

Callala Bay Biodiversity Certification Assessment Report

Sealark Pty Limited



DOCUMENT TRACKING

Project Name	Callala Bay Biodiversity Certification Assessment Report and Biodiversity Strategy
Project Number	19SYD_12581
Project Manager	Alex Gorey
Prepared by	Nicole McVicar, Vivian Hamilton, Belinda Failes and Mike Lawrie
Reviewed by	Robert Humphries, Ryan Smithers and Michelle Frolich
Approved by	Robert Humphries
Status	Final
Version Number	5
Last saved on	31 January 2022

This report should be cited as 'Eco Logical Australia 2022. *Callala Bay Biodiversity Certification*. Prepared for Sealark Pty Limited.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Allen Price & Scarratts Pty Ltd and Sealark Pty Limited

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and Sealark Pty Limited. The scope of services was defined in consultation with The Halloran Trust, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information. Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

Template 2.8.1

Contents

1. Preamble.....	3
1.1 Project background.....	3
1.2 Original biodiversity certification assessment area and Planning Proposal	5
1.3 Description of project timelines, management and governance and strategic context	6
1.4 Community consultation and stakeholder engagement.....	6
1.5 Current biodiversity certification assessment area and proposed landuse	7
1.6 Biodiversity assessment process and implications	9
1.7 Assessment methodology / consultation with NSW OEH	10
2. Biodiversity values assessment report – methodology and results	19
2.1 Methods	19
2.1.1 Literature and data review	19
2.1.2 Background	21
2.1.3 Determination of species credit species requiring survey.....	27
2.1.4 Field assessment	31
2.2 Results	42
2.2.1 Vegetation types and condition.....	42
2.2.2 Flora species	44
2.2.3 Fauna species.....	44
2.2.4 Red Flags	47
3. More Appropriate Local Data used in the Biocertification Assessment.....	49
4. Biocertification credit assessment.....	50
4.1 Biodiversity certification assessment area.....	50
4.2 Vegetation mapping and zones	50
4.3 Transects/plot data and site value scores.....	51
4.4 Landscape score	51
4.4.1 Percent native vegetation cover score	52
4.4.2 Connectivity value.....	52
4.4.3 Adjacent remnant area	52
4.5 Red flags	53
4.6 Indirect Impacts	56
4.7 Mitigation measures.....	57
4.7.1 Buffers on Red flag areas	57
4.7.2 Creation of Bushland Reserve.....	57
4.7.3 Management of APZ in Linear Reserve	58
4.8 Credit calculations	61
4.8.1 Ecosystem credits	61
4.8.2 Species credits	61

5. Biodiversity Certification Strategy	63
5.1 Land proposed for biodiversity certification	63
5.2 Land proposed for retention	63
5.3 Land proposed for biodiversity conservation	63
5.4 Proposed conservation measures.....	63
5.5 Any person or body proposed as a ‘party’ to the biodiversity certification	65
5.5.1 Timing of credit retirement	65
5.6 Is an Improve or Maintain Outcome Achieved?	65
5.7 Statement of commitments.....	66
5.7.1 Biocertification Agreement.....	66
5.7.2 Avoidance, minimisation and mitigation of impacts to biodiversity values within and adjacent to land to be certified.....	66
5.7.3 Management of the proposed bushland park consistent with the EPBC Act conditions of approval.....	66
6. References	68
Appendix A Halloran Land Trust Planning Proposal	70
Appendix B Commonwealth Approval.....	70
Appendix C Project Staff CVs	70
Appendix D Threatened species likelihood tables and assessment of candidate species	88
Appendix E Flora species recorded in Biometric plots	114
Appendix F Fauna species recorded in Callala BCAA by ELA 2016-2017	118
Appendix G Transect/plot data	119
Appendix H Lake Wollumboola BioBank Site Credit Assessment Report	120

List of Figures

Figure 1: Regional location of Callala Bay Biodiversity Certification Assessment Area	12
Figure 2: Land zoning map SLEP 2014	13
Figure 3: Land zoning map SLEP 1985	14
Figure 4: Original Jervis Bay Biodiversity Certification Assessment Area	15
Figure 5: Callala Bay Biodiversity Certification Assessment Area and location of existing conservation area outside the BCAA	16
Figure 6: Indicative development / land use within the BCAA	17
Figure 7: Indicative staging of development	18
Figure 8: Threatened flora species credit records within 5 km radius of BCAA (Source: BioNet and ELA unpublished data)	22
Figure 9: Threatened fauna species credit records within 5 km radius of BCAA (Source: BioNet and ELA unpublished data)	23
Figure 10: Threatened ecosystem credit fauna records within 5 km radius of BCAA (Source: BioNet and ELA unpublished data)	24
Figure 11: SCIVI Vegetation Communities (Tozer <i>et al.</i> 2010)	26
Figure 12: Validated Biometric vegetation type in BCAA	38
Figure 13: Validated vegetation zones and location of plots used in credit calculations	39
Figure 14: Targeted threatened flora survey effort	40
Figure 15: Targeted threatened fauna survey effort	41
Figure 16: <i>Genoplesium baueri</i> Species Polygon	45
Figure 17: Eastern Pygmy Possum Species Polygon	46
Figure 18: Red flag threatened species within the BCAA	48
Figure 19: Assessment circle	54
Figure 20: Connectivity	55
Figure 21: Impacted red flag threatened species	60
Figure 22: Impacted, conserved and retained red flag threatened species	62

List of Tables

Table 1: Summary of lots and zoning	4
Table 2: Biometric vegetation types and their conservation status in the BCAA	7
Table 3: Proposed biocertification land uses in the BCAA	8
Table 4: Previous survey effort and results for validating vegetation communities present and for threatened flora and fauna species	19
Table 5: Potential vegetation communities and equivalent Biometric vegetation types in the BCAA and relationship to threatened ecological communities	25
Table 6: Vegetation zones in the BCAA, plot requirements and plots completed	32
Table 7: Flora survey effort over the BCAA and Lake Wollumboola BioBank Site (Callala)	32
Table 8: Summary of survey effort for fauna candidate species	36
Table 9: Land use breakdown	50
Table 10: Area of vegetation within the BCAA.....	50
Table 11: Area of vegetation zones assessed within the BCAA	51
Table 12: Site value scores allocated to each vegetation zone.....	51
Table 13: Native vegetation cover in assessment circle	52
Table 14: Connectivity scores allocated for the assessment	52
Table 15: Impacts to red flagged threatened species	53
Table 16: Final ecosystem credit results	61
Table 17: Final species credit results.....	61
Table 18: Summary of ecosystem credit surplus/deficit.....	64
Table 19: Summary of species credit surplus/deficit	64

Abbreviations

Abbreviation	Description
ARA	Adjacent Remnant Area
APZ	Asset Protection Zone
BCAR	Biodiversity Certification Assessment Report
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BCAA	Biodiversity Certification Assessment Area
BBAM 2014	BioBanking Assessment Methodology 2014
BCAM	Biodiversity Certification Assessment Methodology
BCS	Biodiversity Certification Strategy
BVT	Biometric vegetation type
CEEC	Critically Endangered Ecological Community
CMA	Catchment Management Authority
DAWE	Commonwealth Department of Agriculture, Water and Environment (DAWE, formerly DotEE)
DEC	former NSW Department of Environment and Conservation (now DPIE)
DECC	former NSW Department of Environment and Climate Change (now DPIE)
DECCW	former NSW Department of Environment, Climate Change and Water (now DPIE)
DotEE	former Commonwealth Department of the Environment and Energy (now DAWE)
DPE	former NSW Department of Planning and Environment (formerly NSW Department of Planning)
DPIE	NSW Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
IoM	Improve or Maintain
LEP	Local Environment Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance (EPBC Act)
NPW Act	NSW <i>National Parks and Wildlife Act 1974</i>
NPWS	NSW National Parks and Wildlife Service (now part of OEH)
NSW	New South Wales
OEH	former NSW Office of Environment and Heritage (now part of DPIE)
SCC	Shoalhaven City Council
SLEP	Shoalhaven Local Environmental Plan 2014 (Previously SLEP 1985)
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>

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 Flags.
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).
Conservation Area	Land 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 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-story 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 <i>National Parks and Wildlife Act 1974</i> (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

Definition	Description
	applied towards the conservation or enhancement of the natural environment.
Moderate-Good Condition	As described in Section 2.3 of the BCAM. Any vegetation that is not in 'low condition' is in 'moderate to good' condition
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, 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.
Biometric vegetation type	A plant community classification system used in BioMetric Tools, including the BioBanking Tool, Biodiversity Certification Tool and Property Vegetation Planning Tool
Red Flags	As described in Section 2.3 of the BCAM. See 'Areas of High Biodiversity Conservation Value' above.
Species credit	As described in the BCAM, the class of credits for biodiversity certification that are generated for a conservation measure or are required for the land proposed for certification

Executive Summary

Eco Logical Australia Pty Ltd (ELA) was commissioned by Sealark Pty Limited on behalf of The Halloran Trust to undertake a Biodiversity Certification Assessment of land along Callala Beach Road, Callala Bay in the Shoalhaven City Council (SCC) Local Government Area (LGA). The proposal is to facilitate land rezoning for the future expansion of Callala Bay township and is estimated to establish approximately 374 new residential lots in a low to medium density residential environment. This outcome is consistent with local and regional strategies and objectives to promote housing diversity.

The purpose of the assessment is to obtain '*biodiversity certification*' of land proposed for residential development and associated infrastructure from the Minister for the Environment. Biocertification is conferred by the Minister if the '*conservation measures*' proposed in the biocertification application result in an overall '*improvement or maintenance*' in biodiversity values.

Due to ongoing investigations required for the Culburra Beach area, the Halloran Trust Lands Planning Proposal was split into two Planning Proposals in June 2018. A second Biocertification application for the Culburra Beach area was submitted to the Minister for the Environment in August 2019.

The '*Biodiversity Certification Assessment Area*' (BCAA) defined for the Callala Bay study area, encompasses a total area of 40.19 ha. The entirety of the BCAA consists of native vegetation, comprising one Biometric vegetation type (BVT), SR592 '*Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion*'. This BVT does not conform to any threatened ecological community (TEC) listed under the now repealed NSW *Threatened Species Conservation Act 1995* (TSC Act), the new NSW *Biodiversity Conservation Act 2016* (BC Act) or the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Whilst one threatened flora species and five fauna species have been recorded in, or near the BCAA, only one endangered species, *Genoplesium baueri* (Bauer's Midge Orchid), and one vulnerable species, *Cercartetus nanus* (Eastern Pygmy-possum), requires specific assessment under the BCAM for impacts to habitat. Both Bauer's Midge Orchid and Eastern Pygmy-possum are classified as a '*species credit*' species and impacts to these species cannot be assessed by the vegetation types.

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

The BCAA is 40.19 ha in size, of which 38.09 ha is proposed for certification and 2.1 ha is proposed for retention as part of a Bushland Park Reserve under the Local Government Act 1993. The application proposes to directly impact 38.09 ha of the assessment area, of which the entirety is mapped as native vegetation. The application also proposes to directly impact 38.09 ha of threatened species habitat for the Eastern Pygmy-possum and one (1) individual of Bauer's Midge Orchid. The remaining 35 Bauer's Midge Orchid will be retained and managed for conservation within the Bushland Park. Impacts to three or more individuals of Bauer's Midge Orchid are categorised as a '*red flag area*' or '*area of high biodiversity conservation value*' by the BCAM. Given the proposal would impact one individual only, the impacts do not meet the definition of a red flag area.

The Biodiversity Certification Assessment has found that **1,598** biocertification ‘ecosystem credits’ are required for direct impacts to SR592 ‘*Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion*’. A total of **762** ‘species credits’ are required for impacts to Eastern Pygmy Possum and **13** species credits for *Genoplesium baueri*.

The application proposes to secure all biodiversity certification credit requirements by the retirement of biodiversity (Biobanking) credits from an existing off-site conservation measure, the adjoining 1,082 ha Lake Wollumboola BioBank Site (BA364), which is owned by Sealark Pty Ltd. Sealark have ‘committed’ the required number and types of ecosystem and species credits from BA 364 for this biocertification application. A BioBanking Agreement is a ‘Permanently Managed and Funded’ or 100% Conservation Measure as outlined in s126L(i) of the TSC Act and section 8.1.1 of the BCAM.

The Lake Wollumboola BioBank Site has available **8,542** SR592 ‘*Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion*’ ecosystem credits, **5,735** species credits for Eastern Pygmy Possum and **895** species credits for *Genoplesium baueri*. Therefore, the full ecosystem and species credit requirement for the biodiversity certification application can be offset by the Lake Wollumboola BioBank Site.

The Lake Wollumboola BioBank Site was registered in February 2019 and will continue to be managed by Sealark Pty Ltd in accordance with the Biobanking Agreement. All of the required credits for this assessment will be retired by the end of year five after commencement of development (expected to be around 2026) and the Total Fund Deposit (TFD) of BA 364 will be met in full. The biobank site will be transferred to the Minister administering the *National Parks and Wildlife Act 1979* and dedicated as an addition to the Jervis Bay National Park at the end of Year 5 after commencement. Sealark Pty Ltd has commenced and will continue to plan for the transfer of the land during this 5 year period such that the land is transferred at the end of Year 5.

Sealark Pty Ltd will enter into a Biodiversity Certification Agreement with the Minister and provide a Bank Guarantee Bond for the full TFD within three months of biodiversity certification being conferred. The bond will be terminated once the required number and types of credits have been retired and the TFD met.

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, even where impacts are only ‘partial’ loss as a result of establishing Bushfire Asset Protection Zones (APZ) or detention basins that would retain some vegetation and act as buffers to the adjacent Lake Wollumboola Biobank site and Bushland Park Reserve. The adjoining Lake Wollumboola BioBank Site is buffered by perimeter roads and a proposed 29m wide linear reserve that provides the APZ requirements for the proposed residential development. The APZ has been assessed as fully impacted, even though biodiversity values will be retained in this area, thereby mitigating any potential indirect impacts to the biobank site.

The proposal can meet an ‘*improve or maintain*’ outcome and is eligible for biodiversity certification. If the Minister confers biocertification on the requested land, SCC 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.

1. Preamble

1.1 Project background

Eco Logical Australia Pty Ltd (ELA) was commissioned by Sealark Pty Limited to undertake a Biodiversity Certification Assessment and to prepare a Biodiversity Certification Strategy (BCS) in accordance with the Biodiversity Certification Assessment Methodology (BCAM) for the proposed residential development at Callala Bay.

An application for biodiversity certification 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 Callala Bay site was one of these projects.

This application for biodiversity certification was submitted to the Minister on 14 August 2019 and has been accepted under these savings provisions. 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 September 2019 and various amendments have been made to this report in response to this review in relation to the timing of credit retirements and land transfers to the Minister for the Environment.

The Biodiversity Certification Assessment Area (BCAA) is located directly west of the existing suburb of Callala Bay. The proposed biocertification will extend current urbanised areas by up to 38.09 ha and provide a core bushland reserve of 2.1 ha in size with surrounding uses (APZ, detention basins, open space). The BCAA is bounded by Callala Beach Road in the west and Emmett Street in the south. The northern boundary of the BCAA shares a common boundary with the Lake Wollumboola BioBank Site which was registered in 2019 and which will form a future extension to Jervis Bay National Park (Figure 1).

The BCAA is located within the Shoalhaven Local Government Area (LGA), within the coastal township of Callala Bay, approximately 20 km south-east of Nowra. The land is currently zoned as a Deferred Matter and RU2 under the Shoalhaven Local Environmental Plan 2014 (SLEP 2014) as shown in Figure 2. The land was originally zoned 1(d) Rural Zone (General Rural) under the Shoalhaven Local Environmental Plan 1985 (SLEP 1985) as shown in Figure 3. The BCAA has been the subject of a planning proposal with Shoalhaven City Council (SCC), the then Department of Planning and Environment (DPE) and the then Office of Environment and Heritage (OEH) since 2014 (**Appendix A**; Allen Price & Associates 2014) and it is intended that the planning proposal and biocertification application will be exhibited concurrently.

The Callala Bay study area comprises of 34 lots which are provided below in Table 1.

Table 1: Summary of lots and zoning

Callala Bay - Lot//DP				
9//253793	603//11388	610//11388	617//11388	624//11388
10//253793	604//11388	611//11388	618//11388	625//11388
11//253793	605//11388	612//11388	619//11388	626//11388
17//253793	606//11388	613//11388	620//11388	627//11388
18//253793	607//11388	614//11388	621//11388	628//11388
20//1263402	608//11388	615//11388	622//11388	2//776260
602//11388	609//11388	616//11388	623//11388	

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

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

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

Only a '*Planning Authority*' as defined by section 126G of the TSC Act may apply to the Minister for biocertification. Shoalhaven City Council (SCC) is a Planning Authority as defined by section 126G. SCC is seeking biocertification of the land identified in this assessment report.

Accredited assessor Jennie Powell (assessor number: 92), oversaw the assessment process and associated credit calculations between 2015 and 2019. As Jennie Powell is no longer with ELA, the current credit calculations and Biocertification Strategy has been reviewed by Ryan Smithers (assessor number: 67). Ryan Smithers is familiar with the development and Lake Wollumboola BioBank Site, having led the vegetation mapping/survey field work and undertaken parts of the targeted flora surveys, with support from other ELA staff. The preparation of documentation has been supported by Belinda Failes, Mike Lawrie, Nicole McVicar, Robert Humphries, Alex Gorey, Michelle Frolich and Vivian Hamilton. Ecological investigations of the BCAA were undertaken by Jennie Powell, Mitchell Scott, Nicole McVicar, Ryan Smithers and David Coombes. Brief CVs for the project team members are

provided in **Appendix B**. It is noted that Jennie Powell, Vivian Hamilton, Mike Lawrie and Mitchell Scott are no longer employed by ELA.

1.2 Original biodiversity certification assessment area and Planning Proposal

The Callala Bay BCAA is part of an original larger Jervis Bay BCAA, which incorporated lands from the Halloran Trust Planning Proposal for Culburra Beach, Callala Bay and Kinghorn Point (Allen Price and Associates 2014). The Halloran Trust is administered by Sealark Pty Limited. The original Jervis Bay BCAA was contiguous with Jervis Bay National Park linking the three distinct geographic areas subject to various proposed biodiversity certification and conservation measures (Figure 4). While Jervis Bay National Park was included within the original BCAA boundary, it was classified as 'Retained Land' i.e., land that is not proposed for development or subject to conservation measures (as part of the biocertification assessment).

The purpose of applying the BCAM to the Jervis Bay BCAA, was to enable the strategic planning of large portions of the Halloran Trust lands to determine their future land use, whilst aiming to achieve improve or maintain outcomes for biodiversity. The intent from the beginning of the planning process, was to fully offset impacts from proposed development with the provision of lands for in perpetuity conservation purposes. Most notably, it was envisioned that over 1,000 hectares of land adjacent to Jervis Bay National Park would be transferred and dedicated to the NSW National Parks and Wildlife Service (NPWS). This would ultimately provide a significant extension to the existing Jervis Bay National Park and by doing so, areas of high biodiversity value would be guaranteed to be secured for conservation in-perpetuity.

Partway through the planning process (November 2016), it was decided in consultation with Council and OEH, that the conservation lands proposed for dedication to the NPWS would be separated out of the Jervis Bay BCAA and instead be registered as a standalone BioBank Site prior to submitting this application for biodiversity certification. The BioBank Site would still be included in the Jervis Bay BCAA boundary, but would be classified as 'Retained Land'. This decision was due to a variety of factors including impending biodiversity conservation reforms (requiring that BioBanking agreements under the repealed TSC Act be submitted prior to 25 August 2017 and finalised/signed prior to 25 February 2019) and timeframes around the transfer of these lands to NPWS. The Lake Wollumboola BioBank Agreement (BA364) was registered in February 2019.

Given the proximity of land proposed for biocertification at Culburra Beach in relation to Lake Wollumboola, Council commissioned a preliminary groundwater investigation which was completed in June 2018. The investigation recommended detailed water quality investigations and ongoing monitoring to take place over a period of at least 2 years. The monitoring program has now been commenced.

Due to ongoing investigations required for the Culburra Beach area, the Halloran Trust Lands Planning Proposal was split into two Planning Proposals in June 2018. The split consists of one part covering the Culburra Beach area and the other part covering the Callala Bay and Kinghorn Point areas. The reasoning behind the decision to split the Halloran Planning Proposal was twofold. Firstly, Callala Bay and Kinghorn Point aren't subject to water quality investigations, therefore splitting them out would facilitate their progression. Secondly, to improve the community engagement process by allowing Callala Bay and Culburra Beach to be consulted on separately, thus enabling a more efficient and targeted approach.

Mirroring the decision to split the Halloran Trust Lands Planning Proposal, Jervis Bay BCAA was split into two separate BCAAs in February 2019. One assessment area covers Callala Bay and the other covers Culburra Beach. Additionally, Jervis Bay National Park and Lake Wollumboola BioBank Site (classified as 'Retained Land') were removed from both of the BCAA boundaries to simplify the assessment areas. Jervis Bay National Park and Lake Wollumboola BioBank Site have a pivotal role in the history of the planning process and the decisions that were made to secure conservation lands. However, had they been kept within each of the separate Callala Bay and Culburra Beach BCAAs, it would have been necessary to split them at a nominal location due to logistics and may have falsely portrayed the idea that only some parts of these lands are relevant to each BCAA. Rather, the relationship of these lands as a whole, are equally important for both the Callala Bay BCAA and Culburra Beach BCAA. As such, their exclusion from both BCAA boundaries is not intended to diminish their importance but is an effort to ensure that there are no misinterpretations. It is important to note that by separating out the Lake Wollumboola BioBank Site from Callala Bay BCAA and Culburra Beach BCAA, improve or maintain outcomes are predominantly achieved through commitments to retire credits from a now existing off-site conservation measures located outside each of the BCAAs.

1.3 Description of project timelines, management and governance and strategic context

The Planning Proposal (Allen Price & Associates 2014) is proposed to be placed on exhibition with this application for biocertification by Shoalhaven City Council. The Planning Proposal determination will define the exact rezoning changes which will inform preparation of subdivision plans for subsequent Development Applications (DA). It is noted that the Masterplan in the Planning Proposal is slightly different to that assessed in this application for biocertification, it has slightly decreased the impact footprint and increased the 'retained area' in the bushland park. Subject to all approvals being in place, construction is proposed to commence in several stages with Stage 1 starting from 2023/24 and subject to demand for lots, be completed by around 2032-34.

The rezoning is estimated to facilitate development of approximately 374 new residential lots in a low to medium density residential environment. The lots sizes are proposed to range in size from 400m² to 2,000 m² and expand the type and choice of residential living available in the township. This outcome is consistent with local and regional strategies and objectives to promote housing diversity.

The purpose of the proposed biocertification is to facilitate appropriate biodiversity values considerations in the land zoning process for the future expansion of Callala Bay township as identified in the *Jervis Bay Settlement Strategy* (October 2003) and the *Shoalhaven Growth Management Strategy* (December 2014) and Shoalhaven LSPS 2020. These strategic documents identified the potential township expansion into approximately 35 hectares of land to the west of the existing urban area.

1.4 Community consultation and stakeholder engagement

Shoalhaven City Council received a Planning Proposal from Allen Price & Associates Pty Ltd (the Proponent) on behalf of the Halloran Trust in August 2014 that was prepared to reflect the vision of the *Jervis Bay Settlement Strategy* (October 2003) and the *Shoalhaven Growth Management Strategy* (December 2014). This Planning Proposal related to the subject land and two other areas (Culburra Beach and Kinghorn Point) that were held in common ownership. All of these lands had been deferred as part of the 2014 direction of the Minister for Planning. The Planning Proposal lodged by the proponent also proposed that some or all of the environmental conservation zoned land would be

‘gifted’ to NPWS as an extension to Jervis Bay National Park. Given the local and wider interest in the land, the Planning Proposal was released for comment prior to being considered by Council. The Planning Proposal was available on Council’s website from 13 August to 5 September 2014 (inclusive). Council received 141 submissions from community groups, members of the public and one government agency (OEH). Generally, 88 were in support and 53 were in opposition of the Planning Proposal.

