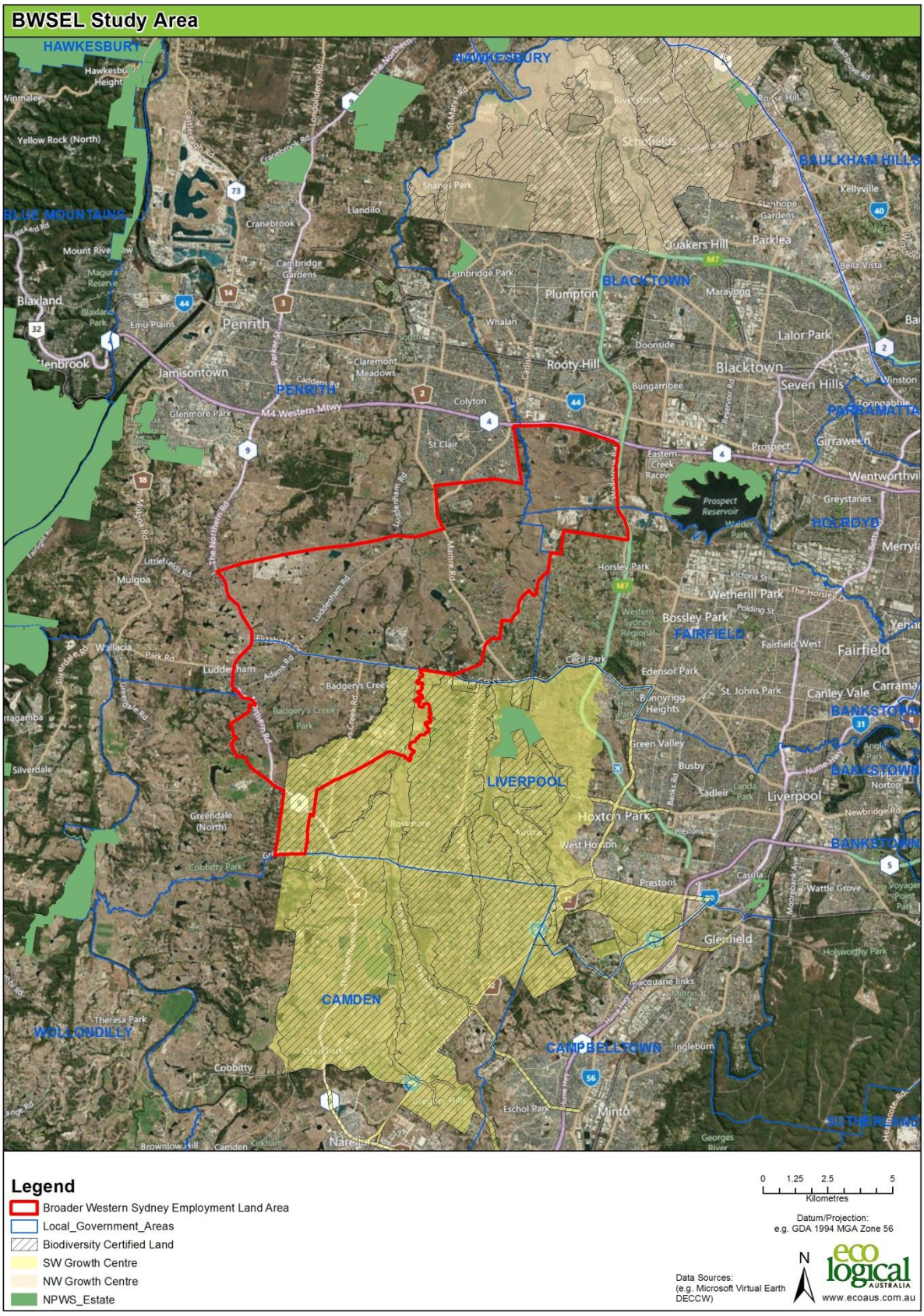


Figure 1: Study Area

2 Planning Framework

A substantial array of legislation, policies and guidelines apply to the assessment, planning and management of biodiversity values within the BWSEA. This information was reviewed and will be used to identify priority constraints and opportunities within the study area.

2.1 COMMONWEALTH LEGISLATION

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. Such assessments are not required if the activity is undertaken in accordance with an approved Strategic Assessment – such as applies to the southern portion of the study area.

2.2 STATE LEGISLATION

Threatened Species Conservation Act 1995 (TSC Act)

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The TSC 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 TSC 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 of an area if the Minister is satisfied that outcomes in a Biodiversity Certification Strategy will lead to the overall improvement or maintenance of biodiversity values – typically at a landscape scale. The effect of granting certification is that any development or activity (under Part 4 and 5 of the EP&A Act respectively) is taken to be 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).

The southern portion of the site is biodiversity certified **(Figure 2**). Urban development within this area will not require assessment of impacts to threatened species at the Development Application stage.

State Environmental Planning Policy (Sydney Region Growth Centres) 2006

The Growth Centres State Environmental Planning Policy (SEPP) under the EP&A Act establishes zoning and other development controls for lands within the Growth Centres. The south eastern portion of the study area that falls within the South West Growth Centre is therefore subject to this SEPP. The SEPP has zoned land as Environment Conservation under Part 3 of the SEPP and contains development controls relating to vegetation removal. The entire portion of land within the BWSEA that also falls within the Growth Centres is biodiversity certified (see effect of biodiversity certification above).

State Environmental planning policy (Western Sydney Employment Lands)

The WSEA SEPP aims to promote economic development on designated land in western Sydney as well as conserve and rehabilitate areas that have high biodiversity or heritage or cultural values, particularly areas of remnant vegetation. The SEPP zones the land to either E2 Environmental Conservation or IN1 General Industrial.

Water Management Act 2000

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.

If a 'controlled activity' is proposed on 'waterfront land', an approval is required under the Water Management Act (s91). Waterfront land is that land within 40m of a river, wetland, lake etc and is measured from the top of the bank. The NSW Office of Water have released *Guidelines for Riparian corridors on waterfront land* (2012) that establishes recommended buffer widths for watercourses depending on their Strahler classification.

Fisheries Management Act 1994

The FM Act aims to (among other things) conserve fish stocks and key fish habitats; and conserve threatened species, populations and ecological communities of fish and marine vegetation. When assessing the environmental impacts of development or activities (under Part 4 or 5 of the EP&A Act) an assessment is required to be made whether that activity will have an impact on such species, populations or endangered communities. The biodiversity certification under the TSC Act does not apply to species listed under the FM Act

2.3 LOCAL PLANNING INSTRUMENTS

Four Local Environmental Plans under the EP&A Act apply to the study area. Two of these have specific clauses relating to the protection of biodiversity and riparian values. Penrith LEP 2010 has two clauses (6.4 Natural Resource Sensitive Land and 6.5 Scenic and Landscape Values) that require the consent authority to consider specific environmental objectives when assessing development applications. Liverpool LEP 2008 has a similar clause (7.6 Environmentally Sensitive Land). These clauses and maps do not however alter the underlying zoning of the land. See **Figure 2**.

Blacktown LEP 1988 and Fairfield LEP 1994 do not have any specific clauses for biodiversity or riparian protection that apply within the study area.

