Hawkesbury City Council

# attachment 2
# to
# item 18

## Biobank Agreements for Biodiversity Certification over the site

date of meeting: 9 February 2021
location: council chambers and
by audio-visual link
time: 6:30 p.m.

# Jacaranda

## Biodiversity Certification Assessment Report and Strategy

## For Public Exhibition

Prepared for
**Celestino Pty Ltd**

22 January 2021

## DOCUMENT TRACKING

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# Abbreviations

| Abbreviation | Description |
|---|---|
| ARA | Adjacent Remnant Area |
| APZ | Asset Protection Zone |
| BAR | Biodiversity Assessment Report |
| BCAA | Biodiversity Certification Assessment Area |
| BC Act | *Biodiversity Conservation Act 2016* |
| BCAM | Biodiversity Certification Assessment Methodology |
| BCS | Biodiversity Certification Strategy |
| BCF | Biodiversity Conservation Fund |
| BVT | Biometric Vegetation Type |
| CBD | Central Business District |
| 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) |
| DLS | Dural Land Snail |
| DotEE | Commonwealth Department of the Environment and Energy |
| DPIE | NSW Department of Planning, Industry and Environment |
| 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* |
| ESS | Environment, Energy and Science Group of DPIE |
| IoM | Improve or Maintain |
| HBT | Hollow Bearing Tree |
| HCC | Hawkesbury City Council |
| LEP | Local Environment Plan |
| LG Act | NSW *Local Government Act 1993* |

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| Abbreviation | Description |
|---|---|
| LGA | Local Government Area |
| MALD | More Appropriate Local Data |
| NES | National Environmental Significance |
| NPW Act | NSW *National Parks and Wildlife Act 1974* |
| NPWS | NSW National Parks and Wildlife Service (now part of OEH) |
| NSW | New South Wales |
| OEH | Former NSW Office of Environment and Heritage (formerly DECCW), now part of DPIE |
| PCT | Plant community type |
| RFEF | River-Flat Eucalypt Forest |
| Tg Score | Response to Management Score |
| TSC Act | NSW *Threatened Species Conservation Act 1995* (now repealed) |
| TSPD | Threatened Species Profile Database |

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# 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 |

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| 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 |

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# Executive Summary

Eco Logical Australia Pty Ltd (ELA) was engaged by Celestino Pty Ltd, to undertake a Biodiversity Certification Assessment for the Jacaranda subdivision, 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 Celestino Pty Ltd, Hawkesbury City Council (HCC) and the then NSW Office of Environment and Heritage (OEH), now Department of Planning, Industry and Environment[1].

The BCAA encompasses a total area of 185.03 ha and includes 37.02 ha of native vegetation communities comprising two Biometric vegetation types (BVT), *'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 Critically Endangered Ecological Community (CEEC) Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW), listed under the NSW *Biodiversity Conservation Act* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and the Endangered Ecological Community (EEC), River-Flat Eucalypt Forest (RFEF), listed under the TSC Act respectively.

The remaining 148.01 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 two endangered species *Pommerhelix duralensis* (Dural Land Snail) 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 **Section 6** respectively.

The application proposes to directly impact 143.72 ha of the assessment area of which 17.28 ha is mapped as native vegetation in low condition.

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.

The application proposes to permanently protect and manage for conservation 28.12 ha (15.54 ha of which is existing vegetation and 12.58 ha is cleared land to be restored) within the assessment area as

[1] All references to the Office of Environment and Heritage (OEH) in this report should be read as the Department of Planning, Industry and Environment (DPIE)

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a 100% conservation measure. Two applications to register Biobanking Agreements were submitted in August 2020 under the Biodiversity Conservations Act 2016 'savings and transition provisions'. In the conservation area, about 24.67 ha would be managed as '*Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' and 3.43 ha managed as '*Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin'*.

The Biodiversity Certification Assessment has found that **278** biocertification ecosystem credits are required for direct impacts to the BVTs and **324** ecosystem credits are generated by the proposed 100% permanently managed and funded conservation measures within the BCAA. Therefore, there will be no deficit of ecosystem credits. All surplus credits generated will be retired as a condition of Biodiversity Certification.

The threatened fauna species that require species credits have been recorded in the BCAA. **14** '*species credits'* are required for impacts to Dural Land Snail. A total of **15** species credits are generated by the 100% conservation measure within the BCAA in '*land to be permanently managed and funded*'. There is a credit surplus of **1** credit for Dural Land Snail. All surplus credits generated will be retired as a condition of Biodiversity Certification

*Species credits* are also required for 'assumed' breeding habitat for Southern Myotis. A total of **192** species credits are required for this species and **49** credits are generated by the 100% conservation measure within the BCAA in '*land to be permanently managed and funded*'. There is a credit deficit of **143** credits for Southern Myotis. Offsets that cannot be met within the BCAA will be met outside the BCAA by the purchase and retirement of **143** Southern Myotis credits from a registered Biobank site, Biodiversity Stewardship Site or the Biodiversity Conservation Fund (BCF) (**Section 6**). The parties have already secured 260 of these credits from two registered Biobank sites.

Impacts to Regional Biodiversity Links and breeding habitat for Dural Land Snail are categorised as 'red flag' areas. Impacts to Southern Myotis have also been considered as red flag impacts on a precautionary basis as the most recent version of the data sets that accompany biodiversity certification assessment does not regard the species as a red flag species. Impacts to red flag areas that cannot be avoided require a '*variation*' from the Minister before Biocertification can be conferred. A red flag variation request addressing the red flag variation criteria for regional biodiversity links and threatened species has been prepared and included in this assessment (**Section 5**). Other areas to be affected are not 'areas of high biodiversity conservation value', or are cleared of native vegetation.

Indirect impacts have been considered in accordance with the BCAM and have been determined to be negligible on the basis that all direct impacts have been assessed on the assumption of complete loss of all biodiversity values including for Asset Protection Zones (APZs). In effect the APZs will provide a buffer between the residential lands and the adjacent conservation area, thereby mitigating any indirect impacts such as increased weeds, storm water run-off, changed noise and light conditions to threatened species and their habitats. These issues will be addressed in further detail at the development application stage and guided by the implementation of a CEMP.

Subject to the Minister's approval of the red flag variation request for impacts to a regional biodiversity link and Dural Land Snail habitat, and the purchase and retirement of the additional species credits for Southern Myotis required from an off-site registered Biobank site and/or the BCF, the proposal can meet an '*improve or maintain*' outcome and is eligible for biodiversity certification. If the Minister confers biocertification on the requested land, HCC 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.

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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 affected and the number of credits required to be retired for each stage by the relevant 'affected parties'. 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.

Celestino Pty Ltd 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 and clearance surveys of fauna will be undertaken in accordance with a Fauna pre-clearance protocol prior to any clearing of vegetation. Pre-clearance surveys will be required for any hollow dwelling fauna, fauna occupying nests in tree canopies and *Pommerhelix duralensis* (Dural Land Snail)
- Dam dewatering protocols prepared and implemented by a suitably qualified Ecologist
- 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.

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# 1 Introduction

## 1.1 Project background

Eco Logical Australia Pty Ltd (ELA) was commissioned by Celestino Pty Ltd, to undertake a Biodiversity Certification Assessment for the Jacaranda subdivision located within the Hawkesbury Local Government Area (LGA), approximately 7 km northeast of Richmond Central Business District (CBD), and to prepare a Biocertification Certification Strategy (BCS). The land is located at Spinks Road (with additional access points along Kurmond Road), Glossodia (**Figure 1**).

The land subject to the Biocertification application was zoned a mixture of R2 Low Density Residential, R5 Large Lot Residential and RE1 Public Recreation with small areas zoned SP2 Infrastructure (Sewerage System) in 2014 under Hawkesbury Local Environment Plan 2012. Prior to 2012, the land was zoned RU1 Primary Production and has had, and continues to be used for agricultural purposes (Poultry production) (**Figure 2**). Celestino have submitted a revised Planning Proposal (Ethos Urban 2020) to modify the current zoning to provide increased protection (E2 zoning) to areas proposed to be registered as Biobank sites (Figure 3**).** It is intended that the rezoning proposal and this application for biodiversity certification will be publicly exhibited together.

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.

On 25 August 2017, the *Biodiversity Conservation Act 2016* (BC Act) came into force and included 'savings and transitional' provisions that allow a number of substantially progressed biocertification assessments under the now repealed TSC Act, to continue to be assessed under Part 7AA of the TSC Act as long as applications are made by 24 August 2019. On 24 November 2017, the Minister published in the gazette a notification that the Jacaranda site was one of these projects.

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.7.3 of the BC 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. Hawkesbury City Council (HCC) is a Planning Authority as defined by section 126G. HCC is seeking biocertification of the residential zoned 'land' and associated infrastructure (APZs and access roads) identified in this assessment report.

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This Biocertification Strategy and the associated credit calculations were undertaken by an accredited assessor, Meredith Henderson (Accreditation Number 0155), other former and current ELA staff (Rebecca Dwyer, Enhua lee, Joanne Daly, Byron Heffernan, Alex Gorey, Nicole McVicar, Carolina Mora, Ian Dixon, Michelle Frolich and Robert Humphries), and field ecologists who undertook ecological investigations of the Biodiversity Certification Assessment Area (BCAA). Brief CVs for the key staff involved in the project are provided in **Appendix A**.

## 1.2 Biodiversity certification assessment area and proposal

The BCAA encompasses a total area of 185.03 ha and is located at Spinks Road (with additional access points along Kurmond Road), Glossodia, in the Hawkesbury LGA (**Figure 4**). It is located directly north of Freemans Reach (bounded by Currency Creek to the south) and approximately 7 km northeast of Richmond CBD. The BCAA includes land proposed for biodiversity certification (and therefore proposed for development; '*land to be certified*'), '*conservation areas*' i.e. land subject to conservation measures, 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 waterway, Currency Creek and cleared floodplains, and small areas associated with dams and proposed open space.

The '*Biodiversity Certification Assessment Area'* (BCAA) defined for this assessment was agreed to between Celestino Pty Ltd, HCC and the NSW Office of Environment and Heritage (OEH) (**Figure 5**).

The BCAA includes approximately 37.02 ha of mapped native vegetation. Vegetation within the BCAA includes two Biometric vegetation types (BVT), '*Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin*' which is equivalent to Cumberland Plain Woodland in the Sydney Basin Bioregion, listed as a critically endangered under the TSC Act and Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest under the EPBC Act.

*'Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin*' is equivalent to River-Flat Eucalypt Forest (RFEF), listed as endangered under the TSC 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 affected (land to be certified or '*development areas*'), land subject to conservation measures (or '*conservation areas*'), and '*retained land*' in the BCAA are shown in **Figure 4**. It is noted that 3.76 ha of land proposed for biocertification comprises an Asset Protection Zone (APZ). The APZ is located adjacent to the '*conservation areas*' on the basis of the future condition of the '*conservation areas*' following restoration and fire hazard these areas will present. No APZ are in the 'conservation areas'. Details of the lots that make up the biocertification land uses in the BCAA are shown in Table 2 and Figure 4 **.**

A draft of this biodiversity certification assessment report was reviewed by the Environment, Energy and Science Group (ESS) of the DPIE for adequacy to exhibit in March and June 2020 and various amendments have been made to this report in response to these reviews.

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**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 (HN528) | 30.20 | CPW (CEEC) | Part of Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest (CEEC)* |
| Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin (HN526) | 6.82 | RFEF (EEC) | - |
| Cleared land | 148.201 | - | - |
| **Total** | **185.03** | | |

**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 | Conservation areas | Retained lands | Total | Land proposed for biodiversity certification | Conservation areas | Retained lands | Total | |
| 1//784300 | 1.38 | 5.95 | 0.86 | 8.19 | 17.82 | 8.06 | - | 25.88 | **34.07** |
| 2//533402 | 0.07 | - | 0.26 | 0.33 | 6.68 | - | 8.71 | 15.39 | **15.72** |
| 2//784300 | 3.38 | 1.05 | 1.14 | 5.57 | 20.12 | 1.06 | - | 21.18 | **26.75** |
| 20//214753 | 0.10 | 0.31 | - | 0.41 | - | - | - | - | **0.41** |
| 3//230943 | 0.91 | 3.66 | 0.03 | 4.60 | 18.71 | 1.36 | - | 20.07 | **24.67** |
| 3//784300 | 3.58 | 0.00 | 0.80 | 4.38 | 19.63 | 0.01 | - | 19.64 | **24.02** |
| 44//214755 | - | - | 0.50 | 0.50 | - | - | 0.20 | 0.20 | **0.70** |
| 50//751637 | 3.36 | 3.15 | 0.54 | 7.05 | 19.43 | 1.60 | - | 21.03 | **28.08** |
| 52//1104504 | 2.97 | 1.43 | 0.08 | 4.48 | 23.55 | 0.48 | 0.28 | 24.31 | **28.79** |
| 75//214752 | 1.53 | - | - | 1.53 | 0.50 | - | - | 0.50 | **2.03** |
| **Total** | **17.28** | **15.55** | **4.21** | **37.04** | **126.44** | **12.57** | **9.19** | **148.20** | **185.03** |

Please note rounding errors of 0.01 ha in various rows/columns due to the splitting of Lots and land use

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## 1.3 Description of project, timelines, management and governance

The Jacaranda is a staged residential subdivision with current planning for approximately 580 lots. The subdivision will create serviced residential lots, public reserves, recreational facilities, roads, APZs and stormwater management facilities. Development of the Jacaranda residential estate is expected to be implemented in four stages over an approximate 5 year timeframe, commencing in late 2021 (subject to demand) and will be subject to the necessary Part 4 and/or Part 5 approvals under the EP&A Act and HCC Development Control Plan (DCP) 2012. No clearing of mapped vegetation will commence in any stage until Celestino Pty Ltd, and other nominated affected parties 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 Jacaranda residential estate**

| Stage | Area (ha) | Likely timeframe | Stage Yield Range |
|---|---|---|---|
| Stage 1 | 43.46 | 2021 (2 Years) | 150-160 lots |
| Stage 2 | 54.14 | 2023 (1.5 Years) | 140-150 lots |
| Stage 3 | 41.28 | 2025 (1.5 Years) | 155-165 lots |
| Stage 4 | 46.33 | 2026 (1 Year) | 115-125 lots |
| | **Total** | | **580** |

## 1.4 Community Consultation and Stakeholder Engagement

The plans for the Jacaranda residential estate have undergone extensive community and stakeholder consultation. Several meetings have been held between Celestino Pty Ltd, HCC, ELA and OEH. Celestino Pty Ltd have also undertaken several community consultation sessions.

Jacaranda has been the subject of a previous Planning Proposal (PP_2012_HAWKE_003_00) that was gazetted on 19 December 2014. Following the gazettal in 2014, a local VPA was executed between the developer and Hawkesbury City Council for the site on 30 January 2017. The VPA provides for the contribution of local infrastructure including road works, new open space and community facilities and the dedication of land zoned RE1 Public Recreation. However, Celestino Pty Limited have submitted a new revised Planning Proposal, PP_2019_HAWKE_004-00 (Ethos Urban 2020) which seeks to increase the provision of RE1 Public Recreation zoned land and introduce new E2 Environmental Conservation land.

The residential yield proposed under the revised Planning Proposal is unchanged from that previously considered suitable for the site at the time the VPAs were executed. Therefore, the demand for infrastructure and community facilities also remains unchanged and no changes are proposed to the existing VPAs for the site in this regard.

Consistent with section 126N of the TSC Act, the proposal to seek biocertification of the site is expected to be placed on public exhibition in February 2021 and a report will be prepared responding to any submissions received.

Further, as there are Matters of National Environmental Significance (MNES) (listed communities and species on the schedules of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) to be affected in the study area, the proposal was also referred to the Commonwealth Department

of the Environment and Energy (DotEE) and was subsequently declared a 'controlled action' under the EPBC Act). A Preliminary Documentation Environmental Assessment Report was prepared and placed on public exhibition in February and May 2020. The Minister for the Environment approved the proposed action in June 2020 (**Appendix B)**.

### 1.5 Strategic context

Hawkesbury City Council resolved to prepare an amendment to the draft LEP for land within the Glossodia area known as Jacaranda in 2014. The objective of the planning proposals was to provide controls through rezoning that would allow for the development of approximately 580 residential allotments with a range of community-recreation facilities, environmental corridors, and a new effluent treatment system. In 2020 an amended planning proposal (Ethos Urban 2020) was submitted to Council to further improve conservation outcomes and provide additional controls on land containing native biodiversity values.

In June 2020, the DPIE issued Gateway Determination for PP_2019_HAWKE_004-00 to amend Hawkesbury Local Environmental Plan 2012 (**Appendix C**).

### 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. They do not include vegetation that is in low condition as described in Section 2.3 of BCAM.

The BCAA includes three red flag entities; impacts to 0.002 ha of a 'Regional Biodiversity Link' as defined by the BCAM, 0.18 ha of Dural land Snail habitat and 8.68 ha of 'assumed' breeding habitat of the Southern Myotis. No native vegetation constitutes a red flag because all of the vegetation present had a site value score of 34 or lower.

### 1.7 Assessment Methodology/Consultation with the OEH

In accordance with OEH's Biodiversity Certification Guide for applicants (OEH 2015a), HCC, Celestino Pty Ltd and ELA consulted with OEH prior to and throughout the assessment to ensure that all decisions and assumptions meet the intent of the BCAM.

A summary of discussions and outcomes are provided below:

- The boundary of the BCAA within the Jacaranda residential estate was modified several times and agreed to between Council, OEH and Celestino Pty Ltd.

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- The proposed biocertification approach: areas of high conservation value (CEECs, riparian areas), and species credits species to be considered. OEH agreed that there was one critically endangered ecological community to be considered and there were no 'state' or 'regional' biodiversity links on site identified by the Director-General, however, Currency Creek, which is classified as a 'major creek' in the BCAM, is by definition a 'regional biodiversity link'.
- The version of the Biocertification calculator tool to be used for calculations. Version 1.9 is to be used. This was confirmed in an email from OEH dated 11 October 2018. Version 1.9 was initially used in 2015 but calculations were updated in May, August and October, December 2017 and December 2018 using version 1.09_HN556_201216 together with amendments to the benchmarks for the number of hollow bearing trees and length of fallen logs for CPW being 1 and 50 respectively.
- The OEH assessment requirements, preparation and exhibition of the BCS, and the application by Hawkesbury City Council 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.

As Version 1.9 of the BCAM tool does not recognise the Dural Land Snail, it has been manually added to the calculations using the equations in BCAM to calculate the number of credits 'required' for impacts and 'generated' by conservation measures using a Tg score of 0.125 (consistent with BBAM 2014).

Further, impacts to Southern Myotis have been assessed as red flag impacts on a precautionary basis only, because whilst the species is categorised in version 1.9_HN556_201216 of the BCAM tool as a species that '*cannot withstand loss*' (i.e. it is a red flag species), its status and Tg score (Response to Management) were changed from 0.13 to 0.45 in after 2012 and to not being a red flag species in the Threatened Species Profile Database (TSPD). Version 1.09_HN556_201216 of the BCAM tool does not recognise these changes and the credit calculations for this species have been calculated using Equation 10 of the BCAM with a Tg score of 0.45.

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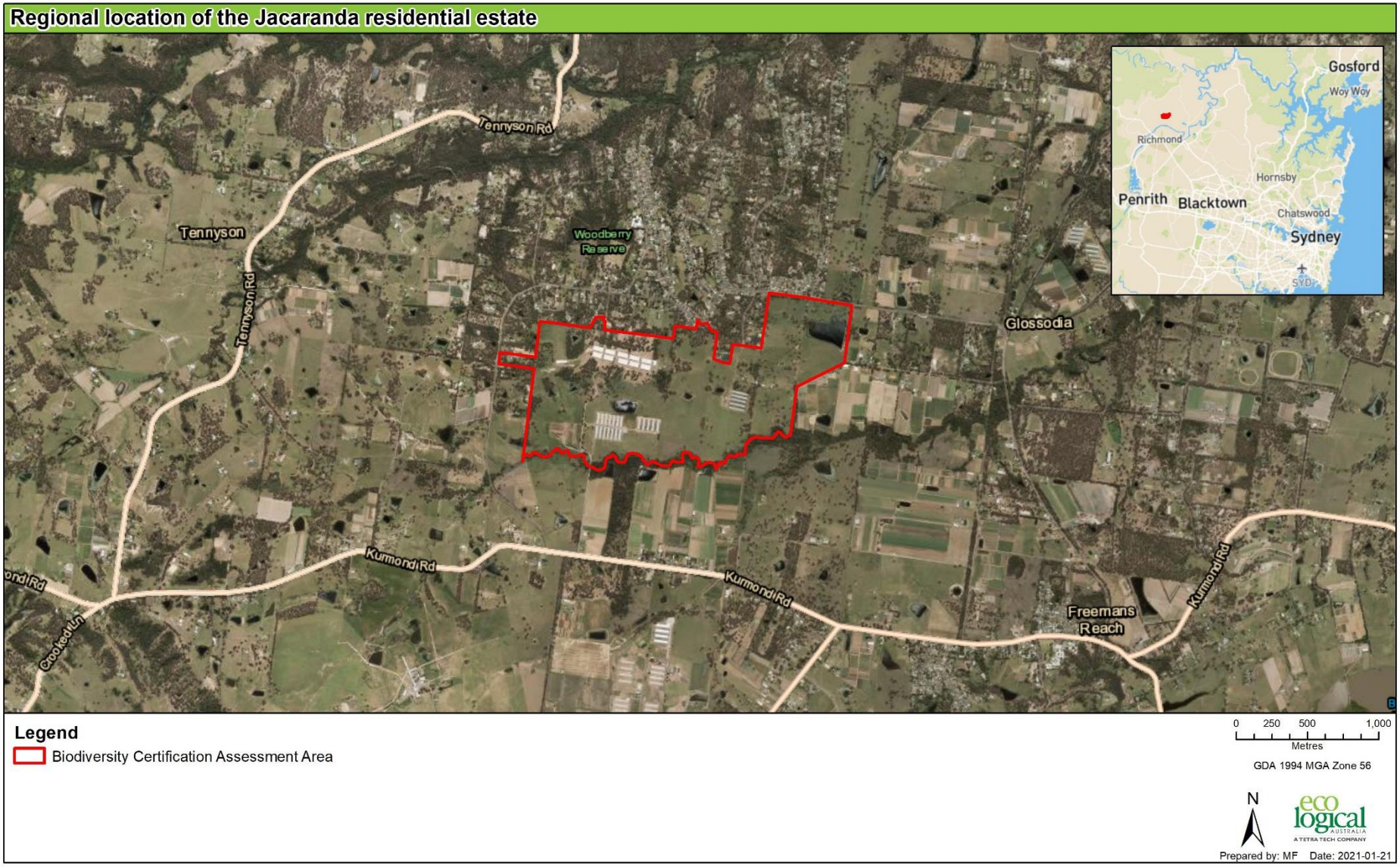


**Figure 1: Regional location of the Jacaranda residential estate**

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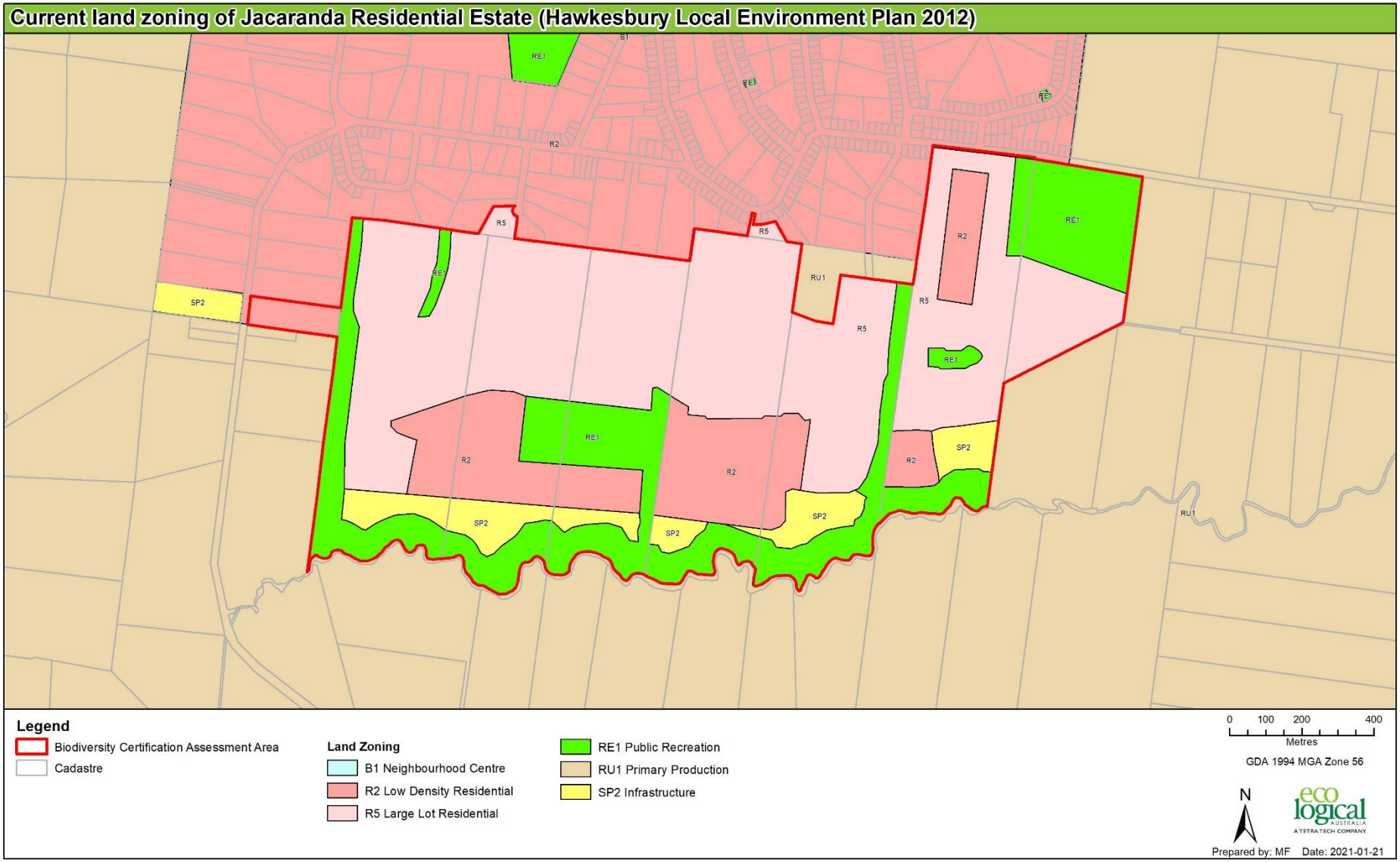


**Figure 2: Current land zoning of Jacaranda (Hawkesbury Local Environment Plan 2012)**

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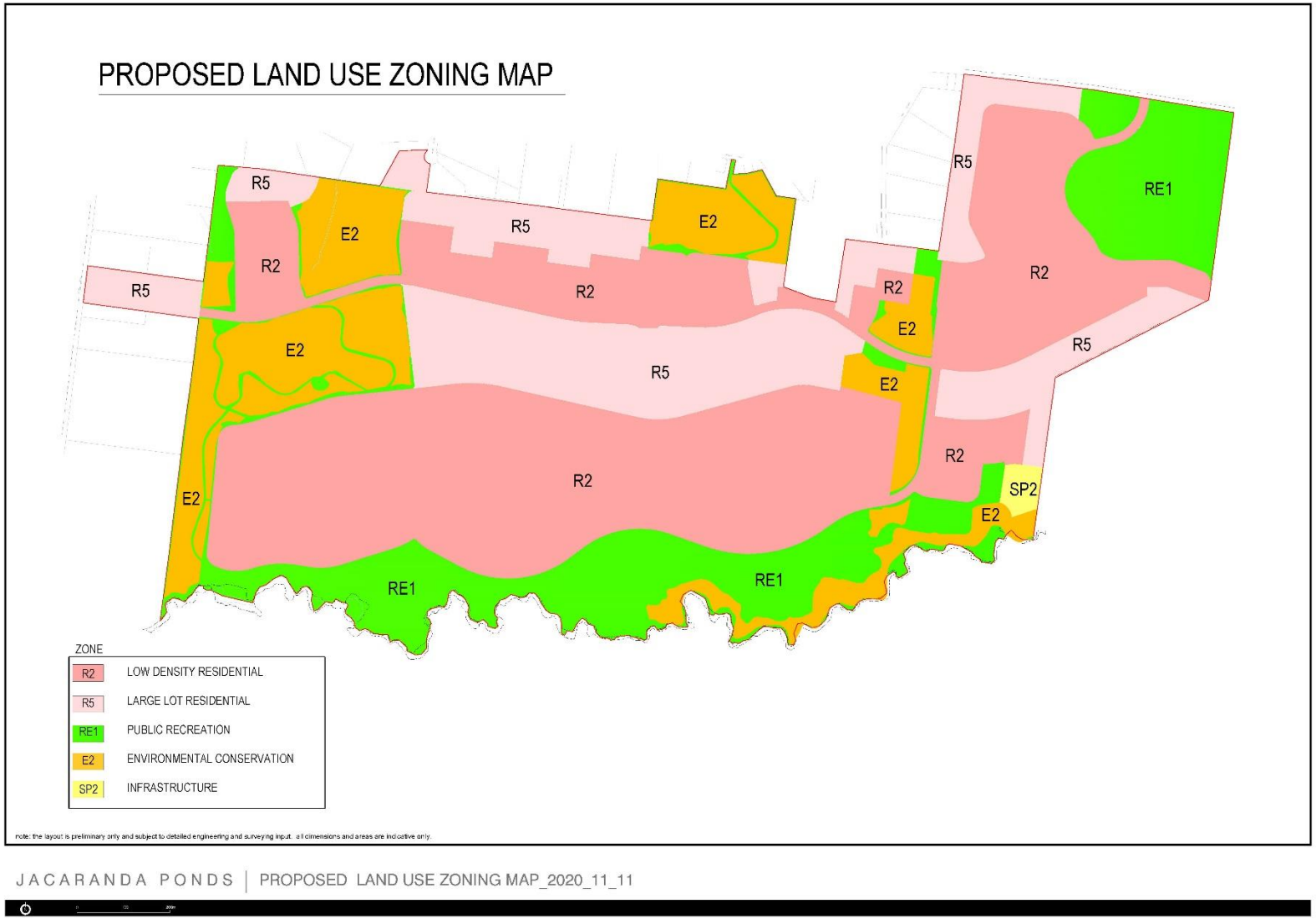


**Figure 3: Proposed land zoning of Jacaranda (Source OneCollective 2020)**

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**Figure 4: Biodiversity Certification Assessment Area**

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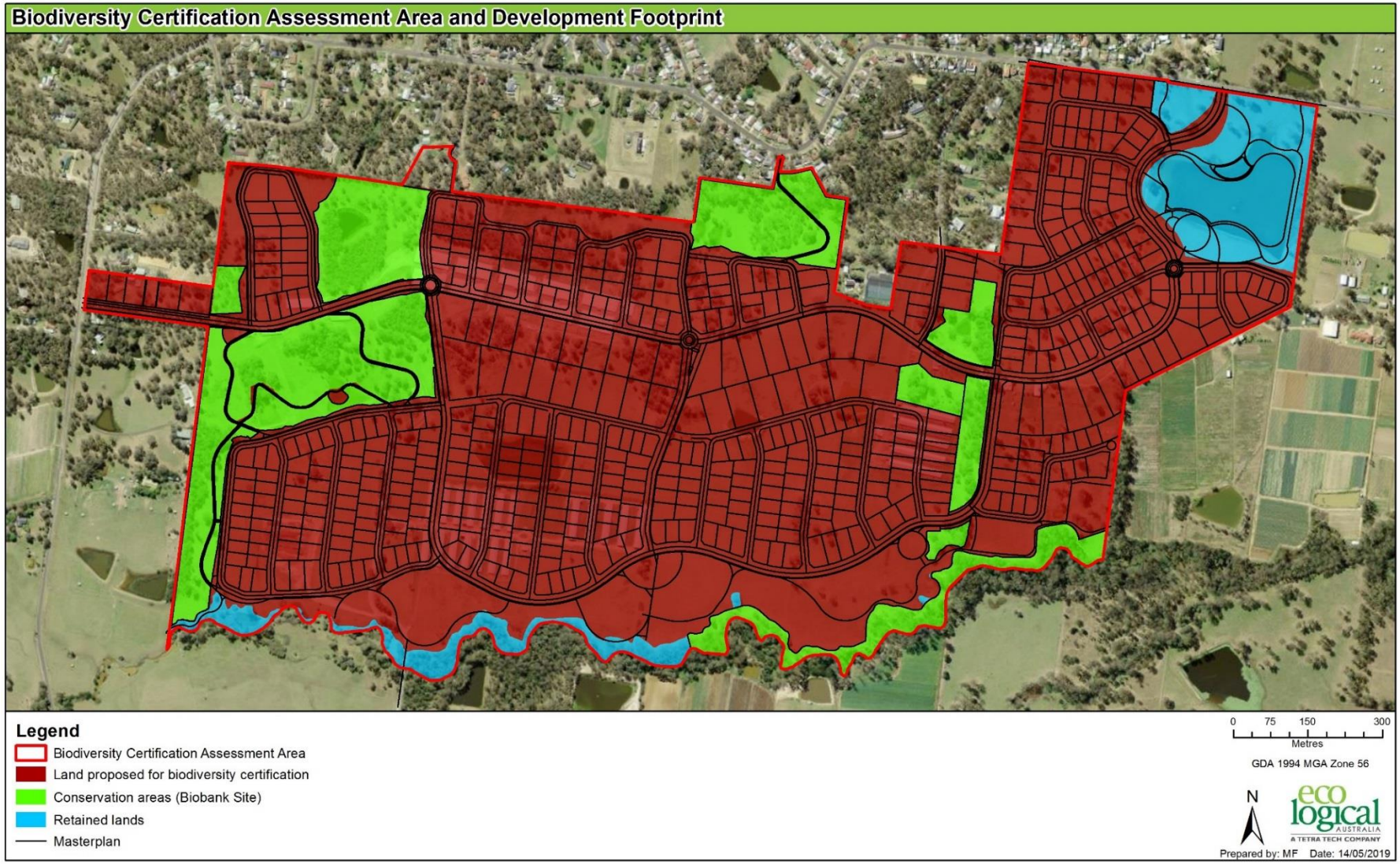


**Figure 5: Relationship between BCAA and Jacaranda Residential Estate development footprint**

Please note that pathways in Biobank sites have been excluded from credit calculations. Lot layout and key pathways in 'retained land' (open space) are indicative only.

