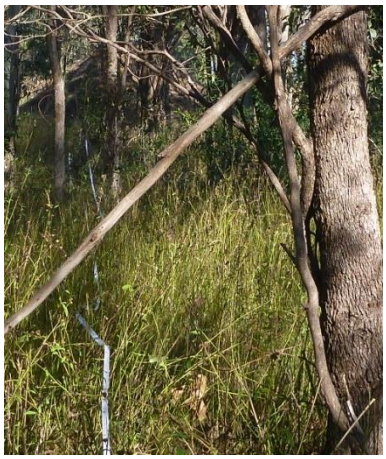
El Caballo Blanco, Gledswood and Camden Lakeside residential estate

Biodiversity Certification Assessment Report and Strategy

Prepared for
Sekisui House Australia Pty Ltd

10 February 2017



DOCUMENT TRACKING

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Project Manager	Robert Humphries 8536 8620 Level 3, Suite 2, 668-672 Old Princes Highway Sutherland NSW 2232
Prepared by	Meredith Henderson, Enhua Lee, Joanne Daly
Reviewed by	Robert Humphries
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ACKNOWLEDGEMENTS

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Abbreviations

Abbreviation	Description
ARA	Adjacent Remnant Area
APZ	Asset Protection Zone
BAR	Biodiversity Assessment Report
BCAA	Biodiversity Certification Assessment Area
BCAM	Biodiversity Certification Assessment Methodology
BCS	Biodiversity Certification Strategy
BVT	Biometric Vegetation Type
CC	Camden Council
CCPD	Canopy cover projection density
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CMA	Catchment Management Authority
CPW	Cumberland Plain Woodland in the Sydney Basin Bioregion
CPSWSGTF	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
DCP	Development Control Plan
DECCW	NSW Department of Environment, Climate Change and Water (now OEH)
DoE	Commonwealth Department of the Environment
ECBGL	El Caballo Blanco, Gledswood and Lakeside
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	*NSW Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
HBT	Hollow Bearing Trees
IoM	Improve or Maintain
LEP	Local Environment Plan
LG Act	NSW *Local Government Act 1993*
LGA	Local Government Area
MALD	More Appropriate Local Data
NES	National Environmental Significance
NPW Act	*National Parks and Wildlife Act 1974*
NPWS	NSW National Parks and Wildlife Service (now part of OEH)

Abbreviation	Description
NSW	New South Wales
OEH	NSW Office of Environment and Heritage (formerly DECCW)
RFEF	River-Flat Eucalypt Forest
Sekisui House Australia	Sekisui House Australia Pty Ltd
SH Camden Lakeside	SH Camden Lakeside Pty Ltd
TSC Act	*NSW Threatened Species Conservation Act 1995*
TSPD	Threatened Species Profile Database

Definitions

The following table provides definitions for the terminology used in biocertification assessments. Where these terms have been used in the report they have been included in 'quotation marks'.

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
Credit Discounting	Applies where there are existing legal obligations to undertake conservation management actions on land.
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 *National Parks and Wildlife Act 1974* (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

DEFINITION	DESCRIPTION
MALD	More appropriate local data. As described in 3.4 of the BCAM, the Director General may certify that more appropriate local data can be used instead of the data in the Vegetation Benchmark Database and Vegetation Types Database, where local data more accurately reflects local environmental conditions.
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.
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

Eco Logical Australia Pty Ltd (ELA) was engaged by SH Camden Valley Pty Ltd (SH Camden Valley), a subsidiary of Sekisui House Australia, to undertake a Biodiversity Certification Assessment for the El Caballo Blanco, Gledswood and Camden Lakeside (ECBGL) Precincts, and prepare a Biocertification Strategy in accordance with the Biocertification Assessment Methodology (BCAM). The purpose of the assessment is to obtain '*biodiversity certification*' of the 'land' proposed for residential development and associated infrastructure from the Minister for the Environment. Biocertification is 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.

The '*Biodiversity Certification Assessment Area'* (BCAA) defined for this application was agreed to between Sekisui House Australia, Camden Council and the NSW Office of Environment and Heritage (OEH) and excludes lands within the ECBGL residential estate that are subject to existing Development Applications (DA 839/2015, DA 840/2015 & DA 1232/2015 for El Caballo Blanco and Gledswood Golf holes, Corade Residential Development) and a DA for the Riley's Creek Sewer Carrier Main.

The BCAA encompasses a total area of 56.10 ha and includes 19.83 ha of a native vegetation community comprising one biometric vegetation type (BVT), '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*'. This BVT forms a component of the vegetation community, Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW), which is listed as a critically endangered ecological community (CEEC) under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The remaining 36.27 ha of the assessment area is exotic/planted vegetation, dams, tracks or existing buildings. Whilst a number of threatened flora and fauna species have been recorded in or near the assessment area, only four species, Pimelea spicata (Spiked Rice-flower), *Meridolum corneovirens* (Cumberland Plain Land Snail), Litoria aurea (Green and Golden Bell Frog) and *Myotis macropus* (Southern Myotis), require specific assessment under the BCAM as they are classified as '*species credit'* species and impacts to these cannot be assessed by the BVT present.

The BCAA and proposed impacts are described in **Section 1**. The Biodiversity values of the BCAA are described in the Biodiversity Assessment Report (BAR) in **Section 2**. The credit calculations and strategy for achieving an 'improve or maintain' outcome are provided in **Section 4** and **6** respectively.

The application proposes to directly impact 47.45 ha of the assessment area of which 14.01 ha is mapped as native vegetation and threatened species habitat. It includes 12.57 ha of a CEEC in moderate to good condition, of which 0.08 ha is an area of vegetation recognised as having regional or state biodiversity conservation significance (a riparian buffer 20 m either side of a minor creek). These are categorised as '*red flag areas'* or '*areas of high biodiversity conservation value*' by the BCAM.

A number of options and alternatives have been considered to avoid and minimise impacts to the maximum extent possible (refer **Section 5.2.1**). In addition, a number of mitigation measures including Construction Environmental Management Plans (CEMPs), pre-clearance surveys, appropriate vegetation restoration, and storm water quality control and management, will be implemented to reduce indirect impacts to native vegetation and threatened species and their habitats.

Impacts to red flag areas that cannot be avoided require a '*variation*' from the Minister before Biocertification can be conferred. A request for a red flag variation is included in **Section 5**. The remaining areas to be impacted are not 'areas of high biodiversity conservation value', or are cleared of native vegetation.

The Biodiversity Certification Assessment has found that **293** biocertification ecosystem credits are required for direct impacts to the BVT and an additional **3** credits for indirect impacts. No ecosystem credits will be generated by any on-site conservation measures. All offsets will be met by the purchase and retirement of biobanking credits from biobank sites outside the BCAA (**Section 6**). A Biobank Agreement application has been submitted for registration of 300 *Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' (HN528) credits at the proposed Hamden Vale Biobank site in the Wollondilly LGA. An agreement has been entered into with the owner of the Hampden Vale site to supply **296** HN528 credits in accordance with the proposed staging plan (**Section 6**). The owner has also consented to the application for biodiversity certification as an 'affected party' and enter into a Biocertification Agreement with the Minister for the Environment under Section 126ZH of the TSC Act.

Similarly, **18** '*species credits'* are required for impacts to Cumberland Plain Land Snail. No Cumberland Plain Land Snail species credits will be generated within the BCAA, therefore, as for ecosystem credits, there are credit deficits for Cumberland Land Snail. The requirement for Cumberland Land Snail credits will be met outside the BCAA by the purchase and retirement of **18** Cumberland Plain Land Snail credits. An agreement has been entered into with the owner of the Summer Hill Biobank site (Agreement No. 100) to sell 18 Cumberland Land Snail credits to SH Camden Valley. The owner has also consented to the application for biodiversity certification as an 'affected party' and enter into a Biocertification Agreement with the Minister for the Environment under Section 126ZH of the TSC Act. These credits will be retired in accordance with the proposed staging plan in **Section 6**.

Indirect impacts have been considered and assessed in accordance with Section 6 of the BCAM and it has been determined that they will either be fully mitigated by development controls associated with the lodgement of Development Applications on the certified land (Stages 1, 2 and 3 which trigger the requirement to prepare and implement a Vegetation Management Plan to restore and enhance Cumberland Plain Woodland on the Golf Course surrounding the certified land in accordance with the Planning Agreement associated with the rezoning of the subject land) or the potential indirect impacts will be offset by the retirement of **3** additional credits for impacts to Stages 4, 5, 6, 7 and 8.

Subject to the Minister's approval of the request for a red flag variation and purchase of the additional ecosystem and species credits, the proposal can meet an '*improve or maintain*' outcome and is eligible for biodiversity certification. If the Minister confers biocertification on the requested land, CC 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.

A staging plan has been provided in the application that provides an indication on the likely timing of each component of the application, the area of vegetation to be impacted and the number of credits required for each stage. The timing and area of impact in each stage may vary due to a number of factors including demand for residential housing lots. Accordingly, clearing for any stage of development will not commence until the required number of credits has been secured, purchased and retired in accordance with the indicative staging plan.

Sekisui House Australia will prepare and implement a Construction Environment Management Plan for vegetation clearing to guide the development outlined in this biocertification assessment and ensure that all direct and indirect impacts (e.g. APZs, utilities, access, stormwater run-off) are contained within the development footprint and appropriate mitigation measures are put in place to minimise any indirect impacts to threatened fauna.

This will include, but not be limited to:

- Temporary and permanent protective fencing will be erected around all areas identified for conservation prior to clearing activities to minimise any inadvertent damage
- Pre-clearance surveys of threatened fauna will be undertaken in accordance with a Fauna pre-clearance protocol prior to any clearing of vegetation
- Protocols for clearing vegetation and adaptive reuse of vegetative material for restoration and habitat augmentation in areas indicated for restoration activity (i.e. fallen logs in conservation areas) will be prepared and implemented.

1 Introduction

1.1 Project background

Eco Logical Australia Pty Ltd (ELA) was commissioned by SH Camden Valley Pty Ltd (SH Camden Valley), a subsidiary of Sekisui House Australia, to undertake a Biodiversity Certification Assessment for the El Caballo Blanco, Gledswood and Camden Lakeside (ECBGL) Precincts located within the Camden Local Government Area (LGA), approximately 8 km northeast of Camden, and to prepare a Biocertification Certification Strategy (BCS). The land is located at 50 Raby Road (with additional access points along Camden Valley Way), Gledswood Hills (**Figure 1**).

The land subject to the Biocertification application is zoned a mixture of R1 General Residential with small areas zoned RE2 Private Recreation and E2 Environmental Conservation under Camden Local Environment Plan 2010. Prior to 2012, the land was zoned RU2 Rural Landscape and has had, and continues to be used for agricultural purposes (horse agistment and cattle grazing). The Camden Lakeside component of the assessment area includes the current Camden Lakeside Golf Course which has also undergone considerable disturbance and modification during the construction of the original Golf Couse in the 1990's (**Figure 2**).

An application for biocertification must follow the Biodiversity Certification Assessment Methodology (BCAM) (Department of Environment, Climate Change and Water [DECCW] 2011) and meet the requirements of Section 126K of the *Threatened Species Conservation Act* 1995 (TSC Act), i.e. be accompanied by a BCS.

The BCAM was developed by the New South Wales (NSW) Office of Environment and Heritage (OEH) and was gazetted by the NSW government in February 2011. The methodology may be applied to land for which '*biocertification is sought'*, and is 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).

The methodology provides an equitable, transparent and scientifically robust framework with 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.

Only a '*Planning Authority'* as defined by section 126G of the TSC Act may apply to the Minister for biocertification. Camden Council (CC) is a Planning Authority as defined by section 126G. CC is seeking biocertification of the residential zoned 'land' and associated infrastructure (APZs and access roads) identified in this assessment report.

This Biocertification Strategy and the associated credit calculations were undertaken by an accredited assessor, Enhua Lee (Accreditation Number 176), who was supported by accredited assessors, Bruce Mullins (Accreditation Number 0156) and Meredith Henderson (Accreditation Number 0155), other ELA staff (Joanne Daly and Robert Humphries), and field ecologists Brian Towle and Rodney Armistead who

undertook ecological investigations of the Biodiversity Certification Assessment Area (BCAA) as part of several previous investigations for rezoning of lands in the BCAA.

1.2 Biodiversity certification assessment area and proposal

The BCAA encompasses a total area of 56.10 ha and is located at 50 Raby Road (with additional access points along Camden Valley Way), Gledswood Hills, in the Camden LGA (**Figure 3**). It lies immediately south of the South-West Sydney Growth Centre Precinct of East Leppington, and east of the Precincts Catherine Fields and Catherine Fields North. Outside of the Growth Centre Precincts, extensive urban development activity is also occurring to the south of the BCAA in the suburb of Gregory Hills and the industrial area of Smeaton Grange. The BCAA includes land proposed for biodiversity certification (and therefore proposed for development; '*land to be certified*') and '*retained land*' i.e. land that is not proposed for development or subject to 'conservation measures'. The retained land within the BCAA is largely a vegetated area that will be subject to a Vegetation Management Plan and managed as an offset to meet Commonwealth Environment Protection and Biodiversity Act 1992 offset requirements. There is also a proposed access road that has been assessed as 'retained' land that is associated with a development application (DA) by a separate landholder adjacent to the BCAA. The impacts of this road, are considered as part of the DA, not the Biocertification application.

The '*Biodiversity Certification Assessment Area'* (BCAA) defined for this assessment was agreed to between Sekisui House Australia, Camden Council and the NSW Office of Environment and Heritage (OEH) and excludes lands within the ECBGL residential estate that are subject to existing Development Applications (DA 839/2015, DA 840/2015 & DA 1232/2015 for El Caballo Blanco and Gledswood golf holes, Corade Residential Development) and a DA for the Riley's Creek sewer carrier main. (**Figure 4**).

The BCAA includes approximately 19.83 ha of mapped native vegetation. Vegetation within the BCAA includes one Biometric vegetation type (BVT), which is listed as a Critically Endangered Ecological Community (CEEC) under the TSC Act and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (**Table 1**). The remaining areas comprise exotic pasture and plantings which fits the definition of 'cleared land' as defined by the BCAM (DECCW 2011) i.e. areas where there is no canopy or shrub layer and the ground cover is greater than 50% exotic cover.

The regional location of the BCAA is shown in **Figure 1**. The areas proposed to be impacted (land to be certified or '*development areas*') and '*retained land*' in the BCAA are shown in **Figure 3**. It is noted that 3.76 ha of land proposed for biocertification comprises an Asset Protection Zone (APZ). The APZ is located around the vegetated '*retained land*' not associated with the proposed road DA and Golf Course on the basis of the future condition following restoration and fire hazard these areas will present. There is 1.92 ha of mapped vegetation in the APZ areas. Details of the lots that make up the biocertification land uses in the BCAA are presented in **Table 2** and shown in **Figure 5**.

Table 1: Biometric vegetation types and their conservation status in the BCAA

Biometric vegetation type	Area (ha)	TSC Act	EPBC Act
Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	19.83	CPW (CEEC)	Part CPSWSGTF (CEEC)*
Cleared land	36.27	NA	NA
Total	**56.10**		

* CPSWSGTF = Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

Table 2: Proposed biocertification land uses and lots in the BCAA

Lot//DP	Native Vegetation (ha)			Cleared (ha)			Grand total
	Land proposed for biodiversity certification	Retained lands	Total	Land proposed for biodiversity certification	Retained lands	Total	
1201//1187381	0.01	0	0.01	0.39	0	0.39	0.40
1203//1187381	0.01	0	0.01	0.13	0	0.13	0.14
50//1175424	8.05	5.82	13.87	11.53	2.83	14.37	28.24
100//1206855	0.41	0	0.41	0.04	0	0.04	0.44
101//1206855	5.54	0	5.54	21.34	0	21.34	26.88
Total	**14.01**	**5.82**	**19.83**	**33.43**	**2.83**	**36.27**	**56.10**

1.3 Description of project, timelines, management and governance

The ECBGL is a staged residential subdivision with current planning for approximately 630 lots, associated with proposed new golf holes within the El Caballo Estate. The subdivision will create serviced residential lots, public reserves, private recreational facilities, roads, APZs and stormwater management facilities. Development of the ECBGL residential estate is expected to be implemented in up to eight stages over an approximate 4 to 7 year timeframe (subject to demand) and will be subject to the necessary Part 4 and/or Part 5 approvals under the EP&A Act and CC Development Control Plan (DCP) 2011. No clearing of mapped vegetation will commence in any stage until Sekisui House has purchased and retired the required number of credits as indicated in **Section 6.3.1.**

A breakdown of the works in each stage and indicative timeframes are provided in **Table 3** and shown in **Figure 6**.

Table 3: Indicative implementation stages of the ECBGL residential estate

Stage	Area (ha)	Likely timeframe	Components
Stage 1	8.78	0-2 Years	Approximately 106 lots and a single park with associated roads and urban infrastructure.
Stage 2	6.64	2-3 Years	Approximately 68 lots with associated roads and urban infrastructure
Stage 3	4.70	3-4 Years	Approximately 69 lots with associated roads and urban infrastructure
Stage 4	4.30	2-3 Years	Number of lots not yet resolved
Stage 5	2.97	3-4 Years	Number of lots not yet resolved
Stage 6	1.89	3-4 Years	Number of lots not yet resolved
Stage 7	10.44	4-6 Years	Number of lots not yet resolved
Stage 8	7.72	5-7 Years	Number of lots not yet resolved

1.4 Community Consultation and Stakeholder Engagement

The plans for the ECBGL residential estate have undergone extensive community and stakeholder consultation, including with the DPE and the OEH, since 2004 when Council resolved to prepare draft LEPs for Camden Lakeside (APP 2007) and land within the Central Hills area at Gledswood Hills, known as the El Caballo Blanco & Gledswood (CC 2012)(**Appendix A**).

A Local Environment Study was prepared and publicly exhibited in November 2007 for Camden Lakeside and February 2009 for El Caballo Blanco and Gledswood as part of this process. The Local Environment Study was supported by a number of specialist studies including Flora and Fauna assessments undertaken by Cumberland Ecology (2005 and 2007) and Eco Logical Australia (2007) and a Vegetation Management Strategy (ELA 2011b).

The rezoning proposal for Camden Lakeside was gazetted in May 2009 and for El Cabello Blanco and Gledswood in March 2013. The Camden LEP was subsequently amended.

Consistent with section 126N of the TSC Act, the proposal to seek biocertification of the site will be placed on public exhibition and a report prepared responding to any submissions received.

1.5 Strategic context

Camden Council resolved to prepare a draft LEP for land within the Central Hills area at Gledswood Hills known as the El Caballo Blanco & Gledswood rezoning and Camden Lakeside in 2004 (CC 2012)(**Appendix A**). The objective of the planning proposals was to provide controls through rezoning that would allow a high quality low scale residential and golf course development in a landscape setting of the Gledswood Homestead and Central Hills (CC 2012). The planning proposal was supported by a Local Environment Study. The ECBG rezoning is consistent with the underlying objectives of the Metropolitan Strategy when considered in the context of development proposed in the adjacent Growth Centre precinct (CC 2012).

1.6 Biocertification Assessment Process and Implications

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 BVTs (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 the OEH.

'*Red flags*' are regarded as '*areas of high biodiversity conservation value*' in section 2.3 of the BCAM, and include vegetation types that are >70% cleared in the Catchment Management Authority Area (CMA), CEECs and EECs listed under the TSC Act and/or EPBC Act, certain threatened species that are regarded as not being able to withstand further loss in the CMA, and areas that are recognised as biodiversity corridors of state or regional significance.

The BCAA includes two red flag entities that will be impacted by the proposal:

- One CEEC, '*Cumberland Plain Woodland in the Sydney Basin Bioregion*' (CPW), involving impacts to 12.57 ha

- One area of vegetation recognised as having regional or state biodiversity conservation significance, a riparian buffer 20 m either side of a minor creek on the coast and tablelands, involving impacts to 0.08 ha.

The riparian buffer 20 m either side of a minor creek that will be impacted is comprised of impacted CEEC. As such, the 0.08 ha impacted is not additional to the 12.57 ha impacted.

The measures taken to avoid, minimise and mitigate impacts to this '*red flag*' are provided in **Section 5**. As all impacts have not been avoided, this assessment report includes a red flag variation request (**Section 5**).

1.7 Assessment Methodology/Consultation with the OEH

In accordance with the OEH's Biodiversity Certification Guide for applicants (OEH 2015a), CC, SH Camden Lakeside and ELA consulted with the OEH prior to and throughout the assessment to ensure that all decisions and assumptions meet the intent of the BCAM. The OEH was also consulted on the proposed impacts to '*red flags'* and the likelihood that these would be supported. The OEH also reviewed draft reports in October 2015 and 2016 and the comments received, in particular those relating to the justification of avoidance measures to red flag areas, assessment of indirect impacts, and further assessment of the Green and Golden Bell Frog and Southern Myotis, have been incorporated into this report.

A summary of discussions and outcomes are provided below:

- The boundary of the BCAA and its relationship to other DAs within the ECBGL residential estate was modified several times and agreed to between Council, OEH and Sekisui House
- The proposed biocertification approach: areas of high conservation value (CEECs, riparian areas, biodiversity links), and species credits species to be considered. The OEH agreed that there was one CEEC) to be considered, and there were no state or regional biodiversity links on site.
- The version of the Biocertification calculator tool to be used for calculations. Version 1.9 is to be used.
- The OEH assessment requirements, preparation and exhibition of the BCS, and the application by CC for conferral of biocertification to the Minister for Environment. The OEH indicated that the BCAM should be followed, as well as Guidelines for the preparation of Biodiversity Assessments and Strategies.
- OEH staff attended a site inspection on 8 September 2015 which confirmed the BVTs present on site and gave approval to use biometric plots partially outside of the final BCAA that were within the same vegetation zone and that were representative of the zone.

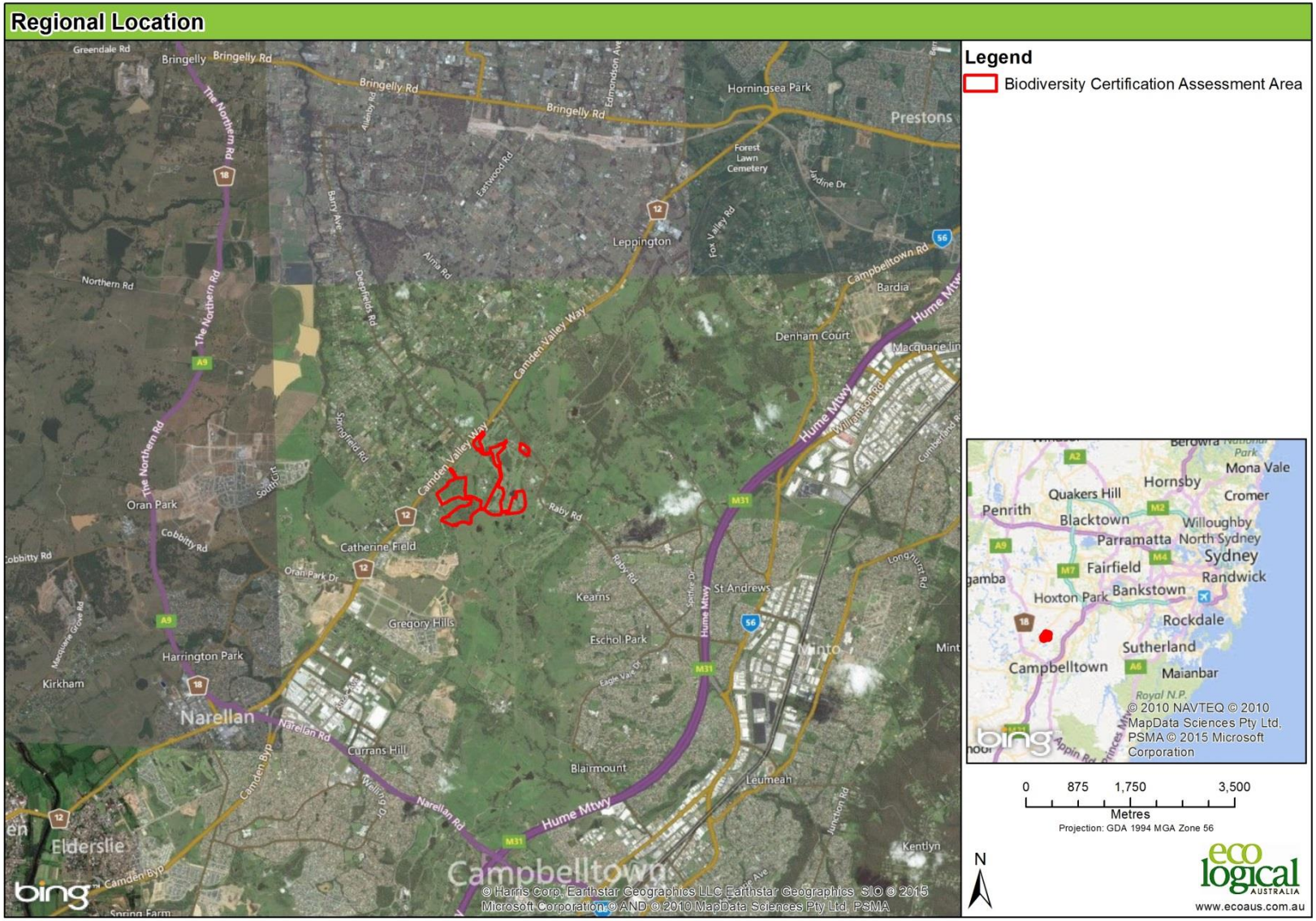

Figure 1: Regional location of the ECBGL residential estate

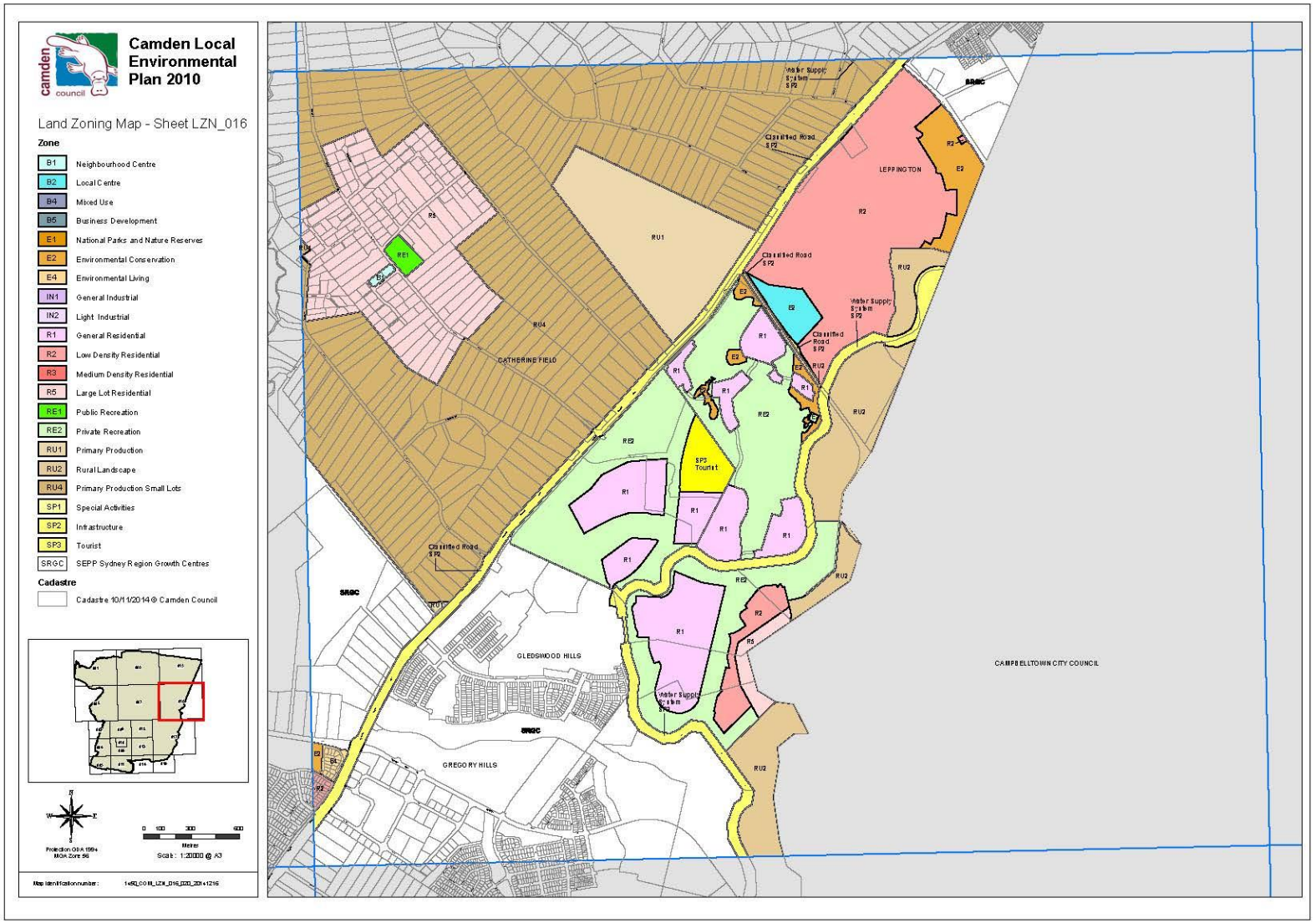

Figure 2: Current land zoning of El Caballo, Gledswood and Lakeside Residential Estate (Camden Local Environment Plan 2010)

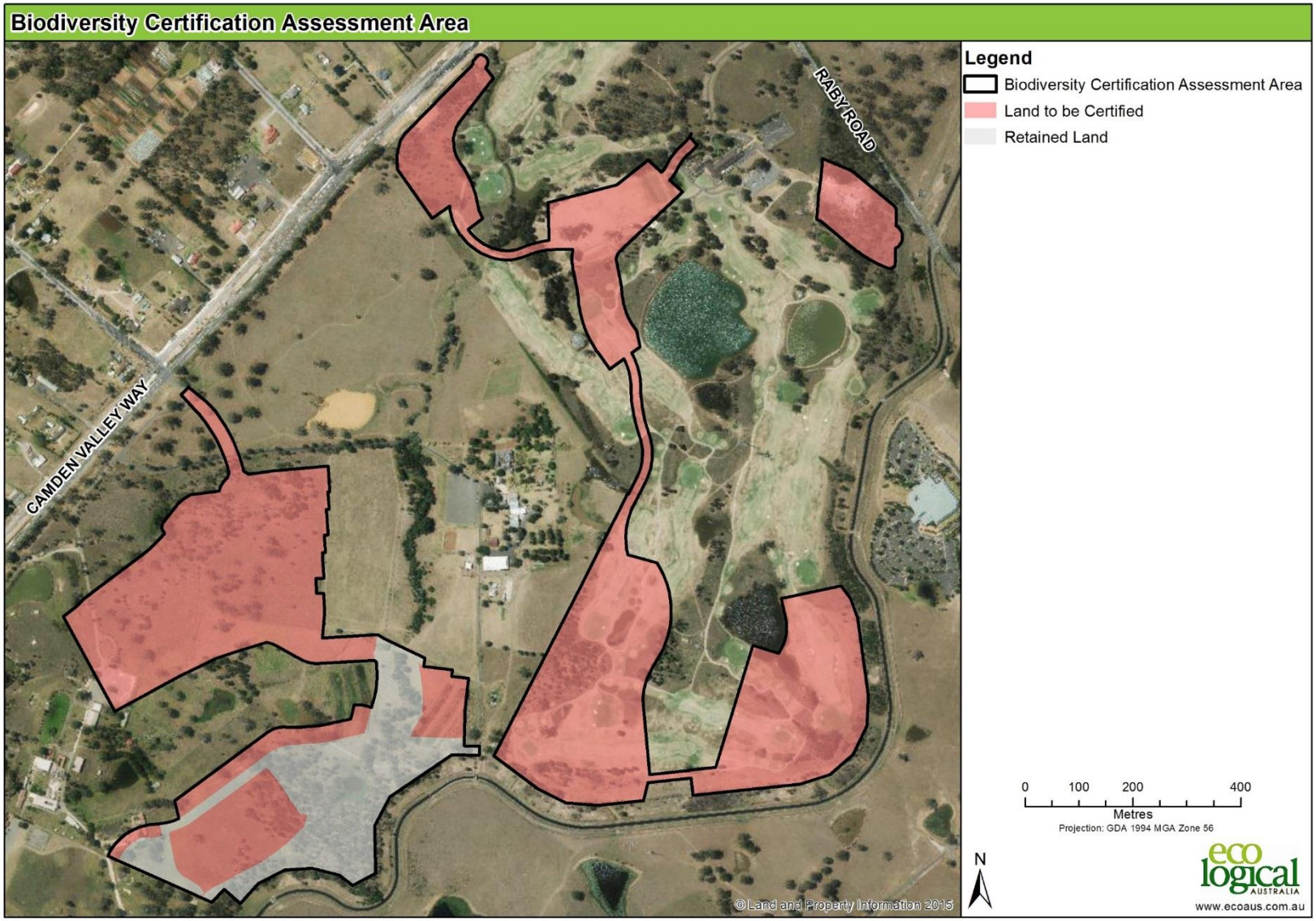

Figure 3: Biodiversity Certification Assessment Area

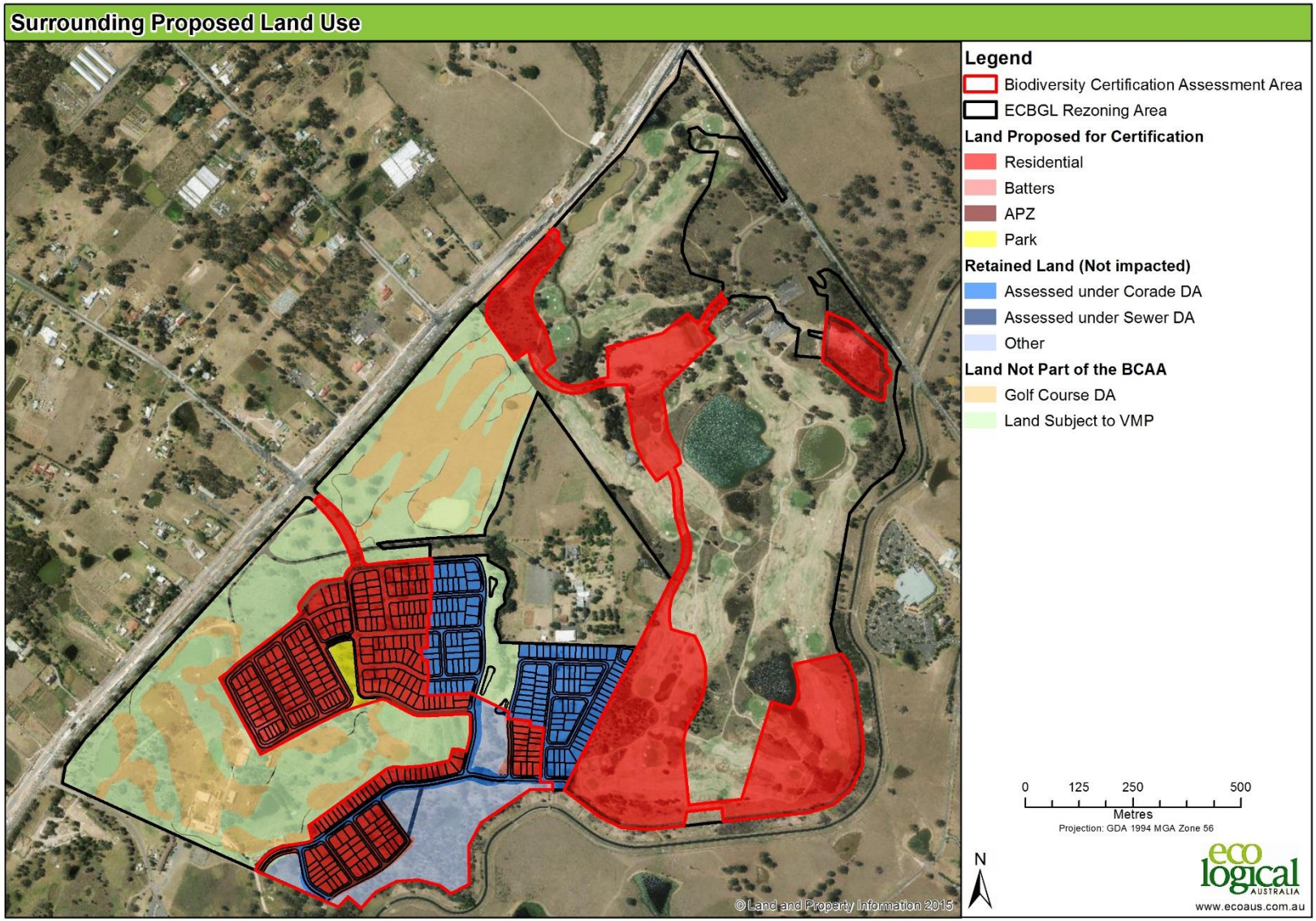

Figure 4: Relationship between BCAA and other Development Applications within the ECBGL Residential Estate