Due to ongoing investigations required for the Culburra Beach area, the Halloran Trust Lands Planning Proposal was split into two Planning Proposals in June 2018. This revised planning proposal and this application for Biodiversity Certification will be publicly exhibited by SCC in accordance with the public notification requirements of the TSC Act Biodiversity Certification Provisions (S.16N of the TSC Act).

1.5 Current biodiversity certification assessment area and proposed landuse

The BCAA encompasses a total area of 40.19 ha. The BCAA is accessed off Callala Beach Road and is located adjacent to the newly established Lake Wollumboola BioBank Site, which after a period of time, will be transferred and managed as part of an extension to Jervis Bay National Park (Figure 1).

The BCAA is made up of 38.09 ha of land proposed for biodiversity certification (and therefore proposed for development; ‘*land to be certified*’) and 2.10 ha of land proposed for retention as a bushland park reserve under the Local Government Act. Included in the land proposed for biodiversity certification, are Asset Protection Zones (APZ) located around the northern, western and partial southern boundaries of the BCAA and the bushland park. Although the APZs will only be partially cleared, these areas are counted as fully impacted in accordance with the BCAM. The land proposed for biodiversity certification also includes detention basins around the perimeter of the bushland park reserve that will be revegetated after construction has been completed.

The BCAA includes approximately 40.19 ha of native vegetation (Table 2). Vegetation within the BCAA includes one Biometric vegetation type (BVT), which is not listed as a threatened ecological community under the TSC Act or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Table 2: Biometric vegetation types and their conservation status in the BCAA

Biometric vegetation type	Area (ha)	TSC Act	EPBC Act
SR592 Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion (PCT 1079)	40.19	N/A	N/A

The regional location of the BCAA is shown in Figure 1. The areas proposed to be impacted through urban development (land to be certified or ‘*development areas*’) and areas to be retained in the BCAA are shown in Figure 5. Details of the proposed land uses within the BCAA are shown in Figure 6 and Table 3. The proposed land uses comprise urban development and associated infrastructure (roads, water, sewage, utilities), asset protection zones (APZs), a minimum 2.1 ha bushland park reserve and recreational facilities within passive and active open space areas. It is noted that the land proposed for biocertification includes bushfire asset protection zones (APZs), which are fully accommodated within the perimeter roads, building setbacks and public reserves, and do not impact on the adjoining Lake Wollumboola BioBank Site.

Table 3: Proposed biocertification land uses in the BCAA

Development footprint	Area (ha)	% of BCAA	Area of native vegetation (ha)	% of native vegetation
Land proposed for Biodiversity Certification (Development)	38.09	94.77	38.09	100
Land proposed for retention (bushland park reserve)	2.1	5.23	2.1	100

Sealark Pty Limited are proposing a residential development with an indicative yield of approximately 374 residential lots to be delivered in a number of stages over approximately 12 years (Figure 7). Development of the site will deliver a broad range of lot sizes consistent with the adjacent residential area and to use the natural features of the site and interface with surrounding roads and environmental conservation areas.

The key concepts of the residential development are to:

- incorporate the existing landscape and topographical characteristics of the site that slopes towards Jervis Bay
- retain *Genoplesium baueri* individuals within the BCAA through the establishment of a bushland park reserve
- Protect and enhance biodiversity in adjoining Lake Wollumboola BioBank Site
- retain existing native vegetation where possible along Callala Beach Road
- protect visually prominent features such as ridgelines
- protect water quality and to ensure no urban run-off north of the site
- provide appropriate bushfire protection
- provide visual links to open space
- encourage passive surveillance and increase safety
- facilitate suitable transport access
- maximise solar access for future lots and sustainable design outcomes
- provide a walkable neighbourhood
- increase the supply of housing within the Shoalhaven LGA.

To facilitate the residential development, extensions and upgrades of associated supporting infrastructure and services will be required. More specifically, the proposal will involve:

- new housing in close proximity to the existing township to support commercial services
- water, sewer, electricity and communication infrastructure upgrades
- stormwater quality improvements for the existing township
- community facility improvements
- Increased bushfire protection for the existing township.

Details of the anticipated outcomes of the residential development area include:

General residential: The Shoalhaven LGA will be able to accommodate future population growth in the new dwellings. This housing supply will assist growing and enhancing surrounding residential services.

Recreation and active open space areas: The development will provide an opportunity to improve both passive and active recreation opportunities to the township and provide additional public open space and walk/cycling opportunities. The indicative cycle path would provide connections to existing cycle paths that run throughout the locality. The development will also create a pocket park in the centre of the development with a walking track to allow access throughout the proposed subdivision.

Services: The development will be serviced by the required infrastructure, including water, sewer and electricity. Subsequent rehabilitation works will be carried out in accordance with a site specific management plan.

Stormwater quality: The development will be designed with detention basins/swales and treatment trains to improve runoff water for the surrounding urban area. The stormwater will be initially captured by a network of kerb and guttering along all roads and appropriately treated to improve water quality.

Roads, access ways, and parking: The street network within the site is to be consistent with Shoalhaven Councils Engineering Design Specification and street network principles including the establishment of a permeable network which encourages walking and cycling.

Asset Protection Zones (APZs): The development will be carried out in a way to ensure prevention of loss of life and property due to bushfires. The lot layout shows that perimeter roads are located along most bushland and landscaped interfaces. APZ's have been calculated in accordance with Planning for Bushfire Protection (RFS 2019). Further, none of the required APZs extend into proposed conservation/offset areas.

Off-site Offset site: The Lake Wollumboola BioBank Site has been established to offset the impacts of the proposed development on biodiversity values. The Lake Wollumboola BioBank Site includes signage and perimeter fencing (along sections that don't adjoin Jervis Bay National Park) that allow for the movement of fauna, but prevent the entry of people and unauthorised vehicles. The site will be actively managed for conservation in-perpetuity via a dedicated management fund and subject to plans of management in accordance with the BioBanking Agreement between Sealark Pty Limited and the Minister for the Environment.

1.6 Biodiversity 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' or 'outside' of the BCMA. 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, vegetation recognised as having

regional or state biodiversity conservation significance, and certain threatened species that are regarded as not being able to withstand further loss in the CMA.

The BCAA includes one red flag entity that will be impacted by the proposal, *Genoplesium baueri* (Bauer's Midge Orchid). Under the BCAM, impacts to > 3 individuals constitutes a red flag to *Genoplesium baueri*. The proposal has used the avoid and minimise principals to limit impacts to one (1) individual. Therefore, the species is not considered a red flag and a red flag variation request is not required.

1.7 Assessment methodology / consultation with NSW OEH

In accordance with the OEH's Biodiversity Certification Guide for applicants (OEH 2015a), Sealark Pty Limited and ELA consulted with OEH and Council prior to and throughout the assessment process to ensure that all decisions and assumptions meet the intent of the BCAM. A summary of discussions and outcomes are provided below:

- The proposed BioBanking and Biocertification approach:
 - At a Council meeting on 26 July 2016, SCC, ELA and representatives for Sealark Pty Limited discussed the formal FBA BioBanking and Biocertification process for lands owned by the Halloran Trust. One agenda item was to discuss incorporating all the land holdings into one BCAA.
 - At an agency meeting held on 8 August 2016, Department of Planning and Environment (DPE), OEH, SCC, Sealark Pty Limited and ELA discussed the rezoning of the Halloran Trust land holdings at Culburra Beach, Callala Bay and Currarong. It was determined that Halloran land holdings located at Culburra Beach, Callala Bay and Currarong will be included within the one BCAA.
 - At the agency meeting on 8 August 2016, it was agreed that to progress project approval, the credit requirement to offset the West Culburra subdivision would be calculated in accordance with the Framework for Biodiversity Assessment (FBA). Post approval of the subdivision, as suggested by OEH, the credit requirement could then be recalculated in accordance with BCAM, resulting in a reduced number of credits required for offset.
- Onsite inspections were undertaken by Ryan Smithers from ELA, Council and OEH on 9 September 2016 to inspect the vegetation and confirm the vegetation communities. OEH was in agreement with the vegetation mapping and survey approach being undertaken for the BCAM and BioBank site assessments.
- A draft red flags map was provided to Council, DP&E and OEH by ELA, prior to an agency meeting on 16 November 2016.
- Council and OEH provided advice on 30 November 2016 in relation to the proposed methodology for the targeted fauna survey plan. It was requested that Elliot traps be replaced with pitfall traps to target the White-footed Dunnart and included guidance on how the pitfalls should be set up.
- Council requested that the Commonwealth Department of Agriculture, Water and Environment (DAWE) approve the proposed residential subdivision prior to their consideration of the BCAA.
- An assessment of Matters of National Environmental Significance was prepared and submitted to DAWE in April 2020. EPBC Approval of the proposed action was granted on 1 June 2021 (Appendix C).

- The Draft Biocertification Assessment was submitted to the Minister for the Environment in August 2019 and was accepted as meeting the Savings and Transitional provisions of the BC Act 2016. Between August 2019 and July 2021, DPIE provided further advice and preferences on the retirement of biodiversity credits and the proposed transfer of conservation lands (the Lake Wollumboola Biobank site) to the Minister which is included as a revised Statement of Commitments in this updated assessment report.

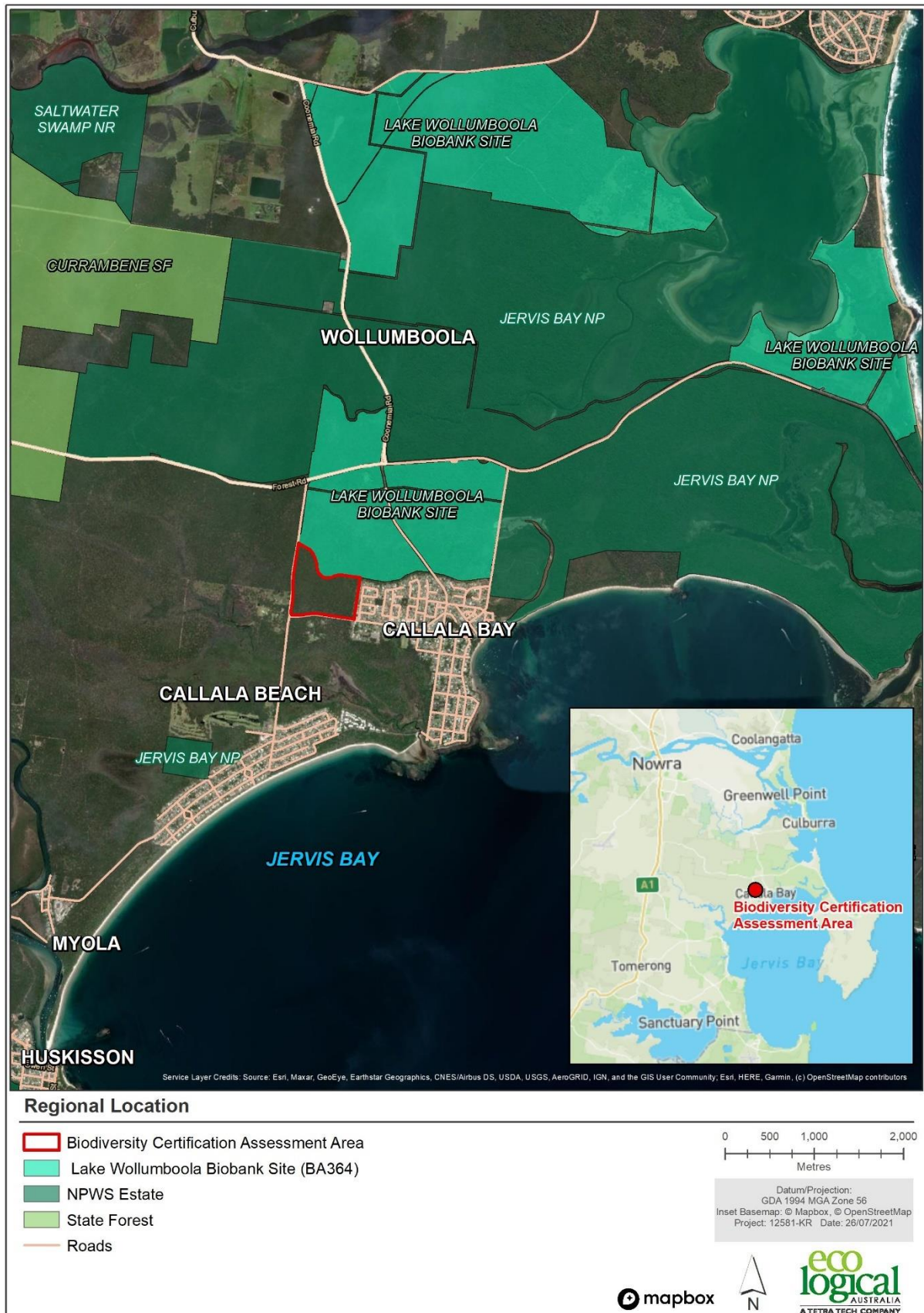


Figure 1: Regional location of Callala Bay Biodiversity Certification Assessment Area

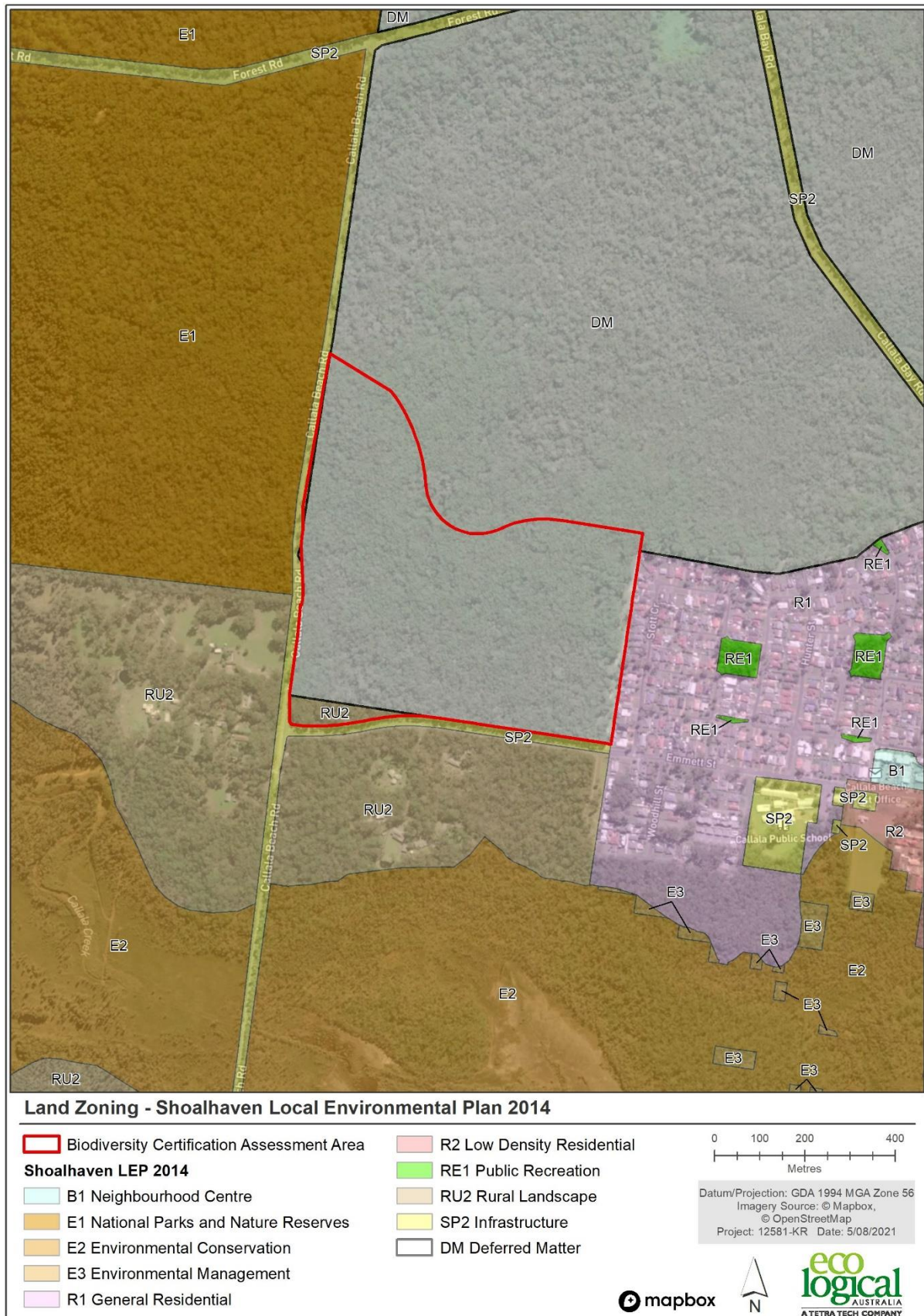


Figure 2: Land zoning map SLEP 2014

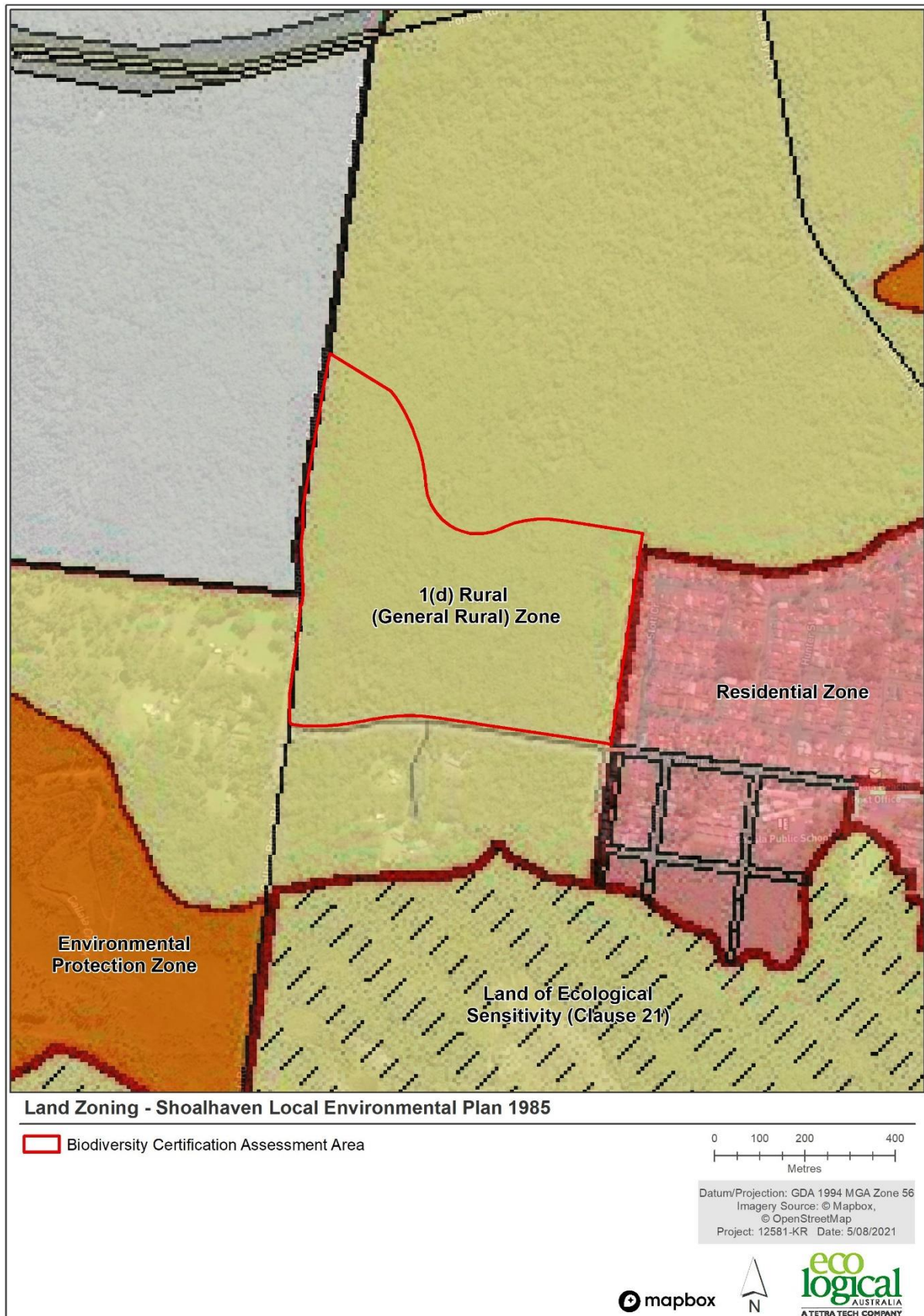


Figure 3: Land zoning map SLEP 1985

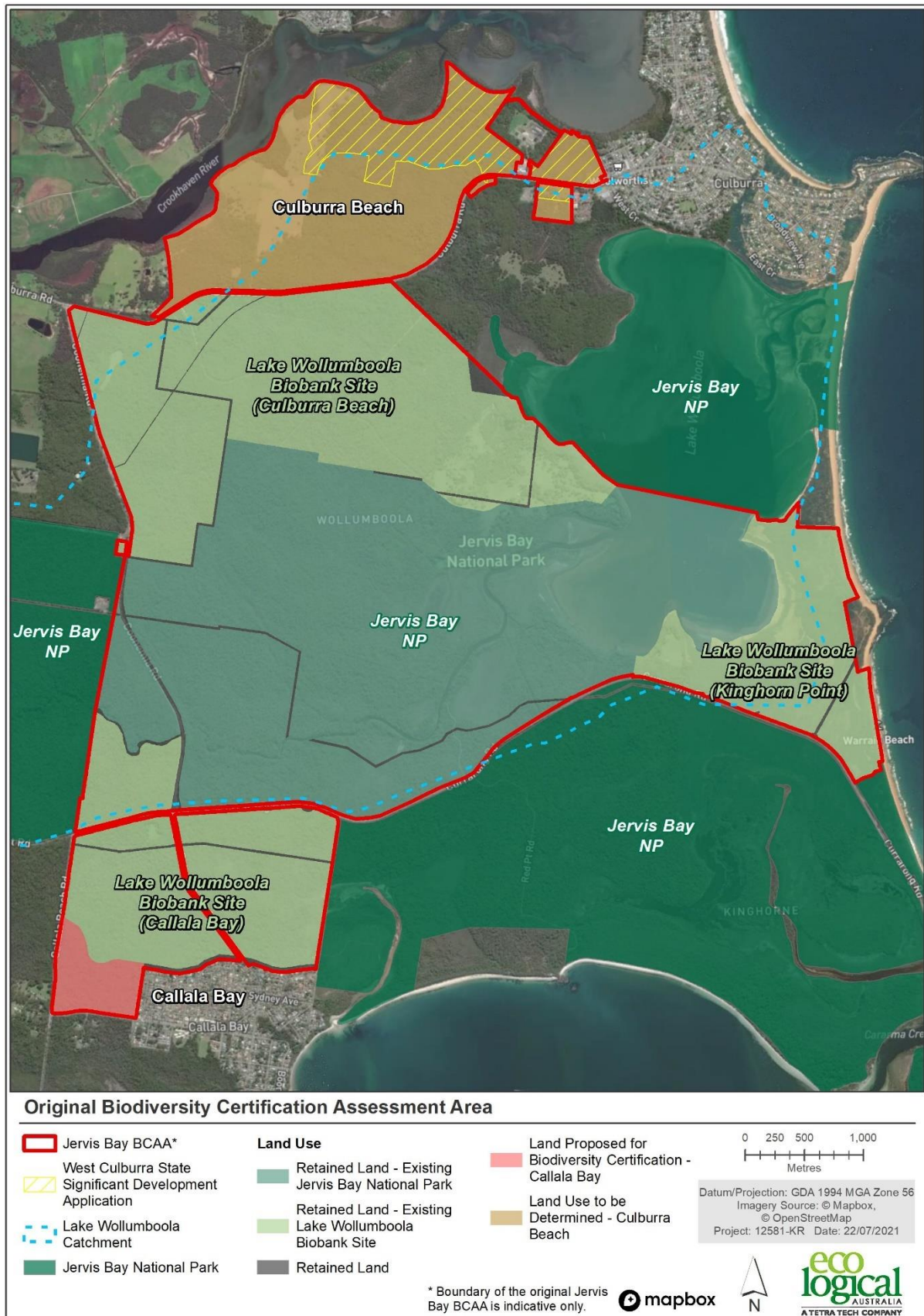


Figure 4: Original Jervis Bay Biodiversity Certification Assessment Area



Figure 5: Callala Bay Biodiversity Certification Assessment Area and location of existing conservation area outside the BCAA



Figure 6: Indicative development / land use within the BCAA

It is noted that the retained land in the final Planning proposal differs slightly to above and has increased the area of retained land in the bushland reserve.