2.4 OTHER PLANS AND STRATEGIES

Table 1 identifies strategic plans with a particular focus on biodiversity conservation. Where the plans include maps identifying biodiversity conservation priorities, maps have been included in Appendix B of this report. Each of the local government areas have prepared biodiversity strategies that provide a conservation significance assessment of the biodiversity in the LGA and then have management recommendations that focus on:

- Improving biodiversity protection in the planning scheme through the use of zoning, biodiversity overlays generally do three things:
- Provide a conservation significance assessment of the LGA
- Priorities for management of public lands
- Priorities for private land conservation
- Public education

Table 1 Biodiversity Plans

Strategy	Author	Relevant content
Cumberland Plain Recovery Plan	**DECCW, 2010**	This is an approved recovery plan under the TSC Act 1995. The plan was prepared in response to the pressures of urban development on the Cumberland Plain of which 13% of the original extent remains. The plan has four key objectives: 1. To build a protected areas network, comprising public and private lands, focussed on the priority conservation lands 2. To deliver best practice management for threatened species, populations and ecological communities across the Cumberland Plain, with a specific focus on the priority conservation lands and public lands where primary management objectives are compatible with conservation 3. To develop an understanding and enhanced awareness in the community of the Cumberland Plain's threatened biodiversity, the best practice standards for its management, and the recovery program 4. To increase knowledge of the threats to the survival of the Cumberland Plain's threatened species, populations and ecological communities, and thereby improve capacity to manage these in a strategic and effective manner The emphasis on priority conservation lands is clearly stated in the strategy. These areas have been mapped and are shown in **Figure 5.** The methodology for identifying priority conservation areas is further detailed in DECCW (2010)

Strategy	Author	Relevant content
Hawkesbury Nepean Catchment Action Plan	HN CMA	HN CMA has mapped regional corridors and priority fauna habitats which align with the priority conservation areas identified in the Cumberland Plain Recovery Plan. The map also recognises the importance of riparian areas in providing corridor linkages.
Draft Fairfield Biodiversity Strategy	FCC 2010	The Draft Fairfield Biodiversity Strategy contains a conservation significance assessment that is based on the methodology used for this report (see section 3.2 below). Areas of high, moderate and low conservation value are generally consistent with the conservation significance assessment undertaken for this report.
Blacktown Biodiversity Strategy	BCC 2011	The Blacktown Biodiversity Strategy contains a conservation significance assessment that is based on the methodology used for this report (see section 3.2 below). It also contains a map of Regional Corridor Potential which is provided in the appendix of this report. The areas of corridor potential roughly align with the areas identified as having high conservation value in this report.
Penrith Biodiversity Strategy	PCC 2004	The Penrith Biodiversity Strategy contains actions such as identifying and protecting ecosystems, managing threatening processes, improving knowledge and community involvement. The Strategy mapping of conservation priorities is an action to be undertaken, so the strategy itself does not contain such maps.
Liverpool Biodiversity Strategy	LCC 2003	The Liverpool Biodiversity Strategy includes a conservation significance assessment that is similar to the methodology used for this report. In terms of regional connectivity, the strategy recognises the importance of the Western Sydney Parklands which falls outside of the BWSEL study area.

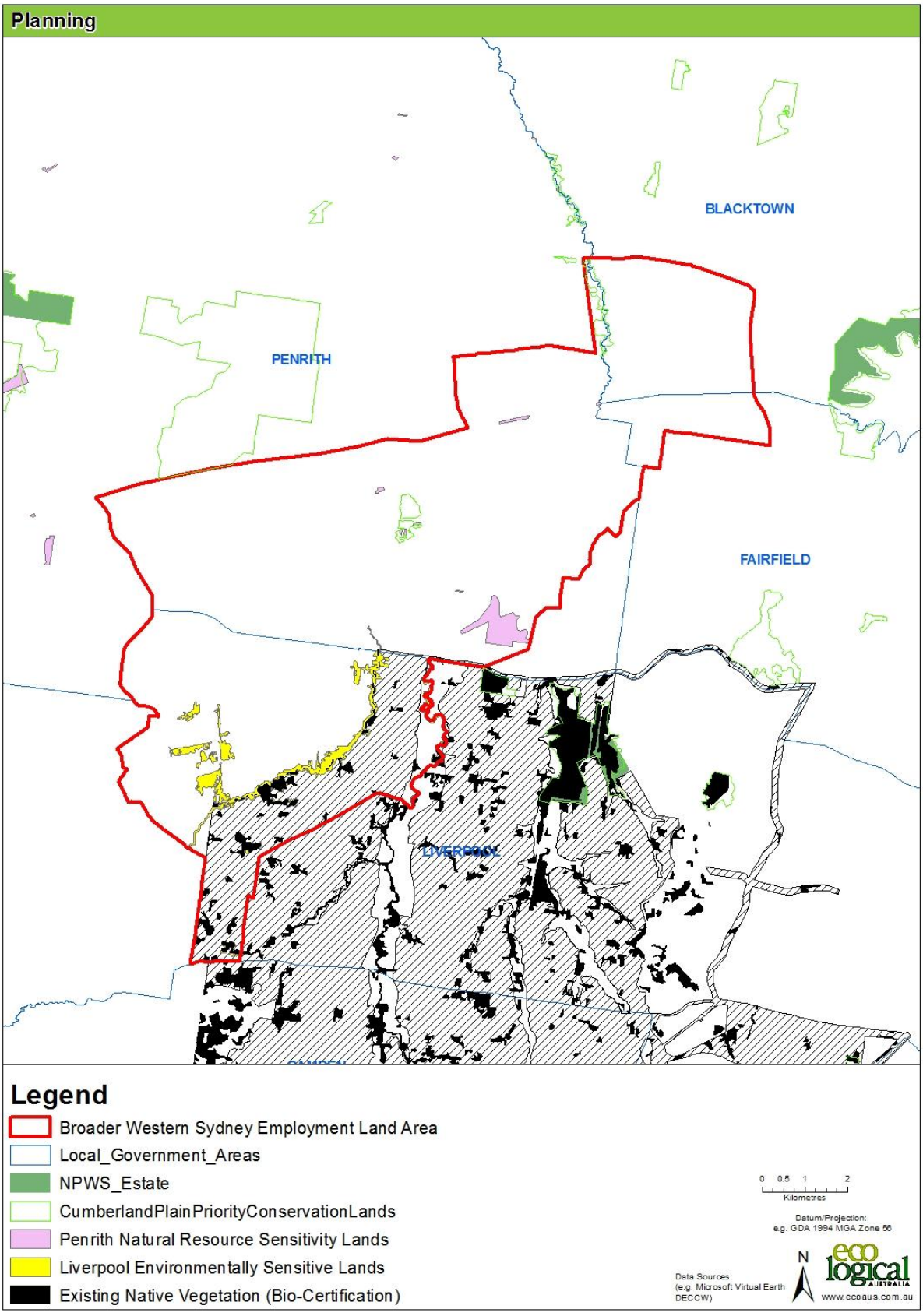


Figure 2 Planning instruments

3 Terrestrial Biodiversity Assessment

3.1 LITERATURE REVIEW AND DATA AUDIT

A data audit was also undertaken to determine the location and extent of previous surveys, identify the constraints within the study area and evaluate the presence of any threatened species, populations and ecological communities listed under the TSC Act and the Commonwealth EPBC Act that could potentially occur within the study area.

An audit of the currently available biodiversity data covering the study area was carried out and is summarised in **Table 2**. This information was primarily limited to vegetation mapping and its associated condition assessment as well as recorded and databased sightings of flora and fauna.

Vegetation mapping within the area is based on a regional mapping exercise carried out by the (then) NSW National Parks and Wildlife Service (2002a). This information has been recognised and accepted as the most consistent and complete definition for vegetation and its distribution in western Sydney; and it is this data set which is modified and built on by more localised assessments in western Sydney.

The available mapping includes limited site validation as part of the original mapping exercise which was carried out in the late 1990's/early 2000's across the whole of western Sydney. A total of 6 validation sites from the original assessment were located within the study area to validate vegetation community and assessed condition, which is limited to an indication of disturbance based on the canopy cover of the mapped vegetation patches and influence of disturbance (eg. Rural, urban etc). The vegetation and condition attributes are described in more detail in Appendix A and NPWS (2002a & b).

This level of data and attribution is adequate for regional level assessments, providing a landscape approach for the identification of overall constraints and allow targeting of key areas of significant biodiversity or hotspots which may require further detailed assessment for validation.

The flora and fauna records database is managed by the Office of Environment and Heritage as the Atlas of NSW Wildlife (Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the Threatened Species Conservation Act) and some fish. The Department of Primary Industries (Fisheries and Aquaculture) web-based Records Viewer was searched however no records within the four LGAs were identified.

