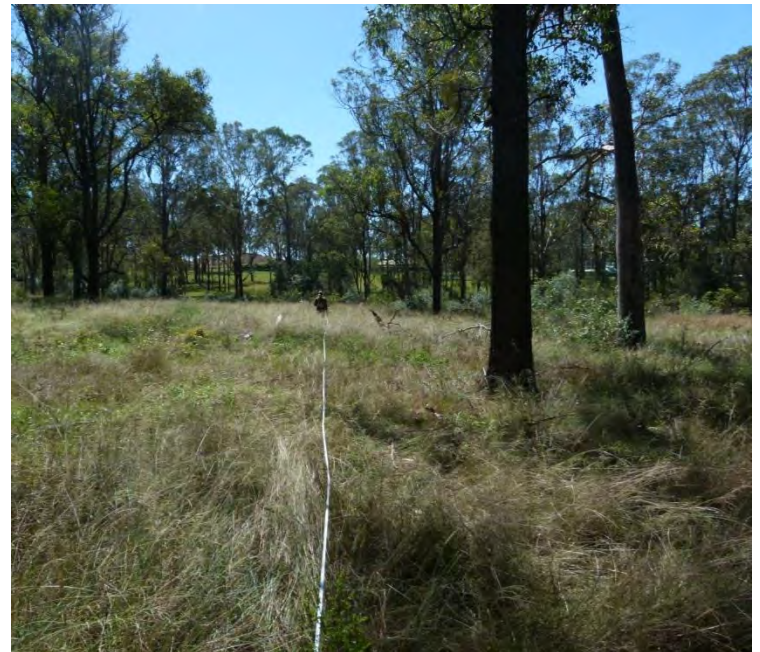




## Emerald Hills Estate

### Biodiversity Certification Assessment Report and Biocertification Strategy

Prepared for  
**Camden Council**  
30 June 2015



## DOCUMENT TRACKING

Item	Detail
Project Name	Emerald Hill Estate – Biodiversity Certification Assessment Report and Biocertification Strategy
Project Number	14WOLENV-0003
Project Manager	Robert Humphries 02 8536 8620 Suite 4, Level 2, 2-4 Merton St, Sutherland NSW 2232
Prepared by	Lucas McKinnon, Ian Curtis, Jo Daly, Jack Talbert, Rebecca Dwyer, Rodney Armistead, Ross Wellington
Reviewed by	Robert Humphries
Approved by	Robert Humphries
Status	Final for Application to Minister
Version Number	Final
Last saved on	30 June 2015
Cover photos (clockwise from top left)	Photographs of various plots during vegetation surveys on the Emerald Hills Estate.

This report should be cited as 'Eco Logical Australia ELA 2015. *Emerald Hills Estate – Biodiversity Certification Assessment Report and Biocertification Strategy*. Prepared for Camden Council, 30 June 2015.

## ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Macarthur Developments Pty Ltd.

### Disclaimer

*This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and Macarthur Developments Pty Ltd. The scope of services was defined in consultation with Macarthur Developments Pty Ltd, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information.*

*Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.*

# Contents

<b>Executive summary</b> .....	<b>x</b>
<b>1 Preamble</b> .....	<b>1</b>
1.1 Project background.....	1
1.2 Description of project timelines, management and governance .....	2
1.3 Community Consultation and Stakeholder Engagement .....	2
1.4 Strategic Context .....	2
1.5 Biodiversity certification assessment area and proposal .....	2
1.5.1 Conditions of Biocertification .....	3
<b>2 Ecological assessment method and results</b> .....	<b>8</b>
2.1 Literature and previous studies review .....	8
2.2 Field assessment overview .....	8
2.3 BioMetric vegetation type, condition and threatened status.....	9
2.4 Determination of species credit species requiring survey .....	18
2.4.1 Step 1 – identify candidate species for initial assessment .....	18
2.4.2 Step 2 – review list to include additional species .....	18
2.4.3 Step 3 – identify candidate species for further assessment.....	18
2.4.4 Step 4 – identify potential habitat candidate species for initial assessment .....	18
2.4.5 Step 5 – determine whether species is present .....	19
2.4.6 Step 6 – identify the threatened species that trigger a red flag.....	20
2.4.7 Step 7 – finalise the boundary of the species polygon and area of impact.....	20
<b>3 Biocertification Assessment Results</b> .....	<b>24</b>
3.1 Biodiversity Certification Assessment Area.....	24
3.2 Vegetation mapping and zones .....	25
3.3 Transect/Plot Data and Site Value Scores .....	27
3.4 Landscape Score.....	28
3.4.1 Native Cover in Landscape .....	28
3.4.2 Connectivity Value .....	29
3.4.3 Adjacent Remnant Area .....	31
3.5 Threatened species assessment.....	31
3.5.1 Species credits .....	31
3.6 Red flags.....	31
3.7 Indirect Impacts .....	33
3.8 Credit Calculations .....	34
3.8.1 Ecosystem Credits.....	34

<b>4</b>	<b>Red flag variation .....</b>	<b>36</b>
4.1	Impact on red flagged areas.....	36
4.2	Red Flag Variation Criteria .....	38
4.2.1	Avoiding and minimising impacts on red flags .....	38
4.2.2	Viability .....	41
4.2.3	Contribution to Regional Biodiversity Values .....	47
4.3	Conclusion .....	54
<b>5</b>	<b>Biocertification strategy .....</b>	<b>55</b>
5.1	Land proposed for biodiversity certification .....	55
5.2	Land proposed for biodiversity conservation.....	55
5.3	Variation to offset rules for using ecosystem credits .....	55
5.4	Proposed conservation measures .....	57
5.4.1	On-site conservation measures.....	57
5.4.2	Off-site conservation measures.....	58
5.5	Existing management obligations.....	58
5.6	Timing of credit retirement.....	58
5.7	Is an Improve or Maintain Outcome Achieved? .....	59
5.8	Any person or body proposed as a party to the biodiversity certification .....	61
	<b>References .....</b>	<b>62</b>
	<b>Appendix 1: Curriculum Vitae of field staff .....</b>	<b>65</b>
	<b>Appendix 2: Species predicted and requiring survey .....</b>	<b>75</b>
	<b>Appendix 3: Expert Report – Green and Golden Bell Frog.....</b>	<b>76</b>
	<b>Appendix 4: Transect/plot data.....</b>	<b>77</b>

# List of figures

Figure 1: Emerald Hills BCAA locality map .....	5
Figure 2: Emerald Hills Estate Indicative Layout Plan .....	6
Figure 3: Site boundary, including biodiversity certification assessment area (BCAA) and land uses .....	7
Figure 4: BioMetric vegetation types and zones within the Emerald Hills Estate .....	13
Figure 5: NSW Wildlife Atlas Records of all species credits species recorded within 10km of the BCAA .....	21
Figure 6: Habitat map for <i>Pimelea spicata</i> and Cumberland Land Snail including reference population and survey effort.....	22
Figure 7: Habitat map for Green and Golden Bell frog including reference population and survey effort.....	23
Figure 8: Assessment circle .....	30
Figure 9: Red flag vegetation .....	32
Figure 10: Red flag vegetation impacted by development.....	37
Figure 11: Consolidation and enlargement of conservation area showing connectivity with adjoining Shale Hills and Shale Plains Woodland vegetation .....	40
Figure 12: Current and future development surrounding the Emerald Hill Estate (Source: Camden Council) .....	44
Figure 13: Area of largest remnant vegetation retained within conservation area.....	46
Figure 14: 'Region' Derived from Adjacent CMA Subregions .....	49
Figure 15: Distribution of Grey Box-Forest Red Gum grassy woodland on shale of the Cumberland Plain, Sydney Basin .....	50
Figure 16: Native Vegetation Extent .....	53
Figure 17: Emerald Hills Estate indicative staging plan .....	60

# List of tables

Table 1: Area of proposed landuses in the biodiversity certification assessment area, including area of vegetation .....	4
Table 2: Relationship between vegetation community names .....	10
Table 3: Vegetation zone descriptions .....	12
Table 4: Land use breakdown .....	24
Table 5: Area of vegetation within the BCAA .....	25
Table 6: Area of vegetation zones assessed within the BCAA .....	26
Table 7: Vegetation zones and transect/plot data .....	27
Table 8: Site value scores allocated to each vegetation zone .....	28
Table 9: Native vegetation in assessment circle .....	28
Table 10: Connectivity scores allocated for the assessment .....	29
Table 11: Impacts to red flagged vegetation .....	31
Table 12: Final ecosystem credit results .....	35
Table 13: Red Flag Vegetation impacted .....	36
Table 14: Relative Abundance of Vegetation in Surrounding Regions .....	48
Table 15: Percent remaining of each vegetation type .....	51
Table 16: Native Vegetation Cover of CMA Subregions .....	52
Table 17: List of species linked to the credit profiles of HN 526 and HN 529 .....	56
Table 18: Proposed timing of credit retirement for on-site and of-site Biobank sites .....	59

# Abbreviations

Abbreviation	Description
ARA	Adjacent Remnant Area
APZ	Asset Protection Zone
BCAA	Biodiversity Certification Assessment Area
BCAM	Biodiversity Certification Assessment Methodology
BCAR	Biodiversity Certification Assessment Report
BCS	Biodiversity Certification Strategy
CC	Camden Council
CEEC	Critically Endangered Ecological Community
CLEP	Camden Local Environment Plan (2010)
CMP	Conservation Management Plan
CPLS	Cumberland Plain Land Snail
CPW	Cumberland Plain Woodland, a critically endangered ecological community
DCP	Development Control Plan
DECCW	NSW Department of Environment, Climate Change and Water (now OEH)
DP&I	NSW Department of Planning and Infrastructure (formerly NSW Department of Planning)
EEC	Endangered Ecological Community
EHE	Emerald Hills Estate
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GGBF	Green and Golden Bell Frog
ILP	Indicative Layout Plan
IoM	Improve or Maintain
LGA	Local Government Area
NPWS	NSW National Parks and Wildlife Service (now part of OEH)
OEH	NSW Office of Environment and Heritage (formerly DECCW, DECC, DEC)
REF	Review of Environmental Factors
RFEF	River-Flat Eucalypt Forest, an endangered ecological community
SEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now the Department of the Environment)
TBSA	Threatened Biodiversity Survey and Assessment guidelines

TEC	Threatened Ecological Community, listed as vulnerable, endangered or critically endangered under the TSC Act and/or EPBC Act
TS	Threatened Species
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>
TSPD	Threatened Species Profile Database



# Definitions

Definition	Description
Area of High Biodiversity Conservation Value	As described under Section 2.3 of the BCAM. Areas include critically endangered and endangered ecological communities (CEEC and EEC) not in low condition, threatened species that cannot withstand further loss, areas of vegetation that have regional or state conservation significance, and state and regional biodiversity corridors. Also termed Red Flag Areas.
Biodiversity Certification Assessment Area	As described in the BCAM, it includes land where certification is proposed to be conferred and any surrounding or adjacent land. Surrounding and adjacent land may be proposed for biodiversity conservation, or neither certification or development (Retained Land).
Biometric Vegetation Type	A plant community classification system used in BioMetric Tools, including the Biobanking Tool, Biodiversity Certification Tool and Property Vegetation Planning Tool
Conservation Area	Land within the Biodiversity Certification Assessment Area that is proposed for conservation measures.
Conservation Measures	The range of measures identified in Section 126L of the TSC Act
Development Area	Land within the Biodiversity Certification area that is proposed for development
Ecosystems Credit	As described under the BCAM, the class of credit for biodiversity certification that are generated for conservation measures or required for the land proposed for certification. Ecosystem credits are also generated for some threatened species that are assumed to be present based on the location of the site and the vegetation types present.
Low Biometric Condition	As described in Section 2.3 of the BCAM. To meet the 'low condition' threshold a number of criteria described in the method must be met, including <50% of the lower benchmark value of over storey percent cover for the relevant vegetation type or native vegetation with a site value score of less than 34 (Site value score is described in Section 3.6.2 of the BCAM)
Managed and Funded Conservation Measure	As described under Section 8.1.1 of the BCAM. Examples include entering into a Biodiversity Banking Agreement with respect to the land under Part 7A of the TSC Act and the reservation of land under the NPW Act.
Managed Conservation Measure	As described under Section 8.1.2 of the BCAM. Examples include entering into a conservation agreement under Division 12, Part 4 of the NPW Act and entering into a planning agreement under the EP&A Act that makes provision for development contributions to be used for or applied towards the conservation or enhancement of the natural environment.
Moderate-Good Biometric Condition	As described in Section 2.3 of the BCAM. Any vegetation that is not in 'low condition' is in 'moderate to good' condition
Planning Instrument Conservation Measure	As described under 8.1.3 of the BCAM. Application of this measure requires a number of conditions to be met that are described under the relevant Section of the method.
Red Flags	As described in Section 2.3 of the BCAM. See 'Areas of High Biodiversity Conservation Value' above.
Retained Land	Land within the Biodiversity Certification Assessment Area that is not land proposed for biodiversity certification or subject to proposed conservation measures.

Definition	Description
Species credit	As described in the BCAM, the class of credits for biodiversity certification that are generated for a conservation measure or are required for the land proposed for certification

---

# Executive summary

The Emerald Hills Estate proposes to develop approximately 151 hectares (ha) of land that has recently been rezoned from RU2 Rural Landscape to R1 Residential under Camden Local Environmental Plan (2010) (CLEP). Five ha of the site has already been biodiversity certified as part of the western Sydney Growth Centres Biocertification Order. The proposal seeks to develop the remainder of the land, which historically has been used for low intensity agricultural production, to accommodate a range of proposed uses including residential development, environmental conservation, public open space and a neighbourhood centre (**Section 1**).

In order to assess and appropriately offset the biodiversity impacts that will result from the changes in land use, the proposal has been assessed using the Biodiversity Certification Assessment Methodology (BCAM). This methodology enables the biodiversity impact of the proposal, together with the conservation benefits that will be realised as a result of proposed '*conservation measures*' to be quantitatively assessed in a scientifically rigorous and repeatable manner. The application of the methodology provides a clear and transparent record of how the impacts of the proposed changes in land use have been assessed and will be compensated for and offset by the proposed conservation measures that will be undertaken both within and outside of the Biodiversity Certification Assessment Area (BCAA).

The assessment has been conducted in accordance with the BCAM and applied to a defined BCAA that includes areas of land that will be impacted by development (for which conferral of biodiversity certification is sought) and land subject to conservation measures. The BCAA also includes land that will not be impacted by either the development or conservation measures; these areas are classified as 'retained lands'.

Two BioMetric Vegetation Types were identified within the site, '*Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain*', and '*Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain*'. Of these, the majority of the '*Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain*' type was assessed to be in 'moderate to good' condition, with a small portion consisting of 'disturbed' woodland and 'scattered paddock trees', assessed to be in 'low condition'. The '*Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain*' was assessed to be to be in 'low' condition (**Section 2**).

A range of threatened species were identified as potentially occurring within the site, however only three of these were identified as '*species credit species*' under the BCAM (Green and Golden Bell Frog, Cumberland Plain Land Snail and Spiked Rice Flower). As required by the methodology, each were subject to targeted survey, however none were recorded within the land to be certified. The Cumberland Land Snail was only recorded in the proposed conservation area (**Section 2**).

Lands proposed for certification equate to approximately 115.61 ha, of which 24.39 ha of both '*moderate to good*' and '*low*' condition vegetation will require clearing. The area of land proposed for certification is mostly cleared, retains only scattered paddock trees or is vegetation in small patches that is generally isolated within the BCAA. In contrast, the proposal has focussed on retaining the majority of the larger contiguous area of moderate to good vegetation in the north-east of the BCAA, within the proposed conservation area. Land proposed for conservation within the BCAA is approximately 20.13 ha, which includes 18.40 ha of moderate to good and 1.73 ha of low condition vegetation (**Section 3**).

In applying the methodology, 470 BCAM ecosystem credits are 'required' for land to be certified and 268 BCAM ecosystem credits are 'generated' in the proposed on-site conservation area. The conservation area will be secured via the registration of a Biobanking Agreement (a 100% 'managed and funded' conservation measure) which was submitted to the Office of Environment and Heritage (OEH) for registration in October 2014 and is expected to be registered in 2015.

Both vegetation types recognised on-site are listed as threatened ecological communities (TECs) under the NSW *Threatened Species Conservation Act 1995* (TSC Act) whilst 'Grey Box – Forest Red Gum grassy woodland' is a component of Cumberland Plain Woodland of the Sydney Basin Bioregion, which is also listed as a critically endangered ecological community (CEEC) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). For the purposes of the BCAM these vegetation types are 'Red Flagged' when they are in moderate to good condition as they are considered to be areas of 'high biodiversity conservation value'. Impacts to these areas requires a 'variation' from the Minister for the Environment. The remaining areas to be developed are either in low condition (and are not red flags) or are cleared of native vegetation. 8.92 ha of 'Grey Box – Forest Red Gum grassy woodland' that is in biometric moderate to good condition will be impacted, accordingly, a Red Flag Variation request has been prepared (**Section 4**).

The on-site BioBank site does not generate sufficient credits to meet an 'improve or maintain' outcome or all of the required credit types. There is a deficit of 23 credits for 'Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain (HN526)' and 179 for 'Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain (HN529)', which are proposed to be met by the purchase and retirement of credits from a Biobank site outside of the BCAA for which an assessment has also been completed and an application for registration of a Biobanking Agreement submitted to OEH in December 2014. The 23 HN526 credits that are in deficit can be met by credits for 'matching' vegetation types in the same formation (i.e. HN529 credits that are all in the Grassy Woodlands Vegetation Formation) subject to the approval of a variation requests to the credit trading rules. A credit trading variation request has been made (**Section 5**).

In order to meet the credit requirements for the proposed development footprint, a combination of conservation measures are proposed, including an on-site 'managed and funded' Biobank site for the large remnant in the northern part of the site owned by D&AI Pty Ltd, as well as the implementation of an off-site conservation measure with the purchase and retirement of Biobanking credits from a BioBank site on land owned by South West Landholdings Pty Ltd, D. Vitocco Constructions Pty Ltd, Palolem Pty Ltd and Shaun Newing. The exact suite and timing of conservation measures proposed is outlined in the Biodiversity Certification Strategy (BCS) that is found in **Section 5** of this report. The commitment to secure these offset areas and retire the credits for this biocertification application will be secured by a Biocertification Agreement entered into between the Minister for the Environment and the 'affected' parties i.e. Camden Council, D&AI Pty Ltd, South West Landholdings Pty Ltd, D. Vitocco Constructions Pty Ltd, Palolem Pty Ltd and Shaun Newing.

Subject to the Minister's approval of the red flag and credit trading variation requests and registration of the two proposed Biobank sites, the proposal meets and 'improve or maintain' outcome and is eligible for biodiversity certification. If the Minister confers biocertification on the requested land, Camden Council as the consent authority for future development applications, is no longer required to assess impacts to biodiversity values as these have already been addressed by the Minister and conservation areas will be required to be managed in perpetuity for conservation.

# 1 Preamble

## 1.1 Project background

Macarthur Developments Pty Ltd (Macarthur Developments) have been in consultation with Camden Council and the Office of Environment and Heritage (OEH) regarding a proposal to rezone land known as the Emerald Hills Estate, located at 1150 Camden Valley Way, Leppington, in south-western Sydney (**Figure 1**). Following this consultation and addressing the various biodiversity issues raised by the OEH, it has been determined that these issues would be strategically addressed through a Biodiversity Certification assessment under Part 7AA of the *Threatened Species Conservation Act 1995* (TSC Act), and thus streamline subsequent biodiversity assessment at the development application stage. An application for Biodiversity Certification must follow the Biodiversity Certification Assessment Methodology (BCAM) (DECCW 2011) and meet the requirements of Section 126K of the TSC Act, i.e., be accompanied by a Biodiversity Certification Strategy (BCS).

The BCAM (DECCW 2011) was developed by the OEH and was gazetted by the NSW government in February 2011. The methodology may be applied to land for which 'biodiversity certification' (biocertification) is sought, and conferred by the Minister for the Environment if the conservation measures proposed in the biocertification application result in an overall improvement or maintenance in biodiversity values. This is referred to under the methodology as satisfying the 'improve or maintain test' (IoM test).

Only a 'Planning Authority' as defined by section 126G of the TSC Act may apply to the Minister for biocertification.

The methodology provides an equitable, transparent and scientifically robust framework within which to address the often competing demands of urban development and biodiversity conservation. If the Minister for the Environment is satisfied that an IoM outcome has been achieved, he/she may confer biocertification on '*land*'. If the Minister confers biocertification on land, a consent/approval authority does not have to take biodiversity issues into consideration when assessing development applications, i.e., for the purpose of s.5A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), the development or activity is not subject to an Assessment of Significance for threatened species, populations or ecological communities.

Eco Logical Australia Pty Ltd (ELA) has been engaged by Macarthur Developments on behalf of Camden Council, the relevant planning authority, to apply the BCAM to assess the proposed Emerald Hills Estate (EHE) rezoning and subsequent development, hereafter the Biodiversity Certification Assessment Area (the BCAA). This has been done by assessing the impacts of the proposed development, together with the biodiversity gains that will be achieved as a result of proposed conservation measures. The net result has then been considered in the context of the 'improve or maintain test' described under the BCAM.

The calculations were undertaken in the BCAM Tool v1.08, and included additional plot data collected for the EHE Biobank assessment. Whilst a more recent version of the Biocertification Tool is now available (v1.09), it was agreed at a meeting between OEH, Camden Council, Macarthur Developments and ELA at a meeting on 13 August 2014 that for consistency the BCAM assessment should continue to use the version of Tool that had been used in the original assessment, submitted for comment to Council and OEH in December 2013.

This Biocertification Strategy and the associated credit calculations have been undertaken by an accredited assessor (Lucas McKinnon and Rebecca Dwyer, Accreditation Numbers 0076 and 0095) and supported by other ELA staff and field ecologists (Joanne Daley, Robert Humphries, Rodney Armistead and Ross Wellington).

## 1.2 Description of project timelines, management and governance

The application for biocertification is being undertaken following rezoning of the BCAA, which was gazetted in September 2014.

Camden Council exhibited this proposal for the minimum required 30 days between May and 15 June 2015. Five submissions were received and a report responding to these submissions has been prepared by Council (Camden Council 2015)..

## 1.3 Community Consultation and Stakeholder Engagement

The rezoning has undergone extensive stakeholder consultation with Camden Council and OEH. Consistent with section 126N of the TSC Act, following public exhibition of the biocertification assessment a report will be prepared responding to any submissions received.

## 1.4 Strategic Context

The strategic context of the biocertification application is outlined in the Insites (2013). Insites (2013) provides a detailed account of the site in a local and regional context, the need for the planning proposal and its relationship to the Camden LEP 2010 the current zoning of the land, relevant planning instruments that apply to the land, environmental, social and economic impact of the planning proposal, community consultation, and State and Commonwealth interest.

## 1.5 Biodiversity certification assessment area and proposal

The EHE is located at 1150 Camden Valley Way, Leppington, in south-western Sydney. The majority of the site is located within the Camden Council Local Government Area (LGA), with a small portion along the eastern boundary situated within the Campbelltown City Council LGA, which is within the conservation area and will not be 'biocertified' (**Figure 1**).

The land is located immediately south of the South-West Sydney Growth Centre Precinct of East Leppington and east of the Catherine Fields and Catherine Fields North Precincts. These three precincts are currently being rezoned through the Growth Centres urban release program. A 5 ha portion of the EHE along the south-western boundary is within the already biodiversity certified land of the Catherine Fields precinct (**Figure 1**). Assessing the biodiversity impacts to this land is not required and the area of certified land was removed from BCAA.

The BCAA (minus that part already certified) is 146 ha in size and is bound by Camden Valley Way to the north-west, St Andrews Road to the north-east, private property to the east, the Sydney Water Canal in the south-east and Raby Road to the south and west.

The site was recently rezoned from RU2 Rural Landscape to R1 Residential under Camden Local Environmental Plan (CLEP 2010), as per **Figure 1**.

At present the site is used for low intensity cattle grazing which has been carried out across all parts of the site, including wooded areas, for a substantial period of time. Several small to medium sized farm dams are scattered throughout the site. The headwaters of a small watercourse originate in the south

west of the site and drains west under Camden Valley Way. A second small, ephemeral drainage line also flows north in the north-west corner of the site towards St Andrews Road.

Vegetation within the site is comprised predominately of open improved pasture, however, approximately 44.97 ha or 31% of the site meets the definition of Shale Hills Woodland, while a further 1.15 ha (<1%) is Alluvial Woodland, as described by NPWS (2002). Shale Hills Woodland is a component of Cumberland Plain Woodland, which is listed as a critically endangered ecological community (CEEC) under both the TSC Act and the EPBC Act. Similarly, Alluvial Woodland is a sub community of the River-flat Eucalypt Forest on Coastal Floodplains (RFEF), an endangered ecological community (EEC) listed under the TSC Act.