Figure 7: Indicative staging of development

2. Biodiversity values assessment report – methodology and results

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 Certification Assessment Report**’. This section addresses this requirement.

2.1 Methods

2.1.1 Literature and data review

A review of readily available reports and databases pertaining to the ecology and environmental features of the BCAA was conducted prior to field surveys and includes the following:

- Gunninah Environmental Consultants 2001 Callala ecological report
- BES 2006a Survey Effort and Results GIS Data
- BES 2006b Targeted Survey Methods Presentation
- Southeast NSW Native Vegetation Classification and Mapping – SCIVI dataset (Tozer *et al.* 2010)
- Culburra, Callala Bay, Kinghorne Point Planning Proposal (Allen, Price & Associates 2014)
- Correspondence with Alan Stephenson regarding threatened orchids (Stephenson 2015)
- Correspondence with SCC (in partnership with OEH) regarding target survey (SCC email dated 21 September 2016).

Relevant legislation and standard technical resources including the *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. As such, these resources were also reviewed.

A summary of the biodiversity values of the BCAA from these sources is provided in Table 4.

Table 4: Previous survey effort and results for validating vegetation communities present and for threatened flora and fauna species

Report	Survey methods	Survey results	ELA outcomes
Gunninah Environmental Consultants 2001	General flora surveys and vegetation mapping, targeted surveys for <i>Prasophyllum affine</i> and <i>Cryptostylis hunteriana</i> . Targeted threatened fauna surveys include: Herpetofauna census, nocturnal call playback (owls, arboreal mammals), Anabats for microbats, diurnal bird census, spotlighting (nocturnal owls, arboreal mammals, amphibians), Elliot traps (ground and arboreal), cage traps, harp traps, hair-tubes.	Surveys recorded evidence of Glossy Black Cockatoos, Yellow-bellied Gliders, Eastern Freetail Bat, Eastern Falsistrelle, Bentwing-Bat, Greater Glider. <i>Cryptostylis hunteriana</i> was recorded within in an area within the adjacent BioBank site.	Some of the survey area includes the BCAA and the adjacent BioBank site. Additional surveys will be conducted to determine the presence of species credit species.

Report	Survey methods	Survey results	ELA outcomes
BES flora survey GIS data 2006a	GIS data has been provided for threatened flora survey locations and location of <i>Genoplesium baueri</i> records	32 <i>Genoplesium baueri</i> located within the BCAA	ELA will survey for orchids and determine the extent and size of the population of <i>Genoplesium baueri</i>
BES powerpoint presentation 2006b	<p>Vegetation plots and validation of vegetation communities</p> <p>Targeted threatened flora surveys:</p> <p><i>Cryptostylis hunteriana</i></p> <p><i>Genoplesium baueri</i></p> <p>Combination of random meander and targeted transects.</p> <p>Targeted threatened fauna surveys:</p> <p>Masked Owl, Powerful Owl</p> <p>Squirrel Glider, Yellow-bellied Glider, Koala</p> <p>Microbats</p> <p>Pygmy Possum, White-footed Dunnart, Southern Brown Bandicoot</p> <p>Surveys include trapping, HBTs marking, hair funnels, spotlighting, call playback.</p>	<p>Vegetation communities</p> <p>Seven vegetation communities mapped, plot number and location not supplied.</p> <p>Threatened flora 344.5 survey hours from 23 Dec 2005 to 21 Mar 2006</p> <p>245.5 survey hours or 440 fauna trap nights during 23 Jan 2006 to 6 May 2006</p>	<p>Vegetation communities were not mapped according to BVTs and stratified according to vegetation zones in accordance with BCAM.</p> <p>ELA will survey for orchids and determine the extent and size of the population of <i>Genoplesium baueri</i></p> <p>A number of these species are ecosystem credit species and do not require targeted surveys. ELA will conduct targeted surveys for species credit species in accordance with the BCAM guidelines.</p>
Alan Stephenson report 2015 (local orchid expert)	Brief site inspection of Jervis Bay BCAA area to identify habitat suitability for the following species; <i>Calochilus pulchellus</i> , <i>Genoplesium baueri</i> , <i>Pterostylis gibbosa</i> and <i>Cryptostylis hunteriana</i> .	Site inspection identified potential habitat for <i>Cryptostylis hunteriana</i> within the Culburra Beach and Kinghorn Point area only.	Other than <i>Genoplesium baueri</i> which is known to occur within the BCAA, it is unlikely that other threatened orchids will occur based on the survey and expert advice from other consultants. However, ELA will conduct opportunistic observations for threatened orchids during surveys and during targeted <i>Genoplesium baueri</i> surveys.
SCC Strategic Planer (Jessica Volkanovski) email correspondence (21 September 2016)	SCC and OEH reviewed ELAs list of candidate species and vegetation zones and proposed methodology for the entire Jervis Bay BCAA and provided additional feedback.	SCC and OEH identified White-footed Dunnart, Brush-tailed Phascogale, Eastern Pygmy-possum and Squirrel Glider require targeted surveys within the BCAA.	ELA updated its proposed candidate species list and survey design to include targeted surveys for these species according to SCC and OEH advice.

2.1.1.1 NSW BioNet Atlas and EPBC Protected Matters

In addition to the database searches of the *Atlas of NSW Wildlife* and *EPBC Protected Matters Search Tool* (DoEE 2019) undertaken by ELA, ELA performed more recent searches of these databases, and used the biocertification credit calculator version 1.9 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 2.1.3.1).

The results of these database searches are included in **Appendix D** and shown in Figure 8, Figure 9 and Figure 10.

2.1.2 Background

An assessment of the biodiversity values of the BCAA and broader area (including Lake Wollumboola BioBank Site) was conducted by BES Environmental Consultancy from December 2005 to May 2006 (BES 2006b). The survey methodologies undertaken by BES were not conducted specifically for assessment in accordance with the BCAM methodology. ELA reviewed GIS data supplied from BES (2006a) and documentation of their survey effort and results (BES 2006b). Table 4 contains a summary of these results. ELA reviewed this information to identify potential candidate target species prior to conducting field surveys within the BCAA.

A site inspection within the original larger Jervis Bay BCAA was conducted in 2015 by local orchid specialist, Alan Stephenson, to determine habitat suitability of the BCAA in providing habitat for *Calochilus pulchellus* and *Pterostylis gibbosa*. This information was used during a review of potential candidate species for further targeted surveys. Prior to implementation of ecological surveys, ELA prepared an inventory and proposed survey methodology of potential candidate species credit species which require targeted surveys. This list was sent to SCC and OEH for review. OEH and SCC conducted a site inspection with ELA on 9 September 2016, to discuss the vegetation mapping and biodiversity values present.

Building on the work undertaken by BES in 2006, the additional information collected by ELA between 2015 and 2017 was used to prepare this Biodiversity Certification Assessment Report (BAR).

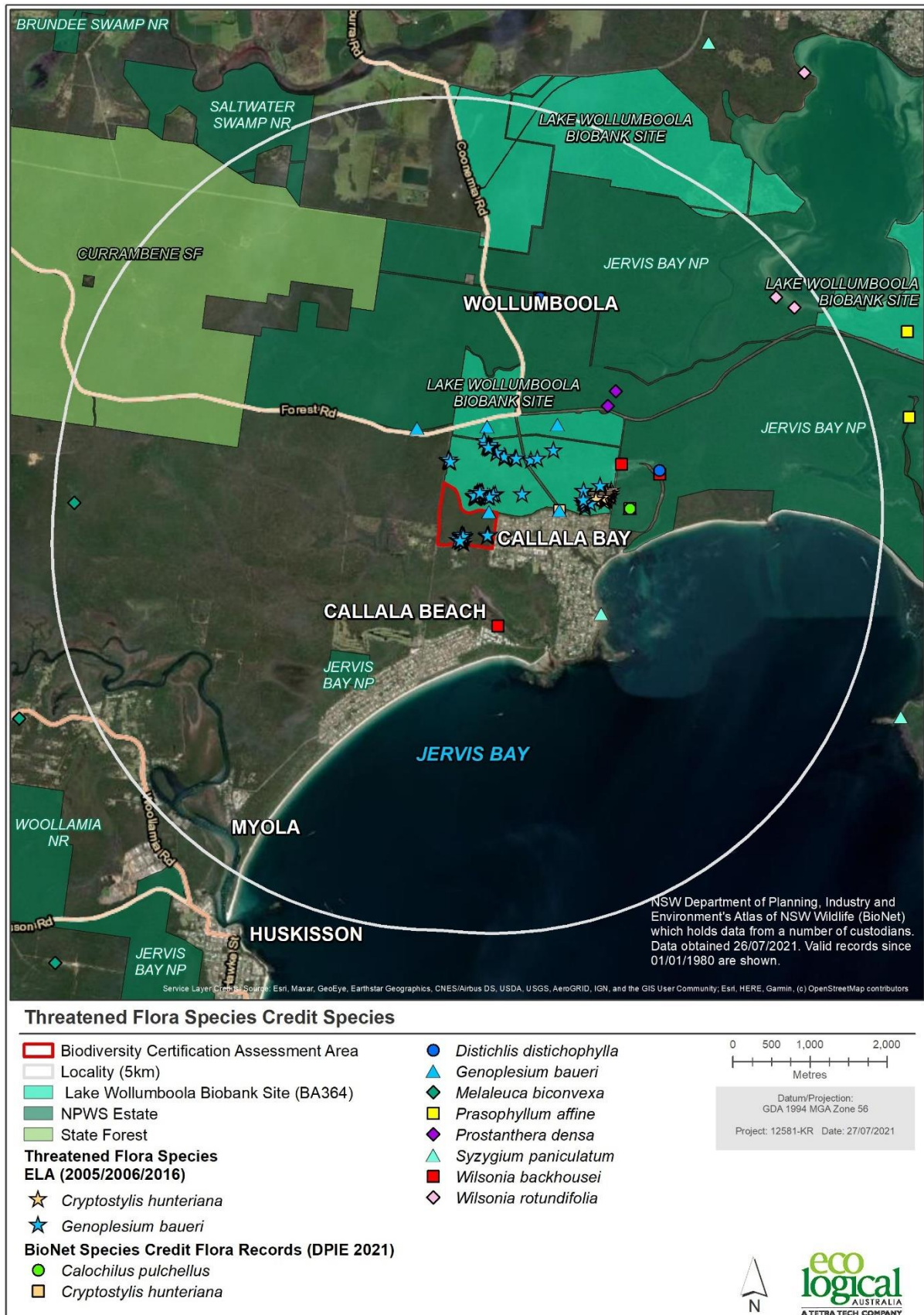


Figure 8: Threatened flora species credit records within 5 km radius of BCAA (Source: BioNet and ELA unpublished data)

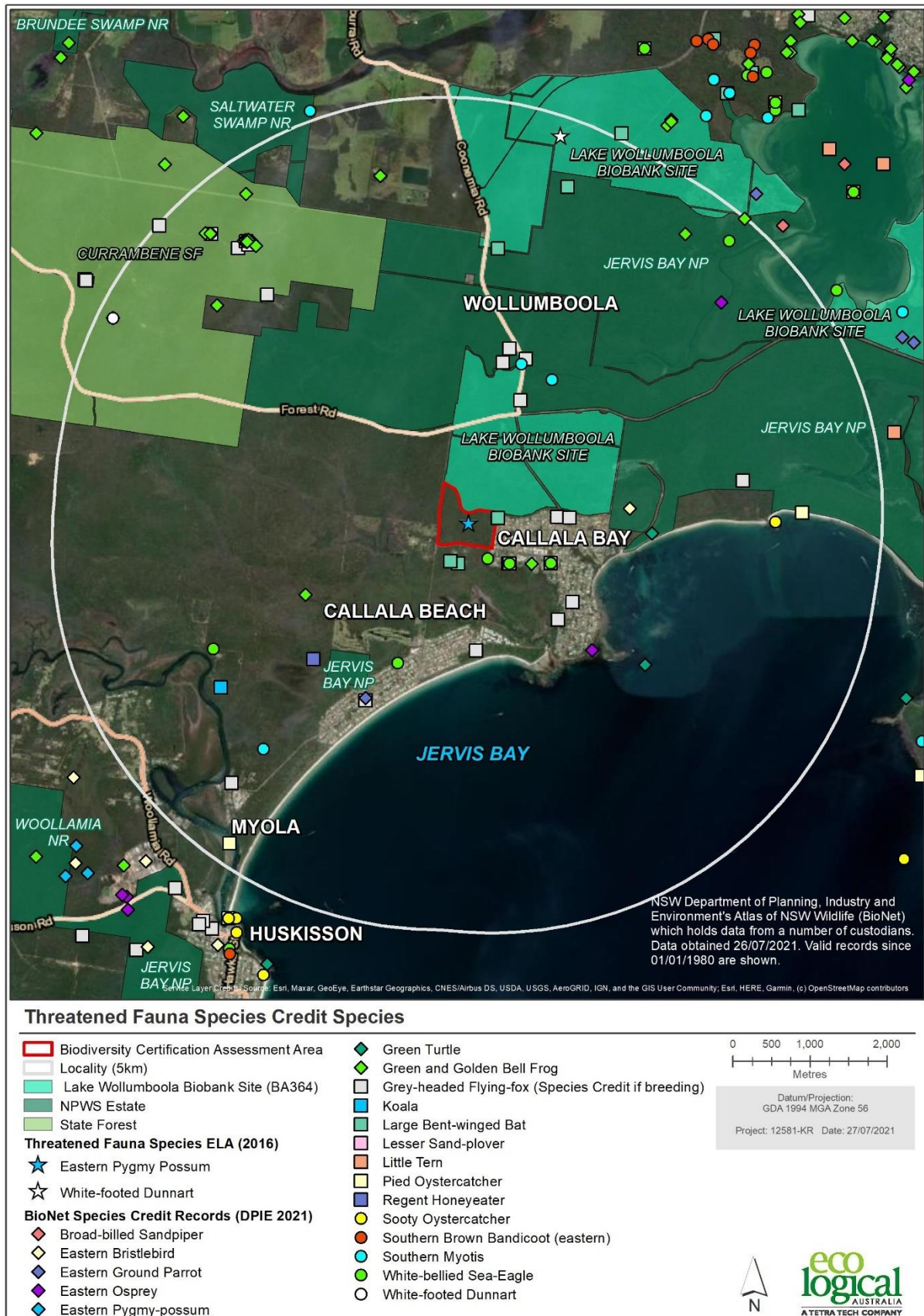


Figure 9: Threatened fauna species credit records within 5 km radius of BCAA (Source: BioNet and ELA unpublished data)

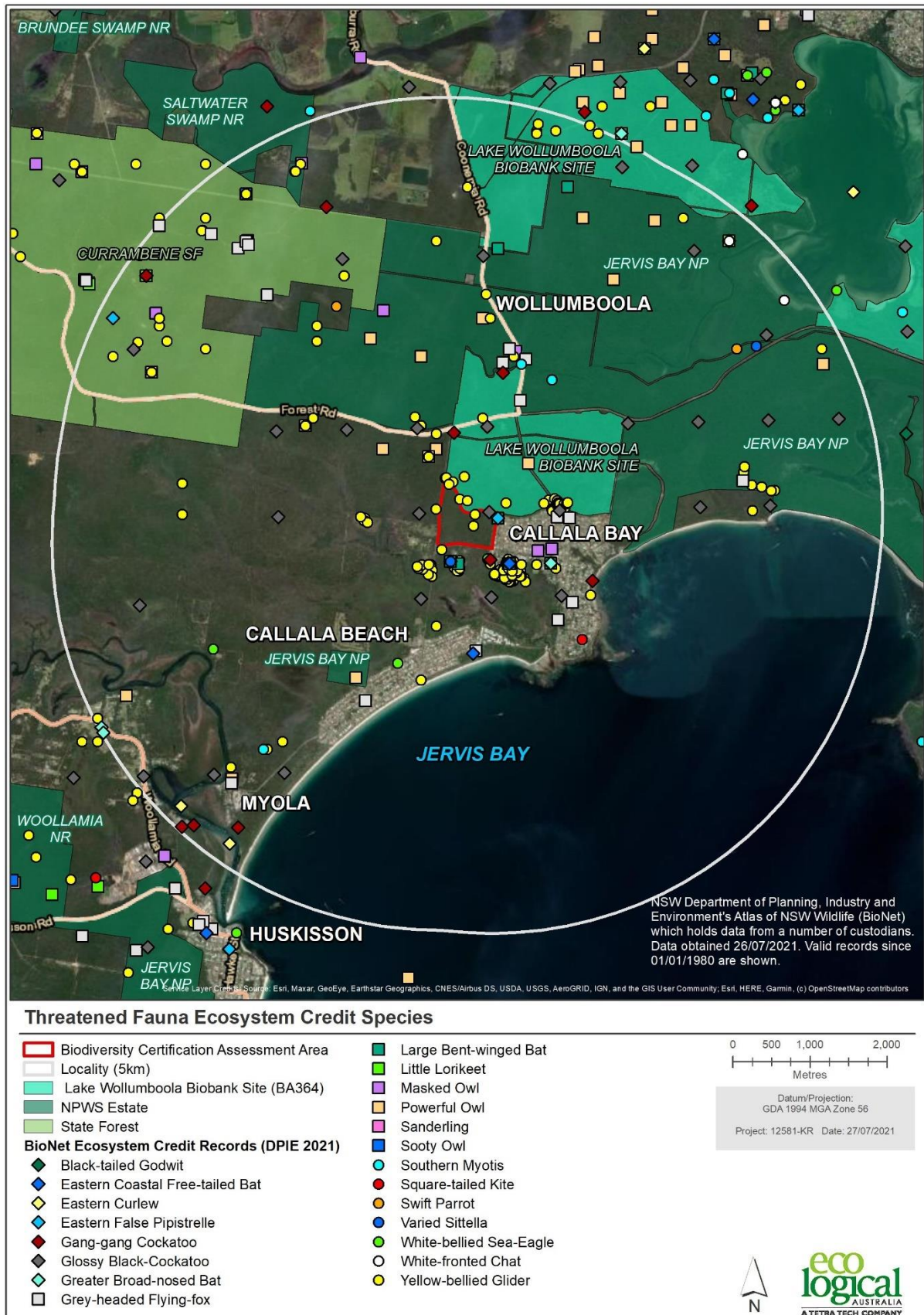


Figure 10: Threatened ecosystem credit fauna records within 5 km radius of BCAA (Source: BioNet and ELA unpublished data)

2.1.2.1 Vegetation Communities

During the desktop assessment, ELA identified two potential vegetation communities mapped within the BCAA based on the Southeast NSW Native Vegetation Classification and Mapping – SCIVI dataset (Tozer *et al.* 2010). These mapped communities are shown in Figure 11.

Undertaking a comparison of vegetation communities against BVTs for vegetation communities recorded by ELA (2016), the best fit BVTs present in the BCAA were correlated (Table 5). The results of the analysis identified two potential BVTs in the BCAA.

In 2017, BVT SR642 was not listed under the TSC Act in the BioNet Vegetation Classification. In 2019, the BioNet Vegetation Classification affiliates this community with '*River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*' EEC (TSC Act). It is noted that BVT SR642 was not found within the BCAA during field validation.

Table 5: Potential vegetation communities and equivalent Biometric vegetation types in the BCAA and relationship to threatened ecological communities

Vegetation community (Tozer <i>et al.</i> 2010)	Biometric vegetation type equivalent (OEH VIS)	TSC / EPBC Acts
Currambene-Batemans Lowlands Forest	SR592-Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	N/A
Murramarang-Bega Lowlands Forest	SR642- Spotted Gum - Grey Ironbark - Woollybutt grassy open forest on coastal flats, southern Sydney Basin Bioregion and South East Corner Bioregion	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community (TSC Act)

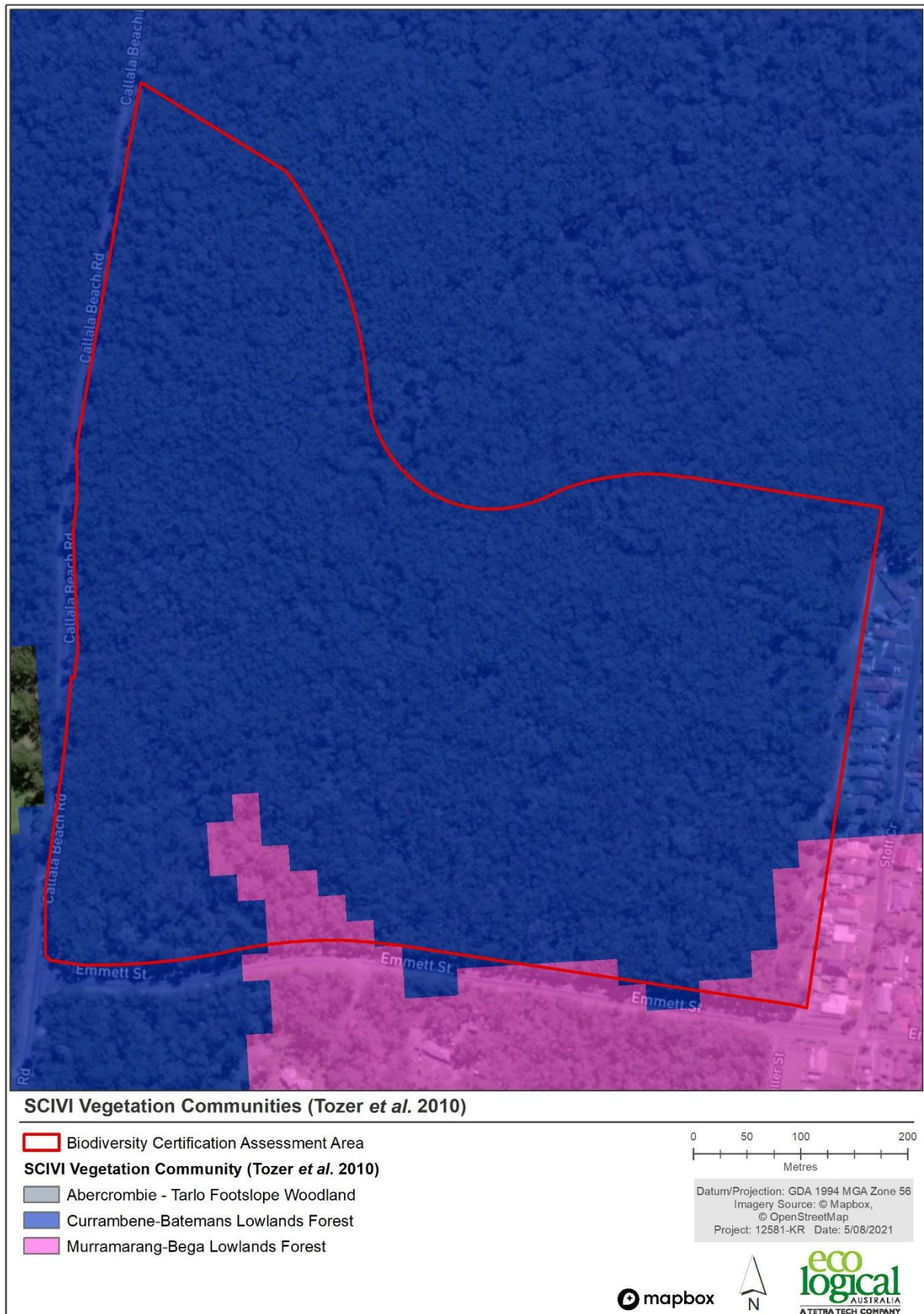


Figure 11: SCIVI Vegetation Communities (Tozer *et al.* 2010)

2.1.3 Determination of species credit species requiring survey

'Species credits' are the class of biodiversity credit created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. All threatened flora and approximately half to two thirds 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 that are classified as '*species credit*' species in accordance with the BCAM on the land that will be impacted by development. Alternatively, species credit species can be 'assumed' to be present.