Table 2 Biodiversity data

Name of dataset (Custodian/Reference)	Attributes / limitations	Coverage	Currency
NSW Wildlife Atlas (OEH)	Threatened flora and fauna species records	NSW	2013 (records are of variable ages)
Western Sydney Vegetation Mapping (NPWS2002a)	Vegetation community	Cumberland Plain	Boundaries derived from aerial photos dated from 1998 - 2001
Western Sydney Condition and Conservation Significance Mapping (NPWS 2002b)	Vegetation patch condition and overall conservation significance analysis	Cumberland Plain	Based on Western Sydney Vegetation Mapping and limited field validation carried out between 1999 - 2001
Liverpool vegetation mapping (LCC)	Vegetation Community, status and Condition	LCC area	Based on Western Sydney Vegetation Mapping and minor desktop vegetation extant validation dated 2003
Blacktown Vegetation mapping (BCC)	Vegetation Community, status and Condition	BCC area	Based on Western Sydney Vegetation Mapping and update of extant validation through LiDAR dated 2009
Fairfield Vegetation mapping (FCC)	Vegetation Community, status and Condition	FCC area	Based on Western Sydney Vegetation Mapping
Penrith Vegetation mapping (PCC)	Vegetation Community, status and Condition	PCC area	Based on Western Sydney Vegetation Mapping and minor desktop vegetation extant validation dated 2004
Cumberland Plain Priority Conservation Areas (DECCW 2010)	Identified lands that could be most effectively managed for conservation boundaries	Cumberland Plain	2010

Whilst vegetation mapping exists for the entire study area, there are notable limitations to this data and gaps in knowledge. Some of these gaps can be filled by detailed field work and analysis at the latter precinct planning stage, whilst others should be addressed at the Structure Planning stage if they have the potential to cover large spatial areas and therefore affect the fundamental aspects of the Structure Plan.

Key among the data gaps to be addressed during the Structure Planning phase is a better understanding of the extent of the Critically Endangered Cumberland Plain Woodland as defined by the

TSC Act and the EPBC Act. Whilst the existing data provides information on the extent of this community in the study area, the mapping only identifies the community where there is a tree canopy. The community also exists without a tree canopy (ie, in a 'derived native grassland' form) and may therefore be more extensive than currently mapped. Conversely, there may be some areas mapped as CPW which do not actually meet the criteria under the NSW or Commonwealth definition. It is recommended that field survey be undertaken to determine the extent of CPW in the study area.

The second data gap relates to 'biometic data' collected in accordance with the NSW OEH biobanking methodology. Biometric data provides a numerical assessment of the condition of native vegetation and habitat for threatened fauna which can be used in running development and conservation scenarios through the biodiversity certification assessment methodology (BCAM) to determine which scenarios achieve an improve or maintain outcome.

Other data gaps such as information on locations of individual threatened flora and fauna will be necessary if biodiversity certification under the TSC Act or Strategic Assessment under the EPBC Act is pursued. If however these are not pursued, searches for these species can occur at the precinct planning stage.

3.2 VEGETATION COMMUNITIES

Seven vegetation communities were identified within the study area, the characteristics of each vegetation community, their conservation significance and ecological condition are summarised below in **Table 3** and presented in **Figures 3 and 4**. A summary of area occupied by vegetation communities and their condition is provided below. As shown in Table 3 all native vegetation communities mapped in the study area are listed under the NSW TSC Act. There is however a significant portion of this vegetation – around 53% that was mapped as being in poor condition.

Three of the communities also potentially meet the definition of *Cumberland Plain Woodland and Shale / Gravel Transition Forest* which is listed under the EPBC Act. To determine whether any of the patches meet the definition under the EPBC Act, site survey will be required to identify the percentage of native perennial groundcover.

The 1,723 ha of native vegetation represents 16% of the study area. The 811 ha of vegetation mapped in 'good' condition is approximately 7.5% of the study area.

Table 3 Area (ha) and condition of native vegetation

	Condition**		
Native Vegetation Community and Status	**Good (A,B,C)**	**Poor (TX, TXR, TXU)**	**Total**
Alluvial Woodland (EEC)	302.6	124.5	427.1
Castlereagh Scribbly Gum Woodland (VEC)	0	40.8	40.8
Castlereagh Swamp Woodland (EEC)	0.3	0	0.3
Cooks River Castlereagh Ironbark Forest (EEC)	16.6	0.8	17.3
Shale/Gravel Transition Forest* (EEC)	8.9	58.3	67.2
Shale Hills Woodland* (CEEC)	164.6	138.6	303.2
Shale Plains Woodland* (CEEC)	318.7	549.1	867.8
Total	**811.6**	**912.1**	**1,723.8**

*Potential critically endangered communities under the EPBC Act

**Appendix A provides an explanation of the condition codes assigned.

VEC – Vulnerable Ecological Community; EEC – Endangered Ecological Community; CEEC – Critically Endangered Ecological Community

3.3 THREATENED FLORA

NSW Wildlife Atlas has 169 records of six separate threatened species within the study area **Figure 3.** It is likely that additional threatened flora and associated species exist within the vegetation communities found within the study area, as the vegetation communities of western Sydney support a range of threatened flora species. These additional species will only be identified through targeted survey carried out at the appropriate season for species identification.

Table 4 Threatened Flora

Botanical Name	Common Name	TSC Status	EPBC Status
Dillwynia tenuifolia		V	-
Grevillea juniperina subsp. juniperina	Juniper leaved Grevillea	V	-
Hypsela sessiliflora		E	X
Persoonia nutans	Nodding Geebung	E	E
Pimelea spicata	Spiked Rice-flower	E	E
Pultenaea parviflora		E	V

V – vulnerable; E – endangered, X - extinct

3.4 THREATENED FAUNA

The following fauna species listed on either the TSC or EPBC acts have been recorded within the site - **Table 5** and **Figure 3**.

It is likely that additional threatened fauna and associated species exist within the vegetation communities found within the study area, as the vegetation communities of western Sydney support a range of threatened species. These additional species will only be identified through targeted survey carried out at the appropriate time of year.

Table 5 Threatened fauna recorded on site in the Wildlife Atlas

Scientific name	Common name	TSC Status	EPBC Status
AMPHIBIANS			
Litoria aurea	Green and Golden Bell Frog	E	V
BIRDS			
Lophoictinia isura	Square-tailed Kite	V	-

Daphoenositta chrysoptera	Varied Sittella	V	-
Hieraaetus morphnoides	Little Eagle	V	-
BIRDS - MIGRATORY			
Ardea ibis	Cattle Egret	-	M
Tringa nebularia	Common Greenshank	-	M
Apus pacificus	Fork Tailed Swift	-	M
Gallinago hardwickii	Latham's Snipe	-	M
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M
MAMMALS			
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	-
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-
Mormopterus norfolkensis	East Coast Freetail Bat	V	-
Myotis macropus	Sothern Myotis	V	-
Pteropus poliocephalus	Grey-headed Flying-Fox	V	V
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
INVERTEBRATES			
Meridolum corneovirens	Cumberland Plain Land Snail	E	-

V – vulnerable; E – endangered, M – migratory

3.5 CONSERVATION SIGNIFICANCE ASSESSMENT

A preliminary desktop assessment was developed using currently available biodiversity datasets. The significance assessment focussed on using the best available (latest iterations) of vegetation information to identify areas of biodiversity conservation significance which may contribute to an ecological constraint to development within the study area. Further detailed information may be required to refine this information at precinct planning stage.

The conservation significance assessment was carried out to identify those areas of greater constraint to development. A detailed description of the methods can be found in Appendix A of this report. In summary the method involves assessing the vegetation community and its condition **Figures 3 & 4** to derive a conservation significance ranking (**Figure 5 Conservation Significance)**. The broad intention for each of the categories is described as:

- **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". These make up the areas of highest constraint.
- **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". These areas contribute a moderate constraint to development.