In rezoning the site, the proponent has aimed to ensure that the overall biodiversity values of the area post development are at least maintained, if not improved, compared to their (existing) predevelopment levels. This will ensure that development of the site takes into account the significant environmental features of the area and focuses development activities in the locations with lesser biodiversity value.

In the context of the BCAM the site has been divided into three areas based on the Indicative Layout Plan (ILP) for the site (**Figure 2**). The Biocertification land uses are:

- *Development area (land to be certified)* – the area proposed for development. Proposed land uses include low density residential, commercial enterprises, education facilities, drainage facilities and passive and active open space. As described in the methodology, the biodiversity values of this area are assessed to enable the biodiversity impacts of development to be quantified.
- *Conservation area* – the areas subject to conservation measures. Like the development area, the biodiversity values of this area are also assessed, but in contrast, they are assessed in order to quantify its capacity to respond to conservation measures that will improve biodiversity values. The conservation area excludes a 4.7m wide easement for wastewater reticulation which has been included in the impact calculations.
- *Retained area* – the area that is not proposed for biodiversity certification or subject to conservation measures.

Together, these three areas comprise the land that will be assessed for biodiversity certification and comprise the Emerald Hills BCAA (**Figure 4**). The area of each proposed landuse is provided in **Table 1**.

### 1.5.1 Conditions of Biocertification

Under the BCAM, the impact of development and conservation measures on biodiversity values is quantified using biodiversity credits which are defined by each of the vegetation types (ecosystem credits) and threatened species present (species credits). In this regard, the methodology determines the number of credits that are required to offset the adverse impacts of development on biodiversity values, and, the number of credits that can be generated by undertaking recognised conservation measures as outlined in s126L of the TSC Act that will improve biodiversity values within the BCAA. Where the number of credits that are created is equal to, or exceeds the number required, the 'improve or maintain' test described under the methodology is considered to be satisfied, provided 'Red Flags' have been avoided, or a Red Flag Variation has been approved by the Director General of OEH.

Red Flags are areas of high biodiversity conservation value, and include vegetation types that are >70% cleared, CEEC and EEC's listed under the TSC Act and/or EPBC Act, certain threatened species and areas that are recognised as biodiversity corridors of state or regional significance. This assessment includes impacts to red flag areas and a Red Flag Variation request is included at (**Section 4**).

**Table 1: Area of proposed landuses in the biodiversity certification assessment area, including area of vegetation**

	Land Proposed for Conservation Measures (ha)	Land Proposed for Biodiversity Certification (ha)	Retained Lands (ha)	Total area (ha)
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin (HN529)	20.13	23.08	1.75	44.97
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin (HN526)	0.0	1.31	0.0	1.31
Cleared land	0.0	98.10	1.27	99.37
	20.13	122.49	3.02	145.65



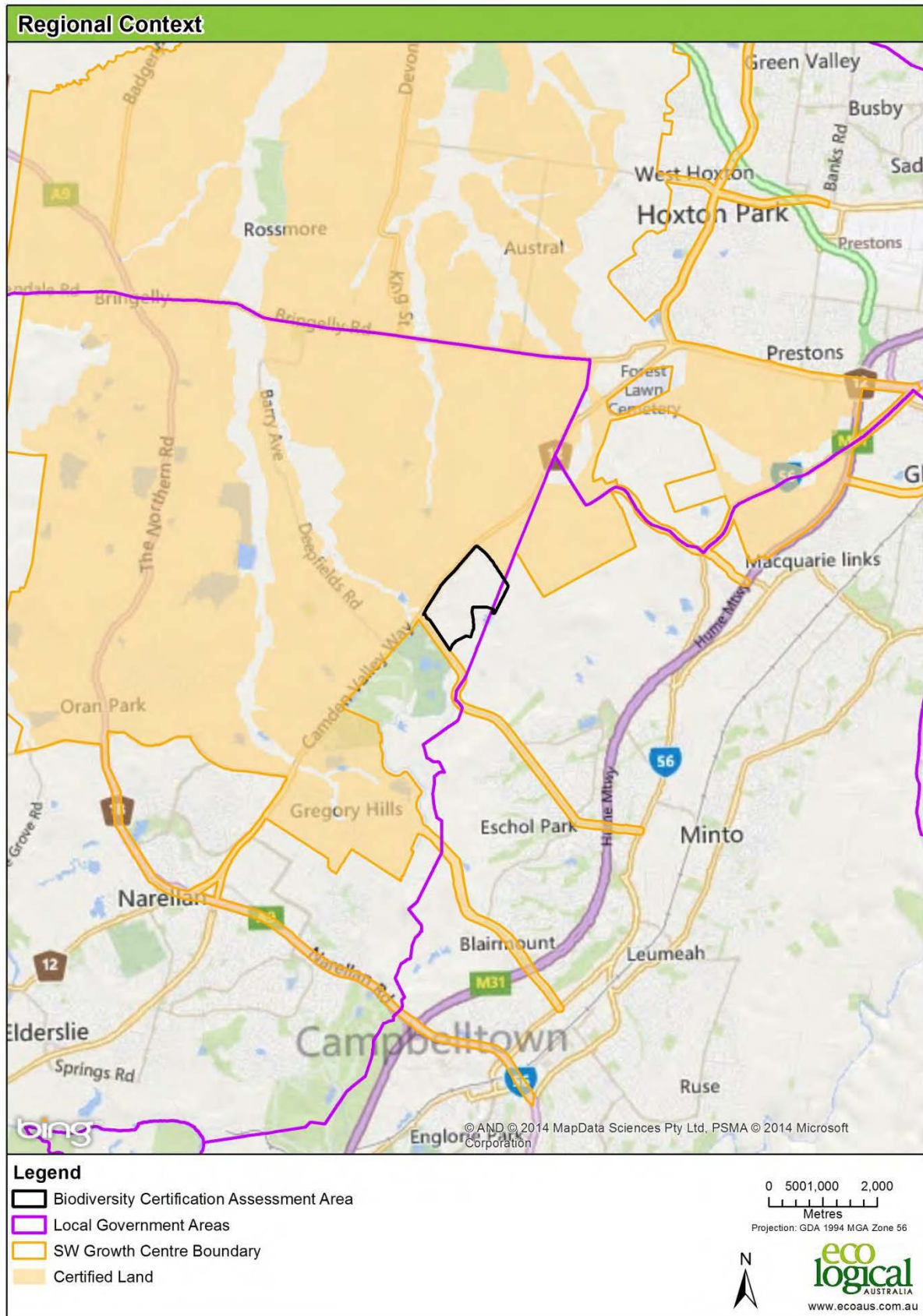


Figure 1: Emerald Hills BCAA locality map

**EMERALD HILLS ESTATE**  
**DRAFT INDICATIVE LAYOUT PLAN**  
 30 June 2015

- Site Boundary
- Low Density Residential
- Environmental Conservation
- Indicative School Location
- Neighbourhood Centre
- Passive Open Space
- Active Open Space
- Drainage
- Riparian Corridor
- Sub Arterial Road
- Local Collector Road
- Local Road
- Pedestrian Path
- Potential Transmission Realignment
- Existing Gas Easement
- Existing Transmission Easement
- Creek
- LGA Boundary

1:8,000 @ A3  
 0 100m 250m 500m

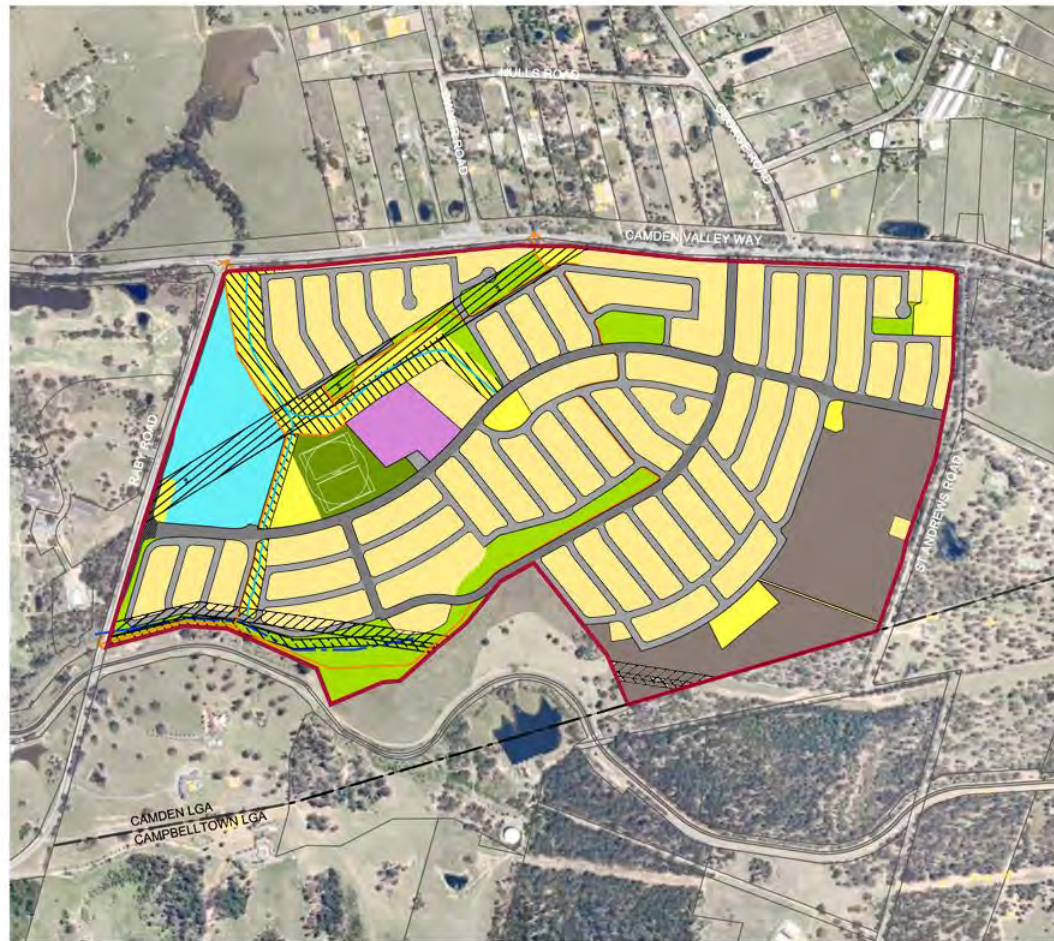


Figure 2: Emerald Hills Estate Indicative Layout Plan

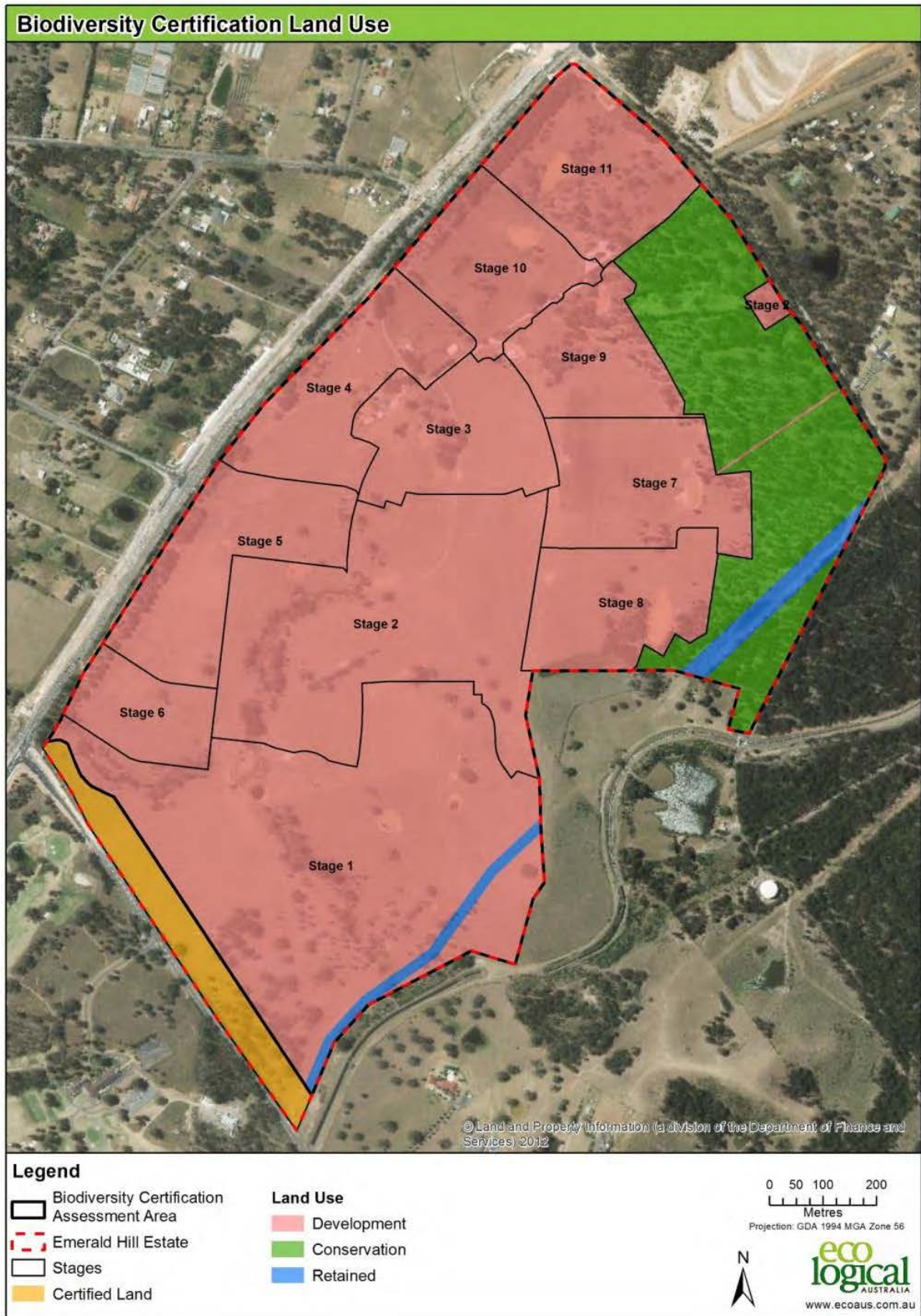


Figure 3: Site boundary, including biodiversity certification assessment area (BCAA) and land uses

## 2 Ecological assessment method and results

An application for biodiversity certification must include an assessment of the biodiversity values of the BCAA undertaken in accordance with the BCAM. This section addresses this requirement.

### 2.1 Literature and previous studies review

The EHE assessment area has been the subject of previous ecological and planning assessment reports, as have the lands immediately adjoining the site (Catherine Fields North, Catherine Fields and East Leppington Growth Centre Precincts). This is coupled with significant urban infrastructure works (the upgrade of Camden Valley Way and the supply of water and wastewater within the Growth Centre) and the rezoning of other substantial landholdings in the area. Relevant studies that were reviewed as part of this assessment include:

- Vegetation community mapping and condition assessment (NPWS 2002)
- 1150 Camden Valley Way Flora and Fauna Assessment (ELA 2009a)
- 1150 Camden Valley Way Property Management Plan (ELA 2009b)
- Emerald Hills Estate – Preliminary Constraints analysis, Ecology & Riparian Issues (ELA 2013a)
- Catherine Fields (Part) Precinct: Australasian Bittern Habitat. Prepared for NSW Department of Planning & Infrastructure (ELA 2013c)
- Catherine Fields, Catherine Fields North, East Leppington, Oran Park, Turner Road rezoning investigation reports (ELA 2012a, ELA 2012b, ELA 2012c, ELA 2007)
- El Caballo Blanco and Gledswood Estate – Ecological, Riparian and Bushfire rezoning investigations (ELA 2010a)
- Water related services for the South West Growth Centres First Release precincts & adjoining developments Stage 2- 5 (ELA 2010b)
- Camden Valley Way Upgrade EIS (ngh Environmental 2010)

An audit of digital data was also undertaken to assist in locating vegetation communities and potential threatened species that may occur within the assessment area. The following information and databases were reviewed:

- Biobanking Assessment Tool v2.0 (DECC 2009b)
- BioNet Atlas of NSW Wildlife (OEH 2012a)
- Threatened Species Profile Database (OEH 2012b)
- EPBC Protected Matters Search Tool (SEWPaC 2012)
- Vegetation Mapping for the Cumberland Plain (NPWS 2002)

### 2.2 Field assessment overview

Field assessment was undertaken over a period of 6 days and conducted in accordance with the requirements of the BCAM, DEC (2004) and NPWS (2000; 2004). A summary of the field assessment is provided below:

- Day 1 & 2 – survey undertaken by ELA ecologists Lucas McKinnon, Rebecca Dwyer and Dr Rodney Armistead on 15 August 2012, and, Rebecca Dwyer and Dr Rodney Armistead on 16 August 2012. Survey included a general site and vegetation assessment, detailed

plot/transect assessment in accordance with the BCAM, targeted threatened flora survey in particular for *Pimelea spicata* and Cumberland Plain Land Snail (*Meridolum corneovirens*). Total survey time 40 hrs.

- Day 3 – survey undertaken by ELA ecologists Rebecca Dwyer and Ross Wellington on 21 February 2013. Survey included targeted survey for Green and Golden Bell Frog (*Litoria aurea*) (GGBF) and threatened flora survey including *P. spicata*. Survey for *P. spicata* was undertaken in the late afternoon and GGBF in the twilight and evening. Total survey time 13 hrs.
- Day 4 – survey undertaken by ELA ecologist Rebecca Dwyer September 2013. Survey included general vegetation assessment and targeted threatened flora including *P. spicata*. Total survey time 3 hrs.
- Day 5 – survey undertaken by ELA ecologists Lucas McKinnon and Bruce Mullins September 2013. Survey included a general vegetation assessment and targeted survey for threatened flora and *P. spicata* in particular. Total survey time 6 hrs.
- Day 6 – survey undertaken by ELA ecologist Bruce Mullins September 2013, targeting threatened flora and *P. spicata* in particular. Total survey time 2.5 hrs.

In all, a total of 64.5 hrs of survey has been undertaken at the site. Of this, 42.5 hrs were dedicated to vegetation assessment and targeted flora survey.

Curriculum vitae for all project staff involved in field assessment are located in **Appendix 1**.

### **2.3 BioMetric vegetation type, condition and threatened status**

The following vegetation units have been previously mapped as occurring within the BCAA (NPWS 2002):

- Shale Hills Woodland (MU 9)
- Shale Plains Woodland (MU 10)
- Alluvial Woodland (MU 11)

This mapping was further refined by ELA based on the findings of field survey conducted as part of this assessment. ELA recorded two unique vegetation communities, which were converted to BioMetric vegetation types through comparison between the vegetation descriptions of NPWS (2002) and the BioMetric Vegetation Types Database (DECC 2008b). The equivalent BioMetric vegetation types for each vegetation community is presented in **Table 2** and described in detail in **Section 2.4**.

**Table 2: Relationship between vegetation community names**

Native Veg of Cumberland Plain (NPWS 2002)	Confirmed within the BCCA	Biometric Vegetation Types (DECC 2008b)	Threatened Ecological Communities (TSC Act <sup>1</sup> and EPBC Act <sup>2</sup> )
Shale Hills Woodland (MU 9)	Yes	Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin (HN 528)	Cumberland Plain Woodland in the Sydney Basin Bioregion <sup>1</sup>
Shale Plains Woodland (MU 10)	No	Grey Box – Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin (HN529)	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest <sup>2</sup>
Alluvial Woodland (MU 11)	Yes	Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin (HN526)	River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney basin and South-East corner Bioregions <sup>1</sup>

Note: River Flat Eucalypt Forest is not listed under the EPBC Act.

Following the conversion of communities to BioMetric vegetation types, the existing vegetation mapping was tagged with the corresponding BioMetric vegetation types as presented in **Table 2**. The vegetation mapping within the BCAA was subsequently updated using high resolution digital imagery and an on-screen digitising approach to capture vegetation which had not previously been mapped or was no longer extant.

Additional vegetation added to the mapping layer included areas of moderately dense paddock trees, dense regrowth which may not have been present during the original mapping and some minor areas which have been added to the assessment area due to boundary changes. Areas which had been cleared since the original mapping were also removed (including a general tidying-up of the vegetation community boundaries).

The vegetation within the assessment area was assigned to either 'cleared', 'low' or 'moderate to good' condition category, and further classified using ancillary codes as defined by the BCAM. The ancillary codes were allocated based on field assessment. Based on site assessment (plots), four vegetation zones were considered to be in 'low condition', which consisted of 'disturbed', 'grazed woodland' and 'scattered paddock trees' over exotic pasture of 'Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin' and 'underscrubbed' vegetation of 'Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin' (**Section 3.3**). One vegetation zone was considered to be in 'moderate-good' condition ('Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin') and the remainder of the site meet the biometric definition of cleared land i.e. no canopy or - present and greater than 50% of the ground cover present consisted of exotic species at the time of assessment (August 2012 and March-April 2014). The cleared category reflects the long history of grazing and pasture improvement across most of the Emerald Hills Estate, which despite retaining in parts higher cover of native species such as Kangaroo Grass (*Themeda Australia*), Purple Wiregrass (*Aristida ramosa*) and Three awn Spear Grass (*Aristida vagans*), Red Grass (*Bothriochloa macra*), Windmill Grass (*Chloris truncata*), Weeping Grass (*Microlaena stipoides*) and Wallaby Grass (*Rhytidisporum procumbens*), these patches

were quite small (generally 20-30m) or had high cover of Paspalum (*Paspalum dilatatum*) and Kikuyu grass (*Pennisetum clandestinum*).

Further, there are several trees that can be clearly seen in the aerial photographs that are either exotic trees or planted native species that are not characteristic of the original vegetation types (e.g. lemon Scented Gums, Spotted Gum and Grey Gums).

The location of the vegetation types identified within the assessment area is presented in **Figure 4**.

**Table 3: Vegetation zone descriptions**

Biometric Vegetation Type	Vegetation Zone	BioMetric condition	Description
Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin	Underscrubbed	Moderate-good	Young (generally <50 years, few hollow bearing trees) intact remnant and regrowth eucalypt over-storey, currently grazed with some selective logging. Moderate to high native species richness, midstorey generally absent but regenerating in parts.
	Disturbed	Low	This area would have been subject to the same management as the remainder of the site, with fencing introduced <10 years previous for the area to be used as a stockpile area for a tree lopping business. Presently, there are non-permanent disturbances for car parking and a shipping container storage shed. The zone also retains a cleared vehicular track and turnaround area for trucks and machinery. Earthmoving has modified the natural contours of this area.
	Grazed	Low	Young (generally <50 years) intact remnant and regrowth eucalypt over-storey, currently grazed with some selective logging. Moderate native species richness, midstorey generally absent.
	Scattered Paddock Trees	Low	Scattered remnant trees over exotic pasture
Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	Underscrubbed	Low	As per Grey Box – Forest Red Gum grassy woodland, though smaller patch size has allowed for greater weed incursion and infestation of creekline by <i>Juncus acutus</i>



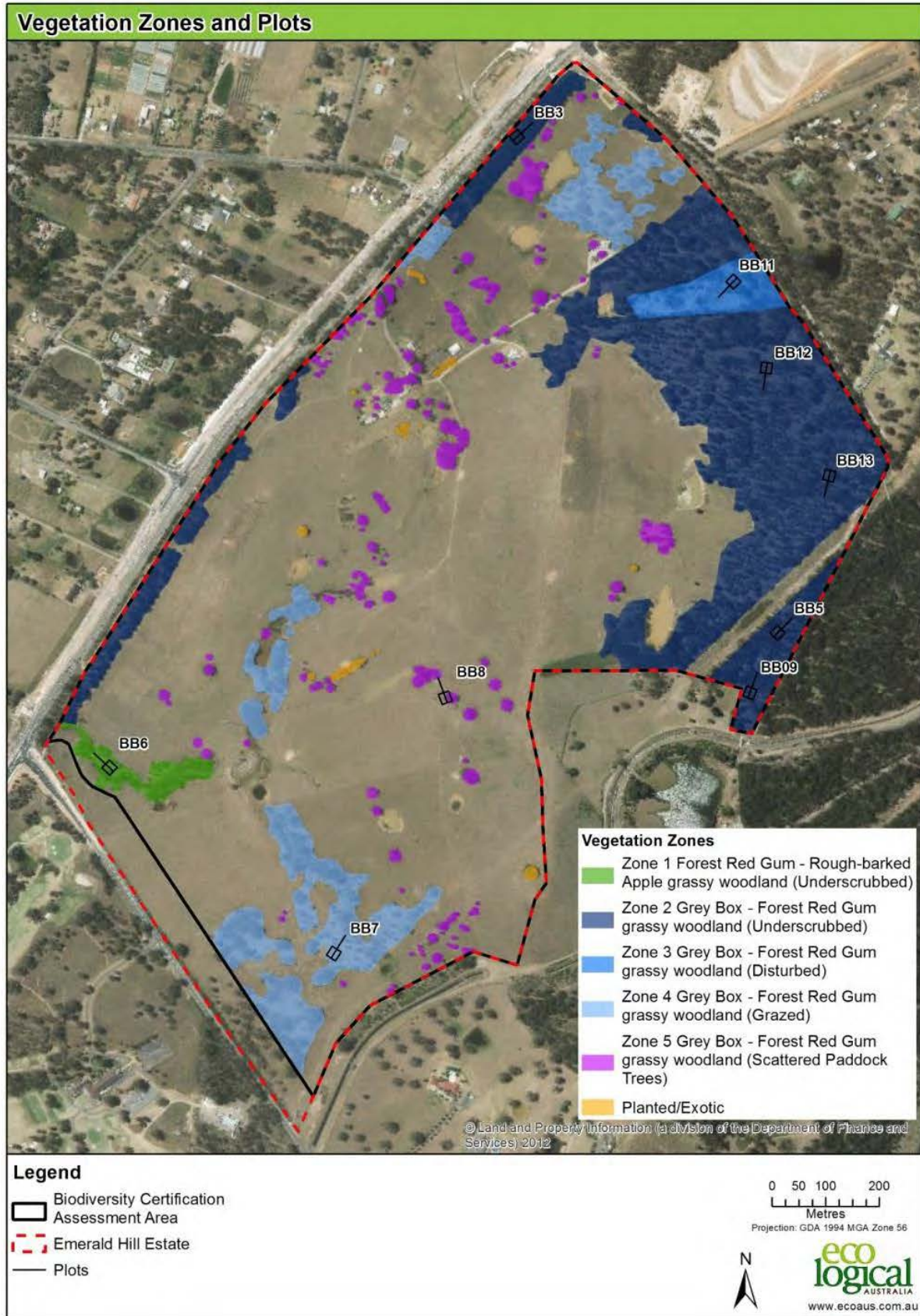


Figure 4: BioMetric vegetation types and zones within the Emerald Hills Estate

*Grey Box – Forest Red Gum grassy woodlands on shale of southern the Cumberland Plains*

In total there are 43.29 ha of 'Grey Box – Forest Red Gum grassy woodlands' vegetation mapped onsite. Both Shale Plains and Shale Hills Woodland have been previously mapped onsite by NPWS (2002), however it was the opinion of the assessors that only Shale Hills Woodland to be present. This community is generally described as a medium height eucalypt woodland with a lower tree layer, an open low shrub layer and a prominent (usually grassy) ground layer.