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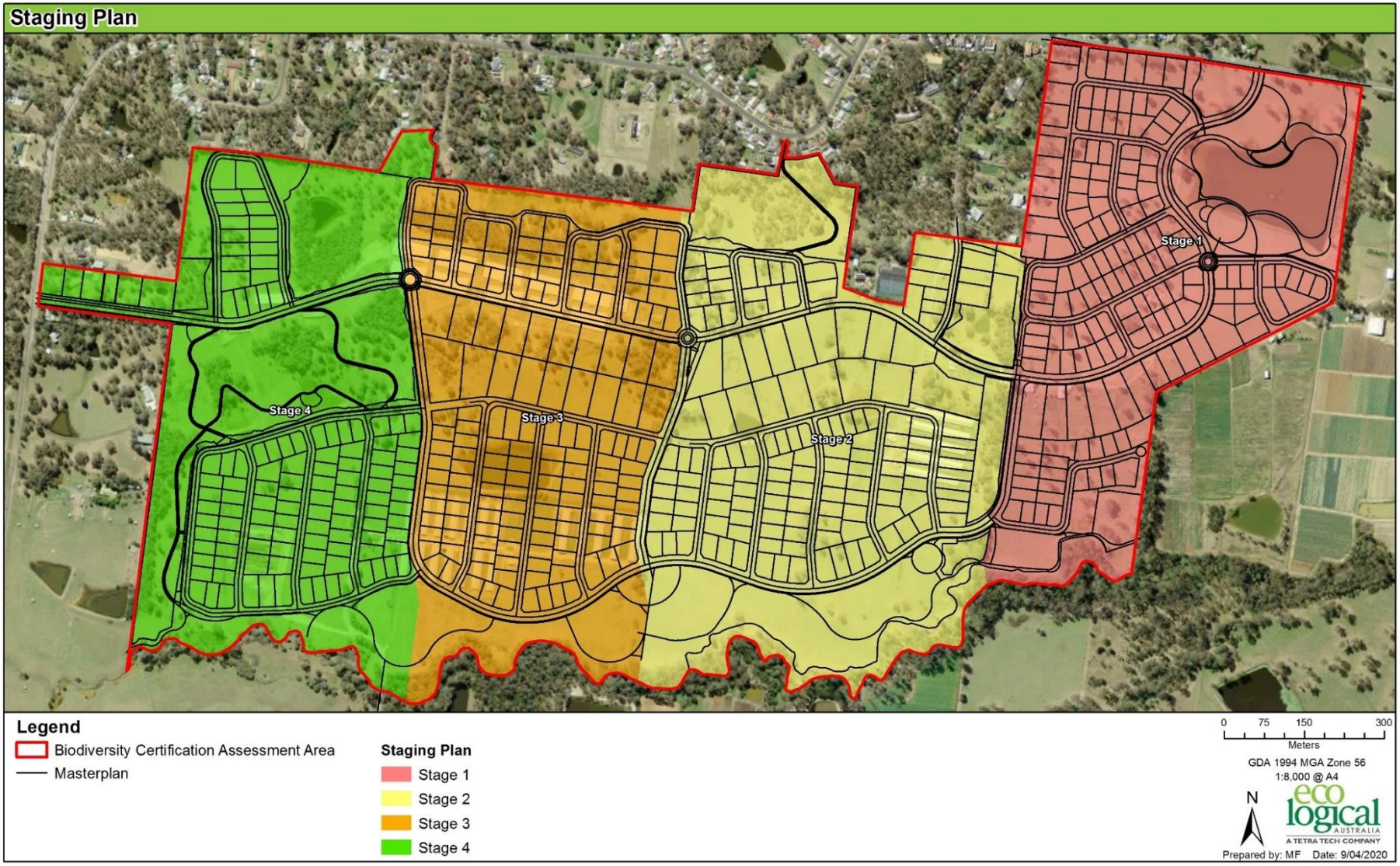


**Figure 6: Indicative stages for the Jacaranda residential estate**

Please note that Lot layout and key pathways in 'retained land' (open space) are indicative only

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# 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.

## 2.1 Methods

### 2.1.1 Literature and data review

Relevant database searches and literature were reviewed prior to field surveys to inform the survey methodologies and provided background information for the ecological assessment, including:

- BioNet Atlas of NSW Wildlife (OEH 2019)
- EPBC Act Protected Matters Search Tool (DotEE 2019)
- Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (DEC 2004)
- existing vegetation mapping (NSW NPWS 2002)
- vegetation mapping undertaken for the site (Travers 2013).

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 2.1.4**).

Relevant legislation and standard technical resources including the Draft *Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (Department of Environment and Conservation [DEC] 2004)* and the Biobanking Assessment Methodology (BBAM 2014) (OEH 2014a) underpinned the survey methodologies and provided background information for the ecological assessment. These resources were also reviewed.

In addition to the database searches of the *Atlas of NSW Wildlife* and *EPBC Protected Matters Search Tool* undertaken by ELA (2014), ELA performed more recent searches of these databases, and used the biocertification credit calculator v 1.9 and version 1.09_HN556_201216 to determine ecosystem and species credit threatened species, validating these against the threatened species profile ecological data from the *BioNet Atlas of NSW Wildlife* (see Step 1 in **Section 2.1.4**).

### 2.1.2 Field survey

The field survey was undertaken by ELA Accredited Assessors Rebecca Dwyer, Enhua Lee and Meredith Henderson, with support from ELA field ecologists Alex Gorey and Nicole McVicar, over a 6 month period from November 2015 to April 2016. There was follow up survey by Alex Gorey and Nicole McVicar on 7 and 11 March 2019 to carry out additional plots and targeted survey for *Pimelea spicata* and on 27 May 2020, 2 June 2020 and 3 June 2020 to complete targeted survey for Cumberland Plain Land Snail and Dural Land Snail. The BCAA was divided into two portions (east and west) due to quarantine restrictions between the existing poultry farm and egg farm. Details of the survey methodology are provided in **Table 4**.

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**Table 4: Survey effort for vegetation and flora**

| Date | Location | Methodology |
|---|---|---|
| 13 November 2015 | Western side of BCAA Area | - One-day survey by two ecologists.<br>- Vegetation mapping was undertaken using aerial photography and ground-truthing the Vegetation of the Cumberland Plain mapping (NPWS 2002).<br>- A random meander of the whole study area was undertaken noting species that occurred in each area following Cropper (1993).<br>- Vegetation was surveyed through one plot/transect (20 m x 20 m plots nested in 20 m x 50 m plots, plus 50 m transect) |
| 16 November 2015 | Eastern side of BCAA Area | - One-day survey by two ecologists.<br>- Vegetation mapping was undertaken using aerial photography and ground-truthing the Vegetation of the Cumberland Plain mapping (NPWS 2002).<br>- A random meander of the whole study area was undertaken noting species that occurred in each area following Cropper (1993).<br>- Vegetation was surveyed through three plots/transects (20 m x 20 m plots nested in 20 m x 50 m plots, plus 50 m transect) |
| 18 – 20 April 2016 | Western side of BCAA Area | - Three-day survey by two ecologists.<br>- Vegetation mapping was undertaken using aerial photography and ground-truthing the Vegetation mapping by ELA in 2015<br>- Vegetation was surveyed through three plots/transects (20 m x 20 m plots nested in 20 m x 50 m plots, plus 50 m transect)<br>- One Anabat unit was placed adjacent to a dam and hollow bearing tree. The device was programmed to record through the entire night and left on site for two consecutive nights.<br>- Targeted threatened flora species searches were undertaken for *Pimelea spicata, Acacia pubescens* and *Grevillea juniperina* subsp. *juniperina*.<br>- *Pimelea spicata* was targeted during meanders.<br>- Two nights of spotlighting and stag watching surveys were undertaken by two ecologists for 30 minutes prior to sunset and 60 minutes after sunset to identify the presence of Grey-headed Flying-fox (GHFF) within the BCAA.<br>- Targeted surveys for Koala were undertaken over two consecutive nights, involving call-playback and spotlighting. The call of the target species was broadcast for up to five minutes, after which 10 minutes of listening and spotlighting was undertaken. This was repeated two times at each of four sites.<br>- Active searches targeting Cumberland Plain Land Snail within leaf litter at the base of trees, under logs and dumped rubbish, and near grass clumps in remnant patches of moderate and good |

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| Date | Location | Methodology |
|---|---|---|
| | | condition CPW in the study area over 15 person hours undertaken over two days. |
| 26 – 28 April 2016 | Eastern side of BCAA Area | - Three-day survey by two ecologists.<br>- Vegetation mapping was undertaken using aerial photography and ground-truthing the Vegetation mapping by ELA in 2015<br>- Vegetation was surveyed through three quadrats (20 m x 20 m plots nested in 20 m x 50 m plots)<br>- Two Anabat units were placed adjacent to dams with hollow bearing trees. The device was programmed to record through the entire night and left on site for two consecutive nights.<br>- Targeted threatened flora species searches were undertaken for *Pimelea spicata, Acacia pubescens* and *Grevillea juniperina* subsp. *juniperina*.<br>- *Pimelea spicata* was targeted during meanders.<br>- Two nights of spotlighting and stag watching surveys were undertaken by two ecologists for 30 minutes prior to sunset and 60 minutes after sunset to identify the presence of GHFF within the BCAA.<br>- Targeted surveys for Koala were undertaken over two consecutive nights, involving call-playback and spotlighting. The call of the target species was broadcast for up to five minutes, after which 10 minutes of listening and spotlighting was undertaken. This was undertaken twice at each of four sites.<br>- Active searches targeting Cumberland Plain Land Snail within leaf litter at the base of trees, under logs and dumped rubbish, and near grass clumps in moderate and good condition remnant patches of CPW in the study area over 15 person hours undertaken over two days. |
| 7 March 2019 | Western area of BCAA | - One-day survey by two ecologists.<br>- Vegetation was surveyed through one quadrat (20 m x 20 m plots nested in 20 m x 50 m plots)<br>- Targeted threatened flora species searches were undertaken for *Pimelea spicata*. Survey involved 5 m parallel transects in moderate to good Cumberland Plain Woodland that would be affected |
| 11 March 2019 | Eastern area of BCAA | - One-day survey by two ecologists.<br>- Vegetation was surveyed through one quadrat (20 m x 20 m plots nested in 20 m x 50 m plots)<br>- Targeted threatened flora species searches were undertaken for *Pimelea spicata*. Survey involved 5 m parallel transects in moderate to good Cumberland Plain Woodland that would be affected |

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| Date | Location | Methodology |
|---|---|---|
| 2 April – 3 July 2019 | Eastern and western side of site | - Targeted survey for forest birds. Ten (10) days of survey conducted by two ecologists on each survey day for the nominated forest birds (Appendix L).<br>- Surveys commenced at dawn for at least 1.5 hours.<br>- Surveys conducted consistent with the Survey Guidelines for Australia's Threatened Birds (DEWHA 2010) and survey guidelines (DEC 2004). All vegetation in the site was surveyed.<br>- Survey involved walking through vegetation with periods of quiet listening and observation.<br>- The *Eucalyptus crebra* and *Eucalyptus moluccana* were in flower during the survey period. All birds observed and heard were noted. Targeted survey for Haliaeetus leucogaster (White-bellied Sea Eagle) nests.<br>- Surveys conducted throughout all vegetation in the site. Surveys involved observing the canopy of trees for large stick nests. |
| 27 May, 2 June and 3 June 2020 | Eastern and western side of site | Vegetation was surveyed through 11 quadrats (20 m x 20 m plots nested in 20 m x 50 m plots)<br>Active searches targeting Cumberland Plain Land Snail and Dural Land Snail within leaf litter at the base of trees, under logs and dumped rubbish, and near grass clumps in moderate and good condition remnant patches of CPW in the study area over 32 person hours undertaken over two days. |

### 2.1.3 BioMetric vegetation type, condition and threatened status

A review of the NSW National Parks and Wildlife Service (2002) vegetation mapping identified five vegetation types within the BCAA (**Figure 9**). Through a desktop comparison of vegetation communities with BVTs for vegetation communities recorded by NPWS (2002) in the BCAA, the best fit BVTs present in the BCAA was determined (**Table 5**). The results of the analysis identified two BVTs in the BCAA. These BVTs correspond to threatened ecological communities under the BC Act and / or EPBC Acts (**Table 5**). **Figure 9** shows the indicative BVTs in the BCAA based on the on the desktop assessment and displays mapping ELA prepared for the original BCAM field assessment.

**Table 5: Vegetation communities and equivalent BVTs in the BCAA and relationship to threatened ecological communities**

| Vegetation community (NPWS 2002, Travers 2013, ELA 2019a and 2019b) | BioMetric equivalent (DECC 2008) | Name of entity under the TSC / EPBC Acts |
|---|---|---|
| Alluvial Woodland | '*Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*' (HN526) | River-flat Eucalypt Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (EEC) (TSC Act only).<br>Currently under consideration for listing under the EPBC Act. |

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| Vegetation community (NPWS 2002, Travers 2013, ELA 2019a and 2019b) | BioMetric equivalent (DECC 2008) | Name of entity under the TSC / EPBC Acts |
|---|---|---|
| Shale Plains Woodland | '*Grey Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion*' (HN528) | Cumberland Plain Woodland / Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CEEC) (TSC and EPBC Act respectively) |

### 2.1.4 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 affected 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 affected.

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 D.**

*Step 1. – Identify candidate species for initial assessment*

A list of candidate species was filtered into the BCAA using 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 D**.

*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 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 the Environment (DotE) 2016) to generate a report to assist to determine whether matters of national environmental significance (NES) were located within 10 km radius of the BCAA.

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*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 D**.

One threatened flora species was recorded by SKM 2010; *Pimelea spicata* (referenced in Travers Bushfire and Ecology Flora and Fauna Constraints Assessment 2013). Two individuals were found by SKM in a patch of Cumberland Plain Woodland on the western side of the BCAA (Travers 2013). No individuals were found by Travers Bushfire and Ecology (2013). Subsequent targeted survey by ELA (2019) throughout the BCAA did not identify the previously recorded individuals or any new individuals. A majority of the BCAA did not present suitable habitat for *Pimelea spicata*. No threatened flora species were recorded by ELA in 2015, 2016, 2017 or 2020 (ELA 2019a, 2019b, 2020a, 2020b) in the BCAA. Given the current land use, history of disturbance and generally poor condition of the vegetation within the BCAA, it was considered unlikely that any threatened flora species would occur.

ELA (2019a, 2019b) identified two threatened fauna species requiring species credits within the BCAA during survey; Cumberland Plain Land Snail and Southern Myotis. However, additional survey in 2020 to confirm the presence of Cumberland Plain Land Snail determined that previous records of Cumberland Plain Land Snail were in error and that all specimens allocated to this species were in fact *Bradybaena similaris* (Asian Trump Snail) (Australian Museum Identification Service and **Appendix E**). Further, a location where the Dural land Snail was located in 2018 was re-assessed and the Dural Land Snail was confirmed to be present (Appendix E). Targeted survey was also undertaken for the Koala. No Koalas were identified in the BCAA during targeted survey.

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

No threatened flora candidate species were identified as requiring targeted survey with the exception of *Pimelea spicata*. Targeted survey was undertaken for this species and none were identified in the BCAA. As such the BCAA footprint does not contain potential habitat for this species.

Habitat polygons for Dural Land Snail (DLS) were mapped based on the presence of records for the species following targeted survey (ELA 2020). Only one area within the BCAA is considered habitat for the DLS and this is where the species was identified during the 2020 surveys. This is also where the species has previously been recorded in 2018 (BioNet 2020). Given the extensive survey effort throughout the BCAA, and verification of all specimens with the Australia Museum, no other areas are considered habitat for this species. Highly degraded areas, (Figure 7 and Figure 8) have not been included as habitat.

Areas of potential breeding habitat were identified for Southern Myotis. Potential habitat for Southern Myotis was assessed as any native vegetation within 100 m of a hollow bearing tree (HBT) that was within 200m of a permanent waterbody (Figure 16). Conversely, following establishment of the proposed biobank sites, loss of HBTs in the urban areas and dam dewatering, the extent of potential Southern Myotis breeding habitat in areas subject to conservation measures was assessed on the basis of only retained dams and waterways suitable for foraging by Southern Myotis (i.e. Currency Creek and the large dam in the north-west of the BCAA) (Figure 17).

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

There was one species confirmed on site that would trigger a red flag; *Myotis macropus* (Southern Myotis). Red flagged Myotis breeding habitat is shown in Figure 18.

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

Habitat polygons for Dural Land Snail and Southern Myotis were mapped within the BCAA 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 (BioNet) as being habitat for the species.

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**Figure 7: Degraded Cumberland Plain Woodland not considered habitat for the Dural Land Snail**

**Figure 8: Degraded Cumberland Plain Woodland not considered habitat for the Dural Land Snail**

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### 2.1.5 Field assessment

Field assessment was designed to meet BCAM requirements for mapping and surveying BVTs.

In relation to BVTs and threatened flora species, ELA principal ecologist, Meredith Henderson, used the desktop assessment to target on-ground validation of the biometric vegetation types and threatened flora species within the BCAA. This led to a revision of the BVT boundaries and a number of '*vegetation zones*' in April 2016 and March 2018, 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 seven BioMetric quadrats/transects were necessary to meet the minimum requirements of BCAM (DECCW 2011) for the BCAA. Field assessment involved vegetation assessment with 10 biometric plots conducted in accordance with the requirements of the BCAM. Surveys occurred over six days, on 13, 16 November 2015,18, 26 April 2016 and 7 and 11 March 2019. They involved accredited assessors Meredith Henderson, Enhua Lee and Rebecca Dwyer, Nicole McVicar and Alex Gorey. The field survey targeted locations that were considered likely to be representative of the mapped vegetation communities in their various condition states.

Table 6 shows the number of plots required and completed for these vegetation zones. The final mapped vegetation types and zones together with the location of plots used in the assessment are shown in **Figure 10**.

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**Table 6: Vegetation zones in the BCAA, plot requirements, and plots completed**

| Veg Zone ID | BioMetric Vegetation Type | Biometric Condition category | Ancillary Condition Code | Area | Plots required (BCAM) | Plots completed and plot names (in brackets) |
|---|---|---|---|---|---|---|
| 1 | Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin | Low | Exotic understorey | 6.82 | 1 | 1 (BB03) |
| 2 | Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin | Low | Good | 12.52 | 2 | 2 (BB02; BB07) |
| 3 | Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin | Low | Moderate | 14.39 | 2 | 3 (BB01; BB05; BB06) |
| 4 | Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin | Low | Regeneration | 0.53 | 1 | 1 (BB08) |
| 5 | Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin | Low | Scattered Paddock Trees | 2.76 | 1 | 1 (BB04) |
| 6 | Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin | Low | Cleared | 12.56 | 2 | 2 (BB09; BB10) |
| | | | | **Total** | **9** | **10** |

In relation to additional flora and fauna survey above the effort undertaken by ELA determined that targeted surveys were required for all candidate species (see **Section 2.1.4** for candidate species). Additional surveys followed formal methods outlined in *Threatened Biodiversity Survey and Assessment Guidelines for Development and Activitie*s (DEC 2004). Specifically, random meanders were used to target threatened flora species, along with quadrats undertaken to survey the vegetation zones consistent with the guidelines (OEH 2016). Active searches were undertaken to target Cumberland Land Snail, Koala, threatened microchiropteran bats and Forest Owls in suitable habitat consistent with the guidelines (OEH 2018). Surveys occurred over five days, on 18, 19, 20 April 2016 and 26, 27 April 2016. **Figure 11** shows the locations of flora and fauna survey effort within the BCAA.

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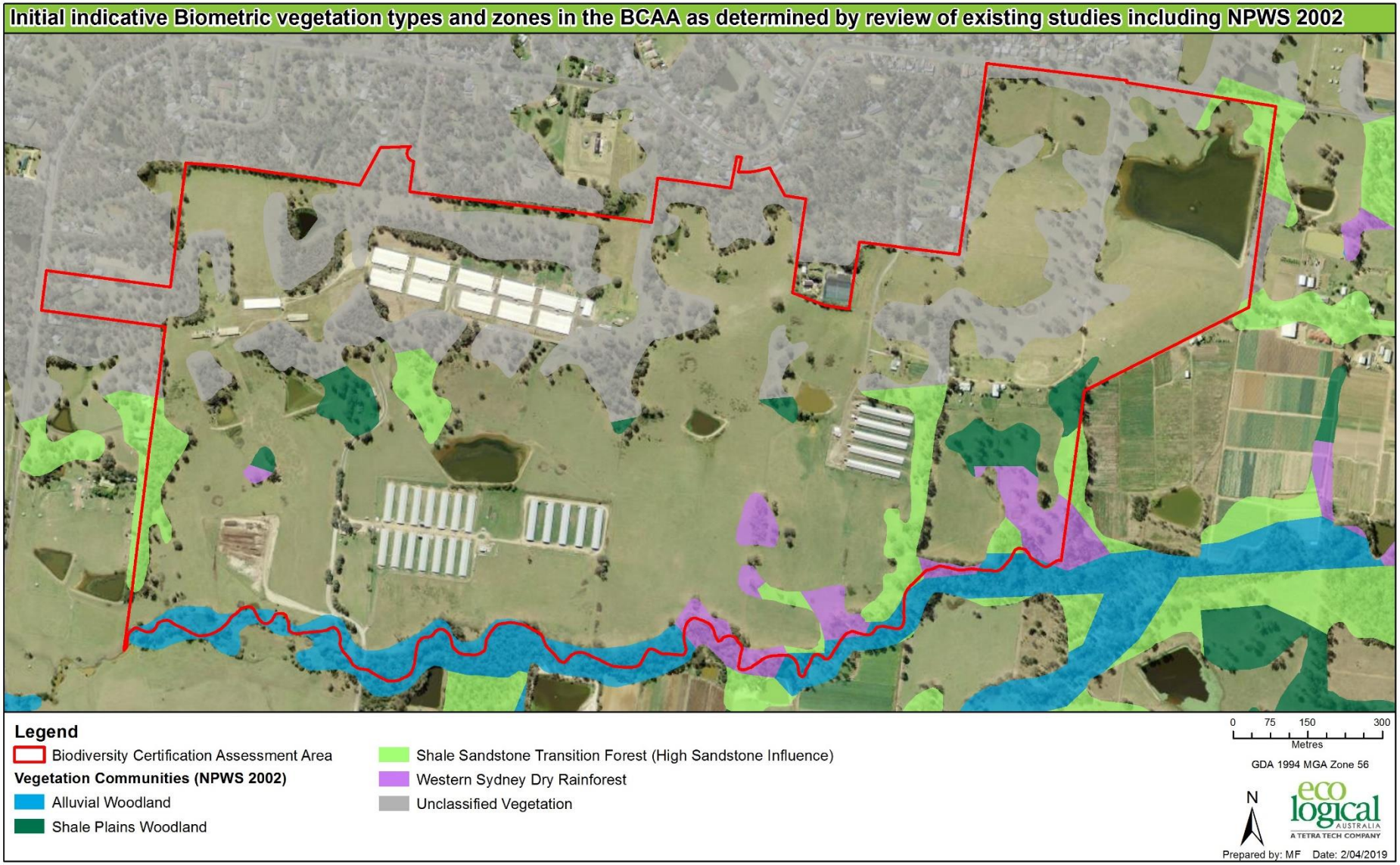


**Figure 9: NPWS (2002) Vegetation Mapping**

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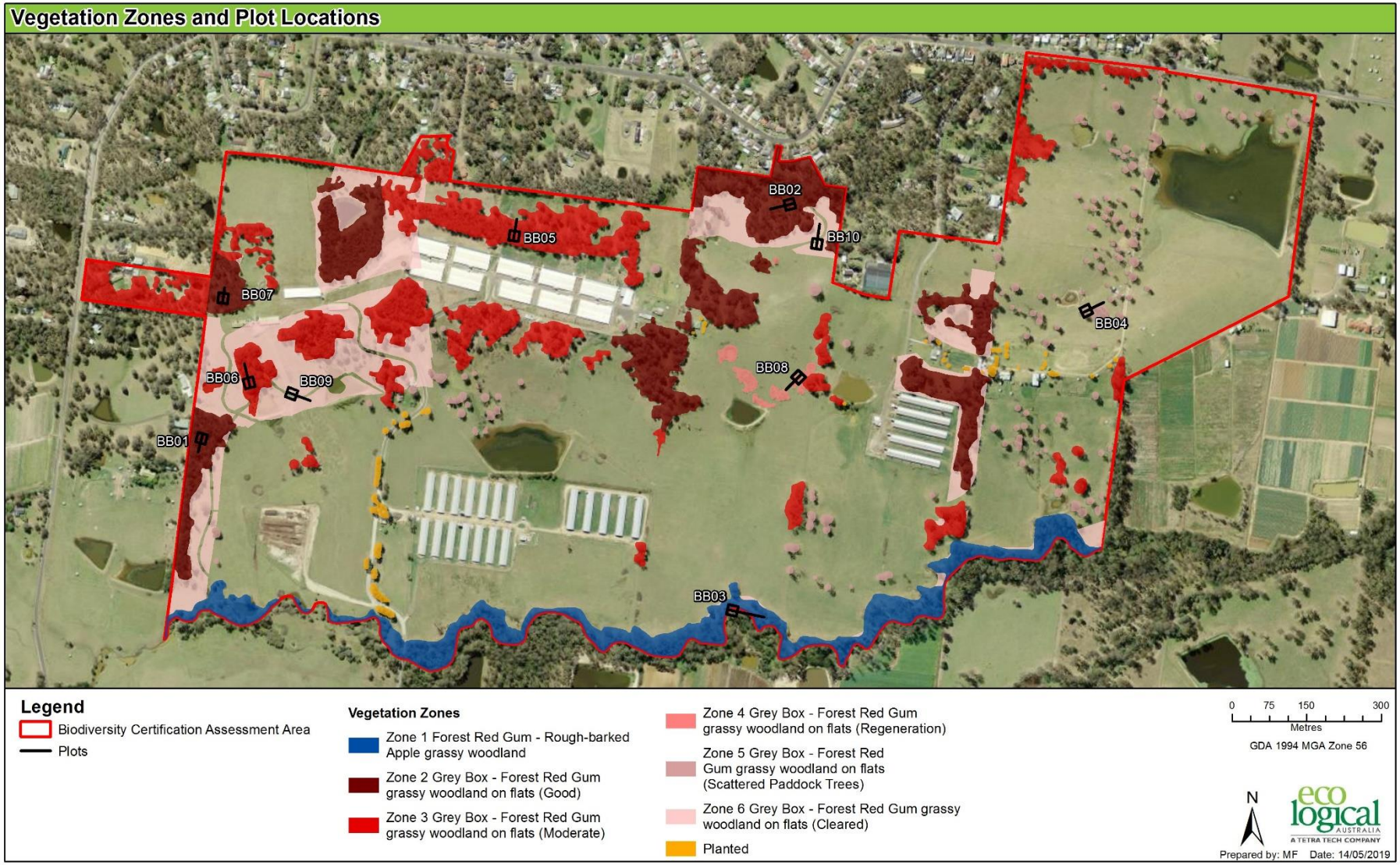


**Figure 10: Validated BioMetric Vegetation Types in BCAA and location of plots used in credit calculations**

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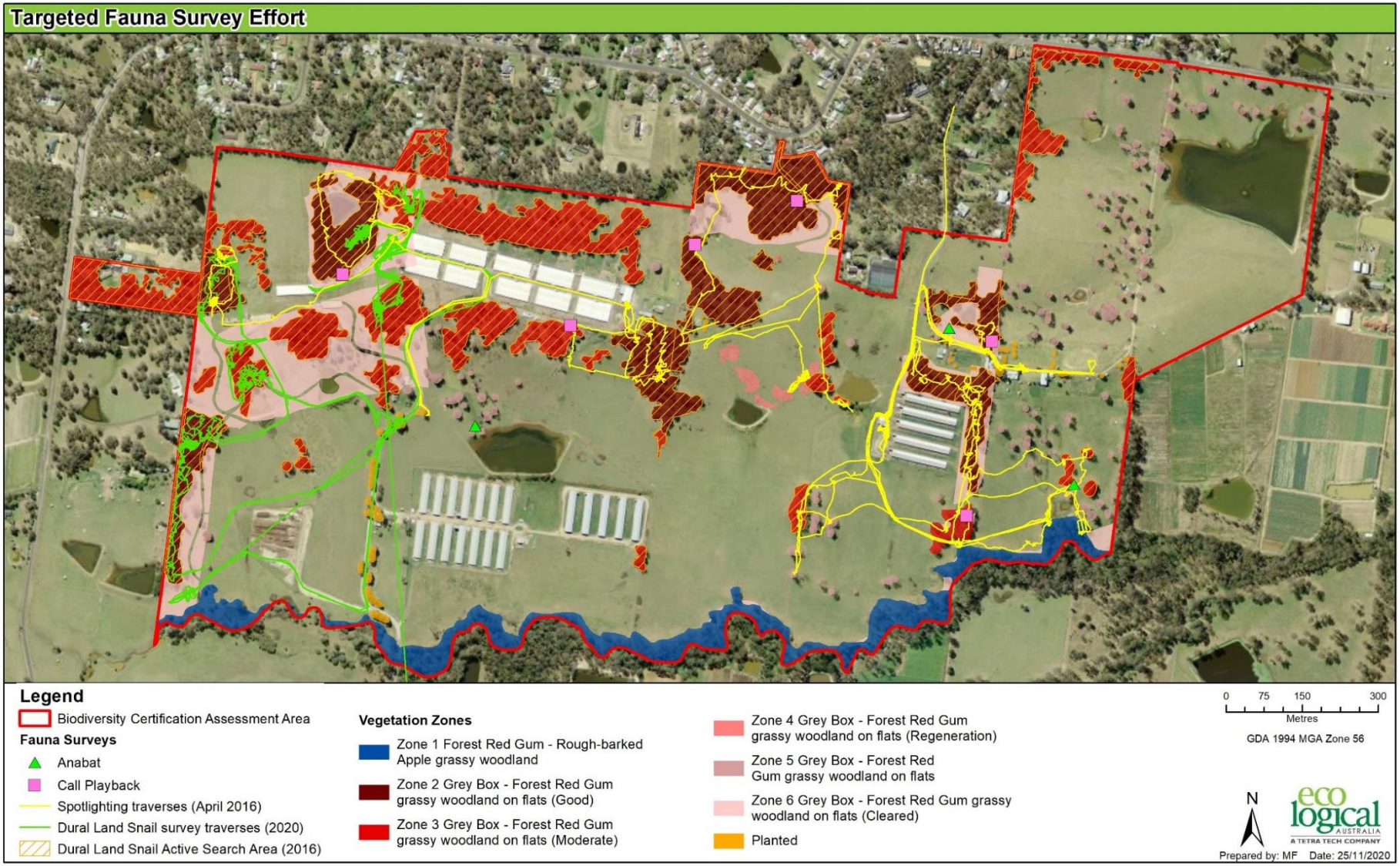


**Figure 11: Fauna survey effort within the BCAA**

Please note figure does not show previous survey effort of SKM (in Travers 2013) and Travers 2013

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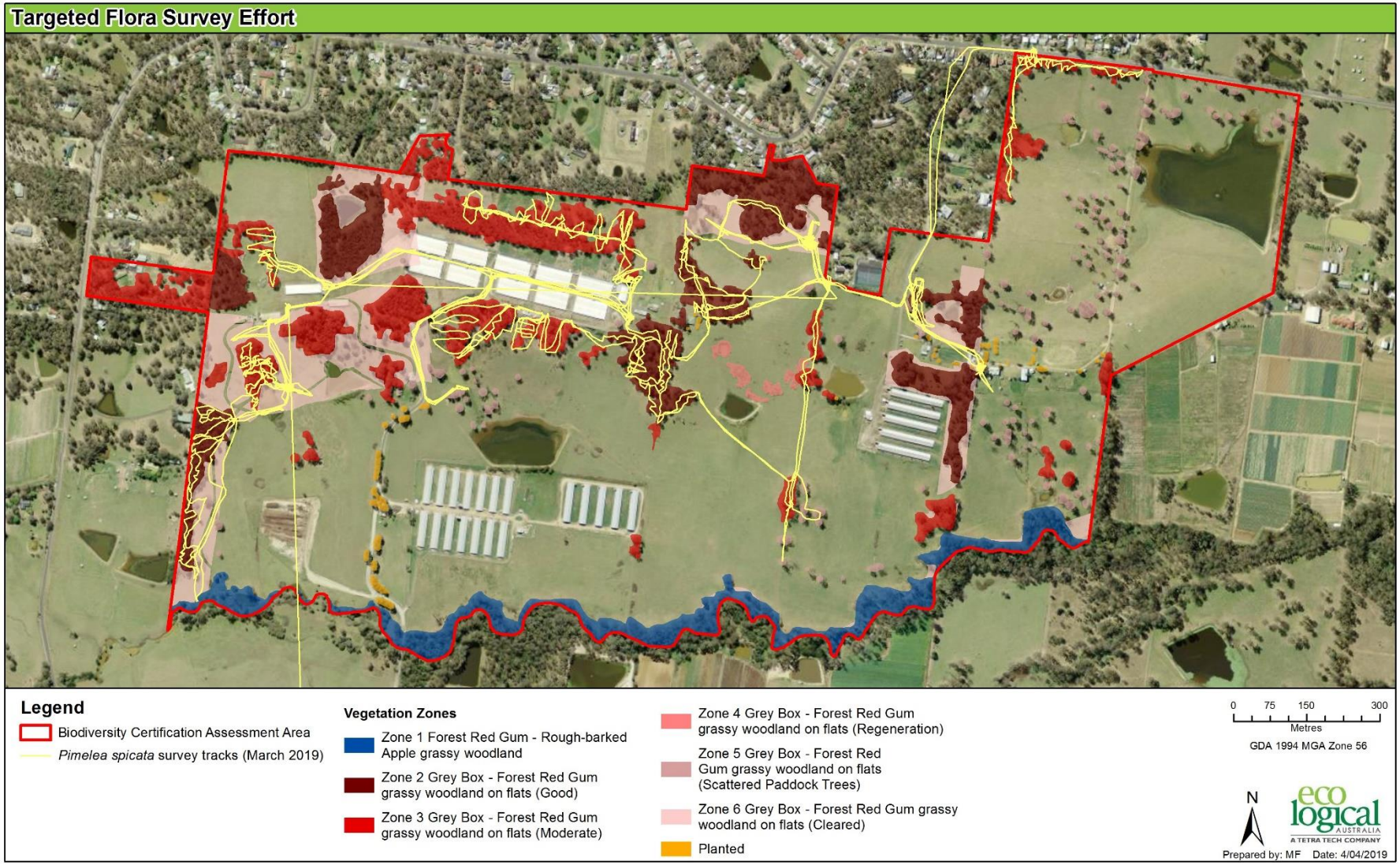


**Figure 12: Flora survey effort in the BCAA**

Please note previous survey effort of SKM (in Travers 2013) and Travers 2013 not shown

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The timing of surveys coincided with the relevant survey guidelines. Details of survey dates and field personnel for the additional survey work undertaken for this assessment are provided in **Table 7**. The total number of field days was eight days (20 person days).

**Table 7: Survey dates and field personnel**

| Survey dates | Survey personnel |
|---|---|
| 13 November 2015 | Enhua Lee, Nicole McVicar |
| 16 November 2015 | Enhua Lee, Nicole McVicar |
| 18 April 2016 | Meredith Henderson, Rebecca Dwyer |
| 19 - 20 April 2016 | Rebecca Dwyer, Alex Gorey |
| 26 - 27 April 2016 | Rebecca Dwyer, Alex Gorey |
| 28 April 2016 | Rebeca Dwyer |
| 7 – 11 March 2019 | Nicole McVicar, Alex Gorey, Carolina Mora |
| 27 May, 2 - 3 June2020 | Alex Gorey, Mike Lawrie, Stacey Wilson |

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. Daily weather conditions from the Richmond RAAF weather station (station 067105) are shown in **Table 8** (BOM 2017; BOM 2019).