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.

2.1.3.1 Step 1. – Identify candidate species for initial assessment

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

2.1.3.2 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 previous surveys of the BCAA (BES 2006), and additional database searches undertaken by ELA which included:

- An updated search of the BioNet Atlas of NSW Wildlife database to identify records of threatened flora and fauna species located within 5 km radius of the site.
- A search of the EPBC Act protected matters search tool website to generate a report to assist with determining whether matters of national environmental significance (MNES) were located within 5 km radius of the site.

2.1.3.3 Step 3. – Identify candidate species for further assessment

The list of candidate species was reviewed to identify only those species that required further assessment in the BCAA, based on the habitat assessment and surveys undertaken by BES in 2006. The species that were removed and a justification supporting the removal of these species from the candidate list are provided in Appendix D. Justifications supporting the decision not to further assess a species included:

- habitat within the BCAA did not represent suitable habitat for the species
- the BioNet records of the species were old/not recent.

The majority of species removed are flora species, for which the site is unlikely to provide suitable habitat. Nevertheless, the survey techniques and survey period over numerous years captured key survey timing for these flora species.

Additionally, a number of shorebirds bird species or species which require waterbodies were also eliminated from the list of candidate species as the BCAA does not contain any waterbodies (freshwater or marine). A comprehensive list of potential candidate species is provided in Appendix C.

The following species were removed from the list of candidate species to survey for the following reasons:

Cryptostylis hunteriana (Leafless Tongue Orchid)

- Intensive targeted surveys have been undertaken for this species by BES during 2005-2006 and did not record this species within the BCAA.
- Opportunistic observations for this species was undertaken during targeted surveys for other threatened species within the BCAA and it was not recorded.
- Based on intensive targeted surveys it was determined that this species is not considered a potential candidate species for surveys as part of the BAM.

Calochilus pulchellus (Pretty Beard Orchid) and *Pterostylis gibbosa* (Illawarra Greenhood)

- Site assessment and correspondence from a recognised local orchid expert (Alan Stephenson dated 20 November 2015) states that the BCAA does not contain habitat for *Calochilus pulchellus* or *Pterostylis gibbosa* and these species were not recorded during surveys of the BCAA.
- Therefore, no additional surveys were required for these species.

Myotis macropus (Southern Myotis) (breeding habitat)

- Targeted surveys were not conducted for this species as the BCAA did not contain any waterbodies (streams, lakes or reservoirs etc.) as defined under the BCAM, nor is the BCAA within 200 m of permanent waterbodies.
- Therefore, breeding habitat was not recorded within the BCAA and no additional surveys were required.

Isodon obesulus subsp. Obesulus (Southern Brown Bandicoot)

- ELA conducted targeted surveys (hair-tubes) for this species in suitable habitat within the Lake Wollumboola BioBank Site (Callala Bay) and did not record this species.
- Previous targeted surveys for this species conducted by BES 2005-2006 did not record this species.
- There are no BioNet records (historic or recent) for this species within a 5 km radius and the only recent records in NSW are located in northern Sydney and Eden areas.
- The BCAA does not support heath vegetation which is considered important habitat for this species.

Chalinolobus dwyeri (Large-eared Pied Bat)

- There are no habitat features as defined in the BAM for this species.

- This species was eliminated from the potential list of candidate species within the credit calculator as the BCAA and adjacent lands do not contain escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels.
- No additional consideration was required for this species.

Phascolarctos cinereus (Koala)

- Previous targeted surveys for this species conducted by BES 2005-2006 did not record this species within the BCAA.
- This species has been recorded from one BioNet record in 1995, approximately 3.5 km south-west of the BCAA which is likely to be a sub-adult male dispersing to new habitat.
- There are no other individuals or populations recorded from BioNet records or other database records within a 5 km radius of the BCAA.
- The BCAA does not contain any of the preferred primary feed trees; *Eucalyptus amplifolia*, *E. tereticornis* and *E. viminalis* (OEH 2019d).
- Based on literature, previous surveys and habitat assessment, it was determined that this species is unlikely to occur within the BCAA and should not be considered as a potential candidate species.

Anthochaera phrygia (Regent Honeyeater)

- Preferred habitat for this species is not present in the development site. Regent Honeyeater is typically associated with Box-Ironbark Woodland and riparian River Sheoak Forests.
- Only one BioNet record occurs for this species within a 5 km radius.
- The vegetation within the BCAA does not contain suitable habitat for this species due to the absence of preferred canopy species which are:
 - *Eucalyptus sideroxylon*
 - *Eucalyptus melliodora*
 - *Eucalyptus albens*
 - *Eucalyptus leucoxylon*
 - *Corymbia maculata*
 - *Eucalyptus robusta*
 - *Amyema cambagei*, *A. miquelii* and *Dendrothoe vitellina*
- Additionally, ELA conducted targeted surveys (Songmeters) for this species in suitable habitat within the Lake Wollumboola BioBank Site (Callala Bay) and did not record this species.

2.1.3.4 Steps 4 - Identify potential habitat for species requiring further assessment

Surveys were undertaken for a number of remaining threatened flora and fauna species from the candidate species list with potential to occur within the BCAA. Surveys were conducted in conjunction with targeted survey for the adjacent BioBank site (Lake Wollumboola Callala Bay). The flora and fauna survey methodology and techniques used are described in Section 2.1.4.

In summary, the candidate threatened species surveyed within the BCAA are provided below:

Threatened flora species:

- *Genoplesium baueri* (Bauer's Midge Orchid)
- *Melaleuca biconvexa* (Biconvex Paperbark)

Threatened fauna species

- *Cercartetus nanus* (Eastern Pygmy-possum)
- *Petaurus norfolcensis* (Squirrel Glider)
- *Phascogale tapoatafa* (Brush-tailed Phascogale)
- *Sminthopsis leucopus* (White-footed Dunnart).

Consultation with NSW Office of Environment (OEH) and Shoalhaven Council regarding the survey design and list of candidate species was conducted prior to initiating Step 4. During the consultation process, Council and OEH (30/11/2016) advised that pitfall trapping would be required to adequately survey for White-footed Dunnart. A combination of pitfalls, hairtubes and Elliot A traps were used to survey for White-footed Dunnart, with hairtubes and Elliot A traps used as supplementary measures.

Haliaeetus leucogaster (White-bellied Sea Eagle) was not originally listed under the TSC Act and was gazetted as a vulnerable species in December 2016. The species became a dual credit species, with breeding habitat identified as a species credit. The gazettal occurred after field survey planning and as such, targeted surveys were not specifically undertaken for the species. However, ELA are confident that the existing survey effort and any incidental sightings would have captured the presence of nests or breeding pairs, had they been present, within the BCAA.

2.1.3.5 Steps 5. – determine whether species is present

The results of the targeted species likelihood assessment are presented in **Appendix D**. The following candidate threatened flora species, *Genoplesium baueri* (Bauer's Midge Orchid) and threatened fauna species, *Cercartetus nanus* (Eastern Pygmy possum) were recorded by ELA (2016-2017) within the BCAA.

Field surveys did not detect White-footed Dunnart or Squirrel Glider within the BCAA or adjacent Lake Wollumboola BioBank Site (Callala Bay). Incidental sightings of the White-bellied Sea Eagle were recorded, however no nests or breeding pairs were observed. Although there is potential habitat for these species within the BCAA, it is considered that survey effort was adequate to detect breeding habitat for this species if it were present in the BCAA.

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

Impacts to three or more individuals of *Genoplesium baueri* are categorised as a 'red flag area' or 'area of high biodiversity conservation value' by the BCAM. The proposed development would impact one (1) *Genoplesium baueri* individual in the land proposed for certification. Impacts to one individual are below of the trigger for a red flag. The BCAM tool automatically flags the presence of a red flag species, however, the red flag status does not change in the tool even if the impacts are below the negligible loss threshold. Whilst the BCAM tool says the species is a red flag, the number of individuals impacted is less than three, thus the proposed development does not require consideration of *Genoplesium baueri* as a red flag species.

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

A 'species polygon' including known records and habitat for Eastern Pygmy-possum and *Genoplesium baueri* was identified and the number of species credits required was calculated. The 'species polygon'

includes all potential habitat for these species within the BCAA as determined by an expert report prepared by Brian Towle (EcoPlanning 2017). The species polygon for Eastern Pygmy-possum was determined by assessing whether the BVT in the BCAA was listed as an associated vegetation type for this species. The species polygon for *Genoplesium baueri* was determined by applying a 50 m buffer to individuals within the BCAA. No other areas were included in the species polygon as the expert report determined that there were no other suitable microhabitats for *Genoplesium baueri* throughout the BCAA.

2.1.4 Field assessment

Field assessments were designed to meet BCAM requirements for mapping and surveying BVTs and to gather data for use in both this biocertification assessment and the submitted BioBank site, while using existing data where relevant. Field assessment therefore focussed on mapping and surveying BVTs, collecting biometric plots and undertaking additional targeted survey for *Genoplesium baueri*, Eastern Pygmy-possum, White-footed Dunnart, Squirrel Glider and Brush-tailed Phascogale.

2.1.4.1 Vegetation communities and plots

Vegetation mapping identified at a desktop level from the southeast of NSW formed the Southeast NSW Native Vegetation Classification and Mapping – SCIVI dataset (Tozer *et al.* 2010), was used to help guide biometric vegetation type mapping within the BCAA. The desktop mapping was field validated using random meander, transects and biometric plot data which recorded dominant species in the canopy, midstorey and ground layers. Supplementary datasets such as contours, drainage layers and soil types were used to help delineate boundaries between vegetation communities.

Biometric plots were conducted over a period from April 2015 to February 2017 across the original Jervis Bay BCAA (Halloran Trust Planning Proposal area including Lake Wollumboola BioBank Site). A total of two biometric plots were collected within the BCAA by ELA botanists along with an additional plot from the adjacent Lake Wollumboola BioBank Site (Table 6).

Field survey was originally conducted over the larger Jervis Bay BCAA, with the minimum requirement of plots spread across both Callala Bay and Culburra Beach. However, the split of Jervis Bay BCAA into two separate BCAAs (after the completion of field survey), has resulted in the count for the minimum number of plots to no longer satisfy the minimum required when calculated for each separate assessment area. Given the large number of total plots collected over the original Jervis Bay BCAA, including the Lake Wollumboola BioBank Site, quantitative data collected concludes that the 2 plots located within the BCAA are an accurate representation of the vegetation zone. Nonetheless, to take a precautionary approach, data from the closest plot located within the same contiguous vegetation zone of the adjoining Lake Wollumboola BioBank Site was included into the credit calculations.

BVTs (Figure 12) were assigned based on a quantitative comparison of the vegetation descriptions, characteristic species in the upper, mid and ground structural layers, vegetation structure, soils, landform and other relevant data contained within the VIS Classification database (OEH 2019c).

Based on the area and number of vegetation zones, the BCAM requires a minimum of 3 Biometric plots/transects (DECCW 2011 Table 11). The field survey targeted locations that were considered likely to be representative of the mapped BVTs in their various condition states. The BCAM allows for survey of BVTs to occur at any time of year (other than to determine whether a BVT is in moderate to good or

low condition), and as such, survey timing was appropriate and was in accordance with the methodology.

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

Veg zone ID	BioMetric vegetation type	Condition	Ancillary code	Area (ha)	Plots required (BCAM)	Plots completed
1	SR592-Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Moderate to Good - Medium	Logged/advanced regrowth with scattered old-growth trees	38.09	3	3*

*ONE PLOT FROM THE ADJOINING LAKE WOLLUMBOOLA BIOBANK SITE (BA364) HAS BEEN USED FOR CREDIT CALCULATIONS TO MEET MINIMUM REQUIREMENTS

The final mapped BVTs and zones, together with the location of plots are shown in Figure 13 together with a cumulative survey effort map for threatened flora that includes lands adjacent to the BCAA (Figure 14).

2.1.4.2 Threatened flora

Targeted surveys for threatened flora species within the BCAA was conducted to cover the survey period identified for each candidate species. The BCAA area was surveyed concurrently with the Lake Wollumboola BioBank Site (Callala Bay). As a result, the following survey effort in Table 7 relates to the combined BCAA and Lake Wollumboola BioBank Site surveys. ELA has utilised data collected from BES Environmental Consultancy from 2005-2006 and ELA's targeted surveys from 2016.

A combination of transects and random meander were undertaken over approximately 505.5 person hours of survey.

Targeted surveys for threatened orchids were undertaken using random meander for *Genoplesium baueri* (Brittle Midge Orchid) and *Cryptostylis hunteriana* (Leafless Tongue Orchid). Additional surveys for *Cryptostylis hunteriana* was not required by ELA during the 2016 surveys as this species was not recorded within the impacted BCAA and only within the Lake Wollumboola BioBank Site.

Intensive survey traverses were conducted for *Genoplesium baueri* over the southern portion of the site in May 2006, and 46 random surveys were conducted within a 100 m radius using random meander throughout the BCAA in May 2006 by BES. Of the 46 random surveys, seven were conducted within the BCAA. Additional surveys were conducted by ELA from 16 to 18 February 2016, within potential habitat adjacent to existing tracks, over three survey days across the BCAA and Lake Wollumboola BioBank Site.

Table 7: Flora survey effort over the BCAA and Lake Wollumboola BioBank Site (Callala)

Consultant	Species	Method	Dates	Effort
Gunninah Environmental Consultants	All flora species	Random meander and mapping of vegetation communities	24 Nov 1998 21 July 1999 18-30 March 2000	TOTAL 94 person hours

Consultant	Species	Method	Dates	Effort
Gunninah Environmental Consultants	<i>Prasophyllum affine</i> and <i>Cryptostylis hunteriana</i>	Targeted surveys in potential habitat which was located outside of the BCAA	21 Dec 2000	Unknown hours
BES	All flora species	Random meander and vegetation plots	23 Jan 2006	8 person hours
			2 Feb 2006	8 person hours
			16 Feb 2006	8.5 person hours
				TOTAL 24.5 hrs
BES	<i>Cryptostylis hunteriana</i>	Targeted orchid survey	23 Dec 2005	40 person hours
			29 Dec 2005	35 person hours
			30 Dec 2005	35 person hours
				TOTAL 110 hrs
BES	<i>Genoplesium baueri</i>	Targeted orchid survey	22 Feb 2006	22 person hours
			23 Feb 2006	26 person hours
			6 Mar 2006	30 person hours
			9 Mar 2006	34 person hours
			17 Mar 2006	34 person hours
			21 Mar 2006	32 person hours
				32 person hours
				TOTAL 210
ELA	<i>Genoplesium baueri</i>	Target orchid survey	16 - 18 Feb 2016	66 person hours
			GRAND TOTAL	505.5 person hrs

2.1.4.3 Threatened fauna

The survey method is generally derived from the *Threatened Species Survey and Assessment Guidelines* (DEC 2004) and EPBC Act guidelines. Surveys were conducted by ELA over several months from 7th December 2016 to 10th February 2017.

When targeted fauna surveys were initially conducted by ELA, the surveys for both the BCAA impact area and the Lake Wollumboola BioBank Site (Callala Bay) were conducted simultaneously. Since the completion of the targeted surveys, the BCAA boundary has changed so that the BCAA (i.e. impact area) has reduced and the BioBank site has increased in area. Although this means a greater conservation area, the changes have impacted the targeted survey effort within the BCAA. As a result, the following survey includes the BCAA targeted fauna species survey effort and the adjacent BioBank site.

Details of the survey method and locations are provided below and are summarised in Table 8 and Figure 15.

2.1.4.3.1 Nest boxes

Twenty-five (25) nest boxes were deployed between 9 December 2016 – 8 February 2017 (62 nights; a total of 1550 nest box trapping nights). Nest boxes were deployed in potential habitat for target species. Nest boxes were inspected for fauna at 2 weekly intervals (i.e. week 2, 4, 6, and 8). No nest boxes were deployed within the BCAA as other targeted methodologies were utilised.

2.1.4.3.2 Elliot B traps (arboreal)

Three (3) sites with eight Elliot B traps were set within potential habitat for target species. Each trap site was set in a line, with traps spaced approximately 20 m apart. Elliot B traps were deployed from 12 to 16 December 2016 (4 nights; total of 96 Elliot B trapping nights). Traps were set approximately 2 - 3 m up a tree, attached to a wooden stage drilled to the tree trunk. Traps were baited with a mixture of peanut butter, honey, oats, and sardines, and included insulation. Traps were covered with a plastic bag in the event of rain.

2.1.4.3.3 Remote camera traps (arboreal)

Infrared remote cameras were used in conjunction with bait stations to identify arboreal fauna species. Eighteen (18) cameras were placed approximately 1 - 2 m off the ground and secured to a tree. Bait stations were secured to an opposing tree at an approximate height of 1.5 – 2 m. Bait consisted of honey, peanut butter, oats, and sardines. Cameras were dispersed throughout potential habitat for target species.

Remote cameras were left in-situ from 9 December 2016 to 8 February 2017 (58 nights), equating to a total of 1,008 camera nights.

2.1.4.3.4 Pitfall traps

One 200 m transect of 15 traps each (five clusters / groups of three traps, each cluster spaced 50 m apart) were set within potential habitat for *Sminthopsis leucopus* (White-footed Dunnart).

Trapping was conducted over three sessions (11 nights total; a total of 165 pitfall trapping nights):

- 12 - 16 December 2016 (4 nights),
- 10 -14 January 2017 (4 nights),
- 6 - 10 February 2017 (4 nights)*.

During trapping, pitfalls contained a thin layer of leaf litter to provide shelter to trapped fauna. Pitfalls contained a small block of foam to ensure fauna could float in the event of rain. A small hole was drilled in the base of each pitfall trap to allow water to drain out in the event of rain. Each cluster of pitfalls included a drift fence approximately 30 – 40 cm high, dug into a trench, which passed over each pitfall trap. Drift-fences were maintained throughout the survey, as some were infrequently impacted by weather and cattle. Pitfall traps were closed between trapping sessions.

*Traps were closed on 7 February 2017 due to heavy rainfall.

2.1.4.3.5 Elliot A traps

A combination of Elliot A traps and hair tubes (see next section below) were used in addition to pitfall trapping, to target White-footed Dunnart and Eastern Pygmy-possum.

Two (2) sites of 15 Elliot A traps were set within potential habitat for the White-footed Dunnart (a total of 30 traps). Each trap site was set in a grid formation (4x5), with traps approximately 10 m apart. Elliot A traps were deployed from 12 to 16 December 2016 (4 nights; total of 120 Elliot A trapping nights). Traps were set on flat ground adjacent to fallen logs, large tree trunks, or beneath dense vegetation. Traps were baited with a mixture of peanut butter, honey, oats, and sardines, and included insulation. Traps were covered with a plastic bag in the event of rain.

2.1.4.3.6 Hair tube

Two (2) sites of 15 hair tubes were set within potential habitat for *Sminthopsis leucopus* (White-footed Dunnart) (a total of 30 hair tubes). Each hair tube was placed within 5 m of an Elliot A trap (Table 8). Hair tubes were deployed from 9 December 2016 to 8 February 2017 (62 nights; total of 1860 hair tube trapping nights). The hair samples were analysed by Georgiana Storey ('Scats About', ANU).

2.1.4.3.7 Remote camera traps (terrestrial)

Infrared remote cameras were used in conjunction with bait stations to identify terrestrial fauna species. Five (5) cameras were secured approximately 1 m up a tree and angled towards the ground, where a bait station was deployed, it was secured to the ground by a tent peg. Bait consisted of honey, peanut butter, oats, and sardines. Cameras were dispersed throughout potential habitat for target species.

Remote cameras were left in-situ from 9 December 2016 to 8 February 2017 (56 nights), equating to a total of 280 camera nights.

2.1.4.3.8 Call playback

The vocalisations of *Petaurus norfolcensis* (Squirrel Glider) were broadcast using a loudhailer from two different locations within the BCAA and one location within the BioBank site.

The call was played for a minimum of five minutes followed by five minutes quiet listening and then repeated. Spotlighting was conducted following call playback. Surveys were undertaken on 7 December 2016 and 10 January 2017 within the BCAA and 10 January and 12 February 2017 within the Lake Wollumboola BioBank Site.

2.1.4.3.9 Spotlight survey

Spotlighting survey was conducted after each broadcast within the BCAA on 7 December 2016 and 10 January 2017. Additional surveys were conducted within the adjacent Lake Wollumboola BioBank Site on 10 January and 12 February 2017 for approximately 2 person hours.

A total of approximately 8 person hours were spent spotlighting. Hand held spotlights and head torches were used during the survey.

2.1.4.3.10 Songmeters

Targeted bird surveys were not conducted within the BCAA as it did not contain suitable habitat for candidate or EPBC listed bird species. However, suitable habitat for threatened bird species was recorded within the adjacent Lake Wollumboola BioBank Site and required targeted surveys.

A total of three (3) songmeters were deployed from 9 to 23 December 2016 within the Lake Wollumboola BioBank Site. Songmeters were set to record between dawn and dusk. Two songmeters were located within potential habitat for heath-specific bird species (i.e. *Dasyornis brachypterus* Eastern Bristlebird). Three (3) hours were selected at random and analysed to identify heath bird calls. One songmeter was located in the BioBank site boundary near a waterway and was used to record possible migratory wetland bird species. Two (2) hours were selected at random from the wetland/migratory species to identify bird calls.

Opportunistic bird observations were also recorded when conducting fieldwork. Birds were identified based on either direct observation or knowledge of calls.