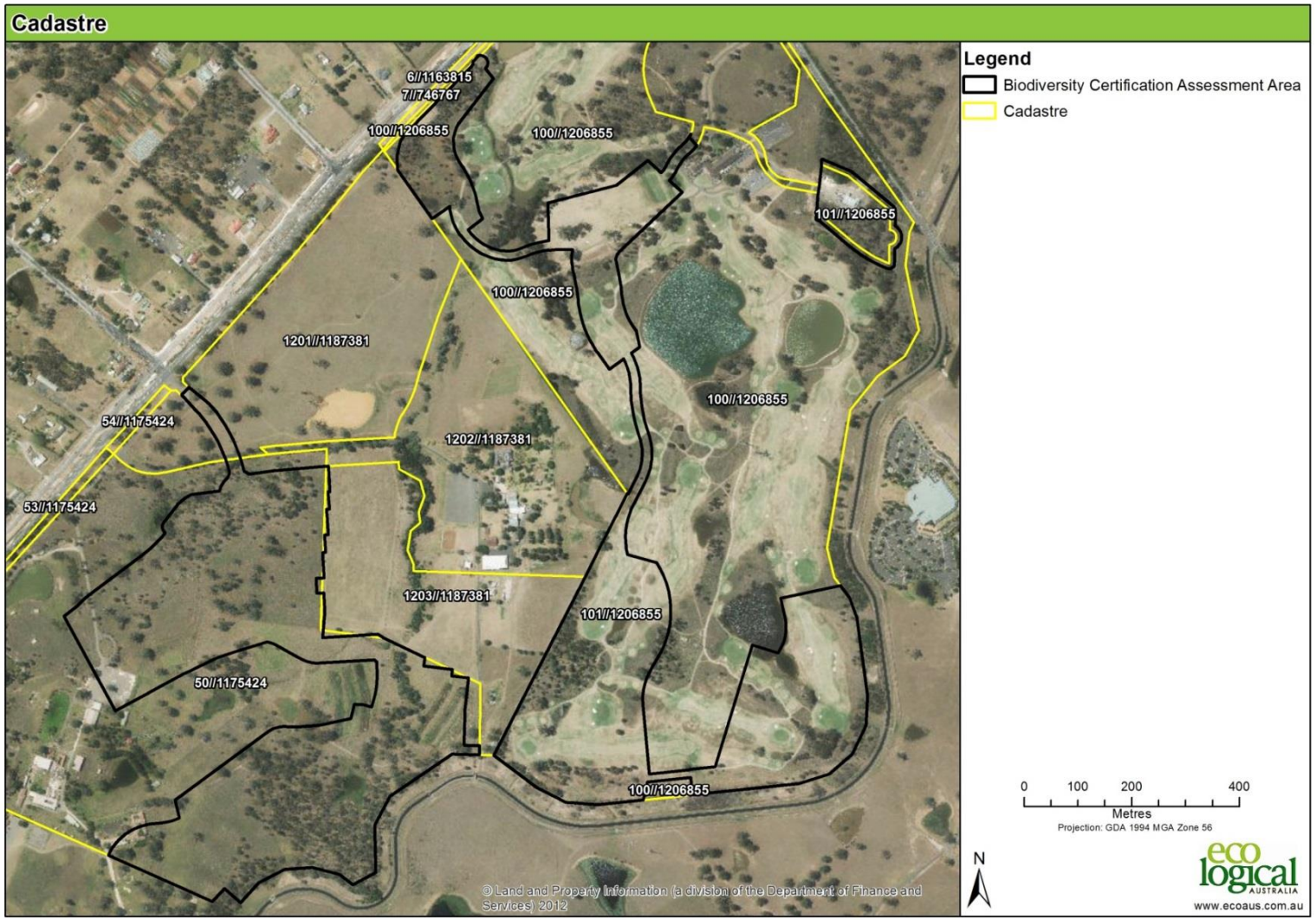

Figure 5: Lots within the BCAA

Note: The Corade DA includes a minor boundary adjustment along the proposed lot boundaries between Lot 1203 Dp 1187381 and Lot 50 Dp 1175424

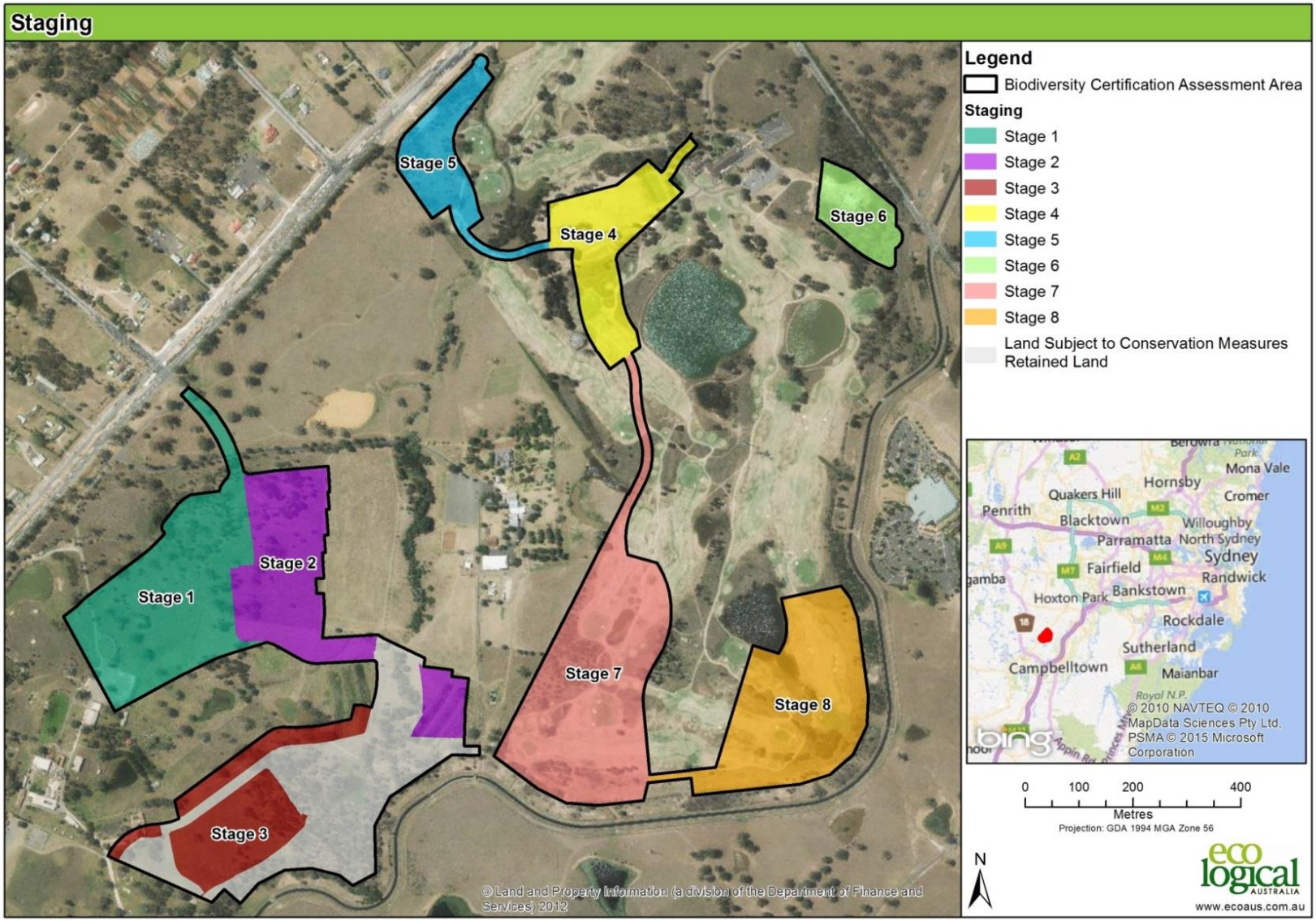

Figure 6: Indicative stages for the ECBGL residential estate

2 Biodiversity Values Assessment Report

An application for biodiversity certification must include an assessment of the biodiversity values of the BCAA undertaken in accordance with the BCAM. The results of the assessment of ecological values are to be included in a report titled 'Biodiversity Assessment Report' (BAR). This section addresses this requirement.

Information from a number of previous studies of the BCAA and broader study area was used to prepare the BAR. Additional information collected by ELA, gathered to fill gaps in survey effort and meet BCAM requirements, were also used. The following sections summarise all survey information and results of previous studies and ELA's survey with regard to the BCAA. Note that ELA's survey (Section 2.1.4) was undertaken following a review of previous effort (Section 2.1.1), determination of biometric vegetation type and number of biometric plots required (Section 2.1.2), and assessment of species requiring survey for determination of species credits (Section 2.1.3). ELA's survey was undertaken prior to a change in the BCAA boundary which meant that more biometric plots were undertaken than was used in the Biocertification Credit Assessment.

2.1 Methods

2.1.1 Literature and data review

The BCAA has been the subject of a number of previous studies mapping the vegetation types and biodiversity values of the area and surrounding lands including:

- *Central Hills Ecological Assessment* (Cumberland Ecology 2005)
- *Camden Lakeside and Gledswood Rezoning Ecological Assessment* (Cumberland Ecology 2007)
- *El Caballo Blanco and Gledswood Rezoning* (ELA 2007)
- *El Caballo Blanco and Gledswood Rezoning – Riparian Assessment Review* (ELA 2009)
- *Camden Lakeside Stage 1 Development – Residential Lots, Ecological Assessment* (ELA 2010)
- *El Caballo Blanco, Gledswood and Scenic Hills 1-3 Rezoning – Camden Natural Assets Policy and Vegetation Offset Requirements* (ELA 2011a)
- *El Caballo Blanco/Gledswood - Vegetation Management Strategy* (ELA 2011b)
- *Catherine Fields (Part) Precinct: Australasian Bittern Habitat* (ELA 2013a)
- *El Caballo Blanco, Gledswood and Lakeside – EPBC Act Impact Assessment* (ELA 2013b)
- *El Cabello Blanco, Gledswood and Lakeside Development Referral* (ELA 2013c)
- *Catherine Park Stage 1 Flora and Fauna Assessment* (ELA 2014)
- *Emerald Hills Biocertification Assessment Report and Strategy* (ELA 2015a)
- *Biodiversity Certification Expert Report for Emerald Hills Estate - Green and Golden Bell Frog (*Litoria aurea*)* (ELA 2015b)
- *Lot 1203 Gledswood Flora and Fauna Assessment* (ELA 2015c).

The study areas for each of these studies are shown in **Figure 7**.

These reports were reviewed for vegetation types and biodiversity values. Given the reports were used to determine the level of additional survey to be undertaken by ELA to meet BCAM requirements, results are summarised in subheadings below, as well as in **Table 4** through to **Table 9**, rather than in Section 0 Results. Survey effort is shown in Section 2.1.4 to show total survey effort (previous effort plus ELA's survey effort).

Relevant legislation and standard technical resources such as the *Threatened Biodiversity Survey and Assessment Guidelines for Development and Activitie*s (DEC 2004) underpinned the survey methodologies and provided background information for the ecological assessment.

In addition to the database searches of the *Atlas of NSW Wildlife* and *EPBC Protected Matters Search Tool* undertaken by previous studies, ELA used the biocertification credit calculator v 1.9 to determine ecosystem and species credit threatened species and validated these against the threatened species profile ecological data from the *BioNet Atlas of NSW Wildlife* (see Step 1 in Section 2.1.3).

Central Hills Ecological Assessment (Cumberland Ecology 2005)

A flora and fauna assessment of a 320 ha area, located within the 'Central Hills' area between Camden and Campbelltown and which includes the whole of the BCAA, was undertaken in September, October and November 2005 to assess the viability and conservation values of native vegetation and flora and fauna habitat (including aquatic habitat) on site, and determine the presence of threatened flora and fauna species.

Survey involved vegetation community surveys, targeted threatened flora and fauna species surveys, and riparian surveys. Vegetation and threatened flora species were surveyed through quadrats, and were supplemented by random meanders through small patches of vegetation scattered through the survey area. Terrestrial fauna were surveyed through active searches (*Meridolum corneovirens* (Cumberland Land Snail), reptiles, and frogs), and using Elliot traps, hair funnels, Anabat recordings, spotlight transects, call playback, bird census, and dip netting. Aquatic fauna and habitat were surveyed using an electrofisher unit and dip nets, and through macroinvertebrates sampling.

The survey recorded one CEEC, CPW, and one EEC, River-Flat Eucalypt Forest (RFEF) in the study area. Due to weed invasion and soil disturbance across the study area, the majority of native woodland was assessed as having either moderate or low recovery potential. Only one significant patch of CPW located in the north east corner of Camden Lakeside Golf Course was found to have high recovery potential (this is within the BCAA, in the north east). Some of the derived native grassland in the south of the study area (both within and outside the BCAA in the south) had moderate recovery potential due to the presence of native grasses and other herbaceous ground covers, with low weed invasion. However, most of the native grassland areas had low recovery potential. With regard to conservation significance, no core or support for core vegetation was assessed to occur within the study area.

Threatened species recorded were *Pimelea spicata*, Cumberland Land Snail, *Myotis macropus* (Southern Myotis), *Mormopterus norfolkensis* (East Coast Freetail Bat), *Miniopterus schreibersii* (Eastern Bentwing Bat), and *Scoteanax rueppellii* (Greater Broad-nosed Bat). A number of species were assessed as having the potential to occur in the study area: *Litoria aurea* (Green and Golden Bell Frog), *Lathamus discolor* (Swift Parrot), *Anthochaera phrygia* (Regent Honeyeater), *Melithreptus gularis* (Black-chinned Honeyeater), *Pyrrholaemus sagittatus* (Speckled Warbler), *Pteropus poliocephalus* (Grey-headed Flying-fox), *Chalinolobus dwyeri* (Large-eared Pied Bat), and *Falsistrellus tasmaniensis* (Eastern False Pipistrelle).

The threatened species information combined with mapping of resilience and conservation significance determined the overall level of ecological constraint in the study area to future development. The majority of the study area had relatively low ecological constraint due to past land clearances. Approximately 9.6 ha of high and 86.1 ha of moderate constraint native vegetation occurred on the study area (both high and moderate constraint native vegetation areas overlaps with the BCAA, in the west and north). The habitat areas with high ecological constraint included the patch of CPW with *Pimelea spicata* (mostly outside the BCAA), and the patch of CPW with Cumberland Land Snail (which occurs within the BCAA in the north east). Additionally, some vegetation along Riley's Creek (within the BCAA in the south west

and outside the BCAA), which supports habitat for threatened bat species, was assessed as high and moderate ecological constraint native vegetation.

Camden Lakeside and Gledswood Rezoning Ecological Assessment (Cumberland Ecology 2007)

An ecological assessment was prepared for the Camden Lakeside and Gledswood area (159 ha), which overlaps with the eastern half of the BCAA, to assess the viability and conservation values of native vegetation and flora and fauna habitat (including aquatic habitat) on site, and determine the presence of threatened flora and fauna species. The assessment appears to have been prepared specifically for the Camden Lakeside and Gledswood area, which forms a smaller component of the study area assessed by Cumberland Ecology (2005). As such, the same surveys undertaken and reported in Cumberland Ecology (2005) were reported in Cumberland Ecology (2007); no additional surveys were undertaken.

Given that no additional surveys were undertaken, results are as per those reported for Cumberland Ecology (2005).

El Caballo Blanco and Gledswood Rezoning (ELA 2007)

A flora and fauna assessment of a 206.9 ha area comprising the El Caballo Blanco, Medallist, and Gledswood areas (which overlaps with the western half of the BCAA), and land to the south of the BCAA, was undertaken between 31 October and 5 November 2007 over a total of 72 person hours to update ecological constraints in the study area, building on work undertaken by Cumberland Ecology (2005, 2007), and to support a rezoning proposal.

Survey involved vegetation community validation and condition mapping, aquatic habitat condition assessment, and targeted threatened flora and fauna species surveys. Little detail is provided for survey techniques and effort. However, it is stated that active searches were undertaken for *Pimelea spicata*, Cumberland Land Snail and Green and Golden Bell Frog, with frog chorus surveys also undertaken; Anabat recordings and harp traps were used; general habitat assessment was undertaken, and species were recorded opportunistically. The aquatic habitat condition survey included classification of streams combining hydrology, physical form, and streamside vegetation, and visual assessment of aquatic macrophytes, water quality and fish.

The survey recorded one CEEC, CPW, and one EEC, RFEF, in the study area. No threatened species were recorded, although East Coast Freetail Bat was identified as possibly occurring (calls recorded by Anabat could not be identified with certainty). A number of other threatened species were identified as having the potential to occur, with potential Green and Golden Bell Frog habitat identified and 18 hollow-bearing trees and an unspecified number of stags recorded, which could be used for roosting or breeding. Despite the presence of potential habitat for Green and Golden Bell Frog in the study area, this species was assessed as highly unlikely to occur on the basis of previous surveys by Cumberland Ecology (2005), which did not record the species, and the low number of records for this species in the Camden LGA. Streams in the study area ranged in condition from moderate/poor to moderate/good.

A total of 46 ha of mostly woodland areas was identified as having moderate ecological constraint, and 39.9 ha of 'core local' and 6.2 ha of 'support for core' was recorded. These areas overlapped with the western portion of the BCAA.

El Caballo Blanco and Gledswood (ECBG) Rezoning – Riparian Assessment Review (ELA 2009)

A letter was prepared in response to the Department of Water and Environment's comments on the exhibition of the Draft Camden LEP No 151 and Draft Camden DCP 2006 for El Caballo Blanco/Gledswood dated 23 March 2009. The letter clarified the methods used in stream mapping undertaken in 2007 (see ELA 2007), as they related to the watercourse categorisation and riparian

corridor mapping, given that the Department of Water and Environment was of the opinion that a number of streams should be categorised differently.

No survey was undertaken for this letter response.

ELA's response to the Department of Water and Environment's stream categorisations and whether streams should be retained or removed was provided. Recommendations were also made for a way forward.

Camden Lakeside Stage 1 Development – Residential Lots, Ecological Assessment (ELA 2010)

A flora and fauna assessment of a 6.21 ha area within the Camden Lakeside area, which lies directly adjacent but outside the BCAA to the north, was undertaken by two ecologists on 5 July 2010. The surveys were undertaken to support a number of development applications in the study area to subdivide land and construct residences and associated infrastructure.

Survey involved vegetation community validation, targeted threatened flora and fauna species surveys, and habitat assessments. Vegetation and threatened flora species were surveyed through an unspecified number of quadrats and random meanders throughout the study area. Fauna were surveyed through active searches (Cumberland Land Snail) and opportunistic observations.

The survey recorded one CEEC, CPW, in the study area, which existed as remnant and regrowth, and potentially derived native grassland. Remaining vegetation was comprised of plantings. An unspecified number of *Pimelea spicata* was recorded. Cumberland Land Snail was also recorded in three locations, which is directly adjacent to one of the northern portions of the BCAA. Four hollow-bearing trees were recorded within and directly adjacent to the study area, representing limited breeding and roosting habitat for hollow-dependant species. Potential Green and Golden Bell Frog habitat was recorded within the ephemeral drainage lines and man-made dam present in the study area.

El Caballo Blanco/Gledswood - Vegetation Management Strategy (ELA 2011b)

A Vegetation Management Strategy was prepared for a 206.9 ha area comprising the El Caballo Blanco, Medallist, and Gledswood areas (which overlaps with the western half of the BCAA), and land to the south of the BCAA, to accompany a Voluntary Planning Agreement as part of the rezoning process for the study area. It was required to provide clear guidance for the protection, restoration, and ongoing management of the environmental values of the study area. Detailed Vegetation Management Plans / works plans would be required to be prepared at subsequent stages of the project for parts of the study area, with these detailing plantings, costings, and on-ground works.

No survey was undertaken for this assessment. Information from the NSW Atlas, Cumberland Ecology (2005), and ELA (2007) was used to detail existing ecological values in the study area.

The study area was split into four management zones (riparian conservation, golf course, Gledswood heritage, and development) according to their expected future characteristics, and the objectives, strategies and performance indicators were outlined per zone. Responsibilities, monitoring requirements, performance criteria, and reporting and auditing requirements were outlined.

Catherine Fields (Part) Precinct: Australasian Bittern Habitat (ELA 2013a)

This report was prepared to form part of the planning agreement for Catherine Fields Precinct. The Catherine Fields study area is located approximately 1 km west of the BCAA. The report followed from a survey for *Botaurus poiciloptilus* (Australasian Bittern) at Catherine Fields which recorded the species on 3 November 2011 in South Creek.

No survey was undertaken for this report.

The report identified the habitat requirements of Australasian Bittern, suitable habitat to be protected and enhanced and created, and provided simple design guidelines for the protection of existing habitat and creation of new habitat in the riparian corridor.

El Caballo Blanco, Gledswood and Lakeside – EPBC Act Impact Assessment (ELA 2013b)

A flora and fauna assessment of a 169.58 ha area within the El Caballo Blanco, Gledswood, and Lakeside area, which overlaps with the whole of the BCAA area, was undertaken on the 29 and 30 May 2013 to investigate the current ecological features of the study area and potential constraints these would pose to potential approval under the EPBC Act.

Survey involved vegetation community validation and condition mapping, and targeted threatened flora and fauna species surveys for communities and species listed under the EPBC Act. Survey followed Commonwealth and NSW (OEH) guidelines for surveying threatened species (DEC 2004). Vegetation communities and threatened flora species, focussing on *Pimelea spicata*, were surveyed through quadrats and random meanders through the survey area in suitable habitat. Threatened fauna species, including Australasian Bittern and Large-eared Pied Bat, were surveyed through habitat assessments and identification of suitable potential habitat, and opportunistic observations.

The survey recorded the EPBC Act listed CEEC, CPW, in two conditions: Condition A and Condition C. *Pimelea spicata* was also recorded. Australasian Bittern and Green and Golden Bell Frog were not recorded and these species were considered unlikely to occur in the study area.

El Cabello Blanco, Gledswood and Lakeside Development EPBC Act Referral (ELA 2013c)

This document followed on from ELA (2013b) which identified the presence of EPBC Act-listed entities in a 164.3 ha area within the El Caballo Blanco, Gledswood, and Lakeside area (this overlaps with the whole of the BCAA area). It detailed impacts to EPBC Act-listed entities as a result of development of the study area, and outlined mitigation measures.

No additional survey to that outlined in ELA (2013b) was undertaken, with results from ELA (2013b) used in the assessment.

The report concluded that the proposed development would not lead to significant impacts on any EPBC Act-listed entities.

The DotE determined the activity to be a 'Controlled Action" under the EPBC Act and a separate assessment report is currently being prepared in parallel to the Biocertification application.

Catherine Park Stage 1 Flora and Fauna Assessment (ELA 2014)

A flora and fauna assessment of the Catherine Fields (Part) Precinct, which lies to the north-west and outside of the BCAA, was undertaken to investigate the current ecological features and assess Australasian Bittern habitat in the study area (Australasian Bittern was previously recorded in the study area). The study used information from other rezoning studies as well as surveyed for Australasian Bittern and its habitat on 29-31 October 2013.

Survey for Australasian Bittern and its habitat was undertaken at 37 spot locations across the study area, with intensive survey undertaken at eight locations. Surveys included daytime searches, reed searches, spotlighting, call census, call playback, and opportunistic observations.

The survey recorded Swamp Oak Floodplain Forest. Australasian Bittern was not recorded, although some foraging habitat was present. No breeding habitat was recorded. Two migratory species, *Ardea ibis* (Cattle Egret) and *Ardea intermedia* (Intermediate Egret), were opportunistically recorded.

The report concluded that urban development would not result in significant impacts to Australasian Bittern or Swamp Oak Floodplain Forest. Even so, a number of recommendations were made to minimise impacts and enhance habitat for Australasian Bittern.

Emerald Hills Biocertification Assessment Report and Strategy (ELA 2015a)

A biocertification assessment of a 145.65 ha area located on land directly adjacent to but outside the BCAA to the east, was undertaken to assess and appropriately offset the biodiversity impacts that would result from rezoning land to accommodate residential development.

Flora and fauna survey was undertaken on 15 and 16 August 2012, 21 February 2013, and three unspecified days in September 2013 over a total of 64.5 hours. It involved vegetation community surveys and targeted threatened flora and fauna species surveys. Vegetation and threatened flora species targeting *Pimelea spicata* were surveyed through quadrats and random meanders through the survey area. Cumberland Land Snail was surveyed through active searches. The threatened fauna species, Green and Golden Bell Frog, was surveyed through habitat assessment followed by active searches and spotlighting, and call playback.

The survey recorded two biometric vegetation communities: '*Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin*' and '*Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin*' which are equivalent to the CEEC, CPW, and the EEC, RFEF, respectively. CPW was recorded in four broad conditions. No threatened flora species were recorded; however, there was potential for *Pimelea spicata* to occur, with 21.71 ha of suitable habitat mapped. One threatened fauna species, Cumberland Land Snail was recorded at nine locations in the north-east of the study area. A minimal amount of potential habitat for Green and Golden Bell Frog (unspecified extent) was recorded in the study area. Due to the lack of recent records in the area and minimal habitat present, Green and Golden Bell Frog was considered unlikely to occur.

*Biodiversity Certification Expert Report for Emerald Hills Estate - Green and Golden Bell Frog (*Litoria aurea*) (ELA 2015b)*

This report was prepared to support the biocertification assessment of a 141.65 ha area located on land directly adjacent to but outside the BCAA to the east (see ELA 2015a). It provided information on the habitat requirements, movement and behaviour, and ecology and distribution of Green and Golden Bell Frog, and expanded on the assessment that the species was not likely to be present in the study area.

No additional survey to that outlined in ELA (2015a) was undertaken, and as such, survey effort and results are as per those reported for ELA (2015a).

The report concluded that Green and Golden Bell Frog was unlikely to be present in the study area due to the low number of historical records (four records dated 1894 to 1970) located approximately 10 km from the study area, and the minimal habitat present.

Lot 1203 Gledswood Flora and Fauna Assessment (ELA 2015c)

A flora and fauna assessment of a 13.8 ha area within the El Caballo Blanco and Gledswood area, which lies directly adjacent to but outside the BCAA (near the centre), was undertaken on the 1 October 2014 by one ecologist to validate vegetation community mapping and determine the presence of threatened flora and fauna species in the study area to inform an impact assessment.

Survey involved vegetation community validation, and targeted threatened flora and fauna species surveys for *Pimelea spicata* and Cumberland Land Snail. Details of targeted survey were not provided.

The survey recorded one CEEC, CPW (present as Shale Plains Woodland), and one EEC, RFEF in the study area. One threatened fauna species, *Glossopsitta pusilla* (Little Lorikeet) was recorded opportunistically flying over the study area.

The report concluded that development would not result in significant impacts to CPW, RFEF, Little Lorikeet or any other threatened flora and fauna species with the potential to occur.

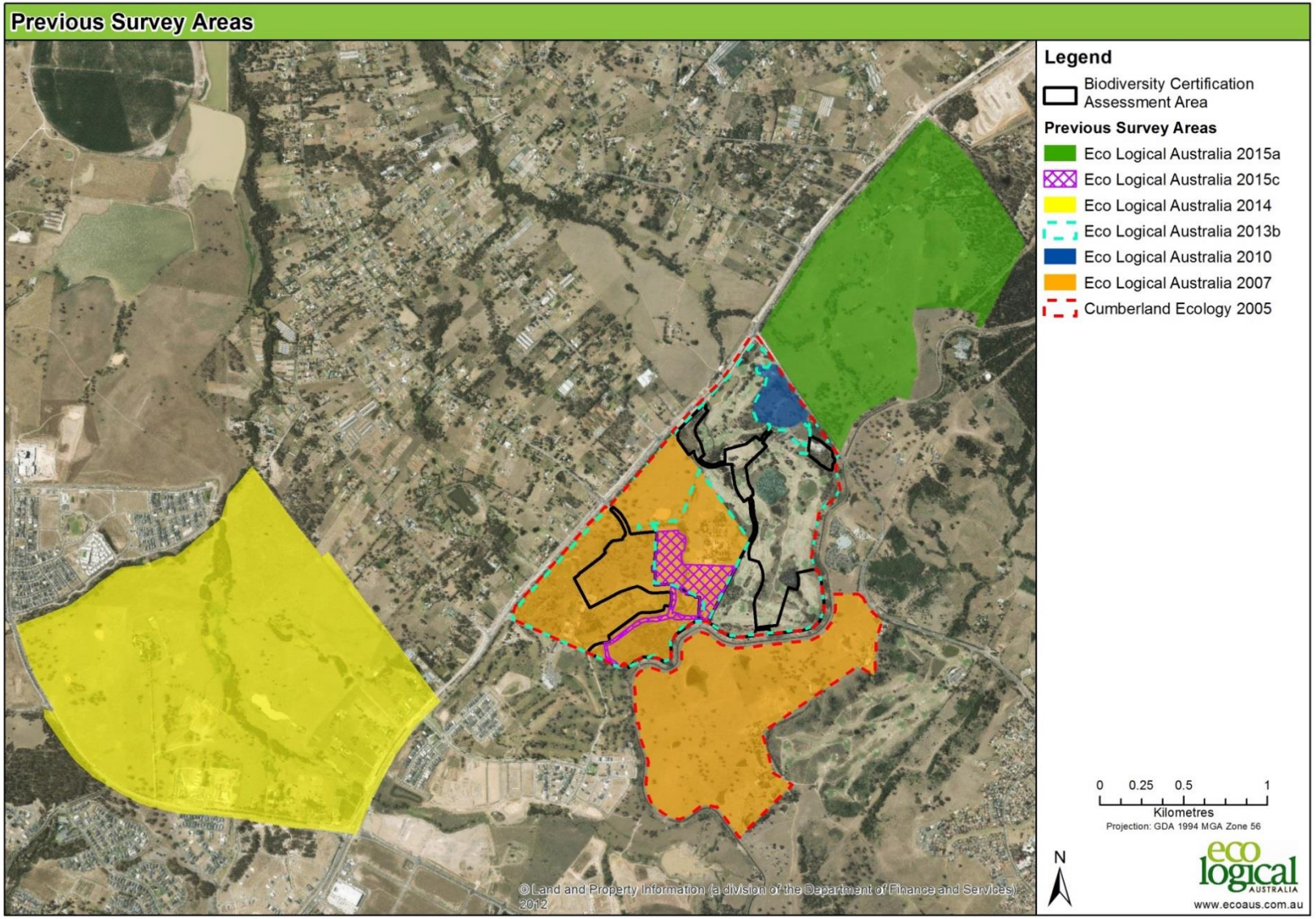

Figure 7: Study area boundaries of previous flora and fauna assessments within and adjacent to the BCAA

Table 4: Previous survey effort for vegetation and flora

Surveyors	Location	Effort	Results
Cumberland Ecology (2005)	320 ha area in the Central Hills area, which overlaps with the whole of the BCAA area.	- Four-day survey on 20 September, 28 October, and 1 and 3 November 2005. - Vegetation was surveyed through 29 quadrats (20 m x 20 m plots) and random meanders. - Targeted threatened flora species searches were undertaken for *Pimelea spicata* and *Thesium australe*. The location of transects was not specified; however, where *Pimelea spicata* was recorded, the number of individuals was counted in five 20 m x 2 m quadrats.	- Two vegetation communities were recorded: the CEEC, CPW, and the EEC, RFEF. CPW existed as intact remnants with a canopy, as well as derived native grassland. - One threatened flora species, *Pimelea spicata*, was recorded (outside the BCAA). Potential habitat in this area was estimated as approximately 2000 m^2. Between 150 and 700 individuals were estimated in this area. There was potential for the species to be present in other high recovery potential areas within the study area (including in the BCAA).
ELA (2007)	206.9 ha area comprising the El Caballo Blanco, Medallist, and Gledswood areas (which overlaps with the western half of the BCAA), and land to the south of the BCAA.	- Six-day survey period between 31 October and 5 November 2007, but only a total of 72 person hours used for survey. - It is unclear how vegetation and flora were surveyed but it is likely that random meanders were used. *Pimelea spicata* was targeted.	- Two vegetation communities were recorded: the CEEC, CPW, and the EEC, RFEF. CPW existed as intact remnants with a canopy, as well as derived native grassland. Intact areas were mapped as sub-units of CPW: Shale Hills Woodland and Shale Plains Woodland.
ELA (2010)	6.21 ha area within the Camden Lakeside area, which lies directly adjacent but outside the BCAA to the north.	- One-day survey on 5 July 2010 by two ecologists. - Vegetation mapping was undertaken using aerial photography and ground-truthing the *Vegetation of the Cumberland Plain* mapping (NPWS 2002). - A random meander of the whole study area was undertaken noting species that occurred in each area following Cropper (1993). *Pimelea spicata* was targeted during meanders.	- One vegetation community was recorded: the CEEC, CPW. CPW existed as intact remnants, and potentially as derived native grassland. - *Pimelea spicata* was recorded. The number of individuals present was not stated.