**Table 8: 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 |
|---|---|---|---|---|---|---|
| November week prior to survey | 6-13/11/2015 | 11.7-18.2 | 21.3-30.8 | 24.4 | - | - |
| November 2015 survey | 13/11/2015 | 15.6 | 29.9 | 4.4 | - | - |
| | 16/11/2015 | 12.8 | 24.2 | 7.4 | - | - |
| April week prior to survey | 11-17/04/2016 | 7.8-17.2 | 22.2-29.7 | 0-0.4 | 58-89 | 29-74 |
| April 2016 survey | 18/04/2016 | 13.6 | 24.7 | 0 | 80 | 76 |
| | 19/04/2016 | 15.7 | 25.8 | 0.4 | 81 | 46 |
| | 20/04/2016 | 14.1 | 27.4 | 0.2 | 95 | 49 |
| | 26/04/2016 | 8.2 | 25.0 | 0 | 91 | 50 |
| | 27/04/2016 | 9.2 | 27.0 | 0 | 99 | 45 |
| | 28/04/2016 | 10.3 | 27.7 | 0 | 98 | 47 |
| | 7 March 2019 | 15.2 | 21.5 | 3.6 | - | - |

| Timing | Date | Minimum temperature (ºC) | Maximum temperature (ºC) | Rainfall (mm) | Relative humidity (%) at 9am | Relative humidity (%) at 3pm |
|---|---|---|---|---|---|---|
| March 2019 survey | 11 March 2019 | 16.9 | 32.1 | 0.2 | - | - |
| May 2020 survey | 27 May 2020 | 8.1 | 20.4 | 0.4 | - | - |
| June 2020 survey | 2 June 2020 | 4.5 | 17.6 | 0 | - | - |
| | 3 June 2020 | 1.3 | 19.5 | 0 | - | - |

## 2.2 Results

### 2.2.1 Vegetation types and condition

Field survey, quantitative analysis of plot data, and consultation with the OEH confirmed two BVTs within the BCAA, and the presence of six 'vegetation zones'. The locations of the plots and vegetation zones are shown in **Figure 10**.

A profile of the BVTs present within the BCAA, including the different ancillary codes identified, is provided in **Appendix E**. Vegetation Zone 6 has been included as part of HN528. These patches would be revegetated to this community as part of the Biobank Agreement.

### 2.2.2 Flora

A total of 87 flora species were recorded in biometric plots undertaken by ELA that were used in this assessment. A full list of species recorded in plots is provided in **Appendix G**.

*Threatened flora species*

No threatened flora species were recorded by ELA in the BCAA, despite searches of the BCAA (**Figure 13**). The BCAA was degraded in most patches of remnant native vegetation. The area has been historically cleared and is subject to current agricultural and farming practices. The previous land management practices have resulted in large areas of the BCAA presenting as relatively degraded and does not provide for threatened flora habitat. Very little mid-storey vegetation or ground cover was present in these remnants. Where groundcover was present, it was dominated by the exotic species *Sida rhombifolia*, *Bidens pilosa*, *Pennisetum clandestinum* and *Paspalum dilatatum*. Areas in 'good' condition contained a more native groundcover of *Microlaena stipoides* var. *stipoides* and *Aristida vagans*. Despite the cover in 'good' areas being between 30% - 50% native, the BCAA was not considered to contain suitable habitat for any threatened flora species.

### 2.2.3 Fauna species

A total of 108 fauna species were recorded in the BCAA. the majority were birds, followed by mammals, amphibians, and reptiles. Some of the fauna species recorded by Travers (2009) and ELA were common to all studies (i.e. were the same species). Species recorded were generally species common to rural environments in north-western Sydney.

Threatened and migratory fauna species

A total of 104 threatened fauna and migratory species were previously recorded within a 5 km radius of the BCAA with eight threatened fauna previously recorded in the BCAA (OEH 2019). The following species have records in the BCAA (OEH 2019):

- *Ardea ibis* (Cattle Egret).
- *Artamus cyanopterus* (Dusky Woodswallow)
- *Circus assimilis*, (Spotted Harrier)
- *Haliaeetus leucogaster* (White-bellied Sea Eagle)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Southern Myotis)
- *Pommerhelix duralensis* (Dural Land Snail).

Field survey conducted by SKM (2009 in Travers 2013) identified *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat), *Mormopterus norfolkensis* (Eastern Freetail-bat), *Myotis macropus* (Southern Myotis) in the BCAA. These same species were identified by Travers Bushfire and Ecology (2013), with *Haliaeetus leucogaster* (White-bellied Sea Eagle) also identified (**Appendix K**). Survey conducted by ELA in 2015, 2016, 2019 and 2020 positively identified five threatened fauna species within the BCAA, including:

- *Pommerhelix duralensis* Dural Land Snail – species credit species
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail-bat)
- *Myotis macropus* (Southern Myotis) – species credit species for breeding habitat.

One additional threatened microbat returned possible calls during targeted survey:

- *Miniopterus australis* (Little Bent-wing Bat).

No migratory species have been identified by ELA in the BCAA. The results of the BioNet search are shown in Figure 13. The locations of threatened fauna species recorded within the BCAA during previous surveys records are also shown in **Figure 13**.

Of the above species, only two species require assessment as species credit species, Dural Land Snail and Southern Myotis, have been identified as being affected by the land to be certified. The other threatened fauna species identified during survey are all ecosystem credit fauna species and are assumed to be present and are assessed as part of the area of vegetation..

*Species Credit Habitat Maps*

A total of 2.76 ha of habitat for Dural Land Snail has been mapped on land in the BCAA (Figure 15). The BCAA includes 0.18 ha of habitat to be affected and 2.58 ha of habitat for Dural Land Snail to be conserved.

A total of 28.13 ha of habitat for Southern Myotis has been mapped on land in the BCAA pre-development (Figure 16). The BCAA includes 8.68 ha of habitat that would be affected and 8.2 ha of habitat subject to conservation measures post development and 0.45 ha of habitat that would be retained.

### 2.2.4 Red flag Area

Vegetation types greater than 70% cleared that are not in low condition

The CEEC recorded in the BCAA, '*Cumberland Plain Woodland in the Sydney Basin Bioregion*', is a red flag community if the community is in moderate to good condition, with a vegetation integrity score of >34. The Cumberland Plain Woodland in the BCAA was mapped into four zones; with the ancillary codes of moderate, good, regeneration and scattered paddock trees. None of the Cumberland Plain Woodland achieved >34 for the site value scores and is therefore classified as being in biometric low condition. As such, Cumberland Plain Woodland does not constitute a red flag in the BCAA.

Areas of vegetation recognised as having regional or state biodiversity conservation significance

There were also areas of vegetation within a 30 m buffer area of a minor river (Currency Creek) within the BCAA (Figure 18). The proposed development would affect 0.002 ha of mapped native vegetation (which forms the residual part of a patch that will be impacted outside of the buffer) within this riparian buffer area. This is classified as a red flag and is discussed in section 4.5.

*Threatened species that cannot withstand loss*

There is one threatened species identified in the Threatened Species Profile Database that cannot withstand further loss; *Myotis macropus* (Southern Myotis). Breeding habitat for this species is a red flag area and is mapped in Figure 16. The species was recorded on an echolocation recording device. It was not confirmed whether the species was utilising the site for foraging, breeding or roosting.

For the purpose of this assessment, breeding habitat has been 'assumed' to be present on the basis of hollow bearing trees within 200 m of permanent water bodies as advised by OEH.

The distribution of red flag areas across the BCAA is shown in Figure 18**.**

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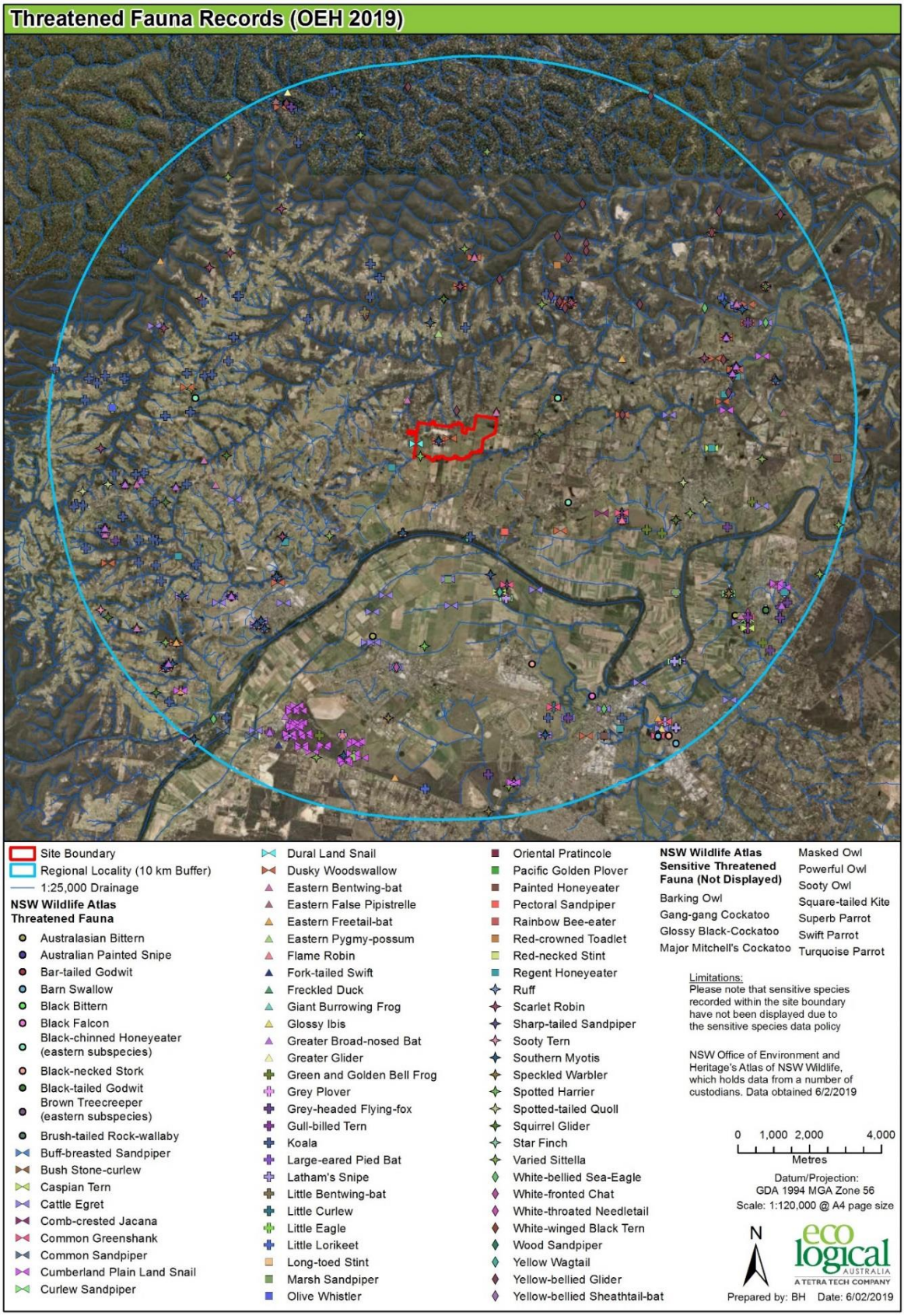


**Figure 13: Threatened fauna species recorded within and adjacent to the BCAA.**

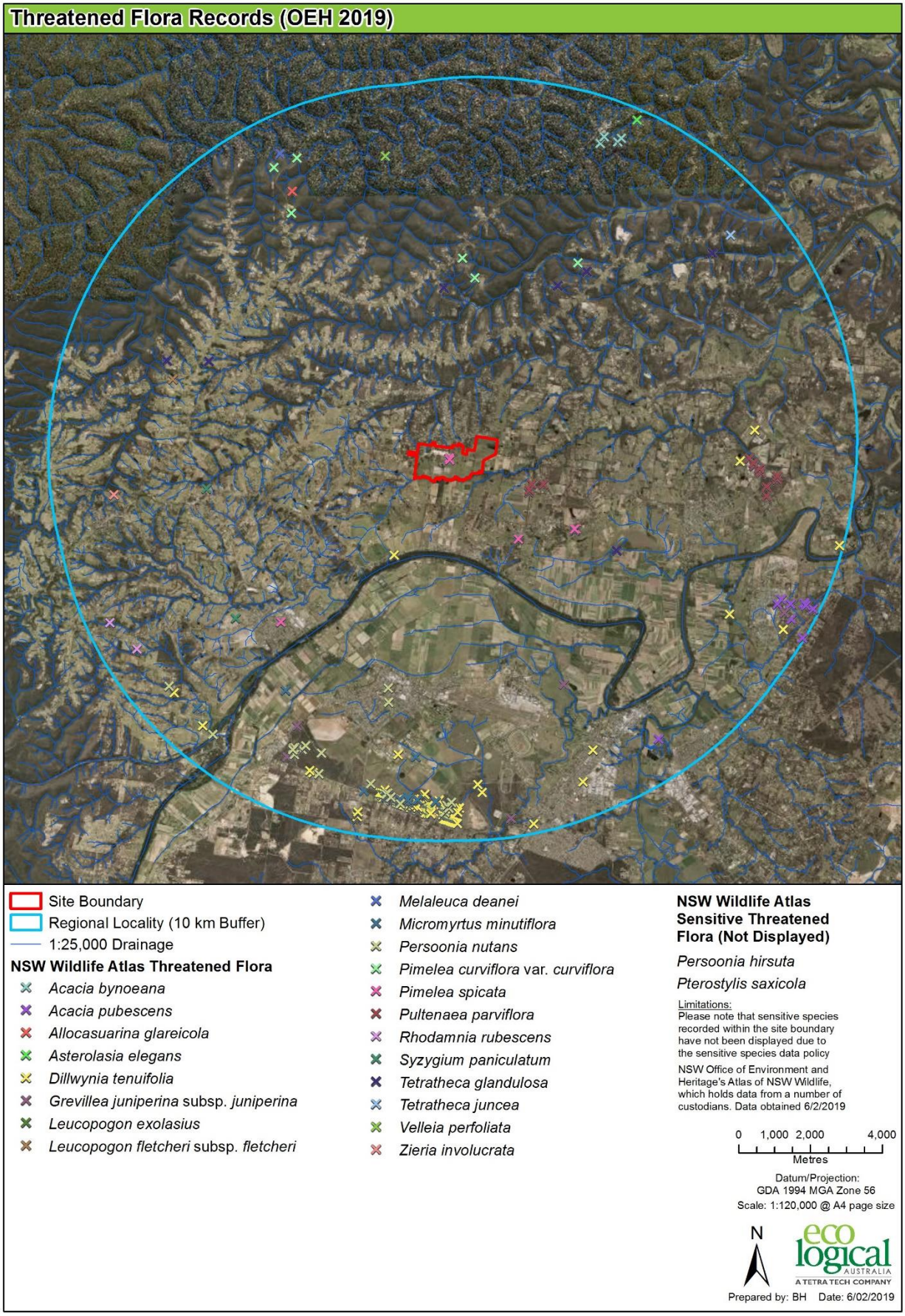


**Figure 14: Threatened flora recorded within and adjacent to the BCAA**

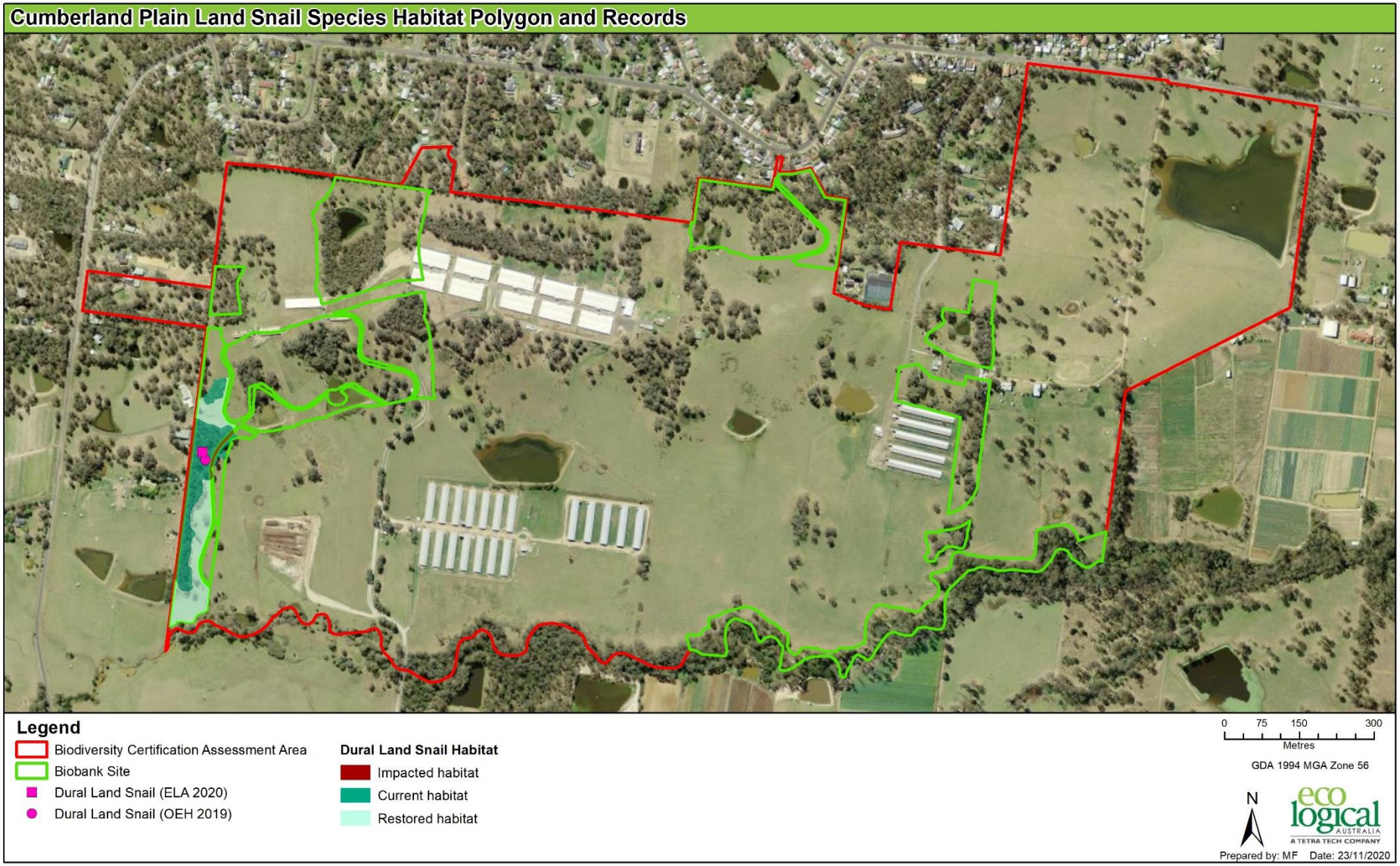


**Figure 15: Habitat polygon and records for Dural Land Snail**

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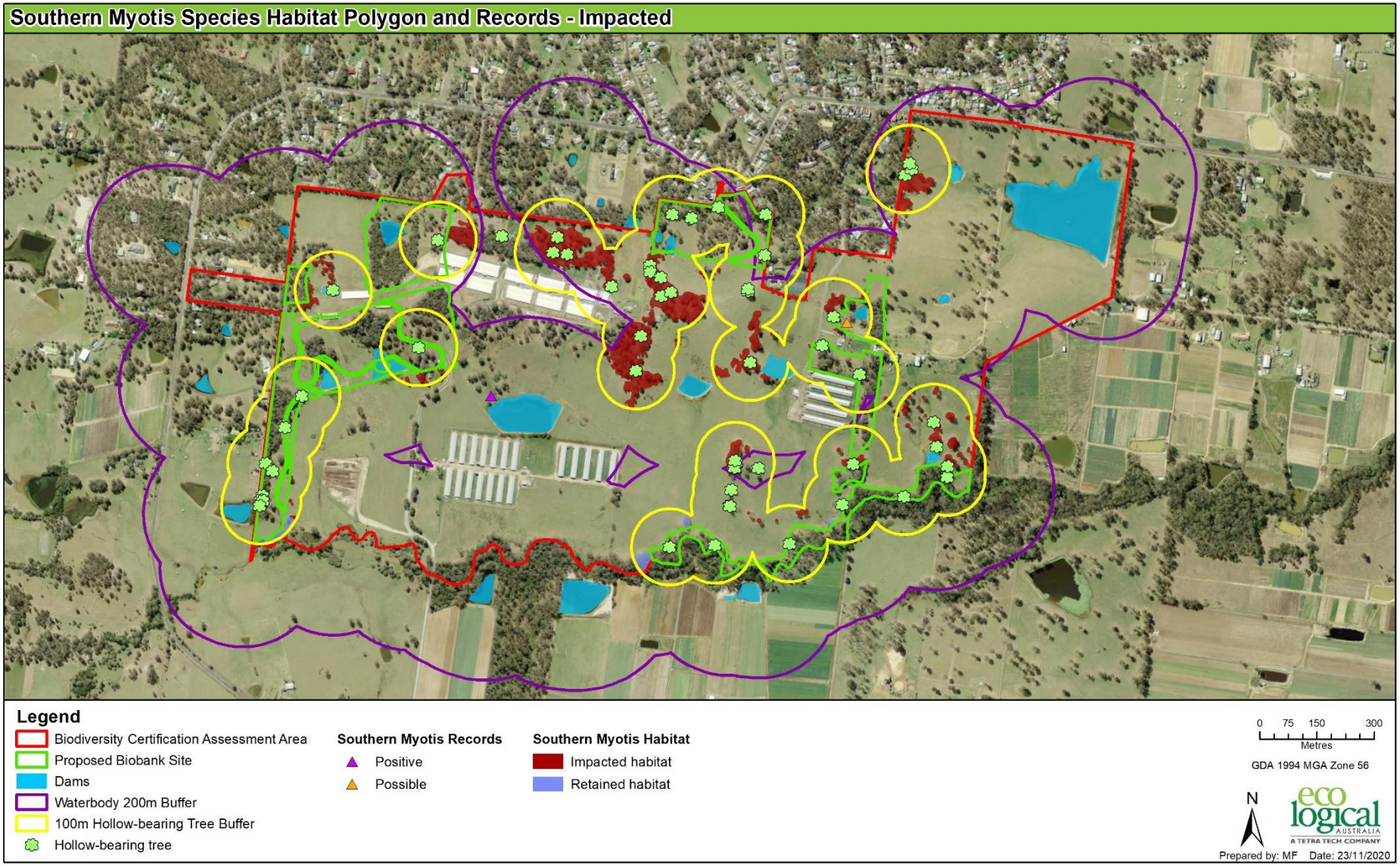


**Figure 16: Habitat polygon for Southern Myotis pre- development**

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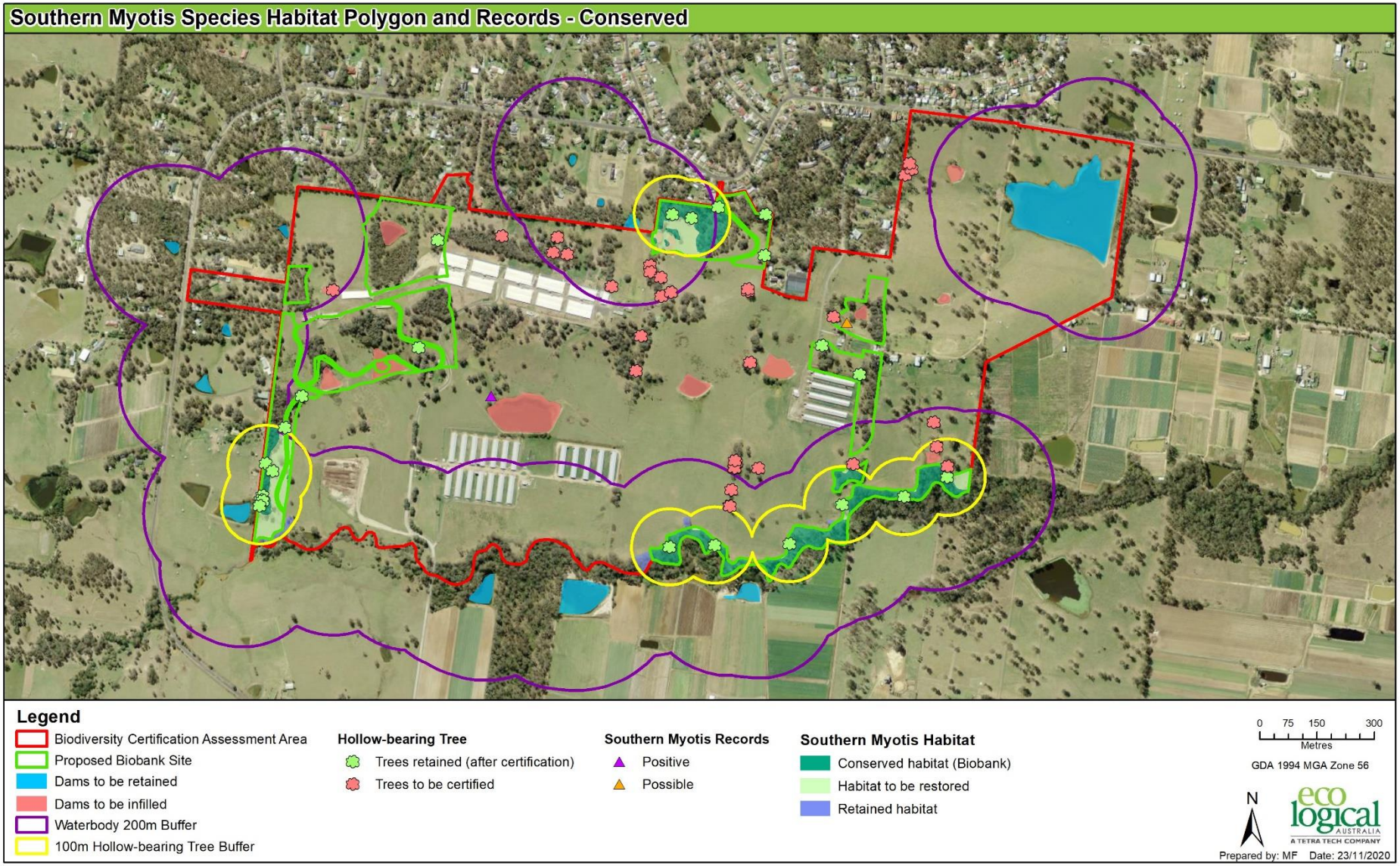


**Figure 17: Habitat polygon for Southern Myotis post- development**

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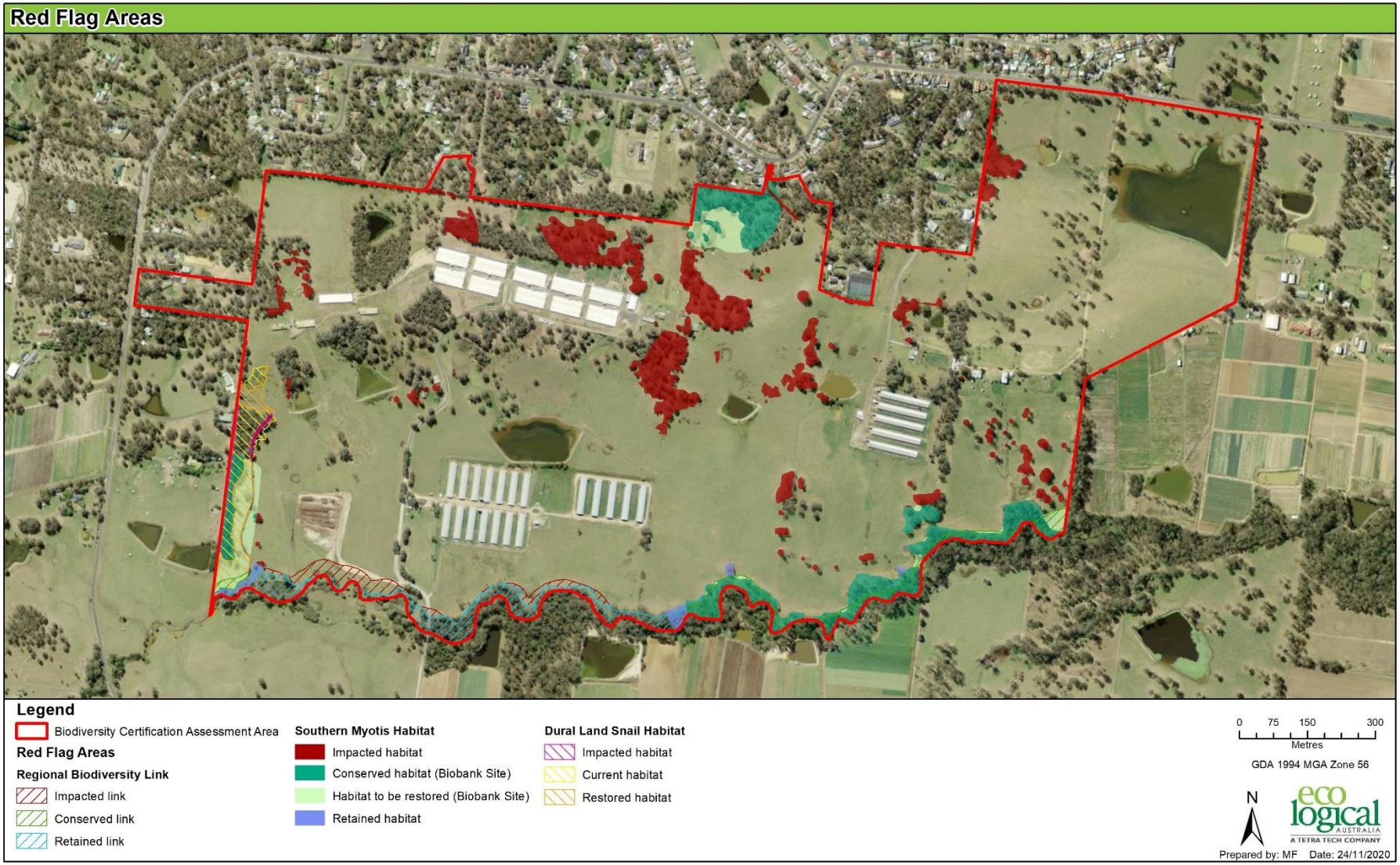


**Figure 18: Red flag areas within the BCAA**

Please note that this figure only shows vegetation that is within 100m of a mapped HBT that is within 200m of a permanent water body for Southern Myotis habitat.

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# 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 CMAs, 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**).

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# 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 4** and is comprised of:

- Land proposed for biodiversity certification – impacts on 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 143.72 ha (17.28 ha of which comprises native vegetation as defined by the BCAM) (**Table 9**). The land proposed for conservation totals 28.10 ha, 15.54 ha of which has been mapped as native vegetation and 12.56 ha to be restored. About 4.20 ha of land has been identified as maintaining its current land use and has therefore been assessed as 'retained land' (i.e. credits are neither required nor generated).

**Table 9: Land use breakdown**

| Development footprint | Area (ha) | % of BCAA | Area of existing native vegetation (ha) | % of native vegetation |
|---|---|---|---|---|
| Land proposed for Biodiversity Certification (Development) | 143.72 | 77.7 | 17.28 | 46.7 |
| Land proposed for conservation | 28.12 | 15.2 | 15.54 | 42.0 |
| Retained lands (land excluded from this assessment) | 13.19 | 7.1 | 4.20 | 11.3 |
| **Total** | **185.03** | **100** | **37.02** | **100** |

## 4.2 Vegetation mapping and zones

As outlined in **Section 2.1.5** and **Section 2.2.1**, two BVT's totalling 37.02 ha were identified in the BCAA (**Table 10**). The BCAA also supported 148.01 ha of 'cleared' land or exotic/planted vegetation, which in the context of the BCAM includes exotic vegetation.

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**Table 10: 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 | 30.20 |
| Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin | 6.82 |
| Cleared | 147.26 |
| Planted | 0.75 |
| **Total** | **185.03** |

The BVTs were separated into six vegetation zones for this assessment (Table 11). All six zones were assessed as being in biometric 'low' condition. The following ancillary codes were used to further stratify the vegetation zones:

- Exotic understorey
- Good
- Moderate
- Regeneration
- Scattered Paddock Trees
- Cleared (to be regenerated).

**Table 11** shows the area of vegetation zones assessed within the BCAA in terms of land proposed for biodiversity certification, land proposed for conservation, and retained land.

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**Table 11: Area of vegetation zones assessed within the BCAA**

| Veg zone ID | Biometric vegetation type | Site Value Score | BioMetric Condition [1] | Ancillary code | Area (ha) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Land proposed for biodiversity certification | Land proposed for conservation | Retained land [2] | Total |
| 1 | Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin | 33 | Low | Exotic understorey | 0.02 | 3.43 | 3.37 | 6.82 |
| 2 | Grey-Box – Forest Red Gum grassy woodlands on flats of the Cumberland Plain, Sydney Basin Bioregion | 29 | Low | Good | 4.35 | 8.17 | 0.00 | 12.52 |
| 3 | Grey-Box – Forest Red Gum grassy woodlands on flats of the Cumberland Plain, Sydney Basin Bioregion | 24 | Low | Moderate | 10.10 | 3.80 | 0.49 | 14.39 |
| 4 | Grey-Box – Forest Red Gum grassy woodlands on flats of the Cumberland Plain, Sydney Basin Bioregion | 17 | Low | Regeneration | 0.53 | 0.00 | 0.00 | 0.53 |
| 5 | Grey-Box – Forest Red Gum grassy woodlands on flats of the Cumberland Plain, Sydney Basin Bioregion | 16 | Low | Scattered paddock trees | 2.28 | 0.14 | 0.34 | 2.76 |
| 6 | Grey-Box – Forest Red Gum grassy woodlands on flats of the Cumberland Plain, Sydney Basin Bioregion | 7.29 | Low | Cleared (to be regenerated) | 0.00 | 12.58 | 0.00 | 12.58 |
| | | | | **Total** | **17.28** | **28.12** | **4.20** | **49.60** |

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

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### 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 eight transects/plots calculated from the combined area of conservation, development and retained lands (Table 11). The collected transect/plot data is provided in **Appendix I**.

Current site value and future site value scores were calculated for each vegetation zone using the transect/plot data collected. The BCAM credit calculator was used to produce the current and future site value scores for both development and conservation areas (**Table 12**). Note that some changes were made to default settings for future site scores. Additional gains within conservation areas were calculated above default for five site attributes: native plant species, native over-storey cover, native mid-storey cover, native groundcover (grass), and the length of fallen logs, in line with the rules set out in Appendix 4 of the BCAM. This was done as it is proposed that logs will be brought into the conservation areas from the adjoining development areas. Also, supplementary planting of over-storey, mid-storey, and groundcover species is proposed in some vegetation zones.

**Table 12: Site value scores allocated to each vegetation zone**

| Veg zone ID | Biometric vegetation type | Ancillary code | Current site value score | Future site value score (Development) | Future site value score (Conservation) |
|---|---|---|---|---|---|
| 1 | Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion | Low_ Exotic understorey | 33 | 0 | 60 |
| 2 | Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion | Low_Good | 29 | 0 | 57 |
| 3 | Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion | Low_Moderate | 24 | 0 | 55 |
| 4 | Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion | Low_Regeneration | 17 | 0 | 39 |
| 5 | Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion | Low_SPT | 16 | 0 | 40 |
| 6 | Grey-Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion | Low_Cleared | 7 | 0 | 30 |

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## 4.4 Landscape Score

The credit calculator calculated a landscape value score of 24.5 for the land to be certified and a score of 18.2 for the land subject to conservation measures. 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 13**. 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 1000 ha circle (**Figure 19**). 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 13**.

A pre-certification score of **13** was determined with 314 ha (314/1000 = 31-40%) native vegetation mapped within the 31 - 40% native vegetation cover class. Vegetation clearance would result in 297 ha of vegetation cover (17/1000 = 1.7%) remaining in the assessment circle. The post certification score is **10.5** because the vegetation cover falls within the 21-30% native vegetation cover class. The change in the percentage of native vegetation cover score (loss resulting from biocertification) is 2.5.