Table 8: Summary of survey effort for fauna candidate species

Survey method	Target species		Effort		Dates	Total hours	person
			BCAA	Lake Wollumboola BioBank Site			
Arboreal mammals							
Nest boxes	EPP		N/A	A total of 25 nest boxes located in good habitat. Inspected at 2 weeks, 4 weeks, 6 weeks and 8 weeks	9 December 2016 8 February 2017 (62 nights)	– 1550	Nest box trapping nights
Elliot (arboreal)	Bs	EPP, SG, BTP	8 Elliot Bs arboreal traps 4 nights duration	Two sites of 8 Elliot Bs arboreal traps (16 traps) Set 2-3 m up in a tree. 4 nights duration	12 December 2016 16 December 2016 (4 nights)	– 96	trapping nights
Remote camera (arboreal)		SG, BTP, EPP	7 cameras set for 8 weeks (tree cameras)	11 tree cameras set for 8 weeks (terrestrial cameras in section below)	9 December 2016 8 February 2017 (56 nights)	– 1008	Remote Camera trapping nights
Call playback		SQ	Call playback SQ at two separate locations over three nights for 5 mins listening and 5 min calling and repeat	Call playback SQ and spotlighting over 2 separate nights at two locations x 1 hr each (2 hrs total)	7 December 2016, 10, 13 and 29 January 2017 (4 nights)	8	spotlight person hours
Spotlighting concurrently with call playback above		Nocturnal birds and mammals	Followed from call playback and spotlighting over 2 separate nights, 1 hr each (2 hrs total)	as above	as above		as above
Ground dwelling mammals							
Elliot terrestrial	A's	EPP, WFD	N/A	Two sites of 15 Elliot A's (30 traps in total).	12 – 16 December 2016 (4 nights duration)	120	trap nights
Hair tubes		EPP, WFD	N/A	Hair tubes: Two sites of 15 hair tubes (30 hair tubes in total) located adjacent to each Elliot A (with Elliot as above)	9 December 2016 8 February 2017 (62 nights)	- 1860	Hair tube trapping nights
Pitfall traps		EPP, WFD	A 200 m transect of 15 traps located in 5 clusters of three traps at 50 m	N/A	Three sessions: • 12 - 16 December 2016 (4 nights),	165	trapping nights

Survey method	Target species	Effort		Dates	Total hours	person
		BCAA	Lake Wollumboola BioBank Site			
		internals conducted at 3 separate sessions		<ul style="list-style-type: none"> 10 -14 January 2017 (4 nights), 6 - 10 February 2017 (4 nights). 		
Remote camera (terrestrial)	EPP	Nil	3 ground cameras set for 8 weeks	9 December 2016 – 8 February 2017 (56 nights)	168	Remote Camera trapping nights
Birds						
Songmeters	Ground Parrot Eastern Bristlebird Bitterns, Curlews	N/A	3 Songmeters (two in heath vegetation)	9 to 23 December 2016	45	songmeter nights

Key: EPP = Eastern Pygmy-possum, WFD = White-footed Dunnart, BTP = Brush-tailed Phascogale, SG = Squirrel Glider, SQ = Spotted-tailed Quoll



Figure 12: Validated Biometric vegetation type in BCAA



Figure 13: Validated vegetation zones and location of plots used in credit calculations

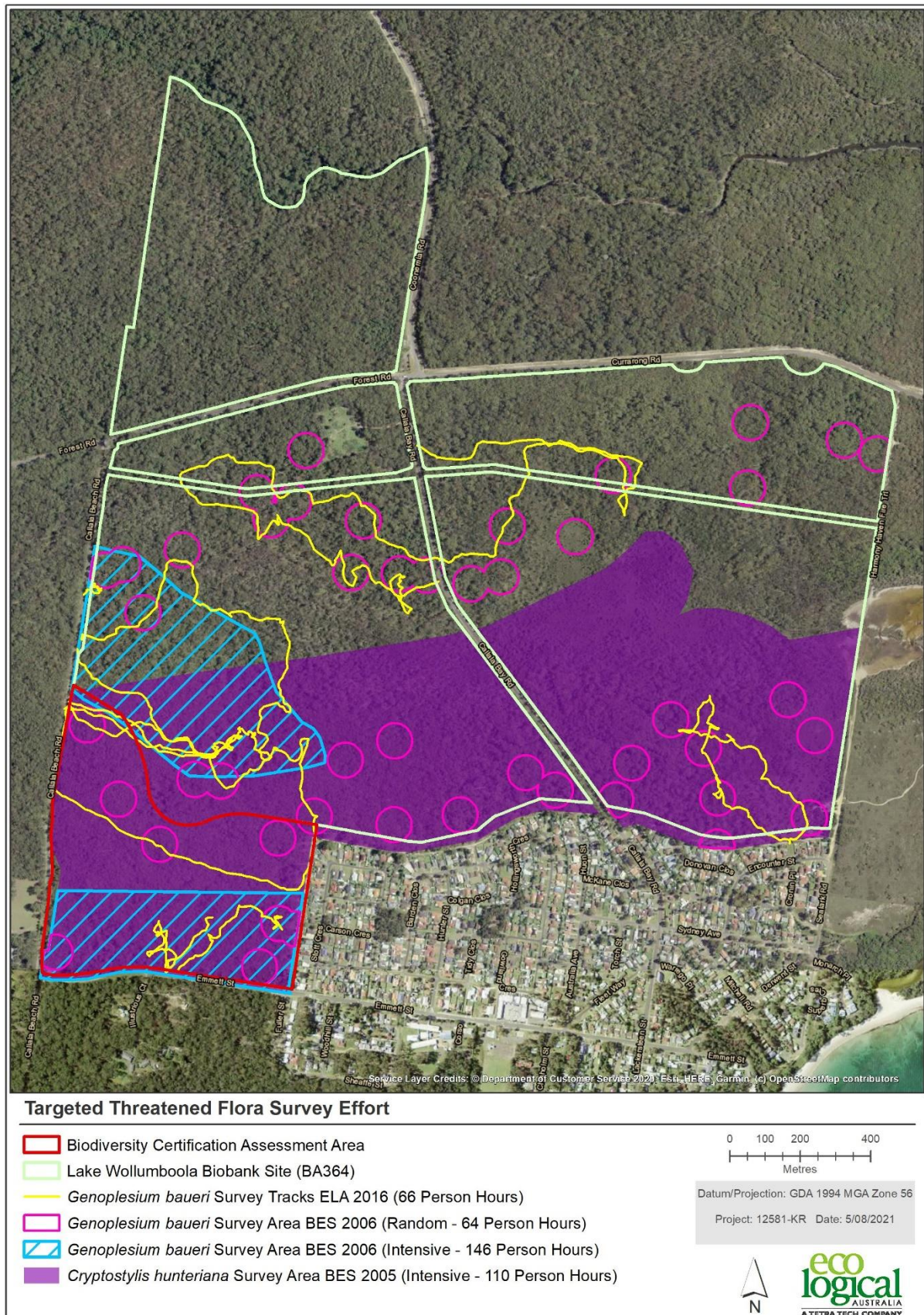


Figure 14: Targeted threatened flora survey effort

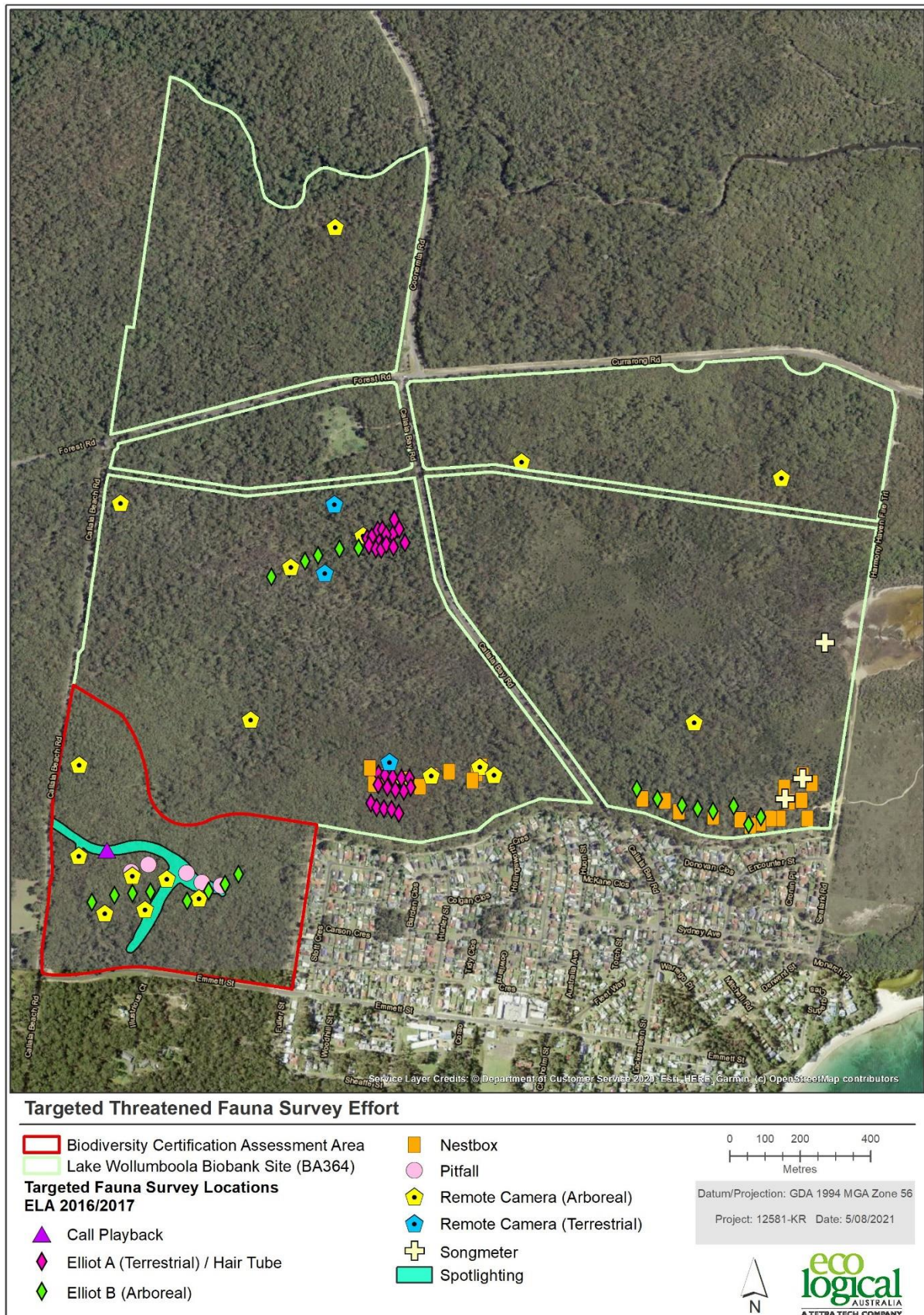


Figure 15: Targeted threatened fauna survey effort

2.2 Results

2.2.1 Vegetation types and condition

Field survey confirmed one BVT, SR592 '*Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion*' in the BCAA. The vegetation within the BCAA was considered ecotonal, however was best fit to the one BVT. As the condition of the BVT was considered homogeneous throughout the BCAA, only one 'vegetation zone' was assigned to this BVT. The BVT was considered in good condition and is not listed under the TSC or EPBC Act.

BVT SR642 '*Spotted Gum - Grey Ironbark - Woollybutt grassy open forest on coastal flats, southern Sydney Basin Bioregion and South East Corner Bioregion*' as mapped in the SCIVI dataset (Tozer *et al.* 2010), was not found to occur within the BCAA.

The full profile for BVT SR592 is provided below.

BVT	SR592-Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion
PCT Code	1079
Hectares	40.19
% cleared (VIS)	45% in Southern Rivers CMA
SCIVI	Currambene-Batemans Lowlands Forest.
Description	<p>Currambene-Batemans Lowlands Forest dominates the assessment area, and the Jervis Bay hinterland generally. The community is characterised by a very diverse suite of canopy species, and also a diverse but generally dry sclerophyll aligned shrub layer.</p> <p>The Currambene-Batemans Lowlands Forest within the assessment area is characteristically variable floristically. In places, the canopy is dominated, sometimes completely, by a single eucalypt species, generally <i>Eucalyptus pilularis</i> or <i>Eucalyptus sclerophylla</i>, although it is often a mix of up to six or eight eucalypt species. The canopy was comprised of <i>Corymbia gummifera</i>, <i>Eucalyptus globoidea</i>, <i>Eucalyptus longifolia</i>, <i>Eucalyptus punctata</i> and <i>Eucalyptus sclerophylla</i>. The midstorey was comprised of <i>Allocasuarina littoralis</i>, <i>Leucopogon juniperinus</i>, <i>Callistemon linearis</i>, <i>Kunzea ambigua</i>, <i>Leptospermum continentale</i>, <i>Leptospermum trinervium</i> and <i>Melaleuca decora</i>. The groundcover was diverse and consisted of sedges, forbs, ferns and grasses. The community was dominated by native species in each structural layer and the presence of exotic species was low.</p> <p>Given the low relief within the site, there is often a broad ecotone between the community and adjoining communities, particularly Coastal Sand Forest, Coastal Sand Swamp Forest, and Shoalhaven Sandstone Forest. Within the site the community has been cleared and/or logged historically in most areas, however, old growth and hollow-bearing trees are scattered throughout. At Copper Cup Point the community has been converted into grazing pastures.</p>
EEC	No



Photo 1: Currumbene-Batemans Lowlands Forest dominates the site. It is highly variable floristically and to a lesser extent structurally.



Photo 2: The Currumbene-Batemans Lowlands Forest within the site is sometimes dominated by *Eucalyptus sclerophylla* and *Corymbia gummifera* with a dense subcanopy of *Allocasuarina littoralis* and an understorey and groundcover of heathy shrubs, forbs and graminoids.

2.2.2 Flora species

A total of 92 flora species were recorded in the biometric plots used for this assessment and adjacent lands, of which, one is a threatened flora species. *Genoplesium baueri* was recorded within the BCAA (see section below). A full list of species recorded in plots is provided in Appendix E.

2.2.2.1 Threatened flora species

One threatened flora species was recorded within the BCAA by ELA during field survey in 2016. *Genoplesium baueri* (Bauer's Midge Orchid) was initially identified within the BCAA by BES in 2006 and a total of 32 individuals were recorded. Surveys undertaken by ELA in 2016 were conducted to confirm its continued presence and recorded 36 individuals. A species polygon was prepared for *Genoplesium baueri* (Figure 16).

2.2.3 Fauna species

A total of 19 fauna species from four fauna guilds were recorded by ELA during targeted surveys or opportunistically. The majority of the species were recorded during pitfall traps which included ground mammals, reptiles and amphibians. A full list of species recorded is provided in Appendix F.

2.2.3.1 Threatened fauna species

One (1) candidate threatened fauna species was detected within the BCAA:

- *Cercartetus nanus* (Eastern Pygmy-possum).

The Eastern Pygmy-possum is a species credit species. Habitat mapping in the form of a species polygon has been defined for this species and shown together with the location of the ELA record within the BCAA (Figure 17). The entire BCAA represents potential breeding and foraging habitat for this species. Breeding habitat includes small tree hollows, fallen logs and stumps. However, they may also choose to roost in bird/possum nests and dense vegetation. Foraging resources includes flowering/nectar producing plants, usually *Myrtaceae* (often *Banksia ericifolia* is important) and occasionally invertebrates.

Opportunistic observations of the following EPBC listed and threatened species under the TSC Act (ecosystem species) were also noted during surveys:

- *Callocephalon fimbriatum* (Gang-gang cockatoo) – vulnerable under the TSC Act
- *Calyptorhynchus lathamii* (Glossy Black-Cockatoo) - vulnerable under the TSC Act
- *Petaurus australis* (Yellow-bellied Glider) – vulnerable under the TSC Act
- *Petauroides volans* (Greater Glider) – vulnerable under the EPBC Act
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle) – vulnerable under the TSC Act and marine under the EPBC Act.



Figure 16: *Genoplesium baueri* Species Polygon



Figure 17: Eastern Pygmy Possum Species Polygon

2.2.4 Red Flags

A red flag area is an area regarded as having high biodiversity conservation values. An area is regarded as a red flag area if it contains one or more of the following:

- a vegetation type that is greater than 70% cleared in the CMA area and is not in 'low' condition
- a critically endangered or endangered ecological community
- One or more threatened species identified in the Threatened Species Profile Database (TSPD) that cannot withstand loss in the CMA area because the species is
 - Naturally very rare, is critically endangered, has few populations or a restricted distribution
 - The species or its habitat are poorly known
- Areas of vegetation recognised as having regional or state biodiversity significance. These areas include:
 - Land that is mapped or defined as a state or regional biodiversity link in accordance with section 3.7.2 of the BCAM
 - a riparian buffer 40m either side of a major river on the coast and tablelands
 - a riparian buffer 30m either side of a minor river or major creek on the coast and tablelands
 - a riparian buffer 20m either side of a minor creek on the coast and tablelands
 - areas listed as a SEPP14 wetland.

A Vegetation type that is greater than 70% cleared as listed in the Vegetation Types Database, and the vegetation is not in low condition.

There were no vegetation types that are greater than 70% cleared and in moderate to good condition within the BCAA.

One or more threatened species identified in the Threatened Species Profile Database that cannot withstand further loss in the CMA area.

Genoplesium baueri (Bauer's Midge Orchid) is identified in the TSPD as a red flag threatened species that cannot withstand further loss in the CMA area, when 3 or more individuals are impacted. There were 36 individuals of *Genoplesium baueri* recorded within the BCAA in 2016 (Figure 18) and only one is proposed to be affected. Therefore, as the number affected is below the number that cannot withstand further loss (less than three individuals impacted), *Genoplesium baueri* is not considered a red flag area.

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

There were no red flag vegetation types or other areas recognised as having regional or state biodiversity conservation significance in the BCAA.



Figure 18: Red flag threatened species within the BCAA

3. More Appropriate Local Data used 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 2011a). 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 values. 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 Types Database held by the OEH. A range of quantitative measures that represent the benchmark conditions for vegetation types are contained within the Vegetation Benchmark Database, also held by the OEH. The Vegetation Benchmark Database is organised by CMA, 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.

There were no amendments made to the default data sets for this application.

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 5 and is comprised of:

- Lands proposed for biodiversity certification – impacts to native vegetation and threatened species habitat in these areas ‘requires’ biodiversity credits
- Retained land – part of a bushland park reserve comprising a minimum 2.1 ha in size (50m buffer on mapped *Genoplesium* records), strategically located to facilitate the retention of 35 *Genoplesium baueri*.

The BCAA is 40.19 ha in area, of which the footprint proposed for biocertification covers an area of 38.09 ha and 2.10 ha is retained land (Table 9). The entire area is comprised of native vegetation as defined by the BCAM.

Table 9: Land use breakdown

Development footprint	Area (ha)	% of BCAA	Area of native vegetation (ha)	% of native vegetation
Land proposed for Biodiversity Certification (Development)	38.09	94.77	38.09	100
Land proposed for retention (bushland park)	2.1	5.23	2.1	100

4.2 Vegetation mapping and zones

As outlined in Section 2.2.1, one BVT was identified in the BCAA (Figure 12 and Table 10). There was 40.19 ha of vegetation mapped in total, of which all comprised ‘*Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion*’.

Table 10: Area of vegetation within the BCAA

Biometric vegetation type	Vegetation formation	% cleared	Area (ha)
SR592-Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Wet sclerophyll forest	30	40.19

The one vegetation type present in the BCAA formed one vegetation zone for this assessment (Figure 13 and Table 11). The vegetation zone was mapped as being in ‘moderate to good’ condition.

Table 11: Area of vegetation zones assessed within the BCAA

Veg zone ID	Biometric vegetation type	Condition ¹	Ancillary code	Land proposed for biodiversity certification Area (ha)
1	SR592-Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Moderate to Good - Medium	Logged/advanced regrowth with scattered old-growth trees	38.09

¹ CONDITION AS DEFINED BY THE BCAM

4.3 Transects/plot data and site value scores

Appendix 3 of the BCAM defines the minimum number of transects/plots required per vegetation zone area (DECCW 2011). Data from a total of two BioMetric vegetation transects/plots were collected across the BCAA, with a transect/plot requirement of three transects/plots. Data for one transect/plot, located in the same contiguous vegetation zone from the adjoining Lake Wollumboola BioBank Site was used to ensure that the condition of the vegetation zone was sufficiently represented (note the site value score calculated did not change with use of additional plot) (2.1.2.1). The collected transect/plot data is provided in Appendix G.

Current site value and future site value scores were calculated for the vegetation zone using the transect/plot data collected. The BCAM credit calculator was used to produce the current and future site value scores for the development areas (Table 12).

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 (after Development)
1	SR592-Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Logged/advanced regrowth with scattered old-growth trees	84	0

4.4 Landscape score

The BCAM credit calculator calculated a landscape value score of **16** for the land to be certified. As there will be no on-site conservation measures (the proposed conservation measure is the retirement of credits from an off-site BioBank site), a score of **0** has been calculated 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 each landscape attribute for 'land to be certified' and 'land subject to conservation measures', as well as an explanation of how the scores were determined, are provided in the sub sections below.

4.4.1 Percent native vegetation cover score

The percent native vegetation cover calculation was completed within a single 500 ha circle. 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 Figure 19.

A pre-certification score of **10** was determined with 401 ha ($401/500 = 80\%$) native vegetation mapped within the 71-80% native vegetation cover class. Vegetation clearance would result in 362.93 ha of vegetation cover (72.6 %) remaining in the assessment circle. The post certification score is also **10** because vegetation cover falls within the same 10% increment (71-80%). Therefore, the change in percent native vegetation cover score for loss is **0** after conferral of biodiversity certification.

Table 13: Native vegetation cover in assessment circle

Circle	Pre-certification			Post-certification		
	Area of vegetation within assessment circle (ha)	Native vegetation cover class (%)	Score	Area of vegetation within assessment circle (ha)	Native vegetation cover class (%)	Score
1 (500 ha)	401.02	80%	10	362.93	72.6 %	10

The land subject to conservation measures (post-biodiversity certification) is 0 ha. Therefore (using Table 3 of the BCAM) a gain of **0** is recorded 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.

Patches of vegetation that conform to the criteria of a 'local biodiversity link' (moderate to good condition, has a patch size >1 ha which is separated by <30 m), occur on land to be developed (Figure 20). According to Table 4 of the BCAM the score for a local biodiversity link is **6**. As a local biodiversity link is located on land proposed for biodiversity certification and will be impacted it was allocated a score of zero after development (Table 14). As there are no on-site conservation measures, a score of **0** was allocated in the calculator.

Table 14: Connectivity scores allocated for the assessment

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

4.4.3 Adjacent remnant area

The BCAA predominantly occurs on the Wandanadian Coastal Plains Mitchell Landscape which is 11% cleared. The vegetation on site is well connected given that the areas of moderate to good vegetation are contiguous with large tracts of vegetation in similar moderate to good condition. The adjacent remnant area (ARA) is 501 ha (Figure 20). This receives a score of **10** for Mitchell Landscapes within the <30% cleared range.

As there are no lands subject to conservation measures, the score allocated in the calculator is **0**.

4.5 Red flags

One endangered flora species found within the BCAA, *Genoplesium baueri* (Bauer's Midge Orchid), is identified in the Threatened Species Profile Database as a threatened species that cannot withstand further loss in the CMA area, when three (3) or more individuals are impacted. This species is therefore 'red flagged' when three or more individuals are impacted.

There are a total of 36 individuals of *Genoplesium baueri* recorded within the BCAA. Only one (1) individual of a red flagged threatened species will be impacted and is shown in Figure 21. Red flag areas should be avoided and can only be impacted in accordance with certain rules outlined in Section 2.4 of the BCAM (i.e. the Director-General approves a red flag variation request).

A total of one (1) individual of the red flagged *Genoplesium baueri* in the BCAA would be impacted by the proposal. The remaining 35 individuals (and a 50 m buffer around these individuals) would be retained in the BCAA as part of the retained lands (Figure 5, Figure 22). In addition, a total of 126 individuals of *Genoplesium baueri* have been committed for conservation within the Lake Wollumboola BioBank Site. Given that the proposed development will not result in impacts to more than three individuals of *Genoplesium baueri*, this species is not considered a red flag for the purposes of this report and therefore, a red flag variation request is not required.

Table 15: Impacts to red flagged threatened species

Red flag threatened species	Individuals considered negligible loss	Red Flags within BCAA (individuals)	Red Flags impacted (individuals)	Proportion impacted (%)
<i>Genoplesium baueri</i> (Bauer's Midge Orchid)	<3	36	1	2.7%



Figure 19: Assessment circle



Figure 20: Connectivity

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 2011a).

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). The outer perimeter of the proposed residential footprint largely adjoins cleared residential land to the east, existing roads to the west, or areas that will be used as an APZ (that have been assessed as fully impacted) and a linear public reserve which will retain biodiversity values and include active ongoing management to mitigate/minimise impacts to the Lake Wollumboola BioBank Site. 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. Therefore, there are negligible indirect impacts.