- **Other Remnant Vegetation** - "all native vegetation that does not fall within the above significance categories. This category has the lowest constraint levels

Table 6 shows the hectares of each conservation significance category. Note that whilst the boundaries of extant vegetation across the site have been broadly updated with the latest available aerial photo interpretation, the condition and community classes are based on the consolidated available vegetation mapping.

As shown in **Figure 5**, much of the remaining vegetation is classified as 'Core habitat', mainly due to its listing as Critically Endangered Ecological Community.

Table 6: Constraints summary within the study area

Conservation Significance	Area (HA)	% of Vegetation with BWSELA	% of BWSELA
Core (high constraint)	1447.8	83.3	13.5
Support for Core (moderate constraint)	208.2	12	2
Other Remnant (low constraint)	82.2	4.7	0.7
TOTAL	**1738.2**		

The Cumberland Plain Recovery Plan (DECCW, 2010a) places emphasis on the protection of Priority Conservation Lands. These areas are important for the long term protection of Cumberland Plain ecology. Whilst this is a data set that is not incorporated into the Conservation Significance Assessment (CSA) methodology as applied throughout western Sydney, the Priority Conservation Lands are identified as being Core habitat as shown in **Figure 5**.

3.6 INDICATIVE MANAGEMENT VIABILITY

The conservation significance assessment shown in **Figure 5** identifies areas of core habitat *where the endangered ecological communities are at imminent risk of extinction.* Regardless of the patch size, any Critically Endangered Ecological Community that is not in an urban area is identified as Core habitat (see Appendix A for the rule-set applying to this analysis). This assessment methodology however does not take into account the viability of the patch size. Smaller patch sizes are subject to edge effects and typically have lower long term viability than larger patches.

A very initial analysis to target areas of vegetation which may have longer term management viability was carried out according to criteria based on vegetation status, condition and patch size as follows:

- **Status** – vegetation that is within an EEC or CEEC. This will ensure the focus is on the shale and alluvial woodland vegetation communities, which occur throughout and contain a very different and distinct set of fauna and flora that are rarely found in adjoining sandstone communities;
- **Condition** – good quality vegetation based on existing mapping (ie. A, B and C quality vegetation from existing vegetation mapping);

- **Size** – vegetation remnants that are equal to or greater than 4 ha. This threshold has been chosen after taking into account the fragmented nature of the remaining vegetation on the Cumberland Plain (61% of remnants are less than 4 ha in size, but make up only 10% of the total remaining vegetation), the relative biodiversity values of larger patches compared to smaller patches in Western Sydney, and the likely pressures on small remnants within the Growth Centres once they are surrounded by intensive urban development.

Figure 6 shows the areas of CEEC and EEC in good condition (ie, ABC condition) in patches greater than 4 hectares. In essence, this figure is a sub-set of Figure 5 based on an elimination of smaller patches that may not be viable in the long term without significant conservation management being undertaken. At this early desktop phase there is risk associated with placing emphasis of these mapping outputs. As noted previously, fieldwork will be necessary to determine whether the vegetation communities do indeed meet the definition of EECs under the State and Commonwealth legislation and to determine their condition. Until such field validation is undertaken, Figures 5 and 6 provide indicative information only.