**Table 13: 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 (1000 ha) | 314 (31%) | 31-40% | 13 | 297 (30%) | 21-30% | 10.5 |

The land subject to conservation measures (after biodiversity certification) is 28.12 ha. Therefore, a gain of 2.2 is recorded by the credit calculator for the percent native vegetation score after conferral of biodiversity certification.

### 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.

Regional Biodiversity Links are defined as either:

a) in a plan approved by the Director General or,

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b) are the riparian buffer of a major river, minor river, major creek or minor creek as defined in Appendix 1 of the BCAM.

Regional biodiversity links have regional biodiversity conservation significance and they are assessed as a red flag area in accordance with section 2.4.4 of the methodology. According to Table 4 of the BCAM the score for a regional biodiversity link is 12 (**Figure 20**). Where local biodiversity links were located on land proposed for biodiversity certification and would be affected it was allocated a score of zero after development (**Table 14**).

Currency Creek meets the definition of a regional biodiversity link. Currency Creek is listed as a tributary of the Hawkesbury River in the Hawkesbury-Nepean Catchment Management Area. Currency Creek has at least one second order tributary upstream. Currency Creek occurs on land subject to conservation measures. Part of the regional biodiversity link is located on land to be developed and is was allocated a score of “0” post-certification. The regional biodiversity links present on land subject to conservation measures will be protected after certification; and accordingly, were allocated a connectivity score of 12.

**Table 14: Connectivity scores allocated for the assessment**

| Connectivity score | Pre-certification | Post-certification |
|---|---|---|
| Land to be certified | 12 | 0 |
| Land subject to conservation measures | 12 | 12 |

### 4.4.3 Adjacent Remnant Area

The BCAA predominantly occurs on the Cumberland Plain Mitchell Landscape which is 89% cleared. All vegetation on-site has been assessed as being in biometric ‘low’ condition, which is allocated an Adjacent Remnant Area (ARA) of ‘0’ ha’. This should receive a score of **‘0’** as it is within a Mitchell Landscapes within the 70-90% cleared range, however, was assigned an area of >50 ha and a score of ‘**10**’.

The land subject to conservation measures also occurs within the same Cumberland Plain Mitchell Landscape and also has an ARA of ‘0’ ha, but was allocated the same ARA of >50 ha. Therefore, the score allocated for the conservation lands is also **10**.

Calculating the ARA as >50 ha rather than ‘0’ ha has increased the number of credits required for impacts.

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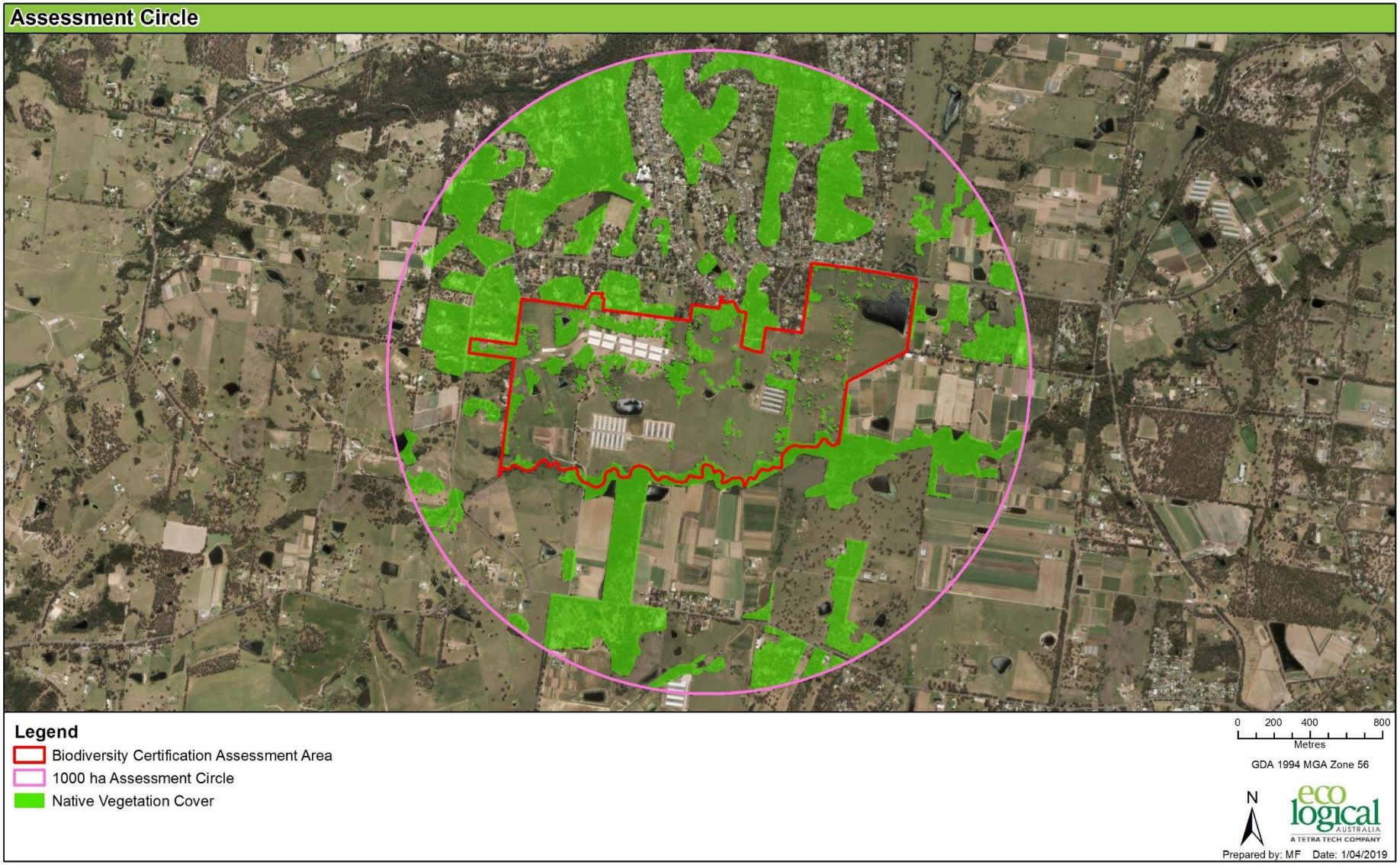


**Figure 19: Assessment circle**

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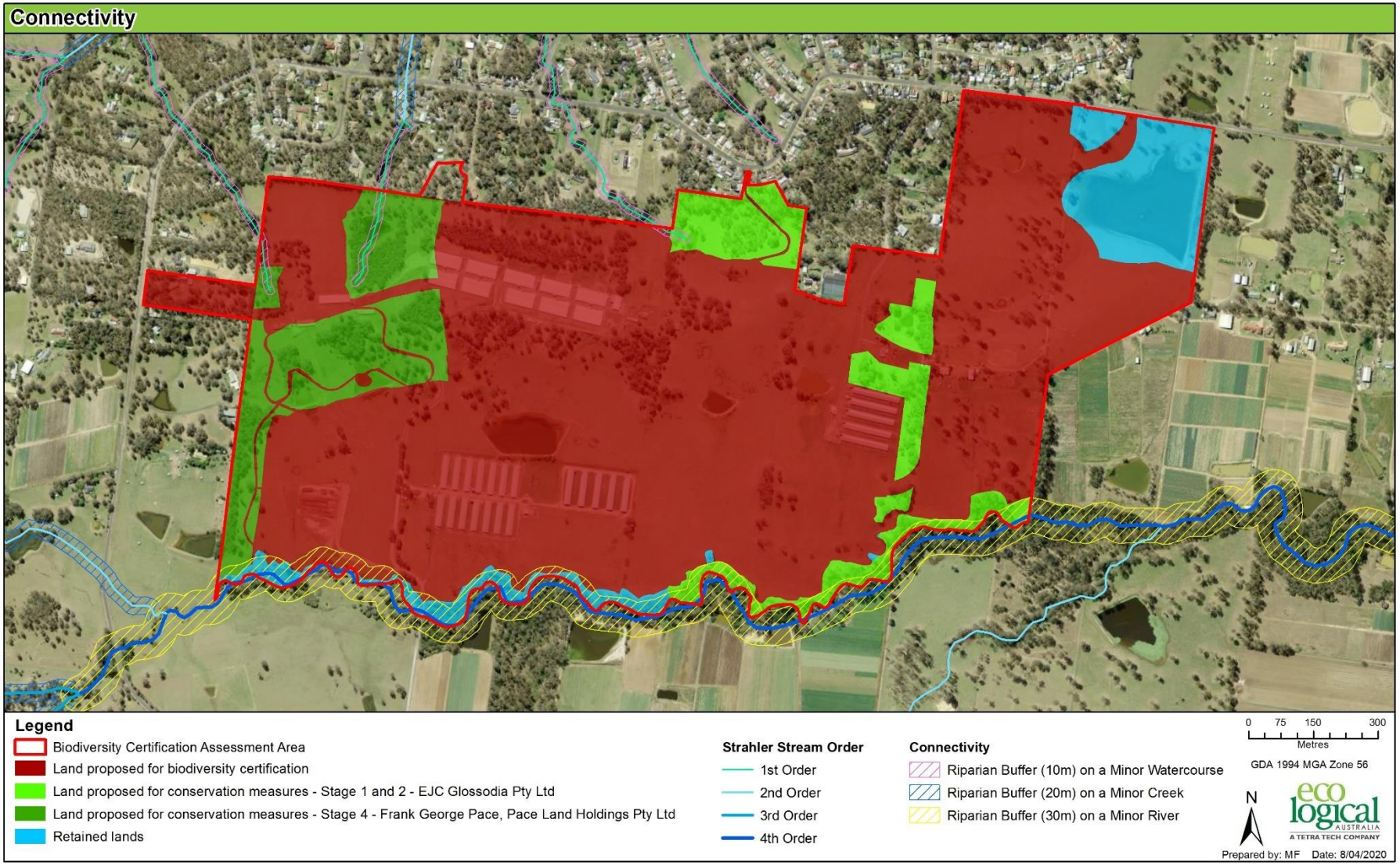


**Figure 20: Connectivity**

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## 4.5 Red Flag Areas

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.

All the 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, no vegetation zones were red flagged.

There were also areas of vegetation within a 30 m buffer area of a minor river (Currency Creek) within the BCAA, the proposed development impacts 0.002 ha of native vegetation within this buffer which is the residual 0.002 ha of a larger patch that is outside of the riparian buffer as shown below and comprises the overhanging canopy only.

Habitat polygons for assumed breeding habitat of Southern Myotis are also located within the BCAA. Breeding habitat for this species is a red-flag area. The extent of red flagged Southern Myotis habitat and regional links is shown in **Table 15** and Figure 18. Red flag areas should be avoided and can only be affected in accordance with certain rules outlined in Section 2.4 of the BCAM. A total of 28.13 ha of red flagged Southern Myotis habitat is present in the BCAA of which 8.68 ha or 30.86 % would be affected.

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.

**Table 15: Impacts to red flags (threatened species)**

| Red flag type | Common name | Red Flag Area within BCAA (ha) | Red Flag Area affected (ha) | Proportion affected (%) |
|---|---|---|---|---|
| *Pommerhelix duralensis* | Dural Land Snail | 2.76 | 0.18 | 17.39 |
| *Myotis macropus* | Southern Myotis | 17.33 | 8.68 | 50.08% |
| *Regional Biodiversity link* | Currency Creek | 4.822 | 0.002 | 0.04% |

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## 4.6 Indirect Impacts

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

Indirect impacts have been considered in accordance with the BCAM and have been determined to be negligible on the basis that all direct impacts have been assessed on the assumption of complete loss of all biodiversity values including where these losses are only partial e.g. for Asset Protection Zones (APZs) and the outer perimeter of the proposed residential footprint largely adjoins cleared rural land or golf courses where remnant vegetation is being restored and actively managed for conservation (and thus negligible in direct impacts). In effect the APZ areas will provide a buffer between the development lands and the adjacent (off-site) conservation areas, thereby mitigating and buffering any indirect impacts such as increased weeds, run-off, changed noise and light conditions.

There is potential for some indirect impacts resulting from the fragmentation of movement corridors or loss of foraging opportunities for some species. For example, removal of vegetation in the north of the BCAA and the replacement with residential housing could impede the movements of fauna species moving within and beyond the BCAA. However, movement corridors will remain in the local landscape and be enhanced along Currency Creek and through the restoration of CPW within the onsite conservation areas.

Indirect Impacts are considered negligible given the quality metrics established for any stormwater. All stormwater must meet: *'The minimum requirement shall be that the average annual pollutant load discharged from the developed site shall be no greater than for existing conditions.'*

Hawkesbury City Council DCP does not have any stormwater quality metrics. The metrics have been adopted for Jacaranda are consistent with the targets adopted for the Pitt Town Development within the Hawkesbury LGA (WorleyParsons, 2015), located approximately 10 km south-east of Jacaranda. These pollutant reduction targets are:

- Total Suspended Solids (TSS) 80% reduction in the average annual load
- Total Phosphorus (TP) 45% reduction in the average annual load
- Total Nitrogen (TSS) 45% reduction in the average annual load
- Gross Pollutants (GP) 90% reduction in the average annual load (Cardno 2018).

The size and type of stormwater quality management measures will be determined based on their ability to satisfy both of the aforementioned objectives. Objectives will also be written into the site specific DCP:

- Drainage from subdivision sites should be consistent in both water quality and quantity terms with the predevelopment stormwater patterns.
- Drainage systems should be designed so as to ensure safety and minimise the likelihood of stormwater inundation of existing and future dwellings (Cardno 2018).

In addition, recycled water from the effluent treatment system will be reticulated to each lot for domestic use. Subject to negotiation with Council recycled water could be used for irrigation of ovals and open space. The recycled water system will not impact the biobank sites as it will be accommodated in the road reserve alongside the sewerage and potable water infrastructure. The water re-entering the environment would be of a high quality and very low nutrient load. As such, no indirect impacts are expected to occur.

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Any indirect impacts likely to occur as a result of the trail running adjacent to the creek would be managed through the implementation of the BioBank Agreement and the Vegetation Management Plan.

## 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, **278** ecosystem credits are required for the proposed development of the area (**Table 18**).

As defined in the BCAM, different levels of protection and management for conservation lands results in the generation of a different number of credits as outlined below:

- Areas that are managed and funded in perpetuity (i.e. Biobank sites or national parks) – 100% credit entitlement – **generating 324 credits**
- Areas that are managed in perpetuity (e.g. classification and management of land as community land 'Natural Area' under the *Local Government Act 1993* and adoption of a Plan of Management etc) – 90% credit entitlement – **generating 292 credits**
- Areas that are secured through planning instrument (i.e. environmental zoning) – 25% credit entitlement – **generating 80 credits**.

It is proposed that the land subject to conservation measures within the BCAA will be secured by registering two Biobank Agreements and then transferring the land to Hawkesbury City Council as a Natural Area – Bushland Reserve, as described in **Section 6** of this report – Biodiversity Certification Strategy. This would generate **324** ecosystem credits as a 100% conservation measure. **Table 18** shows the number of credits generated per vegetation zone for the different levels of protection and management for conservation lands.

There will be no deficit of ecosystem credits, with 278 credits of the 324 generated would be used to offset the development lands in the BCAA. All remaining credits would be retired as a condition of biodiversity certification.

### 4.7.2 Species credits

Species credit requirements have been calculated for Cumberland Land Snail and Southern Myotis which were both recorded in the BCAA and mapped with species polygons 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.

**Table 16: Amount of habitat to be affected, retained and conserved in the BCAA for Species Credit Species**

| Species | Affected (ha) | Conserved (ha) | Retained (ha) | **Total (ha)** |
|---|---|---|---|---|
| Dural Land Snail | 0.18 | 2.58 | 0 | **2.76** |
| Southern Myotis | 8.68 | 8.2 | 0.45 | **17.33** |

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**Table 17: Credits required, credits generated and credit deficit in the BCAA**

| Species | Affected (ha) | Credits required | Conserved (ha) | No. of credits generated in on-site conservation | Credit surplus / deficit |
|---|---|---|---|---|---|
| Dural Land Snail | 0.18 | 14 | 2.58 | 15 | 1 |
| Southern Myotis*** | 8.68 | 192 | 8.2 | 49 | -143 |

*** Based on a Tg score of 0.45 and using Equation 10 of BCAM

A total of 14 species credits for Dural Land Snail and 192 credits for Southern Myotis are required for the land proposed to be certified (**Table 19**). Land proposed for conservation generates 15 and 49 credits respectively. The deficit for Southern Myotis will be secured through off-site conservation measures.

**Section 6** outlines how the deficit of 143 credits for the Southern Myotis is proposed to be met.

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**Table 18: Final ecosystem credit results**

| Veg zone ID | Biometric vegetation type | Condition | Ancillary code | Credits required | Credits generated*** | | | Credit status*** | | | Credit status summary for vegetation type based on 100% conservation measure |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 100% | 90% | 25% | 100% | 90% | 25% | |
| 1 | Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion | Low | Exotic understorey | 0.00 | 42 | 38 | 10 | +42 | +38 | +10 | +42 |
| 2 | Grey Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion | Low | Good | 79 | 100 | 90 | 25 | +21 | +11 | -54 | +21 |
| 3 | Grey Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion | Low | Moderate | 163 | 49 | 44 | 12 | -114 | -119 | -151 | -114 |
| 4 | Grey Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion | Low | Regeneration | 7 | 0 | 0 | 0 | -7 | -7 | -7 | -7 |
| 5 | Grey Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion | Low | SPT | 29 | 2 | 2 | 0 | -27 | -27 | -29 | -27 |
| 6 | Grey Box – Forest Red Gum grassy woodlands on flats of the Southern Cumberland Plain, Sydney Basin Bioregion | Low | Cleared | 0.00 | 131 | 118 | 33 | +131 | +118 | +33 | +131 |
| | | | **Total** | **278** | **324** | **292** | **80** | **+46** | **+14** | **-198** | **+46** |

***The number of surplus or deficit credits for this assessment is based on a 100% conservation measure as the conservation measure will be secured by the registration of two Biobank sites

**Table 19: Final species credit results**

| Habitat | Area affected (ha) | Credits required | Area in conservation areas (ha) | Credits generated*** | | | Credit status*** | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 100% | 90% | 25% | 100% | 90% | 25% |
| Dural Land Snail | 0.18 | 14 | 2.58 | 15 | 14 | 3 | 1 | 0 | -11 |
| Southern Myotis | 8.68 | 192 | 8.2 | 49 | 44 | 12 | -143 | -148 | -180 |

***The number of surplus or deficit credits for this assessment is based on a 100% conservation measure as the conservation measure will be secured by the registration of two Biobank sites

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# 5 Red Flag Variation Requests

## 5.1 Impact on Red Flagged Areas

The Biodiversity Assessment Report for the ecological values within the BCAA (**Section 2**) identified '*red flag areas*' as defined by the BCAM, some of which would be affected by the land proposed for biocertification. Where biodiversity certification is proposed to be conferred on land that is, or forms part of, a red flag area, the Director General may, in certain circumstances, decide that the impacts of certification on the red flag area may be offset in accordance with the rules and requirements of the BCAM. 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 (Table 20 and Figure 18). Each red flag area affected 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.

**Table 20: Red flag areas to be affected within the BCAA**

| Red flag | Number |
|---|---|
| Southern Myotis habitat | 1 |
| Regional Biodiversity Link | 2 |
| Dural Land Snail habitat | 3 |

A vegetation type >70% cleared in the CMA for which it is mapped (not in 'low condition')

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. None of the Cumberland Plain Woodland in the BCAA achieved a score of >34, thus, none are considered a red flag and do not require a red flag variation.

Areas of vegetation recognised as having regional or state biodiversity conservation significance.

Areas of land with regional or state conservation significance will be affected i.e. vegetation within 30m riparian buffer of a minor river. Currency Creek meets the definition of a minor creek. The development will impact 0.002 ha native within the riparian buffer, vegetation (which comprises the overhanging canopy of a patch of vegetation to be certified). As such, this is a red flag impact and requires a red flag variation.

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A threatened species that cannot withstand further loss

Southern Myotis and Dural Land Snail were identified in the BCAA during targeted survey. Dural Land Snail is classified as a species that '*cannot withstand loss*' and is treated as a red flag species in this assessment. Whilst ver 1.9 of the BCAM credit calculator tool classifies Southern Myotis as a red flag species, the BCAM tool has not been updated to reflect changes to the status of this species since 2012 and it is noted that the TSPD was updated to change the TG score and red flag status of this species to a species that '*can withstand loss'* (i.e. it is no longer a red flag species). However, this report has assessed the species as a red flag species on a precautionary basis.

With respect to Southern Myotis, all hollow bearing trees within 200m of a permanent water body have been assumed to be breeding habitat for this species and is thus a red flag area. 8.68 ha of habitat would be affected within the BCAA and 8.2 ha (post development) would be subject to conservation measures. Thus, a red flag variation request is required.

With respect to Dural Land Snail, 2.76 ha of habitat has been identified within the BCAA, based on where the species has been previously recorded. About 0.18 ha of habitat would be affected within the BCAA and 2.58 ha would be subject to conservation measures. Thus, a red flag variation request is required.

## 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 2.4.3 of the BCAM, must be addressed for a threatened species that cannot withstand further loss:

1. The viability of the red flag area must be low or not viable in accordance with section 2.4.3.1
2. The contribution to regional biodiversity values of the red flag area is low in accordance with section 2.4.3.2

The remaining red flag variation criteria (2.4.2 Additional Assessment criteria for vegetation types and 2.4.4 – Additional Assessment criteria for areas with regional or state biodiversity conservation significance) do not need to be addressed in this application as there are no red flag vegetation types or areas with regional or state biodiversity conservation significance being impacted in the BCAA.

The following sections provide the information required for the OEH to assess the feasibility of options to avoid impacts on red flag areas (2.4.1) and for a threatened species categorised as not being able to withstand further loss (2.4.3).

### 5.2.1 Avoiding and Minimising Impacts on Red Flag Areas (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:*

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*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 Jacaranda residential estate have undergone extensive community and stakeholder consultation. Several meetings have been held between Celestino Pty Ltd, HCC, ELA and OEH. The rezoning proposal for Jacaranda was publicly exhibited and gazetted in 2014 and the Hawkesbury LEP 2012 was subsequently amended (Amendment No 5).

The objective of the planning proposals was to provide controls through rezoning that would allow for the development of approximately 605 residential allotments with a range of community-recreation facilities, environmental corridors (Currency Creek), and a new effluent treatment system. In 2018, an revised rezoning proposal was submitted to Council to further improve conservation outcomes and provide additional controls on land containing native biodiversity value including zoning of proposed Biobank sites to E2 and additional RE1 areas (refer to Figure 2 Figure 3).

With respect to Southern Myotis, several patches of red flag habitat to be affected are small, isolated patches surrounded by cleared land that is currently zoned for medium density housing. These small patches of red flag habitat range in size from 0.03 ha to 0.06 ha. These areas are isolated from larger areas of red flag habitat and are generally in poor condition. They are considered unlikely to provide viable habitat in the long-term.

With respect to Dural Land Snail, the area of habitat to be affected is small and located on the edge of an existing patch of higher quality habitat. The edges of the existing patch are adjacent to cleared land that has previously been used for grazing purposes, where there is a higher proportion of edge effects affecting the area of habitat. Impacts to this area of habitat would not fragment or isolate any areas of existing habitat into two or more.

**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 current Hawkesbury LEP the majority of the impacted red flag vegetation is zoned R2, R5 or RE1.

The red flag area has historically and is currently used primarily for agricultural production and private recreation – cattle grazing and poultry. 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.

**Section 2.4.3 Additional Assessment Criteria for threatened species that cannot withstand further loss**

**Section 2.4.3.1 Viability must be low or not viable**

The BCAM states that:

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

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

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

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

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

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

*c) The condition of native vegetation in the red flag area where biodiversity certification is to be conferred is substantially degraded, resulting in loss of or reduced viability. Native vegetation in degraded condition can be unviable or have low viability. 'Degraded condition' means substantially outside benchmark for many of the vegetation condition variables as listed in Table 1 of the methodology (s.3.6.2), without the vegetation meeting the definition of low condition set out in section 2.3. Vegetation that is substantially outside benchmark due to a recent disturbance such as a fire, flood or prolonged drought is not considered degraded for the purposes of the methodology; or*

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

The red flag criteria has been applied with respect to Southern Myotis and Dural Land Snail.

For Southern Myotis, the red flagged habitat in the BCAA to be affected totals 8.68 ha, with 8.2 ha to be conserved and managed in perpetuity under two Biobanking Agreements (Glossodia East and West (ELA 2020a & b). An additional 0.45 ha of habitat will be retained in lands zoned RE1 – Public Recreation (Table 21). For Dural Land Snail, the red flagged habitat in the BCAA to be affected totals 0.18 ha, with 2.58 ha to be conserved and managed in perpetuity as part of the Glossodia West Biobanking Agreement (ELA 2020b).

The red flag habitat to be affected is comprised of some small, isolated patches and some larger patches of habitat that are in poor condition (site value score of <34). The areas to be affected are considered to have low long-term viability given the current and future zoning of the land, size, connectedness of some

patches and condition of the habitat. 8.2 ha of red flagged habitat will be conserved and managed in perpetuity under Biobank Agreements. These patches are in better condition than the areas to be removed, form part of large, contiguous patches and will have long-term viability established through the in-perpetuity management of the Biobank Agreements.

**Table 21: Southern Myotis red flagged habitat to be affected, conserved and retained across the BCAA**

| Species | Affected (ha) | Conserved (ha) | Retained (ha) | **Total (ha)** |
|---|---|---|---|---|
| *Myotis macropus* (Southern Myotis) | 8.68 | 8.2 | 0.45 | **17.33** |
| *Pommerhelix duralensis* (Dural Land Snail) | 0.18 | 2.58 | 0 | **2.76** |

***a. The current or future uses of land surrounding the red flag area***

The current and future land zoning for the area proposed for biodiversity certification in the BCAA consists of R5 – Large Lot Residential, R2 – Low Density Residential and RE1 – Public Recreation. Although the land is mostly zoned residential, the land has been used for agricultural purposes including cattle grazing and poultry farms which has significantly reduced the quantity and condition of suitable habitat for Southern Myotis and Dural Land Snail. Previous clearing has resulted in small, fragmented and poor condition patches of habitat for these species.

The current land uses make the red flag areas unviable. This factor therefore applies regarding low viability.

***b. The size and connectedness of vegetation***

Several patches of red flag habitat to be affected are small, isolated patches surrounded by cleared land that is zoned for medium density housing. These small patches of red flag habitat range in size from 0.03 ha to 0.06 ha, or are on the edge of an existing larger patch. The patches of Southern Myotis habitat are isolated from larger areas of red flag habitat and are generally in poor condition. They are considered unlikely to provide viable habitat in the long-term. This factor therefore applies regarding low viability.

***c. The condition of native vegetation***

The condition of the red flag Southern Myotis and Dural Land Snail habitat in the area to be affected achieved a site value score of <34 (generally 16-29 as shown in Table 12**)**. Accordingly the vegetation is not red flag vegetation (it is red flag habitat) and is substantially outside of benchmark condition.

This factor therefore applies regarding the condition of the potential habitat and low viability.

***d. The area of a red flag area containing a threatened species on land where biodiversity certification is conferred is minor relative to the area containing that threatened species on land subject to proposed conservation measures***

The proposal will impact 8.68 ha or 50.08 % of the red flagged habitat and permanently protect 8.2 ha or 49.02 % of the red flag areas for Southern Myotis. The proposal will impact 0.18 ha or 6.52 % of the red flagged habitat and permanently protect 2.58 or 93.48 % of the red flag areas for Dural Land Snail.

The area of the red flag area to be affected for Southern Myotis is therefore not minor relative to the area proposed for conservation measures and this criteria is not met.

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The area of the red flag habitat to be affected for Dural Land Snail is minor relative to the area proposed for conservation measures. This criteria is met with respect to the Dural Land Snail.

**Section 2.4.3.2 Contribution to regional biodiversity values is low**

> *The BCAM states that the application for biodiversity certification must demonstrate that the threatened species habitat in a red flag area makes a low contribution to regional biodiversity values. In making an assessment that the contribution of the red flag area to regional biodiversity values for the species is low, the Director General must be satisfied that the relative abundance of the individual threatened species, threatened population or threatened species habitat on the land proposed for biodiversity certification is low relative to its abundance in the region.*
>
> *'Region' for the purposes of section 2.4.3.2 means the CMA subregion in which the red flag area is located and any adjoining CMA subregions.*

There are 607 records for the Southern Myotis and 157 records for Dural Land Snail within the Hawkesbury-Nepean Catchment Management Authority (CMA). For Southern Myotis, within the Hawkesbury-Nepean CMA, records are clustered along the Hawkesbury River and other major river systems within the region with records concentrated on the eastern side of the Blue Mountains. Recent aerial photography shows that the river systems within this CMA are mostly heavily vegetated, with remnant patches of native vegetation scattered throughout the landscape. This would suggest that the CMA contains sufficient foraging, roosting and breeding habitat to support the Southern Myotis.

For Dural Land Snail, within the Hawkesbury-Nepean CMA, records are clustered north of Penrith in a mix of National Parks, nature reserves and public land. Recent aerial photography shows that some areas where the species has been previously recorded remain vegetated and form a nature reserve or national park. This would suggest that the CMA may contain sufficient habitat to support the Dural Land Snail.

There is one riparian corridor in the BCAA; Currency Creek (a minor river) which meets the definition as having regional or sate biodiversity conservation significance. Currency Creek runs from west to east along the southern boundary of the BCAA and is vegetated with River-flat Eucalypt Forest along both banks. This vegetation also contains numerous hollow bearing trees. Currency Creek will be 'retained' as a link to other areas of native vegetation to both the east and west of the BCAA, which includes the conservation and retention of red flagged habitat for Southern Myotis. No works are proposed for Currency Creek or any lands that form part of the riparian buffer. The eastern portion of Currency Creek will be managed and conserved in-perpetuity under a Biobank Agreement, which will ensure the long-term viability of part of this link. Detention basins have been strategically located throughout the footprint to manage stormwater and runoff from hardstand surfaces. The detention basins would minimise any indirect impacts to water quality of Currency Creek.

### 2.4.4 Additional assessment criteria for areas with regional or state biodiversity conservation significance

Where the red flag area has regional or state biodiversity conservation significance as defined in section 2.3 of the methodology, the application for biodiversity certification must demonstrate that conferring biodiversity certification on the red flag area:

> a. *will not substantially reduce the width of a riparian buffer with regional or state biodiversity significance, or*
> b. *will not substantially impact on the ecosystem functioning of a state biodiversity link or a regional biodiversity link. This includes considering whether the impacts of conferring*

*biodiversity certification will substantially reduce the migration, colonisation and interbreeding of plants and animals between two or more larger areas of habitat, and*

c. *will not significantly impact on the water quality of a major river, minor river, major creek, minor creek or a listed SEPP 14 wetland.*

*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 (Clause 2.4.4a).*

The proposal will not substantially reduce the riparian buffer along the Currency Creek regional corridor (it will be reduced in area by 0.002 ha of Forest Red Gum – Rough-barked Apple Grassy Woodland. This reduction is considered minor given the conservation or retention of 4.82 ha of vegetation in the riparian buffer that form a regional biodiversity link. Further the vegetation to be impacted is the overhanging canopy of a residual part of a highly degraded patch that will be certified outside of the riparian buffer. The amount of native vegetation to be affected constitutes 0.04% of the Currency Creek riparian buffer. Of the area to be retained, 2.26 ha will be conserved and managed in-perpetuity as part of a BioBank Agreement site. The remaining 2.93 ha will be retained and managed under a VMP.

The portion to be affected is located on the outer edge of the corridor and will not result in large scale fragmentation or severing of the existing biodiversity link. Therefore, the reduction in the regional biodiversity link by 0.002 ha is not considered substantial.

*Ecosystem functioning of a state or regional biodiversity link (Criteria 2.4.4b)*The ecosystem functioning of a state biodiversity link or a regional biodiversity link must not be substantially impacted, considering migration, colonisation and interbreeding of plants and animals between two or more larger areas of habitat.

The proposal will impact 0.002 ha of Forest Red Gum – Rough-barked Apple Grassy Woodland. This area represents a minor proportion of the corridor that runs through the BCAA. The area to be removed would not result in the fragmentation or isolation of the corridor or other areas of habitat. The remaining native vegetation within the corridor provides a link to the surrounding landscape. This would be retained and conserved through the application of a VMP and management as part of a BioBanking Agreement site. The removal of 0.002 ha of native vegetation would not impact the functioning of this corridor as a regional biodiversity link (Figure 18).

*Will not significantly impact on the water quality of a major river, minor river, major creek, minor creek or a listed SEPP 14 wetland*

Impacts to 0.002 ha of the regional biodiversity link is unlikely to significantly impact the water quality of Currency Creek. Quality metrics for all water treated onsite have been established. All stormwater must meet: *'The minimum requirement shall be that the average annual pollutant load discharged from the developed site shall be no greater than for existing conditions.'*

Hawkesbury City Council DCP does not have any stormwater quality metrics. The metrics have been adopted for Jacaranda are consistent with the targets adopted for the Pitt Town Development within the Hawkesbury LGA (WorleyParsons, 2015), located approximately 10 km south-east of Jacaranda. These pollutant reduction targets are:

- Total Suspended Solids (TSS) 80% reduction in the average annual load
- Total Phosphorus (TP) 45% reduction in the average annual load
- Total Nitrogen (TSS) 45% reduction in the average annual load
- Gross Pollutants (GP) 90% reduction in the average annual load (Cardno 2018).

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The size and type of stormwater quality management measures will be determined based on their ability to satisfy both of the aforementioned objectives. Objectives will also be written into the site specific DCP:

- Drainage from subdivision sites should be consistent in both water quality and quantity terms with the predevelopment stormwater patterns.
- Drainage systems should be designed so as to ensure safety and minimise the likelihood of stormwater inundation of existing and future dwellings (Cardno 2018).

In addition, recycled water from the effluent treatment system will be reticulated to each lot for domestic use. Subject to negotiation with Council recycled water could be used for irrigation of ovals and open space. The recycled water system will not impact the biobank sites as it will be accommodated in the road reserve alongside the sewerage and potable water infrastructure. The water re-entering the environment would be of a high quality and very low nutrient load. As such, no indirect impacts are expected to occur.

Any indirect impacts likely to occur as a result of the trail running adjacent to the creek would be managed through the implementation of the BioBank Agreement and the Vegetation Management Plan.

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# 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 4** in **Section 1** of this report.

## 6.2 Land proposed for biodiversity conservation

The land proposed for biodiversity conservation is shown in **Figure 4** in **Section 1** of this report.

*On-site conservation measures*

It is proposed that the land subject to conservation measures within the BCAA will be secured by registration of two biobank sites by the current land holders (Frank George Pace, Pace Land Holdings Pty Ltd and EJC Glossodia Pty Ltd) (**Figure 21),** undertaking the initial management and restoration works and then transferring the land to Hawkesbury City Council. HCC will then categorise the land as 'Community Land' under the *Local Government Act 1993* (LG Act), and it will be managed in accordance with the Biobank Agreements and a Plan of Management. Permanently managed conservation measures are a 100% Conservation Measure as outlined in section 8.1.1 of the BCAM and will generate 100% of the calculated credits as shown in **Table 22**.The Biobank and Local Government management plans for the conservation area will include the standard mandatory suite of biobanking actions to improve biodiversity values by the implementation of the following management actions:

- The erection and maintenance of boundary fencing to prevent in appropriate access
- Council Reserve signage outlining the management objectives of the site
- The active management and reduction of weeds
- The application of fire, where appropriate;
- Replanting or supplementary planting where natural regeneration is insufficient to bring back to benchmark condition within a reasonable timeframe - vegetation zone 6;
- Addition of logs to supplement the current low level of logs in Vegetation Zone 2, 3 and 6.
- Control of rabbits and foxes (as required).
- The retention of regrowth/native vegetation, dead timber, and rocks.