Both Shale Plains and Shale Hills Woodland communities are recognised by a very similar species assemblage, with both dominated by *E. tereticornis* (Forest Red Gum) and *E. moluccana* (Grey Box) with very similar understorey species, and when found in disturbed states they are often only distinguished on the ground through their landscape position.

The BCAA is located in the Scenic Hills area of the Cumberland Plain, with the landscape generally characterised by a transition from the flatter plains to the north to low undulating slopes. Given the disturbed nature of the vegetation in the BCAA, which is underscrubbed and managed by cattle grazing, together with the prominence of rolling hills across the site, all vegetation was identified as Shale Hills Woodland. The BioMetric Vegetation Type equivalent of this vegetation community is, 'Grey Box – Forest Red Gum grassy woodlands on shale of southern the Cumberland Plains'.

Further the Biometric plot data was input to OEHs Cumberland Plain vegetation classification tool which provides an indication of the most likely vegetation community present based on the number of native species recorded and the proportion of diagnostic species determined by quantitative regional scale vegetation survey projects. This analysis indicate both Shale Hills and Shale Plains Woodland as possibly being present, however, following discussion with OEH and based on the largely disturbed nature of the site, it was agreed that the selection of HN529

Within the BCAA, this vegetation type is generally dominated by *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box), with *Eucalyptus crebra* (Narrow-leaved Ironbark) and *E. eugenioides* (Thin-leaved Stringybark) found in lower densities. Some supplementary planting has taken place along the northern boundary of the site within the past 20-30 years, with species indigenous to this vegetation type including *E. crebra* (Narrow-leaved Ironbark), *E. fibrosa* (Broad-leaved Ironbark), complementing existing scattered occurrences of *E. tereticornis*, *E. moluccana* and *E. eugenioides*. A small stand *C. citriodora* (Lemon Scented Gum) was also planted along this boundary, however this species is not native to NSW and was consequently mapped as 'exotic/introduced' vegetation (**Figure 4**).

This community exists in various conditions and in various states of regeneration, which most likely reflects the variable levels of soil disturbance and prolonged grazing and other rural activities across the site. This management history has resulted in areas of relatively intact canopy, with little to no midstorey and generally mixed native and exotic groundcover. The largest remnant of vegetation in the north-eastern part of the site is classified as 'moderate to good' condition under the BCAM (27.32 ha), while the remaining patches are in 'low' condition and exists as 'disturbed woodland', 'grazed woodland' and remnant 'scattered paddock trees' (15.96 ha). A further 1.68 ha of derived native grassland is mapped in retained lands within an easement within the proposed BioBank site, and is not considered further in this assessment.

A summary of the key features of the vegetation type are provided below.

**Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin (HN 529)**

<b>Description</b>	Occurs on undulating terrain on shale hills of the southern Cumberland Plain at altitudes from 50 to 300m.
--------------------	--



<b>Canopy</b>	Grey Box ( <i>Eucalyptus moluccana</i> ), Forest Red Gum ( <i>Eucalyptus tereticornis</i> ), Narrow-leaved Ironbark ( <i>E. crebra</i> ), Spotted Gum ( <i>Corymbia maculata</i> ), Broad-leaved Ironbark ( <i>E. fibrosa</i> )
<b>Midstorey</b>	Blackthorn ( <i>Bursaria spinosa subsp. spinosa</i> ), Native Raspberry ( <i>Rubus parvifolius</i> ), <i>Clematis glycinoides</i>
<b>Groundcovers</b>	Kidney Weed ( <i>Dichondra repens</i> ), <i>Brunoniella australis</i> , <i>Desmodium gunnii</i> , <i>Aristida ramosa</i> , <i>Microlaena stipoides var. stipoides</i> , <i>Carex inversa</i> , Kangaroo Grass ( <i>Themeda australis</i> ), <i>Cyperus gracilis</i> , <i>Dichelachne micrantha</i> , <i>Asperula conferta</i> , <i>Oxalis perennans</i> , <i>Cheilanthes sieberi subsp. sieberi</i> , <i>Desmodium brachypodum</i>
<b>Threatened species, populations, ecological communities</b>	Cumberland Plain Woodlands (Shale Hills sub-community), critically endangered ecological community
<b>Weeds</b>	African Olive ( <i>Olea europaea</i> ), Paddy's Lucerne ( <i>Sida rhombifolia</i> ), Brial Creeper ( <i>Asparagus asparagoides</i> ), Spear Thistle ( <i>Cirsium vulgare</i> ), Fireweed ( <i>Senecio madagascariensis</i> )

*Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain*

'Forest Red Gum – Rough-barked Apple on alluvial flats of the Cumberland Plain' occurs onsite as the Alluvial Woodland sub-community recognised by NPWS (2002). This community occurs exclusively along or in close proximity to watercourses, hence its location along the banks of the watercourse in the south-west of the EHE site. The area of vegetation on site is relatively small at approximately 1.31 ha.

The composition of Forest Red Gum – Rough-barked Apple grassy woodland can vary significantly between patches, but the remnant within the BCAA site is dominated by *E. tereticornis* (Forest Red Gum) and *E. amplifolia* (Cabbage Gum). The lower stratum of small trees includes *Casuarina glauca* (Swamp Oak) and *C. cunninghamiana* (River Oak), *Bursaria spinosa* (Blackthorn) and native ground cover plants including *Sporobolus* spp., *Cymbopogon refractus*, *T. australis* and *Aristida vagans*. The groundcover is mostly dominated by the invasive exotic species *Juncus acutus*.

A summary of the key features of the vegetation type are provided below.

**Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin (HN526)**

**Description** Occurs on stream banks and alluvial flats on the Cumberland Plain.



<b>Canopy</b>	Forest Red Gum ( <i>Eucalyptus tereticornis</i> ), Rough-barked Apple ( <i>Angophora floribunda</i> ), Cabbage Gum ( <i>Eucalyptus amplifolia</i> subsp. <i>amplifolia</i> ), <i>Casuarina cunninghamiana</i> (River-oak), <i>C. glauca</i> (Swamp Oak)
<b>Midstorey</b>	<i>Acacia parramattensis</i> , Blackthorn ( <i>Bursaria spinosa</i> subsp. <i>spinosa</i> ).
<b>Groundcovers</b>	<i>Microlaena stipoides</i> var. <i>stipoides</i> , Kangaroo Grass ( <i>Themeda australis</i> ), <i>Oplismenus aemulus</i> , Shorthair Plumegrass ( <i>Dichelachne micrantha</i> ), Kidney Weed ( <i>Dichondra repens</i> ).
<b>Threatened species, populations, ecological communities</b>	River Flat Eucalypt Forest on Coastal Floodplains (Alluvial Woodland sub-community), endangered ecological community
<b>Weeds</b>	Lantana ( <i>Lantana camara</i> ), Paddys Lucerne ( <i>Sida rhombifolia</i> ), Cassia ( <i>Senna pendula</i> ), Privet spp.

## 2.4 Determination of species credit species requiring survey

The BCAM only requires targeted survey for those species considered to be ‘species credit’ species, and which will be impacted by the proposed development. Species credits are the class of biodiversity credit created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates.

Species requiring survey and the acceptable month of survey under the BCAM are provided in **Appendix 2**. The list includes nine threatened flora species and three threatened fauna species.

The list was reviewed and culled consistent with Section 4.3 of the BCAM to produce a final list of species requiring targeted survey. The steps undertaken to finalise this list are discussed further below.

### 2.4.1 Step 1 – identify candidate species for initial assessment

A list of candidate species were filtered into the BCAA using the Biocertification credit calculator version 1.8 and reviewed for their likelihood of occurrence literature and database review as provided in **Section 2.1**. A search of all threatened species requiring species credits recorded within a 10km radius of the BCAA from the Atlas of NSW Wildlife was also undertaken to augment the candidate species list (**Figure 5**).

### 2.4.2 Step 2 – review list to include additional species

Review of the list of candidate species following considered of the literature and database review (**Section 2.1**) did not identify any additional species credit species as potentially occurring in the BCAA. As part of their review of earlier versions of the assessment, OEH queried whether *Pterostylis saxicola* should have been included as a candidate species. It is the view of the assessors that the vegetation on site is not suitable habitat for the species which is known to prefer the higher sandstone influenced sites. The closest record is from Simmo’s Beach Reserve adjacent to the Georges River in Campbelltown LGA.

### 2.4.3 Step 3 – identify candidate species for further assessment

All species identified in Step 2 above were confirmed to be the subject of targeted survey.

### 2.4.4 Step 4 – identify potential habitat candidate species for initial assessment

For the three species considered most likely to be present in the BCAA (*Pimelea spicata*, Cumberland Land Snail and Green and Golden Bell Frog), due to recent and/or nearby records, a detailed description of the survey effort and findings is provided in Step 5.

Surveys were undertaken in suitable months for all species as indicated in **Appendix 2**.

In addition to survey’s for each species being consistent with the relevant requirements of the *Draft Threatened Biodiversity Survey and Assessment guidelines* (DEC 2004) (TBSA), *Threatened species survey and assessment guidelines: field survey methods for fauna – amphibians* (DECC 2009), *Environmental Impact Assessment Guidelines – for Cumberland Plain Large Land Snail* (NPWS 2000) and *Pimelea spicata* (NPWS 2004) were also followed.

Targeted survey locations and survey effort are depicted in **Figure 6** and **Figure 7**. In addition, an expert report has also prepared by Ross Wellington for GGBF stating that the species is unlikely to be present within the impact area (**Appendix 3**).

## 2.4.5 Step 5 – determine whether species is present

### *Spiked Rice Flower (Pimelea spicata)*

*Pimelea spicata* is found in small populations across the Cumberland Plain, and is associated with the shale soils of both sub-communities of Cumberland Plain Woodland; Shale Hills and Shale Plains Woodlands. It is often found in disturbed sites, where grazing has not been intensive.

The species flowers sporadically in response to rain, and is therefore best targeted when known populations are flowering at nearby sites. It is known from a number of populations in close proximity to the BCAA, one immediately to the south, at Camden Lakeside Golf Course, a site near Harrington Grove Country Club, as well as within the East Leppington precinct immediately to the north. The Camden Lakeside Golf Course and Harrington Grove reference sites were used to confirm the species was flowering prior to each survey period.

Survey effort was focused on disturbed areas within the site that had not been exposed to intensive grazing and which were considered most likely to provide suitable habitat for the species. As a result, effort centred on more vegetated areas within the site and less so on the more intensely grazed open pasture. Similarly, effort was also focussed within the area proposed for Biocertification (i.e. the development area) of the BCAA and not the areas proposed for conservation measures, including the large remnant in the north eastern corner of the site. Within the site it is estimated that 21.71 ha of suitable habitat exists for the species, excluding the area of proposed conservation lands and open pasture. The environmental impact assessment guidelines for the species (NPWS 2004) recommend survey effort should be at least one hour per hectare of suitable habitat. Based on the total number of hours during which targeted and opportunistic survey was undertaken for the species (**Section 2.2**) and the area of potential habitat, it is considered that the requirements of the guideline has been met.

Despite records of this species being identified in the vicinity of the site, none were found during the targeted survey undertaken as part of this study. This result is consistent with previous field work undertaken by ELA on this site during 2009 (ELA 2009a), which also did not reveal the presence of the species. Similarly, the ecological assessment completed by NGH environmental as part of the Review of Environmental Factors for the Camden Valley Way upgrade, did not record any observations of the species within the BCAA (ngh 2010).

The location of the targeted survey for *Pimelea spicata* is shown in **Figure 6**.

### *Green and Golden Bell Frog*

Habitat for the Green and Golden Bell Frog (GGBF) is associated with land within 100 m of emergent aquatic or riparian vegetation, including shallow, still or flowing water and/or widely fluctuating water bodies that are without heavy shading. A number of dams and associated drainage depressions are located within the assessment area, and while not ideal, is considered to provide potential habitat for this species.

GGBF is known from historic records within 5 km of the BCAA, and is a species requiring survey under the BCAM. As such, one night of targeted survey including call playback and spotlighting, consistent with DECC (2009a) was undertaken by Ross Wellington and Rebecca Dwyer, on 21 February 2013. Survey for this species was deliberately postponed following the identification of potential habitat during the August 2012 survey period until such time that the site had experienced a significant rain event during the summer period which would ensure optimal conditions for discovering the species. Ross Wellington, who is an experienced herpetologists and recognised GGBF expert, conducted the survey and concluded this species was unlikely to occur within the BCAA due to lack of recent records in the

area and the minimal amount of potential habitat within the site (ELA 2013a). A copy of the expert report is provided in **Appendix 3**.

The location of the targeted survey for Green and Golden Bell Frog is shown in **Figure 7**.

#### *Cumberland Plain Land Snail*

Cumberland Plain Land Snail (CPLS) is 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 (Rudman 1998). Urban waste may also form suitable habitat (Rudman 1998).

Targeted surveys for this species consistent with the EIA guidelines (NPWS 2002), identified records of this species in the eastern portion of the site in the area of the proposed Biobank site. This area remains relatively under-grazed comparative to the remainder of the site and also abuts an ungrazed patch of Shale Hills Woodland which retains higher amounts of CPLS habitat, in the form of woody debris and leaf litter.

Associated habitat was sparse throughout the remainder of the site and as such, this species is considered to be restricted to the land proposed for conservation area (i.e. the Biobank site).

#### **2.4.6 Step 6 – identify the threatened species that trigger a red flag**

Cumberland Plain Land Snail is not a Red Flag species.

#### **2.4.7 Step 7 – finalise the boundary of the species polygon and area of impact**

There will no impact to CPLS as its habitat will be retained and enhanced through the creation of a Biobank site where it found in the BCAA. A species polygon of potential habitat that has been included in the Biobanking Agreement is presented in **Figure 6**.



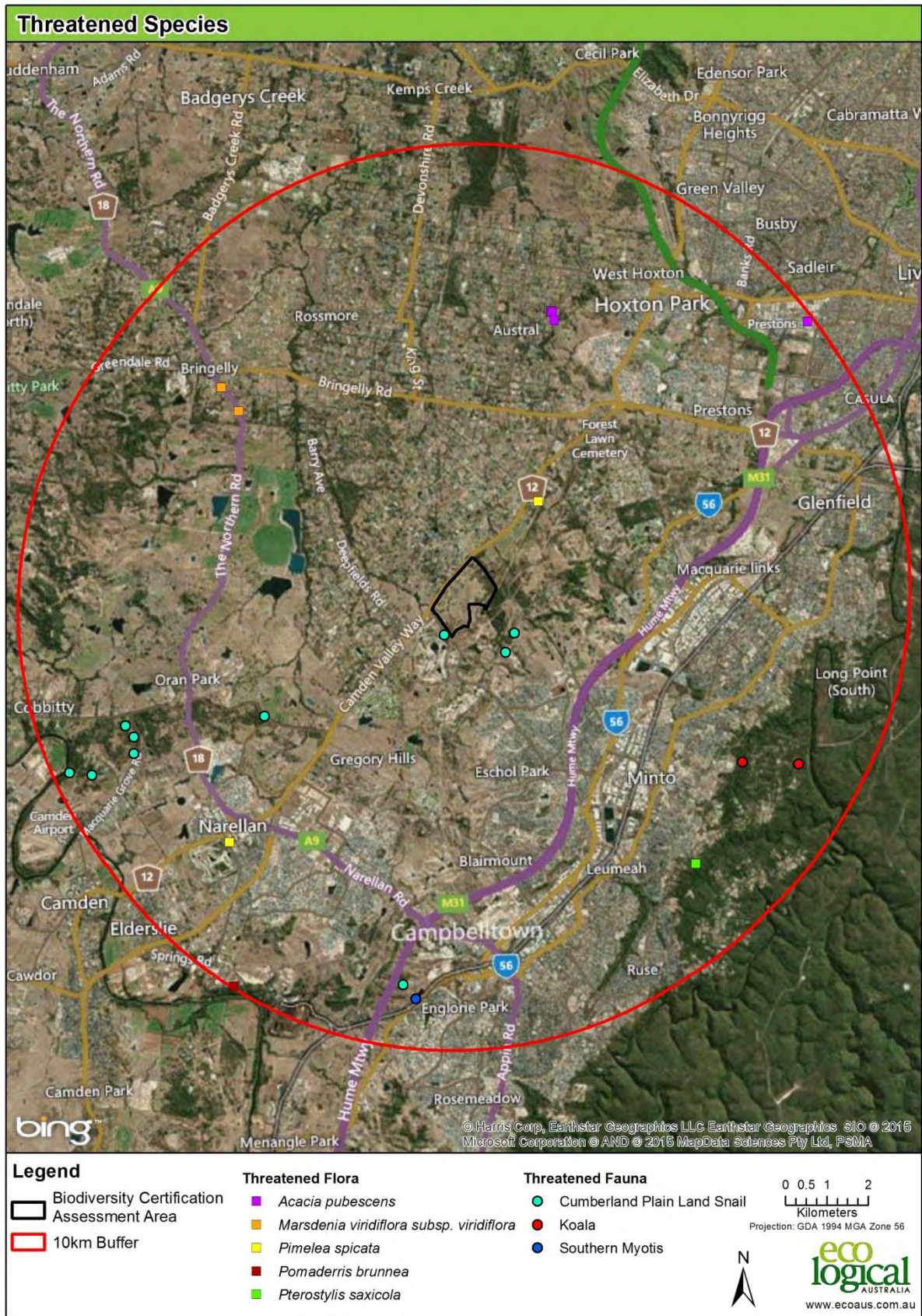


Figure 5: NSW Wildlife Atlas Records of all species credits species recorded within 10km of the BCAA

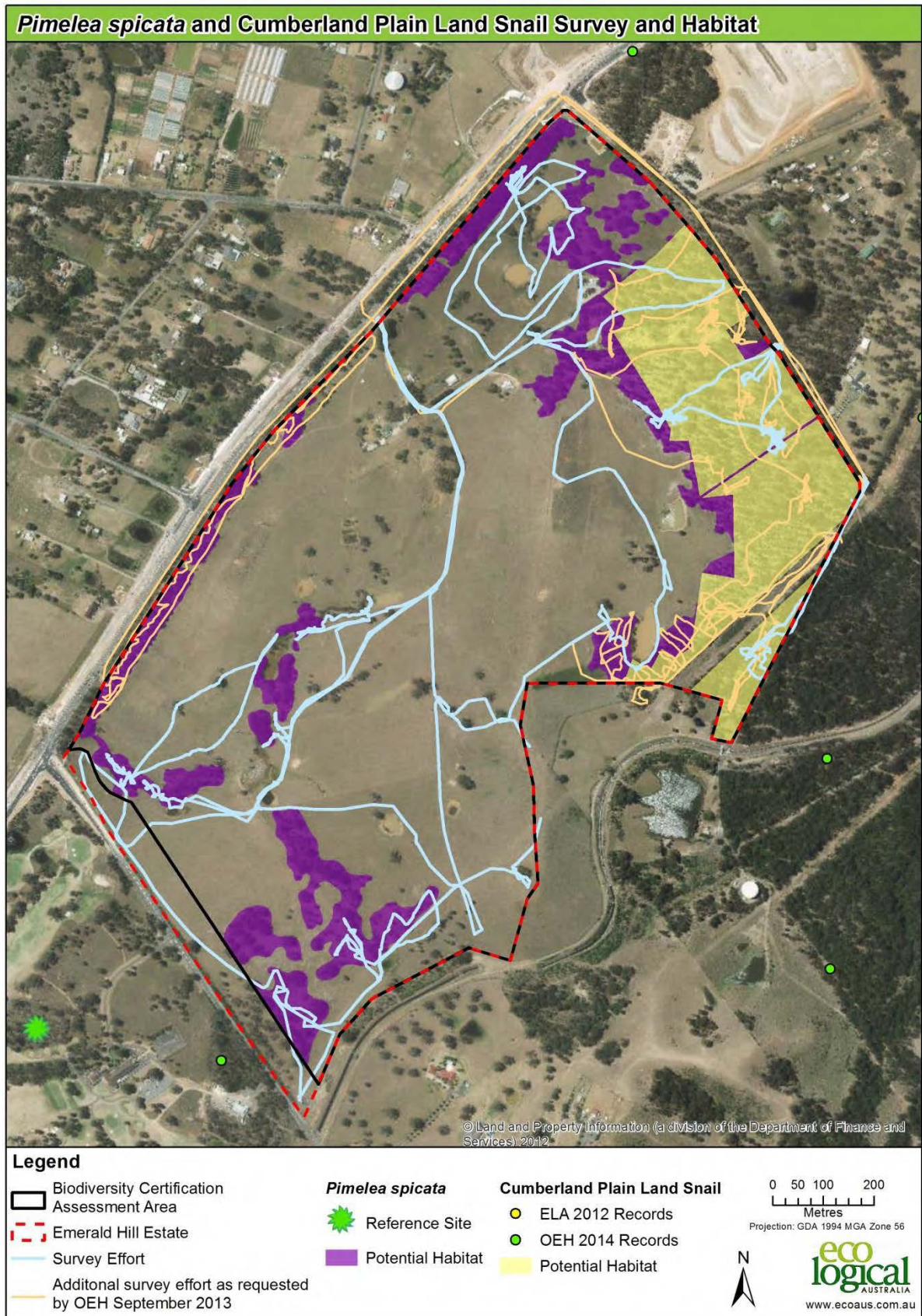


Figure 6: Habitat map for *Pimelea spicata* and Cumberland Land Snail including reference population and survey effort

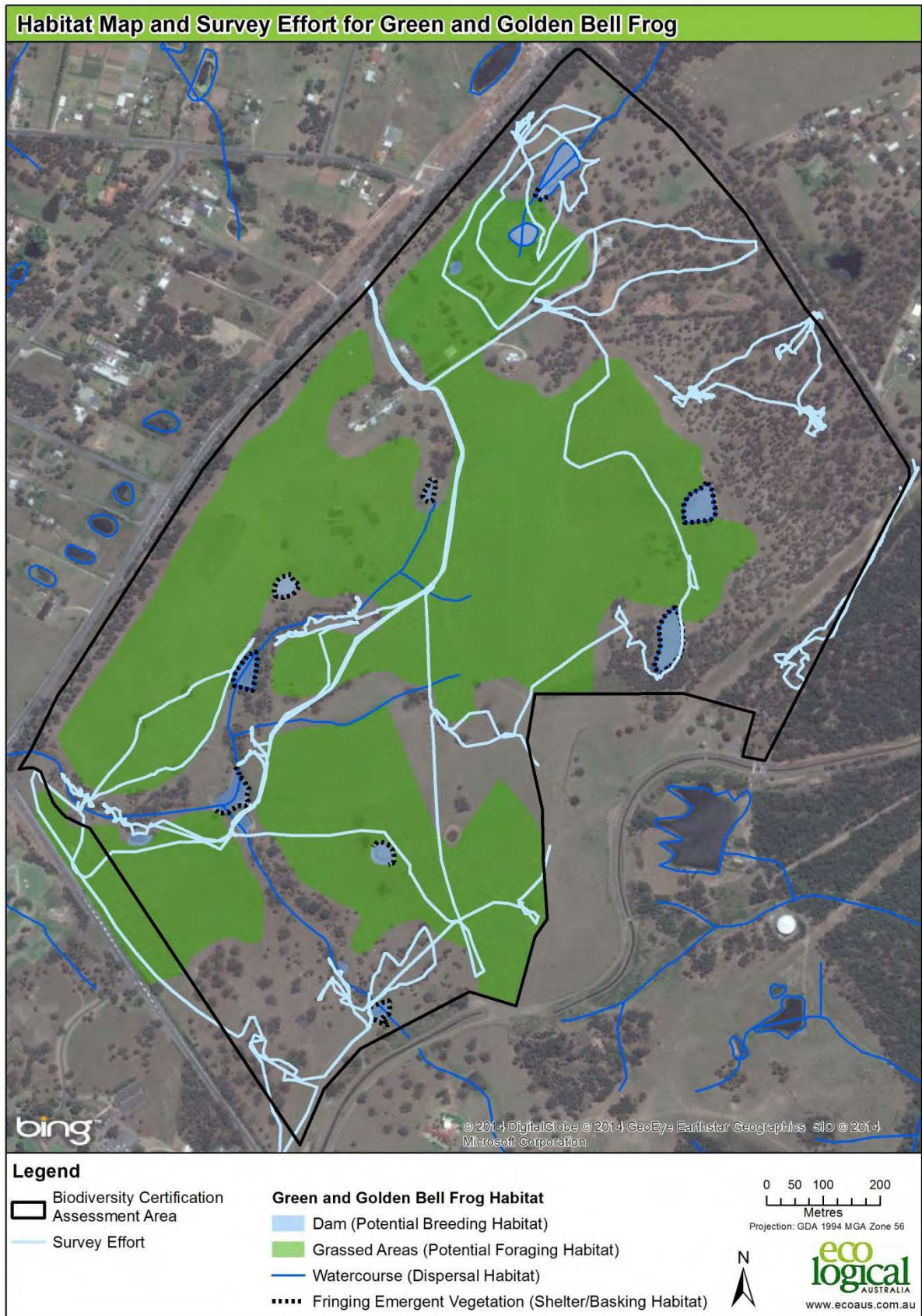


Figure 7: Habitat map for Green and Golden Bell frog including reference population and survey effort

### 3 Biocertification Assessment Results

Provided below are the results of the biodiversity certification assessment conducted to the requirements of the BCAM. The information below is technical in nature, and relies on a broad understanding of the BCAM to understand the methods applied. Readers should make themselves familiar with the BCAM before reviewing this section of the document.