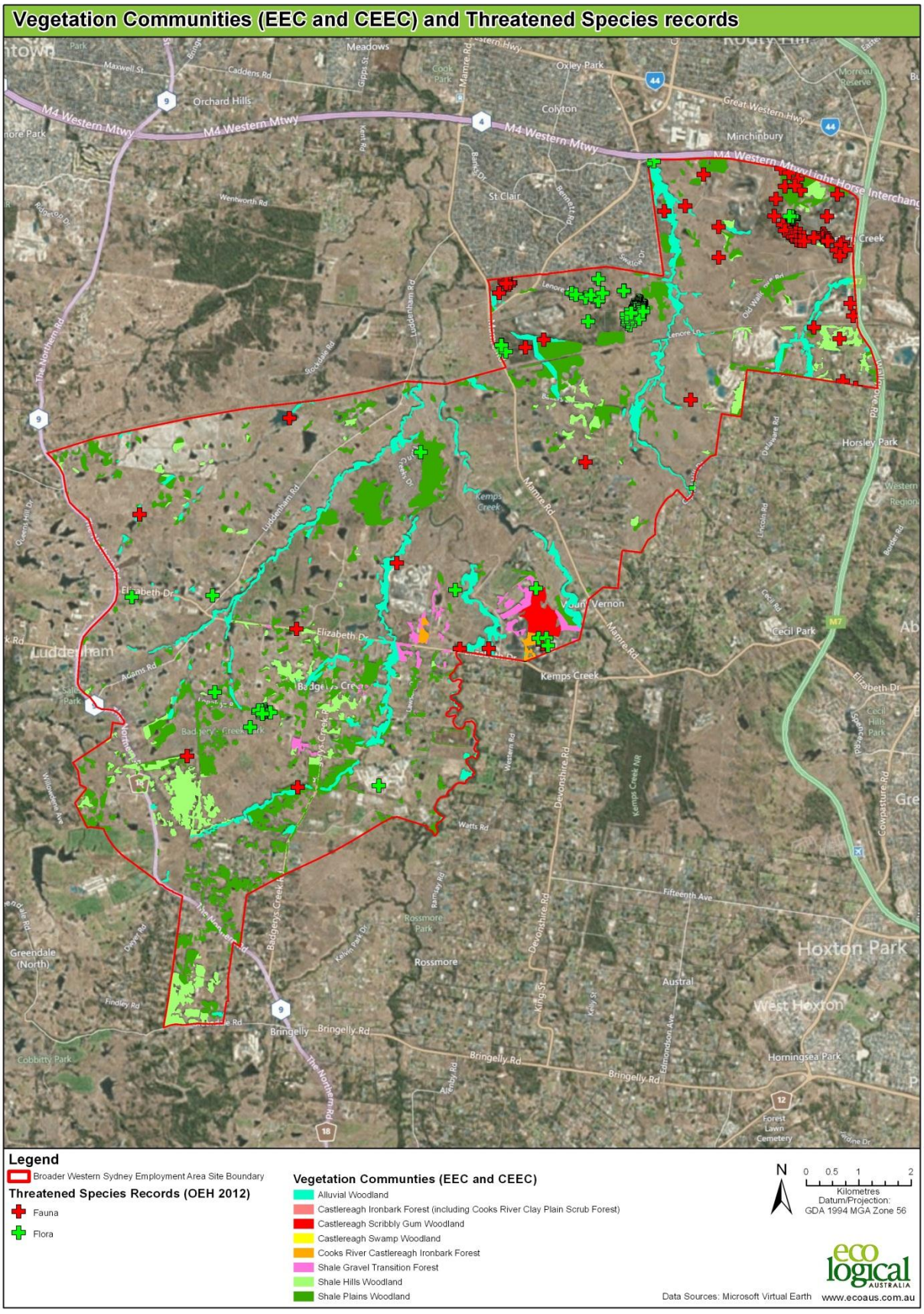


Figure 3 Native vegetation communities and threatened species records

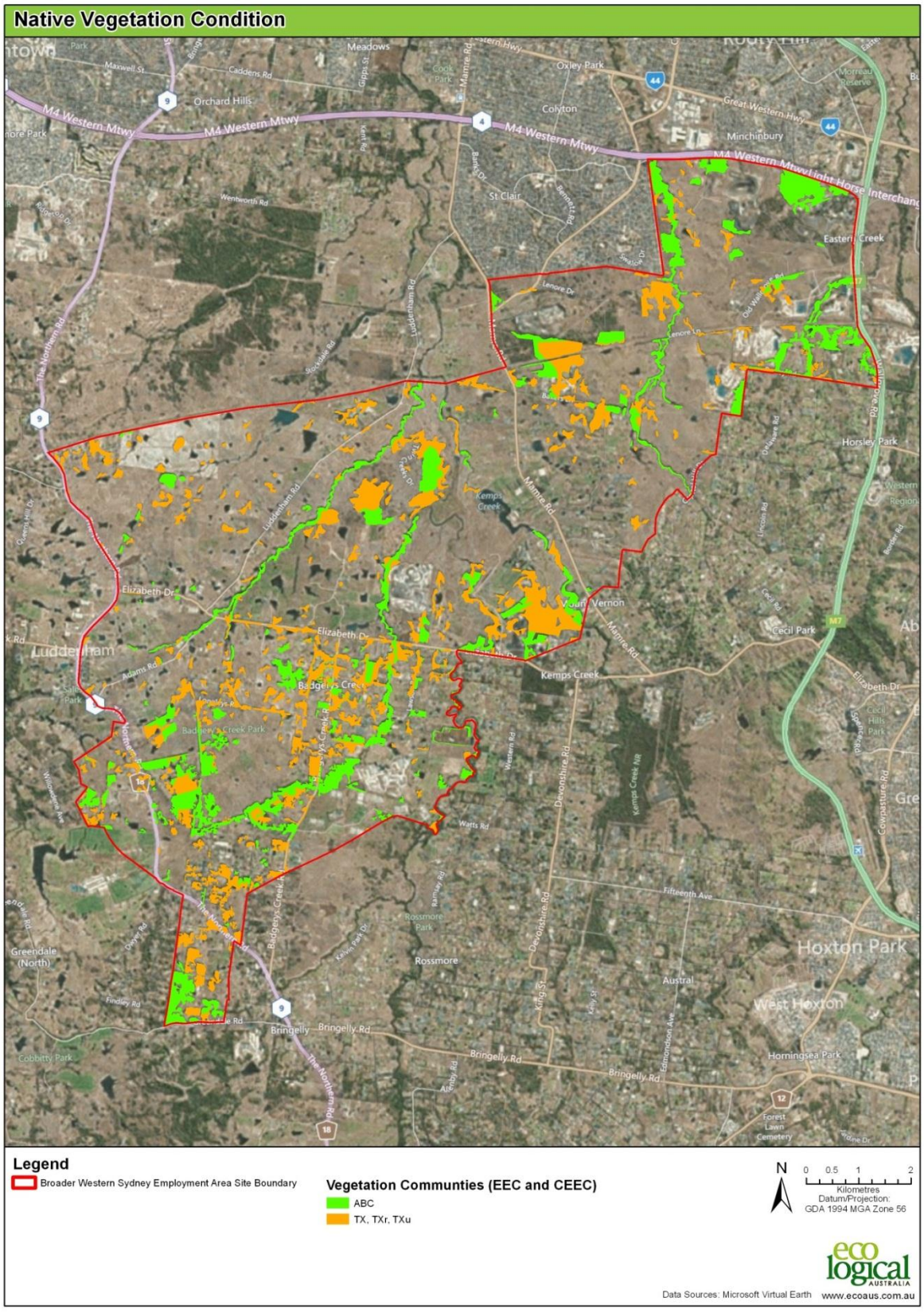


Figure 4 Vegetation communities and condition

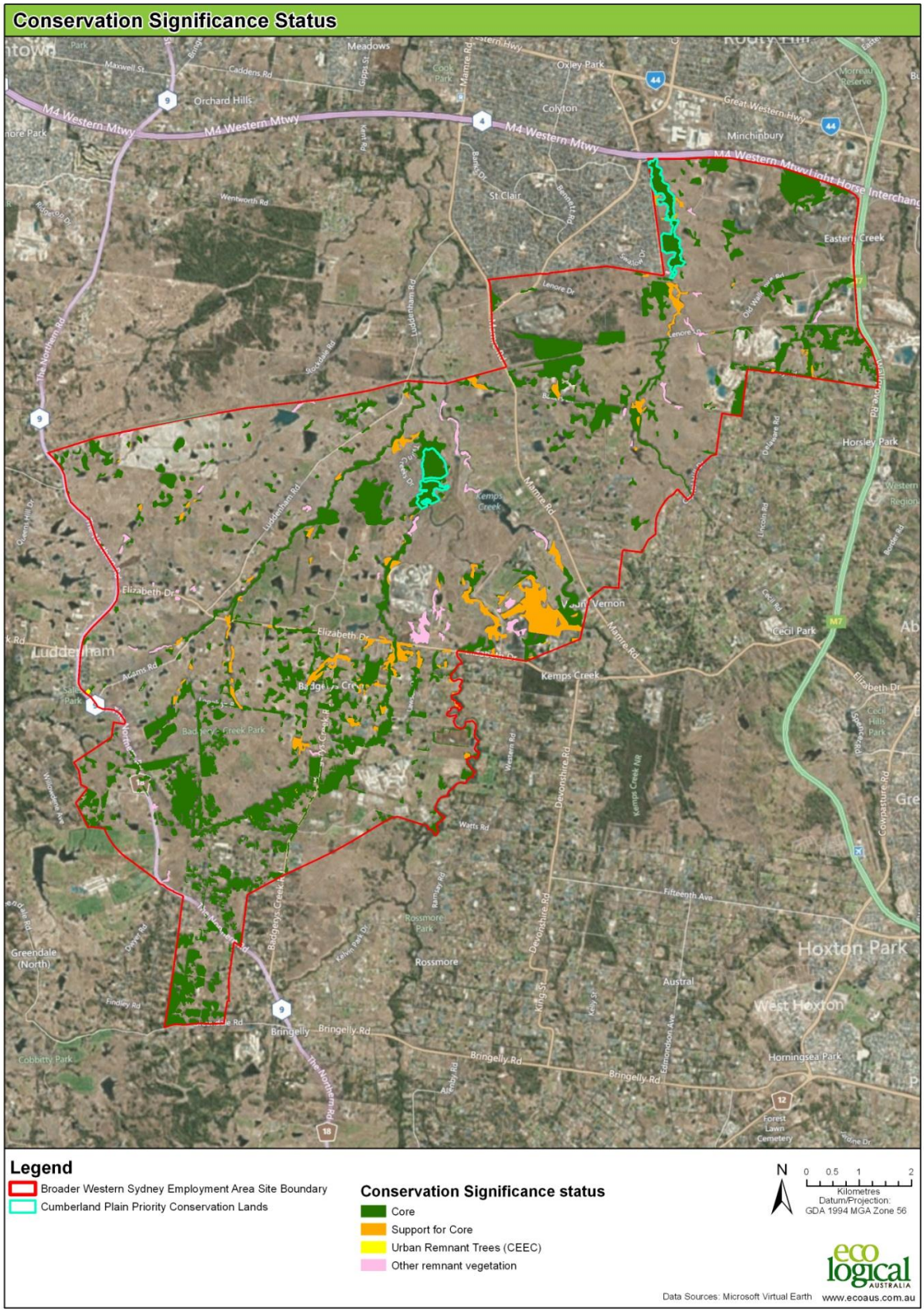


Figure 5 Conservation Significance

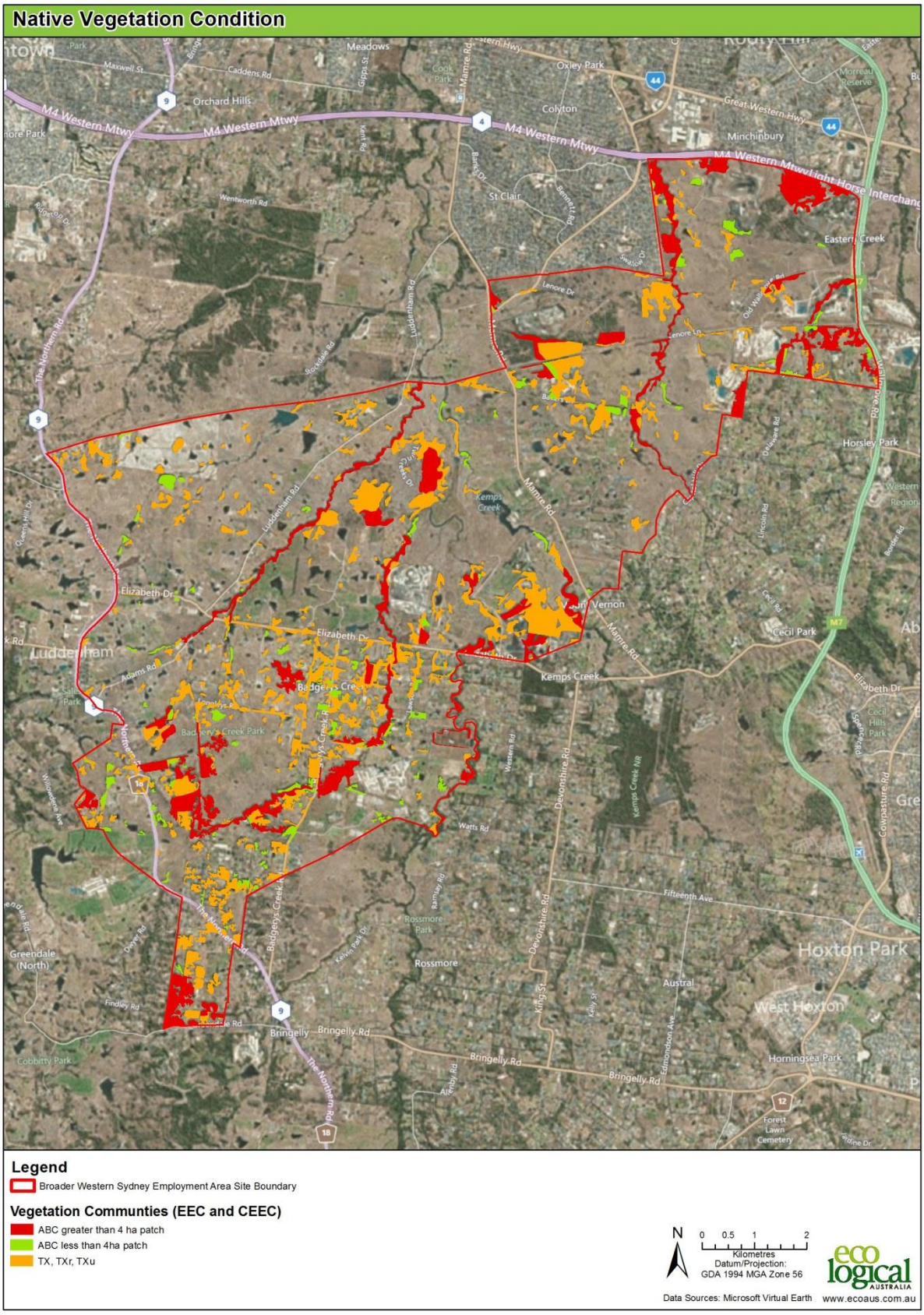


Figure 6 Management Viability

4 Riparian Assessment

4.1 CATCHMENT CONTEXT

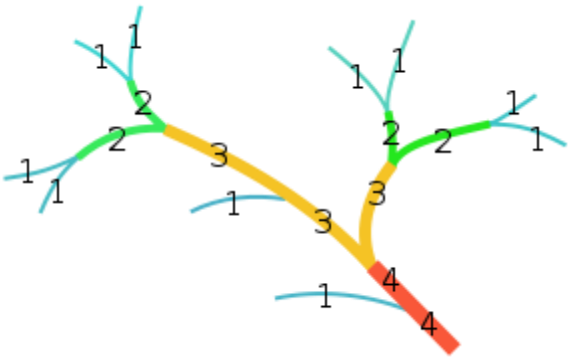
The BWSEA lies within the Hawkesbury-Nepean Catchment which has its headwaters located within largely pristine regions including the Blue Mountains World Heritage Area and Sydney Catchment Authority's lands in the NSW Southern Highlands. These upper reaches provide over 90% of Sydney's drinking water. Once into flatter, floodplain country, the Hawkesbury River flows eastward through rural and semi-rural areas of western Sydney. These middle and lower reaches of the system are highly impacted, both directly through waterway modifications and indirectly through land use practises.

4.2 LITERATURE REVIEW AND DATA AUDIT

Drainage data obtained for analysis was based on the Digital Topographic Database (DTDB) licenced by Land and Property Information. The data is made up of hydrology features depicting the centreline of a watercourse mapped at 1:25,000 scale within the catchments of the study area.

4.3 METHODS

In order to derive the appropriate riparian buffers for the study area, a stream ordering is required for the drainage layer. The stream ordering is based on a Strahler number where the top of the catchment drainage line is ordered 1. As it meets the next segment, the numeric value increases, becoming 2. As more drainage branches come together, the numbering value of each branch increases as described in the following figure.



Strahler Stream Ordering

The following process was carried out to derive stream flow and attribute stream order to the drainage layer through GIS analysis:

1. Implement topology to the drainage layer to ensure that the watercourse linework is continuous – there were a number of gaps in the dataset which required completion.
2. Where the drainage layer linework includes a waterbody such as dams and lakes, ensure that a centreline exists through the feature to enable down stream flow from top of catchment to bottom