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 and their replacement with residential housing, could impede the movements of the species credit species, Eastern Pygmy Possum, as well as other fauna species, in a north-south direction. However, movement corridors will remain in the local landscape immediately to the west of the BCAA which link up to vegetation and habitat in the south. In addition, the adjacent Lake Wollumboola BioBank Site permanently ensures a link to the vegetation in Jervis Bay National Park, thus facilitating the continued movement of species (Figure 1). With respect to *Genoplesium baueri* within the retained area the proposed development, and any indirect impacts, would be limited to potential weed invasion, sedimentation and unauthorised access. The retained *Genoplesiums* are proposed to be protected by a 50 m buffer around the individuals (2.1 ha) and retained within a bushland park reserve that will eventually be between 4 and 5 ha in area with surrounding APZs detention basins and open space. A Construction Environment Management Plan (CEMP) will be prepared and implemented to manage and mitigate these potential indirect impacts during construction such that they would be negligible (see Section 5.7.3). Further, the retained area will be dedicated to Council and classified as Community Land – Natural Area – Bushland, under the Local Government Act and a Plan of Management prepared and adopted (Funded by Sealark). The plan of management will include appropriate fencing and educational signage for the reserve and will be managed by Sealark Pty Limited throughout the development (expected to be up to 10 years) before ongoing management is undertaken by Council. Management will include the provision of a narrow (up to 1.5m wide) walking path through the reserve east-west to discourage the ad-hoc development of tracks, fencing to avoid access to the *Genoplesium* area, the creation of a local bushland management group and ongoing weed control. An annual monitoring report will be prepared by Sealark, consistent with the EPBC approval, for 5 years after the last lot is created.

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

- Preparation and implementation of a Construction Environment Management Plan to manage sedimentation, erosion, changes to water flow, rubbish dumping and unauthorised access to retained vegetation prior to, during and post construction.
- Any trees and hollows removed will be subject to a pre-clearance survey under the supervision of a fauna ecologist. Hollow-bearing trees that cannot be retained will be relocated to within the Lake Wollumboola BioBank Site.
- Preparation and adoption of a Bushland Reserve Plan of Management under the Local Government Act for the ongoing management of the Genoplesium reserve post construction
- Establishment and management of APZ within the Linear Reserve by Sealark.

4.7 Mitigation measures

4.7.1 Buffers on Red flag areas

Section 6 of the BCAM states that *“where a proposed conservation measure is used to protect land that is a red flag area, the area of the proposed conservation measure must include a buffer to mitigate any negative indirect impacts from development following the conferral of biocertification. The buffer area may be secured via a conservation measure and used to offset the impacts of biodiversity certification, or it may be a retained area in the biocertification assessment area” (and not generate any credits).*

A total of 35 *Genoplesium baueri* are proposed for ‘retention’ within the BCAA. The retained individuals do not form a ‘conservation measure’ as defined by the BCAM, however, to mitigate any indirect impacts from the development, a 50 m buffer has been applied to the individuals to be retained (Figure 21). Some small areas of the 50 m buffer would be affected to create an APZ along the northern and western boundary of the buffer. These areas would not be entirely removed but thinned and managed for the purposes of establishing and maintaining the APZ. The bushland park would be managed through the implementation of a CEMP prior to and during construction and then by a Plan of Management adopted under the Local Government Act. The CEMP would manage potential indirect impacts and other threats such as unauthorised access. The ‘retained’ bushland park reserve will not generate any biodiversity credits.

There are 126 *Genoplesium baueri* individuals in the adjacent Lake Wollumboola BioBank site (Figure 22). These red flag areas are located >100 m from the BCAA boundary and are separated by a perimeter road of 16 m width and a public reserve of 28 m in width. In addition, boundary fencing along the Lake Wollumboola BioBank Site will prevent access to the site and as such, the *Genoplesium baueri* located within the conservation area are considered to be adequately buffered.

4.7.2 Creation of Bushland Reserve

Sealark Pty Ltd will establish a Bushland Park Reserve around the 2.1 ha of retained *Genoplesium* habitat that will include additional areas for APZs, detention basins and open space as indicatively shown in Figure 6 prior to the commencement of any clearing and construction activity.

Sealark Pty Ltd will manage the Bushland Park Reserve for conservation from the commencement of development until the development of the last lot (expected to be approximately 10 years after commencement) and implement and report on a monitoring program for the persistence of *Genoplesium baueri*.

Subject to the endorsement of Shoalhaven City Council (SCC), Sealark Pty Ltd will transfer the Bushland Park Reserve to SCC at the completion of construction. The Bushland Park Reserve will be classified as Community Land and categorised as Natural Area – Bushland under the Local Government Act 1993 and a Plan of Management will be prepared, adopted and implemented with funding provided by a Local Planning Agreement between Sealark Pty Limited and Council (expected to be in the order of approximately \$10,000/year for on-going weed control after the initial establishment during the development stage and 10 years of direct management by Sealark.

Sealark Pty Ltd will continue to monitor and report on the persistence of *Genoplesium baueri* in the bushland reserve (and implement any adaptive management actions required) for a period of 5 years after the creation of the last Lot.

Once established, the on-going management of the Bushland Reserve will comprise weed control, maintenance of track, signage and fencing and is expected to cost approximately \$10,000/year and will be enhanced by the establishment of a Local Bushcare Group.

4.7.3 Management of APZ in Linear Reserve

Sealark Pty Ltd will establish a 29m wide Asset Protection Zone along the northern boundary of the certified land as a Linear Passive Reserve between the development and Lake Wollumboola Biobank site. The APZ will be approximately 8.7 ha in area and will be managed with multiple purposes (APZ to development, buffer to biobank site and public reserve with shared path).

The APZ will be managed to the Inner Protection Area (IPA) specifications outlined in Appendix 4 of 'Planning for Bush Fire Protection 2019' (RFS 2019) i.e.

Larger trees (at least 150 mm in diameter measured at chest height) may be within the IPA provided that:

- Tree canopy cover is less than 15% at maturity;
- Trees at maturity should not touch/overhang any buildings;
- Lower limbs to be removed to a height of 2 m above the ground (4 m if overhanging existing concrete pathway);
- Tree canopies should be separated by 2 to 5 m; and
- Preference should be given to retention of native, rainforest, smooth-barked and evergreen trees.

Smaller trees and shrubs (*i.e.* less than 150 mm in diameter at chest height) may be retained if they:

- Create large discontinuities/gaps in the vegetation to retard or break the progress of fire towards buildings;
- Are not located under trees;
- They do not form more than 10% ground cover;
- Clumps of shrubs are separated from exposed windows/doors and any glazed elements of construction by a distance of at least twice the height of the vegetation; and
- A minimal ground fuel at ground level (*e.g.* <5 tonnes/hectare) is to be maintained.

Grass should be kept to a height of no more than 100 mm.

- Regular and ongoing APZ maintenance is required to maintain the fuel management detailed above using the following methods;
- Vegetation management work focused on minimising weed invasion along with regular slashing/mowing; and
- Elevated fuels such as dead trees, limbs and excess bark are to be removed.

The frequency of APZ maintenance will be as follows:

- Maintenance to achieve the above requirements is to occur at least twice per year (i.e. late Spring, then late Summer). All maintenance works are to ensure the APZ is managed to the required specifications above;
- Additional maintenance (beyond 2 sessions per year) may be required in response to seasonal conditions if the fuel levels exceed the specifications; and
- Woody and noxious weeds are to be monitored and controlled as part of routine APZ maintenance activities (i.e. at least twice a year).

The estimated cost for annual maintenance of the established APZ and Linear Reserve from Callala beach Road to Sealark Road (in 2021 dollars) is **\$15,000** and based on the assumption available access to the APZ is good and a large machine (e.g. 8 tonne tritter or slasher behind tractor) can be used. Costs may vary where access is limited manoeuvrability.



Figure 21: Impacted red flag threatened species

4.8 Credit calculations

4.8.1 Ecosystem credits

Ecosystem credits have been calculated for the loss of vegetation resulting from the proposed development. In total, **1,598** SR592 ecosystem credits are required for 38.09 ha of 'land to be certified' (Table 16).

4.8.2 Species credits

Species credit requirements have been calculated for Eastern Pygmy Possum and *Genoplesium baueri*, which have both been surveyed for and are present for this assessment in the 'land to be certified'. A species polygon for likely habitat has been mapped for each species. No other threatened fauna or flora species requiring species credits were recorded or deemed likely to be present and therefore have not been calculated for species credit requirements.

Table 16: Final ecosystem credit results

Veg zone ID	Biometric vegetation type	Condition	Ancillary code	Credits required
1	Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Moderate to Good - Medium	Logged/advanced regrowth with scattered old-growth trees	1,598

Table 17: Final species credit results

Species	Area (ha) or Individuals impacted	Credits required
Eastern Pygmy Possum	38.09 ha	762
<i>Genoplesium baueri</i>	One (1) individual	13

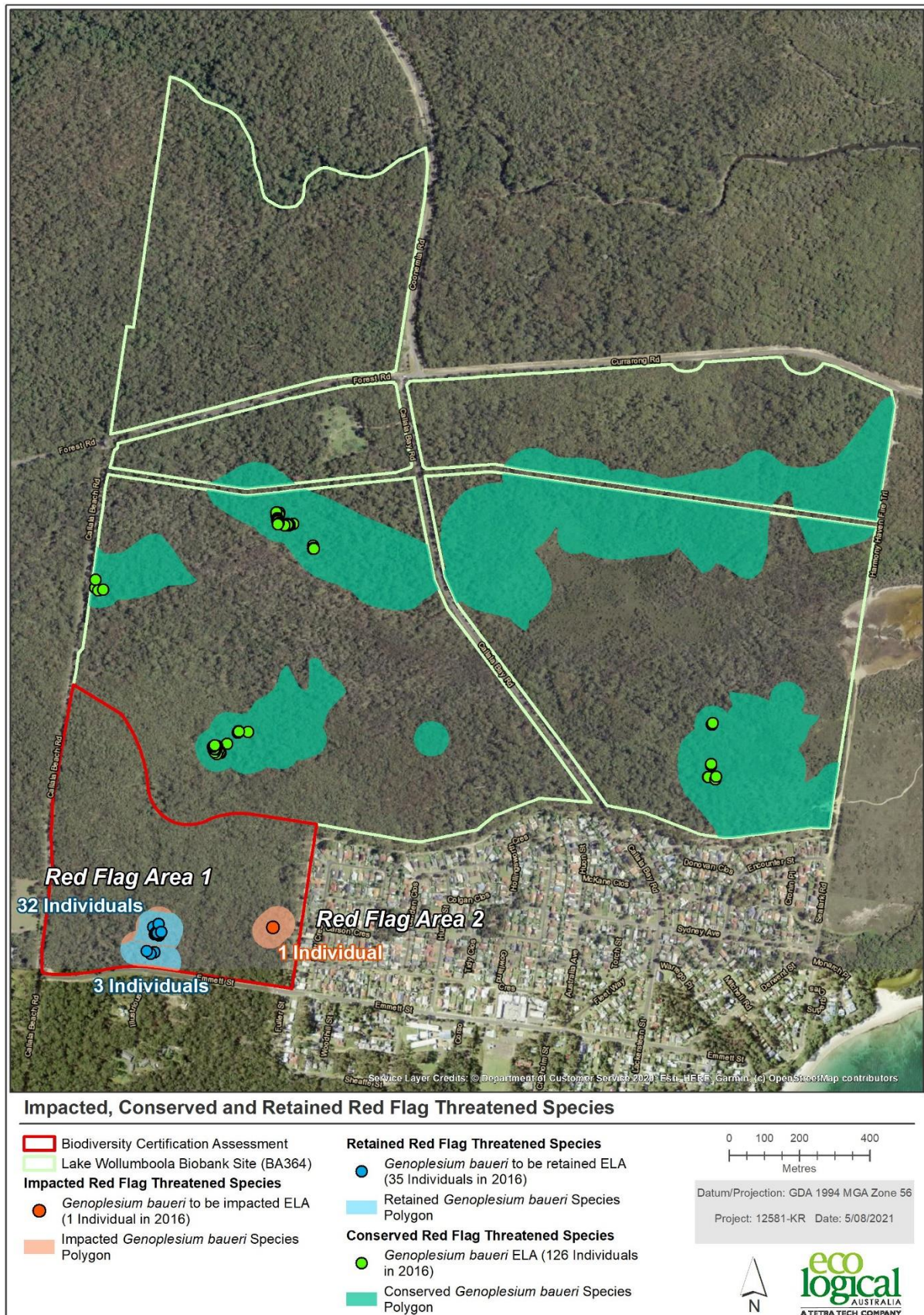


Figure 22: Impacted, conserved and retained red flag threatened species

5. Biodiversity Certification Strategy

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

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

A biodiversity strategy is to include the following:

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

This section addresses these requirements.

5.1 Land proposed for biodiversity certification

The land proposed for biodiversity certification is shown in Figure 5, Section 1 of this report and is 38.09 ha in area.

5.2 Land proposed for retention

The land proposed for retention in the BCAA is shown in Figure 5 of this report and is 2.10 ha in size. This land will form part of a bushland park reserve and allow for passive recreation. Where ancillary infrastructure (APZ, detention basins) is located adjacent to the retained land, this land has been proposed for certification, although revegetation in some areas would occur and contribute to the area of the park and provide additional buffers to indirect impacts.

5.3 Land proposed for biodiversity conservation

No lands are proposed for biodiversity conservation 'within' the BCAA. All conservation measures will be secured off-site by the retirement of biodiversity credits from the adjoining Lake Wollumboola BioBank Site (BA364), owned by Sealark Pty Ltd, as shown in Figure 1, Section 1 of this report.

5.4 Proposed conservation measures

5.4.1.1 Conservation measures 'within' the 'BCAA'

No conservation measures are proposed within the BCAA.

5.4.1.2 Conservation measures 'outside' the BCAA

The number and types of biodiversity credits shown in Tables 18 and 19 will be retired from the Lake Wollumboola BioBank Site (BA364) by the end of year 5 after commencement of development and the Total Fund Deposit (TFD) of BA 364 met in full. The Biobank site is owned by Sealark Pty Ltd and will

continue to be managed by Sealark in accordance with the BioBanking Agreement, including the provision of annual reports.

The retirement of credits from a registered BioBanking Agreement site is a 'Permanently Managed and Funded' or 100% Conservation Measure as outlined in s126L(i) of the TSC Act and section 8.1.1 of the BCAM, and will generate 100% of the required credits.

The Lake Wollumboola BioBank Site generates **8,542** ecosystem credits for SR592 '*Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion*', **5,735** species credits for Eastern Pygmy Possum and **895** species credits for *Genoplesium baueri*.

The number of credits generated by the Lake Wollumboola BioBank Site is more than the credits required for impacts by the land proposed for biodiversity certification (Table 18 and Table 19). The remaining credits will be held by Sealark Pty Limited.

Table 18: Summary of ecosystem credit surplus/deficit

Biometric Vegetation Type	Credits Required	Credits generated within BCAA (100% Measure)	Credit Status within BCAA	Lake Wollumboola BioBank Site (BA364)	Credit Status
SR592 - Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	1,598	0	-1,598	8,542	+6,969

Table 19: Summary of species credit surplus/deficit

Species Habitat	Credits Required	Credits generated within BCAA (100% Measure)	Credit Status within BCAA	Lake Wollumboola BioBank Site (BA364)	Credit Status
Eastern Pygmy Possum	762	0	-762	5,735	+4,985
<i>Genoplesium baueri</i>	13	0	-13	895	+882

A BioBank Agreement is registered on title and enforceable against the owner of the land (i.e. Sealark Pty Limited). The BioBank management plans for the BioBank site include the standard mandatory suite of BioBanking management actions to improve biodiversity values by the implementation of the following management actions:

- The erection and maintenance of boundary fencing to prevent inappropriate access
- 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

- Control of rabbits and foxes (as required)
- The retention of regrowth/native vegetation, dead timber, and rocks.

The BioBank site is subject to the terms of the BioBank Agreement which includes annual conservation management in-perpetuity, submission of an annual report to OEH regarding these management obligations and audit by OEH. The in-perpetuity costs of these management actions have been estimated using the BioBanking in-perpetuity cost spreadsheet and in-principle agreement that has been reached with NPWS regarding the transfer of these lands, once initial management has been undertaken by the current land owners to reach maintenance management. Sealark Pty Limited is responsible for the BioBank Site in accordance with the Agreement.

The Lake Wollumboola Biobank site is proposed to be transferred by Sealark Pty Limited to the Minister within a timeframe of approximately five years after the conferral of the proposed biodiversity certification of the BCAA. The remaining trust fund deposit will also be transferred to NPWS to ensure that the site remains funded in-perpetuity. The remaining credits will be held by Sealark Pty Limited.

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

The Lake Wollumboola BioBank Site Agreement (BA364) has already been registered by the Minister. The subsequent implementation, monitoring, reporting and review of the terms of the agreement will be the sole responsibility of the current owner of the BioBank site, Sealark Pty Limited, until such time when the lands are transferred to NPWS. Sealark Pty Limited is therefore a 'party' to the application.

Sealark Pty Ltd will enter into a Biodiversity Certification Agreement with the Minister to transfer the Lake Wollumboola Biobank Site to the Minister administering the *National Parks and Wildlife Act 1979* and be dedicated as an addition to the Jervis Bay National Park at the end of Year 5 after commencement. Sealark Pty Ltd will provide a Bank Guarantee Bond for the full TFD of BA 364 within three months of biodiversity certification being conferred. The bond will be terminated once the required number and types of credits have been retired and the TFD met.

Sealark Pty Ltd has commenced and will continue to plan for the transfer of the land to the Minister during this 5 year period such that the land is transferred at the end of Year 5.

Upon the transfer of the Biobanking site to the NPWS, the NPWS will assume the ongoing responsibility for the BioBank Site, including receiving the full Trust Fund Deposit amount. The remaining credits will be held by Sealark Pty Limited.

5.5.1 Timing of credit retirement

Consistent with discussions with DPIE, Sealark Pty Limited will retire all of the ecosystem and species credits required for the Callala Bay biocertification assessment by the end of Year 5 (expected to be 2026), regardless of the progress of the development of stages 1-5. The entire TFD for the Lake Wollumboola BioBank Site will be met by the end of Year 5 and the Biobank site will then be transferred to the Minister, together with the full TFD amount.

5.6 Is an Improve or Maintain Outcome Achieved?

Subject to the Secretary's consideration, an 'improve or maintain' outcome can be achieved by the purchase and retirement of credits from the Lake Wollumboola BioBank Site (BA364).

5.7 Statement of commitments

5.7.1 Biocertification Agreement

A Biocertification Agreement will be entered into between Sealark Pty Limited and the Minister stating that Sealark Pty Limited will:-

- Provide a Bank Guarantee Security Bond for the full Total Fund Deposit amount of the Lake Wollumboola Biobank site (BA 346) (plus any necessary indexing and administration fees) within three months of biodiversity certification being conferred
- Retire 1,598 SR592 ecosystem, 762 Eastern Pygmy Possum and 13 *Genoplesium baueri* species credits from the Lake Wollumboola Biobank site by the end of Year 5 after commencement of development and meet the full TFD for the entire Lake Wollumboola Biobank site
- Transfer the Lake Wollumboola Biobank site, together with the full TFD, to the Minister at the end of Year 5 after commencement of development
- Continue to plan for and liaise with the NPWS and Minister regarding the transfer of BA 364 to the NPWS to ensure that the land transfer occurs by the end of Year 5.

5.7.2 Avoidance, minimisation and mitigation of impacts to biodiversity values within and adjacent to land to be certified

Sealark Pty Limited (or any future developer/developers who becomes subject to the Biodiversity Certification Agreement) will prepare and implement a Construction Environment Management Plan (CEMP) to guide the development of the certified land and ensure that all direct and indirect impacts (e.g. APZs, utilities, access, stormwater run-off, erosion) are contained within the development footprint and appropriate mitigation measures are put in place to minimise indirect impacts to the adjoining Lake Wollumboola BioBank Site and land to be retained.

Any trees and hollows removed will be undertaken under the supervision of a fauna ecologist. If any hollow-bearing trees in the APZ area need to be removed, the trunk/branch containing the hollow(s) will be relocated to the Lake Wollumboola BioBank Site.

The CEMP will include details for the monitoring and annual reporting of the persistence of *Genoplesium* within the Bushland Park Reserve throughout the construction and for a period of 5 years after the last Lot is created.

5.7.3 Management of the proposed bushland park consistent with the EPBC Act conditions of approval

The Commonwealth EPBC Act approval (EPBC 2020/8637) was granted with conditions on 1 June 2021. The EPBC Act approval contains specific conditions regarding the management of the proposed Bushland Park which contains 35 *Genoplesium baueri* in the BCAA. The conditions specify the following:

*5. For the protection of the **Yellow Gnat-orchid** in the **Bushland Park**, the approval holder must, prior to the **commencement of the action**, submit a Construction Environment Management Plan (CEMP) to the **Minister** for approval. The CEMP must include:*

*a. a description of the management actions that will be implemented prior to, during and following **construction** to protect the **Yellow Gnat-orchid**, including from stormwater*

discharge and road runoff, sediment and erosion control, unauthorised access and invasion by exotic species and weeds;

*b. monitoring provisions (methods, timing, frequency and effort) for the population of **Yellow Gnat-orchid** within the **Bushland Park** that are suitable and effective for identifying the **Yellow Gnat-orchid** population and capable of identifying any trend suggesting possible decline of the health and/or size of the **Yellow Gnat-orchid** population;*

*c. measures to be implemented in the event that monitoring indicates a decline in the health or size of the **Yellow Gnat-orchid** population. The measures to be implemented must be based on the advice of an **orchid expert** and details of the qualifications and experience of the **orchid expert** must be included in the CEMP; and*

*d. provisions for reporting the results of the **Yellow Gnat-orchid** monitoring, which should include notifying the **Department** of any finding of concern and publishing monitoring data and findings in **compliance reports**.*

6. The approval holder must not commence the action unless the Minister has approved the CEMP in writing. The approval holder must implement the approved CEMP until ownership of the Bushland Park is transferred to the Shoalhaven City Council.

8. The approval holder must continue to monitor and report on findings in relation to the population of the Yellow Gnat-orchid within the Bushland Park in accordance with the approved CEMP for five years after the registration of the last lot.

Consistent with the requirements of the conditions of approval, the proponent will prepare and implement a Construction Environment Management Plan (CEMP) that must be approved by the DAWE prior to the commencement of the action. The purpose of the CEMP is to outline the measures required to establish the bushland park, ensure the *Genoplesium baueri* within the park are not indirectly affected and monitor the population from the commencement of the action and until five (5) years after the registration of the last lot (approximately 15 years). Management actions that could be included in the CEMP to achieve the measures outlined in the conditions of approval include:

- installation of sediment fencing
- installation of temporary exclusion fencing
- installation of no-go signs
- inclusion of a biodiversity component to all site inductions
- management of any weeds on-site prior to the commencement of construction
- strict hygiene protocols to prevent the inadvertent spread of weeds
- management of weeds in the bushland park
- monitoring of the population by a suitably qualified ecologist
- reporting consistent with the approval requirements.

Once established, the on-going management will comprise weed control, maintenance of track, signage and fencing and is expected to cost approximately \$10,000/year and will be enhanced by the establishment of a Local Bushcare Group.