#### 3.1 Biodiversity Certification Assessment Area

The Biodiversity Certification Assessment Area (BCAA) is comprised of:

- Land proposed for biodiversity certification (development) – ‘requires’ biodiversity credits
- Land proposed for conservation – ‘generates’ biodiversity credits
- Lands where the current land use will be retained (retained lands) – neither requires nor generates biodiversity credits

The footprint proposed for biodiversity certification (development) is 122.49 ha (24.39 ha of which is currently vegetated) (**Table 4** and **Figure 3**). The land proposed for conservation totals 20.13 ha. Finally, 3.02 ha of land has been identified as maintaining its current land use (1.75 ha of which is vegetated), and has therefore been assessed as retained land (i.e. credits are neither required nor generated).

**Table 4: Land use breakdown**

Development Footprint	Area (ha)
Land Proposed for Biodiversity Certification (Development)	122.49
Land Proposed for Conservation Measures	20.13
Retained Lands (Land excluded from this assessment)	3.02
Total	145.64

As defined in the BCAM, different levels of conservation security and ongoing management result in the generation of a different number of credits. The credit entitlement for conservation areas are broken into three broad categories, being:

- Areas that are *managed and funded* in perpetuity (i.e. Biobank sites or national parks) – 100% credit entitlement
- Areas that are *managed* in perpetuity (e.g. NPW Act Conservation Agreements etc) – 90% credit entitlement
- Areas that are secured through *planning instrument* (i.e. environmental zoning) – 25% credit entitlement

### 3.2 Vegetation mapping and zones

Across the entire site two vegetation types were identified (**Table 5**). In total 46.28 ha of native vegetation was mapped across the site, with the dominant vegetation types being ‘Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain’ (44.97 ha), and ‘Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain’ (1.31 ha). Cleared land, which in the context of the BCAM includes exotic vegetation and planted trees makes up 99.37 ha of the site.

**Table 5: Area of vegetation within the BCAA**

BioMetric Vegetation Type	Area (ha)
Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain	44.97
Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain	1.31
Cleared land	99.37
<i>Total</i>	<i>145.65</i>

The two vegetation types have been separated into four vegetation zones for this assessment (**Table 6** and **Figure 4**). One zone was mapped as ‘moderate to good’ condition, while four vegetation zones were mapped in ‘low condition’. The following ancillary codes have been used to further separate the vegetation zones:

- Underscrubbed
- Disturbed
- Grazed
- Scattered paddock trees

**Table 6: Area of vegetation zones assessed within the BCAA**

Veg Zone ID	BioMetric Vegetation Type	Condition <sup>1</sup>	Ancillary Code	Area (ha)			
				Land proposed for Conservation	Land proposed for Biodiversity Certification	Retained Land <sup>2</sup>	Total
1	Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats (HN526)	Low	Underscrubbed / grazed	0	1.31	0	1.31
2	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain (HN 529)	M/G	Underscrubbed	18.40	8.92	0	27.32
3		Low	Disturbed	1.73	0.26	0	1.99
4		Low	Grazed		9.98		9.98
5		Low	Scattered Paddock Trees	0.0	3.92	0.07	3.99
N/A		N/A	Derived Native grassland	0.0	0.0	1.68	1.68
<b>Totals</b>				<b>20.13</b>	<b>24.39</b>	<b>1.75</b>	<b>46.28</b>

<sup>1</sup> Condition as defined by the BCAM;

<sup>2</sup> Not assessed as area neither requires or generates credits

### 3.3 Transect/Plot Data and Site Value Scores

Appendix 4 of the BCAM defines the minimum number of transects/plots required per vegetation zone area (DECCW 2011). A total of nine (9) BioMetric vegetation transects/plots were captured across the BCAA, with a transect/plot requirement of seven transects/plots calculated from the combined area of conservation, development and retained lands (**Table 7** and **Figure 4**). The transect/plot data captured is provided in **Appendix 4**.

Field survey deliberately targeted locations that were considered likely to be representative of the mapped vegetation communities in their various condition states. Quadrats were surveyed following the DECCW Interim Vegetation Standard (Sivertsen 2009). Quadrat surveys were 0.04 ha (20 m x 20 m) and recorded presence of all vascular flora species, along with cover and abundance for each species using a modified Braun-Blanquet scale (i.e. measures of cover and abundance to determine species dominating each stratum).

Transect habitat assessments were also undertaken following the NSW Biobanking Assessment Methodology (BBAM) (DECC 2008) in order to provide sufficient information to undertake the ‘improve or maintain’ test as required in the BCAM. Also a component of the BBAM, habitat features were determined over 0.1 ha survey (50 m x 20 m quadrat); measures including the number of hollow bearing trees and length of fallen dead timber greater than 10 cm diameter. Within the 0.04 ha quadrats, projected foliage cover of each strata level and exotic flora was assessed along a 50 m transect.

**Table 7: Vegetation zones and transect/plot data**

Veg Zone ID	BioMetric Vegetation Type	Ancillary Code	Area to be Assessed (ha)	Transects/ Plots Required	Transects/ Plots Collected
1	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain	Underscrubbed	1.31	1	1
2	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain	Underscrubbed	27.32	3	5
3		Disturbed	1.99	1	1
4		Grazed	9.98	1	1
5		Scattered Paddock Trees	3.99	1	1
<b>Total</b>			<b>44.59</b>	<b>7</b>	<b>9</b>

Current site value and future site value scores were calculated for each vegetation zone using the transect/plot data collected. The BCAM credit calculator was used to produce the current and future site value scores for both development and conservation areas (**Table 8**).

**Table 8: Site value scores allocated to each vegetation zone**

Veg Zone ID	BioMetric Vegetation Type	Ancillary Code	Current Site Value Score	Future Site Value Score (Development)	Future Site Value Score (Conservation)
1	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain	Underscrubbed	32	0	49
2	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain	Underscrubbed	42	0	73
3	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain	Disturbed	31	0	56
4	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain	Grazed	33	0	55
5	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain	Scattered Paddock Trees	28	0	44

### 3.4 Landscape Score

#### 3.4.1 Native Cover in Landscape

Native vegetation cover within an assessment circle was calculated for the project (**Figure 8**). The landscape score calculations were completed with a single 1,000 ha circle. The results of the circle assessment are contained in **Table 9**. Pre-certification, 266 ha (27%) of native vegetation was present in the circle. The clearing of 24 ha of vegetation would result in 242 ha of vegetation remaining and was rounded to 24%. The % native vegetation cover pre and post certification is 21-30%.

**Table 9: Native vegetation in assessment circle**

Circle	Before Certification		After Certification	
	Area Of Vegetation Within Assessment Circle (Ha)	Native Vegetation Cover Class (%)	Area Of Vegetation Within Assessment Circle (Ha)	Native Vegetation Cover Class (%)
1 (1,000ha)	266 (27%)	21-30%	242 (24%)	21-30%



The land subject to conservation measures (post biodiversity certification) is 20.13 ha, of which all 20.13 ha is currently vegetated land.

### 3.4.2 Connectivity Value

The current connectivity value of the site was assessed according to Section 3.7.2 of the BCAM. The BCAM identifies three components of connectivity, being the status of the area as a 'state' or 'regional' biodiversity link, the importance of each of the drainage lines within the study area and an assessment of the connectivity of vegetation.

For the purposes of this assessment, a 'minor watercourse' is recognised in the south western corner of the site (**Figure 7**), making a 'local biodiversity link' according to Table 4 of the BCAM and a score of 6 was allocated pre development. Currently the vegetation in this local biodiversity link is located within development lands, and is therefore impacted by development and was allocated a score of 0 after development.

A local biodiversity link is also present in the conservation area, as vegetation is in moderate to good condition, has a patch size >1 ha which is separated by <30 m. As this score is equal to that allocated for the impact to the vegetation connectivity, the score before and after development remains the same.

Under the BCAM, the highest score of all connectivity assessments in the BCAA is awarded. The final results of these assessments are provided in **Table 10**. A description of the scores obtained for each component of the connectivity assessment is provided below.

**Table 10: Connectivity scores allocated for the assessment**

Connectivity Score	Pre Development	Post Development
Development	6	0
Conservation	6	

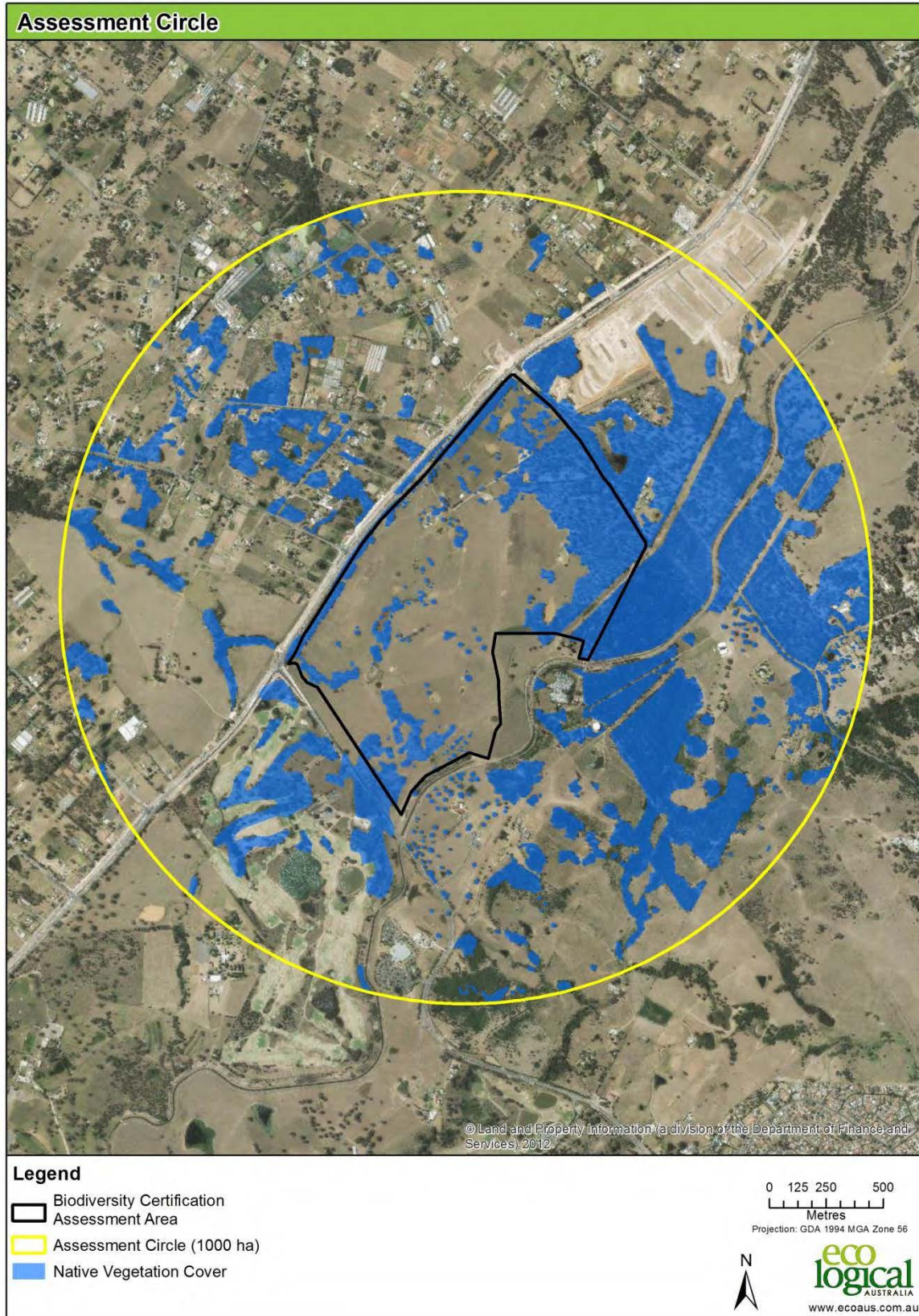


Figure 8: Assessment circle

### 3.4.3 Adjacent Remnant Area

The maximum adjacent remnant area (ARA) was calculated for the proposal in order to determine the score to be allocated for this measure. The site predominantly occurs on the Cumberland Plain Mitchell Landscape, which is 89% cleared. The vegetation on site is well connected, and as such has an ARA of >51 ha, which is the maximum ARA for Mitchell Landscapes >70-90% cleared. This is applicable for both the certification and conservation lands in the proposal.

## 3.5 Threatened species assessment

### 3.5.1 Species credits

No species requiring species credits have been identified within the BCAA, as Cumberland Plain Land Snail is only found in the land proposed for conservation.

## 3.6 Red flags

The two vegetation types within the BCAA have been identified as being either an Endangered Ecological Community (EEC), or Critically Endangered Ecological community, and both are overcleared vegetation types (>70% cleared of original extent) (**Table 11**). These vegetation types are therefore 'red-flagged' when in moderate to good condition under the BCAM (**Figure 9**). Under the BCAM, Red Flag areas should be avoided and can only be impacted in accordance with certain rules outlined in Section 2.4 of the BCAM.

Although most of the vegetation within the BCAA was identified as being in 'moderate to good' condition, on completion of the required BioMetric plots four zones, 'Forest Red Gum-Rough Barked Apple – underscrubbed', Grey Box – Forest Red Gum – disturbed', Grey Box – Forest Red Gum – grazed' and 'Grey Box – Forest Red Gum – scattered paddock trees', were identified as in 'low' condition due to a site value score being less than 34/100. These vegetation zones are therefore not red flagged and are not included in the statistics provided below.

A total of 27.32 ha of red flagged vegetation is present within the BCAA, of which 8.92 ha is impacted by the proposal (**Figure 10**). This represents an impact of 32.7% on red flagged vegetation within the study area. The impact on red flagged vegetation has been assessed in accordance with Section 2.4 of the BCAM and a red flag variation request is included in **Section 4**. It is noted that the red flag variation request must be assessed and approved by OEH before biodiversity certification can be conferred.

**Table 11: Impacts to red flagged vegetation**

BioMetric Vegetation Type	EEC/CEEC Name	% Cleared in CMA	Area Within BCAA (ha)	Area Impacted (ha)	Area Impacted (%)
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain	Cumberland Plain Woodland CEEC	90%	27.32	8.92	32.7



Figure 9: Red flag vegetation

### 3.7 Indirect Impacts

The BCAM requires that any application for formal biodiversity certification must demonstrate how the “*proposed ownership, management, zoning and development controls of the land proposed for biodiversity certification is intended to mitigate any indirect impacts on biodiversity values*” (DECCW 2011).

For the BCAA, all impacts, direct and indirect, have been considered to be completely contained within the area to be biocertified, that is the development area includes all urban development areas and associated roads, stormwater management structures, infrastructure and features such as Asset Protection Zones (APZs) and other impacts within the land identified for development.

The Camden Development Control Plan (DCP) (2011), Part C13 ‘Emerald Hills’ has been adopted by Council, which will assist in mitigating any indirect impacts that may result from the biocertification of the land. In this regard, the DCP will affect biodiversity conservation outcomes both within the biocertified and conservation areas by guiding development outcomes with respect to a range of key considerations including subdivision design, large lot development, stormwater management and vegetation conservation. Relevant objectives listed in the draft DCP include:

- **Subdivision design**
  - Establish an urban structure which will allow for the protection and management of important vegetation
- **Large lot residential development**
  - To preserve significant vegetation, whilst facilitating the provision of appropriate development as a mechanism to own and manage the vegetation
- **Vegetation conservation**
  - Ensure the protection and enhancement of existing significant trees and significant remnant vegetation where practical
  - Facilitate the implementation of the agreed conservation offset package for Emerald Hills
  - Prevent the spread of weeds during and after construction
- **Stormwater management**
  - Provide the framework for the protection and enhancement of water quality and management of stormwater within the site

A Conservation Management Plan (CMP) will also be prepared, which will further guide activities within the site during and following the development phase. The CMP will address the following matters and influence both direct and indirect impacts within the site:

- Pre-clearing survey procedures
- Vegetation clearing procedures
- Injured animal responses
- Stop work incidents and procedures
- Erosion and sediment control
- Topsoil management
- Weed management

Other indirect biodiversity impacts may arise as a result of management practices within the transmission easement that traverses the proposed conservation area. As these areas are considered retained lands within the BCAA and are not proposed for biocertification, these impacts are not a component of this assessment.

Nevertheless, any works within the easement will be considered in the context of a Review of Environmental Factors (REF) which would be undertaken prior to any on ground maintenance activities. In this regard, the REF will most likely be provided to Camden Council as the local consent authority, and while it is not required to provide consent for the activities that are proposed, it will have the opportunity to comment on identified impacts and mitigation measures. In this context, it will also be able to influence the nature and magnitude of any indirect impact that may result from the management activities proposed.

### **3.8 Credit Calculations**

#### **3.8.1 Ecosystem Credits**

Ecosystem credits have been calculated for the impact caused by the proposed rezoning and the improvements to biodiversity values through the management of conservation lands. In total, **470** ecosystem credits are required for the land proposed to be developed (**Table 12**).

All ecosystem requirements will be met through the retirement of Biobanking Credits, either on-site at the Emerald Hills Biobank Site (currently under assessment with OEH), or purchased from an off-site conservation site known as Hardwicke Biobank Site Stage 1 at The Oaks (Wollondilly LGA), that was submitted to OEH for assessment in December 2014. As such, the credit calculations have considered only the 'managed and funded' option for conservation gain under BCAM (**Section 3.1**).

**Table 12: Final ecosystem credit results**

BioMetric Vegetation Type	Condition	Ancillary Zone	Credits Required	Credits Generated (100%)	Credit Status (100%)
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain	Low	Underscrubbed	23	0	-23
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain	Moderate to Good	Underscrubbed	196	248	-179
	Low	Disturbed	5	20	
	Low	Grazed	184		
	Low	Scattered Paddock Trees	62	0	
Total			470	268	-202

With all conservation lands to be ‘funded and managed’, an overall credit deficit of **202** would occur within the BCAA, and these credits will be retired from the Hardwicke Biobank Site that has been assessed as generating 679 *Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin*. Further details on the Biocertification Strategy are outlined in **Section 5**. In this context, setting aside the impacts on red flagged areas, the proposal is able to meet the ‘improve or maintain’ test required for biodiversity certification to be conferred.

## 4 Red flag variation

### 4.1 Impact on red flagged areas

This report has identified an impact, due to the proposed development on red flagged areas as defined by the BCAM. A red flag is triggered under the BCAM when there is an impact on any of the following:

- a vegetation type >70% cleared in the CMA for which it is mapped (not in 'low condition')
- a critically endangered or Endangered Ecological Community (EEC) listed under the TSC Act or EPBC Act (not in 'low condition')
- a threatened species that cannot withstand further loss
- an area of land with regional or state conservation significance

Both vegetation types recorded on site ('Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain', and, 'Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain') meet the definition of threatened ecological communities (TEC) as listed on the schedules of the TSC Act and will be impacted by the proposed development (**Figure 10**). However, only one vegetation zone is in moderate-good condition. In total 8.92 ha of Red Flag Vegetation will be impacted by the proposed development (**Table 13** and **Figure 10**).

**Table 13: Red Flag Vegetation impacted**

Biometric Vegetation Type	EEC Name	% Cleared in CMA	Total Impact (ha)
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain	Cumberland Plain Woodland CEEC	90%	8.92
<b>Total</b>			<b>8.92</b>



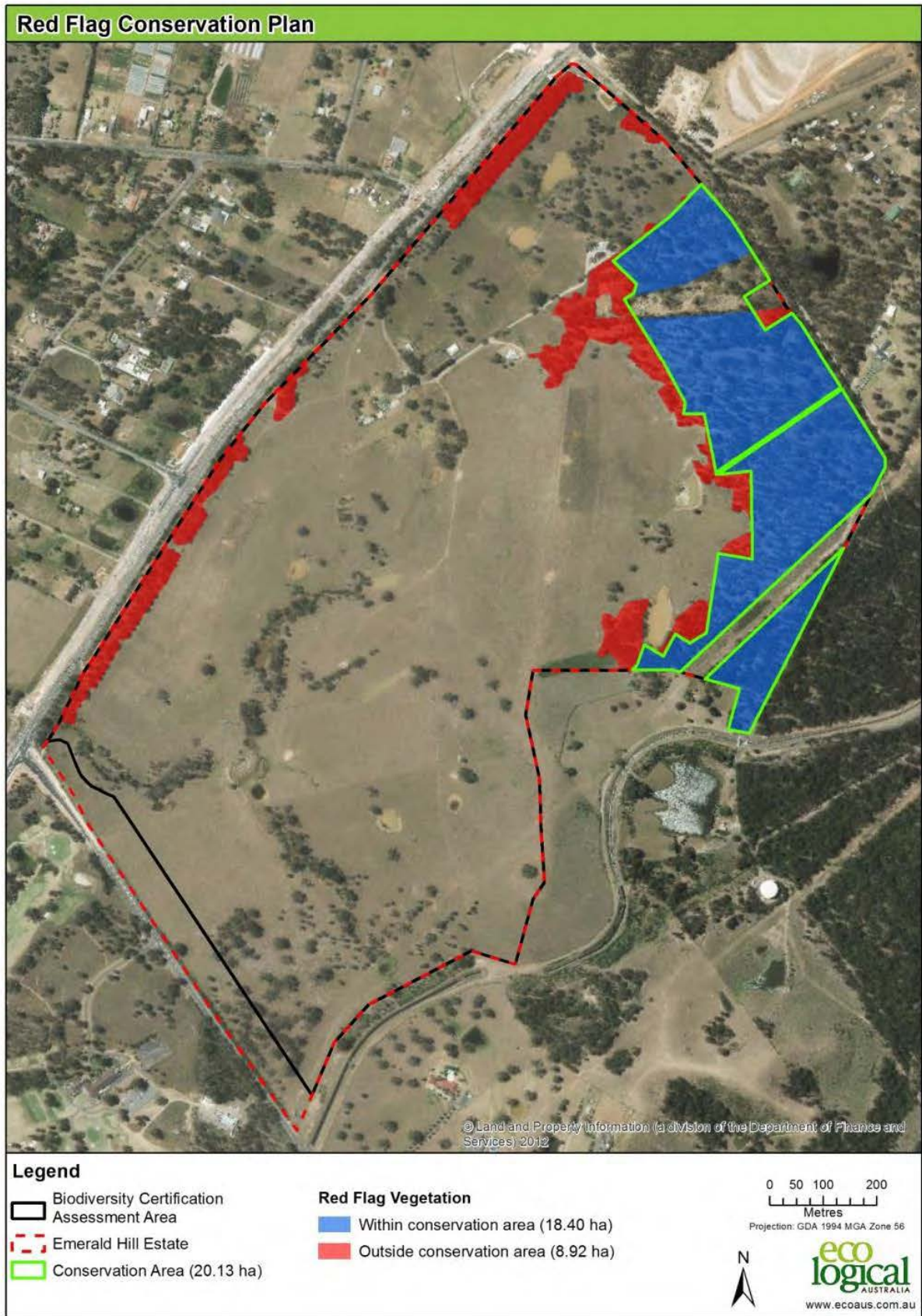


Figure 10: Red flag vegetation impacted by development

## 4.2 Red Flag Variation Criteria

The existence of Red Flags within the proposed development area means that Biocertification of the land cannot be conferred, unless a Red Flag Variation is granted by the Director General of OEH. In order to apply for a red flag variation a request to OEH is required satisfying Section 2.4 of the BCAM (DECCW 2011).