Surveyors	Location	Effort	Results
		- An unspecified number of floristic quadrats (20 m x 20 m) were conducted within vegetation community remnants identified from the vegetation mapping. - A traverse was undertaken in two areas of grassland to compile a list of species, estimate the cover abundance of each species, and search for *Pimelea spicata*.	
ELA (2013b)	169.58 ha area within the El Caballo Blanco, Gledswood, and Lakeside area, which overlaps with the whole of the BCAA area.	- Two-day survey on 29 and 30 May 2013 by three ecologists. - Vegetation was surveyed through four quadrats (20 m x 20 m plots nested in 20 m x 50 m plots) and random meanders. - Targeted searches were undertaken for *Pimelea spicata* via random meander. The locations of the meanders were not specified.	- The EPBC Act-listed CEEC, CPW, was recorded. CPW was recorded in two conditions (A and C). - *Pimelea spicata* was recorded. The number of individuals present was not stated.
ELA (2015a)	145.65 ha area directly adjacent to but outside the BCAA to the east.	- Six-day survey on 15 and 16 August 2012, 21 February 2013, and three other unspecified days (believed to be September 2013) over a total of 42.5 hours. - Vegetation was surveyed through nine quadrats (20 m x 20 m plots nested in 20 m x 50 m plots). - *Pimelea spicata* targeted through random meanders and focussed on disturbed areas that had not been exposed to intensive grazing within areas proposed to be developed.	- Two biometric vegetation communities were recorded: '*Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin*' and '*Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin*' which are equivalent to the CEEC, CPW, and the EEC, RFEF, respectively. CPW was recorded in four broad conditions. - 21 71 ha of suitable *Pimelea spicata* habitat was recorded, excluding the area of proposed conservation lands and open pasture. However, no individuals were recorded.
ELA (2015c)	13.8 ha area within the El Caballo Blanco and Gledswood area, which lies directly adjacent to	- One-day survey on 1 October 2014 over four hours. - Vegetation was surveyed through random meanders.	- Two vegetation communities were recorded: the CEEC, CPW (present as Shale Plains Woodland), and the EEC, RFEF.

Surveyors	Location	Effort	Results
	but outside the BCAA (near the centre)	- Targeted searches were undertaken for *Pimelea spicata* via random meander. The locations of the meanders were not specified.	

Table 5: Previous survey effort for Cumberland Land Snail

Surveyors	Location	Effort	Results
Cumberland Ecology (2005)	320 ha area in the Central Hills area, which overlaps with the whole of the BCAA area.	- Unspecified survey period in November 2005. - Active searches targeting Cumberland Land Snail within leaf litter at the base of trees, under logs and dumped rubbish, and near grass clumps in remnant patches of CPW in the study area (10 locations) over 15 person hours undertaken over two days.	- Two live Cumberland Land Snail were recorded, along with eight shells of the species, at one location.
ELA (2007)	206.9 ha area comprising the El Caballo Blanco, Medallist, and Gledswood areas (which overlaps with the western half of the BCAA), and land to the south of the BCAA.	- Six-day survey period between 31 October and 5 November 2007, but only a total of 72 person hours used for survey. - Cumberland Land Snail was targeted but it is unclear how the species was surveyed as the effort and survey locations were not specified. - General fauna habitat assessment was used to determine threatened species that may be present. - Incidental observations of fauna on the site during the survey period.	- No Cumberland Land Snail was recorded.
ELA (2010)	6.21 ha area within the Camden Lakeside area, which lies directly adjacent but outside the BCAA to the north.	- One-day survey on 5 July 2010 by two ecologists. - General fauna habitat assessments were undertaken with a particular focus on the potential presence of habitat for threatened fauna species. The presence of important habitat features for fauna such as leaf litter, hollow-bearing trees, potential nesting or roosting sites, rocky outcrops, waterbodies and winter-flowering eucalypts were recorded. - Active searches for Cumberland Land Snail were conducted in areas of suitable habitat, at the base of trees characteristic of CPW where there was abundant leaf litter, over approximately 1.5 person hours. - Incidental observations of fauna on the site during the survey period.	- Three Cumberland Land Snail was recorded.

Surveyors	Location	Effort	Results
ELA (2013b)	169.58 ha area within the El Caballo Blanco, Gledswood, and Lakeside area, which overlaps with the whole of the BCAA area.	- Two-day survey on 29 and 30 May 2013 by three ecologists. - General fauna habitat assessment was used to determine threatened species that may be present. - Incidental observations of fauna on the site during the survey period.	- No Cumberland Land Snail was recorded.
ELA (2015a)	145.65 ha area directly adjacent to but outside the BCAA to the east.	- Three-day survey on 15 and 16 August 2012, and 21 February 2013 (1500 Hrs and 2130 Hrs) following significant summer rain. - General fauna habitat assessment was used to determine threatened species that may be present. - Incidental observations of fauna on the site during the survey period.	- Cumberland Land Snail was recorded in the east of the study area. - Cumberland Land Snail habitat was mapped.
ELA (2015c)	13.8 ha area within the El Caballo Blanco and Gledswood area, which lies directly adjacent to but outside the BCAA (near the centre)	- One-day survey on 1 October 2014 over four hours. - Targeted searches were undertaken for Cumberland Land Snail. The locations of searches were not specified. - General fauna habitat assessments were undertaken. - Incidental observations of fauna on the site during the survey period.	- No Cumberland Land Snail was recorded.

Table 6: Previous survey effort for frogs

Surveyors	Location	Effort	Results
Cumberland Ecology (2005)	320 ha area in the Central Hills area, which overlaps with the whole of the BCAA area.	- Unspecified survey period in November 2005. - Habitat assessment of an unspecified number of ponds during a single afternoon followed by active searches and tadpole capture using dip nets on the same afternoon at what appears to be two ponds. - Active searches and spotlighting during the night at an unspecified number of ponds/unspecified locations. Number of nights unspecified. - Call playback for Green and Golden Bell Frog: At each pond in the study area, at least once, with each survey consisting of eight minutes call playback followed by five minutes listening. The number of ponds not specified. - Incidental observations for frogs on the site during the survey period.	- No threatened frog species were recorded.
ELA (2007)	206.9 ha area comprising the El Caballo Blanco, Medallist, and Gledswood areas (which overlaps with the western half of the BCAA), and land to the south of the BCAA.	- Six-day survey period between 31 October and 5 November 2007, but only a total of 72 person hours used for survey. - Two-hour frog chorus census at key dams of interest. The number of dams surveyed was unspecified. - General fauna habitat assessment was used to determine threatened species that may be present. - Incidental observations for frogs on the site during the survey period.	- No threatened frog species were recorded. - Potential Green and Golden Bell Frog habitat was recorded, although the species was assessed as highly unlikely to occur in the study area.
ELA (2010)	6.21 ha area within the Camden Lakeside area, which lies directly adjacent but outside the BCAA to the north.	- One-day survey on 5 July 2010 by two ecologists. - General fauna habitat assessments were undertaken with a particular focus on the potential presence of habitat for threatened fauna species. The presence of important habitat features for fauna such as hollow-bearing trees, potential nesting or roosting sites, rocky outcrops, waterbodies and winter-flowering eucalypts were recorded. - Incidental observations for frogs on the site during the survey period.	- No threatened frog species were recorded. - Potential Green and Golden Bell Frog habitat was recorded.

Surveyors	Location	Effort	Results
ELA (2013b)	169.58 ha area within the El Caballo Blanco, Gledswood, and Lakeside area, which overlaps with the whole of the BCAA area.	- Two-day survey on 29 and 30 May 2013 by three ecologists - General fauna habitat assessments were undertaken with a particular focus on the potential presence of habitat for Australasian Bittern and Green and Golden Bell Frog. - Incidental observations for frogs on the site during the survey period.	- No threatened frog species were recorded. - It was considered unlikely that Green and Golden Bell Frog would be present in the study area.
ELA (2014)	Catherine Fields (Part) Precinct, which lies to the north-west and outside of the BCAA.	- Three-day survey on 29-31 October 2013 (targeting Australasian Bittern). - General fauna habitat assessments for Green and Golden Bell Frog were undertaken in conjunction with the targeted survey for Australasian Bittern. - Incidental observations for frogs on the site during the survey period.	- No threatened frog species were recorded.
ELA (2015a)	145.65 ha area directly adjacent to but outside the BCAA to the east.	- Three-day survey on 15 and 16 August 2012, and 21 February 2013 (1500 Hrs and 2130 Hrs) following significant summer rain. - Habitat assessment of ponds. - Active searches, including using dip netting for tadpoles and turning of ground cover and shelter objects, and spotlighting for Green and Golden Bell Frog during the day and night at all artificial wetlands in the study area. - Call playback for Green and Golden Bell Frog during the day night at artificial wetlands where emergent vegetation growth was substantial and had potential for concealing individuals for 15 minutes per wetland.	- No threatened frog species were recorded. - A minimal amount of potential habitat for Green and Golden Bell Frog was recorded in the study area. Due to the lack of recent records in the area and minimal habitat present, the species was considered unlikely to occur.
ELA (2015c)	13.8 ha area within the El Caballo Blanco and Gledswood area, which lies directly adjacent to but outside the BCAA (near the centre)	- One-day survey on 1 October 2014 over four hours. - General fauna habitat assessment was used to determine threatened species that may be present, including Green and Golden Bell Frog. - Incidental observations for frogs on the site during the survey period.	- No threatened frog species were recorded.

Table 7: Previous survey effort for reptiles and birds

Surveyors	Location	Effort	Results
Cumberland Ecology (2005)	320 ha area in the Central Hills area, which overlaps with the whole of the BCAA area.	- Unspecified survey period in November 2005. - Active searches in potential habitats for reptiles throughout woodland patches in the study area over an entire day. - Call playback for threatened owls (Barking, Powerful and Masked Owls): effort unclear. The number of locations sampled was reported variously as one or three locations in the report. Survey was undertaken over three separate nights. - Bird surveys: eight hours of survey in total undertaken in the early hours of the day over two days. The number of survey locations was unclear. - Spotlighting of larger remnants and along riparian areas in the study area for reptiles and birds: approximately 3 km in total over three separate nights (1 h per night). - General fauna habitat assessment was used to determine threatened species that may be present. - Incidental observations for reptiles on the site during the survey period.	- No threatened reptile or bird species were recorded.
ELA (2007)	206.9 ha area comprising the El Caballo Blanco, Medallist, and Gledswood areas (which overlaps with the western half of the BCAA), and land to the south of the BCAA.	- Six-day survey period between 31 October and 5 November 2007, but only a total of 72 person hours used for survey. - General fauna habitat assessment was used to determine threatened species that may be present. - Incidental observations of fauna on the site during the survey period.	- No threatened reptile or bird species were recorded. - 18 hollow-bearing trees and an unspecified number of stags were recorded.
ELA (2010)	6.21 ha area within the Camden Lakeside area, which lies directly adjacent but outside the BCAA to the north.	- One-day survey on 5 July 2010 by two ecologists. - General fauna habitat assessments were undertaken with a particular focus on the potential presence of habitat for threatened fauna species. The presence of important habitat features for fauna such as hollow-bearing trees, potential nesting or roosting sites, rocky outcrops, waterbodies and winter-flowering eucalypts were recorded.	- No threatened reptile or bird species were recorded. - Four hollow-bearing trees within and directly adjacent to the study area were recorded.

Surveyors	Location	Effort	Results
		- Incidental observations of fauna on the site during the survey period.	
ELA (2013b)	169.58 ha area within the El Caballo Blanco, Gledswood, and Lakeside area, which overlaps with the whole of the BCAA area.	- Two-day survey on 29 and 30 May 2013 by three ecologists. - General fauna habitat assessments were undertaken with a particular focus on the potential presence of habitat for Australasian Bittern and Green and Golden Bell Frog. - Incidental observations of fauna on the site during the survey period.	- No threatened reptile or bird species were recorded. It was considered unlikely that Australasian Bittern would be present in the study area.
ELA (2014)	Catherine Fields (Part) Precinct, which lies to the north-west and outside of the BCAA.	- Three-day survey on 29-31 October 2013 targeting Australasian Bittern. - Daylight searches to map suitable habitats and refine target areas for dawn/dusk targeted surveys. 37 spot locations surveyed. - Active daytime searches at five locations through dense reed habitat to either flush out birds or located nests. - Visual observations before sunset or after sunrise to detect foraging birds at suitable locations (number of locations not specified). - Call census for a minimum of one hour at the ten suitable locations, with three of these locations visited twice. - Call playback at six suitable locations for no more than five minutes play time, followed by 30 minutes listening time. - Spotlighting at 19 locations. - Opportunistic observations while travelling between survey locations.	- No threatened reptile or bird species were recorded. - Two migratory species were recorded: Cattle Egret and Intermediate Egret. - Foraging habitat for Australasian Bittern was recorded. No breeding habitat was recorded.
ELA (2015a)	145.65 ha area directly adjacent to but outside the BCAA to the east.	- Three-day survey on 15 and 16 August 2012, and 21 February 2013 (1500 Hrs and 2130 Hrs) following significant summer rain. - General fauna habitat assessment was used to determine threatened species that may be present. - Incidental observations of fauna on the site during the survey period.	- No threatened reptile or bird species were recorded.

Surveyors	Location	Effort	Results
ELA (2015c)	13.8 ha area within the El Caballo Blanco and Gledswood area, which lies directly adjacent to but outside the BCAA (near the centre)	- One-day survey on 1 October 2014 over four hours. - General fauna habitat assessments were undertaken. - Incidental observations of fauna on the site during the survey period.	- No threatened reptile species were recorded. - One threatened bird species was recorded: Little Lorikeet.

Table 8: Previous survey effort for mammals

Surveyors	Location	Effort	Results
Cumberland Ecology (2005)	320 ha area in the Central Hills area, which overlaps with the whole of the BCAA area.	- Unspecified survey period in November 2005. - Elliot A ground traps: the number of trap nights was not specified. Although it was specified that trapping was undertaken for four consecutive nights at five sites, the number of traps per site was not provided. - Elliot B arboreal traps: the number of trap nights was not specified. Although it was specified that trapping was undertaken for four consecutive nights at five sites, the number of traps per site was not provided. - Hair funnels: the number of trap nights was not specified. Although it was specified that trapping was undertaken for ten consecutive nights at five sites, the number of traps per site was not provided. - Spotlighting of larger remnants and along riparian areas in the study area: approximately 3 km in total over three separate nights (1 h per night). - Anabat recordings: effort unclear. The number of locations sampled was reported variously as one or three locations in the report. Survey was undertaken over three separate nights, with a single unit set to record from dusk to a few hours after dawn. Calls were also recorded while moving (while undertaking frog surveys).	- Four threatened bat species were recorded: Southern Myotis, East Coast Freetail-Bat, Eastern Bentwing Bat, and Greater Broad-nosed Bat.

Surveyors	Location	Effort	Results
ELA (2007)	206.9 ha area comprising the El Caballo Blanco, Medallist, and Gledswood areas (which overlaps with the western half of the BCAA), and land to the south of the BCAA.	- Six-day survey period between 31 October and 5 November 2007, but only a total of 72 person hours used for survey. - Anabat recordings: effort unclear. The number of locations sampled and number of nights surveyed were not specified. - Harp trapping: effort unclear. The number of locations sampled and number of nights surveyed were not specified. - General fauna habitat assessment was used to determine threatened species that may be present. It is likely that surveys of hollow-bearing trees were undertaken given locations were provided in the report. Total effort unspecified. - Incidental observations of fauna on the site during the survey period.	- One threatened bat species was potentially recorded: East Coast Freetail-Bat (calls could not be identified with certainty). - 18 hollow-bearing trees and an unspecified number of stags were recorded.
ELA (2010)	6.21 ha area within the Camden Lakeside area, which lies directly adjacent but outside the BCAA to the north.	- One-day survey on 5 July 2010 by two ecologists. - General fauna habitat assessments were undertaken with a particular focus on the potential presence of habitat for threatened fauna species. The presence of important habitat features for fauna such as hollow-bearing trees, potential nesting or roosting sites, rocky outcrops, waterbodies and winter-flowering eucalypts were recorded. - Incidental observations of fauna on the site during the survey period.	- No threatened mammal species were recorded. - Four hollow-bearing trees within and directly adjacent to the study area were recorded.
ELA (2013b)	169.58 ha area within the El Caballo Blanco, Gledswood, and Lakeside area, which overlaps with the whole of the BCAA area.	- Two-day survey on 29 and 30 May 2013 by three ecologists - General fauna habitat assessments were undertaken. - Incidental observations of fauna on the site during the survey period.	- No threatened mammal species were recorded.
ELA (2015c)	13.8 ha area within the El Caballo Blanco and Gledswood area, which lies directly adjacent to but outside the BCAA (near the centre)	- One-day survey on 1 October 2014 over four hours. - General fauna habitat assessments were undertaken. - Incidental observations of fauna on the site during the survey period.	- No threatened mammal species were recorded.

Table 9: Previous survey effort for aquatic fauna

Surveyors	Location	Effort	Results
Cumberland Ecology (2005)	320 ha area in the Central Hills area, which overlaps with the whole of the BCAA area.	- Unspecified survey period in October 2005. - Fish were sampled at 14 locations in the study area using an Electrofisher unit and dip net. - Macroinvertebrates were sampled at an unspecified number of locations in the study area for five minutes per location using dip nets focussing amongst water plants, sediment, rocks and logs.	- No threatened aquatic species were recorded. - Stream habitats were highly degraded.
ELA (2007)	206.9 ha area comprising the El Caballo Blanco, Medallist, and Gledswood areas (which overlaps with the western half of the BCAA), and land to the south of the BCAA.	- Six-day survey period between 31 October and 5 November 2007, but only a total of 72 person hours used for survey. - Classification of streams combining hydrology, physical form, and streamside vegetation. - Visual assessment of aquatic macrophytes, water quality and fish.	- No threatened aquatic species were recorded. - Streams in the study area ranged in condition from moderate/poor to moderate/good.

2.1.2 BioMetric vegetation type, condition and threatened status

As indicated in Section 2.1.1, Cumberland Ecology (2005) and ELA (2007, 2010, 2013b, 2015a and c) identified between one and three vegetation communities within and adjacent to the BCAA. Of these, three vegetation communities were initially mapped by ELA within the BCAA. The National Parks and Wildlife Service (NPWS 2002) also mapped three vegetation communities in the BCAA.

Through a desktop comparison of vegetation communities with BVTs for vegetation communities recorded by past surveys and NPWS (2002) in the BCAA, the best fit BVTs present in the BCAA was determined (**Table 10**). The results of the analysis identified three BVTs in the BCAA. These BVTs correspond to threatened ecological communities under the TSC and/or EPBC Acts (**Table 10**). **Figure 8** shows the indicative BVTs in the BCAA based on this assessment and displays mapping ELA prepared for the original BCAM assessment.

Table 10: Vegetation communities and equivalent BVTs in the BCAA and relationship to threatened ecological communities

Vegetation community (NPWS 2002, Cumberland Ecology 2005, ELA 2007 and/or 2013b)	BioMetric equivalent (DECC 2008)	TSC / EPBC Acts
Alluvial Woodland	'*Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*' (HN 526)	RFEF (EEC) (TSC Act only)
Shale Hills Woodland	'*Grey Box – Forest Red Gum grassy woodlands on shale of the Southern Cumberland Plain, Sydney Basin Bioregion*' (HN 529)	CPW / CPSWSGTF* (CEEC) (TSC and EPBC Acts)
Shale Plains Woodland	'*Grey Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' (HN 528)	CPW / CPSWSGTF* (CEEC) (TSC and EPBC Acts)
Cumberland Plain Woodland	'*Grey Box – Forest Red Gum grassy woodlands on shale of the Southern Cumberland Plain, Sydney Basin Bioregion*' (HN 529) and '*Grey Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' (HN528)	CPW / CPSWSGTF* (CEEC) (TSC and EPBC Acts)

* CPSWSGTF = Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

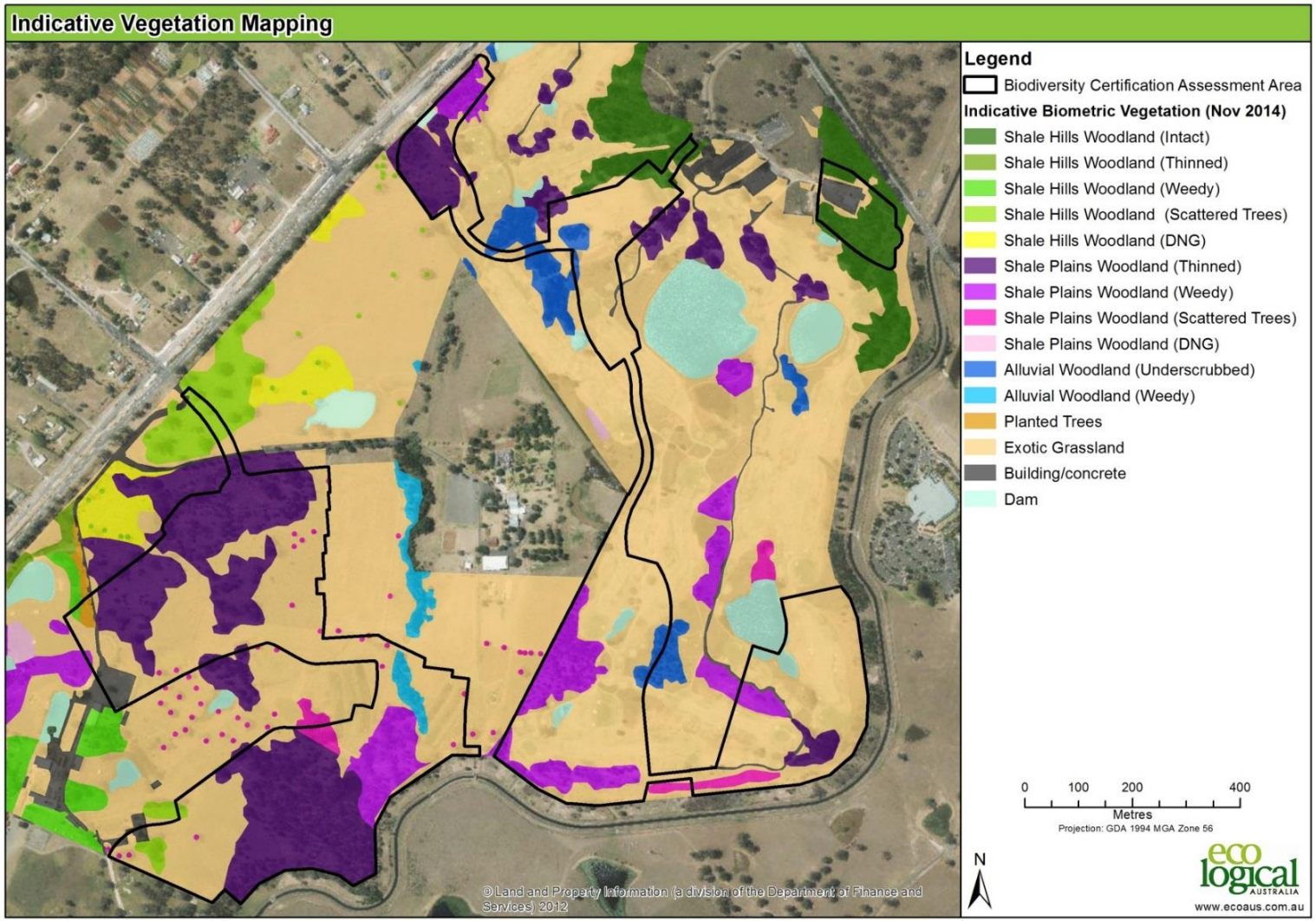

Figure 8: Initial indicative Biometric vegetation types and zones in the BCAA as determined by review of existing studies including NPWS 2002

Note: Following a quantitative analysis of the plot data, and consultation with OEH, it was determined that all vegetation within the BCAA was Shale Plains Woodland

2.1.3 Determination of species credit species requiring survey

'*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. All threatened flora and approximately half of all threatened fauna species are classified as species credits by the BCAM. Furthermore, some species credit species are also 'red flag species' which the BCAM defines as "*a species that cannot withstand further loss in the CMA because it is extremely rare/critically endangered, restricted or its ecology is poorly known*".

The BCAM requires targeted survey for threatened flora and fauna considered to be '*species credit'* species, on the land that will be impacted by development. Where a survey or expert report confirms that a species credit species is present or likely to use potential habitat on land proposed for biodiversity certification then a survey must also be undertaken or expert report prepared for that species on land to be used as an offset confirming its presence or likely presence. The biocertification credit calculator will use the survey results to calculate the number of credits required to offset the loss of the threatened species on land to be certified and the number of credits generated on land subject to conservation measures to determine whether the 'improve or maintain' test is satisfied provided a Red Flag species is not impacted.

Species that require species credits for the land proposed for biodiversity certification or are being used to generate species credits for a proposed conservation measure were identified and assessed in accordance with the seven steps outlined in Section 4.3 of the BCAM. The results of the candidate species identification and assessment process are presented in **Appendix B.**

Step 1. – Identify candidate species for initial assessment

A list of candidate species was filtered into the BCAA using the biocertification credit calculator version 1.9 and validated against the threatened species profile ecological data from the BioNet Atlas of NSW Wildlife. This list is presented in **Appendix B**.

Step 2. – Review list to include additional species

The list of candidate species was reviewed to include additional species for assessment. This was undertaken using the results of Cumberland Ecology (2005), ELA (2007, 2010, 2013b, 2014, and 2015a and c), and database searches undertaken by ELA which included:

- A search of the Atlas of NSW Wildlife database (OEH 2015b) undertaken to identify records of threatened flora and fauna species located within 10 km radius of the BCAA
- A search of the EPBC Act protected matters search tool (Department of Environment (DoE) 2015) to generate a report to assist to determine whether matters of national environmental significance (NES) were located within 10 km radius of the BCAA.

Step 3. – Identify candidate species for further assessment

The revised list of candidate species was reviewed to identify only those species that required further assessment in the BCAA. The species that were removed and a justification supporting the removal of these species from the candidate list are provided in **Appendix B**.

The following species are those identified as candidate species requiring further assessment:

- *Acacia pubescens* (Downy Wattle)
- *Dillwynia tenuifolia*
- *Grevillea juniperina* subsp. *juniperina* (Juniper-leaf Grevillea)
- *Pimelea spicata*

- *Pterostylis saxicola* (Sydney Plains Greenhood)
- Cumberland Plain Land Snail
- Green and Golden Bell Frog
- Southern Myotis

Note that Australasian Bittern was not considered to require further assessment. While Australasian Bittern has been recorded in the Catherine Fields Precinct approximately 1 km west of the BCAA, the species requires shallow water, less than 30 cm deep with medium to low density reeds, grasses or shrubs for foraging, and deeper water with medium to high density reeds, rushes or sedges for nesting, which is not present in the land proposed for certification within the BCAA.

Similarly, species such as Koala, Regent Honeyeater, Eastern Bentwing-bat and Grey-headed Flying Fox were not considered to require further assessment. There are few records for Koala or Regent Honeyeater near the BCAA, and there is no breeding habitat in the proposed impact areas for Grey-headed Flying-fox (roost camp) or Eastern Bentwing-bat (caves).

Steps 4 and 5. – Identify potential habitat for species requiring further assessment and determine whether species is present

Potential habitat (CPW) is present for *Acacia pubescens*, *Dillwynia tenuifolia*, *Grevillea juniperina* subsp. *juniperina*, and *Pterostylis saxicola* in the BCAA. Further*, Pimelea spicata* and Cumberland Plain Land Snail have been recorded within or directly adjacent to the BCAA in CPW. Thus, these species were identified as requiring targeted survey to determine abundance (flora) and habitat polygons (fauna) (see Section 2.1.4). Surveys for these species were undertaken as described in Section 2.1.4 and shown in **Figures 9**, **10** and **11**. Surveys for *Pimelea spicata* were undertaken when the species was flowering at the previously recorded site. Surveys for the other species were all undertaken within the known flowering period for each species as indicated in **Table 12**.

In accordance with advice provided by the OEH, all hollow bearing tress (HBTs) within 200m of permanent water greater than 3m² was considered potential habitat for Southern Myotis, and in agreement with the OEH, these HBTs were surveyed for the presence of breeding females during the breeding season by observing for the presence of bats leaving potential roost sites at dusk on two separate occasions separated by one week, recording all bats with anabats and physically inspecting hollows for the presence of bats by climbing trees (or being aided by a mobile cherry picker) (**Appendix C**).

OEH has also advised of recent (December 2013 and April 2015) Green and Golden Bell Frog records approximately 5.5km south-east of the BCAA at Biriwiri Creek. Accordingly all potential habitat for the Green and Golden Bell Frog in and adjacent to land proposed for certification was assessed for Green and Golden Bell Frog using visual inspections, spotlighting and call playback, in addition to previous surveys undertaken by ELA (2007, 2013b, and 2015a) (**Appendix C**).

The Cumberland Land Snail was the only species recorded within the BCAA. Although Myotis macropus was recorded foraging in the BCAA, no evidence of breeding females using roost trees within the land to be certified was recorded (**Appendix C**).

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

There were no species confirmed as likely to have habitat within the BCAA that trigger a red flag.

Step 7 finalise the boundary of the species polygon and area of impact

Because previous surveys confirmed the presence of Cumberland Plain Land Snail, a habitat polygon for this species was mapped. The habitat polygon was based on the confirmed presence of species and

ELA's opinion of the habitat areas combined with the BioMetric vegetation types recognised by the Threatened Species Profile Database (TSPD) (BioNet) as being habitat for the species.

A species polygon (as requested by OEH) is also provided for Pimelea spicata for the known population that occurs outside of the BCAA and potential habitat within the BCAA that was the subject of targeted survey.

No habitat polygons were mapped for other candidate threatened flora or fauna species as they were not recorded in the BCAA. These species were determined not to be present in Steps 4 and 5 (see also Section 2.2.2).

2.1.4 Field assessment

Field assessment was designed to meet BCAM requirements for mapping and surveying BVTs and to fill gaps in survey effort for species credit species potentially occurring in the BCAA. Previous survey effort by Cumberland Ecology (2005) and ELA (2007, 2010, 2013b, 2014, and 2015a and c) were outlined in **Table 4** to **Table 9** and is shown in **Figure 10**.

Note that fieldwork commenced at a time when a larger BCAA was being considered. The larger area included land to the west and land near the centre of the current BCAA, encompassing Riley's Creek. As such, field assessment and survey included areas that are now outside of, and was larger than, the current BCAA.

In relation to BVTs and threatened flora species, ELA senior botanist and accredited biobank assessor, Meredith Henderson, used the desktop assessment (see Section 2.1.2) to target on-ground validation of the biometric vegetation types and threatened flora species within the original, larger BCAA. This led to a revision of the BVT boundaries and a number of '*vegetation zones*' on 17 November 2014, which are based on BVTs and their condition and are further stratified using ancillary codes as per the BCAM (DECCW 2011). An ancillary code is an optional field which splits zones further to reflect a more homogenous condition state.

Based on the area and number of vegetation zones ELA calculated that 29 BioMetric quadrats/transects were necessary to meet the minimum requirements of BCAM (DECCW 2011) for the original, larger BCAA. Field assessment involved vegetation assessment with 29 biometric plots conducted in accordance with the requirements of the BCAM. Surveys occurred over seven days, on 18, 19, 20 November 2014, 2 and 4 December 2014, 8 April 2015 and 8 September 2015. They involved senior ecologists Meredith Henderson, Elizabeth Norris, Bruce Mullins and Brian Towle, who were supported by other botanists. The field survey targeted locations that were considered likely to be representative of the mapped vegetation communities in their various condition states.

Due to the original, larger BCAA that now includes portions that no longer forms the current BCAA, 19 of the plots were not required or used in the assessment. Further, the BVTs were revised in consultation with the OEH following quantitative analysis of plot data (**Appendix D**), with the result that the OEH was of the opinion that only one BVT was present in and adjacent to the BCAA (present in five vegetation zones). **Table 11** shows the number of plots required and completed for these vegetation zones. Note that the OEH confirmed that plots which were located partially outside the BCAA in the same vegetation zone that was representative of the vegetation within the BCAA (i.e. plots 30-1 and CL-26b) could be used in the assessment. OEH also agreed that areas of previously mapped CPW within the Lakeside Golf Course that were even aged, still retained tree guards and were not identifiable in historic aerial photographs constituted planted vegetation and did not need to be assessed in accordance with the BCAM.

The final mapped vegetation types and zones together with the location of plots used in the assessment are shown in **Figure 9**.

Table 11: Vegetation zones in the BCAA, plot requirements, and plots completed

Veg Zone ID	BioMetric Vegetation Type	Condition	Ancillary Condition Code	Area	Plots required (BCAM)	Plots completed and plot names (in brackets)
1	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Intact	6.56	1	3 (CL26b, 30-2, 30-3)
2	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Sparse	8.05	1	4 (CL11, 34-1, 34-2, 34-3)
3	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Weedy	3.55	1	1 (CL17)
4	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Low	Scattered Trees	0.76	1	1 (30-1)
5	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Low	Derived Native Grassland	0.91	1	1 (CL19)
				Total	**5**	**10**

In relation to additional flora and fauna survey above the effort undertaken by previous consultants, ELA determined that targeted surveys were required for all candidate species (see Section 2.1.3 for candidate species). Additional surveys followed formal methods outlined in *Threatened Biodiversity Survey and Assessment Guidelines for Development and Activitie*s (DEC 2004) and specific requirements to determine the presence of breeding female Myotis macropus in potential breeding habitat (**Appendix C**). Specifically, random meanders were used to target threatened flora species, along with quadrats undertaken to survey the vegetation zones. Active searches were undertaken to target Cumberland Plain Land Snail in suitable habitat. Targeted surveys were undertaken for Green and Golden Bell Frog in and around water bodies deemed to provide suitable habitat (i.e. absence of Gambusia)(**Appendix C**). Hollow bearing trees within 200m of permanent water bodies were searched for the presence of breeding female Southern Myotis (**Appendix C**). Surveys occurred over 10 days, on 17, 18, 19, 20 November 2014, 2 and 4 December 2014, 8 April 2015, 8 September 2015 and 12 and 19 October 2016.