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Application to register two biobank sites (12.01 ha Glossodia East and 16.12 ha Glossodia West) were submitted for registration in August 2020 by EJC Glossodia Pty Ltd and Frank George Pace, Pace Land Holdings Pty Ltd respectively (ELA 2020a and 2020b).

The in-perpetuity cost of these management actions has been estimated using the biobanking in-perpetuity cost spreadsheet and in principle agreement reached with Council regarding the transfer of these funds once initial management has been undertaken by the current land owners to reach maintenance management.

EJC Glossodia Pty Ltd and Frank George Pace, Pace Land Holdings Pty Ltd will be responsible for the boundary fencing and establishment of walking paths (excluded from biobank areas), initial weed and feral animal control, revegetation and supplementary planting and addition of timber and logs. Hawkesbury City Council would be responsible for the on-going maintenance of these activities in-perpetuity from the date that the land is transferred to Council and gazetted as a natural area – bushland. Council will be responsible for the installation of Council Reserve signage.

The land subject to this conservation measure will generate **324** ecosystem credits (282 for HN528 '*Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain'* and 42 HN526 Forest Red Gum – Rough-barked Apple grassy Woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion. There is a surplus of **46** ecosystem credits generated in the areas subject to conservation measures in the BCAA (Table 22). These surplus credits will be retired in accordance with the conditions of biocertification certification.

The conservation measures will also generate **15** species credits for Dural Land Snail and **49** species credits for Southern Myotis. There will therefore be a surplus of **1** Dural Land Snail credits and a deficit of **143** Southern Myotis credits will need to be sourced from an off-site offset or the Biodiversity Conservation fund (Table 23).

*Off-site conservation measures*

The **143** credit deficit of Southern Myotis credits will need to be sourced from an off-site offset or the Biodiversity Conservation fund.

260 of these credits have already been sourced and secured (purchased and transferred to Celestino Pty Ltd) from two registered Biobank sites (BA ID 331 and BA 383). These credits will be able to satisfy all credit requirements for Stages 1 – 4.

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**Table 22: Summary of ecosystem credit surplus/deficit**

| BioMetric vegetation type | Condition | Ancillary code | Credits required | Credits generated (100% measure) | Credit status |
|---|---|---|---|---|---|
| Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin | Low | Good | 79 | 100 | +4 |
| | Low | Moderate | 163 | 49 | |
| | Low | Regeneration | 7 | 0 | |
| | Low | Scattered Paddock Trees | 29 | 2 | |
| | Low | Cleared | 0 | 131 | |
| Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin | Low | Exotic Understorey | 0 | 42 | +42 |
| | | **Total** | **278** | **324** | **+46** |

**Table 23: Summary of species credit surplus/deficit**

| Habitat | Credits required | Credits generated (90% measure) | Credit status |
|---|---|---|---|
| Dural Land Snail | 14 | 15 | +1 |
| Southern Myotis | 192 | 49 | -143 |

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**Figure 21: Location of land proposed for registration of Biobank sites and affected parties**

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### 6.2.1 Existing management obligations

The proposed conservation lands are currently zoned as RE1 – Public Recreation and R5 – Large Lot Residential under the Hawkesbury LEP. There are no existing covenants or conservation funding arrangements for the land proposed for conservation measures or any existing requirements to actively manage the site for biodiversity conservation. The entire conservation area is to be managed for ecosystem credits.

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

The land proposed for conservation measures will be secured by registration of two biobank sites by the current land holders (EJC Glossodia Pty Ltd Lots 3 DP 230943, Lot 50 DP 751637 and Lot 52 DP 1104504 and Frank George Pace, Pace Land Holdings Pty Ltd Lots 1, 2 & 3 DP 784300).

Application to register two biobank sites (12.01 ha Glossodia East and 16.12 ha Glossodia West) were submitted for registration in August 2020 by EJC Glossodia Pty Ltd and Frank George Pace, Pace Land Holdings Pty Ltd respectively (ELA 2020a and 2020b).

These two land owners will therefore become 'parties' to the application and will enter into a Biocertification Agreement with the Minister committing them to the initial management of the biobank sites prior to the transfer of the registered biobank sites and funds for in perpetuity management to Hawkesbury City Council for in-perpetuity conservation management. Hawkesbury City Council will also be a 'party' to the application and have agreed in principle to accept the transfer of this land.

Hawkesbury City Council will be responsible for adopting a Plan of Management in accordance with the Local Government Act after the transfer of the registered Biobank sites.

The Biocertification Agreement will also state that EJC Glossodia Pty Ltd and Frank George Pace, Pace Land Holdings Pty Ltd) will make the credits generated by these biobank sites available to be retired in accordance with the Staging Plan outlined below, and prior to the commencement of the relevant stage of development.

### 6.3.1 Timing of credit retirement

Celestino Pty Ltd will be the party responsible for the retirement of credits. It is proposed to "retire" biodiversity credits in accordance with the staged development of the certified land as outlined in **Tables 23, 24** and **25** and shown in **Figure 6**. The proportion and types of credits to be retired is based on the area of vegetation and habitat 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 Celestino Pty Ltd have provided proof of the retirement of the required quantum of credits in accordance with the staged development of the certified land as outlined in **Tables 23, 24** and **25.**

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

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**Table 24: Indicative staging of development and retirement of ecosystem credits**

| Stage | Timeframe | Responsible Party | Area of Grey Box - Forest Red Gum grassy woodland on flats affected (ha) HN528 | Area of Forest Red Gum - Rough-barked Apple grassy woodland affected (ha) | Proportion of total vegetation affected (%) | BCAM credits required | Cumulative total BCAM credits | Credits available from proposed on-site Conservation Measure |
|---|---|---|---|---|---|---|---|---|
| 1 | 2021<br>2 Years | Celestino Pty Ltd | 2.97 | 0 | 17.2 | 48 | 48 | 98 HN528<br>42 HN526 |
| 2 | 2023<br>1.5 Years | Celestino Pty Ltd | 4.28 | 0 | 24.8 | 69 | 117 | |
| 3 | 2025<br>1.5 Years | Celestino Pty Ltd | 6.93 | 0 | 40.1 | 111 | 228 | 184 HN528 |
| 4 | 2026<br>1 Year | Celestino Pty Ltd | 3.08 | 0.02 | 17.8 | 50 | 278 | |
| **Total** | | | **17.70** | **0.02** | **100** | **278** | **278** | **324** |

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**Table 25: Indicative staging of development and retirement of Southern Myotis species credits*****

| Stage | Timeframe | Responsible Party | Area of habitat affected (ha) | Proportion of total habitat affected (%) | BCAM credits required | Cumulative total BCAM credits | Credits available from proposed on-site Conservation Measure |
|---|---|---|---|---|---|---|---|
| 1 | 2021<br>2 Years | Celestino Pty Ltd | 1.18 | 13.41 | 26 | 26 | 49 credits to be retired from on-site conservation measures<br>143 credits to be retired of 260 off-site credits held***<br>(260 Myotis credits already purchased from registered Biobank sites) |
| 2 | 2023<br>1.5 Years | Celestino Pty Ltd | 3.54 | 40.23 | 78 | 104 | |
| 3 | 2025<br>1.5 Years | Celestino Pty Ltd | 3.2 | 36.36 | 71 | 175 | |
| 4 | 2026<br>1 Year | Celestino Pty Ltd | 0.76 | 10 | 17 | 192 | |
| | | | **8.68** | | **192** | **192** | **192** |

*** Based on a Tg score of 0.45 and using Equation 10 of BCAM. Celestino has already secured 260 Southern Myotis credits from BA#331, BA#383

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**Table 26: Indicative staging of development and retirement of Dural Land Snail species credits**

| Stage | Timeframe | Responsible Party | Area of habitat affected (ha) | Proportion of total habitat affected %) | BCAM credits required | Cumulative total BCAM credits | Credits available from proposed on-site Conservation Measure |
|---|---|---|---|---|---|---|---|
| 1 | 2021<br>2 Years | Celestino Pty Ltd | 0 | 0 | 0 | 0 | 15 (none required for these stages) |
| 2 | 2023<br>1.5 Years | Celestino Pty Ltd | 0 | 0 | 0 | 0 | |
| 3 | 2025<br>1.5 Years | Celestino Pty Ltd | 0 | 0 | 0 | 0 | |
| 4 | 2026<br>1 Year | Celestino Pty Ltd | 0.18 | 100 | 14 | 14 | 15 |
| **Total** | | | **0.18** | **100** | **14** | **14** | **15 (1 surplus)** |

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### 6.4 Is an Improve or Maintain Outcome Achieved?

Subject to the Director-Generals consideration and approval of the red flag variation request, an '*improve or maintain*' outcome can be achieved by the retirement of ecosystem and species credits from the proposed conservation lands, and the purchase of an additional 619 Southern Myotis credits sourced from an off-site Biobank site or Biodiversity Conservation Fund.

## 6.5 Statement of commitments

The following is a summary of the commitments made throughout this biocertification assessment and application.

1. A Biocertification Agreement will be entered into between Celestino Pty Ltd, EJC Glossodia Pty Ltd, Frank George Pace, Pace Land Holdings Pty Ltd, Hawkesbury City Council (HCC), and the Minister stating that the 28.13 ha of land proposed for conservation measures within the BCAA as shown in Figure 4 will be registered as two Biobank Agreements under the Biodiversity Conservations Act 2016 'savings and transition provisions' by 25 August 2021 (Application to register the two biobank sites (12.01 ha Glossodia East and 16.12 ha Glossodia West) were submitted for registration in August 2020 by EJC Glossodia Pty Ltd and Frank George Pace, Pace Land Holdings Pty Ltd respectively (ELA 2020a and 2020b)/
    a. EJC Glossodia Pty Ltd will register a Biobank Agreement over Lots 3 DP 230943, Lot 50 DP 751637 and Lot 52 DP 1104504 as shown in Figure 21 which will generate the equivalent of 98 HN528 and 42 HN526 biocertification ecosystem credits and 38 Southern Myotis species credits, and make all credits generated available to Celestino Pty Ltd to meet the offset requirements for Stages 1 and 2 of development as shown in Figure 6.
    b. Frank George Pace, Pace Land Holdings Pty Ltd will register a Biobank Agreement over Lots 1, 2 and 3 DP 784300 as shown in Figure 21 which will generate the equivalent of 184 HN528 biocertification ecosystem credits and 15 Dural Land Snail and 11 Southern Myotis species credits, and make all credits generated available to Celestino Pty Ltd to meet the offset requirements for Stages 3 and 4 of development as shown in Figure 6.
    c. EJC Glossodia Pty Ltd and Frank George Pace, Pace Land Holdings Pty Ltd will be responsible for the initial management of their respective Biobank sites from 30 days after the conferral of biocertification until such time that HCC is satisfied that the ongoing management is at a maintenance level, expected to be by 2025. This management will include temporary fencing of the conservation area to exclude stock/poultry, establishment of any walking paths , initial weed and feral animal control, revegetation / supplementary planting and the bringing in of fallen timber from the adjacent development area as outlined in the credit calculations.
    d. Following land transfer of these biobank sites to HSC, HCC will be responsible for the on-going maintenance of these activities in perpetuity from the date that the land is transferred to Council in accordance with the Biobank Agreements. Hawkesbury City Council will also be responsible for categorising these lands as "Community Land" and adopting a Plan of Management in accordance with the Local Government.
2. A Biocertification Agreement will be entered into between Celestino Pty Ltd, EJC Glossodia Pty Ltd, Frank George Pace, Pace Land Holdings Pty Ltd stating that EJC Glossodia Pty Ltd, Frank George Pace, Pace Land Holdings Pty Ltd will make available to Celestino Pty Ltd 278 HN528 ecosystem credits, 49 Southern Myotis species credits and 15 Dural Land Snail species credits from the registered Biobank sites to meet the offset obligations. These credits will be retired to meet the credit requirements of this biocertification application as outlined in **Tables 23, 24 and 25**.

3. Celestino Pty Ltd will retire the additional 143[2] Southern Myotis species credits as part of Stage 1 of development in accordance with **Table 24**.
4. Celestino Pty Ltd will prepare and implement a Construction Environment Management Plan for vegetation clearing within the BCAA 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 etc) are contained within the development footprint and appropriate mitigation measures are put in place to minimise indirect impacts to remnant native vegetation and threatened fauna including Dural Land Snail and Southern Myotis. Specifically, this will address the management of the land proposed for conservation measures and its buffer such that surrounding roads will be fully curbed and guttered with no stormwater being discharged into the conservation areas.

In addition, the CEMP 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
- a fauna pre-clearance protocol
- retention of HBTs where possible and practical
- where trees are removed in the development area, these will be salvaged for fauna habitat values in the onsite Biobank sites (i.e. meeting the additional management requirement if importing logs into the conservation area)
- a de-watering plan which includes a native fauna relocation plan for any farm dams that are removed.

[2] 260 of these credits have already been secured (purchased by Celestino) from three biobank sites

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# 7 References

Bureau of Meteorology (BOM) 2019. *Climate statistics for Richmond RAAF (station 067105)*. Available online: http://www.bom.gov.au/climate/data/index.shtml?bookmark=136&zoom=3&lat=-32.5355&lon=147.74&layers=B00000TFFFFFFFTFFFFFFFFFFFFFFFFFFTTT&dp=IDC10002-d

Department of Environment (DoE) 2019. *Protected Matters Search Tool*. 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 2019a. Jacaranda Flora and Fauna Assessment - Planning Proposal. Prepared for Celestino.

Eco Logical Australia 2019b. Jacaranda Residential Subdivision EPBC Assessment Report. Prepared for Celestino Pty Ltd.'

Eco Logical Australia 2020a. Glossodia West Biobank Site Biobanking Agreement Credit Assessment Report. Prepared for Celestino Pty Ltd on behalf of Frank George Pace & Pace Land Holdings Pty Ltd.

Eco Logical Australia 2020b. Glossodia East Biobank Site Biobanking Agreement Credit Assessment Report. Prepared for Celestino Pty Ltd on behalf of EJC Glossodia Pty Ltd.

Eco Logical Australia November 2018. Bushfire Management Strategy, Jacaranda Planning Proposal

Ethos Urban 2020. Amendment to the Hawkesbury Local Environmental Plan 2012 Planning Proposal Jacaranda.

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.

Office of Environment and Heritage (OEH) 2016 *NSW guide to surveying threatened plants*. Available at https://www.environment.nsw.gov.au/resources/threatenedspecies/160129-threatened-plants-survey-guide.pdf

Office of Environment and Heritage (OEH) 2018 *Species credit threatened bats and their habitat – NSW survey guide for the Biodiversity Assessment Method*. Available at

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https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/species-credit-threatened-bats-survey-guide-180466.pdf

Office of Environment and Heritage (OEH) 2019a. *Biodiversity Certification Guide to Applicants*. Office of Environment and Heritage, May 2015

Office of Environment and Heritage (OEH) 2019b. *Atlas of NSW Wildlife database*. Office of Environment and Heritage.

Office of Environment and Heritage (OEH) 2019c. *Biodiversity Certification Operational Manual*. Office of Environment and Heritage, May 2015

Office of Environment and Heritage (OEH) 2019d. *Threatened Species Profiles*. Office of Environment and Heritage. Available online: http://www.environment.nsw.gov.au/threatenedspecies/

Travers Bushfire and Ecology 2013. *Flora and Fauna Constraints Assessment. Jacaranda Off Spinks Road and Kurmond Road, Glossodia*.

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.

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# Appendix A Project Staff CVs

The following are brief curriculum vitae's for the key project staff. Please note that since this project commenced in 2013, there have been a number of staff movements, and some of the staff who undertook the field work and credit calculations are no longer with Eco Logical Australia, they have however been consulted in making revisions to this report.

**Robert Humphries – Project Director**

CURRICULUM VITAE

## Robert Humphries

**MANAGER, BIOBANKING AND BIOCERTIFICATION OFFSETS PROGRAMS**

**QUALIFICATIONS**

- Bachelor of Applied Science, Ballarat C.A.E 1983-85.
- Master of Applied Science (Research) University of Ballarat 1986-89.

Robert is an ecologist, environmental planner and project manager with over 25 years experience. Since graduating with Bachelors and Masters Degrees in wildlife management in 1985, Robert has worked mainly in the public sector with the Department of Environment and Conservation (Victoria) 1988-1996 and NSW National Parks and Wildlife Service, now NSW Office of the Environment & Heritage 1996-2006. Robert joined Eco Logical Australia in March 2008.

Robert was the Manager of the Threatened Species Section of the NSW Department of Conservation and Environment for over 10 years and has extensive experience of the NSW Threatened Species and Environmental Planning legislation, Government policy, the biodiversity of the Greater Sydney and Hunter Regions and the new biodiversity certification and biobanking provisions.

Robert was a member of the Biobanking Ministerial Reference Group from 2007-2012 and is the lead trainer in the BioBanking and Biodiversity Certification Accredited Assessor Training program.

**RELEVANT PROJECT EXPERIENCE**

**BioCertification Assessments**

Have completed or are currently undertaking formal Biodiversity Certification Assessments for:-

- Port Macquarie Airport Master Plan (Port Macquarie- Hastings Council)
- Tuncurry State Significant Site (Urban Growth NSW)
- Emerald Hills Urban Release Area (Camden City Council). Assessment completed and reviewed by OEH
- Warnervale Town Centre (Wyong Council)(Approved March 2014)
- Broulee and South Moruya Urban Release Areas (Eurobodalla Shire Council)(Approved September 2014)
- Mount Gilead Urban Release Area (Campbelltown City Council)
- 
- Have completed informal Biodiversity Certification Assessments for

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- Ralston Avenue, Belrose for Metropolitan Local Aboriginal Land Council (August 2013)
- Greater Sancrox Area for Port Macquarie –Hastings Council (August 2013)
- Glenning Valley Urban Release Area (Travers Ecology and Glenning Valley Partnership 2011);
- Kings Hill Urban Release Area, Port Stephens LGA (Mondell Property Group and Hunter Land 2011);
- Ingleside Release Area, Pittwater/Warringah LGAs (Urban Growth NSW 2011)
- Darkinjung Local Aboriginal Land Council (North Wyong Structure Area)
- Yallah-Marshall Mount Urban Release Area (Wollongong City Council)
- Whitebridge Investigation Area (Urban Growth NSW 2011)
- Balmoral Urban Release Area, north west Sydney (Urban Growth NSW 2013)

**Biodiversity Offset Strategies**

- North West & South West Growth Centres Biodiversity Offset Strategy for Sydney Water Infrastructure developments (May 2013)
- Biodiversity Offset Strategy for the proposed extension of the Pine Dale Mine (Enhance Place Pty Ltd, July 2013)
- Biodiversity Offset Strategy for proposed Stage 1 Modification, Moolarben Coal Mine (Yancoal, May 2013)
- Biodiversity Offset Strategy for Crudine Wind Farm (Wind Prospect CWP Pty Ltd – 2012)
- Biodiversity Offset Strategy for Sapphire Wind Farm (Wind Prospect CWP Pty Ltd – 2011)
- Biodiversity Offset Strategy for Boco Rock Wind Farm (Wind Prospect CWP Pty Ltd – 2011)
- Improve or Maintain Biodiversity Offset Strategy for Kings Hill Urban Release Area, Port Stephens LGA (Mondell Property Group, 2011)
- Biodiversity offset strategy for proposed Narrabri Coal mine (Narrabri Coal Operations Pty Ltd, 2011)
- Biodiversity offset strategy for proposed modification to Rocglen Coal Mine (Whitehaven Coal Pty Ltd, 2010)
- Biodiversity offset strategy for proposed Werris Creek LOM Coal Mine (Werris Creek Coal Pty Ltd, 2010)
- Biodiversity offset strategy for the South West Rail Link (Transport Construction Authority, 2010)
- Biodiversity offset strategy for the Richmond Rail Line duplication (Transport Construction Authority, 2011)
- Biodiversity offset strategy for the Camden Valley Way Upgrade (NSW RTA, 2011)
- Biodiversity Offset Strategy for the Oxley Highway Upgrade, Port Macquarie (NSW RTA, 2010)
- Preparation of Offset Strategy and package for the Kingsgrove to Revesby Quadruplication Project (2008/09 K2RQ/TIDC Alliance)

**Biobank Site Assessments and Registrations**

- 80 ha site at Salamander for Port Stephens Shire Council (Assessment currently being assessed by OEH)
- Two Biobank sites (100 ha) in Western Sydney Parklands as an amendment to the existing Cecil Hills Biobank Site (Agreement No. 120 registered August 2014)
- 54 ha proposed Biobank at the Oaks on the Cumberland Plain (Private landholder) (Agreement No. 100, registered in September 2013)
- 69 ha proposed Biobank for Shoalhaven City Council at (Agreement No. 101, registered in June 2013)
- 45 ha proposed Biobank for Lake Macquarie City Council at Belmont (Agreement No. 103, registered in June 2013)
- 51 ha site west of Camden on the Cumberland Plain (Private landholder) (Agreement No. 88, registered in January 2013)
- 25 ha site west of Camden on the Cumberland Plain (Private landholder) (Agreement No. 3, registered in January 2011).
- 24 ha site in western Sydney (Western Sydney Parklands Trust). (Agreement No. 70, registered in February 2012).
- 10 ha site at Belrose (WSN Environmental Solutions) (Agreement No. 55, registered in March 2012)
- 1,500 ha site near Gunnedah to offset an approved Coal mine (Whitehaven Coal) (Agreement No. 43, registered in August 2012).

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CURRICULUM VITAE

# Meredith Henderson

**PRINCIPAL ECOLOGIST**

Meredith is an ecologist with over 24 years of survey and research experience and is Senior Ecologist in Eco Logical Australia's Wollongong Office. Meredith has worked in a range of sectors including state government, University, non-government organisations and the private sector. She has a PhD and Honours degree in terrestrial ecology. Meredith has well developed capabilities in terrestrial plant ecology and environmental assessment. She is experienced in the design and completion of ecological surveys, environmental impact assessment, monitoring impacts of land management change, literature reviews and synthesis. Meredith has highly developed skills in government and client liaison. Meredith has managed many large and complex projects. She is an accredited BioBanking assessor and has been led biodiversity certification projects and application of the major projects assessment and offsetting requirements. She is one of the lead ecologists in the Infrastructure Sector of ELA, specialising in road impact assessments.

## QUALIFICATIONS

- PhD, Victoria University, Melbourne. Vegetation dynamics in response to fire and slashing in remnants of Western Basalt Plains grasslands and the implications for conservation management.
- Bachelor of Science (Honours), University of Wollongong.
- Accredited BioBanking Assessor (#155)
- Basic Bushfire Training – NSW and SA qualified
- Australasian Interagency Incident Management System – basic training
- Bushfire Behaviour Analyst – Victorian Department of Environment & Sustainability
- Senior First Aid
- Construction Industry White Card
- Westlink M7 induction to November 2017

## PROJECT EXPERIENCE

### ECOLOGICAL SURVEY

- Full floristics vegetation surveys for vegetation mapping, Bega Valley, Illawarra and South Coast (NSW NPWS)
- Vegetation mapping of the Holsworthy Military Area (Janet Cosh Herbarium for Department of Defence)
- Vegetation assessment for bushfire planning and assessment in Lower Snowy area of Kosciuszko National Park (Gary Leonard & Associates for NSW NPWS)
- Monitoring Trachymene saniculifolia plant populations in Kanangra Boyd NP (NSW NPWS)
- Pre-clearance survey in Cumberland Plain Woodland, West Schofields (Mirvac)
- Camden Council Reserves Vegetation Assessment (Camden Council)
- Full floristics, vegetation validation, biobanking plots, and culvert assessments for NorthConnex EIA (Transurban/RMS)
- Full floristics and biobanking plots for proposed Biodoversity Certification (Hardwicke)
- Targeted threatened species surveys (incl. Koala, Green and Golden Bell Frog and number plant species) for a range of infrastructure and residential development clients

### ECOLOGICAL IMPACT ASSESSMENT

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- Rezoning in rural residential area in Dural, NSW (Brown Consulting)
- Flora and fauna assessment for outdoor education facility, Wolgan Valley, NSW (Cranbrook School)
- Flora and Fauna Assessments for residential development, Church Point, Bayview, Balgowlah Heights, North Turramurra (variety of clients)
- Ecological Constraints in Sydney Metropolitan (UrbanGrowth NSW)
- NorthConnex ecological assessment EIS (RMS/Transurban)
- WestConnex the New M5 biodiversity technical report for the EIS (RMS/Sydney Motorway Corporation)
- EPBC Act strategic assessment of procedures and guidelines for works on NSW roads (RMS)

**FUEL HAZARD ASSESSMENT**

- Conduct vegetation fuel hazard assessments and ecological assessments for fire planning and management on the Eyre Peninsula, Mount Lofty Ranges, the SA Murray-Darling, South-east and Kangaroo Island (SA DEH)
- Vegetation fuel hazard assessments for fire behaviour analysis in Mt Taylor, New Zealand ( for CSIRO and Bushfire CRC)

**RESEARCH**

- Vegetation survey and assessment following experimental burning and grazing exclusion in Guy Fawkes River Wilderness Area (NSW NPWS)
- Vegetation assessment and monitoring in mallee following experimental burning and bushfires – design and conduct full floristics and habitat assessment (SA Department of Environment & Heritage)
- Vegetation fuel hazard assessments and joint project leader for Project FuSE in SA MDB Region (SA DEH and Bushfire CRC)
- Review of environmental information required for impact assessment and approvals (SA Department of Environment, Water and Natural Resources)

**EXPERT WITNESS**

- SA Crown v Dunbar – native vegetation clearance – engaged by applicant to provide expert statement on fire impacts on native vegetation (2009)
- Mackenzie Architects v Ku-ring-Gai Council – engaged by applicant to provide expert witness services in the NSW Land and Environment Court (2015)
- Universal Property Group v Blacktown City Council – engaged by respondent to provide expert ecological advice in the NSW Land and Environment Court (2016)

**QUALITY ASSURANCE**

- Transport for NSW train station facility upgrades, Canley Vale and Padstow (NSW Government)
- Several flora and fauna assessments for Bingara Gorge suite of development (Lend Lease, Service Stream Mobile Communications)
- Flora and fauna assessment for outdoor education facility, Wolgan Valley, NSW (Cranbrook School)
- Ecological constraints report, Rookwood to Beaconsfield West (Transgrid)
- Flora and Fauna Assessments for a range of works in the Western Sydney Parklands (Western Sydney Parklands Trust)
- Service Station development at Ulan
- Moolarben Coal Operations mine extension (Yancoal)
- Biodiversity Study for Hurstville City Council

**KEY ROAD INFRASTRUCTURE PROJECTS**

- WestConnex: The New M5. Project Manager and Lead Ecologist, accredited assessor. The New M5 is part of the WestConnex package of works to link the M4 with the M5. Meredith led the Biodiversity Assessment Report and Biodiversity Offset Strategy as well as a species specific management plan. This project was assessed using the Framework for Biodiversity Assessment (FBA).
- NorthConnex: Linking the M1 and M2. Lead Ecologist, writer. This project was another major project undertaken for Roads and Maritime and Transurban. Meredith's role was to lead the design and execution of field work, writing and responding to comments and submissions.
- NorthConnex: Hornsby Quarry Spoil Site Assessment. Project Manager and Lead Ecologist. This project for Roads and Maritime and Transurban was to assess the impacts of the proposed deposition of spoil as a result of the construction of the NorthConnex project. This was assessed as a major project using the FBA.
- Southern Access Motorway: Strategic options. Lead Ecologist and writer. This project for Roads and Maritime was to examine high level ecological challenges for a number of route options.

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- Shoalhaven River alternate crossing: Nowra Bridge. Project Manager, Lead Ecologist and writer. This project for Roads and Maritime was to examine the ecological constraints for five options for an alternate crossing of the Shoalhaven River at Nowra.
- Roads and Maritime EPBC Act Strategic Assessment. Specialist technical adviser. This project was to provide specialist ecological advice to Roads and Maritime for their strategic assessment under the EPBC Act. The strategic assessment negates the need to refer Part 5 projects to the Commonwealth if they are assessed in accordance with the guidelines.
- M12 Options Analysis. Lead ecologist and QA. This project for Roads and Maritime was to provide high level technical advice on the long and short list options for the proposed M12.

**USE OF BIOBANKING AND RELATED METHODS**

- Conduct field work for BCAM (SouthWest Land Holdings)
- Conduct biobanking plots and vegetation mapping for use in assessing impacts – NorthConnex (Transurban / RMS)
- Conduct biobanking plots, survey and run calculations for additional site for NorthConnex (Transurban / RMS)
- Provide advice to client on biobanking feasibility (Stockland)
- Lead assessor for WestConnex The New M5 using FBA (Roads and Maritime)
- Lead assessor for BCAM in northern Sydney region (Celestino)
- Lead assessor for BioBanking Agreement in the Illawarra (Holcim)
- Conduct field work for proposed major mining project in NSW central tablelands / slopes
- Lead assessor for BCAM at Sydney Science City (Celestino)
- Lead assessor for BCAM at El Caballo, Gledswood and Lakeside (Sekisui House)
- Provide advice on biobanking at Calderwood Valley Stage 3B North (Lendlease Communities)

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**Dr Enhua Lee – Senior Field Ecologist – Biometric Plots and threatened flora (now with the Office of Environment and Heritage)**

CURRICULUM VITAE

# Dr Enhua Lee

**SENIOR ECOLOGIST**

## QUALIFICATIONS

- PhD in Ecology and Wildlife Management. The Ecological Effects of Sealed Roads in Australia's Arid Zone. – 2006
- Bachelor of Advanced Science (First Class Honours). Mitochondrial Adjustments in the Muscles of the Fat-tailed Dunnart, *Sminthopsis crassicaudata*, During Cold Acclimation – 2000
- Accredited BioBanking Assessor (number 176)

Enhua is a Senior Ecologist in the Sutherland office of ELA with a Doctor of Philosophy in wildlife management and over 12 years of experience in environmental research and consulting.

Enhua has extensive practical experience in biodiversity survey and monitoring. As a senior ecologist, Enhua has been involved in planning, establishing and undertaking vegetation and fauna monitoring programs, and baseline flora and fauna surveys. Enhua also has well developed research and analytical skills, and time management and project management skills. She is an effective communicator, as demonstrated through her work in developing biodiversity education programs and her invitations to present her research findings at specialist conferences and to lay audiences. She has trained people in conducting flora and fauna surveys in Australia's rangelands and has published peer-reviewed book chapters and papers in international and national scientific journals.

Since joining Eco Logical Australia in 2007, Enhua has completed work for state and federal government agencies, local councils, as well as private businesses and property owners. She has a sound knowledge of environmental and planning legislation (NSW, VIC and WA State legislation and Commonwealth legislation) and has applied her knowledge to a range of projects. Her work has ranged from completing NSW biocertification, biobanking and ecological impact assessments (NSW and WA) to conducting complex statistical analyses to inform management plans. She has also been involved in numerous monitoring projects, strategic assessments, and has provided high level conservation advice to government agencies.

## RELEVANT PROJECT EXPERIENCE

**Biobanking/Biocertification Assessments**

- Mt Gilead Biocertification Assessment (Mt Gilead and S. and A. Dzwonnik) (in progress)
- Macarthur-Onslow Mt Gilead Biobank Assessment (in progress)
- Noorumba-Mt Gilead Biobank Assessment (in progress)
- Hardwicke Stage 1 Biobank Assessment (submitted)
- Hardwicke Stage 2 Biobank Assessment (in progress)
- Port Macquarie Airport Biocertification Assessment (Port Macquarie Hastings Council) (in progress)
- Biobank Feasibility Assessments (Noorumba, Simmo's Beach, and Smiths Creek Reserve) (Campbelltown City Council)

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**Ecological Constraints / Impact Assessment / Flora and Fauna Survey**

- Rossmore Ecological Constraints Assessment (Stephen Bowers Architects)
- Wilton Flora and Fauna Assessment (Sydney Water)
- Wilton Ecological Constraints Assessment for three sites in Wilton (Sydney Water)
- Gregory Hills Flora and Fauna Assessment of non-certified land (Dart West Developments)
- Denham Court Road Flora and Fauna Assessment (Rawson Communities)
- EPBC Act Strategic Assessment of Procedures and Guidelines (RMS)
- Narrabri Ecological Assessment (Santos)
- Lancelin Defence Training Area Flora and Fauna Survey (Defence) (WA)
- Marandoo East Drilling Flora and Fauna Survey for Native Vegetation Clearing Permit (RTIO) (WA)
- Homestead to Silvergrass Rare Flora Survey (RTIO) (WA)
- Brockman 2 Expansion Flora and Fauna Survey for Native Vegetation Clearing Permit (RTIO) (WA)
- McPhee Creek Environmental Approvals (Atlas Iron) (WA)
- Pilbara Expansion Cumulative Impact Assessment (BHPBIO) (WA)
- Kemerton Industrial Park Gap Analysis and Ecological Surveys (LandCorp) (WA)
- WestBank Ecological Survey and Assessment (LandCorp) (WA)
- Ninga Vertebrate Fauna Survey and Habitat Mapping (BHPBIO) (WA)
- Koodaideri Iron Ore and Infrastructure Project (Public Environmental Review) (Rio Tinto Iron Ore) (WA)
- Carnaby's Cockatoo habitat surveys throughout the south-west of WA (DSEWPaC) (WA)
- Warwick Open Space Flora, Fauna and Fungi Survey (City of Joondalup) (WA)
- Edgewater Quarry Flora and Fauna Survey (City of Joondalup) (WA)
- Callawa Vertebrate Fauna Survey (WA Level 2 Fauna Survey) (BHPBIO) (WA)
- Menai Species Impact Statement (Landcom)
- Annangrove Light Industrial Area Flora and Fauna Constraints Assessment (Hills Shire Council)
- Crudine Ridge Wind Farm Ecological Assessment (Part 3A project) (Wind Prospect)
- Narrabri Gas Field Ecological Assessment (Part 3A project) (Eastern Star Gas)
- Beacon Hill Species Impact Statement (The Trustees of the Sisters of the Good Samaritan)
- Pittwater Road Upgrade Flora and Fauna Assessment (City of Ryde)
- Preliminary ecological assessment of Allenby Park (Stage 1) (AMPCI)
- Ecological Assessment of Allenby Park (Stage 2) (AMPCI)
- Ecological Assessment, Proposed Drainage Augmentation, Warringah Mall (AMPCI)
- Glenmore Park Flora and Fauna Assessment (AMPCI)
- Commonwealth BER Flora and Fauna Assessments (Hansen Yunckin)
- Wedderburn Hazard Reduction Flora and Fauna Assessment (Campbelltown Council)
- Stanwell Tops Conference Centre Ecological Assessment (Borst and Conacher Architects)
- Tubbo Farming Grassland Assessment (Tubbo Farming)
- Ecological Impact Assessments – various (Integral Energy)
- Sensitivity Mapping for NW and SW Growth Centre (Sydney Water)
- Western Parklands Ecological Constraints Assessment (DoP)
- Biobanking Pilot Assessments (DECC)
- El Caballo Blanco and Gledswood Rezoning Ecological and Bushfire Assessment (Landcom)
- South Randwick Feasibility Review: Environmental Issues and Constraints (Landcom)
- Whitebridge Constraints Assessment (Landcom)
- Ballanagamang Biobanking Assessment (Ecotrades)
- Fauna Report for the Gap Park Masterplan (Thompson Berril Landscape Design)
- Flora and Fauna Assessment: Compound Sites for Hume Highway Duplication (Leighton Contractors)

**Management Plans**

- Cloudbreak Life of Mine Revegetation Plan and Procedures (Fortescue Metals Group) (WA)
- Sunningdale Vegetation and Fauna Management Plan (Pacific Dunes)
- South Bandiana Landscape Management Plan (Defence)
- North Bandiana Landscape Management Plan (Defence)
- Kapooka Box-Gum Mapping and Monitoring Plan (Defence)
- Cooper Park Management Plan (Woollahra Council)

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- SWC Carrier Flora and Fauna Assessment and Management Plan (Water Infrastructure Group)
- Sydney South West Property Environmental and Vegetation Management Plans (Sydney Water)
- Hawkesbury Roadside Vegetation Management Plan (Hawkesbury Council)
- Flying Fox Plan of Management – Parramatta Park (Parramatta Park Trust)
- *Acacia terminalis* Plan of Management – North Head Sewerage Treatment Plant (Sydney Water)
- North Head Sewage Treatment Plant Fire Management Plan (Sydney Water)

**Vegetation Community Mapping**

- Kapooka Box-Gum Mapping and Monitoring Plan (Defence)
- Wetland Vegetation Surveys for LiDAR, Lowbidgee and Gwydir wetlands (DECC)
- Molonglo River Vegetation and Habitat Survey and Mapping (ACT Planning)

**Ecological Monitoring**

- Drayton Coal Mine Monitoring (Anglo Coal (Drayton Management))
- Bindoon Defence Training Area Annual Monitoring (Defence) (WA)
- Mulgara Trapping, Translocation and Monitoring (Samsung/Roy Hill) (WA)
- Garden Island Weed Monitoring Survey and Assessment (Defence) (WA)
- Lancelin Defence Training Area Rapid Vegetation Monitoring (Defence) (WA)
- Tropicana Gold Mine Vegetation Monitoring (AngloGold Ashanti Australia) (WA)
- Bungaribee *Themeda australis* Relocation Monitoring (Landcom)
- Werris Creek Biodiversity Offset Area Annual Monitoring (Werris Creek Coal)
- Liddell Colliery Flora and Fauna Monitoring (Liddell Coal Operations)
- Kapooka Kangaroo Impact Monitoring (Defence)
- Latchford Barracks Kangaroo Impact Monitoring (Defence)
- Microbat Monitoring, Warringah Mall (AMPCI)
- Metropolitan Colliery Vegetation Monitoring (Metropolitan Colliery)

**Ecological Reviews**

- Review of Dunheved Rail Corridor Ecological Assessment and Advice (Lend Lease)
- EPBC Conservation Advice (DEWHA)
- Review of Threatened Species Recovery Plans (DECC)
- Review of DA documents (Ku-ring-gai Council)

**Statistical Analyses**

- Vegetation Community Assessment (PATN analysis), Neerabup Industrial Area (Landcorp) (WA)
- Historical Impacts of Linear Infrastructure on Sheetflow-dependent Vegetation Associations (API) (WA)
- Habitat Modelling for Flora and Fauna species in the Gold Coast region (Gold Coast Council)
- Rufous Scrub-bird Monitoring Assessment (DECC)
- Habitat Modelling Pilot for Flora and Fauna Species: Swan Coastal Plain and Jarrah Forest IBRAs (WA DEC)
- Far South Coast Fire Assessment: Effects of Fire on Vegetation Composition (DECC)

**Training/Education**

- Biodiversity Awareness Training Course (DECC)
- Part 5 Training Course (Rockdale Council)

**Other**

- Ecological Character Description for the Paroo River Wetlands Ramsar Site (DEWHA)
- Information sheet for the Menindee Lakes System (Australian Floodplain Association)
- Flora assessment at Pinaroo Lake in north-western New South Wales (DEHWA)

**Biodiversity Survey Experience**

Enhua has conducted surveys in a range of ecosystems, including semi-arid woodlands, shrublands and grasslands, temperate woodlands, forests, rainforests, and grasslands, and alpine woodlands across NSW, and

in parts of Victoria (North east region) and WA (Pilbara, Kimberley, and Goldfields-Esperance regions). This experience has exposed her to a diversity of fauna distributed across these ecosystems.