3. Derive stream network and order for the drainage layer through GIS analysis
4. Buffer drainage lines from centreline based on the derived stream order as per Table 7

The buffer location identified through this process is indicative for landscape planning; at the detailed precinct planning stage, buffers are to be measured on ground for the required distance from the identified top of bank.

The Guidelines require a Vegetated Riparian Zone (VRZ) to be established in accordance with the widths in Table 7: Vegetated Riparian Zone. The widths are measured from the top of bank.

Table 7: Vegetated Riparian Zone

Stream order	Vegetated Riparian Zone
1	10m
2	20m
3	30m
4+	40m

4.4 RESULTS

The results of stream order and vegetated riparian zone are shown in **Figure 7**. The main tributaries of the South Creek catchment - including Kemps Creek, Badgerys Creek and Ropes Creek require vegetation riparian zones of 30 - 40 metres. These riparian zones of these watercourses also provide core terrestrial conservation values as shown in **Figure 5** and are also the areas with higher long term management viability as shown in **Figure 6**. The riparian zones of these creeks therefore represent significant ecological values for the study area.

The study area contains numerous 1st and 2nd order streams which, in an extensively cleared landscape such as this, are unlikely to provide significant aquatic habitat (except perhaps for the upper reaches of Ropes Creek). It is likely that many are ephemeral with little existing riparian vegetation and habitat quality. This assumption is based on previous work in the western Sydney growth centres precincts and would need to be tested via site survey. Regardless of the habitat values however, these watercourses are still likely to meet the definition of a river under the Water Management Act and therefore impacts on waterfront land (ie, land within 40m of a river, lake or wetland) will require a Controlled Activity Approval from the Office of Water.

The site also contains numerous farm dams. Whilst many of these will have poor habitat values, they do have the potential to contain habitat for amphibians, fish, birds and mammals. More detailed survey will be required to identify habitat values of the farm dams.