The locations of previous flora and fauna survey effort within and adjacent to the BCAA (within 1 km) are shown in **Figure 10**. Note that no spatial survey effort was provided for surveys undertaken by ELA

(2007, 2010, 2015c), and only part of the survey effort was provided for the survey undertaken by ELA (2013b; location of biometric plots only), so **Figure 10** lacks details of all surveys previously undertaken.

Figure 11 shows the locations of previous and current flora and fauna survey effort within and directly adjacent the BCAA. As for **Figure 10**, not all surveys previously undertaken are shown given ELA (2007, 2010, 2015c) did not provide survey effort, and only part of the survey effort was provided by ELA (2013b). Conversely, 19 plots undertaken in the current survey are shown in **Figure 11** but were not required or used in the assessment.

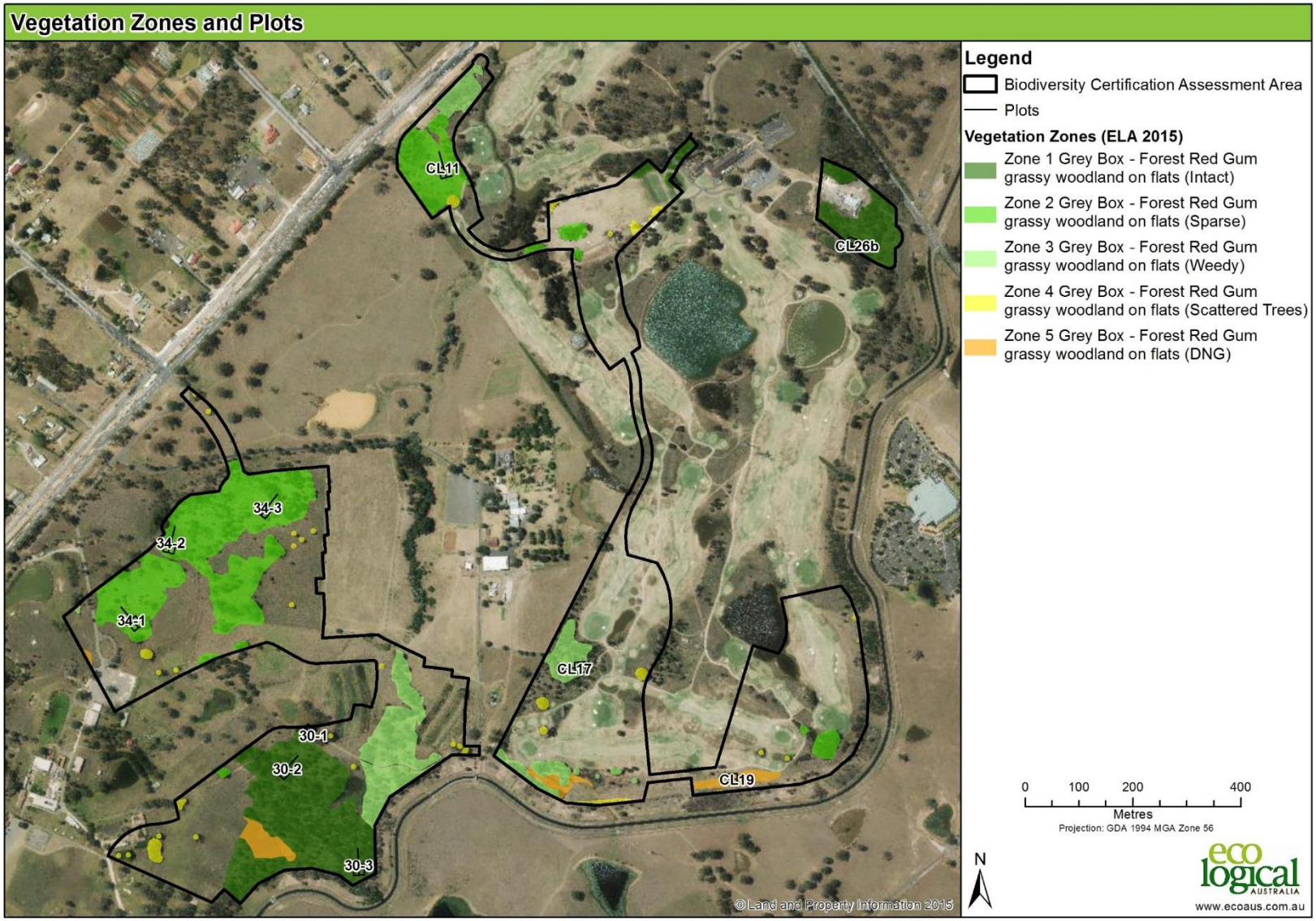

Figure 9: Validated BioMetric Vegetation Types in BCAA and location of plots used in credit calculations

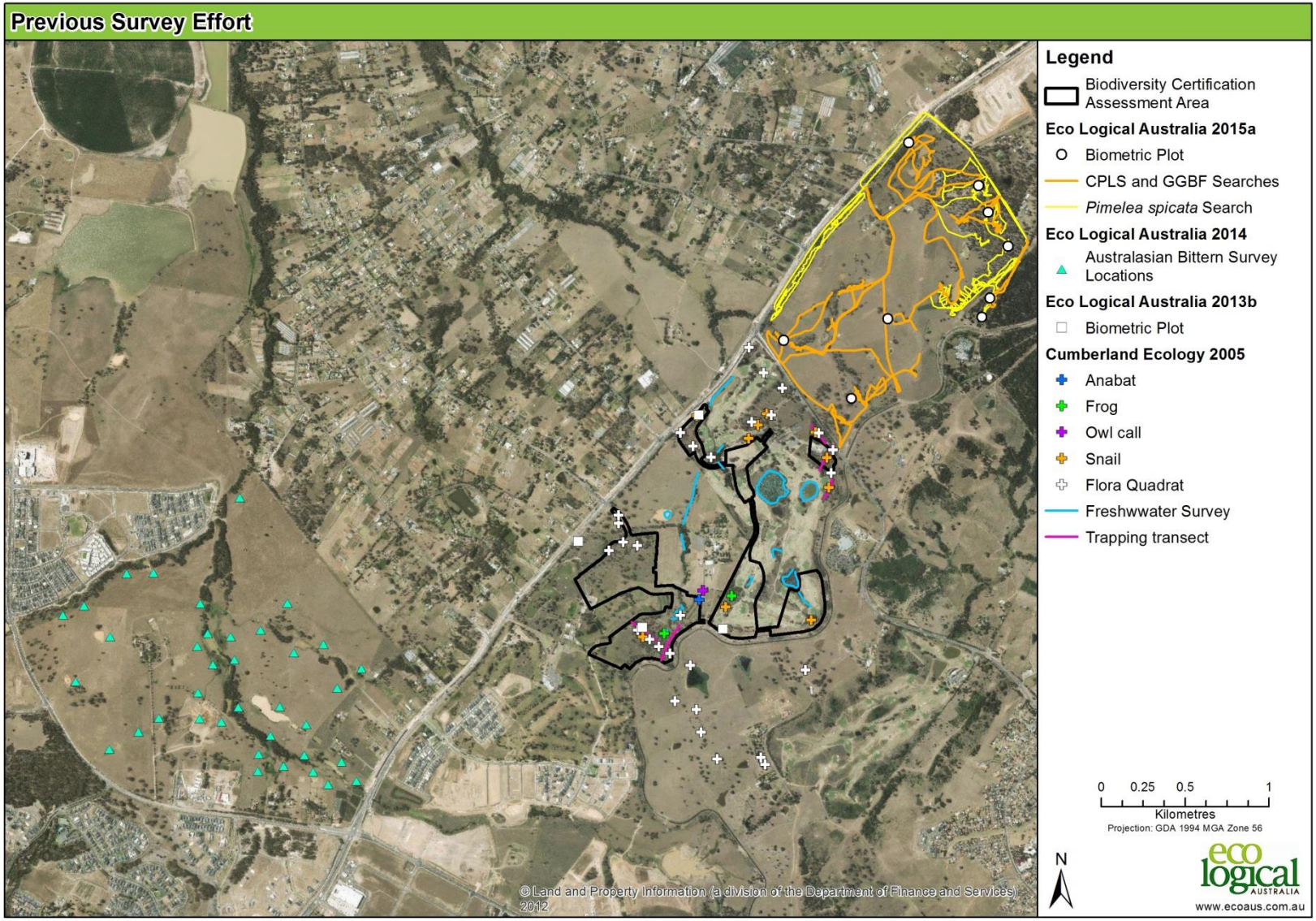

Figure 10: Previous flora and fauna survey effort within and adjacent (within 1 km) to the BCAA

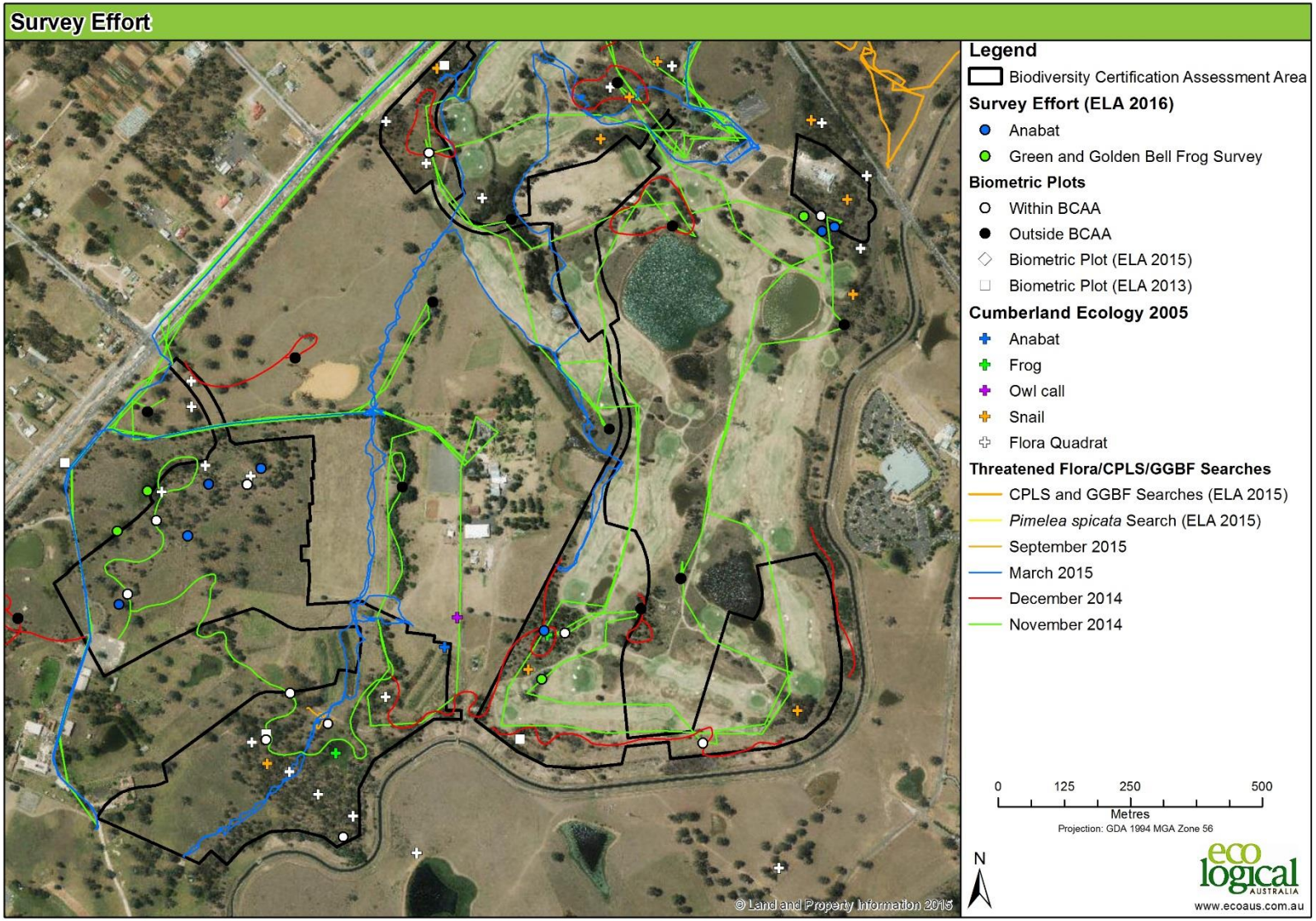

Figure 11: Previous and current flora and fauna survey effort within and directly adjacent to the BCAA

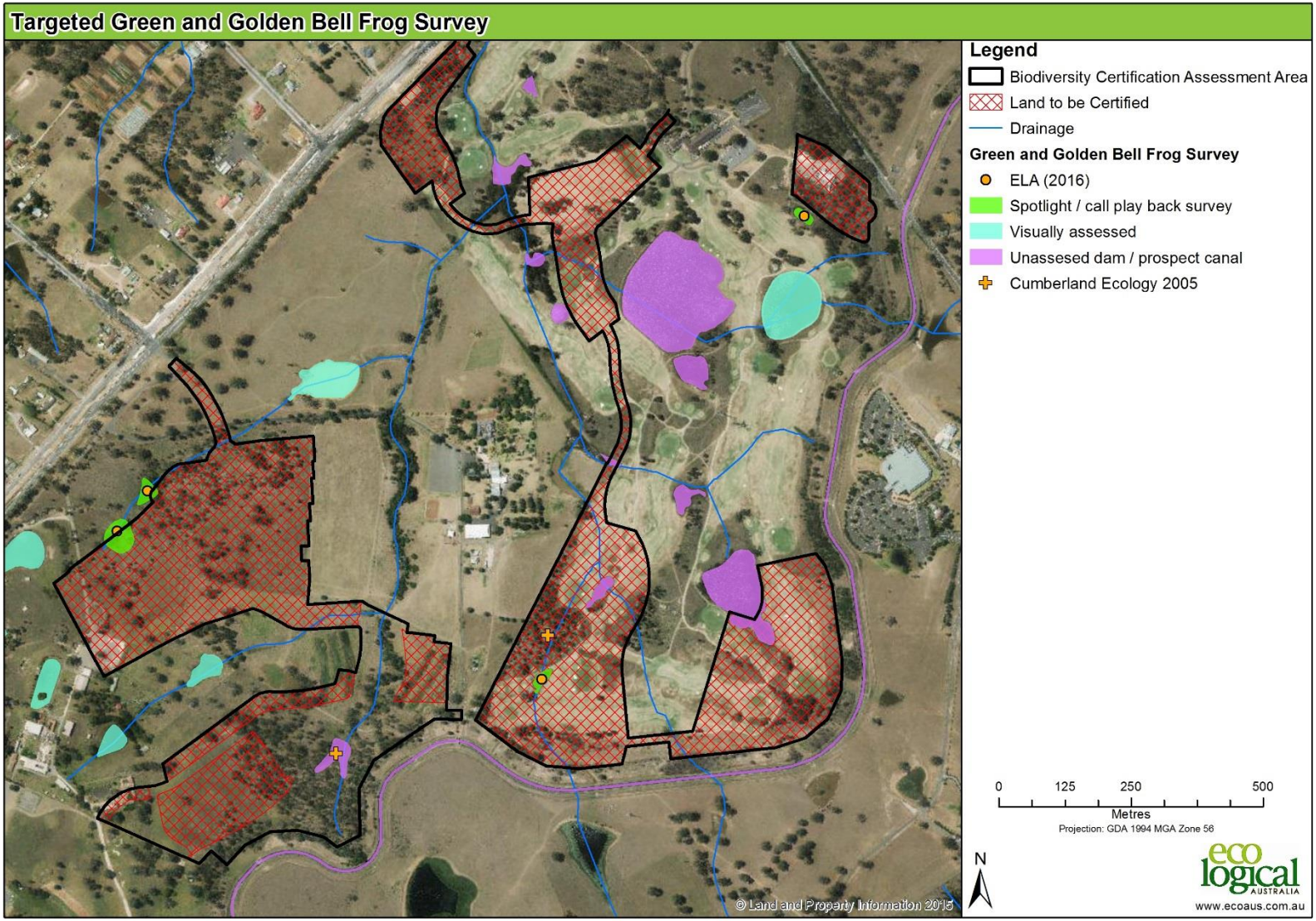

Figure 12: Targeted survey effort for Green and Golden Bell Frog, October 2016

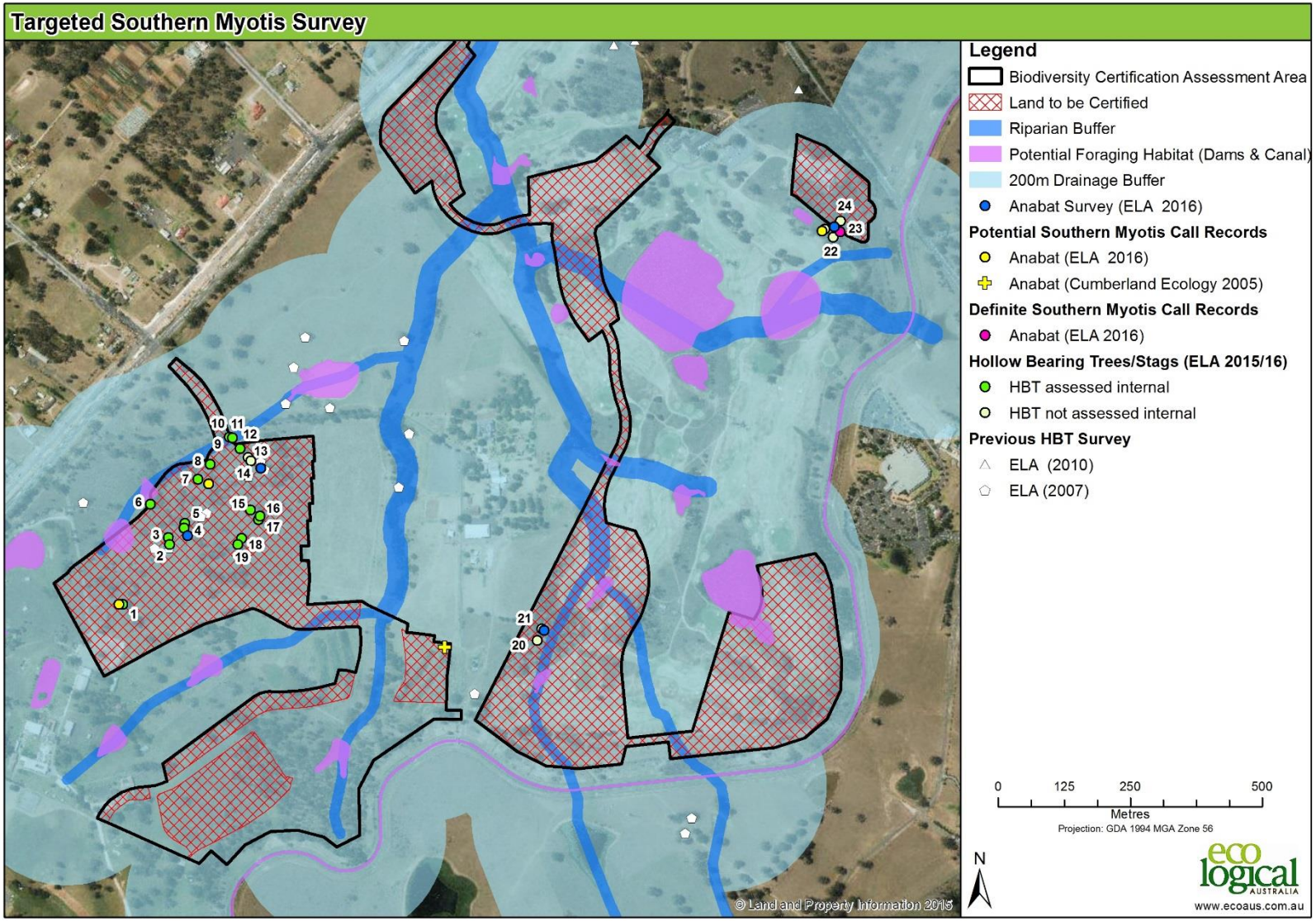

Figure 13: Targeted survey effort for breeding habitat of Southern Myotis, October 2016

The timing of surveys generally coincided with survey guidelines. Details of survey dates and field personnel for the additional survey work undertaken for this assessment are provided in **Table 12**. The total number of field days was 10 days (19 person days).

Table 12: Survey dates and field personnel

Survey dates	Survey personnel
17 November 2014	Dr Meredith Henderson, Ashley Clarke
18 November 2014	Elizabeth Norris, Brian Towle
19-20 November 2014	Elizabeth Norris, Ashley Clarke
2 and 4 December 2014	Elizabeth Norris
8 April 2015	Bruce Mullins, Mitch Palmer
8 September 2015	Dr Meredith Henderson, Robert Humphries
12 and 19 October 2016	Dr Rodney Armistead, Jack Talbot and field assistants

Weather conditions during the survey period were generally considered to be favourable for detecting flora and fauna, with all surveys experiencing some rain in the week leading to and/or during surveys. With regard to the November 2014, December 2014, and April 2015 surveys, higher than average temperatures were experienced on some days in the lead up to and/or during surveys (BOM 2015a). Rainfall may have been slightly below average for these periods (BOM 2015a). Daily weather conditions from the Camden Airport weather station (station 068192) are shown in **Table 13** (BOM 2015b).

Table 13: Weather conditions one week leading to and during surveys

Timing	Date	Minimum temperature (ºC)	Maximum temperature (ºC)	Rainfall (mm)	Relative humidity (%) at 9am	Relative humidity (%) at 3pm
Week leading to November 2014 survey	10/11/2014	16.4	25.9	0	70	59
	11/11/2014	16.4	21.3	0	60	69
	12/11/2014	13.9	25.4	0	68	44
	13/11/2014	16	28.3	0	69	43
	14/11/2014	13.3	40.6	0	65	17
	15/11/2014	17.5	25.6	0	54	52
	16/11/2014	16.1	28	3.6	91	30
November 2014 survey	17/11/2014	9.9	29.5	0	37	26
	18/11/2014	11.7	28.1	0	44	44
	19/11/2014	15.3	27.1	0	65	47
	20/11/2014	15.2	36.4	0	61	24
	25/11/2014	21.1	27	5	33	40
	26/11/2014	17.2	27.7	0	59	47

Timing	Date	Minimum temperature (ºC)	Maximum temperature (ºC)	Rainfall (mm)	Relative humidity (%) at 9am	Relative humidity (%) at 3pm
Week leading to December 2014 survey	27/11/2014	16.9	20.4	0	71	77
	28/11/2014	12.3	26.5	0.2	54	37
	29/11/2014	12.9	32.3	0	59	28
	30/11/2014	13.3	33.4	0	65	57
	1/12/2014	16.9	31.1	17.6	76	43
December 2014 survey	2/12/2014	17.8	34.4	7.8	66	54
	4/12/2014	19.4	32.3	21.6	90	46
Week leading to April 2015 survey	1/04/15	13.7	26.7	1.6	99	52
	2/04/15	13.8	28.7	0.2	99	46
	3/04/15	16	17.6	10.2	71	95
	4/04/15	15.8	19.6	21	99	92
	5/04/15	12.6	26.5	6	65	39
	6/04/15	11.4	24.4	0.2	78	85
	7/04/15	10.7	22.6	1.6	74	36
April 2015 survey	8/04/15	12.6	22.2	8.8	45	44
Week leading to September 2015 survey	1/09/15	1.7	20.4	0	65	25
	2/09/15	0.2	19	0	75	31
	3/09/15	6.1	20.2	5.2	79	38
	4/09/15	12.9	19.5	0	61	48
	5/09/15	5	20.5	0	76	51
	6/09/15	10.3	17.2	2.4	83	66
	7/09/15	8	23.1	0	99	32
September 2015 survey	8/09/15	5.8	18.8	0	42	40
(Myotis and GGBF survey)	12/10/16	3.4	22.3	0	52	
	19/10/16	8.7	22.5	0	35	

2.2 Results

2.2.1 Vegetation types and condition

Field survey, quantitative analysis of plot data, and consultation with the OEH confirmed one BVT in the BCAA, and the presence of five 'vegetation zones'. The locations of the plots and vegetation zones were shown in **Figure 9**.

A profile of the BVT present within the BCAA, including the different ancillary codes identified, is provided in **Appendix E**.

2.2.2 Flora

A total of 137 flora species were recorded in biometric plots by ELA that were used in this assessment. A full list of species recorded in plots is provided in **Appendix F**.

Threatened flora species

No threatened flora species were recorded by ELA in the BCAA, despite additional searches of the BCAA and adjacent areas by ELA, and nearby records of *Pimelea spicata* directly adjacent to the BCAA recorded by Cumberland Ecology (2005) and ELA (2010 and 2013b) (**Figure 14**).

Pimelea spicata previously recorded will not be impacted by the proposed clearing.

2.2.3 Fauna species

A total of 78, 58 and 28 fauna species were recorded in the study areas of Cumberland Ecology (2005), ELA (2007), and ELA (2013b), respectively, which variously overlapped the BCAA. Of these species, the majority of species were birds, followed by mammals, amphibians, reptiles, and fish/invertebrates. Some of the fauna species recorded by Cumberland Ecology (2005) and ELA (2007, 2013b) were common to all studies (i.e. were the same species). Species recorded were generally species common to rural environments in western Sydney.

Threatened and migratory fauna species

A total of 10 threatened and two migratory species has been recorded in or in the vicinity of the BCAA during previous surveys (Cumberland Ecology 2005, and ELA 2007, 2010, 2014, 2015a and c), have been recorded in the Atlas of NSW Wildlife (OEH 2015b) within 5km of the site or were considered candidate species for the biocertification assessment. These species are Cumberland Plain Land Snail, Australasian Bittern, Little Lorikeet, Cattle Egret, Intermediate Egret, Green and Golden Bell Frog, Southern Myotis, East Coast Freetail-Bat, Eastern Bentwing Bat, Greater Broad-nosed Bat, Eastern False Pipistrelle, and Grey-headed Flying-fox. The locations of threatened and migratory species recorded within and around the BCAA during previous surveys and Atlas records are shown in **Figure 14**. As some of these species were recorded opportunistically or use the BCAA broadly (Cattle Egret, Intermediate Egret, and Little Lorikeet; ELA 2014 and 2015c), not all threatened/migratory locations are shown.

Of the above species, only one species requiring species credits, Cumberland Plain Land Snail, has been identified as being impacted within the BCAA by the land to be certified. The other species requiring species credits that have been recorded within the BCAA (Southern Myotis, Eastern Bentwing Bat, Grey-headed Flying-fox) have no breeding habitat within the land to be certified so do not require credits species. The species credit species, Australasian Bittern, was considered unlikely to occur in the BCAA (see Step 3 in Section 2.1.3).

Species Credit Habitat Maps

A total of 1.34 ha of habitat for Cumberland Plain Land Snail has been mapped on land proposed for Biocertification in the BCAA (**Figure 15**). Habitat for Cumberland Plain Land Snail is not present in retained areas.

Whilst not recorded within the BCAA, a species habitat polygon is also included for *Pimelea spicata* (**Figure 16**).

2.2.4 Red flags

Vegetation types and other areas recognised as having regional or state biodiversity conservation significance.

The CEEC recorded in the BCAA, '*Cumberland Plain Woodland in the Sydney Basin Bioregion*', is a red flag community. Vegetation within riparian buffers (20 m either side of a minor creek) is also a red flag area present in the BCAA.

The distribution of red flag areas across the BCAA is shown in **Figure 17**.

Threatened species

There are no red flag threatened species that cannot withstand further loss in the BCAA.

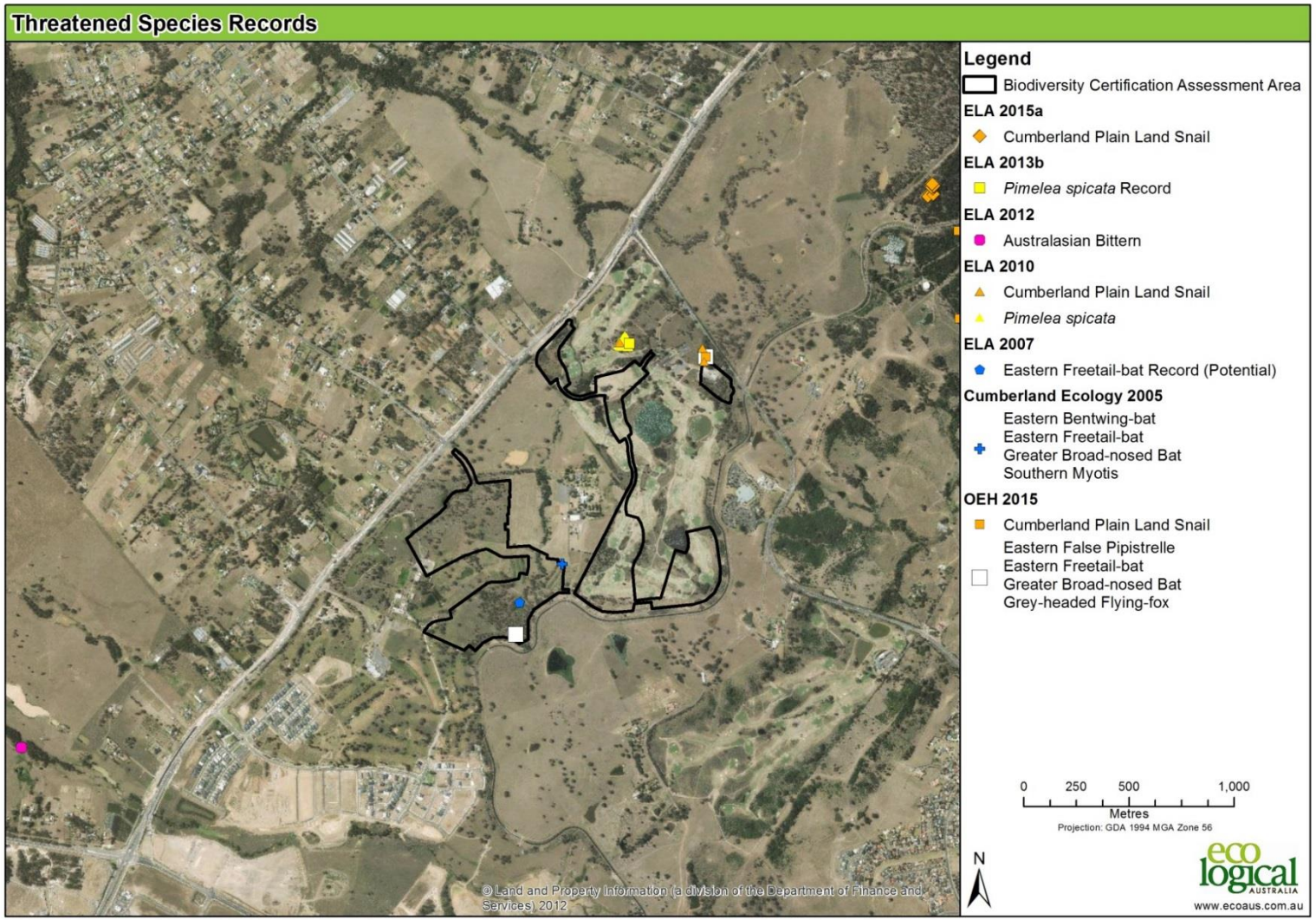

Figure 14: Recorded locations of threatened flora and fauna species within and adjacent to the BCAA.