Section 2.4 of the BCAM outlines the criteria to be considered for a proposal to be regarded as improving or maintaining biodiversity values, even if a red flag has been triggered. The following criteria need to be addressed:

1. Feasibility of options to avoid impacts on red flag area(s) where biodiversity certification is conferred (**Section 4.2.1** below)
2. Viability must be low or not viable. The application for biodiversity certification must demonstrate to the satisfaction of the Director General that the viability of biodiversity values in the red flag area is low or not viable. The viability assessment of the red flagged vegetation should consider such factors as condition, patch size and isolation, current or proposed tenure and surrounding land use, whether mechanisms and funds are available to manage low viability sites such that their viability is improved over time (**Section 4.2.2** below).
3. Contribution to regional biodiversity values must be low. The application for biodiversity certification must demonstrate to the satisfaction of the Director General that the contribution of the red flag area to regional biodiversity values is low. This includes an assessment of relative abundance of the impacted vegetation type in the region, the proportion of the vegetation type remaining in the region and the percent native vegetation (by area) remaining in the region (**Section 4.2.3** below).

This report provides the information required for OEH to assess a red flag variation for the Emerald Hills BCAA.

### 4.2.1 Avoiding and minimising impacts on red flags

*The Director General must be satisfied that the feasibility of options to avoid impacts on red flag areas has been considered in the application for biodiversity certification. An application for biodiversity certification can address this requirement by demonstrating that:*

*a) all reasonable measures have been taken to avoid adverse impacts on the red flag areas and to reduce impacts of development on vegetation remaining within the biodiversity certification area*

*In addressing the criteria for a), the application for biodiversity certification may include information that demonstrates:*

- *how the subdivision design, (including the configuration of lots, minimum lot sizes and/or options for lot averaging and lot clustering) have been used to avoid and minimise impacts on red flag areas*
- *how the spatial distribution, configuration, size of patches and connectedness of the red flag areas proposed for conservation measures within the biodiversity certification assessment area have minimised the overall impacts of conferring biodiversity certification on the red flag areas.*

*b) appropriate conservation management arrangements cannot be established over the red flag area given its current ownership, status under a regional plan and zoning and the likely costs of future management.*

*a) All reasonable measures to avoid adverse impacts*

In the context of the BCAA, the development of the ILP has been iterative and based on the recognition of the sites inherent biodiversity values. Indeed, the ILP has responded to a range of studies, including the assessment of the sites ecological and riparian values (ELA 2013) on which feedback was sought and received from OEH and Camden Council, and consequently incorporated into the final ILP. This has led to a number of amendments to the ILP that have been directly focussed on protecting and improving biodiversity outcomes within the site. However, given the scattered nature of the red flagged vegetation, complete avoidance in concert with the proposed development has not been able to be achieved.

Modifications to the initial development footprint have been prepared in favour of avoiding high quality TEC vegetation and the retention of much of this same vegetation type in environmental conservation lands. Indeed, the configuration of conservation lands has been consolidated and enlarged to form a single contiguous area within the site that has ideal connectivity (<30 m) with adjoining Shale Hills Woodland vegetation and is based upon the largest most viable remnant within the BCAA (**Figure 11**). This area now forms the basis of the proposed conservation area located in the north eastern corner of the site and represents an increase in the total area of retained red flag vegetation in earlier options of more than 3 ha or approximately 18%.

This increase in conservation land has been complimented by the removal of 15 'forest lots' that were previously located within the now conservation area. This change has resulted in the reduction of lots that extend into the conservation land from 15 to 1. The interface between the conservation land and surrounding development will now be fronted by 2.4 km of roadways and drainage basins, or 87.8 % of its total length, further reducing the potential impact of adverse edge effects from residential development. The roads will also contain the required APZs with no impact on extant vegetation within the conservation lands. Furthermore, preliminary plans of the estate earthworks indicate that the perimeter roads adjoining the conservation lands will be slightly elevated and separated by sympathetic retaining walls at the road reserve boundary, which will further assist in the controlled separation of urban and environmental conservation uses.

These amendments mean that 18.40 ha of contiguous red flagged vegetation that is in moderate to good condition with good connectivity to surrounding vegetation will be retained within the BCAA, and managed for conservation in perpetuity. In this regard, the proposed development has been focussed on land that is in the most part already cleared (i.e. grazing/exotic pasture land), is in low condition or contains vegetation that is isolated or disturbed including scattered paddock trees, and as such is more susceptible to edge affects and is therefore considered to have lower viability in the longer term. This matter is discussed further in **Section 4.2.2**.

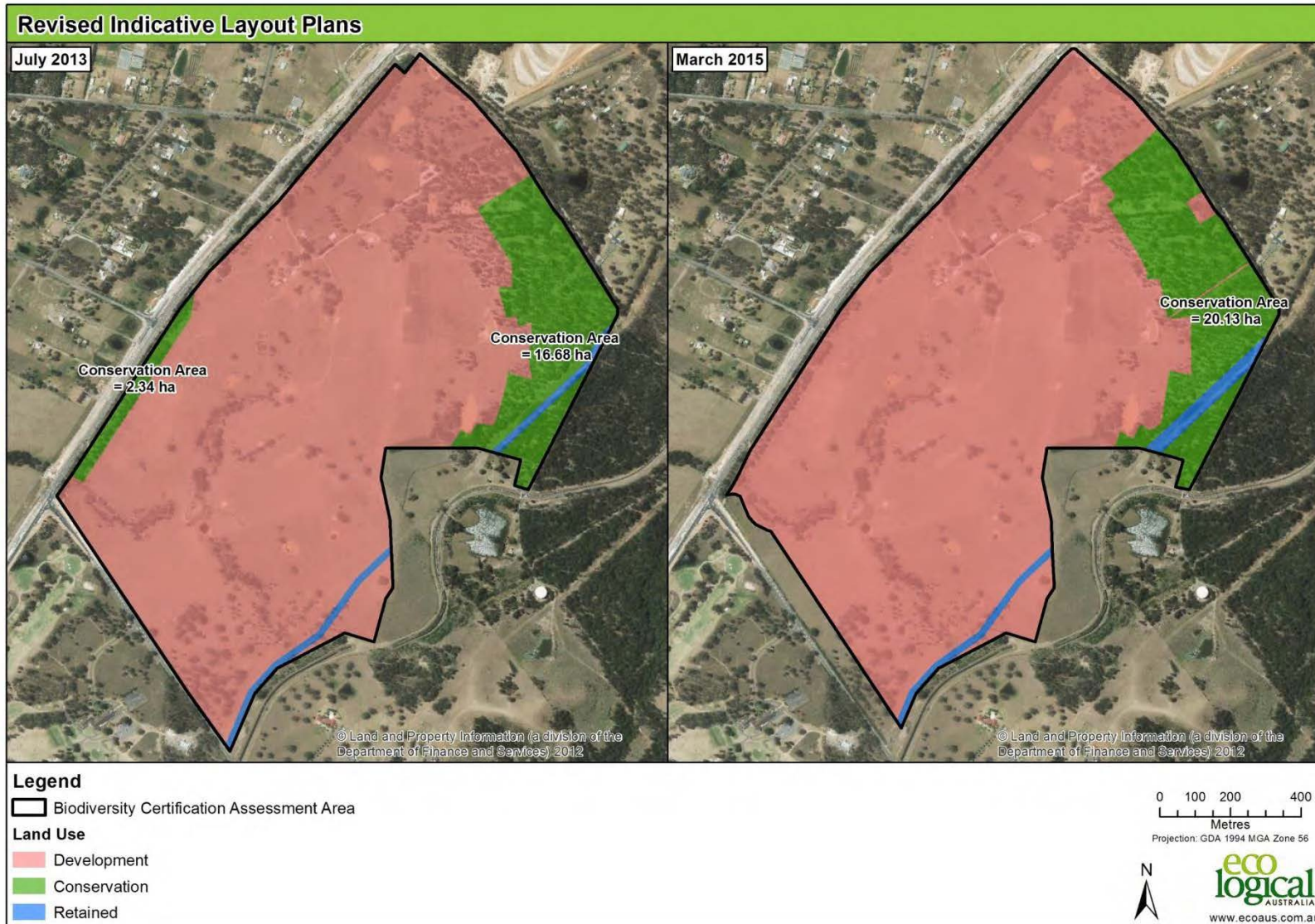


Figure 11: Consolidation and enlargement of conservation area showing connectivity with adjoining Shale Hills and Shale Plains Woodland vegetation

*b) Appropriate conservation management arrangements cannot be established over the red flag area given its current ownership, status under a regional plan and zoning and the likely costs of future management.*

The majority of the site, which is located within the Camden LGA, was previously zoned RU2 Rural Landscape under Camden LEP 2010. The objectives of the zone are focussed on facilitating agricultural land uses with some consideration given to maintaining areas of scenic value. In contrast, much of the land that surrounds the site has been rezoned for urban development either by Camden Council or as part of the broader South West Growth Centre’s process. In this context, the opportunity for red flagged vegetation to be appropriately conserved, particularly in light of continued grazing pressure under the current RU2 zoning, would have been less likely to be pursued and effectively applied. Moreover, ongoing development of the surrounding land will result in further development pressure and potential indirect impacts on the TEC vegetation within the site.

The conferral of biocertification of the BCAA, includes the establishment of a Biobank site over the entire conservation lands, which will provide a significantly higher degree of certainty in terms of protecting red flag vegetation within the site than is likely to be achieved under the previous zoning and management practices. In particular, once a Biobank site is established within the site as proposed, the subject land/red flag vegetation will receive adequate funding to appropriately maintain it in perpetuity.

#### **4.2.2 Viability**

The BCAM states that:

*The application for biodiversity certification must demonstrate to the satisfaction of the Director General that the viability of biodiversity values in the red flag area is low or not viable.*

*For the purpose of the methodology, viability is defined as the ability of biodiversity values at a site to persist for many generations or long time periods. The ecological viability of a site and its biodiversity values depend on its:*

- *condition*
- *the area of the patch of native vegetation and its isolation*
- *current or proposed tenure and zoning under any relevant planning instrument*
- *current and proposed surrounding land use*
- *whether mechanisms and funds are available to manage low viability sites such that their viability is improved over time*

*In making an assessment that the viability of biodiversity values in the red flag area is low or not viable, the Director General must be satisfied that one of the following factors applies:*

*a) The current or future uses of land surrounding the red flag area where biodiversity certification is to be conferred reduce its viability or make it unviable. Relatively small areas of native vegetation surrounded or largely surrounded by intense land uses, such as urban development, can be unviable or have low viability because of disturbances from urbanisation, including edge effects; or*

*b) The size and connectedness of the vegetation in the red flag area where biodiversity certification is to be conferred to other native vegetation is insufficient to maintain its viability. Relatively small areas of isolated native vegetation can be unviable or have low viability; or*

*c) The condition of native vegetation in the red flag area where biodiversity certification is to be conferred is substantially degraded, resulting in loss of or reduced viability. Native vegetation in*

degraded condition can be unviable or have low viability. 'Degraded condition' means substantially outside benchmark for many of the vegetation condition variables as listed in Table 1 of the methodology (s.3.6.2), without the vegetation meeting the definition of low condition set out in section 2.3. Vegetation that is substantially outside benchmark due to a recent disturbance such as a fire, flood or prolonged drought is not considered degraded for the purposes of the methodology; or

d) The area of a vegetation type in a red flag area on land where biodiversity certification is conferred is minor relative to the area containing that vegetation type on land subject to proposed conservation measures.

a) *Current or Future Land Use*

Current land use within the site centres on cattle grazing which has been used to manage vegetation, and in particular exotic pastures within the site. This activity has also had a detrimental impact on areas of remnant TEC vegetation as a result of under scrubbing to maintain pastures and the introduction of exotic weeds via stock feeds. Stock paths, dams and informal roadways have also resulted in increased levels of sedimentation and nutrient accumulation within the watercourses and drainage depressions within the site. This in turn has encouraged weed proliferation and facilitated a general degradation of biodiversity values within these areas.

In this context, the historical and current use of the site for grazing purposes has led to a general decline in the sites biodiversity values and the condition of red flagged vegetation within it. However, should these practices cease and the land lie dormant and unmanaged, it is likely that it would be subject to rapid African Olive (*Olea europaea* subsp. *cuspidata*) infestation and the impacts of localised edge effects from surrounding urban development. Based on the experience of similar landscapes at Harrington Park, which is located within 5 km of the site, grazing management is able to play an important role in controlling African Olive infestations within pasture lands.

As a result of these impacts, it is considered that the viability of the smaller more isolated patches of red flagged vegetation are not viable under the current land use framework. This is particularly the case for the smaller more isolated patches and underscrubbed vegetation in the southern corner of the site and those that extend along existing watercourses and drainage lines. In contrast, the larger more contiguous area of red flagged vegetation in the northwest corner of the site is more likely to remain viable, and hence it is this area that is proposed to be retained within the identified conservation lands within the BCAA.

The impact of current land use practices will also be further compounded by ongoing urban development and the associated edge effects that will affect the site. In this regard, the site currently adjoins existing and forthcoming urban development, with the South West Growth Centres Precincts of East Leppington to the north, and Catherine Fields and Catherine Fields North to the west. Immediately to the south of the site is the Camden Lakeside golf course and The Hermitage estate (**Figure 12**). These developments will give rise to increased edge effects in the form of unauthorised access, illegal dumping, weed invasion and general littering. More specifically, particular areas of red flagged vegetation will be more prone to edge effects than others. For example, areas of narrow linear vegetation within the site such as that which forms its western boundary along Camden Valley Way is likely to experience a higher incidence of illegal dumping and other similar activities as urban development and vehicle movements along the upgraded Camden Valley Way increase. These impacts are also likely to spill over into the broader site as a result of unauthorised access. Again, smaller, more linear areas of vegetation within the site, including those found along existing drainage lines in the southern portion of the site are most likely to be impacted by these activities. Unauthorised access is also likely to increase the incidence of illegal burning and inappropriate fire regimes. This is

particularly the case for the larger more contiguous area of vegetation in the north west corner of the site, however, should certification be conferred, much of this vegetation will form the proposed conservation area and be managed appropriately in terms of maintaining suitable fuel loads and ensuring appropriate fire regimes, as well maintaining appropriate fencing and signage to limit access.

Much like the impact of current land use practices, ongoing urban development within the vicinity of site will impact the smaller, more isolated, disturbed or linear patches of vegetation. While still subject to a range of impacts, the majority of the vegetation that is less prone to these influences and which is located within the north eastern corner of the site is proposed for inclusion as conservation land within BCAA.

Given the impact of current and future land uses within and surrounding the subject site, the viability of red flag vegetation that will be impacted by the proposed development is considered low (or not viable). These areas are comprised of the smaller, more isolated, narrow or highly disturbed areas that are located within the Development Area of the BCAA.

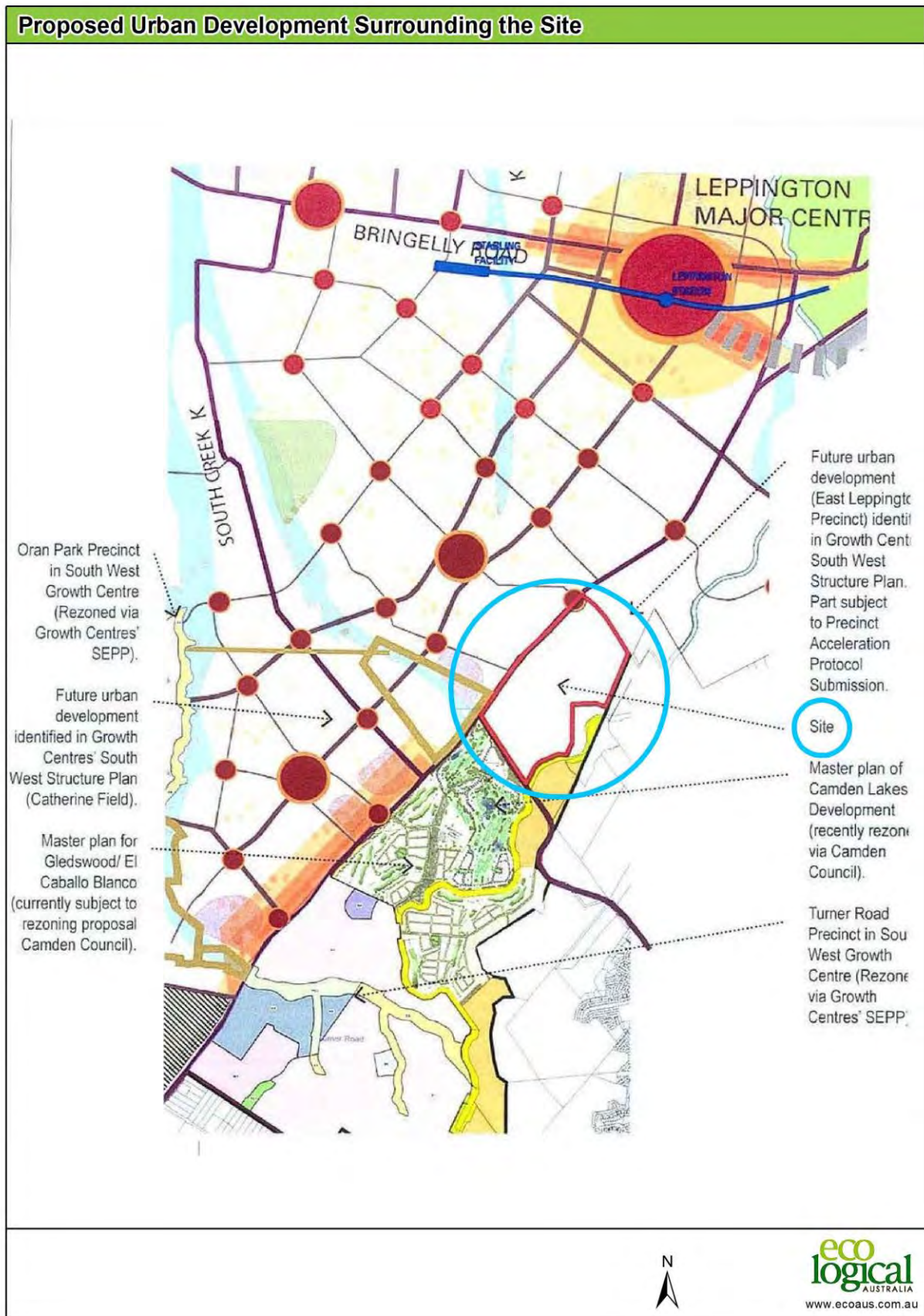


Figure 12: Current and future development surrounding the Emerald Hill Estate (Source: Camden Council)



b) *Size and connectedness*

Not considered.

c) *Vegetation outside of benchmark*

Not considered.

d) *Relative area of clearing proposed*

The largest vegetation remnant found in the north of the site will largely be retained as a Biobank site, should biocertification be conferred. The current ILP proposes that some of the outer edge vegetation of this remnant is removed to minimise edges and consolidate the area into a larger management unit. Moreover, as discussed above, the disturbed portion of this area has also been excised to achieve a more uniform management area that is better suited to the urban development context in which it is located. Indeed, a consolidated area comprised of relatively good quality bushland will be recognised as an important environmental asset by the future residents of the proposed EHE, and play an important role in the ongoing viability of the retained remanent vegetation.

This will require 5.1 ha of clearing from the edges of the area, which equates to 22% of the remnant, with the conserved 78% proposed to be included in the Biobank site (**Figure 13**). The future Biobank site is also adjacent (<30m) to a 60 ha remnant of the equivalent Shale Hills Woodland vegetation. This connectivity will further enhance the biodiversity attributes of the Biobank, while also reducing the relative area of vegetation that is proposed to be removed within the BCAA by 30%. It is proposed that during the preparation of the forthcoming Biodiversity Certification Strategy that opportunities to establish a Biobank site across these adjoining lands will be explored. Should this be achieved it will also enhance the conservation significance of the Biobank site that is proposed within the conservation lands of the BCAA.



Figure 13: Area of largest remnant vegetation retained within conservation area

### 4.2.3 Contribution to Regional Biodiversity Values

The BCAM states that:

*The application for biodiversity certification must demonstrate to the satisfaction of the Director General that the red flag area on land proposed for biodiversity certification makes a low contribution to regional biodiversity values.*

*In making an assessment that the contribution of the red flag area to regional biodiversity values is low, the Director General must consider the following factors for each vegetation type or critically endangered or endangered ecological community regarded as a red flag area:*

*a) relative abundance: that the vegetation type or critically endangered or endangered ecological community comprising the red flag area is relatively abundant in the region; and*

*b) percent remaining is high: that the percent remaining of the vegetation type or critically endangered or endangered ecological community comprising the red flag area is relatively high in the region; and*

*c) percent native vegetation (by area) remaining is high: that the percent remaining of all native vegetation cover in the region is relatively high.*

*'Region' for the purposes of section 2.4.2.2 means the CMA subregion in which the red flag area is located and any adjoining CMA subregions.*

The contribution to regional biodiversity values was assessed for the red flagged vegetation on site, using regional datasets where available. Under the BCAM the 'region' is defined as both the CMA subregion where the red flag area is located (in this case the Cumberland CMA subregion) and adjoining CMA subregions, including the Yengo, Wollemi, Sydney Cataract, Pittwater and Burragorang CMA subregions (**Figure 14**). In some cases consistent data is not available across this entire region. Where alternate regions have been used they have been identified in this assessment.

The use of regional vegetation datasets in this assessment, while the best data currently available, does have limitations. The data in some cases is several years old and therefore the extant mapping may require revision.

In addition, most regional vegetation mapping products only map patches greater than a minimum size (for example 0.5 ha) and generally only map vegetation in reasonably good condition. It is highly likely that smaller patches of the red flag vegetation type exists in the relevant regions, however have not been included in this assessment as the patches are too small to map, or the condition is disturbed and therefore has not been mapped. This includes areas of Derived Native Grassland, which may be considered 'moderate-good' vegetation under the BCAM, but have not been mapped due to the canopy and midstorey vegetation having been removed.

The contribution to regional biodiversity values included an assessment of the relative abundance of the red flagged vegetation type, the percent remaining of the vegetation type, percent native vegetation remaining in the region and vegetation condition across the region. The results are provided below.

#### *a) Relative Abundance*

The first measure for the contribution to regional biodiversity values criteria is a measure of relative abundance of the red flagged vegetation types in the 'region'.

Analysis was conducted into the relative abundance of the red flagged vegetation type across the entire 'region'. The associated data layers that were assessed include:

- Sub CMA Cumberland (Hawkesbury Nepean) (NPWS 2002)
- Sub CMA Cumberland (Sydney Metro) (NPWS 2002)
- Sub CMA Burratorang & Wollemi (Hawkesbury-Nepean) (NPWS 2003a – Native Vegetation of the Warragamba Special Area and BMCC 2002 - Blue Mountains LGA)
- Sub CMA Sydney Cataract (Hawkesbury-Nepean and Sydney Metro) (NPWS 2003b – Native Vegetation of the Woronora, O'Hares and Metropolitan Catchments)

ELA are confident that the data used captures the majority of the Biometric vegetation type 'Grey Box - Forest Red Gum grassy woodland on shale of the Cumberland Plain' as the extent of this vegetation type is restricted to the Cumberland Plain and is largely incorporated into the mapping used.