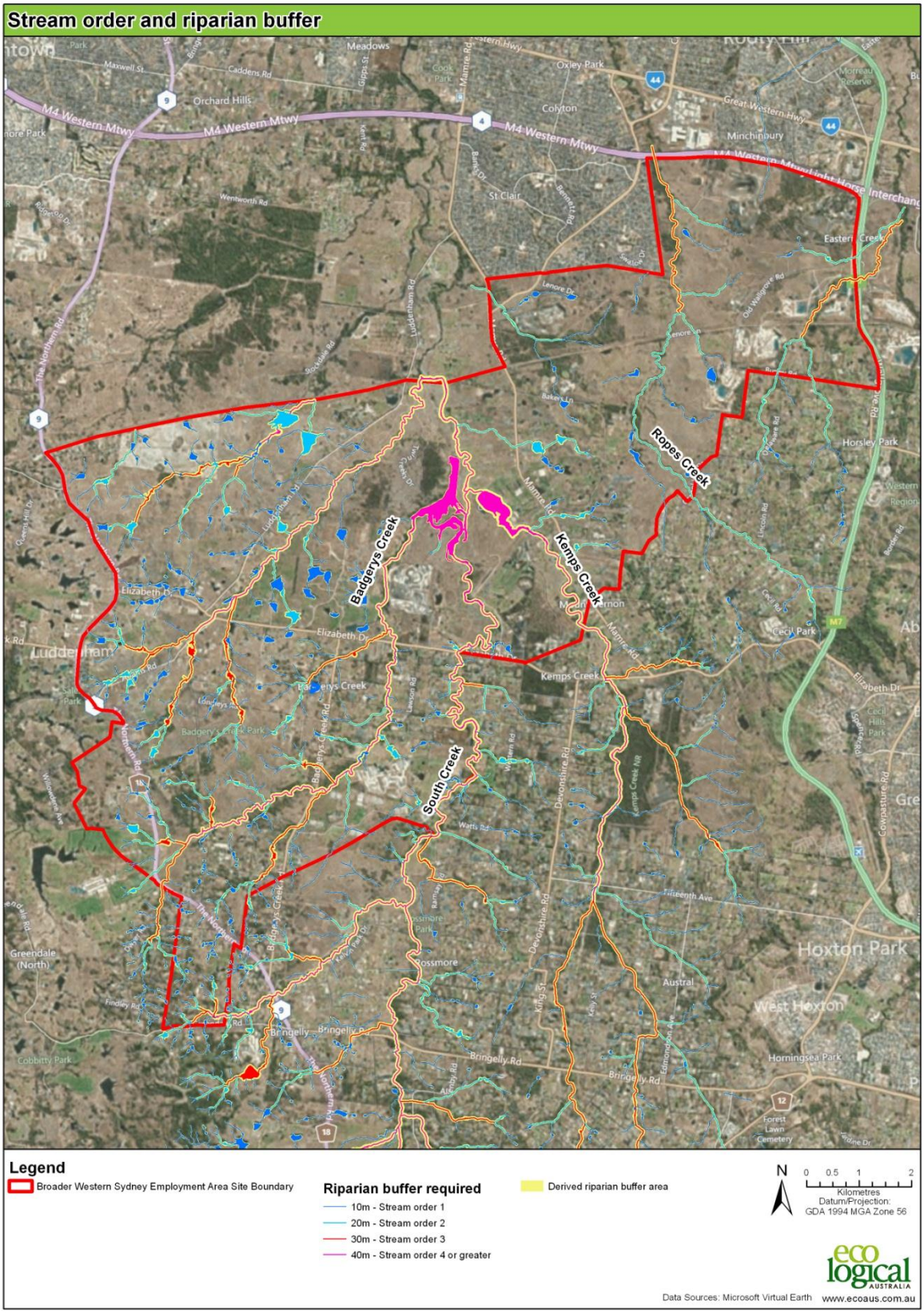


Figure 7 Stream Order and Riparian Zones

5 Conclusion

The BWSEA is a highly fragmented landscape that has been heavily impacted by past landuses. Based on a desktop assessment, 16% of the study area is native vegetation that is either endangered or critically endangered. Critically Endangered Ecological Communities typically pose a significant constraint to development, especially when listed under both State and Commonwealth legislation. However, given the fragmented nature of the patches of vegetation (many of which will have lower long term viability) there may be an opportunity to develop a positive conservation outcome that focuses on protection and management of riparian corridors and the larger patches of good condition vegetation. Such an outcome would not only deliver security to the EECs and CEECs hat have a higher management viability, but has the added benefits of protecting riparian habitats and ecological connectivity through the study area.

In terms of priorities for additional information on ecological values, this report recommends ground-truthing of vegetation communities to determine whether patches of Shale Hills Woodland, Shale Plains Woodland and Shale / Gravel Transition Forest meet the definition of Cumberland Plain Woodland / Shale Gravel Transition Forest as listed under the Commonwealth EPBC Act. A second priority is the collection of biometric vegetation data so that landuse planning can utilise the assessment methodologies (Biobanking or Biocertification) under the TSC Act to determine how development can occur whilst delivering a positive biodiversity outcome. Other data such as threatened fauna survey and top of bank mapping can be collected at later stages of planning to inform detailed design.

Following collection of this data it is recommended that the conservation significance assessment be re-run to identify vegetation and habitat of high, moderate and low conservation value as a key input to BWSEA or precinct level planning.

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Appendix A: Methodology for Conservation Significance Assessment

VEGETATION COMMUNITY AND CONDITION ASSESSMENT

Using a combination of the NPWS Western Sydney Mapping Project and aerial photograph interpretation, vegetation community information, canopy density and understorey condition were assigned to each vegetation polygon.

NSW Cumberland Plain Condition Criteria

The table below outlines the classification rules used to determine canopy and understorey condition. This table is a modification of Table 4 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.

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).

Conservation Significance

As part of the recovery planning process for Cumberland Plain vegetation communities, NPWS (2002b) 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"

Conservation significance matrix

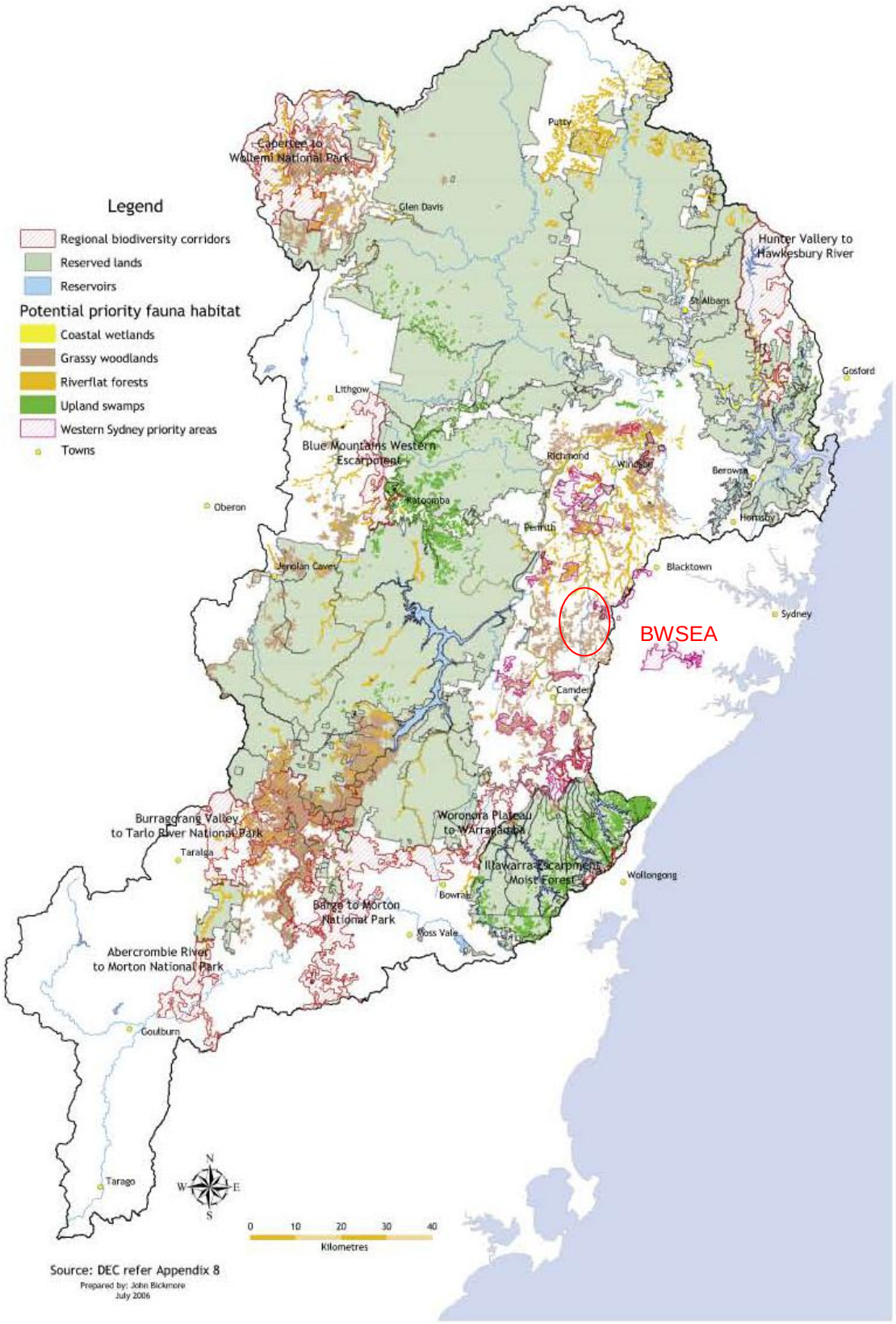
Source: adapted from NSW NPWS (2002b)

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

Appendix B: CMA and Local Government Biodiversity Strategy Maps

Map 9: Regional biodiversity corridors and priority fauna habitats.