Note that not all threatened/migratory species previously recorded are shown as they were recorded opportunistically or use the BCAA broadly

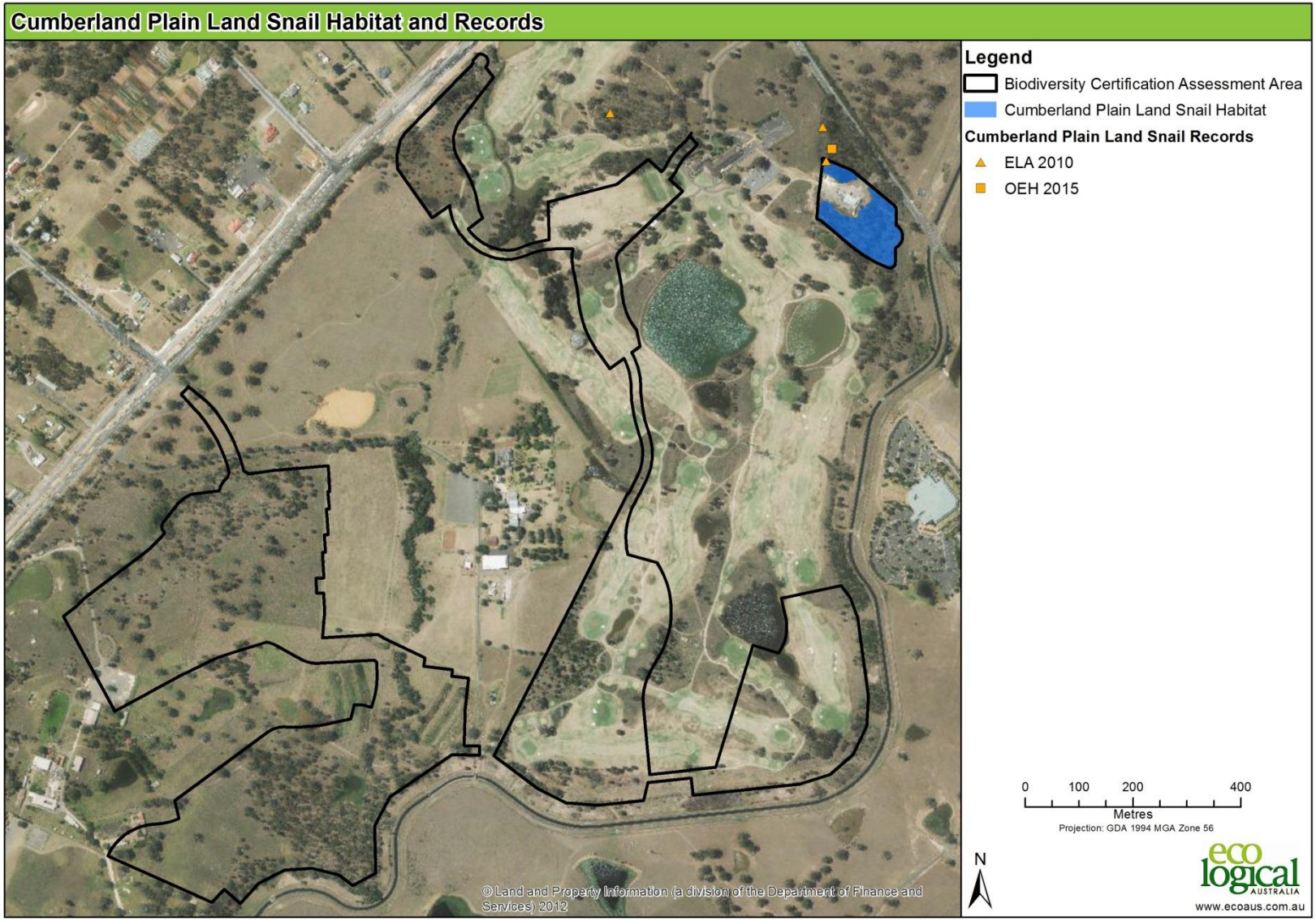

Figure 15: Habitat polygon and records for Cumberland Plain Land Snail

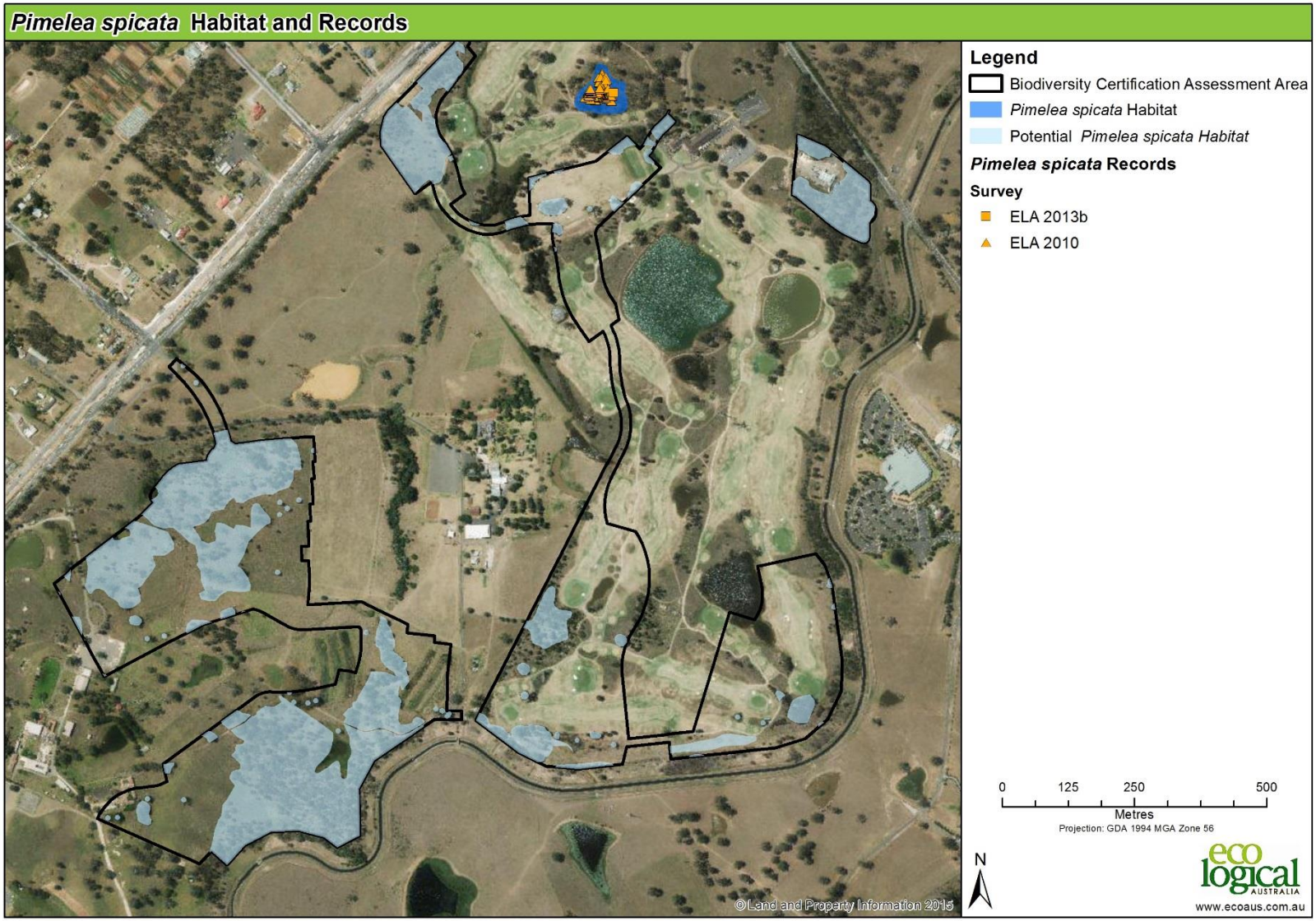

Figure 16: Habitat polygon and records for *Pimilea spicata*

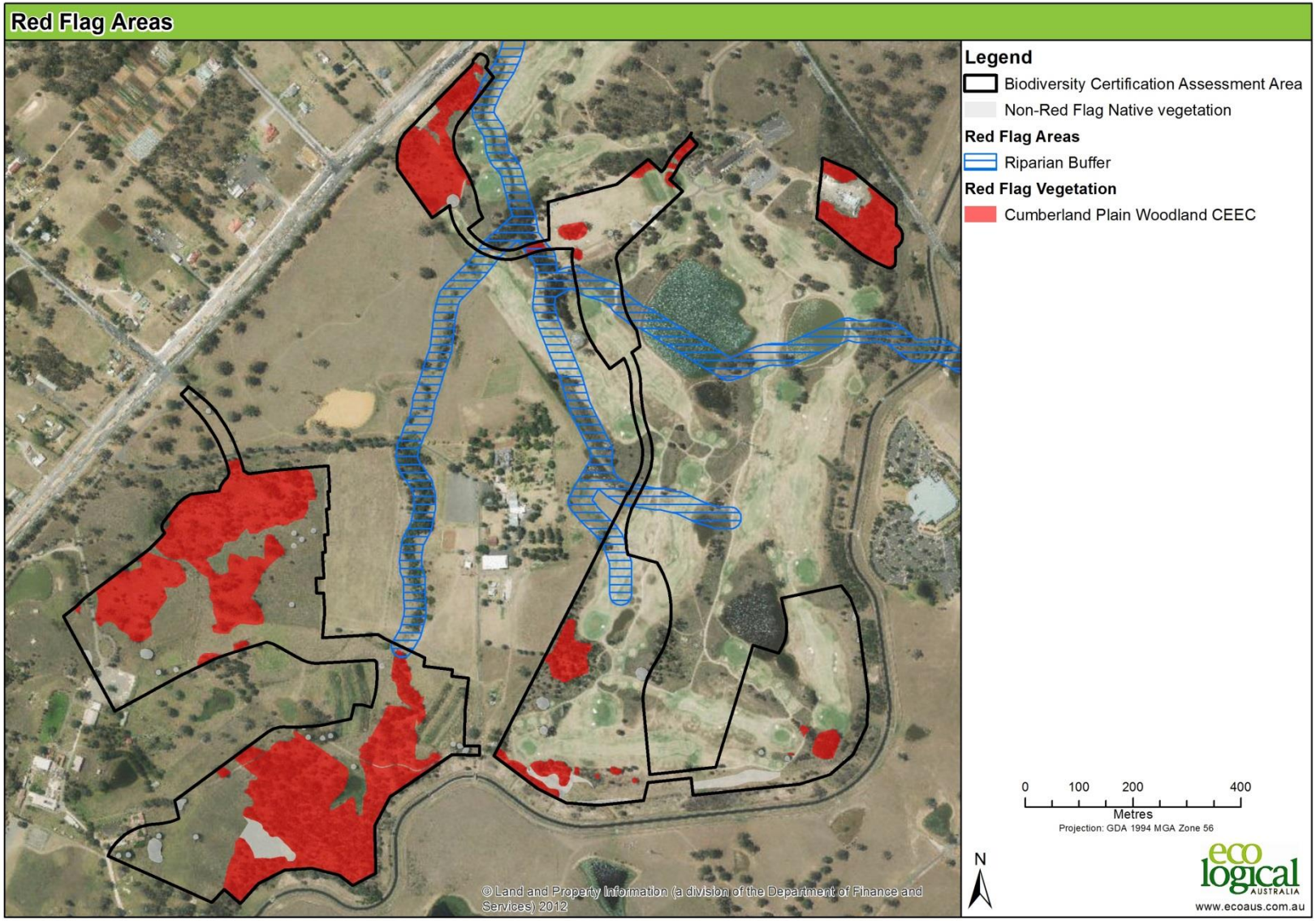

Figure 17: Red flag areas within the BCAA

3 More appropriate local data in the Biocertification Assessment

The BCAM outlines the methods by which general biodiversity values are assessed and measured in the BCAA to determine whether the conferral of biodiversity certification on land, as demonstrated in the application for biodiversity certification, improves or maintains biodiversity values (DECCW 2011). These methods, along with the methods by which measurements of threatened species, assessments of indirect impacts on biodiversity values, and calculations of ecosystem and species credits are made, were followed in the Biocertification Assessment (**Section 4**).

According to the methodology, BVTs are used as surrogates for assessing general biodiversity levels. Information on each BVT, including a description, the vegetation class and formation to which it belongs, and percent cleared value, are contained within the Vegetation Information System Database held by the OEH. A range of quantitative measures that represent the benchmark conditions for vegetation types are contained within the Vegetation Benchmark Database, also held by the OEH. The Vegetation Benchmark Database is organised by CMA's, and as such, information for the same BVTs that may occur across different CMAs are repeated across CMAs, although the range of measures representing benchmark conditions can differ between CMAs to reflect variations in BVTs across their range.

Generally, default data contained in the Vegetation Benchmark Database are used when undertaking an assessment of, and measuring, general biodiversity values. However, the BCAM specifies that the Director General may certify that '*more appropriate local data'* (MALD) can be used instead of the data in this database, '*where local data more accurately reflects local environmental conditions'* (section 3.4 of the BCAM). Benchmark data that more accurately reflect the local environmental conditions for a BVT may be collected from local reference sites, or obtained from relevant published sources. Data other than benchmark data may also be obtained from relevant published sources. The Director General must provide justifications for certifying the use of local data. The certified local data can then be used in applying the methodology.

ELA considered that some of the benchmark values for '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion'*, as contained in the Vegetation Benchmark Database, were not accurate reflections of the benchmark condition of this BVT. This is because the database contained low benchmark values that were not consistent with the vegetation type i.e. zero values for hollow-bearing trees and length of fallen logs, which would be expected to have some hollows and logs when in benchmark condition.

ELA has previously consulted with the OEH on this matter with regard to '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion'*. An outcome of a previous discussion between ELA and Tim Hagar of the OEH was that 'local' benchmark data for the number of trees with hollows and for the length of fallen logs could be added for this BVT, with one and 50 m added for the number of trees with hollows and the length of fallen logs, respectively. This was to be consistent with other woodland/open forest vegetation types on the Cumberland Plain, and is consistent with the assessment undertaken for other assessments undertaken by the OEH on the Cumberland Plain.

As this is considered an error in the Biobanking Tool datasets, it is not considered that a formal application for the use of local benchmark data is required to be submitted to the OEH for approval. Accordingly, the

local benchmark values for the number of trees with hollows and the length of fallen logs in the BVT present were used in the Biocertification Assessment (**Section 4**).

4 Biocertification Credit Assessment

This section details the results of the biodiversity certification assessment conducted to the requirements of the BCAM. Information 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.

4.1 Biodiversity certification assessment area

The BCAA is shown in **Figure 3** and is comprised of:

- Land proposed for biodiversity certification – impacts to native vegetation and threatened species habitat in these areas 'requires' biodiversity credits
- Land proposed for conservation – a commitment to manage these areas for conservation 'generates' biodiversity credits
- Lands where the current land use will be maintained/not changed (retained lands) – neither requires nor generates biodiversity credits i.e. retained land is treated under its current uses and any prosed change to use is assessed under current planning provisions)

The footprint proposed for biocertification is 47.45 ha (14.01 ha of which comprises native vegetation as defined by the BCAM) (**Table 14**). 8.66 ha of land has been identified as maintaining its current land use (part of which is subject to a separate DA (Corade DA as shown in **Figure 4**) on adjoining land), and has therefore been assessed as 'retained land' (i.e. credits are neither required nor generated).

Table 14: Land use breakdown

Development footprint	Area (ha)	% of BCAA	Area of native vegetation (ha)	% of native vegetation
Land proposed for Biodiversity Certification (Development)	47.45	84.57	14.01	70.65
Retained lands (land excluded from this assessment)	8.66	15.43	5.82	29.35
Total	**56.10**	**100**	**19.83**	**100**

4.2 Vegetation mapping and zones

As outlined in Section 2.1.4 and 2.2.1, one BVT totalling 19.83 ha was identified in the BCAA (**Table 15**). The BCAA also supported 36.27 ha of 'cleared' land, which in the context of the BCAM includes exotic vegetation.

Table 15: Area of vegetation within the BCAA

BioMetric Vegetation Type	Area (Ha)
Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	19.83
Cleared	36.27
Total	**56.10**

The BVT was separated into five vegetation zones for this assessment (**Table 11**). Three zones were mapped in 'moderate to good' condition and two vegetation zones were mapped in 'low condition'. The following ancillary codes were used to further stratify the vegetation zones:

- Intact
- Sparse
- Weedy
- Scattered Trees
- Derived native grassland

Table 16 shows the area of vegetation zones assessed within the BCAA in terms of land proposed for biodiversity certification and retained land.

Table 16: Area of vegetation zones assessed within the BCAA

Veg zone ID	Biometric vegetation type	Condition [1]	Ancillary code	Area (ha)		
				Land proposed for biodiversity certification	Retained land [2]	Total
1	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Intact	2.96	3.60	6.56
2	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Sparse	8.05		8.05
3	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Weedy	1.56	1.99	3.55
4	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Low	Scattered trees	0.61	0.16	0.76
5	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Low	Derived native grassland	0.83	0.08	0.91
Total				**14.01**	**5.82**	**19.83**

[1] Condition as defined by the BCAM, [2] Not assessed as area neither requires nor generates credits

4.3 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). Data from a total of 10 BioMetric vegetation transects/plots were collected across the BCAA, with a transect/plot requirement of five transects/plots calculated from the combined area development and retained lands (**Table 11**). The collected transect/plot data is provided in **Appendix G**.

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 the development areas (**Table 17**).

Table 17: 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)
1	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Intact	42.36	0
2	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Sparse	47.57	0
3	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Weedy	61.98	0
4	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Scattered trees	11.46	0
5	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Derived native grassland	15.10	0

4.4 Landscape Score

The credit calculator calculated a landscape value score of 8.5 for the land to be certified. The landscape value is calculated from the sum of the scores obtained from the following three attributes:

- percent native vegetation cover in the landscape
- connectivity value
- adjacent remnant area determined according to the Mitchell landscape in which most of the land proposed for biocertification occurs.

Scores for the each landscape attribute for land to be certified and land subject to conservation measures are provided in **Table 18**. An explanation on how the score was determined for each attribute is provided in the sub sections below.

4.4.1 Percent Native Vegetation Cover Score

The percent native vegetation cover calculation was completed within a single 500 ha circle (**Figure 18**). The area of vegetation cover was digitised from an aerial photograph at a scale of approximately 1:10,000. The results of the assessment are contained in **Table 18**.

A pre-certification score of 7 was determined with 67 ha (67/500 = 13%) native vegetation mapped within the 11-20% native vegetation cover class. Vegetation clearance would result in 54 ha of vegetation cover (54/500 = 11%) remaining in the assessment circle. The post certification score is also 7 because vegetation cover falls within the same 10% increment (11-20%).

Table 18: Native vegetation cover in assessment circle

Circle	Before Certification			After Certification		
	Area Of Vegetation Within Assessment Circle (Ha)	Native Vegetation Cover Class (%)	Score	Area Of Vegetation Within Assessment Circle (Ha)	Native Vegetation Cover Class (%)	Score
1 (500 ha)	67 (13%)	11-20%	7	54 (11%)	11-20%	7

4.4.2 Connectivity Value

The current connectivity value of the site was assessed according to Section 3.7.2 of the BCAM. There are three components of connectivity; these are areas approved as a 'state' or 'regional' biodiversity links by the Director General, the hierarchy and riparian zone width of water courses in accordance with Appendix 1 of the BCAM and an assessment of vegetation connectivity. During consultation with the OEH, the OEH officers confirmed that there were currently no registered state or regional biodiversity links relevant to the BCAA.

'Minor creeks' and 'minor watercourses', defined as a 'local biodiversity link', and patches of vegetation that conform to the criteria of a local biodiversity link (moderate to good condition, has a patch size >1 ha which is separated by <30 m), occur on land to be developed and on land subject to conservation measures (**Figure 19**). According to Table 4 of the BCAM the score for a local biodiversity link is 6. As a local biodiversity link is located on land proposed for biodiversity certification and will be impacted it was allocated a score of zero after development (**Table 19**). As there is no land subject to conservation measures, there is no local biodiversity link present; accordingly, it was allocated a connectivity score of 0.

Table 19: Connectivity scores allocated for the assessment

Connectivity score	Pre-certification	Post-certification
Land to be certified	6	0
Land subject to conservation measures	0	0

4.4.3 Adjacent Remnant Area

The BCAA predominantly occurs on the Cumberland Plain Mitchell Landscape which is 89% cleared. The vegetation on site is not well connected given the areas of moderate to good vegetation are separated

by areas of low condition vegetation and cleared land, resulting in an adjacent remnant area (ARA) of 9 ha (**Figure 19**). This receives a score of **2.5** for Mitchell Landscapes within the 70-90% cleared range.

There is no land subject to conservation measures, therefore the score allocated for the conservation lands is **0**.

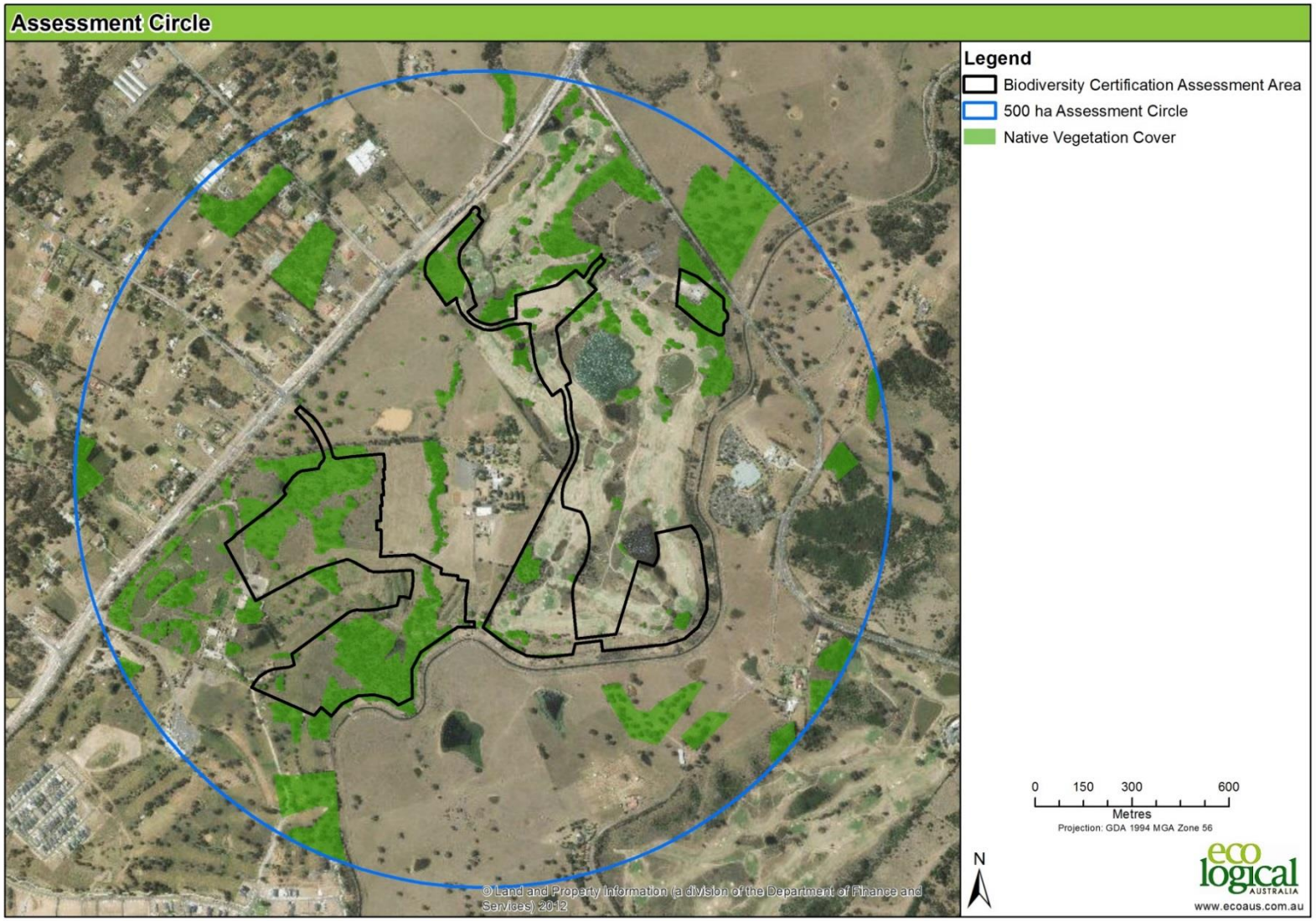

Figure 18: Assessment circle

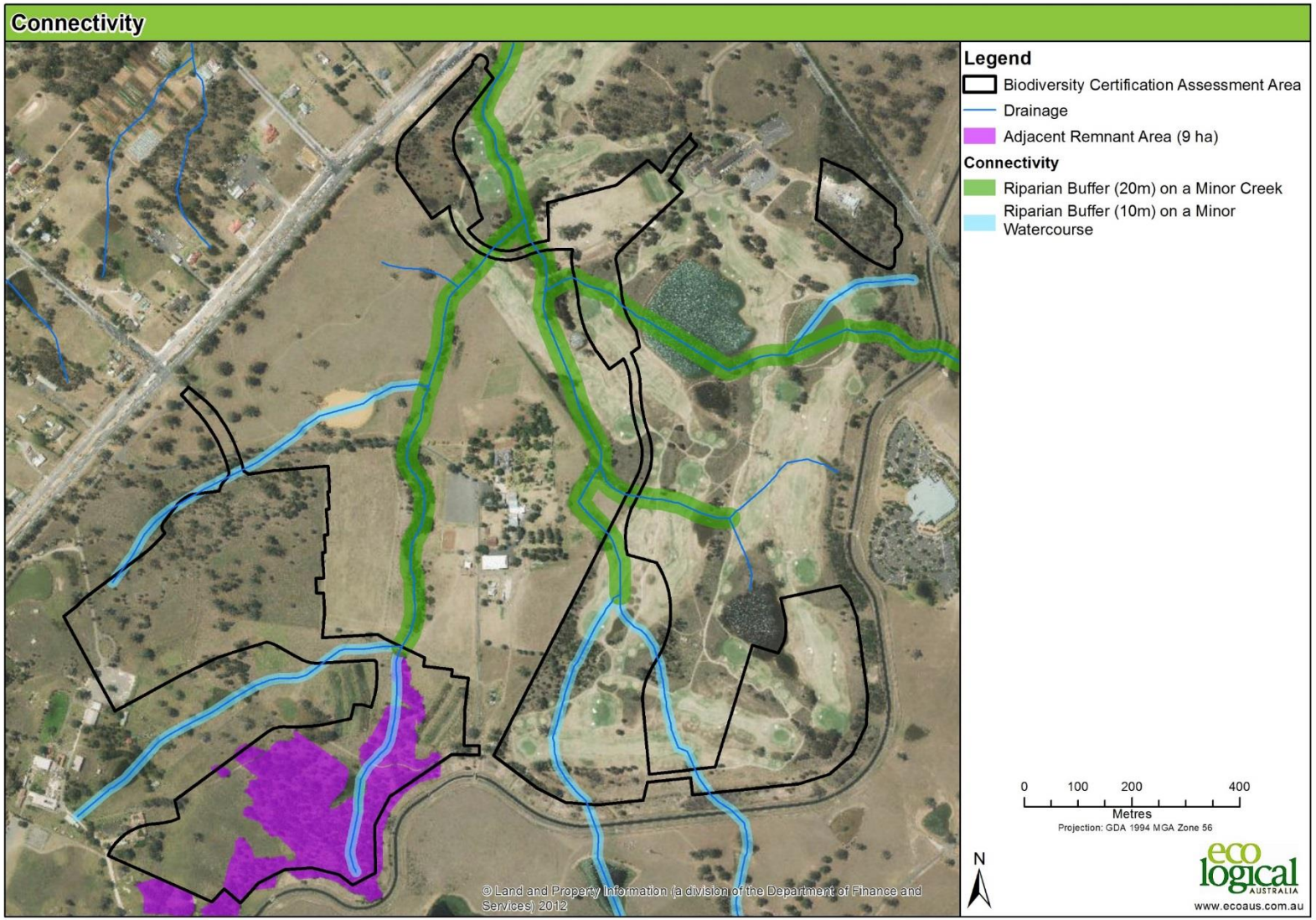

Figure 19: Connectivity

4.5 Red Flags

The BVT, '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' has been identified as comprising one CEEC (CPW). It also classifies as an over-cleared vegetation type (>70% of original extent in the CMA cleared; DECC 2008a). The BVT is therefore 'red-flagged' when in moderate to good condition under the BCAM.

Two zones of the BVT identified as a CEEC were in 'low' condition because the site value scores for these were less than 34/100. Accordingly, these vegetation zones are not red flagged. Three zones had site value scores greater than 34/100.

There were also areas of vegetation within a 20 m buffer area of a minor creek within the BCAA which classify as red flag vegetation.

The extent of red flagged vegetation is shown in **Table 20** and **Figure 17**. Red flag areas should be avoided and can only be impacted in accordance with certain rules outlined in Section 2.4 of the BCAM.

A total of 18.16 ha of red flagged vegetation is present within the BCAA of which 12.57 ha or 69.22% would be impacted by the proposal. A red flag variation request prepared in accordance with the criteria set out in Section 2.4 of the BCAM is provided in **Section 5**. It is noted that a red flag variation request must be assessed and approved by the OEH before biodiversity certification can be conferred.

In accordance with the procedures outlined by the OEH in undertaking a biocertification assessment, the OEH were consulted to determine whether a red flag impact and request for variation of this magnitude would likely be approved by the Director-General of the OEH. OEH advised that each of the relevant criteria must be addressed and the justification was not to include any existing conservation measures required outside of the BCAA (i.e. the required restoration of the Golf Course in accordance with the Vegetation Management Strategy).

Table 20: Impacts to red flagged vegetation

Red flag vegetation (BVTs)	CEEC name	Cleared within CMA	Red Flag Area within BCAA (ha)	Red Flag Area impacted (ha)	Proportion impacted (%)
Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion	95%	18.16	12.57	69.22
Vegetation within riparian buffers	Cumberland Plain Woodland in the Sydney Basin Bioregion	NA	0.10	0.08	80.00
Total*			**18.16**	**12.57**	**69.22**

* Vegetation within riparian buffers is comprised of a CEEC in moderate to good condition. Therefore, the amount of vegetation within riparian buffers does not add to the total.

4.6 Indirect Impacts

Section 6 of 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).

Indirect impacts have been considered and assessed in accordance with Section 6 of the BCAM and it has been determined that any negative indirect impacts will either be:-

- fully mitigated by 'development controls' associated with the lodgement of Development Applications (DAs) on the El Cabello section of the certified land (Stages 1, 2 and 3 in **Figure 4** and **Figure 20**). Any DAs lodged on this land triggers the requirement to prepare and implement a Vegetation Management Plan (VMP). The VMP is required as part of the Planning Agreement associated with the rezoning of the El Caballo and Gledswood section of the rezoning instrument). The objective of the VMP is to restore and enhance remnant Cumberland Plain Woodland on the Golf Course which surrounds the certified land; or
- the potential indirect impacts will be offset by the retirement of **'3'** additional ecosystem credits for impacts to Stages 4, 5, 6, 7 and 8 in the Camden Lakeside section of the certified land as shown in **Figure 4** and **Figure 20**.

VMPs for the Golf Course and Riley's Creek (adjacent to the BCAA) have been prepared (ELA 2015d and 2015e) and tenders are currently being sought to implement them.

The proposed ownership (private), zoning (residential) and management (residential lot management) of the land proposed for certification will not mitigate and indirect impacts on the land proposed for biocertification as by definition, land proposed for certification will lose its biodiversity values as a result of the future development of the land. However, the preparation of a Construction Environment Management Plan (CEMP), a development control, as committed to in in **Section 6.5** (Statement of Commitments), will require that temporary and permanent protective fencing be erected around all areas with biodiversity values on retained land within the BCAA and areas to be protected/restored/enhanced in accordance with VMPs on land adjacent to the BCAA. The CEMP will also provide for the salvage and re-use of vegetative material and soil seed banks for restoration and habitat augmentation in the areas subject to the VMPs.

The preparation and implementation of the CEMP and VMPs on the El Caballo section of the BCAA, will become a condition of development consent for any future DAs on the certified land (i.e. a development control). These measures will reduce indirect impacts during construction and the restoration and enhancement of the adjacent and surrounding vegetation, will fully mitigate any negative indirect impacts that biodiversity certification may have on biodiversity values associated with Stages 1, 2 and 3 of the proposed development i.e. the condition of the surrounding vegetation that may be subject to indirect impacts will be in better condition that it currently is.

The native vegetation on the Lakeside Golf Course and Sydney Water Canal surrounding Stages 4, 5, 6, 7 and 8 is not subject to the Planning Agreement and requirement to prepare and implement VMPs but will be subject to the CEMP to reduce/minimise negative indirect impacts during the construction stage. It is expected that the Lakeside Golf Course will continue its current practice of managing this vegetation as they have done for the past 20 years as part of the landscape management within the golf course. This management has led to an increase in the area and condition of native vegetation in the golf course via plantings and augmentation of remnant patches of vegetation. However, there is potential for some increased negative indirect impacts to occur to this native vegetation as a result of the proposed

residential development that would require either additional mitigation measures (i.e. enhancements to the golf course vegetation management program) or additional offsets to compensate for these impacts.

The Stage 6 development precinct already has a 15m vegetated APZ which has been counted as 100% loss in the biocertification credit calculations. This remaining vegetation in this APZ is likely to buffer/filter any indirect impacts to remaining vegetation on the golf course beyond the APZ boundary and no further indirect impacts are anticipated.

The Stage 4 and 5 development precincts within the Lakeside Golf Course fairways are surrounded by small patches of remnant native vegetation and enhanced native vegetation within the Lakeside Golf Course. These small patches of vegetation are not classified as a high fire risk and managed APZs will not be required, there is therefore the potential for indirect impacts to affect this vegetation. However, given the context of the site and the style of development (i.e. a fully landscaped residential golf course development with the boundaries all lots permanently fenced), any indirect impacts (accidental damage, unauthorised access, rubbish (including garden waste) dumping in these adjacent areas are expected to be very small, any incursions to the private golf course addressed by the golf course, and lead to no more than a 5% reduction in the condition of the vegetation.

The Stage 7 and 8 development precincts within the Lakeside Golf Course are adjacent to the Sydney Water Canal which is currently stock proof fenced for water quality protection and will have a 10m APZ set back. Access to this area will continue to be restricted as a condition of consent with Sydney Water to protect water quality and involve significant enhancements to the current fencing (1800 mm chain mesh fence as a standard condition of consent). Accordingly any negative indirect impacts to this area are expected to be minor and lead to no more than a 5% reduction in the condition of the vegetation.

Given the flat to gentle slope of the land across Stages 4, 5, 6, 7 and 8, it has been estimated that these impacts may occur up to 20m from the boundary of the development (which is considered a reasonable distance to measure the effects of any adverse run-off, nutrient enrichment that may lead to weed plumes and consistent with the average canopy height of the vegetation community in the area). The area of vegetation within this zone has been calculated and then multiplied by a 5% reduction in condition and the number of credits required to offset these impacts determined by the number of credits required per hectare of loss for each vegetation zone as per the credit calculations shown in **Table 22**. The resulting number of credits is shown in **Table 21.** No credits have been allowed for impacts to Zone 4 as it is not anticipated that the condition of any individual trees will be adversely impacted by indirect impacts as these will be protected by existing development controls (i.e. Camden Tree Preservation Order). The number of additional credits required to offset indirect impacts within the Lakeside Section of the BCAA is thus calculated at '**3'**.

Table 21: Number of credits required for potential indirect impacts

Vegetation Zone	20m Indirect Impact Zone	Credits/ha	Credits required for indirect impacts
1: Grey Box - Forest Red Gum grassy woodland on flats (Intact)	0.54	19.93	0.54
2: Grey Box - Forest Red Gum grassy woodland on flats (Sparse)	0.44	22.24	0.49
3: Grey Box - Forest Red Gum grassy woodland on flats (Weedy)	1.35	28.21	1.90
4: Grey Box - Forest Red Gum grassy woodland on flats (Scattered Trees)	0.4	N/A	N/A

5: Grey Box - Forest Red Gum grassy woodland on flats (DNG)	0.13	8.43	0.05
Planted	0.25	0	0.00
Dams	0.42	0	0.00
Total			2.99

Whilst all impacts within the land to be certified have been calculated on the assumption of complete loss, the following mitigation measures have been included to minimise impacts and address indirect impacts to areas proposed for conservation and retained areas:

- All trees and hollows will be removed under the supervision of a fauna ecologist. Trees, including hollow-bearing trees, that cannot be retained will be relocated to within '*retained areas*' that are subject to VMPs

4.7 Credit Calculations

4.7.1 Ecosystem Credits

Ecosystem credits have been calculated for the loss of vegetation resulting from the proposed development. In total, **293** ecosystem credits are required for the proposed development of the area (**Table 22**).