The results of the analysis for each vegetation type can be seen in **Table 14** and the distribution of the vegetation type is displayed in **Figure 15**.

**Table 14: Relative Abundance of Vegetation in Surrounding Regions**

Biometric Vegetation Type	Total Area of Impact (ha)	Area in Cumberland (Hawkesbury-Nepean) Sub CMA (ha)	Area in Cumberland (Sydney Metro) Sub CMA (ha)	Area in Cumberland (Burratorang) Sub CMA (ha)	Area in Cumberland (Sydney Cataract) Sub CMA (ha)	Total Area in Sub CMAs (ha)
Grey Box - Forest Red Gum grassy woodland on shale of the Cumberland Plain	8.92	8,959.6 3,659.6 in ABC condition #)	1,361.0 (646 in ABC condition #)	9.45 (0 in ABC condition #)	5.63 (3.52 ABC condition n#)	10,335.7 (4,309.1 in ABC condition #)

# Vegetation condition follows NPWS (2002) with A, B, C being patches >0.5 ha in area and canopy cover projection density (CCPD) > 10%. Cmi, Tx's being patches > 0.5 ha and CCPD < 10%.

The results for the 'Grey Box - Forest Red Gum grassy woodland' are summarised below:

- 10,335.7 ha (of which 4,309.1 ha is in condition class A, B or C) is recorded within the 'region'. The clearing of 8.92 hectares represents 0.09% of the total extent of the vegetation type in the region and 0.21% in condition A, B or C.
- 8,959.6 ha (of which 3,659.6 ha is in condition class A, B or C) is recorded within the Cumberland (Hawkesbury/Nepean) sub CMA, in which the majority of the study site is located. The clearing of 8.92 hectares represents 0.1% of the total extent of the vegetation type in the Cumberland (Hawkesbury/Nepean) sub CMA and 0.24% in condition A, B or C.

The above information indicates that the impact to the red flagged vegetation type from the proposal is relatively minor when compared to the amount mapped in the regions analysed.



Figure 14: 'Region' Derived from Adjacent CMA Subregions

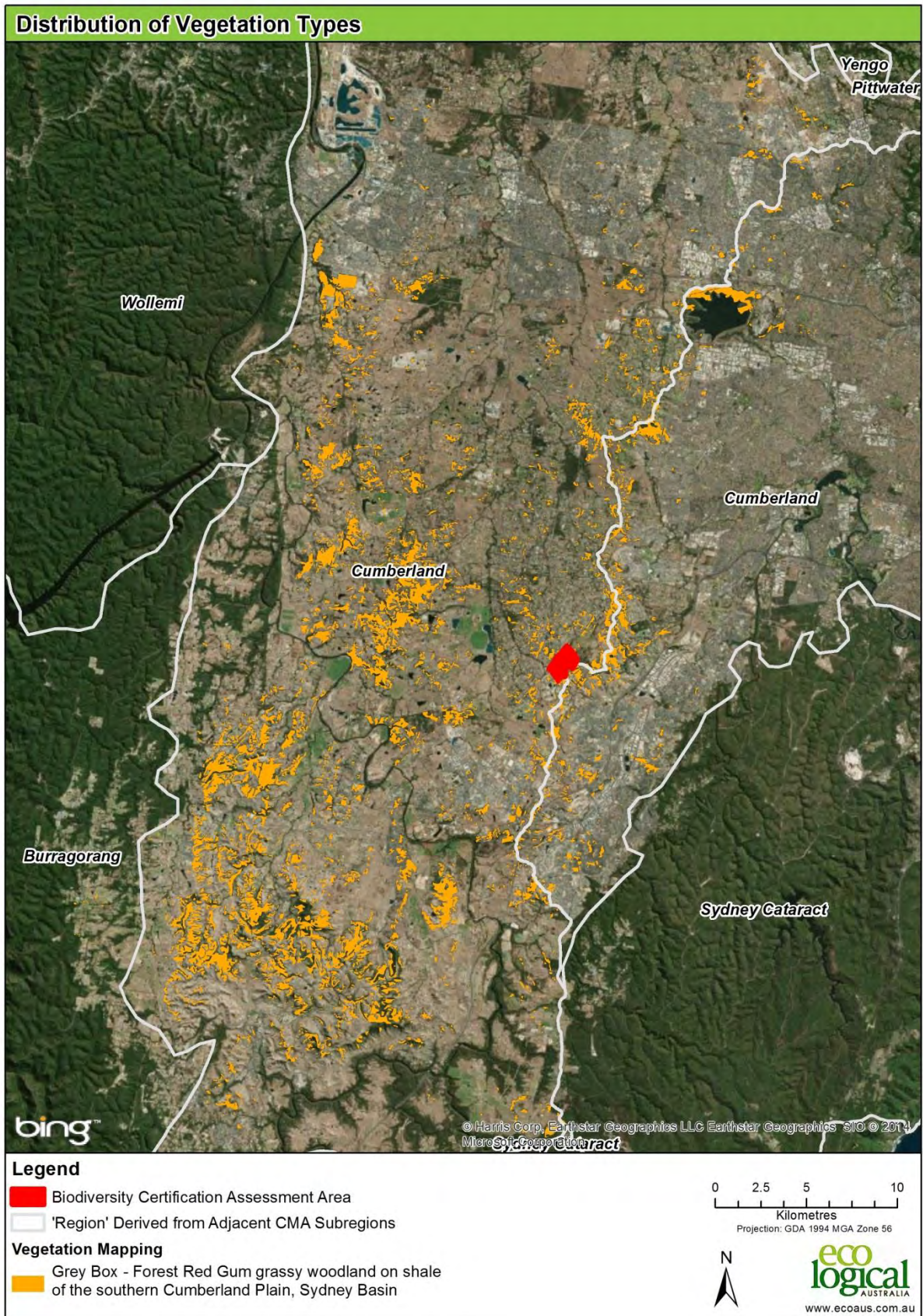


Figure 15: Distribution of Grey Box-Forest Red Gum grassy woodland on shale of the Cumberland Plain, Sydney Basin

b) *Percent Remaining is high*

Several data sources were utilised to determine the percent remaining of each vegetation type, again at various scales due to the lack of consistent data across the 'region'. The data sources used include:

- OEH Vegetation Types Database (DECCW 2008)
- Estimated Pre-1750 Vegetation (DEWHA 2009)
- National Parks and Wildlife Services vegetation mapping (NPWS 2002)

The DECCW Vegetation Types database contains a percent cleared figure for the red flagged vegetation type by CMA. For the other two data sources (where analysis was required) the pre-1750 data for each vegetation type was compared to the extent remaining to determine the percent remaining for each of the red flagged vegetation types.

The results of the analysis are shown in **Table 15**. The DECCW vegetation types database records 'Grey Box - Forest Red Gum grassy woodland on shale of the Cumberland Plain' as being 90% cleared within the Hawkesbury Nepean CMA, therefore leaving 10% of the vegetation type remaining.

Using the vegetation types in NPWS (2002) and for the Cumberland Sub CMAs, 11.3% of the 'Grey Box - Forest Red Gum grassy woodland on shale of the Cumberland Plain' with canopy cover >10%, remains (i.e., condition A, B, C), though with the inclusion of all remaining vegetation (i.e. including condition Tx), 27% remains.

**Table 15: Percent remaining of each vegetation type**

Biometric Vegetation Type	Total Area of Impact-Development Area (ha)	% Remaining in Hawkesbury-Nepean CMA (DECCW 2008)	% Remaining in Cumberland (Hawkesbury Nepean) Sub CMA condition A,B,C + Tx (NPWS 2002)	% Remaining in Cumberland (Sydney Metro) Sub CMA condition A,B,C + Tx (NPWS 2002)
Grey Box - Forest Red Gum grassy woodland on shale of the Cumberland Plain	8.92	10%	27%	21

In conclusion, the percent remaining in the assessed region for the vegetation type is between 10-27%.

c) *Percent Native Vegetation (by area) is high*

The area of native vegetation was calculated for the region, being the Cumberland (Hawkesbury/Nepean (HN)), Cumberland (Sydney Metro (SM)), Wollemi, Burragarang, Sydney Cataract (HN), Sydney Cataract (SM), Pittwater and Yengo (**Table 16** and **Figure 16**). The OEH state-wide vegetation extent layer was used for the assessment (Keith and Simpson, 2006) and was intersected with the seven CMA subregions to determine the proportion of each region with native vegetation cover.

**Table 16: Native Vegetation Cover of CMA Subregions**

CMA subregion	Native Vegetation Cover	Cleared	Vegetated Total
Cumberland (HN)	34,077 (17%)	164,055 (83%)	198,132 (100%)
Cumberland (SM)	5,156 (7%)	71,043 (93%)	76,199 (100%)
Wollemi	485,407 (96%)	19,422 (4%)	504,829 (100%)
Burraborang	192,560 (83%)	40,060 (17%)	232,620 (100%)
Sydney Cataract (HN)	69,428 (94%)	3,847 (6%)	73,275 (100%)
Sydney Cataract (SM)	61,977 (82%)	12,331 (18%)	74,308 (100%)
Pittwater	80,915 (65%)	44,200 (35%)	124,994 (100%)
Yengo	294,637 (91%)	26,937 (9%)	321,574 (100%)
<b>Total</b>	<b>1,224,157 (76%)</b>	<b>381,895 (24%)</b>	<b>1,605,931 (100%)</b>

In total, 76% (1,224,157 hectares) of the assessment region contains native vegetation cover. The proportion of vegetation cover for five of the CMA subregions is high, with Wollemi containing 96% vegetation cover, Burraborang 83%, Sydney Cataract (HN) 94%, Sydney Cataract (SM) 82% and Yengo 91%. The other CMA subregions have been heavily cleared through agriculture and development, with Cumberland (HN) containing 17% native vegetation cover and Cumberland (SM) only 7%.

As stated earlier, the vegetation type impacted is predominantly located on the Cumberland Plain, and therefore very little of the vegetation type is likely to extend into the surrounding five CMA subregions. This assessment demonstrates that the majority of the CMA subregions assessed are relatively well vegetated, however when considering the two Cumberland CMA subregions, which are between 7-17% vegetated, native vegetation cover is low.



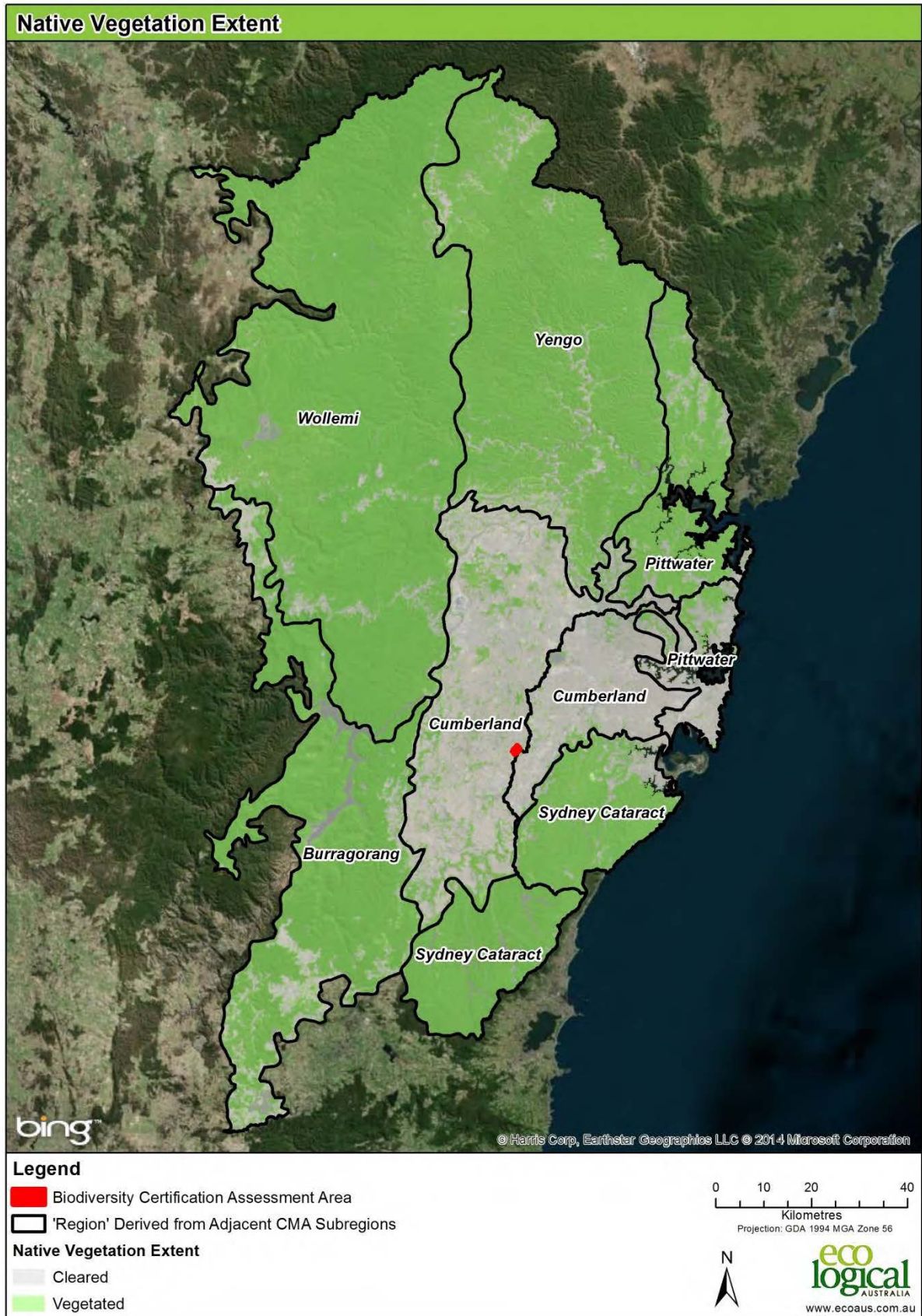


Figure 16: Native Vegetation Extent

### 4.3 Conclusion

The proposed BCAA will impact on one vegetation type that meets the definition of a red flag area, Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain.

In order to avoid impacts on these areas the development footprint has been deliberately centred on existing pasture land which covers the majority of the site. However, given the scattered nature of the red flagged vegetation, it has not been possible to avoid all impacts on red flag areas. Nevertheless, the rezoning focuses on minimising impacts on the larger, more contiguous and therefore more viable areas of red flag vegetation. Indeed, the area of retained vegetation has been revised to increase the size of the remnant in order to achieve a more sustainable biodiversity outcome within the site. Furthermore, during the evolution of the development footprint, lots that previously extended into the proposed conservation areas have been reduced, and all APZs have been accommodated within the area proposed for biocertification. These amendments will help ensure the viability of the of the identified conservation lands in the longer term.

Considering its location, the site will be subject to a range of ongoing impacts associated with significant urban development that will occur adjacent to and within the immediate vicinity of the site. These impacts are likely to result in increased incidences of illegal dumping, weed proliferation and arson. Such impacts will lead to a degradation of the biodiversity values of red flagged vegetation, particularly those areas that are more isolated or linear in nature. Similarly, current agricultural land management practices based around cattle grazing will have comparable affect. In this context, current and future land uses within and surrounding the site are considered to be the most significant constraint on protecting and maintaining red flagged vegetation.

While the abundance of the vegetation type within the region is relatively high, percentage remaining by extent and area is relatively low. However, this should be considered in relation to the sites location within the Cumberland CMA's (Hawkesbury Nepean and Sydney Metro). Both these areas have been subject to substantial clearing for both agricultural and urban development purposes and it is therefore expected that the relative abundance of these vegetation types would be low. Nonetheless, given that the site will be subject to a range of detrimental impacts from both current and future land uses, it is unlikely that the remnants present on site will remain viable in the longer term. In contrast, the measures that are proposed as part of the intended biocertification of the site will ensure that the larger more contiguous area of red flagged vegetation will be protected and afforded adequate security in perpetuity. This is considered a substantially better outcome than that which would be achieved based on the impacts that the site will be exposed to into the future.

Considering the above, ELA believe a red flag variation is justified under Section 2.4 of the BCAM.

## 5 Biocertification strategy

Section 126K of the TSC Act states that biocertification may only be conferred on land by the Minister if the applicant has a biocertification strategy.

Section 126K (2) states that a biocertification strategy is a policy or strategy for the implementation of conservation measures to ensure that the overall effect of biodiversity certification is to improve or maintain biodiversity values. The biocertification strategy is to be used as the basis for the assessment of the application for biodiversity certification.

A biodiversity strategy is to include the following:

- (a) the land proposed for biodiversity certification
- (b) the land proposed for biodiversity conservation
- (c) the proposed conservation measures
- (d) any person or body proposed as a party to the biodiversity certification

This section addresses these requirements.

### 5.1 Land proposed for biodiversity certification

The land proposed for biodiversity certification is shown in **Figure 3** in **Section 3** of this report. The land proposed for biocertification will require **470** ecosystem credits, as calculated using the BCAM Tool (v 1.08) (**Table 12**).

### 5.2 Land proposed for biodiversity conservation

#### *On-site conservation measures*

The land proposed for biodiversity conservation is shown in **Figure 2** and **Section 3** of this report. This area contributes **268** biocertification ecosystem credits to the biodiversity certification (**Table 12**) that are deemed to be equivalent to 207 BioBanking credits calculated under the BioBanking Assessment Methodology (BBAM).

#### *Off-site conservation measures*

Macarthur Developments have submitted an application on behalf of the landowner, D&AI Pty Ltd, to register a second Biobank site of 57.65 ha in the Wollondilly LGA (ELA 2014b). This Biobank site has been calculated to generate in excess of 600 biobanking ecosystem credits for various vegetation types including at least 300 credits for vegetation type HN529 (*Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin*) (subject to OEH audit and approval). The site includes priority conservation lands as identified in the Cumberland Plain Recovery Plan (DECCW 2011). Should this proposed Biobank site not generate sufficient HN529 credits, a second Biobank assessment on the Hardwicke property, Hardwicke Stage 2, of approximately 35 ha is currently being prepared and will be sufficient to make up any shortfall.

### 5.3 Variation to offset rules for using ecosystem credits

A variation in the offset trading rules is requested for '*Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain (HN526)*'. In accordance with Section 10.2.1 of the BCAM, the Director General may approve a variation to the offset rules if satisfied that:

## A. Firstly,

a. All reasonable steps have been taken to secure conservation measures that generate credits that match the credit profile specified for ecosystem credits required for biodiversity certification in section 10.1 of the methodology,

OR

b. the cost of securing a conservation measure capable of generating credits to match the credit profile specified for ecosystem credits required for biodiversity certification in section 10.1 of the methodology is disproportionate to the overall cost of the conservation measures identified in the application for biodiversity certification,

AND

c. the list of threatened species predicted to occur at the offset site is not significantly different to the list of threatened species that are assessed on land where biodiversity certification is proposed when assessed in accordance with section 4.2 of the methodology.

In addressing point a), it is noted that Section 8.5 of the BCAM (DECCW 2011) states, ‘Applicants should in the first instance attempt to generate credits from conservation measures within the biodiversity certification assessment area’. Throughout the planning process for rezoning EHE, undertaken in consultation with OEH and Camden Council, it has been desirable to achieve conservation outcomes in the EHE of the largest, most resilient and highest conservation vegetation onsite. As such, the small (1.31 ha) degraded area of regrowth ‘Forest Red Gum – Rough-barked Apple grassy woodland’ found in the south west of the site was not considered a priority for retention given the issues pertaining to ongoing management and edge effects (see discussion in **Section 4.2**).

As there are no ‘Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain (HN526)’ ecosystem credits generated within the EHE Biobank site, it is proposed that **23** of the on-site ‘Grey Box – Forest Red Gum grassy woodland on shale’ ecosystem credits are retired to meet this end.

It is noted that ‘Grey Box – Forest Red Gum grassy woodland on shale’ is of higher conservation significance than ‘Forest Red Gum – Rough-barked Apple grassy woodland’, being a component of the State and Commonwealth CEEC, Cumberland Plain Woodland, as opposed to solely State listed EEC, River-flat Eucalypt Forest on Coastal Floodplains.

Point c) requires that the list of threatened species predicted to occur at the offset site is not significantly different to the list on the land proposed for Biocertification. A list of the predicted species attached the credit profile of both vegetation types as generated by the BCAM Tool v 1.08 is provided in **Table 17**. It is noted that the species linked to these vegetation types are exactly the same.

**Table 17: List of species linked to the credit profiles of HN 526 and HN 529**

Common Name	Scientific Name	HN526	HN529
Barking Owl	<i>Ninox connivens</i>	Y	Y
Black-chinned Honeyeater (eastern subspecies)	<i>Melithreptus gularis gularis</i>	Y	Y
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	Y	Y
Bush Stone-curlew	<i>Burhinus grallarius</i>	Y	Y
Diamond Firetail	<i>Stagonopleura guttata</i>	Y	Y
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	Y	Y

Common Name	Scientific Name	HN526	HN529
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	Y	Y
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	Y	Y
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	Y	Y
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	Y	Y
Large-footed Myotis	<i>Myotis macropus</i> (formally <i>Myotis adversus</i> )	Y	Y
Little Lorikeet	<i>Glossopsitta pusilla</i>	Y	Y
Masked Owl	<i>Tyto novaehollandiae</i>	Y	Y
Regent Honeyeater	<i>Xanthomyza phrygia</i>	Y	Y
Scarlet Robin	<i>Petroica boodang</i>	Y	Y
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	Y	Y
Swift Parrot	<i>Lathamus discolor</i>	Y	Y
Turquoise Parrot	<i>Neophema pulchella</i>	Y	Y

B. Secondly, that the alternate ecosystem credits are generated from conservation measures:

a. located on land within the same IBRA region as the land proposed for biodiversity certification, regardless of the CMA subregions identified in attribute 1,

AND

b. on land containing a vegetation type of the same vegetation class as the vegetation type specified in attribute 2 of the credit required for the land proposed for biodiversity certification as set out in section 10.1 of the methodology,

OR

c. if paragraph (b) cannot be complied with, on land containing a vegetation type from the same vegetation formation as the vegetation type specified in attribute 3 of the credit required for the land proposed for biodiversity certification as set out in section 10.1 of the methodology.

The land proposed for Biodiversity Certification is within the Sydney Basin IBRA (Thackway and Creswell 1994), as is the land proposed for conservation measures, and both are in the Keith Vegetation Formation, Grassy Woodlands (Keith 2004).

## 5.4 Proposed conservation measures

### 5.4.1 On-site conservation measures

The land subject to conservation measures within the BCAA will be protected by a Biobanking Agreement under Part 7A of the TSC Act, and includes the standard conservation management actions required by a Biobanking Agreement (e.g. including but not restricted to the management actions outlined under Section 2.6 of the Biobanking Assessment Methodology [BBAM]).

Biobanking (i.e. BBAM) credits are created under s127V of the TSC Act, and for the purposes of the BCAM these credits are deemed to be 'equivalent' (DECCW 2011; OEH 2014). When the EHE Biobank Site is entered in the Biobanking Calculator (DECC 2008), it is calculated to generate **207** BBAM ecosystem credits. As such, whilst only **207** ecosystem credits are created under s127V at the EHE Biobank site, the overall credit requirement for the EHE will reduce by **268** BCAM ecosystem

credits. A scaling factor of 0.77 (207 BBAM credits / 268 BCAM credits) has been allowed for in all on-site credit retirement calculations below (OEH 2014).

A Biobanking Agreement is a 'Permanently Managed and Funded' or 100% Conservation Measure as outlined in s126L (i) of the TSC Act and Section 8.1.1 of the BCAM and will generate 57 % of the required credits as shown in **Table 18** (i.e. 207 BBAM ecosystem credits that are equivalent to 268 of the required 470 BCAM ecosystem credits). This Biobanking Agreement, Emerald Hill Estate Biobank Site, has already been prepared and submitted to OEH and is currently under review (ELA 2014a). It is expected to be registered in 2015.

Once registered, and following the retirement of all ecosystem and species credits, this Biobank site may be on sold with an adjacent residential parcel and will be managed in accordance with the BioBank Agreement (including annual reporting in perpetuity). The EHE Biobank Site will generate 207 BBAM credits which are equivalent to **268** BCAM ecosystem credits as calculated by the BCAM (ver. 1.08).

#### 5.4.2 Off-site conservation measures

As not all ecosystem credits are attainable on-site, a second Biobank Agreement has been prepared and submitted to OEH for a property known as Hardwicke BioBank site, at The Oaks, in the Wollondilly LGA. This Biobank site has been assessed to generate in excess of 600 BBAM 2014 ecosystem credits of which around 300 are for vegetation type HN 529 (ELA 2014b). In consultation with OEH (meeting August 2014), ELA were advised that credits to be obtained from conservation measures outside of the BCAA cannot apply the same scaling factor, and ecosystem credit calculations are therefore obtained on a 1:1 basis from this site. The residual **202** ecosystem credits required will therefore be obtained from this site, and retired accordingly at a ratio of 1 BBAM credit for 1 BCAM credit. Should the Hardwicke BioBank site not generate sufficient HN529 credits, a second BioBank assessment of approximately 35 ha (Hardwicke Stage 2) on the Hardwicke property is currently underway that will be sufficient to make up any shortfall.