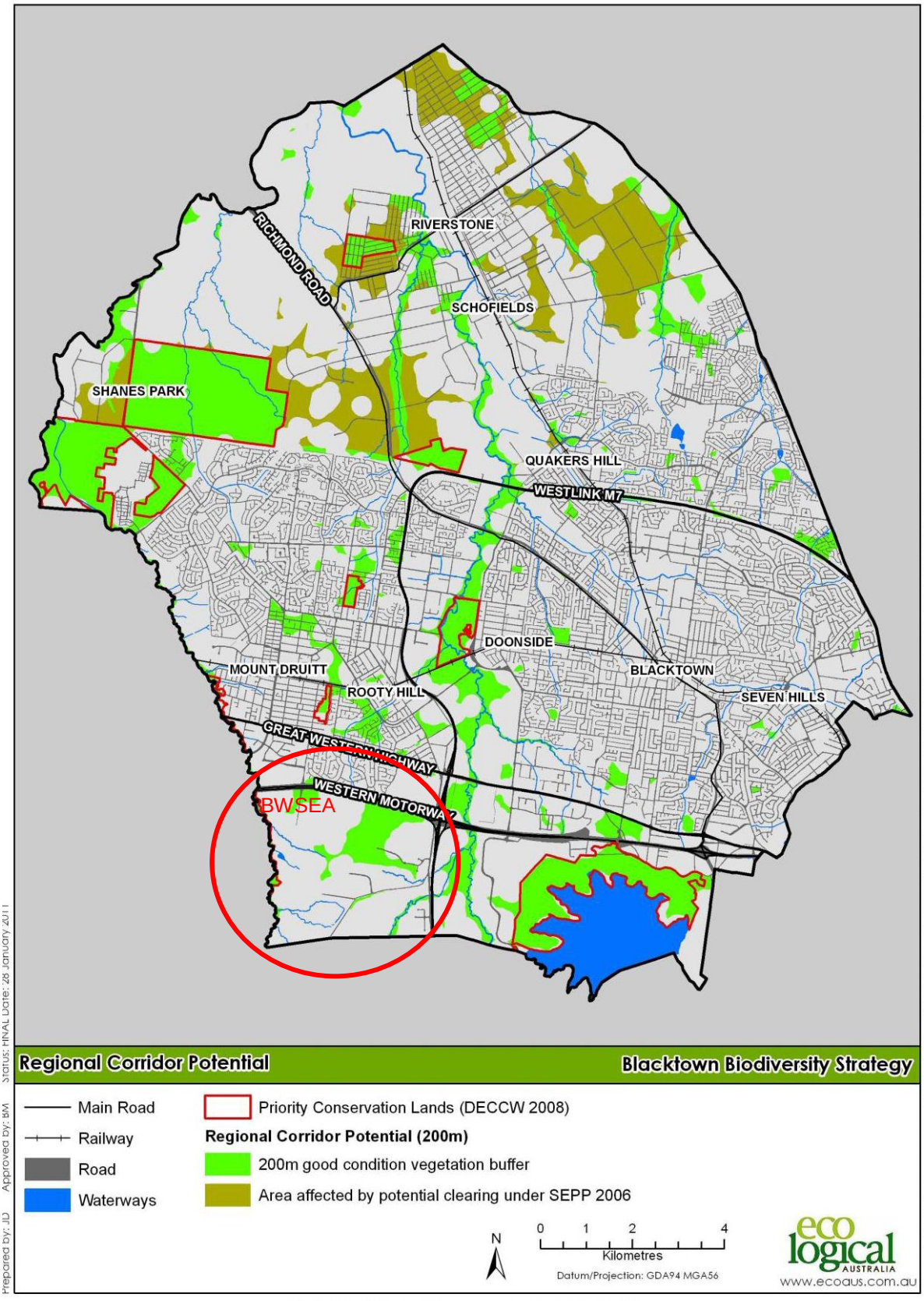

RIVERSTONE
RICHMOND ROAD
SCHOFIELDS
SHANES PARK
QUAKERS HILL
WESTLINK M7
DOONSIDE
MOUNT DRUITT
ROOTY HILL
BLACKTOWN
SEVEN HILLS
GREAT WESTERN HIGHWAY
WESTERN MOTORWAY
BWSEA
Regional Corridor Potential
Blacktown Biodiversity Strategy
Main Road
Railway
Road
Waterways
Priority Conservation Lands (DECCW 2008)
Regional Corridor Potential (200m)
200m good condition vegetation buffer
Area affected by potential clearing under SEPP 2006
N
0 1 2 4
Kilometres
Datum/Projection: GDA94 MGA56
eco logical AUSTRALIA
www.ecoaus.com.au
Client: Blacktown City Council
Project Number: 105-015
Prepared by: JD Approved by: BM Status: FINAL Date: 28 January 2011
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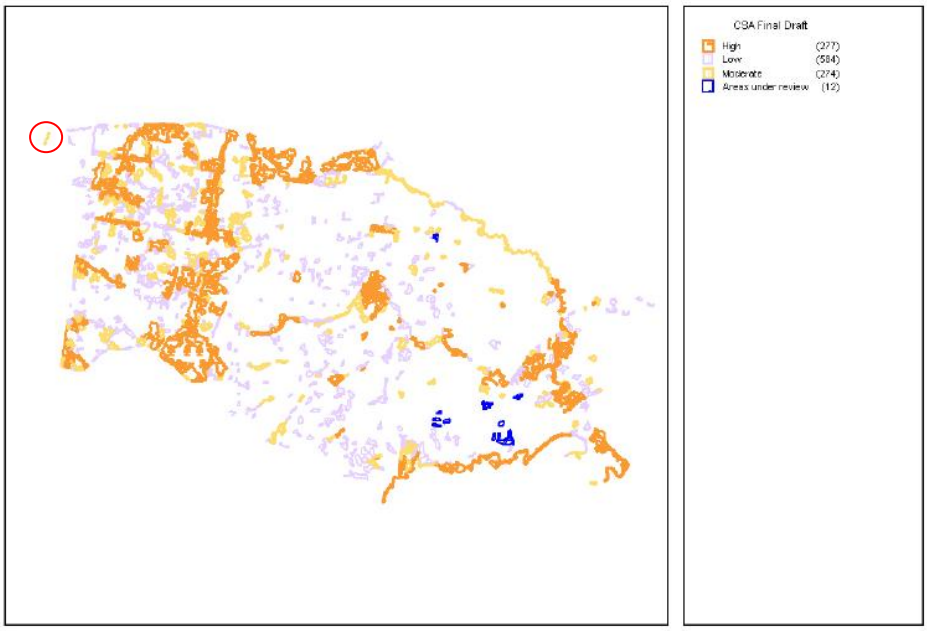
Figure 2: Draft Conservation Significance Assessment for Fairfield City



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