As there are no proposed conservation areas within the BCAA, all 293 credits will be secured from outside the BCAA. **Section 6** outlines how the deficit of 293 credits is proposed to be met.

4.7.2 Species credits

Species credit requirements have been calculated for Cumberland Plain Land Snail which was recorded in and adjacent to the BCAA and mapped with a species polygon for likely habitat. No other threatened fauna or flora species requiring species credits were detected and therefore have not been calculated for species credit requirements.

A total of 18 species credits are required for Cumberland Plain Land Snail for the land proposed to be certified (**Table 23**).

Section 6 outlines how the deficit in species credits is proposed to be met.

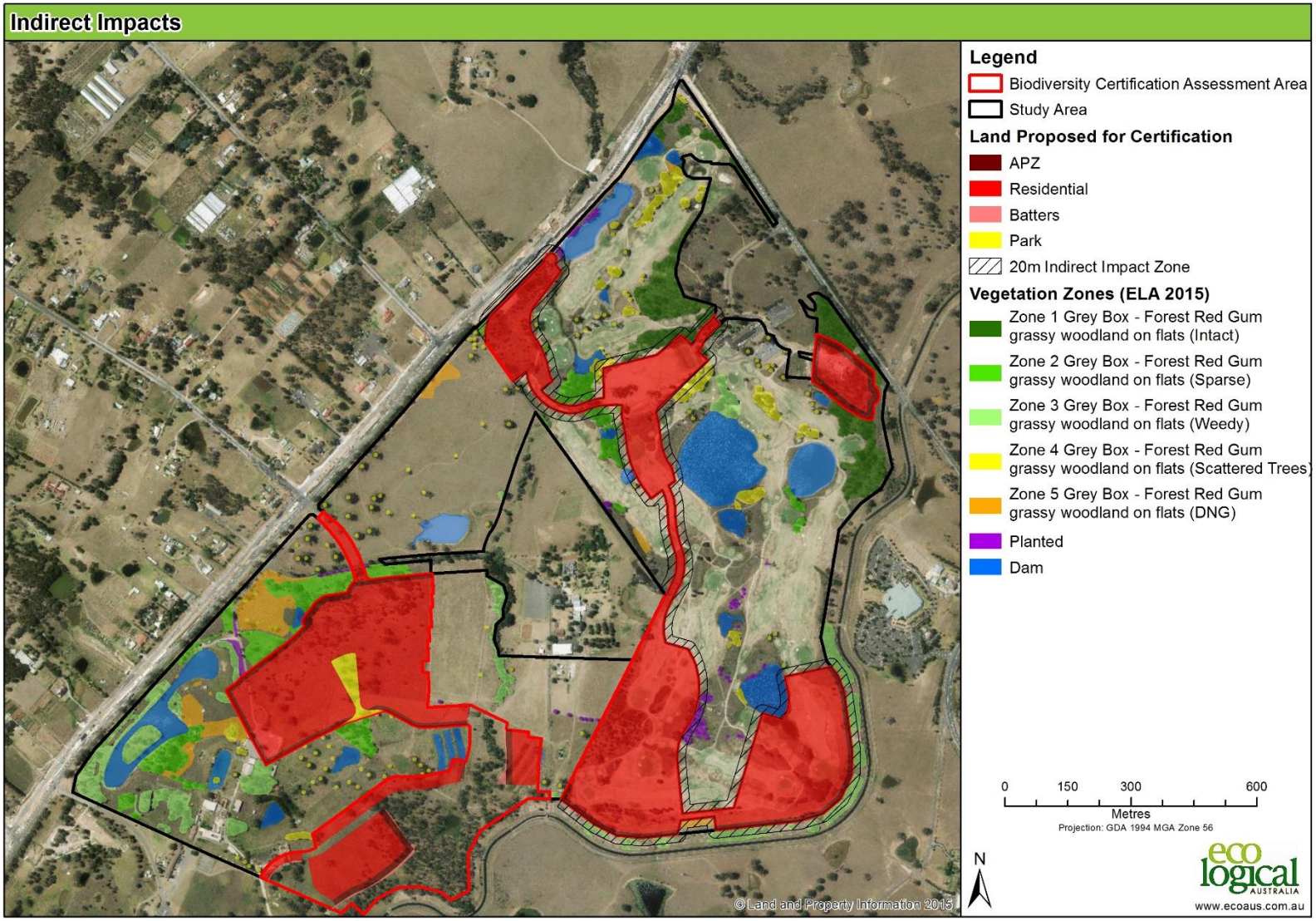

Figure 20: Indirect impact zones

Table 22: Final ecosystem credit results

Veg zone ID	Biometric vegetation type	Condition	Ancillary code	Area impacted (ha)	Credits required	Credits/ha
1	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Intact	2.96	59	19.93
2	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Sparse	8.05	179	22.24
3	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Weedy	1.56	44	28.21
4	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Low	Scattered trees	0.61	4	6.56
5	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Low	Derived native grassland	0.83	7	8.43
Total				**14.01**	**293**	**20.91**

Table 23: Final species credit results

Habitat	Area impacted (ha)	Credits required
Cumberland Plain Land Snail	1.34	18

5 Red Flag Variation Request

5.1 Impact on Red Flagged Areas

The Biodiversity Assessment Report for the ecological values within the BCAA (**Section 2**) identified '*red flags*' as defined by the BCAM, some of which would be impacted by the land proposed for biocertification. The BCAM requires each of the criteria set out in Section 2.4 of the BCAM to be addressed in order for the Director-General to be satisfied that impacts to these '*red flags*' are able to be offset. This section addresses this requirement.

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 CEEC or EEC listed under the TSC Act or EPBC Act (not in 'low condition')
- a threatened species that cannot withstand further loss
- areas of vegetation recognised as having regional or state biodiversity conservation significance.

The Biodiversity Certification Operational Manual (OEH 2015c) states that each red flag area within the proposed biodiversity certification area should be numbered and listed in a table and shown on a map. Each red flag area impacted will require a separate red flag variation request unless the responses are the same for each entity, i.e. vegetation type is the same, patches are of similar condition, patches have the same connectivity etc.

The BVT recorded within the BCAA is equivalent to '*Cumberland Plain Woodland in the Sydney Basin Bioregion'* (CPW), which is a CEEC listed on the schedules of the TSC Act. Parts of the BVT are also equivalent to CPW listed under the EPBC Act. Areas of CEECs are only considered as red flags if they are in moderate to good condition. Three out of five vegetation zones are in moderate to good condition, and all of these will be impacted, totalling 12.57 ha.

In addition, areas of land with regional or state conservation significance will be impacted i.e. vegetation within riparian buffers. A total of 0.08 ha of vegetation within riparian buffers will be impacted.

There are no other areas of land with regional or state conservation significance, vegetation types >70% cleared in the Hawkesbury Nepean CMA, or threatened species requiring species credits that cannot withstand further loss that will be impacted within the BCAA.

Impacts on red flagged areas according to vegetation zones are shown in **Table 24**. The distribution of red flag vegetation on land proposed for biodiversity certification is discussed below for each of the red flag variation criteria outlined in section 2.4 of the BCAM, and is shown in **Figure 21**, along with red flag vegetation that will retained.

Red flag vegetation is considered in 'groups' or similar or like attributes in order to address the red flag variation criteria. These groups are presented in **Table 25** and are shown in **Figure 22**.

Table 24: Impacted red flag vegetation

Veg zon e ID	Biometric vegetation type / red flag vegetation	CEEC	Condition	Ancillary code	Area impacted (ha)	Site Value Scores
1	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion	Moderate to good	Intact	2.96	42.36
2	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion	Moderate to good	Sparse	8.05	47.57
3	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion	Moderate to good	Weedy	1.56	61.98
NA	Vegetation within riparian buffers	Cumberland Plain Woodland in the Sydney Basin Bioregion	NA	NA	0.08*	N/A
Total					**12.57**	

* Vegetation within riparian buffers is comprised of a CEEC in moderate to good condition. Therefore, the amount of vegetation within riparian buffers does not add to the total.

Table 25: CEEC red flag groups on land proposed for biodiversity certification

CEEC red flag group	Veg zone ID	Biometric vegetation type / red flag vegetation	Ancillary code	Location	Area impacted (ha)
1	1	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Intact	South west of the BCAA on land zoned as general residential (R1) (the area marked for Stage 3 development; see **Figure 6** staging map)	1.37
	2		Sparse		0.04
2	2	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Sparse	West of the BCAA on land zoned as general residential (R1) and private recreation (RE2) (the area marked for Stages 1 and 2 development; see **Figure 6** staging map)	6.06
	3		Weedy		0.05
3	2	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Sparse	South east of the BCAA on land zoned as general residential (R1) (the area marked for Stages 7 and 8 development; see **Figure 6** staging map)	0.24
	3		Weedy		1.05
4	1	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Intact	North east of the BCAA on land zoned as general residential (R1) (the area marked for Stage 6 development; see **Figure 6** staging map)	1.36
5	1	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Intact	North of the BCAA on land zoned as general residential (R1), environmental conservation (E2) and private recreation (RE2) (the area marked for Stages 4 and 5 development; see **Figure 6** staging map)	0.24
	2		Sparse		1.72
	3		Weedy		0.45
Total					**12.57**

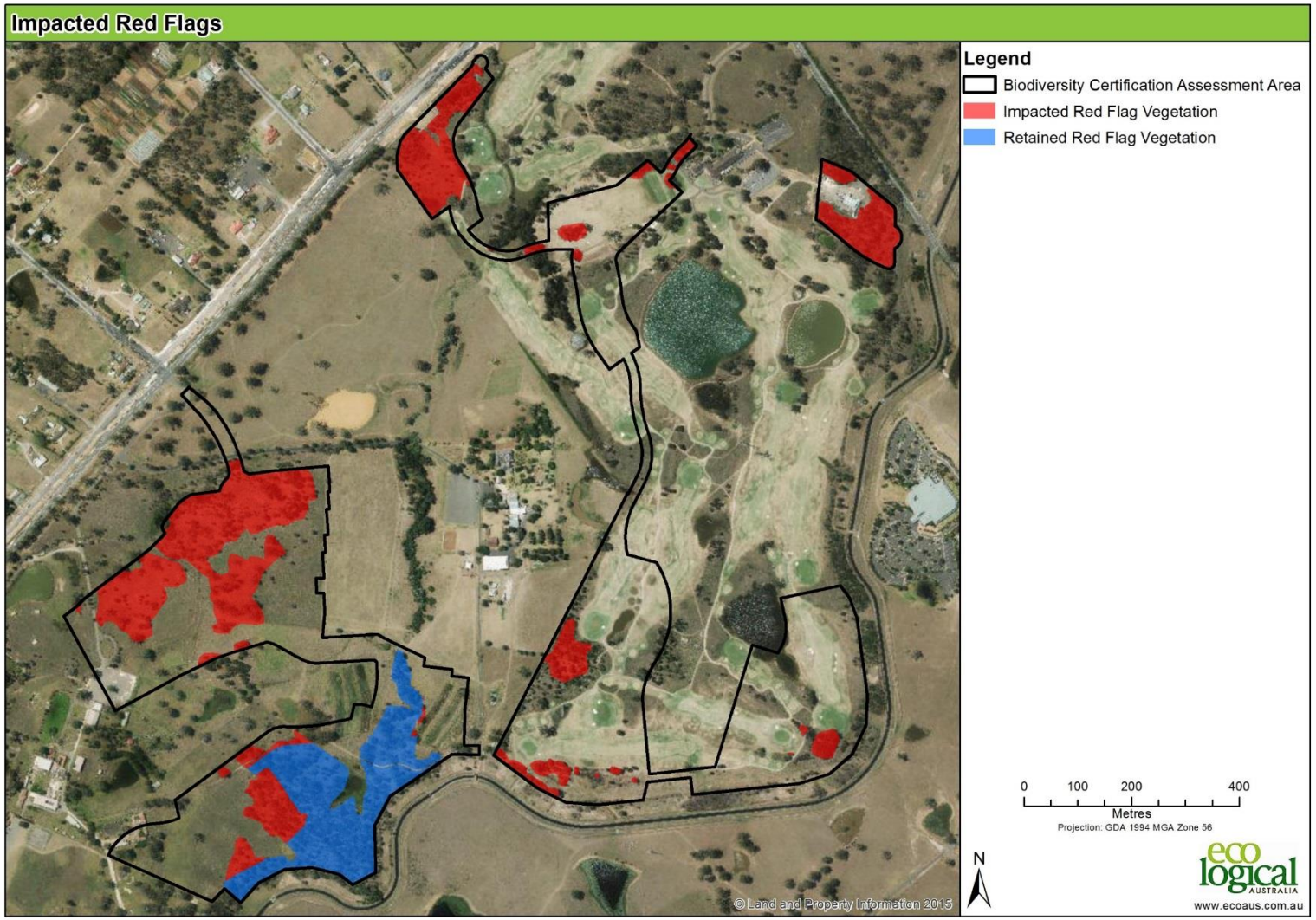

Figure 21: Impacted, conserved and retained red flag vegetation

Note: The scattered trees and derived native grassland in the assessment area do not constitute red flags as their site value score < 34.

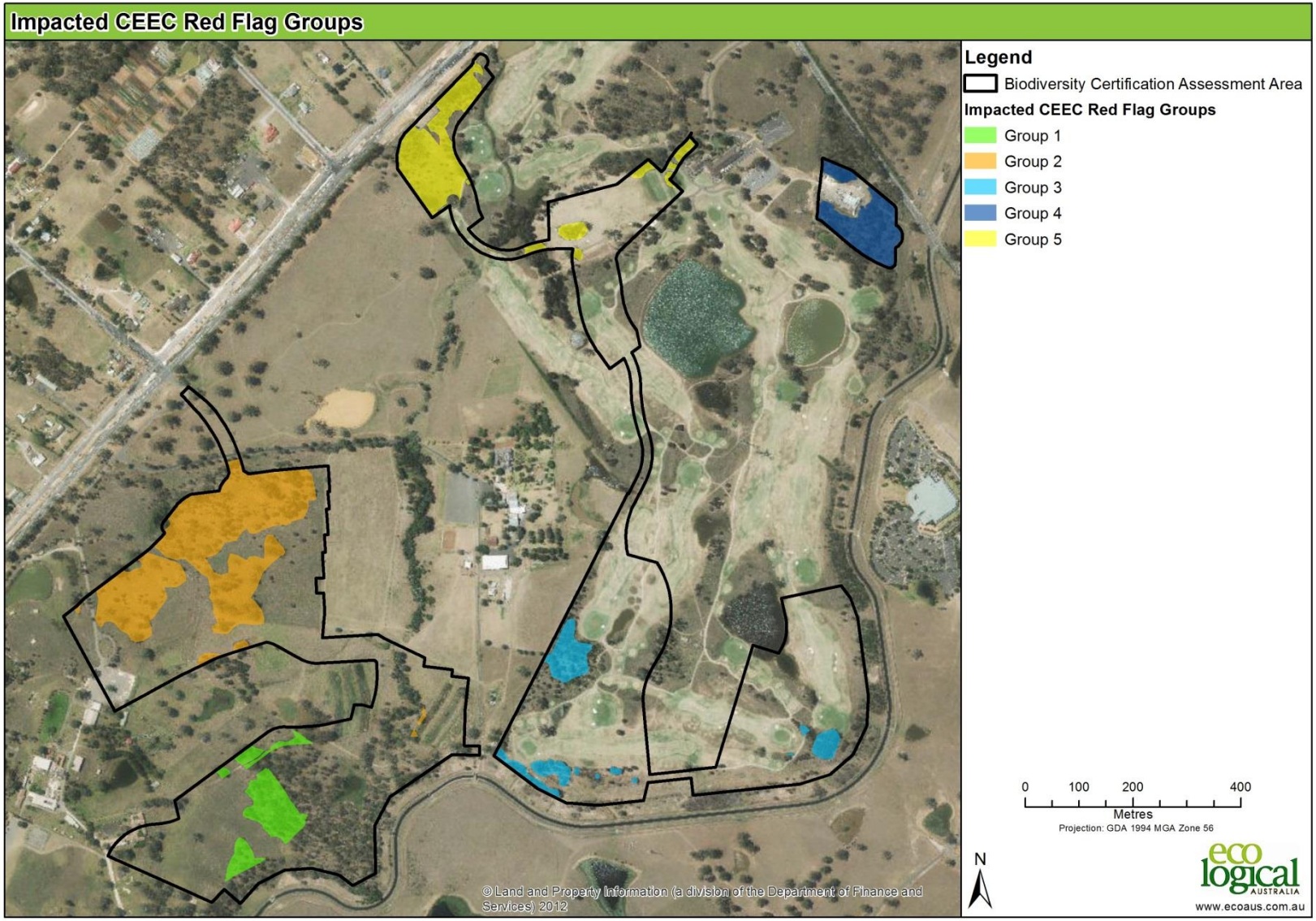

Figure 22: Impacted CEEC red flag groups

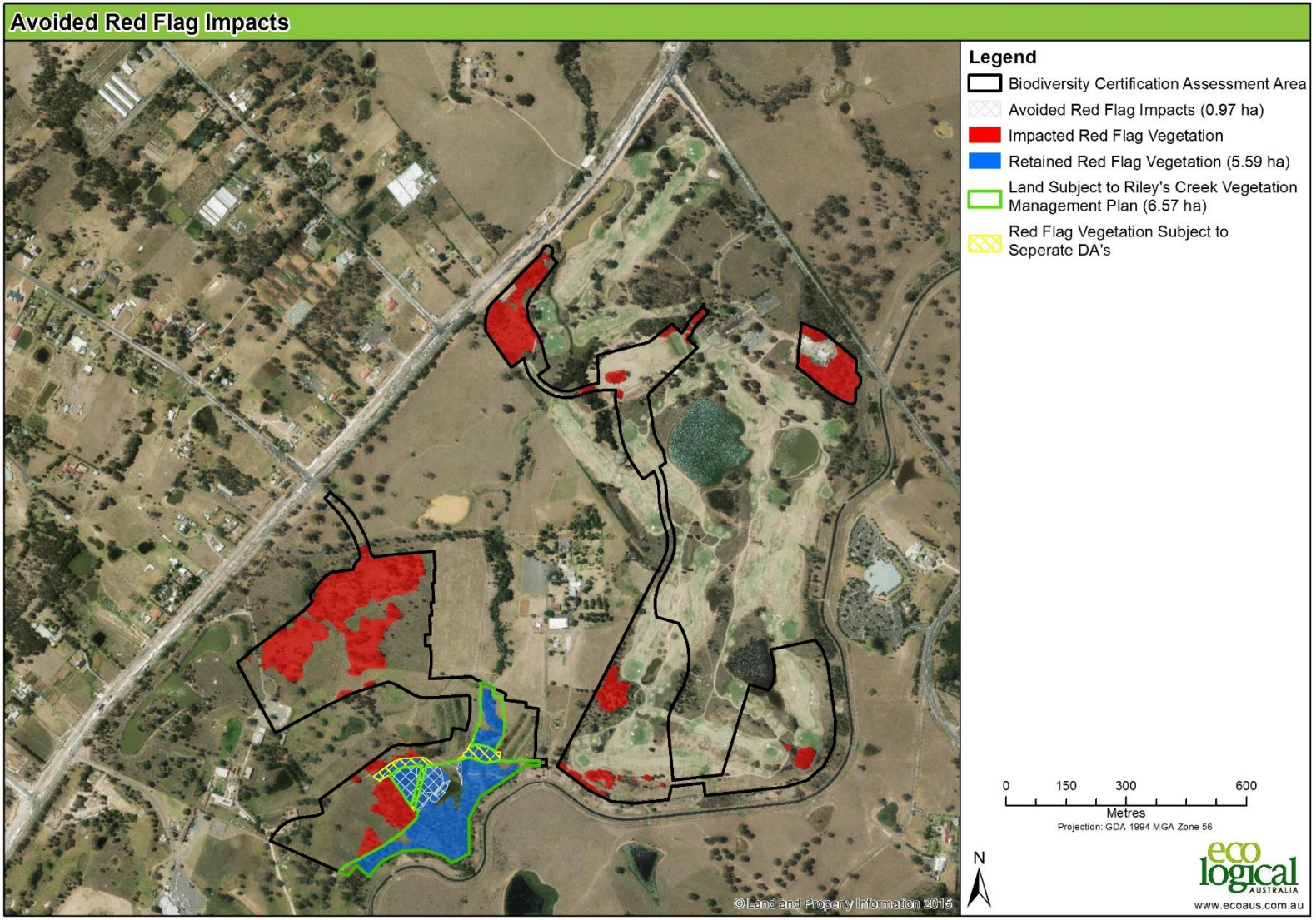

Figure 23: Avoided red flag vegetation within the BCAA

5.2 Red Flag Variation Criteria

The presence 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 the OEH. An application for a red flag variation must satisfactorily address the criteria in Section 2.4 of the BCAM (DECCW 2011) for a proposal to be regarded as improving or maintaining biodiversity values.

Firstly, as outlined in Section 2.4.1 of the BCAM, the feasibility of options to avoid impacts on red flag area(s) where biodiversity certification is conferred must be addressed.

In addition, the following criteria, as outlined in Section 2.4.2 of the BCAM, must be addressed for a vegetation type which is greater than 70% cleared or is a CEEC or EEC:

1. Viability must be low or not viable (Section 2.4.2.1 of the BCAM).
2. Contribution to regional biodiversity values must be low (Section 2.4.2.2 of the BCAM).

The following criteria, as outlined in Section 2.4.4 of the BCAM must be addressed for areas with regional or state biodiversity conservation significance:

1. The width of a riparian buffer with regional or state biodiversity significance must not be substantially reduced.
2. The ecosystem functioning of a state or regional biodiversity link, considering migration, colonisation and interbreeding of plants and animals between two or more larger areas of habitat, must not be substantially impacted.
3. The water quality of a major or river, major or minor creek, or a listed SEPP 14 wetland, must not be significantly impacted.

The remaining red flag variation criteria (2.4.3 – species that cannot withstand further loss) does not need to be addressed in this application as there are no such red flag species to be impacted in the BCAA.

The following sections provide the information required for the OEH to assess a red flag variation for the impacted areas of the CEEC, CPW (Section 5.2.1, 5.2.2), and the impacted areas with regional or state biodiversity conservation significance in the BCAA (Section 5.2.3).

5.2.1 Avoiding and Minimising Impacts on Red Flags (Criteria 2.4.1 of the BCAM)

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

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

The plans for the ECBGL residential estate have undergone extensive community and stakeholder consultation, including with the DPE and the OEH, since 2004 when Council resolved to prepare draft LEPs for Camden Lakeside (APP 2007) and land within the Central Hills area at Gledswood Hills, known as the El Caballo Blanco & Gledswood (CC 2012)(**Appendix A**).

A Local Environment Study was prepared and publicly exhibited in November 2007 for Camden Lakeside and February 2009 for El Caballo Blanco and Gledswood as part of this process. The Local Environment Study was supported by a number of specialist studies including Flora and Fauna assessments undertaken by Cumberland Ecology (2005 and 2007) and Eco Logical Australia (2007) and a Vegetation Management Strategy (ELA 2011b).

The rezoning proposal for Camden Lakeside was gazetted in May 2009 and for El Cabello Blanco and Gledswood in March 2013. The Camden LEP was subsequently amended.

The objective of the planning proposals was to provide controls through rezoning that would allow a high quality, low scale residential and golf course development in a landscape setting of the Gledswood Homestead and Central Hills (CC 2012).

At the commencement of this biocertification assessment, the land proposed for Biocertification included all of the land zoned General Residential in the Camden LEP 2010. Following consultation with Camden Council and OEH, the BCAA boundary was modified and separate development applications were lodged for the Golf Course and Corade land. Within the remaining BCAA boundary, the design and configuration of the proposed development precincts within the land to be certified were modified a number of times to avoid and reduce impacts to red flag vegetation within and adjacent to the BCAA where possible, including the following measures:-

- A reduction of impacts to 0.97 ha of red flagged vegetation in Stage 3 zoned residential and adding this to a 'retained' area, of 6.57 ha that will be subject to the Riley's Creek VMP and forms part of the EPBC Act offset requirement for the project (**Figure 23**)
- The avoidance of 5.59 ha of red flagged vegetation in the southern part of the BCAA that is categorised as 'retained land', 4.98 ha of which and will be subject to a VMP as part of the Vegetation Management Strategy for the El Cabello/Gledwood section of the BCAA and forms part of the EPBC Act offset requirements (**Figure 3**). The remainder of this red flag vegetation is impacted by a separate DA that is not part of the biocertification application.
- assessment and inclusion of the APZ requirements within the certified land footprint. These APZ impacts are counted as 100% loss of biodiversity values as shown in **Figure 4**, however under the performance objectives of APZs will retain significant biodiversity values, thus minimising impacts to red flag vegetation (in particular the 15m APZ provided around the proposed Stage 6 precinct that contributes 0.41 ha of red flagged vegetation).
- Inclusion of 0.43 ha of red flagged vegetation in the land to be certified in an 'urban' park within the proposed Stage 2/3 development precinct which will also retain a significant proportion of the existing tree canopy and contribute to the overall landscape

i.e. of the 18.16 ha of red flagged vegetation within the BCAA, 4.98 ha will be avoided and managed under VMPs to enhance and retain the native vegetation. Of the 12.57 ha that will be impacted, 0.84 ha will be managed as APZ or an urban park and thus not completely lost. Further, of the impacted patches of red flag vegetation, e.g. the patches in Stages 1 and 2 (Red Flag Group 2), Stage 6 (Red Flag Group 4) and Stages 5 and 6 (Red Flag Group 5) are of 'degraded condition' and considered not viable or Stages 7 and 8 (Red Flag Group 3) were too small to be viable as outlined in **Section 5.2.2.**

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

Under the Camden LEP the majority of the impacted red flag vegetation is zoned R1 General Residential and RE2 Private Recreation, with a small amount zoned E2 Environmental Conservation (proposed road joining Stages 4 and 5 in **Figure 6**). The area zoned Environmental Conservation is a red flag area, both supporting a CEEC and a riparian buffer 20 m either side of a minor creek.

The red flagged land has historically and is currently used primarily for agricultural production and private recreation – cattle grazing and horse agistment associated with the previous El Cabello Blanco equine facility and Australiana Park. Under the current land zoning, the land is not required to be managed for conservation and there is no adequate source of funding available to manage the land for conservation without a development outcome providing a source of funding, removing livestock and setting aside areas for in perpetuity conservation.

5.2.2 Assessment criteria for red flag areas that contain CEECs (Criteria 2.4.2 of the BCAM)

Viability (Criteria 2.4.2.1 of the BCAM)

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 <u>one</u> 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 <u>outside benchmark for many</u> 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.

Reference is made to **Table 25** and **Figure 22** when addressing the viability of red flag vegetation comprising the CEEC in the BCAA. In summary, 12.57 ha of red flag CPW, which occurs in three condition classes (in five red flag groupings) will be impacted.

Note that different criteria/factors (a, b, c or d) are considered in assessing the viability of the separate CEEC red flag groups. Not all CEEC red flag groups are discussed under the different factors given viability is dependent on a number of factors, with some factors more relevant for some CEEC red flag groups and not others. However, each CEEC red flag group is discussed under at least one of the factors to demonstrate that viability of biodiversity values in red flag groups is low or not viable. **Table 26** summarises the criteria that are satisfied by the CEEC red flag group, with detail provided under each criteria. Criteria 'd' was not met by any of the red flag groups so is not discussed.

Table 26: Criteria satisfied by CEEC red flag groups

CEEC red flag group	Section 2.3.2.2. criteria satisfied
Group 1	A - current and/or future proposed land use surrounding red flag area reduces viability
Group 2	A - current and/or future proposed land use surrounding red flag area reduces viability C - red flag area is substantially degraded
Group 3	B – size and connectedness is insufficient to maintain viability
Group 4	C - red flag area is substantially degraded
Group 5	C - red flag area is substantially degraded

a) Current or Future Land Use surrounding the red flag area

Lands surrounding the red flag groups 1 and 2 are currently zoned general residential and private recreation. Although mostly zoned residential, land is currently used and has historically been used for grazing cattle. This current land use reduces the viability of CPW in these areas. The red flag groups occur as relatively small patches (Group 1 is 1.41 ha, Group 2 is 6.11 ha), with red flag group 1 contiguous with a larger patch of CPW that occurs in proposed 'retained' land that will be managed as part of the Riley's Creek VMP and as an EPBC Act offset. However, red flag groups 1 and 2 are surrounded by open, exotic grassed areas that are grazed. Current land use is likely to result in on-going long-term impacts on the edges of the patches, particularly red flag group 2 which includes narrow sections. These impacts, termed "edge effects" describe the various consequences on vegetation and wildlife, which occur as a result of vegetation sharing a border with a developed/cleared area.

The type of edge effects likely to impact the vegetation patches at these locations, under existing land uses and without active conservation management include nutrient enrichment, weed invasion and lack

of natural regeneration. Indeed, red flag groups 1 and 2, particularly red flag group 2, are already subject to weed invasion. Plot 34-1 within red flag group 2 recorded 32% exotic plant cover, with other plots within red flag group 2 (plot 34-2 and 32-3) recording 12% and 16.5% exotic plant cover, respectively. Plots located close to red flag group 1 (plots 30-2 and 30-3), which were part of the same patch of vegetation but occur within proposed 'retained' land, each recorded 12% exotic plant cover (see 'EPC' [Exotic Plant Cover] column in tables presented in **Appendix G**).

Although the vegetation in red flag groups 1 and 2 have a good level of plant species diversity and are in good condition, because this land is not protected in some form of reserve, and these impacts are currently not actively managed or will not be managed in the future, current land use will result in a long-term decline in biodiversity values.

b) Size and connectedness

The size and connectedness of the vegetation comprising red flag group 3 are insufficient to maintain their viability, reducing the viability of CPW represented by this red flag group. The total area of patches comprising red flag group 3 is 1.29 ha. However, the group is comprised of ten smaller patches, ranging in size from 0.004 ha to 0.58 ha. The patches in red flag group 3 also have minimal connectivity given their location in the BCAA (within an existing Golf Course), although planted vegetation improves connectivity to other patches of CPW west of red flag group 3. Relatively small areas of native vegetation can be unviable or have low viability.

c) Vegetation substantially 'outside' of benchmark condition

Red flag groups 2, 4 and 5 were considered to be 'degraded', despite their being in biometric 'moderate-good' condition. The site value scores for the vegetation zones that comprised red flag groups 2, 4 and most of red flag group 5 (i.e. vegetation zone 2 for red flag group 2, vegetation zone 1 for red flag group 4, and vegetation zones 1 and 2 for red flag group 5) were low at 42.36 and 47.57 for vegetation zones 1 and 2, respectively. These are close to a site value score of 34 which is considered 'low condition' and therefore not red flagged. Red flag group 5 also contained a small amount of vegetation in vegetation zone 3. The site value score for vegetation zone 3 was higher at 61.98. However, this vegetation zone was also considered to be 'degraded'. The high site value score for vegetation zone 3 was due to the number of trees with hollows recorded (two hollows from one plot representing this zone). Of the vegetation condition variables, the number of trees with hollows is highly weighted (20%), and consequently increased the site value score significantly. The majority of other vegetation condition variables for vegetation zone 3 were either 'below' or 'above' benchmark (i.e. outside of benchmark condition.

Plot data for vegetation zone 1 collected where red flag group 4 was located (plot CL-26b) showed that the majority of vegetation condition variables were outside benchmark. Native over-storey and mid-storey cover values, and the length of fallen logs, were below benchmark, while native groundcover (grass) and (shrubs) cover values were above benchmark (i.e. of the 8 attributes with a benchmark value, 5 were either below or above benchmark which is considered to meet the criteria that "*Degraded condition means substantially outside benchmark for <u>many of the vegetation condition variables</u> as listed in Table 1 of the methodology"*. Similarly, plot data for vegetation zone 2 collected where red flag groups 2 and 5 were located (plots 34-1, 34-2, 34-3, and CL-11) showed that the majority of vegetation condition variables were outside benchmark. The number of native species, native over-storey and mid-storey cover values, number of trees with hollows, and the length of fallen logs, were below benchmark, while native groundcover (grass) cover values were above benchmark.

Details of plot data are presented in **Appendix G**.

Contribution to Regional Biodiversity Values (Criteria 2.4.2.2 of the BCAM)

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 CEEC, CPW, in the BCAA, 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 subregion of the Hawkesbury Nepean CMA) and adjoining CMA subregions: the Cumberland (Sydney Metro), Burragorang, Pittwater, Sydney Cataract (Hawkesbury/Nepean), Sydney Cataract (Sydney Metro), Wollemi, and Yengo CMA subregions as shown in **Figure 24**.

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.

Information on the contribution to regional biodiversity values, including an assessment of the relative abundance of the red flagged vegetation type, the percent remaining of the vegetation type, and percent native vegetation remaining in the region, is 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 types across the entire 'region'. The associated data layers that were assessed included:

- Sub CMA Cumberland and Yengo (Hawkesbury Nepean) (Cumberland Plain western Sydney vegetation mapping; NPWS 2002);
- Sub CMA Cumberland (Sydney Metro) (Cumberland Plain western Sydney vegetation mapping; NPWS 2002);
- Sub CMA Pittwater (Cumberland Plain western Sydney vegetation mapping; NPWS 2002);
- Sub CMA Burragorang and Wollemi (Hawkesbury-Nepean) (Native Vegetation of the Warragamba Special Area; NPWS 2003a); and
- Sub CMA Sydney Cataract (Hawkesbury-Nepean and Sydney Metro) (Native Vegetation of the Woronora, O'Hares and Metropolitan Catchments; NPWS 2003b).

ELA is confident that the data used capture the majority of the BVT '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' as the extent of this BVT is restricted to the 'region' as defined by the BCAM and is largely incorporated into the mapping used. The results of the analysis can be seen in **Table 27** and the distribution of the BVT is displayed in **Figure 25**.

The results for the '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' are summarised below:

- 14,350 ha (of which 5,707 ha is in condition class A, B or C) is recorded within the Cumberland (Hawkesbury Nepean) CMA where the BCAA is located. The clearing of 12.57 ha of red flagged vegetation represents 0.09% of the total extent of the BVT in the Cumberland (Hawkesbury Nepean) CMA and 0.22% in condition A, B or C.