She is familiar with both active and passive survey techniques, including:

- Terrestrial and arboreal Elliott trapping
- Pitfall trapping
- Cage trapping
- Harp trapping
- Funnel trapping
- Active searches (herpetofauna)
- Bird point and transect census
- 'Distance' transect surveys (for population density estimation)
- Call playback
- Remote camera survey
- Anabat detection
- **Call detection**

**Scientific Publications**

Lee, E., Croft, D. B., and Achiron-Frumkin, T. (2015). 'Roads in the Arid Lands: Issues, Challenges and Potential Solutions'. In: Handbook of Road Ecology. van der Ree, R., Smith, D.J. and Grilo, C (eds.). John Wiley & Sons, Oxford. 552 pp. ISBN: 978-1-118-56818-7.

Dawson, T. J., Webster, K. N., Lee, E. and Buttemer, W. A. (2013). 'High muscle mitochondrial volume and aerobic capacity in a small marsupial (Sminthopsis crassicaudata) reveals flexible links between energy-use levels in mammals.' Journal of Experimental Biology, 216: 1330-1337.

Lee, E., Ramp, D. and Croft, D. B. (2010). 'Flight response as a causative factor in kangaroo-vehicle collisions'. In: Macropods (Eds. G. Coulson and M. Eldridge). Surrey Beattie and Sons, Chipping Norton.

Lee, E. and Croft, D. B. (2009). 'The effects of an arid-zone road on vertebrates: Priorities for management?' In: Too Close for Comfort: Contentious issues in human-wildlife encounters (Eds. D. Lunney, A. Munn and W. Meikle). The Royal Zoological Society of New South Wales, Mosman.

Lee, E., Klöcker, U., Croft, D. B. and Ramp, D. (2004). 'Kangaroo-vehicle collisions in Australia's sheep rangelands, during and following drought periods'. Australian Mammalogy, 26: 215-226

Dawson, T. J., Webster, K. N., Mifsud, B., Raad, E., Lee, E. and Needham, A. D. (2003). 'Functional capacities of marsupial hearts: Size and mitochondrial parameters indicate higher aerobic capacities than generally seen in placental mammals'. Journal of Comparative Physiology – B, 173(7): 583-590

CURRICULUM VITAE

# Nicole McVicar

**SENIOR ECOLOGIST**

Nicole has worked as an ecologist for over 12 years for both Government and private industry. Recently she has been managing Biodiversity Assessment Methodology (BAM) projects involving production and review of Biodiversity Development Assessment Reports and Flora and Fauna Assessments in the Sydney Metro region. Nicole has recently been the lead ecologist managing intensive remote botanical work, completing full floristic surveys and rapid revegetation assessments for McArthur River Mine in the Northern Territory. Nicole is also commissioned annually as the lead ecologist to undertake floristic survey and monitoring assessments in the Narrabri area for biodiversity offset and revegetation lands for Whitehaven Coal. Prior to working at ELA, Nicole worked for 7 years as a Senior Environmental Officer – Bushland at Northern Beaches Council (formally Warringah Council). In this role she has managed a range environmental projects with consultants, state government agencies and other stakeholders to produce and improve standards and procedures for bushland management across the region. She has also worked for the Northern Territory Parks and Wildlife Service and Manly Dam Reserve as a Park Ranger with experience ranging from remote landscape bush fire hazard reduction works, broad scale weed control, infrastructure maintenance, management of contractors and water quality management and track and trail management and construction.

## QUALIFICATIONS

- Bachelor of Environmental Science, Macquarie University
- Bush Regeneration Certificate II, Ryde TAFE
- Accredited BAM Assessor BAAS 18077

## PROJECT EXPERIENCE

- McArthur River Mine – Northern Territory – lead ecologist annual long-term revegetation monitoring, rapid revegetation assessments and salinity monitoring
- Tarrawonga Mine Monitoring - Boggabri – lead ecologist flora surveys and condition plot collection
- RocGlen Mine Monitoring Gunnedah - lead ecologist floristic surveys and condition plot collection
- Kenna Offset Mine Monitoring - Narrabri South - lead ecologist flora surveys and biometric plot collection
- Narrabri South Mine flora surveys and BAM plot collection (Biodiversity Assessment Methodology)
- Taralga Wind Farm Biobanking Assessment - lead ecologist - BBAM plot collection, management actions fieldwork and reporting
- Northern Beaches Council Development Application Assessment – secondment to undertake assessment of biodiversity components of part 4 development applications
- Flora and Fauna Statement including Biobanking Feasibility Study – Belrose TAFE - lead ecologist
- Land and Environment Court Malnic vs Northern Beaches Council Case Number 2016/00383520 – Expert Witness researching, reporting and court attendance
- Biobank field assessment and reporting Jervis Bay Biocertification and Biobanking projects
- Glenhaven Retirement Village Expansion – Biobanking Assessment, Flora and Fauna Assessment and Vegetation Management Plan - lead ecologist
- Old Northern Road Maroota - Flora and Fauna Assessment (Sydney Turpentine Ironbark Forest Critically Endangered Ecological Community) - lead ecologist
- Targeted threatened species survey - Acacia pubescens and vegetation community validation – M5 Motorway
- Melrose Park South Structure Plan – Preliminary Ecological Assessment -City Plan Services
- Preliminary Biobanking Assessment – Irwin Rd East Kurrajong
- Targeted threatened species surveys – Prostanthera marifoliia – OEH Saving Our Species program

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- Biobank field assessment and management actions-Taralga Wind Farm
- Curl Curl Optus Telecommunication Tower Flora and Fauna Assessment and Biodiversity Management Plan
- West Schofields Part Precinct Biodiversity and Riparian Assessment
- Eton Rd Lindfield Flora and Fauna Assessment – Darwinia biflora
- Bexley Cable Bridge remediation Flora and Fauna Assessment – TransGrid
- Castle Hill Flora and Fauna Assessment – Sydney Turpentine Ironbark Forest in the Sydney Basin Bioregion
- Prince of Wales Hospital Site Infrastructure Investigations – Biodiversity Study
- Fauna monitoring and analysis - Ingleside Reserve Biobank Assessment - Pittwater Council
- Nestbox survey, monitoring and data analysis – Manildra to Parkes – TransGrid
- Gordon Anglican Retirement Village Flora and Fauna Assessment –Blue Gum High Forest in the Sydney Basin Bioregion, Grey-headed Flying-fox
- Assessment of proposed Biobank sites with Waitara Creek Bushland and Arcadia Park, Hornsby local government area – Biobank assessment fieldwork, condition mapping and costing
- Biodiversity Certification consistency reporting and mapping – Department of Planning and Environment
- Targeting threatened species surveys Kurri Kurri Biodiversity Certification - Eucalyptus parramattensis, Grevillea parviflora
- Targeted threatened species surveys Jervis Bay Biodiversity Certification – Genoplesium baueri
- Targeted threatened species surveys Ingleside Planning study – Microtis angusii
- Development of local government management systems and procedures. Biodiversity Restoration Study 2011 (categorisation and prioritisation of Council bushland reserves using conservation significance ratings), Operational Management Standards for bushland management procedures, and Warringah Pittwater Bush Fire Risk Management Plan 2010 (prioritisation of bush fire risk and management actions)
- Development and project management of Warringah Council's Bush Regeneration Costing Methodology project; a new council procedure to allow staff to use a standardised method of estimating costs/effort of bush regeneration projects
- Management of Warringah Council bushland restoration contracts and threatened species projects. This included management of an annual $1.2 million budget
- Co-ordination of Warringah Council's bush fire management program. This entailed all operational and strategic bush fire mitigation and planning works under the Bush Fire Risk Management Plan and NSW Rural Fires Act (RF Act)
- Project management, data collection and ecological monitoring of soil and threatened plant translocation projects, specifically Duffys Forest Endangered Ecological Community and Grevillea caleyi
- Coordination of federal Green Army Program.

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CURRICULUM VITAE

# ALEX GOREY

**ECOLOGIST**

## QUALIFICATIONS

- Master of Sustainability: University of Sydney – 2015.
- Bachelor of Science: Double major in Environmental Science and Geography, University of Sydney – 2012.
- National OHS Construction Induction Training (White Card) – 2016.
- Lyssavirus Vaccinated December 2016
- RISI and ACS cards 2019

Alex has worked as an ecologist for 3 years. Alex has experience in managing and conducting ecological surveys and reporting associated with the preparation of Flora and Fauna Assessments and Biodiversity Development Assessment Reports under the Biodiversity Assessment Methodology (BAM). Alex is practiced in the application of the *NSW Biodiversity Conservation Act 2016* (BC Act) and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and other relevant legislation for a range of stakeholders, including land holders, private groups and government. Alex has extensive experience in the preparation of a range of environmental report writing, including constraints advice, planning proposals, Federal referrals and preliminary documentation, Flora and Fauna Assessments, Management Plans, Review of Environmental Factors and Biodiversity Development Assessment Reports.

Prior to joining Eco Logical, Alex completed a Master of Sustainability at the University of Sydney. Alex's research project involved working with Taronga Zoo's sustainability department to improve environmental compliance and help deliver the integration of voluntary sustainability initiatives. Alex also has experience in GIS mapping of coastal environments and assessing both terrestrial and aquatic flora and fauna. Alex has also worked on delivering sustainable economic empowerment for subsistence farming communities in Tanzania.

## RELEVANT PROJECT EXPERIENCE

### BbAM and BAM Assessments

- Calderwood BDAR Assessment
- Mt Gilead BioBanking Assessment
- Mt Brown BioBanking Assessment
- Cawdor BioBanking Assessment
- Wambo Coalmine Peabody – Hunter Valley
- Rickards Road, Castlereagh – BioBanking Assessment

### Planning Proposals and Rezoning

- South Campbelltown Planning Proposal (Mir Group of Companies)
- West Dapto Planning Proposal (Stocklands)
- Jacaranda Planning Proposal (Celestino)
- Sydney Science Park Planning Proposal (Celestino)
- Corrimal Cokeworks Planning Proposal (Legacy Property)
- Kiama Saddleback Mountain Rd Planning Proposal(Unicomb Development Services Pty Ltd)
- Elizabeth Street, Redfern Planning Proposal (Land and Housing Corporation NSW)

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**Federal Approvals**

- Macarthur Gardens North Preliminary Documentation (Land and Housing Coroporation NSW)
- Rickards Road, Castlereagh Post Approvals Management and Referral
- Jacaranda Preliminary Documentation (Celestino)
- El Caballo Blanco Gledswood Hills Post Approvals Management (Sekisui House)
- CSR Horsley Park Post Approvals Management (CSR & Calibre Consulting)

**Impact Assessments**

- Barkers Mill - Biodiversity and Riparian Assessment (Macarthur Developments)
- Canyonleigh – Flora and Fauna Assessment (Highlands Heavy Industries)
- Coalcliff - Flora and Fauna Assessment (Ingham Planning)
- Cromer – Flora and Fauna Assessment (Brewster Murray Architects)
- Elizabeth Macarthur Creek – Flora and Fauna Assessment (AECOM)
- Freemans Reach – Vegetation validation and targeted flora and fauna surveys (Celestino)
- Kingswood – Ecological Constraints Analysis
- Delhi Road Upgrade – Flora and Fauna Assessment
- Jacaranda – Rezoning Planning Proposal
- Oakdale – Constraints Analysis (Michael Brown Planning)
- Quakers Hill – Constraints Analysis (AECOM)
- Western Sydney Parklands Trust – Ecological Constraints Analysis
- Wollongong LGA– Review of Environmental Factors (Wollongong City Council)
- Calderwood Valley – Flora and Fauna Assessments and Ecological Constraints Analysis (Lendlease)
- Gregory Hills Sewer Pipeline - REF (Dart West Developments)
- Kogarah Sewer Pipeline - REF (Rose Atkins Rimmer Infrastructure)
- Camden Road Sewer Pipeline - REF (Rose Atkins Rimmer Infrastructure)
- Riverstone Sewer Pipeline – REF (Rose Atkins Rimmer Infrastructure)

**Fauna Handling and Clearance Supervision**

- Kellyville Residential subdivision – Dam Dewatering
- Mt Carmel – Hollow bearing tree clearance supervision (Western Earthmoving)
- Schofields – Hollow bearing tree clearance supervision (North Western Surveys)
- El Cabello Blanco Cumberland Plain Land Snail clearance survey (Cardno)
- Glenmore Park Cumberland Plain Land Snail clearance survey (CCL Developments)

**Threatened Fauna Management Plans**

- Horsley Nest Box Management Plan (Allan Price and Scarratts)
- Manooka Valley – Hollow Bearing Tree Assessment and Nest Box Installation Plan (Green Fields Development Company)
- Warrawong Green and Golden Bell Frog Management Plan (Kennards Self Storage)
- Riverstone Green and Golden Bell Frog Management Plan (Rose Atkins Rimmer Infrastructure) Targeted Fauna Survey
- Mt Gilead – Targeted Microchiropteran bat surveys, frog surveys and squirrel glider surveys (Lend Lease)
- Glenarra - Targeted Squirrel Glider surveys
- Helensburgh – Targeted microbat surveys
- Jacaranda – Targeted Koala, microbat and forest owl survey
- Sydney Science Park – targeted migratory bird survey, Green and Golden Bell Frog, Microbat survey
- Calderwood Targeted Powerful owl Survey
- Corrimal Grey-headed Flying-fox camp Mapping, targeted microbat survey and Green and Golden Bell Frog habitat assessment

**Other relevant skills**

- Participated in 4-day Advanced Plant Identification Skills for Research and Environmental Assessment Course run by Belinda Pellow and David Keith, 2016.

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# Appendix B 2018 / 8246 Jacaranda Ponds EPBC Act Approval

Australian Government
Department of Agriculture, Water and the Environment

EPBC Ref: 2018/8246

Mr Andrew Jennings
Development Assistant
Celestino Pty Limited
642 Great Western Highway
PENDLE HILL NSW 2145

Dear Mr Jennings

**Decision on approval**
**Jacaranda Ponds residential subdivision, Glossodia, NSW (EPBC 2018/8246)**

I am writing to you in relation to your proposal to construct a residential development of approximately 580 lots and associated infrastructure on a 185 hectare (ha) parcel of land at Glossodia, NSW (Proposed Action).

I have considered the proposal in accordance with Part 9 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and have decided to grant an approval to Celestino Pty Limited. A notice of my decision is attached for your information. The proposal must be undertaken in accordance with the conditions specified in the approval.

I would appreciate your assistance by informing me when you start the action and who will be the contact person responsible for the administration of the approval decision.

Please note, any plans required as conditions of approval will be regarded as public documents unless you provide sufficient justification to warrant commercial-in-confidence status.

You should also note that this EPBC Act approval does not affect obligations to comply with any other laws of the Commonwealth, state or territory that are applicable to the action. Neither does this approval confer any right, title or interest that may be required to access land or waters to take the action.

The department has an active audit program for proposals that have been referred or approved under the EPBC Act. The audit program aims to ensure that proposals are implemented as planned and that there is a high degree of compliance with any associated conditions. Please note that your project may be selected for audit by the department at any time and all related records and documents may be subject to scrutiny. Information about the department's compliance monitoring and auditing program is enclosed.

If you have any questions about this decision, please contact the project manager, Brooke Connors, by email to brooke.connors@awe.gov.au, and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

Louise Vickery

Louise Vickery
Assistant Secretary
Environment Approvals and Wildlife Trade Branch
17th June 2020

GPO Box 787 Canberra ACT 2601 • Telephone 02 6274 1111 • www.awe.gov.au

# Appendix C Planning Proposal Gateway Determination

Planning, Industry & Environment

## Gateway Determination

***Planning proposal (Department Ref: PP_2019_HAWKE_004_00)**: to introduce E2 Environmental Conservation land use zone and redistribute other land uses at Jacaranda Ponds.*

I, the Executive Director of Central River City and Western Parkland City, at the Department of Planning, Industry and Environment, as delegate of the Minister for Planning and Public Spaces, have determined under section 3.34(2) of the *Environmental Planning and Assessment Act 1979* (the Act) that an amendment to the *Hawkesbury Local Environmental Plan (LEP) 2012* to rezone land at Jacaranda Ponds should proceed subject to the following conditions:

1. Prior to public exhibition, the planning proposal must be amended to include the following:
   (a) Consult and address the concerns raised by the Environment, Energy and Science (EES) Group's as identified in its letter Biodiversity Certification Adequacy Letter dated 5 March 2020:
      i. Any requirements for amending land use zones to comply with a future biobank agreement are to be addressed such as the preference for biobank sites to be E2 Environmental Conservation not RE1 Public Recreation; and
      ii. Review whether the minimum lot size within the R5 Large Lot Residential land use zone will appropriately protect the Grey Box-Forest Red Gum grassy woodland, particularly areas mapped as Good and Moderate condition; and
      iii. Update the proposed maps and information in the proposal including table calculations to reflect the changes following the resolution of matters raised by EES.
   (b) Under Part 2 Explanations of Provisions, include a restricted lot yield map for 580 residential lots across the subject site.
   (c) Review the implications of converting the RE1 Local Open Space to E2 Environmental Conservation along Currency Creek on the provision of RE1 local open space to support the new community. The review would include revising all references to quantum of RE1 and E2 land, a catchment and accessibility analysis of the RE1 land for the future residents and an analysis against 2.63ha/1,000 persons.
   (d) Preparation of a site-specific development control plan including a section on desired character such as landscape character and density for the site, and the identification of the irrigation areas.
   (e) Review of how the local convenience retail needs of the community will be met and incorporation of a planning provision to address these if they are not found to be met by the existing Glossodia Village.

(f) Consult the NSW Rural Fire Service prior to public exhibition in accordance with section 9.1 Direction 4.4 Planning for Bushfire Protection and address any comments from this agency.

2. After satisfying condition 1, the planning proposal is to be forwarded to the Department for endorsement prior to public exhibition.

3. Public exhibition of this planning proposal should be in conjunction with the public exhibition of the draft Development Control Plan supporting Jacaranda Ponds, a revised voluntary planning agreement and the biodiversity certification application.

4. Council is to ensure that appropriate measures are in place to provide for adequate local facilities to support the development. These measures may include a Voluntary Planning Agreement. Any Agreement should be exhibited in conjunction with the planning proposal and Development Control Plan.

5. Public exhibition is required under section 3.34(2)(c) and schedule 1 clause 4 of the Act as follows:

   (a) the planning proposal must be made publicly available for a minimum of **28 days**; and
   (b) the planning proposal authority must comply with the notice requirements for public exhibition of planning proposals and the specifications for material that must be made publicly available along with planning proposals as identified in section 6.5.2 of *A guide to preparing local environmental plans* (Department of Planning and Environment, 2018).

6. Consultation is required with the following public authorities/organisations under section 3.34(2)(d) of the Act and/or to comply with the requirements of relevant section 9.1 Directions:

   - Department of Planning, Industry and Environment – Water & Utility team
   - NSW Environment, Energy and Science
   - NSW Rural Fire Service
   - NSW Office of Water
   - IPART

   Each public authority/organisation is to be provided with a copy of the planning proposal and any relevant supporting material and given at least 21 days to comment on the proposal.

7. A public hearing is not required to be held into the matter by any person or body under section 3.34(2)(e) of the Act. This does not discharge Council from any obligation it may otherwise have to conduct a public hearing (for example, in response to a submission or if reclassifying land).

PP_2019_HAWKE_004_00 (IRF 19/7022)

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8. The planning proposal authority is authorised as the local plan-making authority to exercise the functions under section 3.36(2) of the Act subject to the following:

   (a) the planning proposal authority has satisfied all the conditions of the Gateway determination;
   (b) the planning proposal is consistent with section 9.1 Directions or the Secretary has agreed that any inconsistencies are justified; and
   (c) there are no outstanding written objections from public authorities.

9. The time frame for completing the LEP is to be **18 months** following the date of the Gateway determination.

Dated 9th day of June 2020.

**Catherine Van Laeren**
**Executive Director, Central River City & Western Parkland City**
**Department of Planning, Industry and Environment**

**Delegate of the Minister for Planning and Public Spaces**

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# Appendix D 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.

| *Scientific Name* | Common Name | Credit Type | Data source | TSC Act Status | EPBC Act Status | Habitat association | Recorded on site | Likelihood | Justification | Additional survey required |
|---|---|---|---|---|---|---|---|---|---|---|
| ***FAUNA*** | | | | | | | | | | |
| *Anthochaera phrygia* | Regent Honeyeater | Species | Atlas, PMST, BCAM | E4A | CE | Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North-West Plains, North-West and South-West Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions; also recorded in the Central Coast and Hunter Valley regions. Eucalypt woodland and open forest, wooded farmland and urban areas with mature eucalypts, and riparian forests of *Casuarina cunninghamiana* (River Oak). | No | Unlikely | No – not identified during survey | No |
| *Apus pacificus* | Fork-tailed Swift | Ecosystem | Atlas, PMST | - | M | Recorded in all regions of NSW. Riparian woodland, swamps, low scrub, heathland, saltmarsh, grassland, Spinifex sandplains, open farmland and inland and coastal sand-dunes. | No | Unlikely | No – no habitat in BCAA | N/A. Ecosystem credit species |
| *Ardea alba* | Great Egret | Ecosystem | PMST | - | - | Widespread, occurring across all states/territories. Also a vagrant on Lord Howe and Norfolk Island. Swamps and marshes, grasslands, margins of rivers and lakes, salt pans, estuarine mudflats and other wetland habitats. | No | Potential | No – not identified during survey | N/A. Ecosystem credit species |
| *Ardea ibis* | Cattle Egret | Ecosystem | Atlas, PMST | - | - | Widespread and common across NSW. Grasslands, wooded lands and terrestrial wetlands. | No | No | No – not identified during survey | N/A. Ecosystem credit species |
| *Artamus cyanopterus cyanopterus* | Dusky Woodswallow | Ecosystem | Atlas, PMST | V | - | Dusky woodswallows are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. | Yes | Known | Yes – sighted incidentally during survey | N/A. Ecosystem credit species |
| *Botaurus poiciloptilus* | Australasian Bittern | Ecosystem | Atlas, PMST | E1 | E | Found over most of NSW except for the far north-west. Permanent freshwater wetlands with tall, dense vegetation, particularly *Typha* spp. (bullrushes) and *Eleocharis* spp. (spikerushes). | No | Unlikely | No – not identified during survey | N/A. Ecosystem credit species |
| *Calidris ferruginea* | Curlew Sandpiper | Ecosystem | Atlas, PMST | E1 | M | Occurs along the entire coast of NSW, and sometimes in freshwater wetlands in the Murray-Darling Basin. Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland. | No | Unlikely | No – no habitat in the BCAA | N/A. Ecosystem credit species |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo | Ecosystem | Atlas, PMST | V | - | In NSW, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. Isolated records known from as far north as Coffs Harbour and as far west as Mudgee. Tall mountain forests and woodlands in summer; in winter, may occur at lower altitudes in open eucalypt forests and woodlands, and urban areas. | No | Unlikely | No – not identified during targeted survey | No. Ecosystem credit species |
| *Calyptorhynchus lathami* | Glossy Black-Cockatoo | Ecosystem | Atlas | V | - | In NSW, widespread along coast and inland to the southern tablelands and central western plains, with a small population in the Riverina. Open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. | No | Unlikely | No – no habitat in the BCAA | No. Ecosystem credit species |
| *Cercartetus nanus* | Eastern Pygmy-possum | Ecosystem | Atlas | V | - | In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Rainforest, sclerophyll forest (including Box-Ironbark), woodland and heath. | No | No | No – no habitat in the BCAA | N/A. Ecosystem credit species |
| *Chalinolobus dwyeri* | Large-eared Pied Bat | Species (Breeding) | Atlas, PMST | V | V | Recorded from Rockhampton in Qld south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney | No | No | No – not identified during survey | No. Foraging offset as ecosystem credit. |

| *Scientific Name* | Common Name | Credit Type | Data source | TSC Act Status | EPBC Act Status | Habitat association | Recorded on site | Likelihood | Justification | Additional survey required |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | basin and the NSW north-west slopes. Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country. | | | | |
| *Circus assimilis* | Spotted Harrier | Ecosystem | Atlas | V | - | Found throughout the Australian mainland, except in densely forested or wooded habitats, and rarely in Tasmania. Grassy open woodland, inland riparian woodland, grassland, shrub steppe, agricultural land and edges of inland wetlands. | No | Unlikely | No – not identified during survey | N/A. Ecosystem credit species |
| *Daphoenositta chrysoptera* | Varied Sittella | Ecosystem | Atlas | V | - | Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, mallee and Acacia woodland. | No | Unlikely | No – not identified during survey | N/A. Ecosystem credit species |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | Ecosystem | Atlas | V | - | South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range. Tall (greater than 20m) moist habitats. | No | Unlikely | No – not identified during survey | N/A. Ecosystem credit species |
| *Gallinago hardwickii* | Latham's Snipe | Ecosystem | Atlas, PMST | - | M | Migrant to east coast of Australia, extending inland west of the Great Dividing Range in NSW. Freshwater, saline or brackish wetlands up to 2000 m above sea-level; usually freshwater swamps, flooded grasslands or heathlands. | No | Unlikely | No – not identified during survey | N/A. Ecosystem credit species |
| *Glossopsitta pusilla* | Little Lorikeet | Ecosystem | Atlas | V | - | In NSW, found from the coast westward as far as Dubbo and Albury. Dry, open eucalypt forests and woodlands, including remnant woodland patches and roadside vegetation. | No | Unlikely | No – not identified during survey | N/A. Ecosystem credit species |
| *Grantiella picta* | Painted Honeyeater | Ecosystem | Atlas | V | - | Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas. Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. | No | Unlikely | No – not identified during survey | N/A. Ecosystem credit species |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle | Dual – Ecosystem (Foraging), Species (Breeding) | Atlas, PMST | - | M | Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia. Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas. | Yes | Known | Recorded by incidental sighting | Ecosystem and species credit species. Species credit when breeding habitat identified in the BCAA. Yes – searches for live large old trees within 1 km of water, and presence of a large stick nest in tree canopy or pair of adults duetting within breeding period |
| *Heleioporus australiacus* | Giant Burrowing Frog | Species | Atlas, PMST | V | V | South eastern NSW and Victoria, in two distinct populations: a northern population in the sandstone geology of the Sydney Basin as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. | No | No | No – no habitat in the BCAA | No |
| *Hieraaetus morphnoides* | Little Eagle | Ecosystem | Atlas | V | - | Throughout the Australian mainland, with the exception of the most densely-forested parts of the Dividing Range escarpment. Open eucalypt forest, woodland or open woodland, including sheoak or Acacia woodlands and riparian woodlands of interior NSW. | No | Unlikely | No – not identified during survey | N/A. Ecosystem credit species |

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| *Scientific Name* | Common Name | Credit Type | Data source | TSC Act Status | EPBC Act Status | Habitat association | Recorded on site | Likelihood | Justification | Additional survey required |
|---|---|---|---|---|---|---|---|---|---|---|
| *Hirundapus caudacutus* | White-throated Needletail | Ecosystem | Atlas, PMST | - | M | All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide. Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland. | No | Unlikely | No – not identified during survey | N/A. Ecosystem credit species |
| *Hoplocephalus bungaroides* | Broad-headed Snake | Species | PMST | E1 | V | Largely confined to Triassic and Permian sandstones within the coast and ranges in an area within approximately 250 km of Sydney. Dry and wet sclerophyll forests, riverine forests, coastal heath swamps, rocky outcrops, heaths, grassy woodlands. | No | No | No – no habitat in the BCAA | No |
| *Lathamus discolor* | Swift Parrot | Ecosystem | Atlas, PMST | E1 | E | Migrates from Tasmania to mainland in Autumn-Winter. In NSW, the species mostly occurs on the coast and south west slopes. Box-ironbark forests and woodlands. | No | Unlikely | No – not identified during survey | N/A. Ecosystem credit species |
| *Limosa lapponica* | Bar-tailed Godwit | Ecosystem | Atlas, PMST | - | M | Summer migrant to Australia. Widespread along the coast of NSW, including the offshore islands. Also numerous scattered inland records. Intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons, bays, seagrass beds, saltmarsh, sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. Rarely inland wetlands, paddocks and airstrips. | No | Unlikely | No – no habitat in the BCAA | N/A. Ecosystem credit species |
| *Litoria aurea* | Green and Golden Bell Frog | Species | Atlas, PMST, BCAM | E1 | V | Since 1990, recorded from ~50 scattered sites within its former range in NSW, from the north coast near Brunswick Heads, south along the coast to Victoria. Records exist west to Bathurst, Tumut and the ACT region. Marshes, dams and stream-sides, particularly those containing Typha spp. (bullrushes) or Eleocharis spp. (spikerushes). Some populations occur in highly disturbed areas. | No | Unlikely | No – no habitat in the BCAA | No |
| *Litoria littlejohni* | Littlejohn's Tree Frog | Species | PMST | V | V | Plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest south to Buchan in Victoria. The species has not been recorded in southern NSW within the last decade. Breeding habitat is the upper reaches of permanent streams and perched swamps. Non-breeding habitat is heath-based forests and woodlands | No | Unlikely | No – no habitat in the BCAA | No |
| *Lophoictinia isura* | Square-tailed Kite | Ecosystem | Atlas, PMST | V | - | In NSW, it is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast. Timbered habitats including dry woodlands and open forests, particularly timbered watercourses. | No | Unlikely | No – not identified in the BCAA during survey | N/A. Ecosystem credit species |
| *Melithreptus gularis gularis* | Black-chinned Honeyeater (eastern subspecies) | Ecosystem | Atlas | V | - | Widespread in NSW from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Also Richmond and Clarence River areas and a few scattered sites in the Hunter, Central Coast and Illawarra regions. Open forests or woodlands dominated by box and ironbark eucalypts, or by smooth-barked gums, stringybarks, river sheoaks and tea-trees. | No | Unlikely | No – not identified in the BCAA | N/A. Ecosystem credit species |
| *Meridolum corneovirens* | Cumberland Plain Land Snail | Species | Atlas, PMST, BCAM | E1 | - | Areas of the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool, west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. Primarily inhabits Cumberland Plain Woodland. Also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest. | Yes | Known | Identified during field survey | No |