#### 5.5 Existing management obligations

The entire on-site Biobank site is zoned E2 Environmental Conservation under the Camden LEP 2010. There are no covenants or conservation funding arrangements for the property or any existing requirements to actively manage the site for biodiversity conservation. The entire Biobank site is to be managed for ecosystem and species credits.

Similarly, the entire off-site Biobank (Hardwicke property - Lot 1 Dp 1101523) site is zoned RU2 Rural Landscape, has no covenants or existing obligations to manage the site for biodiversity conservation.

#### 5.6 Timing of credit retirement

The land to be biocertified at EHE will be developed in a staged manner as presented in **Figure 17**, and following the below estimated timeline:

- 2015: Stages 1, 2 and 3 (544 lots)
- 2015-2016: Stages 4, 5 and 6 (337 lots)
- 2017: Stage 7 and 8 (205 lots)
- 2018: Stage 9 (125 lots)
- 2019: Stage 10 (121 lots)
- 2020: Stage 11 (73 lots)

As impacts to biodiversity will occur over a likely 5-6 year period, credits are proposed to be retired proportionally following the staging of the release areas. The appropriate number of credits to be retired has been calculated following this timeline and based on the proportion of vegetation to be impacted in each stage. The results are presented in **Table 18** for the on-site and off-site BioBank sites.

The requirements for the retirement of credits from the on-site offset set are expressed in this strategy as credits calculated using the BCAM. As the site will be secured as a BioBank site it will be the credits calculated using the BBAM 2014 that are actually retired. The credit requirement in BCAM credits expressed in this strategy will be converted into an equivalent amount of BBAM 2014 credits. This conversion will be based on the proportion of the BCAM credits required to be retired for each credit type i.e. if 30% of BCAM credit type X is required to be retired then 30% of BBAM 2014 credit type X will be retired. Further, as the on-site BioBank site is within the BCAA, any 'surplus' ecosystem or species credits generated will also be retired and will not be available to use for other offsets.

All credits from the on-site BioBank (268 BCAM or 207 BBAM) site will be retired by the end of 2016 prior to the commencement of Stage 7.

The commitment to secure these offset areas and retire the credits for this biocertification application will be secured by a Biocertification Agreement entered into between the Minister for the Environment and D&AI Pty Ltd, the land owner.

Management of the on-site BioBank site will occur prior to the commencement of any clearing of vegetation.

Management of the off-site BioBank site will occur in accordance with the Biobanking Agreement.

**Table 18: Proposed timing of credit retirement for on-site and off-site Biobank sites**

Stage	Area of vegetation impacted (ha)	% of Impacts	BCAM Credits Required	Cumulative Total BCAM Credits	Equivalent BBAM Credits	Cumulative Total BBAM Credits
On-site BioBank Site (Scaling factor of 0.77 applied)						
Stage 1	7.71	31.61%	149	149	115	115
Stage 2	2.41	9.88%	46	195	36	151
Stage 3	0.65	2.67%	13	208	10	160
Stage 4	0.96	3.94%	18	226	14	175
Stage 5	1.35	5.54%	26	252	20	195
Stage 6	0.65	2.67%	16	268	12	207
Off-site BioBank Site (no scaling factor applied)						
Stage 7	1.22	5.00%	20	288	20	227
Stage 8	1.33	5.45%	26	314	26	253
Stage 9	2.55	10.46%	49	363	49	302
Stage 10	1.42	5.82%	27	390	27	329
Stage 11	4.14	16.97%	80	470	80	409
<b>Total</b>	<b>24.39</b>	<b>100.00%</b>	<b>470</b>	<b>470</b>	<b>409</b>	<b>409</b>

Note percentages are approximate due to rounding errors.

The number of credits required in Stage 6 has been increased by 3 to completely retire all on-site credits by the end of Stage 6 and conversely reduced by 3 in Stage 7.

## 5.7 Is an Improve or Maintain Outcome Achieved?

Subject to the Director-Generals consideration and approval of the red flag variation request (**Section 4**) and variation to the credit trading rules (**Section 5.3**) an improve or maintain outcome is achieved.

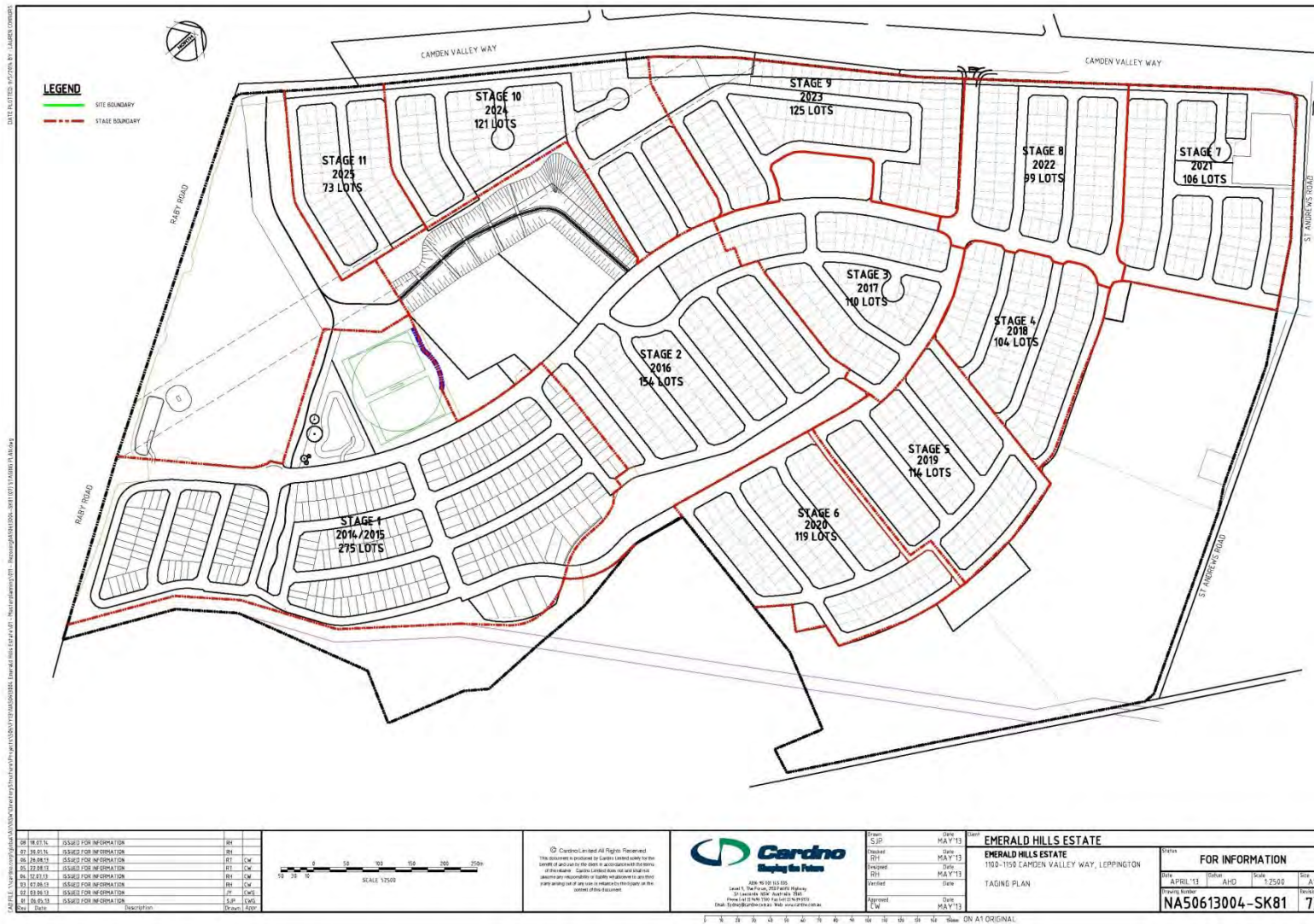


Figure 17: Emerald Hills Estate indicative staging plan



### **5.8 Any person or body proposed as a party to the biodiversity certification**

The area to be biocertified is wholly within the Camden LGA, and as such the applicant for Biodiversity Certification will be Camden Council.

The lands to be biocertified are currently in the ownership of D&AI Pty Ltd with Hazcorp Developments Pty Ltd and Taurus Development Company Pty Ltd ATF Emerald Hills Estate being the developer and Macarthur Developments the Project Manager. D&AI Pty Ltd is thus also a party to the certification.

The on-site BioBank 'Emerald Hills' BioBank site is wholly owned by D&AI Pty Ltd.

The off-site BioBank site, known as 'Hardwicke' BioBank site (and if required Hardwicke Stage 2), is owned by a consortium of land owners, South West Landholdings Pty Ltd, D. Vitocco Constructions Pty Ltd, Palolem Pty Ltd and Shaun Newing. As all land proposed for conservation measures will be registered as Biobank sites the current owners of this site will also be parties to the biocertification application. However, any future owners of these lands, if any, will not be required to be parties to the certification as they will be managed in accordance with Part 7A of the TSC Act.

## References

Camden Council 2015. Submissions: Emerald Hills Estate Biodiversity Certification Application – June 2015.

DEC 2004. *Draft Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*. NSW Department of Environment and Conservation, Sydney.

DECC 2008a. *BioBanking Assessment Methodology*. NSW Department of Environment and Climate Change, Sydney.

DECC 2008b. *Vegetation Types Database*, NSW Department of Environment and Climate Change, Sydney. Available <http://www.environment.gov.au/biobanking/VegTypeDatabase.html>

DECCW 2009a. *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians*. DECCW, Sydney.

DECC 2009b. *Biobanking Credit Calculator*, DECC, Sydney

DECCW 2011. *Biodiversity Certification Assessment Methodology*. NSW Department of Environment Climate Change and Water, Sydney.

DSEWPaC 2012. *EPBC Online Protected Matters Database Search*. Commonwealth Department of Sustainability, Environment, Water, Populations and Communities. Available <http://www.environment.gov.au/erin/ert/epbc/imap/map.html>

ELA 2007. *Oran Park Precinct Ecological Assessment*. Prepared for NSW Growth Centres Commission, by Eco Logical Australia.

ELA 2009a. *1150 Camden Valley Way Flora and Fauna Assessment*. Prepared for D & AI Pty Ltd, by Eco Logical Australia.

ELA 2009b. *Camden Valley Way Property Management Plan*. Prepared for D & AI Pty Ltd, by Eco Logical Australia,

ELA 2010a. *El Caballo Blanco and Gledswood Estate – Ecological, Riparian and Bushfire rezoning investigations*. Prepared by Eco Logical Australia

ELA 2010b. *Water related services for the South West Growth Centres First Release precincts & adjoining developments Stage 2- 5*. Prepared by Eco Logical Australia.

ELA 2012a. *Catherine Fields Part Precinct – Biodiversity Assessment*. Prepared for NSW Department of Planning and Infrastructure, by Eco Logical Australia.

ELA 2012b. *Leppington Rezoning Assessment: Biodiversity and Riparian Studies*. Prepared for NSW Department of Planning and Infrastructure, by Eco Logical Australia.

ELA 2012c. *East Leppington Rezoning Study: Biodiversity, Riparian and Bushfire Assessment*. Prepared for NSW Department of Planning and Infrastructure, by Eco Logical Australia.

ELA 2013a. *Emerald Hills Estate – Preliminary Constraints analysis, Ecology & Riparian Issues*. Prepared for Inspire Urban Design and Planning Pty Ltd, by Eco Logical Australia.

ELA 2013b. *Biodiversity Certification Expert Report for Emerald Hills Estate, Green and Golden Bell Frog (Litoria aurea)*. Prepared for Inspire Urban Design and Planning Pty Ltd, by Eco Logical Australia.

ELA 2013c. *Catherine Fields (Part) Precinct: Australasian Bittern Habitat*. Prepared for NSW Department of Planning & Infrastructure, by Eco Logical Australia.

ELA 2014a. *Emerald Hills Estate – Hardwicke Property – Biodiversity Agreement Credit Assessment Report*. Prepared for Macarthur Developments Pty Ltd.'

ELA 2014b. *Biodiversity Agreement Credit Assessment Report - Hardwicke*. Prepared for Macarthur Developments Pty Ltd.'

Insites 2013. Emerald Hills Planning Report. prepared by Whelans InSites Pty Ltd on behalf of Camden Council via Inspire Urban Design and Planning Pty Ltd.

IUDP 2013. *Draft Emerald Hills Estate Development Control Plan*. Inspire Urban Design and Planning, South Sydney. Prepared for Macarthur Developments.

Keith, D. A. 2004. *Ocean Shores to Desert Dunes – The native vegetation of New South Wales and the Australian Capital Territory*.

Keith, D & Simpson, C. 2006. NSW Extant Native Vegetation- Version 002. Prepared for NSW Department of Environment and Conservation.

ng environmental 2010. *Ecological Assessment: Camden Valley Way Cobbitty Road to Cowpasture Road Upgrade*. May 2010.

NPWS 2002. *Environmental Impact Assessment Guidelines – Cumberland Plain Large Land Snail*. NSW Parks and Wildlife Service, Hurstville.

NPWS 2002. *Native vegetation of the Cumberland Plain, Western Sydney Vegetation Community, Condition and Conservation Significance Mapping*. NSW National Parks and Wildlife Service, Sydney.

NPWS 2003a *The Native vegetation of the Warragamba Special Area*. NSW National Parks and Wildlife Service, Sydney, August 2003.

NPWS 2003b *The Native vegetation of the Woronora, O'Hares and Metropolitan Catchments*. NSW National Parks and Wildlife Service, Sydney, August 2003.

NPWS 2004. *Environmental Impact Assessment Guidelines, Pimelea spicata* EIA. NSW National Parks and Wildlife Service.

OEH 2012a. *NSW BioNET: Atlas of NSW Wildlife online search tool*. NSW Office of Environment and Heritage. Available: <http://www.bionet.nsw.gov.au/>

OEH 2012b. *NSW Threatened Species Database*. Available online: <http://www.environment.nsw.gov.au/threatenedspecies/>

OEH 2014. Letter from OEH to Camden Council regarding Planning Proposal and Biodiversity Certification Strategy for the Emerald Hills Estate at Leppington. From Susan Harrison, Senior Team Leader Planning, Greater Sydney Region, NSW Office of Environment and Heritage.

Rudman, W.B. 1999. *Threatened and Endangered Landsnail species - Meridolum corneovirens*. <http://www.austmus.gov.au/science/division/invert/mal/endangered/meridolum.htm>

SEWPaC 2012. EPBC Protected Matters Search Tool. Commonwealth Dept. of Sustainability, Environment, Water, Populations and Communities.

Sivertsen, D. 2009. *Native Vegetation Interim Type Standard*. NSW Department of Environment, Climate Change, and Water, Sydney.

SMCMA 2009. *Draft native vegetation of the Sydney Metropolitan Catchment Management Authority Area*, Prepared by Sydney Metropolitan Catchment Management Authority and NSW Department of Environment and Climate Change, Sydney

Thackway and Creswell 1994. *Toward an Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program*. Reserve Systems Unit, ANCA, Canberra.

# Appendix 1: Curriculum Vitae of field staff



## CURRICULUM VITAE

### Lucas McKinnon

#### SENIOR ECOLOGIST

#### QUALIFICATIONS

- Bachelor of Environmental Science (Honours), University of Wollongong  
Thesis topic: *Validation and Field Assessment of Endangered Ecological Communities on Community Lands within the Wollongong LGA*
- Graduate certificate in Ornithology, Charles Sturt University
- BioBanking Accredited Assessor (No. 0076), *Threatened Species Conservation Act 1995*, TAFE NSW and DECCW
- Aboriginal Cultural Awareness Training, TAFE NSW
- Forest Soil and Water Protection, TAFE NSW

Lucas is a senior ecologist with 10 years' post graduate experience working in both the private and public sectors. After completing an honours thesis studying endangered ecological communities (EECs) in the Wollongong LGA, he went onto to further studies in vegetation at the University of Wollongong and with the Australian Museum. He has worked with native vegetation policy at the former NSW Department of Natural Resources, working on the implementation of the *Native Vegetation Regulation 2005*, and with the co-ordination of threatened species policy, and went on to work in biodiversity conservation policy at the former NSW Department of Environment and Climate, Change (DECC). Whilst with DECC, Lucas also worked with the on-ground regulation of native forestry on private land on the north coast of NSW.

Lucas has worked with property scale vegetation planning with qualifications in the assessment of broadscale clearing and farmscale private native forestry under the *Native Vegetation Act, 2003*, and is an accredited BioBanking Assessor under the *Threatened Species Conservation Act, 1995*, qualified to undertake and prepare surveys and assessments for the NSW BioBanking and Biocertification Schemes.

Lucas has highly developed skills in research, policy development and project management, and these skills are complemented by his field skills with flora and fauna survey. Since starting ELA in October 2009, he has worked as a Project Manager and Field Ecologist on a variety of small and large scale projects, including vegetation mapping, impact assessment, biodiversity offset strategies, flora and fauna monitoring, Biobanking approvals, targeted threatened species surveys and most recently a number of Biocertification projects.

## RELEVANT PROJECT EXPERIENCE

- *Biobanking Agreement, Puckey's Estate, North Wollongong*: currently preparing the first **Biobanking Agreement** for the Illawarra and Southern River CMA area through OEHs Linking Landscapes program on behalf of Wollongong City Council.
- *Biobanking Statement, McPhails Estate, Horsley*: currently preparing the first **Biobanking Statement** for the Illawarra and Southern Rivers CMA area for development lands in the West Dapto Urban Release Area.
- *Biobanking Statement, Tahmoor Central*: preparation of **Biobanking Statement** for development lands in Shale-Sandstone Transition Forest, Wollondilly LGA.
- *Updated vegetation mapping and biodiversity conservation options for the West Dapto urban release area*: **Project Manager** and **Lead Ecologist** for revised mapping project and potential Biocertification options in the West Dapto URA, on behalf of Wollongong City Council.
- *Yallah-Marshall Mount Ecological Sensitivity Analysis*: Lead Ecologist for **ecological sensitivity analysis** of the Yallah – Marshall Mount area of Wollongong LGA on behalf of Council, including vegetation map validation and targeted threatened species survey, Biocertification advice. New records identified of the threatened climber, *Cynanchum elegans* and the endangered population of *Chorizema parviflorum*
- *Cannes Reserve Species Impact Statement*: **Project Manager** for SIS in Pittwater LGA at site with Grey-headed Flying Fox, and the EECs Littoral Rainforest and Pittwater Spotted Gum Forest.
- *West Dapto and Adjacent Growth Areas*: Lead Ecologist for Part 3A **flora, fauna and ecological assessment** of West Dapto Urban Release Area and Adjacent Growth Areas, including the Yallah and Marshall Mount area.
- *Western Sydney Parklands*: Project Manager and Biobanking Assessor for three **Biobanking Agreements** in the Western Sydney Parklands.
- *Kembla Grange Biobanking Statement*: Biobanking Assessor preparation of **Biobanking Statement** for land retaining Red Flag Vegetation, Illawarra Lowland Grassy Woodland EEC, including Species Credit surveys for *Pterostylis gibbosa*.
- *Tahmoor Biobanking Statement*: Biobanking Assessor preparation of **Biobanking Statement** for land retaining Red Flag Vegetation, Shale Sandstone Transition Forest EEC, including Species Credit surveys for Giant Burrowing Frog and *Pterostylis saxicola*.
- *Brownlow Hill*: Biobanking Assessor for 60ha Cumberland Plain Woodland **Biobanking Agreement**.
- *Tharbogang BOS*: Project Manager and Lead Ecologist for **Biodiversity Offset Strategy** for landfill and quarry, Griffith LGA.
- *Spring Farm*: Project Manager and Lead Ecologist for Elderslie Banksia Scrub Forest **Species Impact Statement**.
- *ARTC*: Project Manager and Lead Ecologist for **Purple Copper Butterfly habitat assessment**
- *Pine Dale Coal Mine*: Project Manager and Lead Ecologist for **vegetation mapping** project and **Purple Copper Butterfly** survey.
- *Werris Creek Coal Mine*: Project Manager and Lead Ecologist for **monitoring program** of offset lands including collection of baseline data for flora and fauna.
- *Marsden Park; Eastern Creek; Camden*: Ecologist for **flora assessment** of potential threatened ecological community, Cumberland Plain Woodlands and Derived Native Grasslands, including additional threatened species survey for *Grevillea juniperina* and Cumberland Plain Snail.
- *Werris Creek Coal mine*: Project Manager and Lead Ecologist for **flora and fauna assessment** of Part 3A development proposal for Life of Mine Extension Project in Box-Gum Woodland Critically Endangered Ecological Community (CEEC) on the Liverpool Plains, NSW.
- *Thornton Park TOD*: Lead Ecologist for **flora, fauna and riparian assessment** of proposed 1200 lot Transit Oriented Development (TOD) at North Penrith.
- *Grasmere*: Lead Ecologist for **flora, fauna and riparian assessment** of proposed 30 lot sub-division of rural land containing Cumberland Plain Woodland (CEEC), at Grasmere, Camden LGA, south west of Sydney.
- *Yellow Rock*: Project Manager for **Management Plan** of Deerubbin Local Aboriginal Land Council lands at Yellow Rock, Blue Mountains LGA.
- *Molongolo*: **vegetation survey** – determination of the presence and extent of EPBC Box-Gum Woodland CEEC on the outskirts in Molongolo growth area of Canberra.
- *Trale Station*: **Invertebrate survey** for the threatened Golden Sun Moth (*Synemon plana*) near Queanbeyan.
- *Metropolitan Colliery*: **vegetation survey and monitoring** for Metropolitan Colliery, west of Helensburgh in Sydney Catchment Area lands.
- *Warringah Council*: **Impact Assessment** of infrastructure development adjacent to a sandstone community at Belrose, northern Sydney.
- *Penrith Lakes Development Corporation*: **preliminary ecological advice** on future development adjacent to the Nepean River.

## Rebecca Dwyer

### ECOLOGIST

### QUALIFICATIONS

- Bachelor of Landscape Management and Conservation (Honours), University of Western Sydney
- BioBanking Accredited Assessor, Threatened Species Conservation Act 1995, TAFE NSW and DECCW

Rebecca is an ecologist and holds a Bachelor of Landscape Management and Conservation, majoring in Natural Resource Conservation and Restoration.

Rebecca has 7-years on-ground experience in ecology. She had been involved in a large number of ecological studies of varying scales throughout Australia. Rebecca has highly developed skills in research, project management, teamwork and effective communication, and these skills are complemented by his field skills with flora and fauna survey on a variety of small and large scale projects.

She is well trained and experienced in ecological investigations including botany, amphibians, mammals, threatened species monitoring, threatened ecological communities, vegetation mapping, erosion and weed control, habitat assessment, natural heritage, environmental impact assessment and preparation of management plans.

Rebecca is also an Accredited Biobanking Assessor in NSW. She had delivered a number of Biobanking offset agreements and feasibility studies for both private and government sectors.