- In the region (17,839 ha, of which 6,711 ha is in condition class A, B or C), 12.57 ha to be impacted by this proposal represents 0.07% of the extant '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion'* or 0.19% of the extent of condition class A, B or C in the region.

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

Table 27: Relative abundance of red flag vegetation/CEECs in surrounding regions

Biometric vegetation type	Area impacted (ha)	Vegetation condition#	Area in Sub CMA (ha)								Total area in sub CMAs (ha)
			Cumberland (HN)	Cumberland (SM)	Burragorang	Pittwater	Sydney Cataract (HN)	Sydney Cataract (SM)	Wollemi	Yengo	
Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	12.57	ABC	5,707	861	0.29	0	0	4	0	173	6,745.29
		Cmi & Txs	8,643	2,000	95	0	0	57	22	277	11,094
Total			**14,350**	**2,861**	**95.29**	**0**	**0**	**61**	**22**	**450**	**17,839.29**

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

Figure 24: 'Region' derived from adjacent CMA subregions

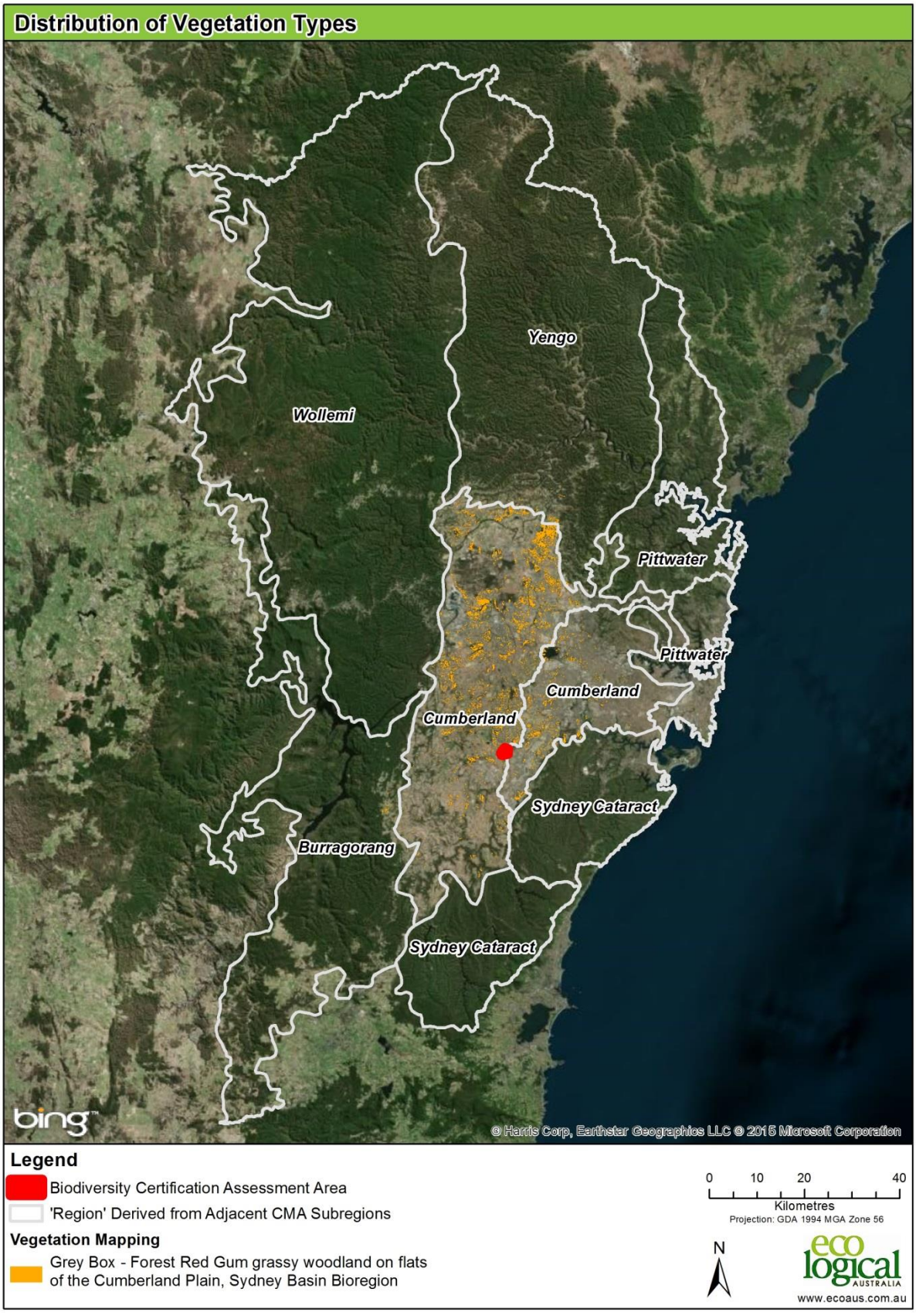

Figure 25: Regional distribution of red flag vegetation

b) Percent Remaining is high

There are few data sources available to determine the percent remaining of the vegetation type in the 'region'. While the database for BVTs (DECC 2008a) has estimates for the percent remaining of each vegetation type, estimates are for entire CMAs, not for individual CMA subregions. Information at the subregion level is required to estimate the percent remaining of the vegetation type in the 'region' given the definition of 'region' includes the CMA subregion in which the BCAA occurs and adjoining CMA subregions.

Given the lack of data sources to determine the percent remaining of the vegetation type in the 'region', information on the percent remaining of the vegetation type in the Hawkesbury Nepean CMA and the Sydney Metro CMA from the BioMetric Vegetation Types database (DECC 2008a) is provided. It is acknowledged that the percent remaining of the vegetation type in these CMAs may not be an accurate reflection of the percent remaining in the 'region'. To supplement information, the National Parks and Wildlife Service's (NPWS) Cumberland Plain western Sydney vegetation mapping (NPWS 2002) was also used. The pre-1750 data for each vegetation type was compared to the extent remaining to determine the percent remaining for the red flagged vegetation type.

The results of the analysis are shown in **Table 28**. The BVTs database (DECC 2008a) records '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' as being 95% cleared within the Hawkesbury Nepean CMA and 85% cleared within the Sydney Metro CMA, therefore leaving 5-15% of the vegetation type remaining. Using the vegetation types in Western Sydney mapping for the Cumberland CMA sub-region (NPWS 2002), 7.7% of the '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' with canopy cover >10%, remains (i.e., condition A, B, C), though with the inclusion of all remaining vegetation (i.e. including condition Tx), 20.5% remains. Note that the mapping by NPWS (2002) does not included derived native grasslands in these percent remaining figures, which also meets the biometric condition 'moderate-good' definition. Thus, a proportion of the Tx category meets the biometric condition 'moderate-good' definition and thus would be red flagged.

Table 28: Percent remaining of each vegetation type/CEEC

Biometric vegetation type	Area impacted (ha)	% remaining in Hawkesbury Nepean CMA (DECC 2008a)	% remaining in the Sydney Metro CMA (DECC 2008a)	% remaining in the Cumberland Plain (ABC condition) (NPWS 2002)	% remaining in the Cumberland Plain (ABC & Tx condition) (NPWS 2002)
Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	12.57	5	15	7.7	20.5

c) Percent Native Vegetation (by area) is high

The area of native vegetation was calculated for the region, being the Cumberland (Hawkesbury/Nepean), Cumberland (Sydney Metro), Wollemi, Burragorang, Sydney Cataract, Sydney Cataract, Pittwater and Yengo CMA subregions, is shown in **Table 29** and **Figure 26**. The OEH state-wide vegetation extent layer was used for the assessment (Keith and Simpson 2006) and was intersected with the six CMA subregions to determine the proportion of each region with native vegetation cover.

Table 29: Native vegetation cover of CMA subregions

Native vegetation cover	Burragorang (ha)	Cumberland (ha)	Pittwater (ha)	Sydney Cataract (ha)	Wollemi (ha)	Yengo (ha)	Total (ha)
Cleared	41,567 (18%)	231,218 (84%)	44,079 (35%)	17,095 (12%)	21,260 (4%)	29,613 (9%)	384,831 (24%)
Vegetated	192,769 (82%)	44,200 (16%)	80,915 (65%)	131,254 (88%)	485,884 (96%)	293,273 (91%)	1,228,296 (76%)
Total	**234,335 (100%)**	**275,418 (100%)**	**124,994 (100%)**	**148,349 (100%)**	**507,144 (100%)**	**322,886 (100%)**	**1,613,127 (100%)**

In total, 76% (1,228,296 ha) of the assessment region contains native vegetation cover. The proportion of vegetation cover for five of the CMA subregions is high, with Burragorang containing 82%, Pittwater containing 65%, Sydney Cataract containing 88%, Wollemi containing 96% and Yengo containing 91% vegetation cover. As stated earlier, the vegetation types impacted are predominantly located on the Cumberland Plain, and therefore very little of the vegetation types are 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.

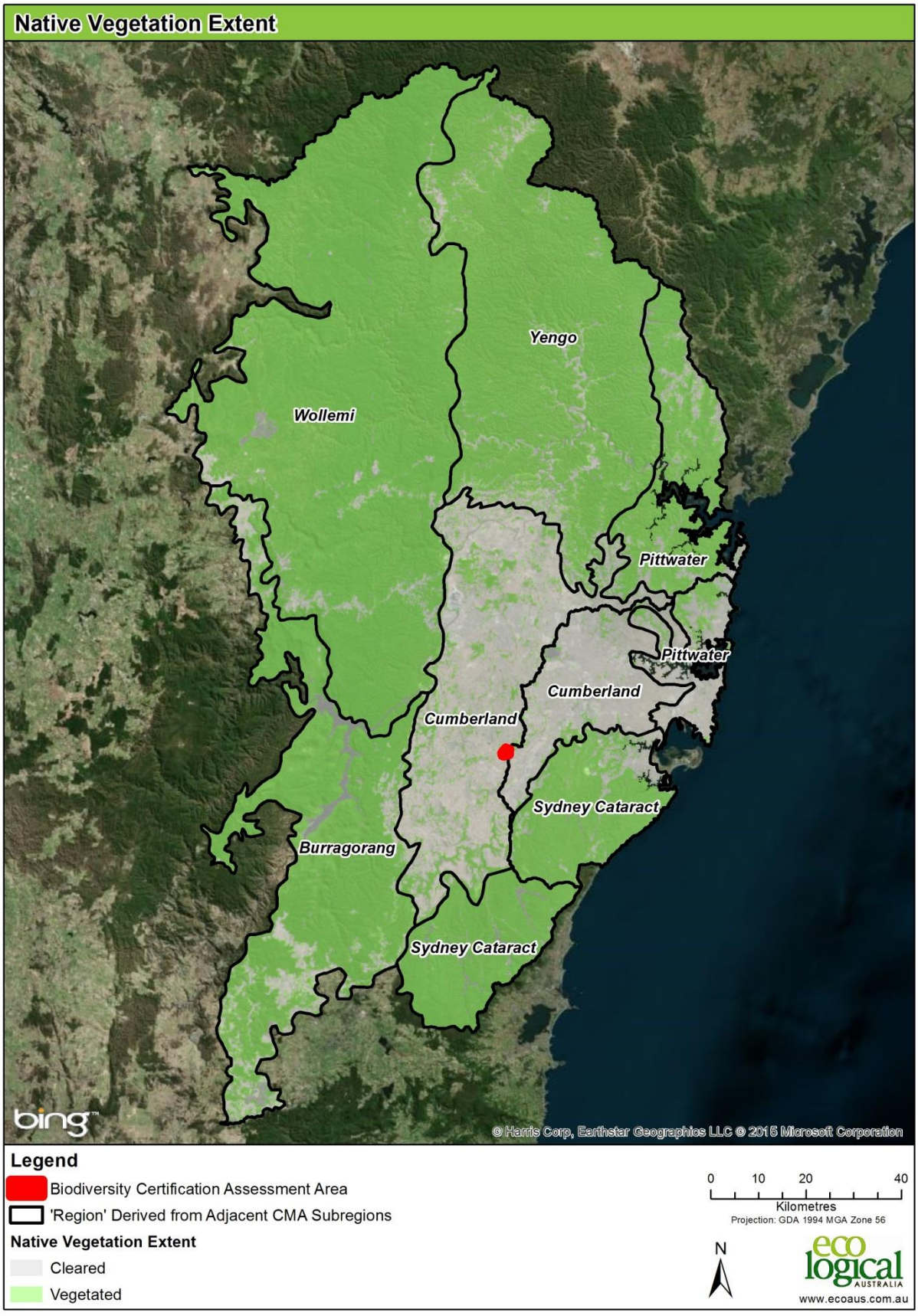

Figure 26: Native vegetation extent

5.2.3 Additional assessment criteria for areas with regional or state biodiversity conservation significance (Criteria 2.4.4 of the BCAM)

Width of riparian buffer with regional or state biodiversity significance (Criteria 2.4.4 (1))

The width of a riparian buffer with regional or state biodiversity significance (i.e. the riparian buffers on major or minor creeks and rivers) must not be substantially reduced. The proposal will reduce the riparian buffer on streams within the BCAA (**Table 24** and **Figure 17**). However, the reduction is not considered to be substantial, with only 0.08 ha impacted. The BCAA contains a total of 0.10 ha of riparian buffers of regional or state biodiversity significance. It is also noted that the streams to which the major or minor rivers database refers to no longer exist on the ground, having been significantly modified during the construction of the Lakeside Golf Course in the 1990's.

The riparian buffers that will be impacted are located in the north of the BCAA where residential development and a road are proposed (**Figure 17** and **Figure 21**). The width of the riparian buffers impacted in the north of the BCAA will be reduced to 27 m and by 40 m by residential development and the road, respectively, over a short distance of less than 100 m. This is not considered to be a substantial reduction in the riparian corridor. The riparian corridors in this area are poorly defined, generally lack vegetation and have been significantly modified during earth works associated with the development of the Lakeside Golf Course in the 1990's. Where a defined drainage channel remains, culverts will be incorporated into the road at the point where the road crosses the riparian buffer.

Ecosystem functioning of a state or regional biodiversity link (Criteria 2.4.4 (2))

There are no state or regional biodiversity links in the BCAA, and as such, this criteria has not been addressed.

Water quality of the minor creek (Criteria 2.4.4 (3))

The water quality of a major river, minor river, major creek, minor creek, or a listed SEPP 14 wetland must not be significantly impacted. The proposal will result in impacts to vegetation present within riparian buffers in the north of the BCAA where residential development and a road are proposed (**Figure 17** and **Figure 21**).

Removal of vegetation from within these riparian buffers is unlikely to significantly impact water quality provided controls are in place to prevent sediment from being transported in to creeks during vegetation removal, and erosion controls are installed pre and post-vegetation removal. Standard sediment and erosion controls will be implemented during vegetation clearing associated with residential development and the construction of roads. Controls associated with diverting water from hard surfaces will also be implemented as part of the development approval process. These controls will prevent impacts to water quality in creeks adjacent to vegetation that will be cleared where soil will be exposed by the removal of trees. As stated above, the riparian corridors in this area are poorly defined, generally lack vegetation and have been significantly modified during earth works associated with the development of the Lakeside Golf Course in the 1990's. Where a defined drainage channel remains, culverts will be incorporated into the road at the point where the road crosses the riparian buffer.

6 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.

6.1 Land proposed for biodiversity certification

The land proposed for biodiversity certification is shown in **Figure 3** in **Section 1** of this report.

6.2 Land proposed for biodiversity conservation

On-site conservation measures

As there is no land subject to conservation measures within the BCAA, the entire ecosystem and species credit deficit will need to be met from outside the BCAA.

Off-site conservation measures

SH Camden Valley Pty Ltd will secure **293** credits for direct impacts to '*Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain'* and **3** credits for indirect impacts, **18** credits for Cumberland Plain Land Snail, by purchasing the required credits from registered Biobank sites in the Cumberland Plain CMA subregion.

A Biobank Agreement application has been submitted for registration of 300 *Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' (HN528) credits at the proposed Hamden Vale Biobank site in the Wollondilly LGA. An agreement has been entered into with the owner of the Hampden Vale site to supply 296 HN528 credits in accordance with the proposed staging plan in **Table 32**. The owner has also consented to the application for biodiversity certification as an 'affected party' and enter into a Biocertification Agreement with the Minister for the Environment under Section 126ZH of the TSC Act.

Several sources of Cumberland Land Snail credits have been identified and an agreement has been reached with the owner of the Summer Hill Biobank site (Agreement No. 100), who has submitted a variation to an existing agreement to generate Cumberland Land Snail credits. The owner has agreed to sell 18 Cumberland Land Snail credits to SH Camden Valley. The owner has also consented to the application for biodiversity certification as an 'affected party' and enter into a Biocertification Agreement with the Minister for the Environment under Section 126ZH of the TSC Act. These credits will be retired

in accordance with the proposed staging plan in **Table 32**. Should these credits not be available, alternative sources of Cumberland Land Snail credits have been identified that will be able to be secured prior to impacts occurring.

An agreement has been entered into with the owner of the Summer Hill Biobank site (Agreement No. 100) to sell 18 Cumberland Land Snail credits to SH Camden Valley.

SH Camden Valley will not commence any clearing for any Stage of development until the required number of credits has been secured, purchased and retired as indicated in **Section 6.3.1**.

Table 30: Summary of ecosystem credit surplus/deficit

BioMetric vegetation type	Condition	Ancillary code	Credits required (Direct impacts)*	Credits generated	Credit status
Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion	Moderate to good	Intact	59	0	-293
	Moderate to good	Sparse	179	0	
	Moderate to good	Weedy	44	0	
	Low	Scattered trees	4	0	
	Low	Derived native grassland	7	0	
Total			**293**	**0**	**-293**

*An additional 3 ecosystem crest are required for indirect impacts

Table 31: Summary of species credit surplus/deficit

Habitat	Credits required	Credits generated	Credit status
Cumberland Plain Land Snail	18	0	-18

6.3 Any person or body proposed as a party to the biodiversity certification

The owners of the proposed Hamden Vale Biobank site and Summer Hill BioBank site have consented to be signatories to the application for biodiversity certification as an 'affected party' and enter into a Biocertification Agreement with the Minister for the Environment under Section 126ZH of the TSC Act.

6.3.1 Timing of credit retirement

It is proposed to "retire" the 296 ecosystem credits required for direct and indirect impacts and 18 species credits in accordance with the staged development of the certified land as outlined in **Table 32** and **Table**

33 and shown in **Figure 6**. The number of credits to be retired is based on the area of vegetation calculated to be cleared in each stage of development.

A likely time frame is provided; however, this will be subject to a range of factors including the demand for housing lots and may occur sooner or later than indicated. No clearing of mapped vegetation will occur in each stage until Sekisui House Australia has provided proof of the retirement of the required quantum of credits in accordance with **Table 32** and **Table 33**.

This proof will be in the form of a 'certificate' of credit retirement issued by the OEH.

Table 32: Indicative staging of development and retirement of ecosystem credits

Stage	Likely timeframe	Area of Grey Box - Forest Red Gum grassy woodland on flats impacted (ha)	Proportion of total vegetation impacted (5)	BBAM credits required	Cumulative total BBAM credits	Indirect Impacts
Stage 1	0-2 Years	4.23	30.18	88	88	
Stage 2	2-3 Years	2.02	14.45	42	130	
Stage 3	3-4 Years	1.82	12.96	38	168	
Stage 4	2-3 Years	0.55	3.93	12	180	1
Stage 5	3-4 Years	2.05	14.60	43	223	
Stage 6	3-4 Years	1.34	9.58	28	251	
Stage 7	4-6 Years	1.42	10.14	30	281	1
Stage 8	5-7 Years	0.58	4.16	12	293	1
Total		**14.01**	**100**	**293**		**3**

Table 33: Indicative staging of development and retirement of Cumberland Plain Land Snail species credits

Stage	Likely timeframe	Area of Cumberland Plain Land Snail habitat impacted (ha)	Proportion of total habitat impacted	BBAM credits required	Cumulative total BBAM credits
Stage 1	0-2 Years	0	0	0	0
Stage 2	2-3 Years	0	0	0	0
Stage 3	3-4 Years	0	0	0	0
Stage 4	2-3 Years	0	0	0	0
Stage 5	3-4 Years	0	0	0	0
Stage 6	3-4 Years	1.34	100	18	18
Stage 7	4-6 Years	0	0	0	18
Stage 8	5-7 Years	0	0	0	18
Total		1.34	100	18	

6.4 Is an Improve or Maintain Outcome Achieved?

Subject to the Director-Generals consideration and approval of red flag variation request, an '*improve or maintain*' outcome can be achieved by the retirement of ecosystem credits from the proposed conservation lands, and the purchase and retirement of **296** ecosystem credits and **18** Cumberland Plain Land Snail credits from outside the BCAA.

6.5 Statement of commitments

Sekisui House Australia will prepare and implement a Construction Environment Management Plan (CEMP) to guide the development outlined in this biocertification assessment and ensure that all direct and indirect impacts (e.g. APZs, utilities, access, stormwater run-off) are contained within the certified land footprint and appropriate mitigation measures are put in place to minimise indirect impacts to any threatened fauna.

This will include, but not be limited to:

- Temporary and permanent protective fencing will be erected around all areas identified for conservation prior to clearing activities to minimise any inadvertent damage
- Pre-clearance surveys of threatened fauna will be undertaken in accordance with a Fauna pre-clearance protocol prior to any clearing of vegetation
- Protocols for clearing vegetation and adaptive reuse of vegetative material for restoration and habitat augmentation in areas indicated for restoration activity (i.e. fallen logs in conservation areas) will be prepared and implemented.

References

APP Corporation Pty Ltd 2007 Camden Lakeside Rezoning Local Environmental Study. Report prepared for Camden Council by APP Corporation Pty Ltd, November 2007.

Bureau of Meteorology (BOM) 2015a. *Climate statistics for Camden Airport (station 068192)*. Available online: http://www.bom.gov.au/climate/averages/tables/cw_068192.shtml

Bureau of Meteorology (BOM) 2015b. *Daily Weather Observations at Camden Airport (station 068192)*. Available online: http://www.bom.gov.au/climate/dwo/201411/html/IDCJDW2024.201411.shtml

Camden Council (CC) 2010. *Camden Local Environmental Plan*. Available online at: http://www.legislation.nsw.gov.au/maintop/view/inforce/epi+514+2010+cd+0+N

Camden Council 2012 El Caballo Blanco & Gledswood Rezoning Planning Proposal. Report prepared by Camden Council and APP Corporation Pty Ltd, February 2012.

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

Cumberland Ecology 2005. *Central Hills Ecological Assessment*. Report prepared for Camden Council.

Cumberland Ecology 2007. *Camden Lakeside and Gledswood Rezoning Ecological Assessment*. Report prepared for Camden Council.

Department of Environment (DoE) 2015. *Protected Matters Search Tool*. Search undertaken around coordinates -34.004529 150.783797 on 19 October 2015. Accessible at: http://www.environment.gov.au/epbc/protected-matters-search-tool

Department of Environment and Conservation (DEC) 2004 *Threatened species survey and assessment; guidelines for developments and activities (working draft)* New South Wales Department of Environment and Conservation, Hurstville, NSW.

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

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

Eco Logical Australia (ELA) 2007. *El Caballo Blanco and Gledswood Rezoning*. Report prepared for Camden Council.

Eco Logical Australia (ELA) 2009. *El Caballo Blanco and Gledswood Rezoning – Riparian Assessment Review*. Letter report prepared for Sekisui House Developments Pty Ltd to the Department of Water and Energy.

Eco Logical Australia (ELA) 2010. *Camden Lakeside Stage 1 Development – Residential Lots, Ecological Assessment*. Report prepared for SH Camden Lakeside Pty Ltd.

Eco Logical Australia (ELA) 2011a. *El Caballo Blanco, Gledswood and Scenic Hills 1-3 Rezoning – Camden Natural Assets Policy and Vegetation Offset Requirements*. Report prepared for APP Corporation.

Eco Logical Australia (ELA) 2011b. *El Caballo Blanco/Gledswood - Vegetation Management Strategy*. Report prepared for SH Camden Valley Pty Ltd on behalf of the Landowners.

Eco Logical Australia (ELA) 2013a. *Catherine Fields (Part) Precinct: Australasian Bittern Habitat*. Report prepared for NSW Department of Planning and Infrastructure.

Eco Logical Australia (ELA) 2013b. *El Caballo Blanco, Gledswood and Lakeside – EPBC Act Impact Assessment*. Report prepared for SH Camden Lakeside Pty Ltd.

Eco Logical Australia (ELA) 2013c. *El Cabello Blanco, Gledswood and Lakeside Development Referral*. Prepared on behalf of Sekisui House.

Eco Logical Australia (ELA) 2014. *Catherine Park Stage 1 Flora and Fauna Assessment.* Report prepared for Hixson Pty Ltd.

Eco Logical Australia (ELA) 2015a. *Emerald Hills Biocertification Assessment Report and Strategy*. Report prepared for Inspire Macarthur Developments Pty Ltd.

Eco Logical Australia (ELA) 2015b. *Biodiversity Certification Expert Report for Emerald Hills Estate – Green and Golden Bell Frog (*Litoria aurea*)*. Report prepared for Macarthur Developments Pty Ltd.

Eco Logical Australia (ELA) 2015c. *Lot 1203 Gledswood Flora and Fauna Assessment*. Report prepared for SH Camden Valley Pty Ltd & Corade Developments Pty Ltd.

Eco Logical Australia (ELA) 2015d. *Vegetation Management Plan El Cabello Blanco and Gledswood Estate (ECBG) Golf Course*. Report prepared for SH Camden Valley Pty Ltd Pty Ltd, July 2015.

Eco Logical Australia (ELA) 2015e.*Vvegetaion Management Plan Riley's Creek Riparian Corridor* . Report prepared for SH Camden Valley Pty Ltd & Corade Developments Pty Ltd, July 2015.

Keith, D. A. and Simpson, C. 2006. *Spatial data layers for extant native vegetation in NSW*. Department of Environment and Climate Change.

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

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

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

Office of Environment and Heritage (OEH) 2015a. *Biodiversity Certification Guide to Applicants*. Office of Environment and Heritage, May 2015

Office of Environment and Heritage (OEH) 2015b. *Atlas of NSW Wildlife database*. Office of Environment and Heritage. Search undertaken around coordinates -34.004529 150.783797 on 19 October 2015.

Office of Environment and Heritage (OEH) 2015c. *Biodiversity Certification Operational Manual*. Office of Environment and Heritage, May 2015

Office of Environment and Heritage (OEH) 2015d. *Threatened Species Profiles*. Office of Environment and Heritage. Available online: http://www.environment.nsw.gov.au/threatenedspecies/

Tozer, M. G., Turner, K., Keith, D. A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. and Cox, S. 2010. 'Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands'. *Cunninghamia* **11(3):** 359-405.

Appendix A: El Cabello Blanco - Gledswood and Camden Lakeside Planning Proposal Reports

Provided as separate documents.

Appendix B: Threatened species likelihood tables and assessment of candidate species

The table below lists the threatened species known or considered likely to occur within the BCAA based on previous surveys, Atlas, EPBC Act Protected Matters Search, Biodiversity certification credit calculator tool and/or expert opinion. Those species categorised as 'species credit' species (all threatened flora species and approximately half of all threatened fauna species) that were filtered into the BCAA by the biocertification credit calculator version 1.9 and validated as species credit species against the threatened species profile ecological data from the BioNet Atlas of NSW Wildlife (Step 1 of section 4.3 of the BCAM) are indicated. At this stage of the candidate species assessment, additional species are added to the list if they have been recently listed in the TSC Act, there are records on the Atlas or have been recorded in past ecological surveys/reports (Step 2 of section 4.3 of the BCAM). A Wildlife Atlas search was undertaken by ELA in October 2015 to identify any additional species to be added to the table.

The 'Likelihood' and 'Justification' columns justifies the culled list of candidate species for further assessment and the 'Additional survey required' indicates whether additional survey is required to complete a formal Biocertification assessment (Step 3 of section 4.3 of the BCAM).

Five categories for likelihood of occurrence of species are used in this report and are defined below. Assessment of likelihood was based on species locality records, presence or absence of suitable habitat features within the BCAA, results of previous studies, on site field surveys and professional judgement.

- known/yes - the species is known to occur within suitable habitat within the study area.
- likely - a medium to high probability that a species occupies or uses habitat within the study area.
- potential - suitable habitat for a species occurs within the study area, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur.
- unlikely - a very low to low probability that a species occupies or uses habitat within the study area.
- no - habitat within the study area and in the immediate vicinity is unsuitable for the species, or, in the case of plants, the species was not located during searches of the study area.

TSC/EPBC Act Status

- CE = Critically Endangered species, population or ecological community.
- E = Endangered species, population (E2) or ecological community (E3).
- V = Vulnerable species, population or ecological community.

Threatened flora

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
Acacia bynoeana	Bynoe's Wattle	E	V	BCAM	*Acacia bynoeana* is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains, and has recently been found in the Colymea and Parma Creek areas west of Nowra. It is found in heath and dry sclerophyll forest, typically on a sand or sandy clay substrate, often with ironstone gravels (OEH 2015d).	No	No	No suitable habitat present.	No
Acacia pubescens	Downy Wattle	V	V	Atlas, BCAM, PMST	*Acacia pubescens* occurs on the NSW Central Coast in Western Sydney, mainly in the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. It is associated with Cumberland Plains Woodlands, Shale / Gravel Forest and Shale / Sandstone Transition Forest growing on clay soils, often with ironstone gravel (OEH 2015d).	No	Potential	Suitable habitat present.	Yes
Allocasuarina glareicola		-	E	PMST	*Allocasuarina glareicola* is primarily restricted to the Richmond district on the north-west Cumberland Plain, with an outlier population found at Voyager Point. It grows in Castlereagh woodland on lateritic soil (OEH 2015d).	No	No	No habitat present and outside known range.	No
Asterolasia elegans		E	E	PMST	*Asterolasia elegans* is restricted to a few localities on the NSW Central Coast north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs. It is found in sheltered forests on mid- to lower slopes and valleys, in or adjacent to gullies (OEH 2015d).	No	No	No habitat present and outside known range.	No
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	PMST	*Cryptostylis hunteriana* is known from a range of vegetation communities including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); where it appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*). Coastal Plains Scribbly Gum Woodland and Coastal Plains Smoothed-barked Apple Woodland is potential habitat on the Central Coast. Flowers between November and February, although may not flower regularly (OEH 2015d).	No	No	No suitable habitat present.	No
Cynanchum elegans	White-flowered Wax Plant	E	E	Atlas, BCAM, PMST	*Cynanchum elegans* is a climber or twiner with a variable form, and flowers between August and May, peaking in November. It occurs in dry rainforest gullies, scrub and scree slopes, and prefers the ecotone between dry subtropical rainforest and sclerophyll woodland/forest. The species has also been found in littoral rainforest; *Leptospermum laevigatum – Banksia integrifolia* subsp. *integrifolia* coastal scrub; *Eucalyptus tereticornis* open forest/ woodland; *Corymbia maculata* open forest/woodland; and *Melaleuca armillaris* scrub to open scrub (OEH 2015d).	No	No	No suitable habitat present.	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
Dillwynia tenuifolia		V	-	BCAM	The core distribution is the Cumberland Plain from Windsor and Penrith east to Dean Park near Colebee. Other populations in western Sydney are recorded from Voyager Point and Kemps Creek in the Liverpool LGA, Luddenham in the Penrith LGA and South Maroota in the Baulkham Hills Shire. In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays (OEH 2015d).	No	Potential	Marginal habitat present.	Yes
Eucalyptus benthamii	Camden White Gum	V	V	Atlas, PMST	*Eucalyptus benthamii* occurs in wet open forest on well drained sandy alluvial soils along stream channels, small terraces and alluvial flats on valley floors (OEH 2015d).	No	No	No suitable habitat present.	No
Genoplesium baueri	Bauer's Midge Orchid	V	-	Atlas, PMST	Known from coastal areas from northern Sydney south to the Nowra district. Previous records from the Hunter Valley and Nelson Bay are now thought to be erroneous. Grows in shrubby woodland in open forest on shallow sandy soils (OEH 2015d).	No	No	No suitable habitat present.	No
Grevillea juniperina subsp. *juniperina*	Juniper-leaf Grevillea	V	-	BCAM	Endemic to Western Sydney. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels. Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest (OEH 2015d).	No	Potential	Marginal habitat present.	Yes
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	PMST	*Grevillea parviflora* subsp. *parviflora* is sporadically distributed throughout the Sydney Basin mainly around Picton, Appin and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie and Cessnock and Kurri Kurri. It grows in sandy or light clay soils over thin shales, often with lateritic ironstone gravels. It often occurs in open, slightly disturbed sites such as tracks (OEH 2015d).	No	No	Marginal habitat present.	No
Gyrostemon thesioides		E	-	Atlas	Within NSW, has only ever been recorded at three sites, to the west of Sydney, near the Colo, Georges and Nepean Rivers. Grows on hillsides and riverbanks and may be restricted to fine sandy soils (OEH 2015d).	No	No	No suitable habitat present.	No
Haloragis exalata subsp. *exalata*	Wingless Raspwort	V	V	PMST	Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. It appears to require protected and shaded damp situations in riparian habitats (OEH 2015d).	No	No	No suitable habitat present.	No
Hypsela sessiliflora		E	Ex	BCAM	Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland ecotone (OEH 2015d).	No	No	Outside of range.	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
Leucopogon exolasius	Woronora Beard-heath	V	V	Atlas, PMST	*Leucopogon exolasius* is found along the upper Georges River area and in Heathcote National Park. It is associated with Sydney Sandstone Gully Forest on rocky hillsides and creek banks (OEH 2015d).	No	No	No suitable habitat present.	No
Marsdenia viridiflora subsp. *viridiflora*	*Marsdenia viridiflora* R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	E	-	Atlas	Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range. Grows in vine thickets and open shale woodland (OEH 2015d).	No	Unlikely	Marginal habitat present and no recorded individuals of the population.	No
Melaleuca deanei	Deane's Paperbark	V	V	PMST	Found in heath on sandstone, and also associated with woodland on broad ridge tops and slopes on sandy loam and lateritic soils (OEH 2015d).	No	No	No suitable habitat present.	No
Pelargonium sp. *striatellum*	Omeo's Stork's Bill	E	E	PMST	The species is known to occur in habitat usually located just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is known to colonise exposed lake beds. It is not known if the species' rhizomes and/or soil seedbank persist through prolonged inundation or drought (OEH 2015d).	No	No	No suitable habitat present.	No
Persoonia bargoensis	Bargo Geebung	E	V	BCAM, PMST	Associated with woodland to dry sclerophyll forest, on sandstone and clayey laterite on heavier, well-drained, loamy, gravelly soils of the Hawkesbury Sandstone and Wianamatta Shale in the catchments of the Cataract, Cordeaux and Bargo Rivers (OEH 2015d).	No	No	No suitable habitat present.	No
Persoonia hirsuta	Hairy Geebung	E	E	Atlas, PMST	*Persoonia hirsuta* occurs from Singleton in the north, south to Bargo and the Blue Mountains to the west. It grows in dry sclerophyll eucalypt woodland and forest on sandstone (OEH 2015d).	No	No	No suitable habitat present.	No
Persoonia nutans	Nodding Geebung	E	E	Atlas, PMST	Associated with dry woodland, Castlereagh Scribbly Gum Woodland, Agnes Banks Woodland and sandy soils associated with tertiary alluvium, occasionally poorly drained. Endemic to the Western Sydney (OEH 2015d).	No	No	No suitable habitat present.	No
Pimelea curviflora var. *curviflora*		V	V	BCAM, PMST	*Pimelea curviflora* var. *curviflora* is confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. It grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands (OEH 2015d).	No	No	No suitable habitat present.	No
Pimelea spicata	Spiked Rice-flower	E	E	Atlas, BCAM, PMST	In western Sydney, *Pimelea spicata* occurs on an undulating topography of well structured clay soils, derived from Wianamatta shale. It is associated with Cumberland Plains Woodland (CPW), in open woodland and grassland often in moist depressions or near creek lines. Has been located in disturbed areas that would have previously supported CPW (OEH 2015d).	No	Potential	Suitable habitat present.	Yes