6. References

- Allen, Price & Associates, 2014. *Planning Proposal – The Halloran Trust - Culburra, Callala Bay, Kinghorne Point*.
- BES 2006a *Threatened Biodiversity Survey and Assessment Emmett St, Callala Bay, Presentation for Coolangatta*. Powerpoint Presentation.
- BES 2006b *GIS targeted flora species survey effort and results*.
- Debus, S.J.S. 1994. 'The Sooty Owl *Tyto tenebricosa* in New South Wales', *Australian Birds*, 28:s4-s19.
- Department of the Environment and Energy (DoEE) 2019. Protected Matters Search Tool EPBC Act. [Online] <http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf> (Accessed March 2019).
- Department of Environment, Climate Change and Water (DECCW) 2011. *Biodiversity Certification Assessment Methodology*. NSW Department of Environment Climate Change and Water, Sydney.
- 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*. Department of Environment and Climate Change, Sydney.
- Eco Logical Australia (ELA) 2019. *Biobanking Agreement Credit Assessment Report – Lake Wollumboola Biobank Site*. Report prepared for The Halloran Trust, February 2019.
- Ecoplanning 2017. Expert Report for *Genoplesium baueri*, Lake Wollumboola BioBank Site. Prepared for Eco Logical Australia Pty Ltd.' Eco Logical Australia (ELA) 2019. *BioBanking Agreement Credit Assessment Report – Lake Wollumboola BioBank Site*. Report prepared for The Halloran Trust, February 2019.
- Environment Australia 2000. *Comprehensive and Regional Assessments for North-East NSW*. Report to National Parks and Wildlife Service.
- Hyem, E.L. 1979. 'Observation on Owls in the Upper Manning River District, New South Wales', *Corella*, 3(2):17-25.
- Garnett, S. (Ed) 1993. *Threatened and extinct birds of Australia*. Royal Australian Ornithologists Union and Australian NPWS, Royal Australian Ornithologists Union Report, No. 82.
- Gunninah Environmental Consultants 2001. *Callala Environmental report*.
- Jones, D.L. *A complete guide to Native orchids of Australia including the Island Territories*. Reed New Holland, Sydney.

- Tozer, K. Turner, D.A. Keith, D. Tindall, C. Pennay, C.Simpson, B. MacKenzie, P. Beukers and S. Cox, 2010. *Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands*.
- Marchant and Higgins 1993. *Handbook of Australian, New Zealand and Antarctic Birds*. Oxford University Press, Melbourne.
- McKilligan, N. 2005. *Hérons, Egrets and Bitterns*, CSIRO Publishing.
- Morcombe, M. 2004. *Field Guide to Australian Birds*, Steve Parish Publishing.
- Office of Environment and Heritage (OEH) 2015a. *Biodiversity Certification Operational Manual*. NSW Office of Environment and Heritage for the NSW Government, Sydney
- Office of Environment and Heritage (OEH), 2019a. *NSW BioNet Atlas of NSW Wildlife – search tool* [online]. (accessed March 2019).
- Office of Environment and Heritage (OEH), 2019b. Threatened species profiles. Online.
- Office of Environment and Heritage (OEH) 2019c. *Vegetation Information System*, NSW Office of Environment and Heritage, Sydney. Available <https://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx?ReturnUrl=%2fNSWVCA20PRapp%2fsearch%2fpctsearch.aspx>
- Office of Environment and Heritage (OEH), 2019d. Koala habitat and feed trees. Online.
- Shoalhaven City Council (SCC) and Department of Infrastructure, Planning and Natural Resources (DIPNR) 2002. Jervis Bay Settlement Strategy.
- Shoalhaven City Council (SCC) and Department of Infrastructure, Planning and Natural Resources (DIPNR) 2014. Shoalhaven Growth Management Strategy.
- Shoalhaven City Council (SCC), 2016. Email correspondence dated 21st September 2016.
- Simpson, K. and Day, N. 2004. *Field guide to the birds of Australia 7th edn.*, Penguin Books Australia Ltd, Ringwood Victoria.
- Stephenson, A. W., 2015. Orchid Letter dated 20 November 2015.
- Schodde, R. and Tidemann, S. (Eds) 1986. *Readers Digest complete book of Australian Birds*, 2nd Edn., Reader's Digest Services Pty Ltd, Sydney

Appendix A Halloran Land Trust Planning Proposal

Provided as a separate document

Appendix B Commonwealth Approval

Provided as a separate document.

Appendix C Project Staff CVs

The following are brief curriculum vitae's for the key project staff. Please note that since this project commenced in 2015, 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.

Belinda Failes ECOLOGIST

Belinda has been working as an ecologist with Eco Logical Australia since 2011, and has been involved in the monitoring of, and preparation of reports for, threatened flora and endangered ecological communities, as well as the preparation of Vegetation Management Plans (VMP), Part 3A and Section 5A Assessments under the EP&A Act, Local Environment Studies, and Species Impact Statements (SIS). Belinda has built on the skills she learned while studying a Master of Wildlife Management at Macquarie University through on-going professional development, and is skilled in both flora and fauna identification.

QUALIFICATIONS

- Master of Wildlife Management (Macquarie University)
- Bachelor of Environmental Science, (University of Newcastle)
- Senior First Aid Certificate
- OHS Construction Induction Certificate – White Card
- Rail Industry Safety Induction (RISI) Card
- Working at heights
- Tree Rescue training
- Basic Tree Climbing training

PROJECT EXPERIENCE

BIOBANKING AND BIOCERTIFICATION

- Mount Gilead rezoning Biocertification
- Teralba Quarry Biobanking
- Ingleside rezoning Biocertification

FLORA AND FAUNA IMPACT ASSESSMENTS

- Bunya, Doonside, flora and fauna field work
- National Broadband Network ISEPP and DA approvals
- ITS for Sydney Water REF
- Water Infrastructure Group REF
- Jet Strike Fighters EIS - ecological impacts literature review
- Bunya, Doonside Themeda - relocation monitoring project (field work)
- South West Growth Centres - translocation of Cumberland Plain Land Snail
- North West Rail Link - ecological assessment (field work)
- Moxham Quarry, Northmead, impact assessment
- Schofield Road, Alex Avenue Precinct - impact assessment
- North Narrabeen Dunes, NSW - impact assessment
- Curl Off-leash Dog Park Proposal - impact assessment
- Kilcare Rd, Blacktown - impact assessment
- Harbord Diggers - ecological constraints and impact assessment
- Metropolitan Colliery Vegetation Monitoring (field work)
- Hamlyn Terrace – ecological constraints and impact assessment

- Greta Freight Train Upgrade, Greta - pre-clearance surveys
- Withers Rd, Kellyville, impact assessment
- Schofields Defence Housing Association
- Wolgan Valley Road – Cranbrook School
- St Leonards Plaza
- Jemena gas pipeline
- Woolahra Biodiversity Management Plan – field work

VEGETATION MANAGEMENT PLANS

- Bunya, Doonside Landscaping DA
- Richmond Road Upgrade, Marsden Park, RMS
- The Hills Shire Council Weed Management Plan
- Hills M2 Corridor Weed Management Plan
- Edmondson Park Development
- Schofields Defence Housing Association
- Glenfield Stage 3
- Campbelltown Comprehensive Koala Plan of Management – field work

MONITORING FIELD WORK

- Moolarben Mine Monitoring – flora and fauna monitoring
- Wivenhoe Bird Monitoring

RELOCATION

- Bunya Cumberland Plain Land Snail
- South West Growth Centres - translocation of Cumberland Plain Land Snail

PRE-CLEARANCE SURVEYS

- Hamlyn Terrace
- Greta Freight Train Upgrade, Greta
- Tomago industrial development
- M5 surreys

CONSTRAINTS ASSESSMENT

- Menangle Park Wastewater
- Harbord Diggers
- Wolgan Valley Road – Cranbrook School

David Coombes SENIOR ECOLOGIST

David has 15 years of experience in ecological survey, assessment and natural resource management. As a consultant, this has included a range of flora and fauna assessments, biodiversity and threatened species projects for commonwealth, state, local government and private sector clients. Duties have included supervision and training of staff, field survey, GIS mapping and analysis, research, impact assessment and mitigation, preparation of various assessment reports and management plans. David has held various positions with NSW National Parks and Wildlife Service including Project Officer, Threatened Species Planning Officer and Technical/GIS Officer. In these positions, David was responsible for natural heritage issues including threatened species survey, environmental assessment, protected area management and resource mapping. During his time at NSW State Forests (Research Division), David investigated large forest owl ecology and response to habitat disturbance for over three years and coordinated field work including surveys, trapping and radio-tracking. David has also coordinated environmental education programs for local government focussing on the ecology and management of the urban bushland environment.

QUALIFICATIONS

- Bachelor of Applied Science, Charles Sturt University

PROJECT EXPERIENCE

- Hundreds of flora and fauna surveys and assessments in south east NSW

SPECIFIC EXPERIENCE INCLUDES:

- Threatened Biodiversity Assessments: Heritage, Verons, Nebraska & Jerberra Estates, Shoalhaven Council
- Nowra-Bomaderry Structure Plan flora and fauna studies
- Flora and fauna assessments for residential, rural and industrial subdivisions, Shoalhaven area
- Flora and Fauna Assessments for ecotourism, industrial and sporting facilities, Shoalhaven area
- Old Cooma Road realignment Species Impact Statement & EPBC referral, Queanbeyan Council
- Green and Golden Bell Frog study, Shoalhaven City Council
- Environmental Management Plans, Vincentia, Nowra
- Review of Environmental Factors, Shoalhaven area
- Numerous targeted surveys for 8 threatened orchid species
- Jervis Bay National Park mammal, reptile and frog surveys
- Powerful Owl surveys and assessments, Shoalhaven Council, NPWS, Environment Australia, Sydney Water
- Yellow-bellied Glider surveys, Shoalhaven Council, NPWS
- Nocturnal bird and mammal surveys, south eastern NSW, Forests NSW
- Berowra Valley Bushland Park Threatened Flora and Fauna survey, Hornsby Shire Council
- Pre-clearing fauna surveys and supervision of clearing for major residential centres at Vincentia and Horsley.
- Threatened species and EEC monitoring, Vincentia, Nowra, Worrige, Horsley

Mike Lawrie ECOLOGIST

Mike is an ecologist with over 4 years of experience in ecological consulting. Mike has worked on projects in a variety of sectors including roads, electrical, infrastructure, residential, agriculture and mining. Prior to working with Eco Logical Australia he worked as an ecological consultant in Newcastle with Wildthing Environmental Consultants and SLR Consulting. His expertise includes preparation of technical reports, survey planning and execution, data collection and analysis, literature review and GIS. Through his role as an ecologist Mike has extensive experience in conducting flora and fauna surveys in several locations including Sydney, the Hunter region, coastal and western New South Wales. Mike is experienced in the preparation of Fauna and Flora Assessments under the NSW *Biodiversity Conservation Act 2017* (BC Act), *Threatened Species Conservation Act 1995* (TSC Act) and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). He has experience in collecting field data and preparing reports using the Biodiversity Assessment Method (BAM) including floristic plots. He is also proficient in the preparation of Vegetation Management Plans, Wildlife Management Plans and Koala Management Plans.

QUALIFICATIONS

- Bachelor of Environmental Science and Management - University of Newcastle 2011
- Master of Environment (Specialisation in Environmental Science) – Macquarie University 2016
- National OHS Construction Induction Training (White Card)
- Work Safely at Heights
- Apply First Aid certificate

PROJECT EXPERIENCE

- Review of Environmental Factors for a sewer main – Austral
- Flora and Fauna Assessment for bank stabilisation works – Eastlakes
- Biodiversity Assessment for Transmission Feeder – Marsden Park
- Flora and Fauna Assessment for a subdivision – Nelson
- Ecological Constraints Assessment for a residential development – Mulgoa
- Flora and Fauna Assessment for a residential development – Baulkham Hills
- Ecological Impact Assessment - Summerhill Waste Management Centre
- Flora and Fauna Assessment for a subdivision and quarry – Koorainghat
- Flora and Fauna Assessment for a residential development – Medowie
- Flora and Fauna Assessment for a road upgrade – Mirannie
- Flora and Fauna Assessment for a residential development – Salamander Bay
- Flora and Fauna Assessment for an eco-tourism facility – Tanilba Bay
- Flora and Fauna Assessment for rural residential subdivision – Broke
- Flora and Fauna Assessment for a proposed poultry farm - Kulnura
- Flora and Fauna Assessment for a poultry farm – Bishops Bridge
- Biobanking Assessment Report for a proposed sand mine – Bob's Farm
- Targeted threatened flora searches for Biocertification report - Ingleside
- Targeted threatened flora search for *Diuris praecox* and *Diuris arenaria* – Bob's Farm
- Targeted threatened flora search for *Cryptostylis hunteriana* and *Corybas downlingii* – Nerong

- Targeted threatened flora search for *Tetratheca juncea* – Elmore Vale
- Targeted threatened flora search for *Eucalyptus camfieldii* and *Hibbertia procumbens* - Kulnura
- Vegetation Management Plan for a residential development – Cooranbong
- Vegetation Management Plan for a poultry farm – Bishops Bridge
- Nest Box Management Plan and installation – Toronto
- Nest Box installation and monitoring – Hamlyn Terrace
- Dam Dewatering and Fauna Relocation – Hamlyn Terrace
- Koala Plan of Management for university housing – Port Macquarie
- Vegetation plots using Biodiversity Assessment Method (BAM) and BioBanking Assessment Methodology (BBAM)
- Targeted fauna trapping surveys including Elliott traps, pitfalls, hair tubes, arboreal traps and harps traps
- Bat Surveys using Anabat
- Pre-clearance surveys, tree clearance supervision and fauna relocation

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 (formerly 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

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

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 marifolia* – OEH Saving Our Species program
- 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.

Robert Humphries MANAGER, BIODIVERSITY OFFSETS PROGRAMS

Robert is an ecologist, environmental planner and project manager with over 30 years experience. Since graduating with Bachelors and Masters Degrees in wildlife management in 1985 and 1989, Robert has worked mainly in the public sector with the Department of Environment and Conservation (Victoria) 1988-1996 and the then NSW National Parks and Wildlife Service, now NSW Office of the Environment & Heritage (OEH) 1996-2006. Robert joined Eco Logical Australia in March 2008 after two years working in the urban development sector. 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 NSW Threatened Species and Environmental Planning legislation, Government policy, the biodiversity of the Greater Sydney and Hunter Regions and the former biodiversity certification and biobanking provisions. Robert was a member of the Biobanking Ministerial Reference Group from 2007-2012 and was the lead trainer in the BioBanking and Biodiversity Certification Accredited Assessor Training program that Eco Logical Australia developed and implemented under licence from the OEH for 8 years between 2008 and 2015. Robert is now actively involved in working with land owners wishing to register Land Stewardship Agreements under the new Biodiversity Conservation Act 2016 and sourcing and securing biodiversity credits for proponents.

QUALIFICATIONS

- Bachelor of Applied Science, Ballarat College of Advanced Education 1983-85.
- Master of Applied Science (Research) University of Ballarat 1986-89.

PROJECT EXPERIENCE

THREATENED SPECIES CONSERVATION ACT 1995

Biocertification Assessments

Robert has completed or is currently undertaking formal Biodiversity Certification Assessments for:-

- Port Macquarie Airport and Area 13 Urban Release Area (Port Macquarie Hastings Council). Biocertification conferred August 2018
- El Caballo – Gledswood – Lakeside Residential Estate (Camden City Council). Biocertification conferred June 2018
- Mount Gilead Urban Release Area (Campbelltown City Council) Application with Minister for determination August 2018
- Emerald Hills Urban Release Area (Camden City Council). Biocertification conferred December 2015
- Maquariedale Road, Appin Urban Release Area (Wollondilly Council) Application with Minister for determination August 2018
- Tuncurry State Significant Site (Urban Growth NSW). Application submitted to OEH for audit – July 2015
- Warnervale Town Centre (Wyong Council). Biocertification conferred March 2014
- Broulee and South Moruya Urban Release Areas (Eurobodalla Shire Council). Biocertification conferred September 2014
- Ralston Avenue, Belrose for Metropolitan Local Aboriginal Land Council. Application being reviewed by Warringah Council and OEH
- Halloran Lands Culburra (Shoalhaven Council)

Biobank Site Assessments and Registrations

Robert has prepared and/or project managed through to registration **20** BioBanking Agreements and undertaken numerous feasibility studies for State and Local Government Agencies, Corporate entities and private land holders interested in biobanking, including:

- A 25 ha Biobank site west of Camden on the Cumberland Plain (Private landholder) (Agreement No. 3, registered in January 2011)
- A 24 ha site in western Sydney (Western Sydney Parklands Trust). (Agreement No. 70, registered in February 2012)
- A 10 ha site at Belrose (WSN Environmental Solutions) (Agreement No. 55, registered in March 2012)
- A 1,500 ha site near Gunnedah to offset an approved Coal mine (Whitehaven Coal) (Agreement No. 43, registered in August 2012)
- A 51 ha Biobank site west of Camden on the Cumberland Plain (Private landholder) (Agreement No. 88, registered in January 2013)
- A 69 ha proposed Biobank for Shoalhaven City Council at (Agreement No. 101, registered in June 2013)
- A 45 ha proposed Biobank for Lake Macquarie City Council at Belmont (Agreement No. 103, registered in June 2013)
- A 54 ha proposed Biobank at the Oaks on the Cumberland Plain (Private landholder) (Agreement No. 100, registered in September 2013)
- A 31.2 ha site (M7 West) in Western Sydney Parklands (Agreement No. 119, registered August 2014)
- A 19.37 ha site (Kemps Creek) in Western Sydney Parklands (Agreement No. 120, registered August 2014)
- A 324 ha site at Broulee for Eurobodalla Shire Council (Agreement No. 153, registered September 2014)
- A 29 ha site at Puckey's Estate in the Wollongong LGA prepared as part of OEHs Linking Landscapes project (Agreement No. 163, registered March 2015)
- A 72.64 ha site at Salamander for Port Stephens Shire Council (Agreement No. 148 – registered November 2015)
- A 25 ha site at Emerald Hills in the Camden LGA (Agreement No. 159 – registered November 2015)
- A 25 ha site at Dunmore in Shellharbour LGA for Holcim Pty Ltd (Agreement No. 203 – registered December 2015)
- A 50 ha site at Oaklands (Hardwicke Stage 1) in Wollondilly Shire Council (Agreement No. 168 registered – March 2017)
- 24 ha proposed Biobank site west of Camden (Brownlow Hill Stage 3) on the Cumberland Plain (Private landholder) Agreement No. 156 Registered October 2017)
- A 45 ha site at Gilead (Noorumba Reserve) in Campbelltown LGA for Campbelltown City Council (Agreement 239, Registered January 2018)
- A 30 ha site at Brownlow Hill (Brownlow Hill Stage 4) for Brownlow Hill Pty Ltd (Agreement 274 Registered January 2018)
- A 250 ha site near Crooked Corner, Glenara for Glenara Pastoral Pty Ltd– Agreement No. 353, Registered May 2018

Identification and sourcing of Biodiversity credits for proponents

- Robert has been engaged by various proponents to source and secure biodiversity credits to meet approval conditions.

- Eastern Creek Business Hub – Frazers Property Group – 40 HN528 credits
- RMS Growth centres – various credits
- West Connex RMS – various credits
- El Cabello for Sekisui House - 293 HN528 credits and 30 Cumberland Land Snail credits
- Mt Gilead for Lendlease Communities– 50 HN556 credits and 250 Koala credits
- Spurway Drive for Sekisui House – 55 HN528 credits and 6 HN526
- Taralga Wind Farm for Pacific Hydro– 10 HN571 credits
- Davistown Development – 10 Green and Golden Bell Frog species credits
- Sydney Olympic Park for Ecove – 20 Green and Golden Bell Frog species credits
- McPhails Wollongong – purchase of 224 SR545 credits
- Holcim Australia – Lynwood Quarry – 2018 -
- Queanbeyan-Palerang Regional Council – Ellerton Drive Project - 2017
- Tahmoor Central
- Moorebank Intermodal Project - 2018

Biobank Statements

Robert has prepared and/or project managed through to approval 6 BioBank Statement applications:-

- Biobank Statement for a Commercial Development, Salamander Way, Port Stephens Council (Biobank Statement No. 50, August 2018)
- Biobank Statement for proposed urban development at West Dapto, Wollongong LGA (Biobank Statement 16 issued October 2014)
- Biobank Statement for proposed commercial development at Tahmoor, Wollondilly LGA (Biobank Statement 15 issued September 2014)
- Biobank Statement for proposed residential subdivision at Davistown in Gosford LGA (Biobank Statement 7 issued January 2013)
- Biobank Statement for proposed retirement Village residential at Beacon Hill, Warringah LGA (Biobank Statement 3 issued May 2011)
- Biobank Statement for proposed residential subdivision at Forrester's beach (Biobank Statement 2 issued December 2010)

ENVIRONMENTAL PLANNING and ASSESSMENT ACT 1979

Biodiversity Offset Strategies and Packages

Robert has prepared numerous Biodiversity Offset Strategies and Packages to meet policy frameworks and conditions of approval for Major Projects:-

- West Connect for SMC and RMS – 2016-2017
- White Rock Wind Farm for Gold Wind Australia
- Taralga Wind Farm for Pacific Hydro
- Prepared an offset strategy and secured offsets for the North West Rail Line project in north western Sydney (2014)
- 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)
- Biodiversity Offsets review, Cockatoo Coal NSW & Qld Projects (Cockatoo Coal Pty Ltd, 2011)
- Revised Biodiversity Strategy for Tharbogang Quarry and Landfill (Griffith City Council, 2011)
- Improve or Maintain Biodiversity Offset Strategy for proposed rezoning at Greta, Cessnock LGA (Hardie Holdings Pty Ltd, 2011)
- Improve or Maintain Biodiversity Offset Strategy for Kings Hill Urban Release Area, Port Stephens LGA (Mondell Property Group, 2011)
- Preparation of Biodiversity offset strategy for the proposed Narrabri Coal mine (Narrabri Coal Operations Pty Ltd, 2011)
- Preparation of Biodiversity offset strategy for proposed modification to Rocglen Coal Mine (Whitehaven Coal Pty Ltd, 2010)
- Preparation of Biodiversity offset strategy for the proposed Werris Creek LOM Coal Mine (Werris Creek Coal Pty Ltd, 2010)
- Preparation of Biodiversity offset strategy for the South West Rail Link (Transport Construction Authority, 2010)
- Preparation of Biodiversity offset strategy for the Richmond Rail Line duplication (Transport Construction Authority, 2011)
- Preparation of 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)

Environmental Impact Assessments for the Urban Development Projects

- Threatened Species Impact Statement for proposed residential subdivision Bong Bong Road, Horsley, Wollongong LGA, NSW (Stockland, 2014).
- Threatened Species Impact Statement for retail development at Windale, Lake Macquarie LGA, NSW (Hydrox Nominees, 2012).
- Threatened Species Impact Statement for proposed retirement village at Beacon Hill, Warringah LGA, NSW (Beacon Hill Retirement Pty Ltd, 2010).
- Threatened Species Impact Statement for proposed residential subdivision at Menai, Sutherland LGA, NSW (Landcom, 2009/10).
- Native Grassland Assessment of proposed residential rezoning application at Beveridge, Victoria (2008 Nick Baldi Constructions)
- Threatened species review and advice for proposed rezoning at Ashtonfield, Maitland LGA, NSW (Ashtonfield Developments Pty L:td), 2008
- Threatened Species review and advice for proposed rezoning at Taylors Beach, Port Stephens LGA, NSW (North Arm Cove Joint Venture Pty Ltd, 2008)
- Threatened Species Impact Statement for proposed residential development at Halekalani for Darkinjung Aboriginal Land Council
- Flora and Fauna Assessment for Subdivision at Catti Ridge Rd – Glenorie for Andrew Taouk and Anthony Symin - 2017
- Biobank Assessment case studies for Cessnock and Whitebridge Urban Release Areas (Landcom, 2008/9)

Ryan Smithers SENIOR ECOLOGIST

Ryan brings to ELA 12 years experience in natural resource management (9 yrs as a consultant, and 3 yrs with Sydney Catchment Authority as a Catchment Protection Officer). He has extensive practical experience in flora and fauna surveying, fire fighting, planning and land management throughout eastern NSW and has undertaken numerous flora and fauna surveys and has been responsible for the preparation of numerous biodiversity plans, environmental impact assessments, vegetation management plans, fire management plans and weed management plans. Relevant projects include a Biodiversity Planning Project for Upper Lachlan Shire Council, Aboriginal Land Management Biodiversity Project for DECC, Stony Range Reserve Plan of Management for Shellharbour City Council and a Queanbeyan Biodiversity Study.