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| *Scientific Name* | Common Name | Credit Type | Data source | TSC Act Status | EPBC Act Status | Habitat association | Recorded on site | Likelihood | Justification | Additional survey required |
|---|---|---|---|---|---|---|---|---|---|---|
| *Merops ornatus* | Rainbow Bee-eater | Ecosystem | Atlas, PMST | - | - | Distributed across much of mainland Australia, including NSW. Open forests and woodlands, shrublands, farmland, areas of human habitation, inland and coastal sand dune systems, heathland, sedgeland, vine forest and vine thicket. | No | Unlikely | No – no habitat in the BCAA | N/A. Ecosystem credit species |
| *Miniopterus australis* | Little Bentwing-bat | Dual – Ecosystem (Foraging), Species (Breeding) | Atlas, BCAM | V | - | East coast and ranges south to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. | Yes | known | Yes – identified during targeted survey | No. Ecosystem credit species. Species credit species for breeding habitat. Breed in caves. No caves present in BCAA or vicinity. |
| *Miniopterus schreibersii oceanensis* | Eastern Bentwing-bat | Dual – Ecosystem (Foraging), Species (Breeding) | Atlas | V | - | In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga. Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland. | Yes | known | Yes – identified during targeted survey | No. Ecosystem credit species. Species credit species for breeding habitat. Breed in caves. No caves present in BCAA or vicinity. Buildings present within the BCAA do not represent potential habitat as they are currently used for poultry farming. |
| *Mixophyes balbus* | Stuttering Frog | Species | Atlas, PMST | E1 | V | Along the east coast of Australia from southern Qld to north-eastern Victoria. Rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. | No | No | No – no habitat in the BCAA | No |
| *Monarcha melanopsis* | Black-faced Monarch | N/A | PMST | - | M | In NSW, occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Wolden Valley, Wollemi National Park and Wombeyan Caves. It is rarely recorded farther inland. Rainforest, open eucalypt forests, dry sclerophyll forests and woodlands, gullies in mountain areas or coastal foothills, Brigalow scrub, coastal scrub, mangroves, parks and gardens. | No | Unlikely | No – not identified during survey | No |
| *Monarcha trivirgatus* | Spectacled Monarch | N/A | PMST | - | Bonn, Mar | Coastal eastern Australia south to Port Stephens in NSW. Mountain/lowland rainforest, wooded gullies, riparian vegetation including mangroves. | No | No | No-no habitat in the BCAA | No |
| *Mormopterus norfolkensis* | Eastern Freetail-bat | Ecosystem | Atlas | V | - | Found along the east coast from south Qld to southern NSW. Dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. | Yes | Known | Identified on site during targeted survey | N/A. Ecosystem credit species |
| *Motacilla flava* | Yellow Wagtail | N/A | Atlas, PMST | - | M | Regular summer migrant to mostly coastal Australia. In NSW recorded Sydney to Newcastle, the Hawkesbury and inland in the Bogan LGA. Swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land, lawns. | No | Unlikely | No – no habitat in the BCAA | No |
| *Myiagra cyanoleuca* | Satin Flycatcher | N/A | PMST | - | Mr | In NSW, widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. Eucalypt-dominated forests, especially near wetlands, watercourses, and heavily-vegetated gullies. | No | Unlikely | No – not identified during survey | No |

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| *Scientific Name* | Common Name | Credit Type | Data source | TSC Act Status | EPBC Act Status | Habitat association | Recorded on site | Likelihood | Justification | Additional survey required |
|---|---|---|---|---|---|---|---|---|---|---|
| *Myotis macropus* | Southern Myotis | Species | Atlas, PMST, BCAM | V | - | In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers. Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation up to 20m. | Yes | known | Identified on site during targeted survey | No |
| *Neophema pulchella* | Turquoise Parrot | Ecosystem | Atlas | V | - | Occurs along the length of NSW from the coastal plains to the western slopes of the Great Dividing Range. Eucalypt and cypress pine open forests and woodlands, ecotones between woodland and grassland, or coastal forest and heath. | No | No | No – distribution does not overlap | N/A. Ecosystem credit species |
| *Ninox connivens* | Barking Owl | Ecosystem | Atlas | V | - | Wide but sparse distribution in NSW, avoiding the most central arid regions. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Woodland and open forest, including fragmented remnants and partly cleared farmland, wetland and riverine forest. | No | Potential | No – not identified during survey | N/A. Ecosystem credit species |
| *Ninox strenua* | Powerful Owl | Ecosystem | Atlas | V | - | In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains. Woodland, open sclerophyll forest, tall open wet forest and rainforest. | No | Potential | No – not identified during survey | N/A. Ecosystem credit species |
| *Numenius madagascariensis* | Eastern Curlew | Ecosystem | Atlas, PMST | - | M | Summer migrant to Australia. Primarily coastal distribution in NSW, with some scattered inland records. Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish lakes, saltworks and sewage farms. | No | No | No – no habitat in the BCAA | N/A. Ecosystem credit species |
| *Petaurus australis* | Yellow-bellied Glider | Ecosystem | Atlas | V | - | Along the eastern coast to the western slopes of the Great Dividing Range, from southern Qld to Victoria. Tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. | No | No | No – no habitat in the BCAA | N/A. Ecosystem credit species |
| *Petaurus norfolcensis* | Squirrel Glider | Species | Atlas | V | - | Widely though sparsely distributed on both sides of the Great Dividing Range in eastern Australia, from northern Qld to western Victoria. Mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. | No | No | No - no habitat in the BCAA | No |
| *Petrogale penicillata* | Brush-tailed Rock-wallaby | Species | Atlas, PMST | E1 | V | In NSW they occur from the Qld border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges. | No | No | No – no habitat in the BCAA | No |
| *Petroica boodang* | Scarlet Robin | Ecosystem | Atlas | V | - | In NSW, it occurs from the coast to the inland slopes. Dry eucalypt forests and woodlands, and occasionally in mallee, wet forest, wetlands and tea-tree swamps. | No | Unlikely | No – no habitat in the BCAA | N/A. Ecosystem credit species |
| *Phascolarctos cinereus* | Koala | Species | Atlas, PMST, BCAM | V | V | In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands. Eucalypt woodlands and forests. | No | No | No – not identified during targeted survey | No |
| *Pseudomys novaehollandiae* | New Holland Mouse | Ecosystem | PMST | - | V | Fragmented distribution across eastern NSW. Open heathlands, woodlands and forests with a heathland understorey, vegetated sand dunes. | No | No | No – no habitat in the BCAA | N/A. Ecosystem credit species |
| *Pseudophryne australis* | Red-crowned Toadlet | Species | Atlas | V | - | Confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. Open forests, mostly on | No | No | No – no habitat in the BCAA | No |

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| *Scientific Name* | Common Name | Credit Type | Data source | TSC Act Status | EPBC Act Status | Habitat association | Recorded on site | Likelihood | Justification | Additional survey required |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. | | | | |
| *Pteropus poliocephalus* | Grey-headed Flying-fox | Dual – Ecosystem (Foraging), Species (Breeding) | Atlas, PMST, BCAM | V | V | Along the eastern coast of Australia, from Bundaberg in Qld to Melbourne in Victoria. Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. | No | Potential | No – not identified during survey | No. No camps within the BCAA |
| *Rhipidura rufifrons* | Rufous Fantail | N/A | PMST | - | M | Coastal and near coastal districts of northern and eastern Australia, including on and east of the Great Divide in NSW. Wet sclerophyll forests, subtropical and temperate rainforests. Sometimes drier sclerophyll forests and woodlands. | No | No | No – no habitat in the BCAA | No |
| *Rostratula australis* | Australian Painted Snipe | Ecosystem | Atlas, PMST | E1 | E, M | In NSW most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Swamps, dams and nearby marshy areas. | No | Unlikely | No- not identified during survey | N/A. Ecosystem credit species |
| *Tringa nebularia* | Common Greenshank | N/A | Atlas, PMST | - | M | Summer migrant to Australia. Recorded in most coastal regions of NSW; also widespread west of the Great Dividing Range, especially between the Lachlan and Murray Rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions. Terrestrial wetlands (swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans, saltflats, sewage farms and saltworks dams, inundated rice crops and bores) and sheltered coastal habitats (mudflats, saltmarsh, mangroves, embayments, harbours, river estuaries, deltas, lagoons, tidal pools, rock-flats and rock platforms). | No | Unlikely | No – not identified during survey | No |
| *Tyto novaehollandiae* | Masked Owl | Ecosystem | Atlas | V | - | Recorded over approximately 90% of NSW, excluding the most arid north-western corner. Most abundant on the coast but extends to the western plains. Dry eucalypt forests and woodlands from sea level to 1100 m. | No | Potential | No – not identified during survey | N/A. Ecosystem credit species |
| ***FLORA*** | | | | | | | | | | |
| *Acacia bynoeana* | Bynoe's Wattle | Species | Atlas, PMST, BCAM | E1 | V | Found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. Heath or dry sclerophyll forest on sandy soils. | No | No | No | No |
| *Acacia pubescens* | Downy Wattle | Species | Atlas, PMST, BCAM | V | V | Restricted to the Sydney region around the Bankstown-Fairfield-Rockwood and Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. Open woodland and forest, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. Occurs on alluviums, shales and at the intergrade between shales and sandstones. | No | Potential | No – not identified during field survey | No |
| *Allocasuarina glareicola* | | Species | Atlas, PMST | E1 | E | Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Castlereagh woodland on lateritic soil. Found in open woodland with *Eucalyptus parramattensis*, *Eucalyptus fibrosa, Angophora bakeri*, *Eucalyptus sclerophylla* and *Melaleuca decora.* | No | Unlikely | No – not identified during field survey | No |
| *Asterolasia elegans* | | Species | Atlas, PMST | E1 | E | Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys. | No | No | No – not identified during field survey | No |

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| *Scientific Name* | Common Name | Credit Type | Data source | TSC Act Status | EPBC Act Status | Habitat association | Recorded on site | Likelihood | Justification | Additional survey required |
|---|---|---|---|---|---|---|---|---|---|---|
| *Cryptostylis hunteriana* | Leafless Tongue Orchid | Species | Atlas, PMST | V | V | In NSW, recorded mainly on coastal and near coastal ranges north from Victoria to near Forster, with two isolated occurrences inland north-west of Grafton. Coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. | No | No | No – habitat does not overlap with BCAA | No |
| *Cynanchum elegans* | White-flowered Wax Plant | Species | BCAM | E1 | E | Restricted to eastern NSW, from Brunswick Heads on the north coast to Gerroa in the Illawarra region, and as far west as Merriwa in the upper Hunter River valley. | No | No | No – habitat does not overlap with BCAA | No |
| *Dillwynia tenuifolia* | | Species | Atlas, BCAM | V | - | Mainly on the Cumberland Plain, but also Bulga Mountains at Yengo in the north, and Kurrajong Heights and Woodford in the Lower Blue Mountains. Scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest, transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland, and disturbed escarpment woodland on Narrabeen sandstone. | No | Unlikely | No – not identified during survey | No |
| *Eucalyptus benthamii* | Camden White Gum | Species | BCAM | V | V | Alluvial flats of the Nepean River and its tributaries. Mainly Kedumba Valley of the Blue Mountains National Park and Bents Basin State Recreation Area. Also along the Nepean River around Camden and Cobbitty, at Werriberri (Monkey) Creek in The Oaks, and on the Nattai River in Nattai National Park. | No | No | No – habitat does not overlap with BCAA | No |
| *Genoplesium baueri* | Bauer's Midge Orchid | Species | Atlas, PMST | E1 | E | Has been recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. Dry sclerophyll forest and moss gardens over sandstone. | No | No | No – habitat does not overlap with BCAA | No |
| *Grevillea juniperina* subsp. *juniperina* | Juniper-leaved Grevillea | Species | BCAM | V | - | Endemic to Western Sydney, centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town. | No | Unlikely | No – not identified during survey | No |
| *Haloragis exalata* subsp. *exalata* | Square Raspwort | Species | Atlas, PMST | V | V | Disjunct distribution in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Protected and shaded damp situations in riparian habitats. | No | Unlikely | No – not identified during survey | No |
| *Hibbertia* sp. Bankstown | | Species | BCAM | E4A | CE | Known to occur in only one population, at Bankstown Airport in Sydney's southern suburbs. "Heavily modified low grass/shrub association (ex Cooks River/Castlereagh Ironbark Forest) on sandy alluvium with a high silt content. | No | No | No – distribution does not overlap with the BCAA | No |
| *Hypsela sessiflora* | | Species | BCAM | X | - | Currently known from only one property at Erskine Park in the Penrith LGA. Previously sighted at Homebush and at Agnes Banks. Damp places on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland, and alluvial woodland/shale plains woodland. | No | Unlikely | No – not identified during survey | No |
| *Leucopogon fletcheri* subsp. *fletcheri* | | Species | Atlas | E | - | Restricted to north-western Sydney between St Albans in the north and Annangrove in the south, within the local government areas of Hawkesbury, Baulkham Hills and Blue Mountains. Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs. Flowers August to September. Fruit produced in October. Evidence suggests the species responds slowly to fire. The species is an obligate seeder and slow growing with a maturation period likely to exceed 5 years | No | Unlikely | No – not identified during survey | No |

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| *Scientific Name* | Common Name | Credit Type | Data source | TSC Act Status | EPBC Act Status | Habitat association | Recorded on site | Likelihood | Justification | Additional survey required |
|---|---|---|---|---|---|---|---|---|---|---|
| *Melaleuca deanei* | Deane's Paperbark | Species | Atlas, PMST | V | V | Ku-ring-gai/Berowra area, Holsworthy/Wedderburn area, Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas. Heath on sandstone. | No | No | No | No |
| *Olearia cordata* | | Species | Atlas, PMST | V | V | A NSW endemic generally restricted to the south-western Hunter Plateau, eastern Colo Plateau, and the far north-west of the Hornsby Plateau near Wisemans Ferry east of Marcota. Open sclerophyll forest and open shrubland, on sandstone ridges. | No | No | No – no habitat within the BCAA | No |
| *Persicaria elatior* | Tall Knotweed | Species | BCAM | V | V | In south-eastern NSW recorded from Mt Dromedary, Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Globeragee State Forests). Beside streams and lakes, swamp forest or disturbed areas. | No | Unlikely | No – not identified during survey | No |
| *Persoonia bargoensis* | Bargo Geebung | Species | BCAM | E1 | V | Restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau and the northern edge of the Southern Highlands. Woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravelly soils of the Wianamatta Shale and Hawkesbury Sandstone. | No | Unlikely | No – not identified during survey | No |
| *Persoonia hirsuta* | Hairy Geebung | Species | Atlas, PMST | E1 | E | Scattered distribution around Sydney, from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. Sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. | No | No | No – no habitat in the BCAA | No |
| *Pimelea curviflora* var. *curviflora* | | Species | Atlas, PMST | V | V | Confined to the coastal area of the Sydney and Illawarra regions between northern Sydney and Marcota in the north-west and Croom Reserve near Albion Park in the south. Woodland, mostly on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes. | No | No | No - no habitat in the BCAA | No |
| *Pimelea spicata* | Spiked Rice-flower | Species | Atlas, PMST | E1 | E | Two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama). Well-structured clay soils. Eucalyptus moluccana (Grey Box) communities and in areas of ironbark on the Cumberland Plain. Coast Banksia open woodland or coastal grassland in the Illawarra. | No | Potential | No – not identified during field survey | No |
| *Pomaderris brunnea* | Brown Pomaderris | Species | Atlas, PMST | E | V | In NSW, found around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands. Moist woodland or forest on clay and alluvial soils of flood plains and creek lines. | No | Unlikely | No – not identified during survey | No |
| *Pterostylis gibbosa* | Illawarra Greenhood | Species | Atlas, PMST | E1 | E | Known from a small number of populations in the Hunter region (Millbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). Open forest or woodland, on flat or gently sloping land with poor drainage. | No | No | No – not identified during survey | No |
| *Pterostylis saxicola* | Sydney Plains Greenhood | Species | Atlas, PMST | E1 | E | Restricted to western Sydney between Freemans Reach in the north and Picton in the south. Small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines, adjacent to sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. | No | No | No – no habitat in the BCAA | No |

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| *Scientific Name* | Common Name | Credit Type | Data source | TSC Act Status | EPBC Act Status | Habitat association | Recorded on site | Likelihood | Justification | Additional survey required |
|---|---|---|---|---|---|---|---|---|---|---|
| *Pultenaea parviflora* | | Species | Atlas, PMST | E1 | V | Endemic to the Cumberland Plain. Mainly from Windsor to Penrith and east to Dean Park, with outlier populations at Kemps Creek and Wilberforce. Dry sclerophyll forest, especially Castlereagh Ironbark Forest, Shale Gravel Transition Forest and transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. Can occasionally be found in Cumberland Plain Woodland, however this is only likely when the community grades into the aforementioned communities. There are no such transitions in the BCAA. | No | No | No - no habitat in the BCAA. If this species was present it would have been incidentally recorded during survey | No |
| *Pultenaea pedunculata* | Matted Bush-pea | Species | BCAM | E1 | - | In NSW it is represented by just three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. Woodland, sclerophyll forest, road batters and coastal cliffs. | No | Unlikely | No – not identified during survey | No |
| *Tetratheca glandulosa* | | Species | | V | - | Found from Sampons Pass (Yengo NP) in the north to West Pymble (Lane Cove NP) in the south. The eastern limit is at Ingleside (Pittwater LGA) and the western limit is at East Kurrajong (Wollemi NP). Heath, scrub, woodlands and open forest on upper-slopes and mid-slope sandstone benches. Soils generally shallow, consisting of a yellow, clayey/sandy loam. | No | Unlikely | No – no habitat in the BCAA | No |
| *Thesium australe* | Austral Toadflax | Species | Atlas, PMST | V | V | In eastern NSW it is found in very small populations scattered along the coast, and from the Northern to Southern Tablelands. Grassland on coastal headlands or grassland and grassy woodland away from the coast. | No | No | No – no habitat in the BCAA | No |

*TSC Act Key: v = vulnerable, E1 = endangered, E2 = endangered population, E4A = critically endangered*

*EPBC Act Key v = vulnerable, E = endangered, CE = critically endangered, C, J, K = migratory under CAMBA, JAMBA, RoKAMBA, Bonn = Migratory under the Bonn convention, Mar = Marine*

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# Appendix E Australian Museum Dural Land Snail identification confirmation

Australian Museum Research Institute
1 William Street Sydney NSW 2010

**Australian Museum Research Institute**

**Results Report**

| | | |
|---|---|---|
| **Case No:** AMRI 042 | **Date:** 23/06/2020 | **Service:** Species Identification |
| **Species:** Asian Tramp Snail (*Bradybaena similaris*) | | |
| **Client contact:** Alex Gorey, Ecological | | |
| **Report prepared by:** Dr Frank Koehler, Senior Research Scientist, Malacology | | |
| **Laboratory work conducted by:** not applicable | | |

Dear Alex,

You have sent me four specimens as well as photographs of an additional specimen that was not collected. All specimens were found in Glossodia, NSW, within patches of Cumberland Plain Woodland. An identification of the physical samples can be made.

All physical samples (specimens labelled "S1 Pace", "S1 EJC", "S2 EJC", "S3 EJC") are identified as the non-native Asian Tramp Snail, *Bradybaena similaris* (Férussac, 1822), family Camaenidae.

Typical characteristics are: the shape and size of the shell (tightly coiled, well rounded whorls), open umbilicus, spiral peripheral band on uniform background, shape of aperture, slightly reflected, thin lip.

The specimen labelled "S2 Pace" (only photo available) exhibits features that are consistent with the other four specimens above and is therefore tentatively also identified as *Bradybaena similaris*.



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**Methods used:**

The images have been examined with reference to the most up to date and currently accepted taxonomic literature.

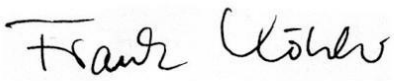
The specimens have been studied and compared with specimens in our research collection as well as with reference literature.

**Relevant literature references:**

Stanisic, J., Shea, M., Potter, D. & Griffiths, O. (2010) *Australian land snails. 1. A field guide to eastern Australian species*. Bioculture Press, Riviere des Anguilles, Mauritius.

Please feel free to contact us if you wish to discuss these results further. We also encourage any feedback that may help us improve our services

Yours sincerely,



Dr Frank Koehler

Senior Research Scientist

**The taxonomists of the Australian Museum Research Institute have access to thousands of specimens in Australia's oldest zoological reference collection (the Australian Museum), ensuring accurate and trustworthy results.**

*Disclaimer: This report is not to be used for court purposes. A court statement can be prepared upon request.*



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# Appendix F Vegetation type profile

| **Biometric Vegetation Type** | **HN528 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. In some areas 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** | All mapped HN528 was assessed as being in "low" biometric condition. Five different ancillary codes were identified for this vegetation type as follows:<br>• Good – applied to six patches of vegetation within the BCAA, which were in moderate to good condition. These patches contained moderate 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.<br>• Moderate - applied to patches mostly in the west and north of the BCAA, but also occurred in the east of the BCAA. Patches lacked an intact mid-storey, and had a ground layer containing a mix of native and exotic species<br>• Regeneration – applied to patches on the western side of the BCAA, and one central patch in the BCAA. These areas were comprised of midstorey species and regenerating Eucalyptus species in the canopy. The goundcover was dominated by native species.<br>• Scattered paddock trees – patches occurred across the BCAA. They were comprised of scattered trees over an exotic-dominated groundcover. No mid-storey was present<br>• Cleared – patches occurred across the BCAA and were comprised of exotic groundcover species, with scattered native groundcover species. The exotic groundcover species were >50% of the patch |
| **Sampling locations** | Good – BB01, BB02, BB07,<br>Moderate – BB05, BB06<br>Regeneration – BB08<br>Scattered paddock trees – BB04<br>Cleared – BB09, BB10 |
| **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. |

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| | |
|---|---|
| **Midstorey** | A majority of moderate – good patches in the BCAA contained a shrub layer. Where present, it was largely composed of the small trees, with native *Bursaria spinosa* (Blackthorn). |
| **Groundcovers** | The ground cover was composed of native and exotic grasses dominated by *Microlaena stipoides* (Weeping Grass), *Aristida* spp., *Themeda triandra* (Kangaroo Grass), *Cenchrus clandestinus* (Kikuyu), and *Setaria parviflora*. 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. Four threatened bat species and the Cumberland Plain Land Snail were recorded. |

| Biometric Vegetation Type | HN526 Forest Red Gum – Rough-barked Apply Grassy Woodland in the Sydney Basin Bioregion |
|---|---|
| |  |
| **Description** | This community had a woodland structure. The mid stratum was present in the patch, of varying densities. The ground stratum included a combination of grasses and herbs. Some areas contained a higher level of invasion by exotic species in the midstorey and groundcover layers. |
| **Location and habitat** | The community occurred along Currency Creek in the BCAA. The patch occurred on the banks of Currency Creek on low lying land. |
| **Ancillary codes** | All mapped HN526 was assessed as being in "low" biometric condition. One ancillary code was used for this vegetation type as follows:<br>• Low – applied to the entire patch along Currency Creek. This patch contained moderate species richness and presence of fallen logs. It had a mid-storey comprised of a mix of native and introduced species, and an understorey dominated by native grasses. |
| **Sampling locations** | BB03 |
| **Upper stratum** | The canopy of this vegetation type was dominated by *Eucalyptus tereticornis* (Forest Red Gum). |
| **Midstorey** | The patch contained midstorey of *Bursaria spinosa* and exotic species including *Lantana camara.* |
| **Groundcovers** | The ground cover was composed of native and exotic grasses and herbs dominated by *Microlaena stipoides* (Weeping Grass), *Entolasia marginata* (Bordered Panic), *Einadia hastata* and *Paspalum dilatatum* (Paspalum). |
| **Corresponding vegetation type** | River-flat Eucalypt Forest |
| **Threatened Species** | No threatened flora were recorded within this BVT. Four threatened microbat species may utilise this BVT for foraging purposes. |

# Appendix G Flora species recorded in BioMetric plots

| Species | BB01 | BB02 | BB03 | BB04 | BB05 | BB06 | BB07 | BB08 | BB09 | BB10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *Acacia decurrens* | | | 1 | | | | | | | |
| *Anagallis arvensis** | | 1 | | | | | | | | |
| *Anisopogon avenaceus* | | | | | | 1 | | | | |
| *Araujia sericifera** | | 1 | | | | 1 | | | | |
| *Aristida vagans* | | | | | | | 1 | 1 | | |
| *Austrostipa ramosissima* | | | 1 | | | | | 1 | | |
| *Bidens pilosa** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | |
| *Bothriochloa macra* | | | | | | | 1 | 1 | | |
| *Bromus catharticus** | | | | | | | | | 1 | 1 |
| *Bromus* spp.* | 1 | | 1 | 1 | | | | | | |
| *Brunoniella australis* | 1 | | | | | 1 | | | | |
| *Bursaria spinosa* | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | | |
| *Caesia parviflora* | 1 | 1 | | | | | | | | |
| *Carex inversa* | 1 | | | | 1 | 1 | 1 | | | |
| *Cenchrus clandestinus** | | | 1 | 1 | 1 | | 1 | | 1 | 1 |
| *Centella asiatica* | | 1 | | | | | | | | |
| *Cerastium glomeratum** | | | 1 | | | | | | | |
| *Chenopodium album* | | | | | | | | | 1 | |

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| Species | BB01 | BB02 | BB03 | BB04 | BB05 | BB06 | BB07 | BB08 | BB09 | BB10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *Chloris gayana** | | | | 1 | | | | | 1 | |
| *Chloris truncata* | | | | | | 1 | | | | |
| *Chloris ventricosa* | | | | | | | 1 | | | |
| *Cirsium vulgare** | 1 | | 1 | | | 1 | 1 | | 1 | |
| *Commelina cyanea* | 1 | 1 | 1 | 1 | | | | | | 1 |
| *Conyza bonariensis** | 1 | 1 | 1 | 1 | | | | | 1 | 1 |
| *Conyza sp.** | | | | | | 1 | | | | |
| *Cynodon dactylon* | | 1 | 1 | 1 | 1 | | | | 1* | 1* |
| *Cyperus gracilis* | 1 | 1 | | 1 | | | | | | |
| *Desmodium varians* | 1 | 1 | | | 1 | 1 | 1 | | | |
| *Dichelachne* spp. | | 1 | | | | | | | | |
| *Dichondra repens* | 1 | 1 | | | | 1 | 1 | | | |
| *Echinapogon* sp. | 1 | | | | | | | | | |
| *Ehrharta erecta** | 1 | 1 | | 1 | 1 | 1 | 1 | | | |
| *Einadia hastata* | 1 | | 1 | | 1 | 1 | 1 | | | |
| *Einadia trigonos* | 1 | 1 | 1 | 1 | | | | | | 1 |
| *Eleusine tristachya** | | | | | | | | | | 1 |
| *Entolasia marginata* | 1 | 1 | 1 | | | | | | | |
| *Entolasia stricta* | | | | | | 1 | | | | |
| *Eragrostis brownii* | | | | | | | 1 | 1 | | |
| *Eragrostis curvula** | | | | | 1 | | | | | |

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| Species | BB01 | BB02 | BB03 | BB04 | BB05 | BB06 | BB07 | BB08 | BB09 | BB10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *Eragrostis leptostachya* | | | | | 1 | | | | | 1 |
| *Eucalyptus crebra* | 1 | | | 1 | 1 | 1 | 1 | | | |
| *Eucalyptus eugenioides* | 1 | | | | | | | | | |
| *Eucalyptus tereticornis* | 1 | 1 | 1 | | | 1 | | 1 | | |
| *Euchiton* sp. | 1 | | | | | | | | | |
| *Geranium homeanum* | | 1 | | | | | | | | |
| *Glycine clandestina* | | 1 | | | | | 1 | | | |
| *Glycine tabacina* | 1 | 1 | | | | | | | | |
| *Hypericum gramineum* | | 1 | | | | | | | | |
| *Hypochaeris radicata** | 1 | 1 | | | | | | | | |
| *Juncus usitatus* | | | | | | | | | 1 | |
| *Lantana camara** | 1 | 1 | 1 | | | 1 | 1 | | | |
| *Lepidium africanum** | | | | | | | | | 1 | |
| *Lepidium pseudohyssopifolium* | | 1 | | | | | | | | |
| *Lepidium* spp. * | | | 1 | 1 | | | | | | |
| *Ligustrum sinense** | | 1 | | | | | | | | |
| *Lilly* sp. | | 1 | | | | | | | | |
| *Lomandra filiformis* | | | | | | 1 | | | | |
| *Malva* sp. * | | | | | 1 | | | | | |
| *Microlaena stipoides* | 1 | 1 | 1 | | | 1 | 1 | | | 1 |
| *Modiola caroliniana** | 1 | | 1 | 1 | | 1 | | | | |

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| Species | BB01 | BB02 | BB03 | BB04 | BB05 | BB06 | BB07 | BB08 | BB09 | BB10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *Opercularia diphylla* | | | | | | | 1 | | | |
| *Oplismenus aemulus* | 1 | 1 | | | | 1 | | | | |
| *Oxalis perennans* | 1 | 1 | 1 | 1 | | 1 | | | | |
| *Paspalum dilatatum** | 1 | | 1 | 1 | | 1 | 1 | 1 | 1 | 1 |
| *Plantago lanceolata** | 1 | 1 | | 1 | | | 1 | 1 | 1 | 1 |
| *Portulaca oleracea* | | | | | | | | | 1 | 1 |
| *Portulaca* spp. | | | | | 1 | | | | | |
| *Pratia purparescens* | | 1 | | | | | | | | |
| *Rubus fruiticosis** | | | | | | | 1 | | | |
| *Rytidosperma caespitosum* | | | | | | 1 | | | | |
| *Senecio madagascariensis** | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 |
| *Setaria parviflora** | | | | | | 1 | | 1 | 1 | 1 |
| *Sida rhombifolia** | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 |
| *Solanum mauritianum** | 1 | | 1 | | | 1 | | | | |
| *Solanum nigrum** | 1 | | | | | | | | | |
| *Solanum prinophyllum* | 1 | | | | | | | | | |
| *Solanum* sp. | | 1 | 1 | | | | | | | |
| *Soliva sp. ** | | | | 1 | | | | | | |
| *Sonchus oleraceus** | | | | | 1 | | | | | |
| *Sporobolus africanus** | | | | | | 1 | 1 | | 1 | |
| *Sporobolus creber* | | | | | | | | 1 | | 1 |

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| Species | BB01 | BB02 | BB03 | BB04 | BB05 | BB06 | BB07 | BB08 | BB09 | BB10 |
|---|---|---|---|---|---|---|---|---|---|---|
| *Tagetes minuta** | | | | | | 1 | | | | |
| *Trifolium repens** | | | | 1 | | | | | | |
| *Urochloa panicoides* | | | | | | | | | 1 | |
| *Verbena bonariensis** | | | | | | 1 | 1 | 1 | 1 | |
| *Verbena officinalis* | | | | | | | | | | 1 |
| *Wahlenbergia* spp. | 1 | | | | | | | | | |

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# Appendix H Fauna species identified in the BCAA

| Common name | Scientific name | Identified by |
|---|---|---|
| An exotic garden snail * | *Bradybaena similaris* | Travers 2013 |
| Antechinus species | *Antechinus sp.* | Travers 2013 |
| Australasian Grebe | *Tachybaptus novaehollandiae* | Travers 2013, ELA 2019 |
| Australasian Shoveler | *Anas rhynchotis* | Travers 2013 |
| Australian Ibis | *Threskionis moluccus* | ELA 2019 |
| Australian Magpie | *Gymnorhina tibicen* | Travers 2013, ELA 2019 |
| Australian Pelican | *Pelecanus conspicillatus* | Travers 2013, ELA 2019 |
| Australian Raven | *Corvus coronoides* | Travers 2013, ELA 2019 |
| Australian Wood Duck | *Chenonetta jubata* | ELA 2019 |
| Bell Miner | *Manorina melanophrys* | Travers 2013, ELA 2019 |
| Black faced cuckoo shrike | *Coracina novaehollandiae* | ELA 2019 |
| Black Rat* | *Rattus rattus* | Travers 2013 |
| Black Swan | *Cygnus atratus* | Travers 2013 |
| Black-faced Cuckoo-shrike | *Coracina novaehollandiae* | Travers 2013 |
| Black-shouldered Kite | *Elanus axillaris* | Travers 2013 |
| Black-winged Stilt | *Himantopus himantopus* | Travers 2013 |
| Brown falcon | *Falco berigora* | ELA 2019 |
| Brown Gerygon | *Gerygone mouki* | Travers 2013 |
| Brown Goshawk | *Accipiter fasciatus* | Travers 2013 |
| Brown Honeyeater | *Melithreptus brevirostris* | ELA 2019 |
| Brown Quail | *Coturnix ypsilophora* | Travers 2013 |
| Cattle Egret | *Ardea ibis* | Travers 2013, ELA 2019 |
| Chestnut Teal | *Anas castanea* | Travers 2013 |
| Chocolate Wattled Bat | *Chalinolobus morio* | Travers 2013, ELA 2016 |
| Common Bronzewing | *Phaps chalcoptera* | Travers 2013 |
| Common Brushtail Possum | *Trichosurus vulpecula* | Travers 2013 |
| Common Eastern Froglet | *Crinia signifera* | Travers 2013 |
| Common Myna* | *Acridotheres tristis* | Travers 2013 |
| Common Ringtail Possum | *Pseudocheirus peregrinus* | Travers 2013, ELA 2016 |

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| Common name | Scientific name | Identified by |
|---|---|---|
| Common Starling* | *Sturnus vulgaris* | Travers 2013 |
| Crested pigeon | Ocyphaps lophotes | ELA 2019 |
| Crested Shrike-tit | *Falcunculus frontatus* | Travers 2013 |
| Cumberland Plain Land Snail+ | *Meridolum corneovirens* | ELA 2016 |
| Double-barred Finch | *Taeniopygia bichenovii* | Travers 2013, ELA 2019 |
| Dusky Moorhen | *Gallinula tenebrosa* | Travers 2013 |
| Dusky Woodswallow+ | *Artamus cyanopterus* | Travers 2013 |
| Dwarf Tree Frog | *Litoria fallax* | Travers 2013 |
| East Coast Freetail-bat+ | *Micronemes norfolkensis* | Travers 2013 |
| Eastern Bentwing-bat+ | *Miniopterus schreibersii oceanensis* | Travers 2013, ELA 2016 |
| Eastern Rosella | *Platycercus eximius* | Travers 2013 |
| Eastern Water Dragon | *Physignathus lesueurii* | Travers 2013 |
| Eastern Whipbird | *Psophodes olivaceus* | ELA 2019 |
| Eastern Yellow Robin | *Eopsaltria australis* | ELA 2019 |
| Eurasian Coot | *Fulica atra* | Travers 2013 |
| European Red Fox* | *Vulpes vulpes* | Travers 2013 |
| Feral pigeon | *Columba livia domestica* | ELA 2019 |
| Flame Robin | *Petrocia phoenicea* | ELA 2019 |
| Galah | *Cacatua roseicapillus* | Travers 2013, ELA 2019 |
| Gould's Wattled Bat | *Chalinolobus gouldii* | Travers 2013, ELA 2016 |
| Grass Skink | *Lampropholis guichenoti* | Travers 2013 |
| Great Cormorant | *Phalacrocorax carbo* | Travers 2013 |
| Great Egret | *Ardea alba* | Travers 2013 |
| Grey Butcher bird | *Cracticus torquatus* | EL 2019 |
| Grey Fantail | *Rhipidura fuliginosa* | Travers 2013 |
| Grey Shrike-thrush | *Colluricincla harmonica* | Travers 2013 |
| Grey Teal | *Anas gracilis* | Travers 2013 |
| Hardhead | *Aythya australis* | Travers 2013 |
| Hoary-headed Grebe | *Poliocephalus poliocephalus* | Travers 2013 |
| King Parrot | *Alisterus scapularis* | ELA 2019 |
| Land Snail | *Pommerhelix cf bowdeniae* | Travers 2013 |
| Laughing Kookaburra | *Dacelo novaeguineae* | Travers 2013, ELA 2019 |
| Lewin's Honeyeater | *Meliphaga lewinii* | Travers 2013 |