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
Pomaderris brunnea	Rufous Pomaderris	V	V	Atlas, PMST	*Pomaderris brunnea* occurs in a limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands and in far eastern Gippsland in Victoria It grows in moist woodland or forest on clay or alluvial soils of floodplains and creek lines (OEH 2015d).	No	Unlikely	Marginal habitat present.	No
Pterostylis gibbosa	Illawarra Greenhood	E	E	PMST	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). It is apparently extinct in western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage (OEH 2015d).	No	No	No suitable habitat present.	No
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Atlas, BCAM, PMST	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated (OEH 2015d).	No	Potential	Marginal habitat present.	Yes
Pultenaea parviflora		E	V	PMST	Endemic to the Cumberland Plain. Core distribution is from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce. May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays (OEH 2015d).	No	Unlikely	Marginal habitat present.	No
Pultenaea pedunculata	Matted Bush-pea	E	-	BCAM	In NSW, *Pultenaea pedunculata* is known from three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. It grows in woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area (OEH 2015d).	No	Unlikely	Marginal habitat present.	No
Thelymitra sp. Kangaloon	Kangaloon Sun-orchid	CE	CE	PMST	*Thelymitra* sp. *Kangaloon* is only known to occur on the southern tablelands of NSW in the Robertson / Kangaloon / Fitzroy Falls area at 550-700 m above sea level. It is thought to be a short-lived perennial, flowering in late October and early November. It is found in swamps in sedgelands over grey silty grey loam soils. It is known to occur at three swamps that are above the Kangaloon Aquifer, and that are a part of the ecological community “Temperate Highland Peat Swamps on Sandstone” which is listed under the EPBC Act.	No	No	Outside known range.	No
Thesium australe	Austral Toadflax	V	V	PMST	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast (OEH 2015d).	No	No	Outside known range.	No

Threatened fauna

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
Invertebrate	*Meridolum corneovirens*	Cumberland Plain Land Snail	E	-	Atlas, BCAM	Species	Associated with open eucalypt forests, particularly Cumberland Plain Woodland. Found under fallen logs, debris and in bark and leaf litter around the trunk of gum trees or burrowing in loose soil around clumps of grass. Urban waste may also form suitable habitat (OEH 2015d).	Yes	Suitable habitat present and records in BCAA	Yes
Fish	*Macquaria australasica*	Macquarie Perch	-	E	PMST		Occurs in Murray-Darling Basin of the Lachlan, Murrumbidgee and Murray Rivers and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven Catchments	No	No suitable habitat present	No
Fish	*Prototroctes maraena*	Australian Grayling	-	V	PMST		Streams and rivers on the eastern and southern flanks of the Great Dividing Range; in NSW, it occurs south from the Shoalhaven River	No	No suitable habitat present	No
Amphibian	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	PMST	Species	Forages in woodlands, wet heath, dry and wet sclerophyll forest. Associated with semi-permanent to ephemeral sand or rock based streams, where the soil is soft and sandy so that burrows can be constructed (OEH 2015d).	No	No suitable habitat present	No
Amphibian	*Litoria aurea*	Green and Golden Bell Frog	E	V	Atlas, PMST	Species	This species has been observed utilising a variety of natural and man-made waterbodies such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water. Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading. Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes–Typha sp. and spikerushes–Eleocharis sp.) adjacent to open grassland areas for foraging are preferable. Ponds that are typically inhabited tend to be free from predatory fish such as Mosquito Fish (*Gambusia holbrooki*) (OEH 2015d).	Potential	Suitable habitat is present and there are recent, nearby records (5.5km south-east of BCAA in 2013 and 2015.	Yes
Amphibian	*Litoria littlejohnii*	Littlejohn's Tree Frog	V	V	PMST	Species	Littlejohn's Tree Frog occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It appears to be restricted to sandstone woodland and heath communities at mid to high altitude (OEH 2015d).	No	No suitable habitat present	No
Amphibian	*Litoria raniformis*	Southern Bell Frog	E	V	PMST	Not listed in Bionet	Relatively still or slow-flowing sites such as billabongs, ponds, lakes or farm dams, especially where Typha sp., Eleocharis sp. and Phragmites sp. (Bulrushes) are present. This species is common in lignum shrublands, black box and River Red Gum woodlands, irrigation channels and at the periphery of rivers in the southern parts of NSW. This species occurs in vegetation types such as open grassland, open forest and ephemeral and permanent non-saline marshes and swamps. Open grassland and ephemeral permanent non-saline marshes and swamps have also been associated with this species (OEH 2015d).	No	No suitable habitat present	No

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
Reptile	*Hoplocephalus bungaroides*	Broad-headed Snake	E	V	PMST	Species	Typical sites consist of exposed sandstone outcrops and benching where the vegetation is predominantly woodland, open woodland and/or heath on Triassic sandstone of the Sydney Basin. They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (OEH 2015d).	No	No suitable habitat present	No
Birds	*Anthochaera phrygia*	Regent Honeyeater	E	E & M	Atlas, BCAM, PMST	Species	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (*Casuarina cunninghamiana*). Areas containing Swamp Mahogany (*Eucalyptus robusta*) in coastal areas have been observed to be utilised. The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes. As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken
Birds	*Botaurus poiciloptilus*	Australasian Bittern	V	-	Atlas, PMST	Species	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats. Reedbeds, swamps, streams, estuaries (OEH 2015d).	Unlikely	Marginal habitat present. Australasian Bittern requires shallow water, less than 30 cm deep with medium to low density reeds, grasses or shrubs for foraging. It needs deeper water with medium to high density reeds, rushes or sedges for nesting	No. Species unlikely to be present and bird surveys already undertaken
Birds	*Burhinus grallarius*	Bush Stone-curlew	E	-	Atlas, BCAM	Ecosystem	Associated with dry open woodland with grassy areas, dune scrubs, in savanna areas, the fringes of mangroves, golf courses and open forest / farmland. Forages in areas with fallen timber, leaf litter, little undergrowth and where the grass is short and patchy. Is thought to require large tracts of habitat to support breeding, in which there is a preference for relatively undisturbed in lightly disturbed (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	-	Atlas, BCAM	Ecosystem	During summer in dense, tall, wet forests of mountains and gullies, alpine woodlands. In winter they occur at lower altitudes in drier more open forests and woodlands, particularly box-ironbark assemblages. They sometimes inhabit woodland, farms and suburbs in autumn/winter (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V	-	Atlas	Ecosystem	Associated with a variety of forest types containing Allocasuarina species, usually reflecting the poor nutrient status of underlying soils. Intact drier forest types with less rugged landscapes are preferred. Nests in large trees with large hollows (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Chthonicola sgittata*	Speckled Warbler	V	-	Atlas	Ecosystem	The Speckled Warbler lives in a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
										and this is an ecosystem species
Birds	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V	-	BCAM	Ecosystem	Distributed through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys. The Brown Treecreeper occupies eucalypt woodlands, particularly open woodland lacking a dense understorey. It is sedentary and nests in tree hollows within permanent territories (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Daphoenositta chrysoptera*	Varied Sittella	V	-	Atlas, BCAM	Ecosystem	Distribution includes most of mainland Australia except deserts and open grasslands. Prefers eucalypt forests and woodlands with rough-barked species, or mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods from bark, dead branches, or small branches and twigs (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Dasyornis brachypterus*	Eastern Bristlebird	E	E	PMST	Species	Habitat is characterised by dense, low vegetation and includes sedgeland, heathland, swampland, shrubland, sclerophyll forest and woodland, and rainforest, as well as open woodland with a heathy understorey. In northern NSW occurs in open forest with tussocky grass understorey. All of these vegetation types are fire prone, aside from the rainforest habitatas utilised by the northern population as fire refuge. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously (OEH 2015d).	No	No suitable habitat present	No. No suitable habitat
Birds	*Glossopsitta pusilla*	Little Lorikeet	V	-	Atlas, BCAM	Ecosystem	In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including melaleucas and mistletoes (OEH 2015d).	Likely (recorded adjacent)	Suitable habitat present	No as this is an ecosystem species
Birds	*Grantiella picta*	Painted Honeyeater	V	V	PMST	Ecosystem	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests (OEH 2015d).	No	No suitable habitat present	No. Bird surveys already undertaken and this is an ecosystem species

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
Birds	*Hieraaetus morphnoides*	Little Eagle	V	-	Atlas, BCAM	Ecosystem	Utilises open eucalypt, sheoak and acacia forest, woodland or open woodland. Uses tall trees for nesting, with a large stick nest being built. Lays eggs in spring, and young fledge in early summer. Preys on birds, reptiles and mammals, and occasionally feeds on large insects or carrion (OEH 2015d).	Potential	Suitable habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Lathamus discolor*	Swift Parrot	E	E	Atlas, BCAM, PMST	Ecosystem	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts. Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*) (OEH 2015d).	Potential	Suitable habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	V	-	Atlas, BCAM	Ecosystem	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas (OEH 2015d)	Unlikely	MArginal habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V	-	Atlas, BCAM	Ecosystem	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis) (OEH 2015d).*	Unlikely	Prefers other habitats	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Neophema pulchella*	Turquoise Parrot	V	-	Atlas, BCAM	Ecosystem	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland (OEH 2015d).	Unlikely	Prefers other habitats	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Ninox connivens*	Barking Owl	V	-	BCAM	Ecosystem	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas (OEH 2015d).	Potential	Marginal habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Ninox strenua*	Powerful Owl	V	-	Atlas	Ecosystem	The Powerful Owl is associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes. Large trees with hollows at least 0.5m deep are required for shelter and breeding (OEH 2015d).	Potential	Suitable habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Oxyura australis*	Blue-billed Duck	V	-	Atlas	Ecosystem	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Petroica boodang*	Scarlet Robin	V	-	Atlas, BCAM	Ecosystem	Occurs from the coast to the inland slopes in NSW. After breeding (July-Jan), some disperse to the lower valleys and plains of the tablelands and slopes. Primarily resides in dry eucalypt forests and woodlands, with usually open and grassy understorey, with scattered shrubs. Abundant logs and fallen timber are important habitat components. In autumn and	Unlikely	Prefers other habitats	No. Bird surveys already undertaken and this is an ecosystem species

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
							winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees, and may join mixed flocks of other small insectivorous birds (OEH 2015d).			
Birds	*Petroica phoenicea*	Flame Robin	V	-	Atlas	Ecosystem	The Flame Robin is endemic to south eastern Australia, and ranges from near the Queensland border to south east South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Rostratula australis*	Painted Snipe (Australian subspecies)	E	V	PMST	Ecosystem	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Breeding is often in response to local conditions; generally occurs from September to December. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Stagonopleura guttata*	Diamond Firetail	V	-	Atlas, BCAM	Ecosystem	Typically found in grassy eucalypt woodlands, but also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. It is often found in riparian areas and sometimes in lightly wooded farmland. Appears to be sedentary, though some populations move locally, especially those in the south (OEH 2015d).	Unlikely	Prefers other habitats	No. Bird surveys already undertaken and this is an ecosystem species
Birds	*Stictonetta naevosa*	Freckled Duck	V	-	Atlas	Ecosystem	Associated with a variety of plankton-rich wetlands, such as heavily vegetated, large open lakes and their shores, creeks, farm dams, sewerage ponds and floodwaters (OEH 2015d).	Unlikely	Marginal habitat present	No. Bird surveys already undertaken and this is an ecosystem species
Mammal	*Dasyurus maculatus* *Dasyurus maculatus maculatus*	Spotted-tailed Quoll Spotted-tailed Quoll (SE mainland population)	V -	- E	BCAM, PMST	Ecosystem	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests, more frequently recorded near the ecotones of closed and open forest. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (OEH 2015d).	Unlikely	Marginal habitat present	No. Mammal surveys already undertaken and this is an ecosystem species
Mammal	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E	V	PMST	Species	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (OEH 2015d).	No	No suitable habitat present	No
Mammal	*Phascolarctos cinereus*	Koala	V	V	Atlas, BCAM, PMST	Species	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70%, with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: *Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis* (OEH 2015d)	Unlikely	Marginal habitat present and few nearby records	No. This species is unlikely to be present.
Mammal	*Pseudomys novaehollandiae*	New Holland Mouse	-	V	PMST	Ecosystem	A small burrowing native rodent with a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Inhabits open	No	No suitable habitat present	No

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
							heathlands, open woodlands with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid stages of vegetation succession typically induced by fire (OEH 2015d).			
Mammal-bat	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	Atlas, PMST	Species (breeding habitat)	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces. Found in well-timbered areas containing gullies (OEH 2015d).	Potential	Marginal habitat present	No. No breeding habitat (caves) present.
Mammal-bat	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	-	Atlas	Ecosystem	Prefers moist habitats with trees taller than 20m. Roosts in tree hollows but has also been found roosting in buildings or under loose bark (OEH 2015d).	Potential	Suitable habitat present	No as species is an ecosystem species
Mammal-bat	*Miniopterus australis*	Little Bentwing Bat	V	-	Atlas	Ecosystem and Species (breeding)	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub (OEH 2015d).	Potential	Suitable habitat present	No as ecosystem species and no suitable breeding habitat
Mammal-bat	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat	V	-	Atlas	Ecosystem and Species (breeding	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland. It forages above and below the tree canopy on small insects. Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (OEH 2015d).	Yes	Recorded by Cumberland Ecology (2005)	No as already recorded and species is an ecosystem species. There is no suitable breeding habitat present
Mammal-bat	*Mormopterus norfolkensis*	East Coast Freetail Bat	V	-	Atlas	Ecosystem	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range. Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges. Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (OEH 2015d).	Yes	Recorded by Cumberland Ecology (2005) and potentially by ELA (2007)	No as already recorded and species is an ecosystem species
Mammal-bat	*Myotis macropus*	Southern Myotis	V	-	Atlas	Ecosystem and Species (breeding)	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Will occupy most habitat types such as mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River Red Gum woodland, close to water. While roosting (in groups of 10-15) is most commonly associated with caves, this species has been observed to roost in tree hollows, amongst vegetation, in clumps of Pandanus, under bridges, in mines, tunnels and stormwater drains, however with specific roost requirements. Forages over streams	Yes	Recorded by Cumberland Ecology (2005)	Yes, potential breeding habitat (hollow bearing trees) present within 200m of permanent water.

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
							and pools catching insects and small fish. In NSW females have one young each year usually in November or December (OEH 2015d)			
Mammal-bat	*Pteropus poliocephalus*	Grey-headed Flying-Fox	V	V	Atlas, PMST	Ecosystem and Species (breeding	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (OEH 2015d).	Yes	Suitable habitat present and previous Atlas record	No as ecosystem species and no suitable breeding habitat present.
Mammal-bat	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat	V	-	Atlas	Ecosystem	Found in almost all habitats, from wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies. Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock and in abandoned sugar glider nests. The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (OEH 2015d).	Potential	Suitable habitat present	No as ecosystem species
Mammal-bat	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	-	Atlas	Ecosystem	Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range, tending to be more frequently located in more productive forests. Within denser vegetation types use is made of natural and man-made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (OEH 2015d).	Yes	Recorded by Cumberland Ecology (2005)	No as species is an ecosystem species
Migratory	*Apus pacificus*	Fork-tailed Swift	-	M	PMST	Ecosystem	Sometimes travels with Needletails. Varied habitat with a possible tendency to more arid areas but also over coasts and urban areas.	Potential	Species may use site on occasion	No as ecosystem species
Migratory	*Ardea alba*	Great Egret	-	M	PMST	Ecosystem	The Great Egret is common and widespread in Australia. It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats.	Potential	Suitable wetland areas present	No as ecosystem species
Migratory	*Ardea ibis*	Cattle Egret	-	M	PMST	Ecosystem	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments. Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range.	Yes	Recorded nearby to the north of the BCAA by ELA (2014)	No as this species is an ecosystem species
Migratory	*Cuculus optatus*	Oriental Cuckoo	-	M	PMST	Ecosystem	Mainly inhabits forests	Unlikely	Marginal habitat present	No
Migratory	*Gallinago hardwickii*	Latham's Snipe	-	M	PMST	Ecosystem	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover. Occupies a variety of vegetation around wetlands including wetland grasses and open wooded swamps.	Unlikely	Marginal habitat present	No
Migratory	*Haliaeetus leucogaster*	White-bellied Sea Eagle	-	M	PMST	Ecosystem	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas. Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away.	Unlikely	Marginal habitat present	No

Group	Scientific name	Common name	TSC Act	EPBC Act	Data Source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required
Migratory	*Hirundapus caudacutus*	White throated Needletail	-	M	PMST	Ecosystem	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas. Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather.	Potential	Species may use site on occasion	No as this is an ecosystem species
Migratory	*Merops ornatus*	Rainbow Bee-eater	-	M	PMST	Ecosystem	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May. Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs. Nest is a chamber a the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting.	Likely	Suitable open habitat available	No as this is an ecosystem species
Migratory	*Monarcha melanopsis*	Black-faced Monarch	-	M	PMST	Ecosystem	Rainforest and eucalypt forests, feeding in tangled understorey.	No	No suitable habitat present	No
Migratory	*Monarcha trivirgatus*	Spectacled Monarch	-	M	PMST	Ecosystem	Coastal eastern Australia south to Port Stephens in NSW. Mountain/lowland rainforest, wooded gullies, riparian vegetation including mangroves.	No	No suitable habitat present	No
Migratory	*Motacilla flava*	Yellow Wagtail	-	M	PMST	Ecosystem	Swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land, lawns.	Unlikely	Marginal suitable habitat present	No
Migratory	*Myiagra cyanoleuca*	Satin Flycatcher	-	M	PMST	Ecosystem	Wetter dense forest.	No	No suitable habitat present	No
Migratory	*Pandion cristatus*	Eastern Osprey	V	M	PMST	Ecosystem	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.	No	No suitable habitat present	No
Migratory	*Rhipidura rufifrons*	Rufous Fantail	-	M	PMST	Ecosystem	The Rufous Fantail is a summer breeding migrant to southeastern Australia. The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation. Open country may be used by the Rufous Fantail during migration.	No	No suitable habitat present	No

Appendix C: Supplementary Southern Myotis and Green and Golden Bell Frog survey methodology and results

Provided as separate documents

Appendix D: Quantitative analysis of plot data

Mapping by NPWS (2002) and by previous surveys overlapping the BCAA (Cumberland Ecology (2005) and ELA (2007 and 2013b)) included three BVTs within the BCAA. Quantitative analysis of plot data using the OEH vegetation tool, developed by Tim Hager and Greg Steenbeeke, was undertaken to support BVT mapping. Plot data collected for 25 plots were used in the analysis. This data was collected for a larger area than the current BCAA prior to a change in the boundary of the BCAA, and the majority of these plots were not subsequently included in this biocertification assessment.

Results of the quantitative analysis are provided below. The OEH vegetation tool uses positive diagnostic species of vegetation communities, matching flora species collected in plots to the diagnostic species of vegetation communities to determine likely vegetation communities. Note that the tool does not use other attributes, such as substrate, underlying geology, slope, aspect, elevation, and landscape position to assign data to a vegetation community.

Consultation with OEH was undertaken following quantitative analysis and it was subsequently determined that only one BVT was present in the BCAA. This was present in a number of conditions and was used in this assessment.

Summary of results (ratio of actual to required positive diagnostic species) from plot data entered into the OEH vegetation tool determining likely matches for vegetation communities. Plots used in this biocertification assessment (10 plots) are highlighted in blue (one additional plot used in the assessment is missing as it was located in an exotic-dominated/cleared area)

Survey plot name *	Ratio of actual to required positive diagnostic species in vegetation communities (after Tozer et al 2010) (%)^								
	SSTF	SHW	SPW	SGTF	STIF	CRFF	GMDR	WSDR	MSW
30_1	0	10	8	4	0	6	0	5	5
30_2	42	80	65	44	39	50	33	9	53
30_3	73	115	115	80	65	106	28	32	58
32_1	15	30	27	16	17	44	17	18	16
32_2	4	20	12	8	4	38	22	14	11
33_1	12	45	35	12	9	19	11	5	11
34_1	31	100	69	36	13	38	22	18	42
34_2	35	90	65	44	25	50	22	23	37
34_3	27	70	58	32	17	44	17	14	21
CL01	35	85	77	52	39	56	28	18	42
CL06	19	55	38	20	26	31	17	14	26
CL11	27	75	50	32	30	38	22	14	37
CL13	42	105	81	48	30	63	28	18	58
CL15	27	40	42	28	30	56	22	23	21

Survey plot name *	Ratio of actual to required positive diagnostic species in vegetation communities (after Tozer et al 2010) (%)^								
	SSTF	SHW	SPW	SGTF	STIF	CRFF	GMDR	WSDR	MSW
CL16	4	10	12	8	4	13	0	9	5
CL17	42	60	54	48	35	75	28	23	42
CL19	35	40	50	44	26	31	6	5	16
CL23	27	55	50	28	26	44	17	14	37
CL26a	58	95	100	64	48	100	28	32	58
CL26b	50	85	88	68	35	69	28	18	53
CL27	46	80	88	68	39	75	33	32	47
D01	8	30	23	4	9	6	0	0	11
D02	69	95	104	84	57	81	28	23	53
D03	27	45	50	32	30	44	11	9	37
GW_03	19	60	54	28	22	31	11	9	32

* Note that data for four plots are not included in the table due to these plots being located in exotic-dominated/cleared areas.

^ Results are only shown for these eight vegetation communities. SSTF = Shale Sandstone Transition Forest, SHW = Shale Hills Woodland, SPW = Shale Plains Woodland, SGTF = Shale Gravel Transition Forest, STIF = Sydney Turpentine Ironbark Forest, CRFF = Cumberland River Flat Forest, GMDR = Grey Myrtle Dry Rainforest, WSDR = Western Sydney Dry Rainforest, MSW = Moist Shale Woodland.

Appendix E: Vegetation type profile

Biometric Vegetation Type	Grey Box - Forest Red Gum grassy woodland on flats of the southern Cumberland Plain, Sydney Basin Bioregion
Description	This community had a woodland structure. The mid stratum was present in some areas and absent in others. The ground stratum included a combination of grasses and herbs. The community has been subject to a long history of disturbance.
Location and habitat	The community occurred across the BCAA and occurred in patches. The patches occurred on gentle slopes at low topography on clay soils.
Ancillary codes	Five different ancillary codes were identified for this vegetation type as follows: • Intact – applied to two north eastern patches and a patch in the south west which were in moderate to good condition due to the high species richness, presence of fallen logs and trees with hollows. It had a mid-storey comprised of a mix of native and introduced species, and an understorey dominated by native grasses. • Sparse - applied to patches mostly in the west and north of the BCAA, but also occurred in the south east of the BCAA. Patches lacked an intact mid-storey, and had a ground layer dominated by native grasses. • Weedy – applied to patches mostly located in the south of the BCAA, although a patch was present in the north of the BCAA. These areas were comprised of canopy species with a weedy groundcover, although native species were also present. A sparse mid-storey was present. • Scattered trees – patches occurred across the BCAA. They were comprised of scattered trees over an exotic-dominated groundcover. No mid-storey was present. • Derived native grassland – applied to patches located in the south of the BCAA where a canopy was absent, and groundcover was dominated by native grasses.
Sampling locations	Intact – CL26b, 30-2, 30-3 Sparse – CL11, 34-1, 34-2, 34-3 Weedy – CL17 Scattered trees – 30-1 Derived native grassland – CL19
Upper stratum	The canopy of this vegetation type was dominated by *Eucalyptus tereticornis* (Forest Red Gum), although *E. crebra* (Narrow-leaved Ironbark) and *E. moluccana* were also present.
Midstorey	A shrub layer was absent through most of the BCAA. Where present, it was largely composed of the small trees, with native *Bursaria spinosa* (Blackthorn) and the introduced species *Olea europaea* var. *cuspidata* (African Olive), also present.
Groundcovers	The ground cover was composed of native and exotic grasses dominated by *Microlaena stipoides* (Weeping Grass), *Aristida* spp., *Themeda triandra* (Kangaroo Grass), *Pennisetum clandestinum* (Kikuyu), and *Setaria* spp. It also included herbs and scramblers such as *Dichondra repens* (Kidney Weed), and *Glycine tabacina*.
Corresponding vegetation type	Cumberland Plain Woodland
Threatened Species	No threatened flora were recorded within this BVT but a number of threatened bat species and Cumberland Plain Land Snail were recorded.

Appendix F: Flora species recorded in BioMetric plots

Species	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion									
	Intact			Sparse				Weedy	Scattered trees	Derived native grassland
	CL26b	30_2	30_3	CL11	34_1	34_2	34_3	CL17	30_1	CL19
Acacia decurrens								x		
Acacia parramattensis			x							
Alternanthera denticulata								x		
Amyema miquelii		x								
**Anagallis arvensis*			x	x	x	x		x		x
Angophora subvelutina			x				x			
**Araujia sericifera*	x	x						x		
Aristida ramosa	x	x		x	x					x
Aristida vagans			x							
Arthropodium sp.		x								
Asperula conferta	x	x		x	x	x		x		
Astroloma humifusum			x							
Austrodanthonia caespitosa	x									
Austrodanthonia racemosa	x		x		x		x			
**Avena barbata*					x					
**Axonopus fissifolius*										x

Species	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion									
	Intact			Sparse				Weedy	Scattered trees	Derived native grassland
	CL26b	30_2	30_3	CL11	34_1	34_2	34_3	CL17	30_1	CL19
**Bidens pilosa*	x				x			x		
Bothriochloa macra				x		x	x			
**Briza subaristata*	x	x	x	x	x	x	x			x
**Bromus catharticus*				x	x	x		x	x	
**Bromus* sp.						x				
Brunoniella australis	x	x	x	x		x		x		
Bursaria spinosa	x		x					x		
Caesia parviflora var. parviflora	x									
Calotis lappulacea					x					
Carex inversa		x	x	x	x	x	x			
Casuarina cunninghamiana subsp. *cunninghamiana*								x		
**Centaurium* sp.			x							
**Centaurium tenuiflorum*										x
Centella asiatica			x							
Cheilanthes sieberi	x		x							x
**Chenopodium album*		x								
**Chloris gayana*				x	x			x		

Species	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion									
	Intact			Sparse				Weedy	Scattered trees	Derived native grassland
	CL26b	30_2	30_3	CL11	34_1	34_2	34_3	CL17	30_1	CL19
**Cirsium vulgare*		x	x	x	x	x		x		x
Convolvulus erubescens							x			
**Conyza* sp.	x	x								
**Cotula* sp.										
Crassula sieberiana		x								
**Cyclospermum leptophyllum*	x			x		x				
#Cynodon dactylon	x		x	x	x	x	x	x	x	x
**Dactylis glomerata*				x						
Daviesia genistifolia										x
Desmodium varians				x	x	x	x			
Dianella longifolia	x			x				x		
Dianella sp.			x			x				x
Dichelachne micrantha	x	x	x		x	x	x			x
Dichondra repens	x	x	x	x		x		x		
Dillwynia sieberi	x									
Echinopogon ovatus			x							
**Echium plantagineum*		x								
**Ehrharta erecta*	x	x							x	

Species	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion									
	Intact			Sparse				Weedy	Scattered trees	Derived native grassland
	CL26b	30_2	30_3	CL11	34_1	34_2	34_3	CL17	30_1	CL19
Einadia hastata		x								
Einadia nutans	x					x				
Einadia nutans subsp. *nutans*					x					
Einadia trigonos			x						x	
Elymus scaber	x			x	x	x				
Eragrostis brownii										x
**Eragrostis curvula*	x	x			x					
Eragrostis leptostachya	x				x		x			
Eucalyptus crebra		x	x	x	x					
Eucalyptus eugenioides			x							
Eucalyptus moluccana	x	x				x			x	
Eucalyptus tereticornis	x		x		x	x	x	x		
Euchiton sp.										x
Geranium solanderi							x			
Glycine clandestina	x							x		x
Glycine tabacina		x	x	x	x	x	x	x		
**Gomphocarpus* sp.								x		
**Gomphrena celosioides*		x								

Species	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion									
	Intact			Sparse				Weedy	Scattered trees	Derived native grassland
	CL26b	30_2	30_3	CL11	34_1	34_2	34_3	CL17	30_1	CL19
Hardenbergia violacea	x									
**Hirschfeldia incana*					x					
**Hordeum* sp.									x	
Hypericum gramineum			x							
**Hypochaeris microcephala* var. *albiflora*	x	x			x					
**Hypochaeris radicata*	x		x				x	x		x
Juncus usitatus								x		
Lachnagrostis filiformis	x		x							
**Lactuca serriola*								x		
**Linum trigynum*			x							
**Lolium perenne*					x					
**Lolium* sp.	x					x				
Lomandra filiformis		x								
Lomandra filiformis subsp. *filiformis*	x		x	x						x
Lomandra multiflora subsp. *multiflora*										x
**Lotus angustissimus*				x						

Species	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion									
	Intact			Sparse				Weedy	Scattered trees	Derived native grassland
	CL26b	30_2	30_3	CL11	34_1	34_2	34_3	CL17	30_1	CL19
**Lycium ferocissimum*		x								
Mentha satureioides						x				
Microlaena stipoides	x	x	x	x	x	x	x	x		x
**Modiola caroliniana*			x	x						
**Olea europaea*	x		x				x			
**Olea europaea* subsp. *cuspidata*								x		
Opercularia diphylla	x									x
Oxalis perennans			x		x	x		x		
**Paronychia brasiliana*			x		x		x			
Paspalidium criniforme	x									
**Paspalum dilatatum*	x	x	x		x	x	x	x		
**Paspalum* sp.										x
**Pennisetum clandestinum*					x			x	x	
**Phalaris aquatica*				x						
Phyllanthus virgatus			x		x	x	x			
Plantago debilis					x					
**Plantago lanceolata*	x	x	x	x	x	x		x		x
Plectranthus parviflorus	x									

Species	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion									
	Intact			Sparse				Weedy	Scattered trees	Derived native grassland
	CL26b	30_2	30_3	CL11	34_1	34_2	34_3	CL17	30_1	CL19
Poa sieberiana				x				x		
Poranthera microphylla		x								
**Richardia stellaris*										x
**Romulea rosea* var. *australis*										x
Rumex brownii				x				x		
**Rumex crispus*										
Senecio linearifolius						x				
**Senecio madagascariensis*	x	x	x	x	x	x	x	x	x	x
Senecio quadridentatus								x		
**Setaria gracilis*										
**Setaria parviflora*								x		
**Setaria* sp.										x
**Sherardia arvensis*										
Sida corrugata				x	x					
**Sida rhombifolia*	x	x	x	x	x	x	x	x	x	x
**Sisyrinchium iridifolium*										x
**Solanum nigrum*				x				x		x
Solanum pungetium		x	x							

Species	Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion									
	Intact			Sparse				Weedy	Scattered trees	Derived native grassland
	CL26b	30_2	30_3	CL11	34_1	34_2	34_3	CL17	30_1	CL19
**Sonchus oleraceus*				x	x	x	x	x		
Sporobolus creber			x		x		x			
**Sporobolus fertilis*			x							
Stackhousia muricata	x									x
Stackhousia sp.			x							
Themeda triandra	x	x	x	x	x	x	x	x		x
Tricoryne elatior	x		x		x	x	x	x		x
**Trifolium subterraneum*										
**Verbena bonariensis*	x	x	x	x		x	x	x	x	
**Verbena quadrangularis*					x	x				
**Verbena* sp.	x									
Veronica plebeia		x	x				x			
**Vulpia muralis*			x							
**Vulpia* sp.		x								
Wahlenbergia gracilis	x									x
Wahlenbergia sp.			x							

Appendix G: Transect/plot data

Vegetation Zone 1: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion – Moderate to Good (Intact)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
CL26b	29	11	9.9	68	12	14	13.9	1	1	2	296044	6235547	56
30_2	19	10	0	56	0	10	12	0	1	7	294993	6234557	56
30_3	34	23	2.5	80	0	8	12	0	1	0	295140	6234373	56

Vegetation Zone 2: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion – Moderate to good (Sparse)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
CL11	17	0.4	0	92	0	12	34	0	1	0	295302	6235667	56
34_1	21	6.5	0	56	0	20	32	0	1	0	294731	6234832	56
34_2	20	14.5	2	76	0	12	12	0	1	0	294786	6234971	56
34_3	17	13.5	14	80	0	6	16.5	2	1	7	294958	6235040	56

Vegetation Zone 3: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Moderate to good (Weedy)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
CL17	19	15.5	17.5	94	0	16	16	2	1	0	295560	6234759	56

Vegetation Zone 4: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion – Low (Scattered trees)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
30_1	2	13	0	2	0	4	94	0	0	0	295039	6234646	56

Vegetation Zone 5: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion – Low (Derived native grassland)

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
CL19	16	0	0	90	0	0	66	0	0	0	295821	6234550	56

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