### RELEVANT PROJECT EXPERIENCE

- Burrells Road, Menangle – Flora and Fauna Assessment, R&J Consultancy, NSW (2013)
- Drovers Way, Lindfield - Vegetation Management Plan, Steve Nolan Constructions, NSW (2013)
- Stormwater Infrastructure, Ropes Crossing -Weed Management Plan, Lend Lease, NSW (2013)
- Strategic Advice on Flora and Fauna Conservation and Management at Parramatta Park, NSW Government Architects Office (2013)
- Drovers Way, Lindfield Nest Box Installation and Pre-clearance Surveys, Steve Nolan Constructions, (2013)
- Moolarben Mine Biobanking Assessment, Moorlarben Coal Operations Pty Ltd, NSW (2013)
- Road Land Release Strategic Assessment Report, CCL Developments, The Hills, NSW (2013)
- Sydney Water man hole and vent shaft ecological assessments, Water Infrastructure, Sydney, NSW (2013)
- Summer Hill Biobanking Assessment, Private Landholder, The Oaks NSW (2013)
- Woolooware Bay Vegetation Management Plan, Bluestone Property Solutions, NSW (2012)
- Bandicoot Pre-clearance Surveys, Inner West Light Rail, NSW (2012)
- Mount Hunter Quarry Environmental Impact Assessment, Crown Mount Hunter Pty Ltd (2012)
- Mount Hunter Quarry Vegetation and Weed Management Plan, Crown Mount Hunter Pty Ltd (2012)
- Western Sydney Parkland Biobanking Assessment, Western Sydney Parklands, NSW (2012)
- Harrington Grove Biobanking Offset Assessment, Camden Council (2012)
- North West Growth Centre Biodiversity Offset Strategy, Sydney Water, NSW (2012)
- Windale EPBC Act Referral, ARTRO Management, NSW (2012)
- Townson Road, West Schofields Flora and Fauna Assessment , Mecone, NSW (2012)
- Holsworthy ZS Proposed Feeder Works Flora and Fauna Assessment, Endeavour Energy, NSW (2012)
- Silverdale Rd, Silverdale Flora and Fauna Assessment, Nix Management, NSW (2012)
- Taren Point Ecological Assessment, Sutherland Shire Council, NSW (2012)

- Emerald Hill Biocert Analysis, Inspire Urban Design and Planning, NSW (2012)
- Box Hill Biobanking Assessment, Sydney Water, NSW (2012)
- Bunya Precinct 6 Flora and Fauna Assessment, APP Corporation, NSW (2012)
- Leppington Vegetation Mapping, Roads and Transport Authority, NSW (2012)
- SE Qld Defence Natural Heritage Management Plan, Department of Defence, Qld (2012)
- HMAS Cerberus Natural Heritage Management Plan, Department of Defence, Victoria (2012)
- HMAS Cerberus Landscape Management Plan, Department of Defence, Victoria (2012)
- Condition and Integrity of Natural Heritage Places in Australia, Department of Sustainability, Water, Environment, Populations and Communities (2011)
- Carrum Downs Ecological and Net Gains Assessment, IForm Creations, Victoria (2011)
- Holsworthy Training Area Flora and Fauna Assessment, Department of Defence (2010-2011)
- Flora and Fauna Assessment, Woomera, South Australia, Department of Defence (2010)
- Environmental Impact Assessment - Murray Bridge Training Area and RAAF Base Edinburgh, South Australia. Department of Defence (2010)
- Natural Heritage Assessment, Northern Territory. Department of Finance September (2010)
- Donnybrook Habitat Hectare and Flora and Fauna Assessment, Shell, Victoria (2010)
- Ecological and Net Gain Assessment, Torquay Victoria. Ironbridge Holdings (2010)
- Wongawilli Colliery (Nebo Area) Ecological Assessment, Gujarat NRE Pty Ltd, NSW (2009 - 2010)
- Ecological and Heritage Assessment, Department of Finance, Northern Territory (2009)
- Moorebank Units Relocation and Puckapunyal Redevelopment Initial Environmental Review, Department of Defence (2010)
- Initial Environmental Review for seven Defence Properties, Defence Logistics Campaign, Department of Defence (2010)
- Flora and Fauna Assessment, Cooma to Bega 66kV Powerline Upgrade, Country Energy, NSW (2009)
- Scarborough Park Ecological Assessment, Kogarah Council, NSW (2009)
- Triple Bottom Line Reporting, Landcom (2008-2011)
- Threatened Species Monitoring, Department of Defence, Canberra, ACT (2010-2011)
- IICATS Ecological Assessment, NSW (2008 - 2009)
- NRE Colliery Gujarat Ecological Assessment, Gujarat NRE Pty Ltd, NSW (2008)
- Vegetation Monitoring for Majura Training Area (MTA) Kangaroo Exclusion Fence, Department of Defence, ACT (2008)



## Dr Rodney Armistead

### ECOLOGIST

### QUALIFICATIONS

- PhD in Conservation Biology from Murdoch University, Perth Western Australia. The impact of Phytophthora Dieback on the Mardo or Yellow Footed Antechinus (*Antechinus flavipes leucogaster*). – 2008
- Bachelor of Advanced Science (Honours), Deakin University, Geelong. A phylo-genetic assessment of Swamp Antechinus *Antechinus minimus*. - 2001

Rodney is an ecologist with a Doctor of Philosophy in Conservation Biology with >10 years' experience in environmental research and consulting. Rodney has been fortunate to have been able to gather considerable experience conducting flora, Phytophthora Dieback, terrestrial and aquatic fauna assessments through a variety of desert, alpine, coastal and woodland habitats in Western Australia, Victoria, Tasmania and New South Wales. He has particular experience in establishing and conducting mark, recapture and release population, biodiversity and presence-absence surveys for native mammals, lizards, frogs and bird surveys. Rodney has undertaken assessments of how threatening ecological processes impact upon Australia's native fauna. He has had the pleasure of researching, monitored and surveying the ecology and biology of several threatened and iconic native fauna species, including Western Quolls, Brush-tailed Bettongs, Platypus and Mountain Pygmy Possums.

### RELEVANT PROJECT EXPERIENCE

#### Impact assessments

- Flora and Fauna Assessment, West Dapto, NSW
- Busselton Flora and Fauna Assessment, Western Australia. (Coffey Environments)
- Pinjarra urban growth Flora and Fauna Assessment, Western Australia. (Coffey Environments)
- Flora and Fauna Assessment at Mount Gibson, Western Australia. (Coffey Environments)
- Pilbara Fauna Assessment, Western Australia. (Coffey Environments for Fortescue Metals)
- Murchison Flora and Fauna Assessment, Western Australia (ecologia)
- Great Victoria Desert Flora and Fauna Assessment, Western Australia (ecologia)
- Impact of fibrinol baiting for yellow-crazy ants on Christmas Island's native invertebrates and waterways (CESAR Consultants and Christmas Island National Parks)
- Manor Lakes Flora and Fauna Assessment, Victoria. (Biosis Research and Urban Growth Authority)
- Stella Property Flora and Fauna Assessment, Victoria. (Biosis Research and Urban Growth Authority)
- Rye Flora and Fauna Assessment, Victoria. (Biosis Research and Urban Growth Authority)
- Flinders St, Rye Flora and Fauna Assessment, Victoria. (Biosis Research and Department of Education)
- Preliminary Flora, Fauna and geomorphic Assessment at Grantville, Victoria (Biosis Research and Melbourne Water)
- Rockbank Golden Grass Frog and Golden Sun Moth Surveys, Victoria. (Biosis Research and Urban Growth Authority)
- Port Campbell gas pipeline alignment Flora and Fauna Assessment, Victoria. (Biosis Research)
- Flora and Fauna Assessment at Moxham Quarry, Northmeade, NSW

### Ecological Monitoring

- The distribution of Swamp Antechinus in the eastern Otway Range (Deakin University)
- The distribution and status of Mountain Pygmy-possums on Mount Buller, Mount Hotham and Bogong High Plains (Dean Heinze Environmental Consulting, ARMB and Parks Victoria)
- Spotted Tree Frog surveys in north-eastern Victoria (Dean Heinze Environmental Consulting and Parks Victoria)
- Dibbler surveys on Whitlock Island (University of Western Australia)
- Woylies or Brush-tail Bettong surveys in the Dryandra Woodlands (Murdoch University)
- Spring vegetation surveys in rehabilitated bauxite mine pits (Alcoa World Alumina)
- Seasonal hydrological changes in areas where bauxite mining and habitat rehabilitation has occurred (Alcoa World Alumina)
- Stream monitoring in areas where bauxite mining and habitat rehabilitation has occurred (Alcoa World Alumina)
- Habitat use by small mammals, reptiles and frogs in rehabilitated bauxite mine pits (Murdoch University and Alcoa World Alumina)
- Southern Brown Bandicoot and Brush-tail Phascogale surveys in urban Busselton (Coffey Environments)
- Platypus surveys in Melbourne's urban streams (CESAR Consultants and Melbourne Water)
- Modified gill net platypus surveys in the Wimmera region (CESAR Consultants and Project Platypus)
- Platypus surveys in the Mackenzie River, Grampians National Park (CESAR Consultants and Wimmera Catchment Management Authority)
- Golden Grass Frog surveys in the urban growth areas of Melbourne (Biosis Research)
- Plains Wanderer surveys in the urban growth areas of Melbourne (Biosis Research)
- Golden Sun Moth surveys in the urban growth areas of Melbourne (Biosis Research)
- Striped Legless Lizard surveys in the urban growth areas of Melbourne (Biosis Research)
- Dwarf Galaxias surveys in urban Melbourne (Biosis Research)
- Dwarf Galaxias relocation surveys in urban Melbourne (Biosis Research)
- Broad Toothed Rat surveys in areas impacted by the Black Saturday Fires (Biosis Research and DSE)
- Migratory shorebirds and Waders at Cronulla and Kurnell
- Green and Golden Bell Frog Surveys at Cronulla and Kurnell

## Ross Wellington

SENIOR CONSULTANT

### QUALIFICATIONS

- Bachelor of Arts (Biological Sciences), Macquarie University (1974-1977)
- Diploma of Education, Macquarie University (1974-1977)
- Teaching Certificate, NSW Department of Education and Training
- Certificate IV Geographic Information Systems, Newcastle TAFE (2005)

Ross is an ecologist/zoologist with over 30 years experience in wildlife and environmental investigations. Since graduating with a triple major in biological sciences from Macquarie University in 1977 he has worked as a science teacher and environmental educator (NSW DET), ecological/environmental consultant, technical officer within the herpetology and ornithology departments of the Australian Museum and as a senior wildlife conservation and management officer within the NSW National Parks and Wildlife Service, now Department of Environment & Climate Change 1998 - 2005.

Consequently, Ross has an extensive repertoire of skills and experience in undertaking, coordinating or reviewing outcomes of an array of projects that include: wildlife survey, plans of management, taxonomic studies and environmental planning and impact assessment. He is considered a noted authority in the specialist area of herpetology.

Ross has had a wide range of roles and functions throughout his working life and these have variously included being a participant in some of the early ecological investigations into NSW Forestry practices, undertaking fauna surveys as part of the state-wide CRA process, preparing State and National Recovery Plans for high profile endangered species such as the Green and Golden Bell Frog and Broad-headed Snake, a NSW Government representative on national working groups dealing with wildlife diseases and pest species management and contributing to various NSW wildlife conservation and management policy and plan development.

### RELEVANT PROJECT EXPERIENCE

#### Government Infrastructure Projects

- Sydney Water Cronulla STP and pipeline up grade
- Sydney Harbour and Foreshore Authority Cooks Cove redevelopment REP
- Sydney Olympic Park (WRAMS) predominantly Green and Golden Bell Frog related issues.

#### Major Industry Projects

- Dendrobium, Mt Owen, Ravensworth, Warkworth and Cumnock coal mines and mine expansions
- Port Warratah and Kooragang Island coal loading terminal

#### Residential and Commercial Developments

- Hunter Economic Zone (HEZ)
- Somersby Industrial Estate
- Australand's Kurnell Peninsula residential area
- Lensworth's Wallarah Peninsula residential estate
- North Lakes Residential release area
- Johnson Property Group and AV Jennings Westminster Homes Wadalba residential release
- Crighton Properties Gwandalan residential release area

**Threatened Species Recovery Programs**

- Threatened species recovery plan- Green and Golden Bell Frog
- Threatened species recovery plan- Broad-headed Snake
- Threatened species recovery plan- Blue Mountains Water Skink
- Threatened species recovery plan- Gould's Petrel
- Threatened species recovery plan- *Grevillea caleyi*
- Threatened species recovery plan- Southern Brown Bandicoot
- Threatened species recovery plan- Brush-tailed Rock-wallaby
- Threatened species recovery plan- Yellow-bellied Glider
- Threatened species recovery plan- Giant Burrowing Frog

**Ecology**

- On-site environmental management plan for the Red-crowned Toadlet, Giant Burrowing Frog and *Darwinia glaucophila* Lot 4 Piles Road, Somersby.
- Herpetofauna Survey of the Ravensworth State Forest Area
- Reptile and Amphibian Surveys of the Narooma Forestry District – Wandella
- Morisset Forestry District Environmental Impact Statement. Supporting Document No. 7
- Tania Park and Wellings reserves Manly, LGA Fauna surveys and habitat assessment surveys
- Five Forests surveys and ecological investigations of wildlife on the south coast of NSW
- Wellings Reserve, Balgowlah Heights Fire Management and Ecological assessment
- Aquatic and Terrestrial Ecological Assessment of proposed Bellfield College Site, Rossmore NSW.
- Planting the Seed' vegetation mapping and weed management along the Cooks River
- Stormwater management and drain maintenance assessment of Davistown, NSW GGBF

**Environmental Impact Assessment**

- Environmental Impact Assessment Lot 4 Piles Road, Somersby NSW.
- Environmental Impact Assessment Lot 2 Piles Road, Somersby
- Pre-harvest Threatened Species habitat assessment in Doyles River SF, Enfield SF, Bulga SF, Dingo Tops SF and Mt Boss SF
- Bulga State Forest Threatened Species habitat assessment
- Environmental Impact Assessment and 8 Part-test Headlands: Hawkeshead Drive, Killcare NSW
- Flora and Fauna Assessment and 8 Part-test: Greens Parade, Kellyville NSW
- Environmental Impact Assessment and 8 Part-test: Round Drive, Avoca, NSW
- Environmental Impact Assessment and 8 Part-test: Failford Road, Failford, NSW
- Environmental Impact Assessment and 8 Part-test: Westfield, Tuggerah, NSW
- Environmental Impact Assessment and 8 Part-test: Tramway Road, North Avoca, NSW
- Flora, fauna and archaeological investigations for Telstra
- Environmental impact assessment Broad-headed Snake St Helens Park and Wedderburn
- 150 Lot subdivision Precinct 1 Northlakes, Estelville; Requirements for Species Impact Statements
- 280 Lot subdivision Precinct 2 & 3 Northlakes, Estelville; Requirements for SIS
- 86 Lot subdivision Precinct 4 Northlakes, Estelville; Requirements for Species Impact Statements
- Dendrobium Coal Mine Proposal, Appin; Requirements for Species Impact Statements
- SEPP 5 aged development at Normanhurst Requirements for Species Impact Statements
- Somersby Fields (*Vulcan Materials*) Vegetation and threatened flora species mapping
- Bar Point, Hawkesbury River Threatened Flora and Fauna assessment and 8 part-test
- Bunnerong STS to Kurnell STS Terrestrial ecological assessment
- Review of Environmental Factors for the Blowering Dam upgrade (State Water)
- Kemp's Creek between Elizabeth Dve and Gurners Rd Cecil Park, NSW REF
- Fishway Construction Ecological Assessment – (Rockdale Canterbury City Councils)
- Woy Woy Waste Depot expansion proposal – (Gosford City Council)
- Environmental Impact Assessment Lot 18 Balkala Rd Bayview Hts - (Walker & Walker)
- Botany Bay Cable Project (Part 3A) Referral
- Statement of Environmental Effects Proposed expansion to Barker College, Hornsby
- Gulph Creek, Nerrigundah Review of Environmental Factors
- Woy Woy Waste Depot expansion proposal – (URS & Gosford City Council)



## CURRICULUM VITAE

**Bruce Mullins****MANAGER, ECOLOGY AND ASSESSMENT, SENIOR ECOLOGIST****QUALIFICATIONS**

- Master of Science, University of Technology, Sydney. Factors affecting the vegetation of mined and unmined areas in a montane forest.
- Bachelor of Science, University of Technology, Sydney

Bruce is an ecologist with 20 years post-graduate experience and is Eco Logical Australia's Senior Ecologist and Manager of the Ecology and Assessment team. Following the completion of a Master of Science thesis examining patch dynamics and plant ecophysiology at an abandoned mine site in the central tablelands of NSW, Bruce has been working as a researcher and environmental consultant. For seven years he managed the environmental consulting activities of Charles Sturt University, principally through the Johnstone Centre, after which time he joined Eco Logical Australia.

Bruce has highly developed skills in research and consulting. He is experienced in the design and execution of ecological surveys, environmental impact assessment, the development of management plans, literature reviews and all aspects of project management.

**RELEVANT PROJECT EXPERIENCE**

- Towra Point Artificial Bird Roosts REF, DECCW
- Southern Highlands Transfer, Identification of Flora and Fauna Constraints, Dept Commerce
- Shoalhaven Water Transfers, Terrestrial Ecology and Wetlands, Dept Commerce
- Metropolitan Colliery Vegetation Monitoring Program
- Ecological Assessment, Proposed Hume Highway Duplication, RTA
- Flora and Fauna Impact Assessment, Roadside Vegetation Maintenance, Old Princes Highway, Bulli Tops to Waterfall, Wollongong City Council
- Ecological Assessment, Proposed Hume Highway Duplication, RTA
- Goodnight Island Ecological Assessment, Studio Internationale
- Research and Monitoring Program, DEF COMMSTA Morundah, Dept of Defence
- Wetland Vegetation Surveys for LiDAR comprising the Gwydir Wetlands, DECCW
- Wetland Characterisation and Management, Port Stephens Council
- EPBC Box Gum woodland survey and mapping, Molonglo region, ACT
- Tallawarra Local Environment Study, TRUenergy
- Shellharbour Hardrock Extraction Flora and Fauna Assessment, NSW Dept of Planning
- Campbelltown Biodiversity Study, Campbelltown City Council
- Native Vegetation Guide for the Riverina, Greening Australia
- Buckingbong State Forest Environmental Assessment, Dept of Defence
- Wagga Wagga Planning Studies, Willana Associates
- Historical distribution of Native Grasses through Parkes, Forbes and Lachlan Shires, Western Research Institute
- A review of the ecological health of the Murrumbidgee River, Living Murray
- Systematic Vegetation Surveys, Upper Hunter Valley
- Environmental investigations and vegetation mapping, DEF COMMSTA properties, Dept of Defence
- Vegetation Condition Assessment, Woodlands Historic Park, Melbourne, Parks Victoria

- Flora survey, Riverine Plain (62 sites), DLWC
- Flora survey, Jingellic, Bogandyera and Clarkes Hill Nature Reserves, NPWS
- Flora survey, Wagga Wagga LGA, DEC
- Googong Environmental Investigations for Local Environment Study, Willana Associates
- Gum Swamp Management Plan and Operation and Maintenance Manual, Gum Swamp, DLWC
- Evaluation of 1750 mapping of vegetation by the Riverina Vegetation Committee, NPWS
- Edwin Land Parkway, Queanbeyan, GHD
- Vegetation validation - Narrandera, Ardlethan, Barmedman and Coolamon 1:100,000 Map Sheets, DECCW
- Scoping Report for the Development of a Biodiversity Strategy and Plan for the Rice Industry, Rice Growers Association
- Council Appointed Expert, terrestrial ecology, Proposed Subdivision Hampton Cres Blacktown
- Council Appointed Expert, terrestrial and aquatic ecology, Rooty Hill
- Box-Gum Woodland Mapping and Monitoring Plan for Kapooka Military Area, Dept of Defence
- Monitoring the Impacts of Kangaroo Grazing in the Kapooka Military Area, Dept of Defence
- Monitoring the Impacts of Kangaroo Grazing in Latchford Barracks, Dept of Defence
- North Bandiana Landscape Management Plan, Dept of Defence
- South Bandiana Landscape Management Plan, Dept of Defence
- Vegetation Condition Assessment, South West Slopes, DEWHA
- Flora and Fauna Assessment, Proposed Bayswater 2 Powerstation, Part 3A, AECOM
- Hargraves to Windeyer Powerline Ecological Assessment, Barnson Pty Ltd
- Moolarben Coal Mine Preclearing Survey, Moolarben Coal Operations
- Vegetation Mapping, Mulwala Explosives Facility, Mulwala, Dept of Defence
- Native Grassland Condition Assessment, Tubbo Station, Tubbo Farming.
- Wagga Wagga Linepack Extension, Environmental Licencing Professionals
- Ecological Assessment, Cooktown, QLD, Airservices Australia
- Assessment of Irongrass Natural Temperate Grassland, Taillem Bend, SA, Airservices Australia
- Moorlaben Coal, Flora and Fauna Monitoring 2010-2011, Moolarben Coal Operations
- Superb Parrot Surveys, selected sites in ACT.
- Eastern Highlands Vegetation Surveys, (Kosciusko NP and ACT), DECCW and ACT government.
- West Dapto and Adjacent Growth Areas, Part 3A Assessment, Sydney Water Corporation
- Tharbogang Landfill Biodiversity Offset Strategy, Griffith City Council
- Tralee Station proposed rezoning, environmental assessment and constraints analysis, Queanbeyan, Urbis.

## Appendix 2: Species predicted and requiring survey

Highlights indicated months during which targeted surveys were undertaken

Scientific Name	Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Survey Undertaken	Recorded
<i>Acacia pubescens</i>	Downy Wattle	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
<i>Cynanchum elegans</i>	White-flowered Wax Plant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
<i>Eucalyptus benthamii</i>	Camden White Gum	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
<i>Hibbertia</i> sp. Bankstown	<i>Hibbertia</i> sp. Bankstown									Yes	Yes	Yes	Yes	Yes	No
<i>Hypsela sessiliflora</i>	<i>Hypsela sessiliflora</i>									Yes	Yes	Yes		Yes	No
<i>Litoria aurea</i>	Green and Golden Bell Frog	Yes	Yes	Yes					Yes	Yes	Yes	Yes	Yes	Yes	No***
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Miniopterus australis</i> (Breeding Habitat)	Little Bentwing-bat (Breeding Habitat)		Yes	Yes	Yes						Yes	Yes	Yes	Yes	No Breeding habitat
<i>Persicaria elatior</i>	Tall Knotweed	Yes	Yes	Yes	Yes	Yes							Yes	Yes	No
<i>Phascolarctos cinereus</i>	Koala	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
<i>Pimelea spicata</i>	Spiked Rice-flower	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
<i>Pultenaea pedunculata</i>	Matted Bush-pea									Yes	Yes	Yes		Yes	No

\*\*\* An Expert report regarding the ‘assumed absence’ of Green and Golden Bell Frog” is provided in Appendix 3.

## Appendix 3: Expert Report – Green and Golden Bell Frog

Provided as a separate Pdf document



## Appendix 4: Transect/plot data

**Vegetation Zone 1:** Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin – Low (Underscrubbed)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
BB6	14	21.5	4.5	54	0	10	100	0	1	0	295835	6236278	56

**Vegetation Zone 2:** Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin – MG (Underscrubbed)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
BB3	22	58	7	38	0	76	46	0	0.4	0	296580	6237454	56
BB5	23	27	6.5	54	0	36	42	0	0.4	0	297066	6236528	56
BB09	28	24.5	2	66	0	16	12.5	1	0.4	12	297017	6236414	56
BB12	36	30	0	60	2	20	4	0	0.4	8	297053	6237039	56
BB13	31	9	3.5	92	6	36	16	0	0.4	27	297054	6237039	56

**Vegetation Zone 3:** Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin – Low (Disturbed)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
BB11	17	17.5	0	6	0	2	78.5	0	0.5	6	296998	6237198	56

**Vegetation Zone 3:** Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin – Low (Disturbed)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
BB7	11	14	6	48	0	20	78	0	0.5	0	296264	6235966	56

**Vegetation Zone 4:** Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin – Low (SPT)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
BB8	14	2	0	58	0	4	94	1	1	5	296458	6236405	56

**HEAD OFFICE**

Suite 4, Level 1  
2-4 Merton Street  
Sutherland NSW 2232  
T 02 8536 8600  
F 02 9542 5622

**CANBERRA**

Level 2  
11 London Circuit  
Canberra ACT 2601  
T 02 6103 0145  
F 02 6103 0148

**COFFS HARBOUR**

35 Orlando Street  
Coffs Harbour Jetty NSW 2450  
T 02 6651 5484  
F 02 6651 6890

**PERTH**

Suite 1 & 2  
49 Ord Street  
West Perth WA 6005  
T 08 9227 1070  
F 08 9322 1358

**DARWIN**

16/56 Marina Boulevard  
Cullen Bay NT 0820  
T 08 8989 5601

**SYDNEY**

Level 6  
299 Sussex Street  
Sydney NSW 2000  
T 02 8536 8650  
F 02 9264 0717

**NEWCASTLE**

Suites 28 & 29, Level 7  
19 Bolton Street  
Newcastle NSW 2300  
T 02 4910 0125  
F 02 4910 0126

**ARMIDALE**

92 Taylor Street  
Armidale NSW 2350  
T 02 8081 2681  
F 02 6772 1279

**WOLLONGONG**

Suite 204, Level 2  
62 Moore Street  
Austinmer NSW 2515  
T 02 4201 2200  
F 02 4268 4361

**BRISBANE**

PO Box 1422  
Fortitude Valley QLD 4006  
T 0400 494 366

**ST GEORGES BASIN**

8/128 Island Point Road  
St Georges Basin NSW 2540  
T 02 4443 5555  
F 02 4443 6655

**NAROOMA**

5/20 Canty Street  
Narooma NSW 2546  
T 02 4476 1151  
F 02 4476 1161

**MUDGEES**

Unit 1, Level 1  
79 Market Street  
Mudgee NSW 2850  
T 02 4302 1230  
F 02 6372 9230

**GOSFORD**

Suite 5, Baker One  
1-5 Baker Street  
Gosford NSW 2250  
T 02 4302 1220  
F 02 4322 2897

1300 646 131  
[www.ecoaus.com.au](http://www.ecoaus.com.au)