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| Common name | Scientific name | Identified by |
|---|---|---|
| Little Corella | *Cacatua sanguinea* | Travers 2013 |
| Little Pied Cormorant | *Phalacrocorax melanoleucos* | Travers 2013 |
| Magpie-lark | *Grallina cyanoleuca* | Travers 2013, ELA 2019 |
| Masked Lapwing | *Vanellus miles* | Travers 2013 |
| Noisy Friarbird | *Philemon corniculatus* | Travers 2013, ELA 2019 |
| Noisy Miner | *Manorina melanocephala* | Travers 2013, ELA 2019 |
| Pacific Black Duck | *Anas superciliosa* | Travers 2013, ELA 2019 |
| Pallid Cuckoo | *Cuculus pallidus* | Travers 2013 |
| Peaceful Dove | *Geopelia striata* | Travers 2013 |
| Pied Cormorant | *Phalacrocorax varius* | ELA 2019 |
| Purple Swamphen | *Porphyrio porphyrio* | Travers 2013 |
| Rabbit* | *Oryctolagus cuniculus* | Travers 2013 |
| Rainbow Lorikeet | *Trichoglossus haematodus* | Travers 2013, ELA 2019 |
| Red-Bellied Black Snake | *Pseudechis porphyriacus* | Travers 2013 |
| Red-browed Finch | *Neochmia temporalis* | Travers 2013 |
| Red-rumped Parrot | *Psephotus haematonotus* | Travers 2013, ELA 2019 |
| Red-whiskered Bulbul* | *Pycnonotus jocosus* | Travers 2013 |
| Richard's Pipit | *Anthus novaeseelandiae* | Travers 2013 |
| Ride’s Freetail Bat | *Ozimops ridei* | ELA 2016 |
| Rufous Whistler | *Pachycephala rufiventris* | Travers 2013 |
| Satin Bowerbird | *Ptilonorhynchus violaceus* | Travers 2013 |
| Scarlet Honeyeater | *Myzomela sanguinolenta* | Travers 2013 |
| Scarlet Robin | *Petrocia boodang* | ELA 2019 |
| Silvereye | *Zosterops lateralis* | ELA 2019 |
| Southern Forest Bat | *Vespadelus regulus* | ELA 2016 |
| Southern Myotis+ | *Myotis macropus* | Travers 2013, ELA 2016 |
| Spoonbill | *Platella sp.* | ELA 2019 |
| Spotted Pardalote | *Pardalotus punctatus* | Travers 2013 |
| Spotted Turtle-Dove* | *Streptopelia chinensis* | Travers 2013, ELA 2019 |
| Straw-necked Ibis | *Threskiornis spinicollis* | Travers 2013, ELA 2019 |
| Striated Pardalote | *Pardalotus striatus* | Travers 2013 |
| Striped Marsh Frog | *Limnodynastes peronii* | Travers 2013 |
| Sulphur Crested Cockatoo | *Cacatua galerita* | Travers 2013 |

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| Common name | Scientific name | Identified by |
|---|---|---|
| Superb Fairy-wren | *Malurus cyaneus* | Travers 2013 |
| Swamp Rat | *Rattus lutreolus* | Travers 2013 |
| Tree Martin | *Hirundo nigricans* | Travers 2013 |
| Wedge-tailed Eagle | *Aquila audax* | Travers 2013 |
| Welcome Swallow | *Hirundo neoxena* | Travers 2013, ELA 2019 |
| Whistling Kite | *Haliastur sphenurus* | Travers 2013, ELA 2019 |
| Whistling Tree Frog | *Litoria verreauxii* | Travers 2013 |
| White throated gerygone | *Gerygone olivacea* | ELA 2019 |
| White-bellied Sea-Eagle+ | *Haliaeetus leucogaster* | Travers 2013 |
| White-breasted Woodswallow | *Artamus leucorynchus* | ELA 2019 |
| White-faced Heron | *Egretta novaehollandiae* | Travers 2013, ELA 2019 |
| White-necked Heron | *Ardea pacifica* | Travers 2013 |
| White-plumed Honeyeater | *Lichenostomus penicillatus* | Travers 2013 |
| White-striped Freetail-bat | *Austronomus australis* | Travers 2013, ELA 2016 |
| White-throated Treecreeper | *Cormobates leucophaeus* | Travers 2013 |
| White-winged Chough | *Corcorax melanorhhamphos* | Travers 2013 |
| Willie Wagtail | *Rhipidura leucophrys* | Travers 2013, ELA 2019 |
| Yellow Thornbill | *Acanthiza nana* | Travers 2013, ELA 2019 |
| Yellow-faced Honeyeater | *Lichenostomus chrysops* | Travers 2013 |
| Yellow-rumped Thornbill | *Acanthiza chrysorrhoa* | Travers 2013 |
| Key: * = exotic, + = threatened species | | |

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# Appendix I Transect/plot data

| Plot name | NPS | NOS | NMS | NGCG | NGCS | NGCO | EPC | NTH | OR | FL | Easting | Northing | Zone | Veg Zone |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BB01 | 22 | 27.5 | 0 | 80 | 0 | 14 | 18 | 0 | 0.33 | 29.5 | 291883 | 6286341 | 56 | 3 |
| BB02 | 22 | 24 | 0 | 78 | 0 | 12 | 28 | 0 | 1 | 25 | 292073 | 6286803 | 56 | 2 |
| BB03 | 12 | 31.5 | 0 | 52 | 0 | 6 | 64 | 0 | 0 | 30 | 292928 | 6278985 | 56 | 1 |
| BB04 | 6 | 10 | 0 | 24 | 0 | 8 | 74 | 0 | 0.5 | 3.5 | 292651 | 6286582 | 56 | 5 |
| BB05 | 8 | 44 | 0 | 8 | 0 | 0 | 18 | 0 | 0.33 | 4.6 | 292508 | 6286721 | 56 | 3 |
| BB06 | 16 | 59 | 0 | 52 | 2 | 8 | 88 | 0 | 0.33 | 5 | 291979 | 6286432 | 56 | 3 |
| BB07 | 13 | 59 | 0 | 84 | 6 | 36 | 84 | 0 | 1 | 9 | 291923 | 6286602 | 56 | 2 |
| BB08 | 7 | 0 | 8 | 84 | 22 | 0 | 90 | 0 | 1 | 0 | 292088 | 6286460 | 56 | 4 |
| BB09 | 2 | 0 | 0 | 0 | 0 | 0 | 88 | 0 | 0 | 0 | 292053 | 6286423 | 56 | 6 |
| BB10 | 5 | 0 | 0 | 8 | 0 | 0 | 84 | 0 | 0 | 0 | 292117 | 6286709 | 56 | 6 |

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# Appendix J Anabat survey methodology and results

**Methodology**

During this survey one anabat unit was placed at one distinct location within the study area and was left for two consecutive nights over 26 – 27 April 2016.

Bat calls were analysed by Dr Rodney Armistead using the program AnalookW (Version 3.8 25 October 2012, written by Chris Corben, www.hoarybat.com). Call identifications were made using regional based guides to the echolocation calls of microbats in New South Wales (Pennay et al. 2004); and south-east Queensland and north-east New South Wales (Reinhold et al. 2001) and the accompanying reference library of over 200 calls from north-eastern NSW, which is available: (http://www.forest.nsw.gov.au/research/bats/default.asp).

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Rinehold et al. 2001). To ensure reliable and accurate results the following protocols (adapted from Lloyd et. al. 2006) were followed:

- Search phase calls were used in the analysis, rather than cruise phase calls or feeding buzzes (McKenzie et al. 2002)
- Recordings containing less than three pulses were not analysed and these sequences were labelled as short (Law et al. 1999)
- Four categories of confidence in species identification were used (Mills et al. 1996):
    - Definite / positive identification – identity not in doubt
    - probable – low probability of confusion with species of similar call profiles
    - possible – medium to high probability of confusion with species that have similar call profiles
    - unidentifiable – calls made by bats which cannot be identified to even a species group.
- *Nyctophilus* spp. are difficult to identify confidently from their calls and no attempt was made to identify this genus to species level (Pennay et al. 2004)
- Sequences not attributed to microbat echolocation calls were labeled as junk or non-bat calls and don't represent microbat activity at the site
- Sequences labelled as low were of poor quality and therefore not able to be identified to any microbat species, they can however be used as an indicator of microbat activity at the site.

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### Results

There were approximately 145 sequences recorded on the anabat. Of the 145 sequences submitted, 216 (62.61%) were of sufficient quality or length to enable positive identified to genus or species. The remaining sequence were either to short or of low quality, thus preventing positive identification.

There were at least 11 species identified in this survey, including **four** species listed as **vulnerable** under the NSW TSC Act 1995 (Error! Reference source not found. **-** Error! Reference source not found. **and Figure 23** - **Figure 22**). As outlined in Error! Reference source not found., the five threatened species recorded included the possible occurrence of ***Miniopterus australis*** **(Little Bentwing Bat) and** ***Nyctophilus*** **spp.** as well as the positive identifications for the following species:

- *Miniopterus australis* (Little Bent-wing Bat)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat)
- *Myotis macropus* (Southern Myotis)
- *Mormopterus norfolkensis* (Eastern Freetail Bat).

The most commonly recorded species included *Mormopterus* (Ozimops) *ridei* (Ride's Freetail Bat) as well as the threatened Eastern Bentwing Bat and Eastern Freetail Bat (Error! Reference source not found.).

Activity levels were spread across the night with the majority of the bat activity occurred in the evening and early mornings between dusk and 0100 (am). Only a few calls were recorded on each anabat between 0100 (am) and dawn. Generally, single bat calls were recorded every five minutes across the three sites.

Most of the bat calls that were recorded during this survey were clear, often long and easily interpreted. Only a few feeding buzzes were observed in the data set indicating that bats were some levels of foraging actively at the study site.

**Survey Limitations**

Calls were only positively identified when defining characteristics were present such as call shape and when the characteristic frequency allowed discrimination of a species. In this survey, there were a number of species call profile that due to similarities among species could not be positively identify to species level. Where this was apparent, these species with similar call profiles were lump together into groups of two or three potential species depending on the recorded and defining all call characteristics. When this occurred these calls were assigned to the lowest certainty level of 'possible'.

In this survey, the calls of Gould's Wattle Bat and Free-tail Bat Species were recorded that were difficult to separate. Calls were identified as Eastern Freetail Bat if the call shape was flat and the frequency was between 28.5 – 31.5 kHz whilst Gould's Wattled Bat was distinguished by a frequency of 27.5 – 33 kHz with alternation in call frequency between pulses. When no distinguishing characteristics were present calls were assigned as follows (Gould's Wattle Bat / Free-tail Bat Species).

In addition, the calls of Southern Myotis are very similar to all *Nyctophilus* species and it is often difficult to separate these species. Calls were identified as *Nyctophilus* spp. when the time between calls (TBC) was higher than 95 ms and the initial slope (OPS) was lower than 300. Calls were identified as Southern Myotis when the TBC was lower than 75 ms and the OPS was greater than 400.

Finally, the calls of *Vespadelus regulus* (Southern Forest Bat) and *Miniopterus schreibersii* (*orianae*) *oceanensis* (Eastern Bentwing Bat) can be difficult to separate in the range 43.5 – 46 kHz. Calls were

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identified as Southern Forest Bat when even consecutive pulses with up-sweeping tail was present within the call profiles (Penny et al. 2004). Alternatively, calls with curved, often down sweeping tails were generally identified as Eastern Bentwing Bat. When no distinguishing characteristics were present within the calls, they were assigned as Southern Forest Bat / Eastern Bentwing Bat.

The call profiles that were difficult to separate are not shown in this document as all of the species discussed were positively identified.

***Call profiles***

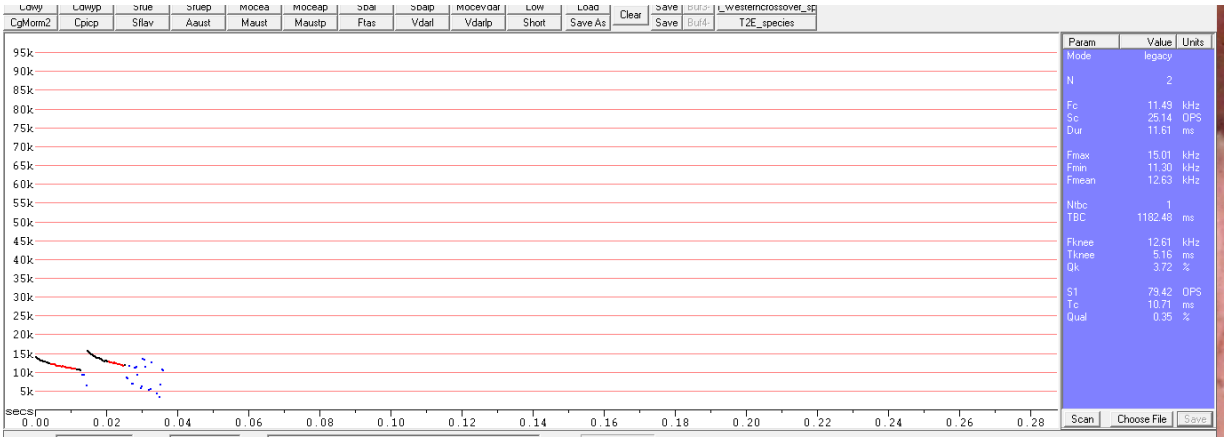

**Figure 22. Call profile for *Austronomus australis* recorded on AB1 – East at 21.00, 26 April 2016**

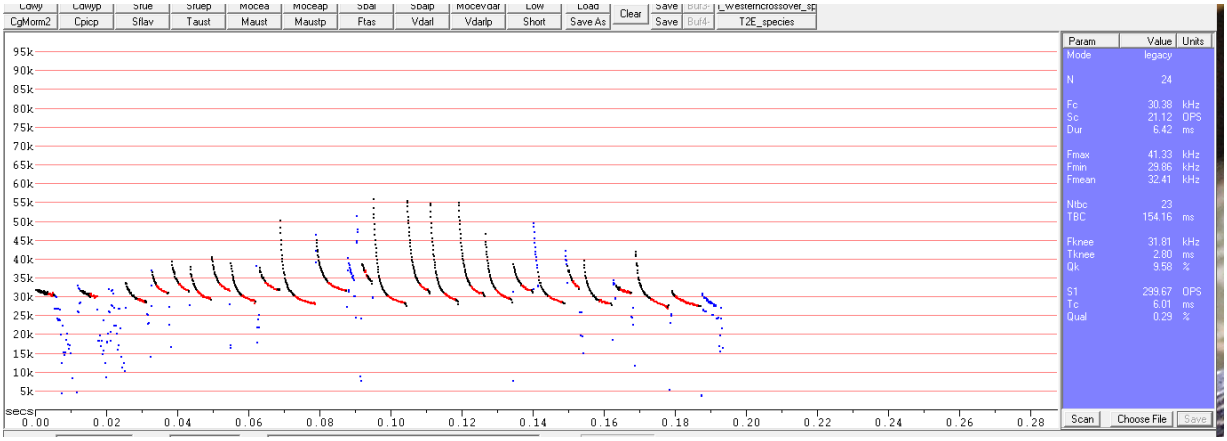

**Figure 23. Call profile for *Chalinolobus gouldii* (Goulds Wattled Bat) recorded on AB – 1 East at 17.45 pm, 26 April 2016**

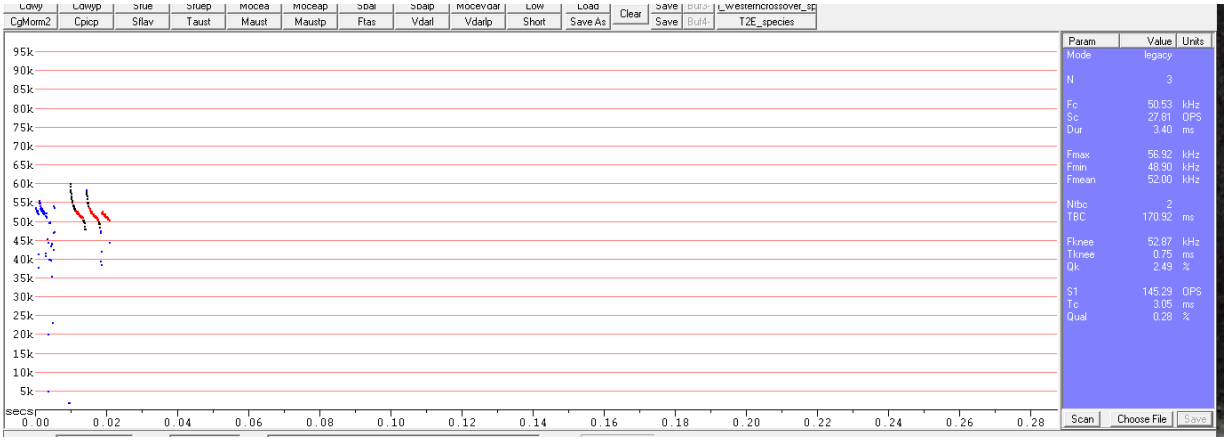

**Figure 24. Call profile for *Chalinolobus morio* (Chocolate Wattled Bat) recorded on AB2 - East at 12.50 pm, 26 April 2016**

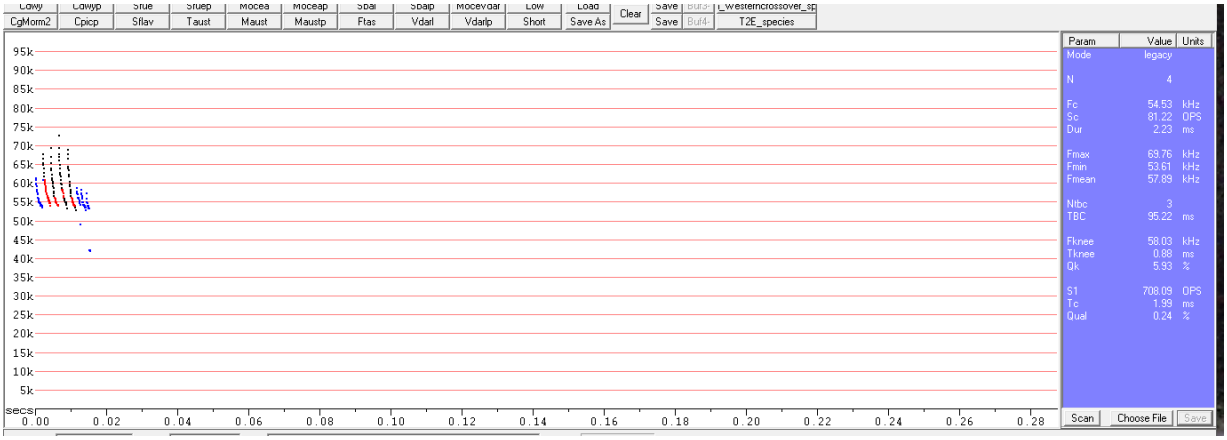


**Figure 25. Possible call profile for *Miniopterus australis* (Little Bentwing Bat) recorded on AB2 at 21.55 pm, 27 April 2016**

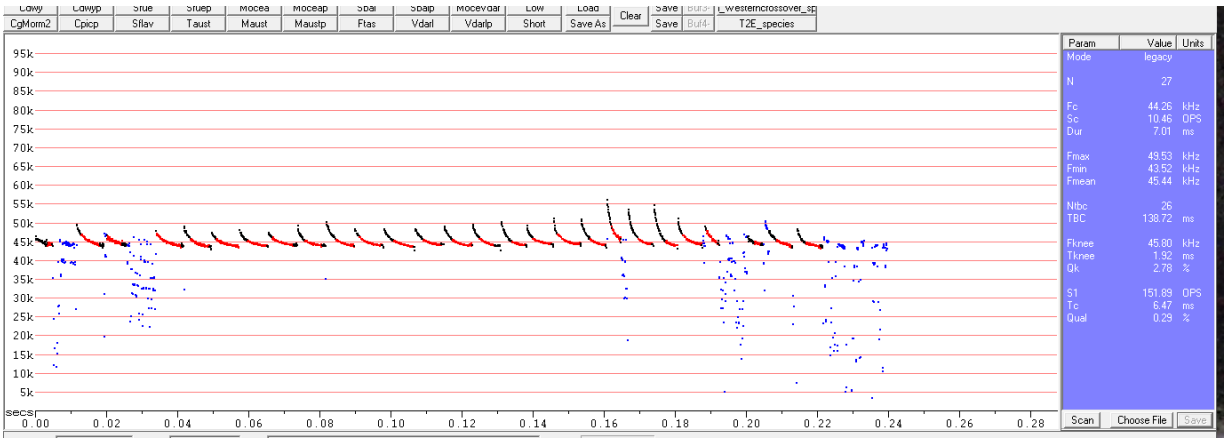


**Figure 26. Call profile for *Miniopterus schreibersii* (*orianae*) *oceanensis** (Eastern Bentwing Bat) recorded on AB1 – East at 01.01, 27 April 2016**

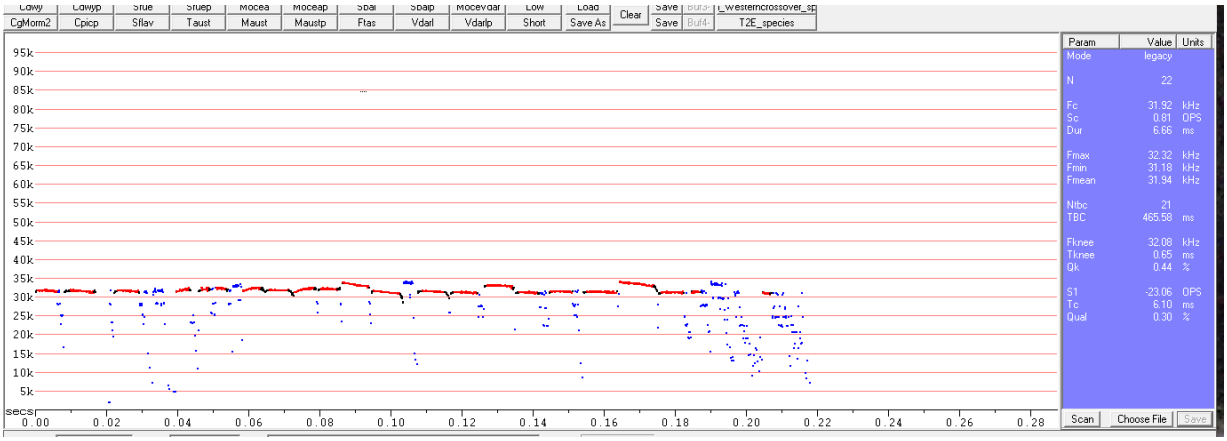


**Figure 27. Call profile for *Mormopterus* (*Micronomus*) *norfolkensis* (Eastcoast Freetail Bat) recorded on AB 1 – East at 19.29, 26 April 2016.**

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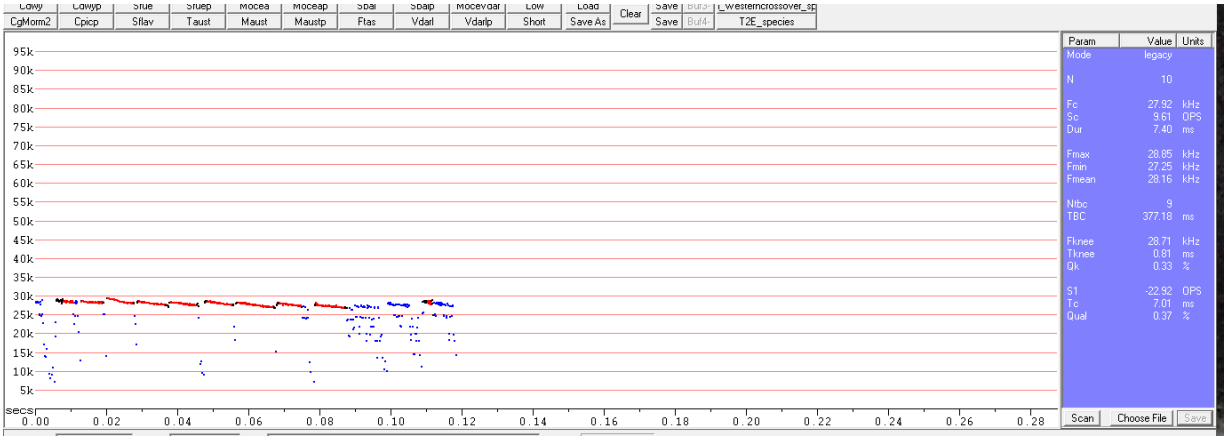


**Figure 28. Call profile for *Mormopterus* (Ozimops) *ridei* (Eastern Freetail Bat) recorded on AB1 – East at 18.05, 27 April Feb 2016**

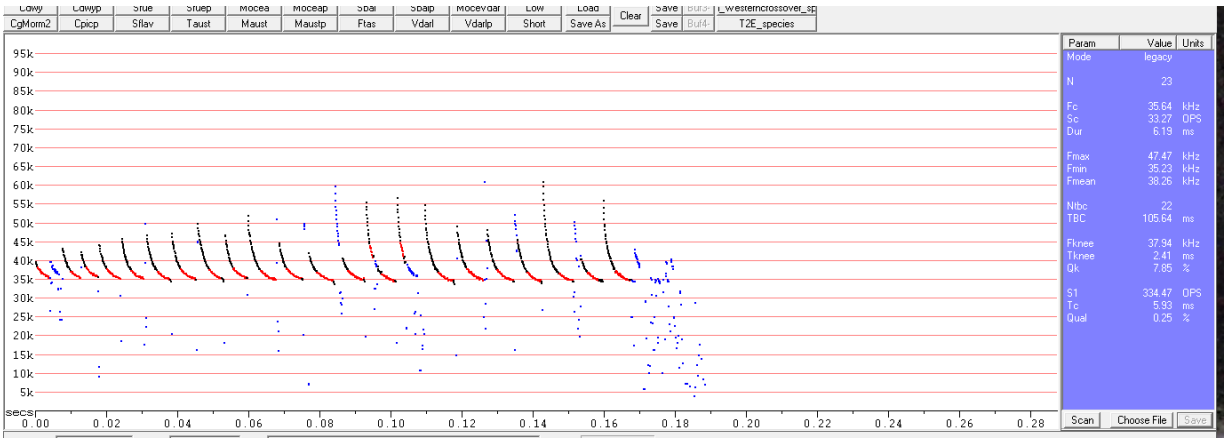


**Figure 29. Call profile for *Scotorepens orion* (Eastern Broad-nosed Bat) recorded on AB1 – East at17.50, 27 April 2016**

**Table 27: Analysed echolocation survey data April 2016**

| Species Name | Common Name | AB1 – West (18 – 19 April) | | AB1 – East (26 – 27 April) | | AB2 – East (26 – 27 April) | |
|---|---|---|---|---|---|---|---|
| | | Definitely present | Potentially present | Definitely present | Potentially present | Definitely present | Potentially present |
| *Austronomus australis* | White-striped freetail Bat | X | | X | | | |
| *Chalinolobus gouldii* | Gould's Wattled Bat | X | | X | | X | |
| *Chalinolobus morio* | Chocolate Wattled Bat | | X | | | X | |
| *Falsistrellus tasmaniensis** | Eastern False Pipistrelle | | X | | X | | |
| *Micronomus norfolkensis** | Eastern Coastal Freetail Bat | X | | X | | X | |
| *Miniopterus australis** | Little Bent-winged Bat | | | | | | X |
| *Miniopterus schreibersii* (*orianae*) *oceanensis** | Eastern Bentwing Bat | X | | X | | X | |
| *Myotis macropus** | Large-footed Myotis | X | | | X | | X |
| *Nyctophilus gouldi* | Gould's Long-eared Bat | | X | | X | | X |
| *Nyctophilus geoffroyi* | Lesser Long-eared Bat | | X | | X | | X |
| *Ozimops ridei* | Ride's Freetail Bat | X | | X | | X | |
| *Scoteanax rueppellii** | Greater Broad-nosed Bat | | X | | X | | |
| *Scotorepens orion* | Eastern Broad-nosed Bat | | X | | X | | |
| *Vespadelus darlingtoni* | Large Forest Bat | | | | X | | |
| *Vespadelus pumilus* | Eastern Forest Bat | | X | | | | X |
| *Vespadelus regulus* | Southern Forest Bat | | X | X | | | X |
| *Vespadelus vulturnus* | Little Forest Bat | | X | | | | X |
| **Species Diversity (Definitely present only)** | | 6 | - | 7 | | 5 | |

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| | | | | | | |
|---|---|---|---|---|---|---|
| **Species Diversity (incl Potentially present)** | - | 9 | | 7 | | 7 |
| **Total** | **6** | **15** | **7** | **14** | **5** | **12** |

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# Appendix K Travers Bushfire and Ecology Ecological Constraints Assessment 2013

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# Appendix L Targeted bird survey results and weather conditions

| Survey date | Survey time | Person hours | Temperature (min °C) | Temperature (max °C) | Rainfall (mm) |
|---|---|---|---|---|---|
| 2 April 2019 | 7 am -8.30 am | 3 | 15.1 | 23.0 | 0.00 |
| 9 April 2019 | 7 am -8.30 am | 3 | 13.4 | 28.9 | 0.00 |
| 30 April 2019 | 7 am -8.30 am | 3 | 10.7 | 24.2 | 0.00 |
| 1 May 2019 | 7 am -8.30 am | 3 | 12.6 | 23.4 | 0.00 |
| 28 May 2019 | 7 am -8.30 am | 3 | 2.7 | 19.0 | 0.00 |
| 30 May 2019 | 7 am -9.00 am | 4 | 2.7 | 17.5 | 0.00 |
| 4 June 2019 | 7 am -8.30 am | 3 | 2.4 | 16.1 | 16.8 |
| 12 June 2019 | 7 am -9.00 am | 4 | 5.3 | 23.8 | 0.00 |
| 28 June 2019 | 7 am -9.00 am | 4 | 5.6 | 20.2 | 0.2 |
| 3 July 2019 | 7 am -8.30 am | 3 | -0.8 | 19.7 | 0.00 |
| | **Total** | **33** | | | |

| Common name | Scientific name | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Australian Golden Whistler | *Pachycephala pectoralis* | | | | | | | | | | O |
| Australian Ibis | *Threskiornis moluccus* | O | O | | | | OW | | | | |
| Australian King Parrot | *Alisterus scapularis* | | W | | | | | | | | |
| Australian Raven | *Corvus coronoides* | O | O | WO | WO | WO | OW | OW | OW | O | OW |
| Australian Wood Duck | *Chenonetta jubata* | | | | O | O | | | OW | O | O |

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| Common name | Scientific name | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Australian Magpie | *Cracticus tibicen* | O | | W | | W | | W | OW | O | |
| Bar-shouldered Dove | *Geopelia humeralis* | | | | | | | | | | O |
| Bell Miner | *Manorina melanophrys* | W | O | WO | W | W | | OW | O | O | W |
| Black Faced Cuckoo Shrike | *Coracina novaehollandiae* | | | | | O | | | | | OW |
| Black Swan | *Cygnus atratus* | | | | | | | | O | O | |
| Brown Falcon | *Falco berigora* | | O | | | | | | | | |
| Brown Honeyeater | *Lichmera indistincta* | O | | | | O | | | | | |
| Cattle Egret | *Bubulcus ibis* | | | O | | | OW | | | | O |
| Chestnut Teal | *Anas castanea* | | | | | | | | | | O |
| Common Mynah | *Acridotheres tristis* | | | | O | | | | | | OW |
| Common Starling | *Sturnus vulgaris* | | | | | | | | | O | |
| Crested Pigeon | *Ocyphaps lophotes* | | O | | | O | OW | | O | O | |
| Crested Shrike-tit | *Falcunculus frontatus* | | | | | | | | | | O |
| Double-barred Finch | *Taeniopygia bichenovii* | O | O | O | WO | O | OW | | OW | | OW |
| Dusky Woodswallow* | *Artamus cyanopterus* | | | | | | | | | O | O |
| Eastern Rosella | *Platycercus eximius* | | O | O | O | | OW | OW | O | | |
| Eastern Whipbird | *Psophodes olivaceus* | | W | W | | | | OW | | O | W |
| Eastern Yellow Robin | *Eopsaltria australis* | | O | | | | | | | | |
| Eurasian Coot | *Fulica atra* | | | | | O | O | | | | O |
| Feral Pigeon | *Columba livia domestica* | | | | O | | | | | | O |
| Galah | *Eleolophus roseicapilla* | | | W | O | | | | OW | O | O |

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| Common name | Scientific name | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Grey Butcher Bird | *Cracticus torquatus* | | | O | | | | OW | | O | O |
| Grey Fantail | *Rhipidura albiscapa* | O | O | O | O | O | | OW | OW | | OW |
| Grey shrike thrush | *Colluricincla harmonica* | | | | | O | O | | | | |
| Jacky Winter | *Microeca fascinans* | | | | | | | | | | O |
| Laughing Kookaburra | *Dacelo novaeguineae* | O | W | | W | W | | | O | O | W |
| Little Corella | *Cacatua sanguinea* | | | | W | | | | W | W | |
| Little Eagle* | *Hieraaetus morphnoides* | | O | | | | | O | | O | O |
| Magpie | *Gymnorhina tibicen* | | | | | | | | | | O |
| Magpie Lark | *Grallina cyanoleuca* | W | O | WO | WO | WO | OW | OW | OW | O | O |
| Masked Lapwing | *Vanellus miles* | O | | | WO | | | | W | O | |
| Noisy Minor | *Manorina melanocephala* | | O | WO | WO | W | | OW | | O | |
| Pacific Black Duck | *Anas superciliosa* | | O | WO | O | O | OW | OW | OW | O | O |
| Peaceful Dove | *Geopelia placida* | | O | O | O | | | O | | O | O |
| Pied Cormorant | *Phalacrocorax varius* | | | | | | | | | O | |
| Purple Swamphen | *Porphyrio porphyrio* | O | | | | | O | | | | O |
| Rainbow Lorikeet | *Trichoglossus moluccanus* | O | | | WO | WO | | W | OW | O | |
| Red Junglefowl | *Gallus gallus domesticus* | | | | | | | | | | |
| Red-browed Finch | *Neochmia temporalis* | | O | | | | | | | O | |
| Red-rumped Parrot | *Psephotus haematonotus* | | O | | WO | O | | OW | OW | | O |
| Restless Flycatcher | *Myiagra inquieta* | | | | | | | | | | O |
| Rose Robin | *Petroica rosea* | | | | | | | O | O | | |

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| Common name | Scientific name | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rufous whistler | *Pachycephala rufiventris* | | | | | | O | | | | |
| Silvereye | *Zosterops lateralis* | | O | | | WO | | | | | O |
| Royal Spoonbill | *Platalea regia* | | | O | | | | | | | |
| Spotted Dove | *Spilopelia chinensis* | | | | | | O | | | | |
| Spotted Pardalote | *Pardalotus punctatus* | | | | | | | | W | | W |
| Straw-necked Ibis | *Threskiornis spinicollis* | | O | WO | WO | W | OW | | O | O | |
| Sulphur crested cockatoo | *Cacatua galerita* | | | | | | | | | O | |
| Superb Fairywren | *Malurus cyaneus* | O | O | O | O | O | | OW | OW | O | OW |
| Welcome Swallow | *Hirundo neoxena* | | | O | O | O | O | O | | O | |
| Whistling Kite | *Haliastur sphenurus* | | O | O | O | | | O | O | O | O |
| White-breasted Woodswallow | *Artamus leucorynchus* | | O | | O | O | OW | | | | |
| White-bellied Sea-Eagle* | *Lichenostomus penicillatus* | O | | O | | | | O | | | |
| White-faced Heron | *Egretta novaehollandiae* | | O | | O | | | | O | | O |
| White-plumed Honeyeater | *Rhipidura leucophrys* | O | O | W | O | O | | OW | | | |
| Willie Wagtail | *Acanthiza nana* | W | | | OW | O | OW | | OW | W | O |
| Yellow-tailed Black Cockatoo | *Calyptorhynchus funereus* | | | | | | | | | O | |
| Yellow Faced Honey Eater | *Lichenostomus chrysops* | | | | | | | | OW | | |
| Yellow Thornbill | *Acanthiza nana* | | | | | | OW | OW | OW | | W |
| Yellow-rumped Thornbill | *Acanthiza chrysorrhoa* | | | | | | | OW | | | W |

* = threatened species under the BC Act and / or a Matter of NES under the EPBC Act

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