QUALIFICATIONS

- BEnvSc (Land Resources Management), University of Wollongong with 1st Class Honours.
- Spillage Incident Management Training
- Bush Fire Fighting Training (Advanced Fire fighter, Village Fire fighter)
- AIIMS - Australian Inter-Service Incident Management Systems training
- Senior First Aid, St. Johns Ambulance 2005.

PROJECT EXPERIENCE

- South-east Corner Biometric Benchmark Project
- Queanbeyan Biodiversity Study for LEP review
- Upper Lachlan Biodiversity Planning Framework
- Upper Lachlan and Temora Shire Natural Resource Management Projects
- Eurobodalla Biodiversity Study for future Urban Expansion Lands
- Wollongong Bushfire Asset Protection Zone Risk Management Strategy Stages 1 2; and 3
- Designing GIS models and databases for a range of land management applications
- Assisting the presentation and capture of expert advice and evidence to the Land & Environment Court
- Monitoring of controlled activities *e.g.* quarries, agricultural enterprises, mines, *etc.*, and liaison with utilities *i.e.* electricity, roads, gas pipeline, SRA for Sydney Water
- Practical experience in flora and fauna surveying, fire fighting, planning and land management throughout eastern NSW
- Old Comma Road deviation Species Impact Statement
- Large-scale biodiversity impacts assessments on the NSW south-coast
- Flora and fauna assessments within the Sydney Basin, South-eastern Highlands and South-east Corner bioregions including numerous studies using flora and fauna surveying techniques including direct observation, spotlighting, call recognition, scat and track analysis, small-cage trapping, pitfall trapping, hair tubing, harp trapping, ultrasonic call recording, and call playback;
- Fire management plans and fire action plans including plans for lands both within the state and nationally. Including plans for the Beecroft Weapons Range, Arakwal National Park, Sydney Catchment Authority freehold lands within the Warragamba and Blue Mountains Special Areas, and plans for thirteen Australian Bush Heritage Fund reserves in a diverse range of environments in Tasmania, Queensland and Western Australia;

- Weed management plans for NSW NPWS conservation reserves, including five year plans for Seven Mile Beach National Park and part of the Shoalhaven River Corridor
- Sub-Regional Serrated Tussock, African Lovegrass and St John's Wort Plans for the Monaro Noxious Weeds Committee.
- Bushfire protection assessments for more than 50 development applications, including subdivisions, retirement villages, and eco-tourism resorts
- Planning bush regeneration projects and supervising their implementation

Vivian Hamilton SENIOR ENVIRONMENTAL CONSULTANT

Vivian has completed a Bachelor of Environmental Management at Macquarie University and has been with Eco Logical Australia for over 9 years. Vivian has also worked in technical policy within government, in the Forestry Branch of the NSW Environment Protection Authority. She has been involved in a wide variety of projects ranging from local, regional, and to statewide scales such as the: NSW Natural Resources Commission River Red Gum assessment; refinement of the Mitchell Landscapes data layer; NSW State of the Parks mapping; and North West Rail Link Ecological and Riparian Assessment. Vivian has a multidisciplinary background with a range of specialized technical skills that include: high quality map design and production, aerial photograph interpretation, environmental modeling, and spatial data analysis. Having completed the Biodiversity Offsets Scheme Training Course, she is able to apply GIS along with the methodology to undertake calculations and mapping for assessments.

QUALIFICATIONS

- Bachelor of Environmental Management Macquarie University – 2007
- Completed the BioBanking and Biocertification Assessor Accreditation Training Course (AHCLPW503A), OEH
- Completed Biodiversity Offsets Scheme Training, OEH - 2018

PROJECT EXPERIENCE- ACT

ENVIRONMENTAL PLANNING AND POLICY

- ACTEWAGL, Cotter Dam Offset Implementation
- Land Development Agency, Molonglo River Riparian Strategy

ENVIRONMENTAL ASSESSMENT AND MAPPING

- ACT Planning and Land Authority, Molonglo River Riparian Vegetation Mapping

PROJECT EXPERIENCE- NSW

BIOBANKING AND BIOCERTIFICATION ASSESSMENTS

- Department of Planning and Environment, Ingleside - Biodiversity Certification Assessment
- Department of Planning and Environment, Wilton and Menangle Offset Analysis
- Halloran Trust, Jervis Bay and Sussex Inlet - Biodiversity Certification Assessment, Major Project and Biobank Agreement
- Holcim, Albion Park - Biobank Agreement
- Hornsby Shire Council, Arcadia and Waitara – Biobank Agreements
- Hydro Aluminium, Kurri Kurri Smelter – Biodiversity Certification Assessment
- Macquariedale Road, Appin – Biodiversity Assessment & Biocertification Strategy
- Northern Beaches Council, Ingleside Chase Reserve – Biobank Agreement
- Office of Environment and Heritage - Preparation of the BBAM 2014 and FBA Operational Manuals
- Office of Environment and Heritage - Development of Material and Marker for OEH Biobank/Biocertification and FBA Accredited Assessor 2015 Training Courses
- Office of Environment and Heritage, Linking Landscapes – Narrawallee Biobank Agreement

- Ralston Avenue, Belrose – Biodiversity Certification Assessment

BUSHFIRE MANAGEMENT PLANS

- Bunya Precinct 4 Bushfire Attack Level Assessment
- Moolarben Coal Operations, Bushfire Management Plan
- Oran Park, Bushfire Attack Level Assessment
- Ravensworth Operations, Bushfire Management Plan
- Thales Australia, Mulwala Bushfire Management Plan
- Wilpinjong Coal, Barrigan Valley Extension Bushfire Management Plan

ECOLOGICAL ASSESSMENTS

- Beacon Hill Retirement Village SIS
- Department of Planning, Area 20 Precinct Planning Biodiversity Study
- Marsden Park Employment Precinct Ecological Assessment
- Schofields Precinct Biodiversity Project
- Transport NSW, North West Rail Link Ecological and Riparian Assessment
- Wind Prospect - Boco Rock, Crudine and Sapphire Wind Farm Ecological Assessments

ENVIRONMENTAL ASSESSMENT AND MAPPING

- DEWHA, Hunter Spatial Offsets
- Hunter Development Corporation, Hunter Catchment – Biodiversity Sensitivity Analysis
- Manly Council, Natural Assets Survey
- North West and South West Growth Centres Sensitivity Mapping
- NSW Natural Resources Commission, River red gum forests assessment, mapping and modelling of conservation significance for river red gum forests in the Riverina
- NSW Natural Resources Commission, South-western cypress state forests assessment
- Office of Environment and Heritage, Refining Mitchell Landscapes
- Office of Environment and Heritage, State of the Parks Mapping
- Port Stephens Council, Conservation Assessment Database
- Wollondilly Shire Council, Vegetation Prioritisation Analysis

ENVIRONMENTAL PLANNING AND POLICY

- Bankstown City Council, Crest to Lansdowne Final Masterplan
- Bidjigal Reserve Plan of Management
- Campbelltown City Council, Park Central Plan of Management
- City of Ryde, Review of Environmental Protection Zones - Ryde Riverside Reserve & Putney Park
- City of Ryde, Review of Environmental Protection Zones - Shrimpton's Creek Parklands
- Dargan Creek Reserve Plan of Management
- Parramatta City Council, Ponds Subiaco Creek Masterplan
- Parramatta Park Cycleways Review of Environmental Factors
- Planning NSW, Western Sydney Bio restoration Strategy Mapping
- South and Ropes Creeks Monitoring and On-ground Biodiversity Restoration Contracts
- Strathfield Council, Local Environmental Plan and Zoning Update
- Tallawarra Lands Part 3A Concept Plan

VEGETATION MANAGEMENT PLANS

- Camden Lakeside Ecological Assessment and Vegetation Management Plan
- Gregory Hills Vegetation Management Plan
- Hunter Water Corporation, LHRWI Tree Planting for Carbon Offset

PROJECT EXPERIENCE- NT

ECOLOGICAL ASSESSMENTS

- Defence Establishment Berrimah, RAAF Base Darwin and Shoal Bay Receiving Station Fauna and Flora Assessment
- Department of Lands, Planning & Environment, Lot 5468, Woolner Fauna and Flora Assessment
- Department of Lands, Planning & Environment, Myilly Point, Old Hospital Site Significant Tree Survey
- Energy Resources of Australia, Ranger 3 Deeps Fauna and Flora Assessment
- NT Department of Mines and Energy, Rum Jungle Fauna and Flora Assessment
- 740 Bees Creek Road, Weddell – *Atalaya brevialata* Threatened Species Survey

ENVIRONMENTAL ASSESSMENT AND MAPPING

- Pacific Aluminium, Katherine to Gove Gas Pipeline - Environmental Impact Statement

LAND CAPABILITY ASSESSMENTS

- Nightcliff Preliminary Site and Planning Suitability Assessment
- Section 1742, Hundred of Cavenagh – Land Capability Assessment

PROJECT EXPERIENCE- QLD

ECOLOGICAL ASSESSMENTS

- South Burnett Regional Council, EPBC Act Significance Assessment

PROJECT EXPERIENCE- WA

ECOLOGICAL ASSESSMENTS

- AARNT Vegetation, flora and fauna survey of cable alignment Kojarena to Geraldton
- BHP Billiton Iron Ore Newman Powerline Level 1 Fauna and Flora Assessment
- BHP Billiton Iron Ore Callawa Level 2 Vertebrate Fauna Survey
- BHP Billiton Iron Ore Orebody 37 Level 1 Vertebrate Fauna Assessment
- LandCorp Flora and Fauna Survey Mapping - Dalwallinu, Lake Grace and Morawa
- LandCorp Regional Development Assistance Program - Hyden Level 1 Flora Survey Mapping
- Fluor SKM Jimblebar Project Habitat Assessment

ENVIRONMENTAL ASSESSMENT AND MAPPING

- DECWA, Gnaragarra Species Habitat Modelling
- Rio Tinto, *Aluta quadrata* Habitat Modelling

ENVIRONMENTAL PLANNING AND POLICY

- Hannans Reward, Lake Johnston Project Conservation Management Plan
- Shire of Exmouth, Exmouth Foreshore and Public Open Space Development Plan
- Swan River Trust, Swan Riverpark River Protection Strategy
- LandCorp, Alkimos District Strategic Advice

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 on 23rd April 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 BCAA.
- **likely** - a medium to high probability that a species occupies or uses habitat within the BCAA.
- **potential** - suitable habitat for a species occurs within the BCAA, 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 BCAA.
- **no** - habitat within the BCAA 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 BCAA.

TSC/EPBC Act Status

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

Threatened flora

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
<i>Calochilus pulchellus</i>	Pretty Beard Orchid	E	-	BCAM	At Vincentia the species grows in low Scribbly Gum dominated woodland with a low wet heath understorey. The soil is a sandy loam overlying sandstone. In Booderee National Park it grows in a tall heathy association. In Morton National Park on the Little Forest Plateau it occurs in low heath among scattered clumps of emergent eucalypts and Banksia in shallow coarse white sand over sandstone.	Unlikely	The BCAA does not contain suitable habitat for this species i.e. open woodland or heath habitat. The BCAA vegetation contains to density of overstorey and/or groundcover vegetation for this species. Previous targeted surveys have not recorded this species	This species was surveyed by BES in 2005. Site assessment and correspondence from Alan Stephenson states this species is unlikely to occur within the BCAA.	No
<i>Caladenia tessellata</i>	Thick-lipped Spider orchid	E	V	PMST	Associated with open woodlands and heath, typically occurring in treeless areas or very open areas, which are often rocky and where there are only skeletal soils. It does not occur in forested habitats. Plants may lay dormant for 10-20 years, only flowering for one to two years following a mid-late summer fire. Outside this period it is highly unlikely that any plants will flower and thus that there will be any above ground biomass of the species.	Unlikely	The study area does not contain suitable habitat for this species i.e. open woodland or heath habitat. Previous targeted surveys have not recorded this species	No	No
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V	BioNet, PMST	Cryptostylis hunteriana is known from a range of vegetation communities including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (<i>Eucalyptus sclerophylla</i>), Silvertop Ash (<i>E. sieberi</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and Black Sheoak (<i>Allocasuarina littoralis</i>); where it appears to prefer open areas in the understorey of this community and is	Potential	Previous surveys in 2006 have not recorded this species within the BCAA, however, it is known in adjacent lands.	No. Previous surveys have determined that this species is unlikely to occur within the BCAA	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
					often found in association with the Large Tongue Orchid (<i>C. subulata</i>) and the Tartan Tongue Orchid (<i>C. erecta</i>). Coastal Plains Scribbly Gum Woodland and Coastal Plains Smoothed-barked Apple Woodland is potential habitat on the Central Coast. Flowers between November and February, although may not flower regularly (OEH 2015).				
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	PMST	<i>Cynanchum elegans</i> is a climber or twiner with a variable form, and flowers between August and May, peaking in November (DECC 2007). It occurs in dry rainforest gullies, scrub and scree slopes, and prefers the ecotone between dry subtropical rainforest and sclerophyll woodland/forest (NPWS 1997). The species has also been found in littoral rainforest; <i>Leptospermum laevigatum</i> – <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> coastal scrub; <i>Eucalyptus tereticornis</i> open forest/ woodland; <i>Corymbia maculata</i> open forest/woodland; and <i>Melaleuca armillaris</i> scrub to open scrub	Unlikely	The study area does not contain suitable habitat for this species i.e. open woodland or heath habitat. Previous targeted surveys have not recorded this species	No	No
<i>Distichlis distichophylla</i>	Australian Saltgrass	E	-	BioNet	This species is predominately found in saltmarsh and margins, although it has been found in other locations. There are three known locations in NSW, Murrah Lagoon, Wowly Gully (Jervis Bay) and Lake Cargelligo.	No	Suitable habitat not recorded in BCAA	No	No
<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E	E	BioNet, PMST	Known from coastal areas from northern Sydney south to the Nowra district. Previous records from the Hunter Valley and Nelson Bay are now thought to be erroneous. Grows in	Known	ELA conducted additional surveys required for species polygon (in 2016)	Yes. conducted targeted surveys in 2016	Yes

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
shrubby woodland in open forest on shallow sandy soils (OEH 2015).									
<i>Genoplesium vernale</i>	East Lynne Midge-orchid	V	V	PMST	This species is known from a narrow distribution in dry sclerophyll forest and woodlands from south of Batemans Bay to north of Ulladulla. Grows in shrubby forests on well drained clay-loam between 30-100m altitude (Jones 2006).	Unlikely	The distribution for this species does not occur within the BCAA area. There are no BioNet records for this species within a 5km radius of the BCAA.	No	No
<i>Hibbertia sp. nov. 'Menai'</i>		E	-	BCAM	This species is known within a small area of Jervis Bay which includes north of Milton to Ulladulla, Snapper Point, and extending inland near Batemans Bay to near Currowan Creek. It occurs in dry sclerophyll forest and woodland. Dominant tree species at various sites include <i>Corymbia gummifera</i> , <i>Angophora costata</i> , <i>Eucalyptus resinifera</i> , <i>E. piperita</i> and <i>Allocasuarina littoralis</i> .	Unlikely	The vegetation description for this species does not fit with the vegetation recorded within the BCAA. There are no BioNet records for this species within a 5km radius of the BCAA.	No. Additionally, this species would have been recorded during targeted surveys and vegetation plot surveys.	No
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V	BCAM, PMST	<i>Melaleuca biconvexa</i> occurs in coastal districts and adjacent tablelands from Jervis Bay north to the Port Macquarie district. It grows in damp places often near streams	Potential	Potential habitat present, however, this is a conspicuous species and has not been recorded during previous surveys by BES 2005.	Yes, surveys undertaken in suitable habitat during vegetation surveys. This species was not recorded during surveys and therefore unlikely to occur.	No
<i>Prasophyllum affine</i>	Jervis Bay Leek Orchid	E	E	BioNet, PMST	This species is known from three sites – Kinghorn Point, Wowly Gully near Callala Bay and near Vincentia township. Grows on poorly drained clay soils that support low heathland and sedgeland communities.	Unlikely	This species has been recorded 1.7 km east of the BCAA. However, the vegetation within the BCAA does not support suitable habitat (heathy/swampy) for this species.	No. Additionally, this species would have been recorded during targeted	No

Scientific name	Common name		TSC Act	EPBC Act	Data source	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
									surveys for <i>Cryptostylis hunteriana</i> in 2005 within the BCAA	
<i>Prostanthera densa</i>	Villous bush	Mint-	V	V	BCAM, BioNet, PMST	Generally grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea.	Unlikely	This species is highly conspicuous and has not been recorded in BCAA despite extensive flora surveys.	No	No
<i>Pterostylis gibbosa</i>	Illawarra Greenhood		E	E	BCAM, PMST	Near Nowra, open forest of Spotted Gum, Forest Red Gum and Grey Ironbark i.e. a transition forest between grassy woodlands and lowland sclerophyll woodlands.	Unlikely	Previous targeted surveys have been conducted by BES in 2005. No individuals were recorded despite intensive surveys. There are no Bionet records for this species within a 5km radius of BCAA.	No Site assessment and correspondence from Alan Stephenson states this species is unlikely to occur within the BCAA.	No
<i>Pterostylis ventricosa</i>	Halbury Rustyhood		CE	-	BCAM, PMST	Predominantly in more open areas of tall coastal eucalypt forest often dominated by one or more of the following tree species:- Turpentine, Spotted Gum, Grey Ironbark, Blackbutt, White Stringybark, Scribbly Gum and Sydney Peppermint. Populations are known at St Georges Basin, Sussex Inlet and west of Nowra.	Potential	Previous targeted surveys have been conducted by BES in 2005. No individuals were recorded despite intensive surveys. There are no Bionet records for this species within a 5km radius of BCAA.	No. Targeted surveys within the BCAA would have detected this species during other orchid surveys.	No
<i>Rhizanthella slateri</i>	Eastern Australian Underground Orchid		V	E	BCAM, PMST	The habitat requirements of this species are poorly understood. It may occur in variable habitats forests and woodlands. This species completes its entire life cycle underground. It is known from ten locations in NSW, closest is a population recorded near Nowra.	Potential	This species is highly cryptic and difficult to detect. Survey for this species may actually damage any living individuals and are therefore, not recommended. The BCAA is located outside of the Nowra population, additionally there are no BioNet records for this species within a 5km radius of the BCAA.	No. Survey for this species is not recommended. It is unlikely that this species occurs within the BCAA	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E	V	BCAM, BioNet, PMST	Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest.	Unlikely	This species is highly conspicuous and has not been recorded within the BCAA despite previous targeted flora surveys. The vegetation description for this species does not fit the vegetation associated with the BCAA.	No	No
<i>Thesium australe</i>	Austral Toadflax	V	V	PMST	Occurs in grassland or grassy woodland. Often found in damp sites in association with <i>Themeda australis</i> (Kangaroo Grass).	Unlikely	The vegetation description for this species does not fit the vegetation associated with the BCAA. There are no BioNet records for this species recorded within a 5km radius of the BCAA.	No	No
<i>Triplarina nowraensis</i>	Nowra Heath-myrtle	E	E	PMST	Poorly drained, gently sloping sandstone shelves or along creek lines underlain by Nowra Sandstone. The sites are often either treeless or have a very open tree canopy due to the impeded drainage.	Unlikely	This species is highly conspicuous and has not been recorded within the BCAA despite previous targeted flora surveys. The vegetation description for this species does not fit the vegetation associated with the BCAA.	No	No
<i>Wilsonia backhousei</i>	Narrow-leafed Wilsonia	V	-	BioNet	Located in intertidal saltmarsh and margins particularly within Jervis Bay region.	No	The vegetation recorded within the BCAA does not support suitable habitat for this species (i.e. saltmarsh).	No	No
<i>Wilsonia rotundifolia</i>	Round-leafed Wilsonia	E	-	BioNet	Occurs in saltmarsh and margins. This species is known from four locations at Lake Wollumboola, Swan Lake, Meringo Lagoon and Lake Coila.	No	The vegetation recorded within the BCAA does not support suitable habitat for this species (i.e. saltmarsh).	No	No

E = ENDANGERED V = VULNERABLE. CE = CRITICALLY ENDANGERED

Threatened Fauna

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
Amphibian										
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	BioNet	Species	Amongst emergent aquatic or riparian vegetation and amongst vegetation, fallen timber adjacent to and within 500m of breeding habitat, including grassland, cropland and modified pastures.	Unlikely	The BCAA does not contain waterbodies or is adjacent to suitable habitat for this species.	No	No
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	PMST	Species	Forages in woodlands, wet heath, dry and wet sclerophyll forest. Associated with semi-permanent to ephemeral sand or rock based streams, where the soil is soft and sandy so that burrows can be constructed.	Unlikely	The BCAA does not contain waterbodies or is adjacent to suitable habitat for this species.	No	No
<i>Litoria littlejohnii</i>	Littlejohn's Tree Frog	V	V	PMST	Species	Littlejohn's Tree Frog occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It appears to be restricted to sandstone woodland and heath communities at mid to high altitude (OEH 2019b).	No	The BCAA does not contain waterbodies or is adjacent to suitable habitat for this species.	No	No
Diurnal Birds										
<i>Anthochaera phrygia</i>	Regent Honeyeater	E	E & M	BCAM, PMST	Species	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts,	Unlikely	Primary habitat not present within the BCAA due to lack of associated feed	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						and riparian forests of River Oak (<i>Casuarina cunninghamiana</i>). Areas containing Swamp Mahogany (<i>Eucalyptus robusta</i>) in coastal areas have been observed to be utilised. The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes. As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (OEH 2019b.		trees or breeding habitat. Single BioNet record within 5km of the BCAA. Targeted surveys are not required for this species.		
<i>Ardea ibis</i>	Cattle Egret	-	M	BioNet	-	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments (McKilligan, 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan, 2005).		Note: this species is subject to an assessment under the EPBC Act only. It is not listed under the TSC Act accordingly there is no requirement for offset in accordance with BCAM	No	No
<i>Arenaria interpres</i>	Ruddy Turnstone	-	M	BioNet	-	Frequents beaches along the coast of NSW. Flies from Siberia or Alaska to	Unlikely	Note: this species is subject to an assessment under the EPBC Act only.	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						Australia in August - September each year		It is not listed under the TSC Act accordingly there is no requirement for offset in accordance with BCAM		
<i>Artamus cyanopterus</i>	Dusky Woodswallow	V	-	BoNet	Ecosystem	A widespread species which is known to breed on the western slopes of the Great Dividing Range. Inhabits dry open eucalypt forest and woodlands	Unlikely	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Botaurus poiciloptilus</i>	Australasian Bittern	V	-	PMST	Species	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats. Reedbeds, swamps, streams, estuaries (OEH 2019b).	No	The BCAA does not contain suitable habitat (aquatic) for this species.	No	No
<i>Calidris canutus</i>	Red Knot	-	E; M	PMTS	-	Red Knots are widespread around the Australian coast, less in the south and with few inland records. Small numbers visit Tasmania and off-shore islands. It is widespread but scattered in New Zealand. They breed in North America, Russia, Greenland and Spitsbergen. Red Knots are a non-breeding visitor to most continents.	Unlikely	Note: this species is subject to an assessment under the EPBC Act only. It is not listed under the TSC Act accordingly there is no requirement for offset in accordance with BCAM	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
<i>Calidris ferruginea</i>	Curlew Sandpiper	E	CE; M	PMTS	-	Intertidal mudflats of estuaries, lagoons, mangrove channels; around lakes,, dams, floodwaters, flooded saltbush surrounds of inland lakes (Morcombe, 2004).	Unlikely	Note: this species is subject to an assessment under the EPBC Act only. It is not listed under the TSC Act accordingly there is no requirement for offset in accordance with BCAM	No	No
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	BCAM, BioNet	Ecosystem	During summer in dense, tall, wet forests of mountains and gullies, alpine woodlands. In winter they occur at lower altitudes in drier more open forests and woodlands, particularly box-ironbark assemblages. They sometimes inhabit woodland, farms and suburbs in autumn/winter (OEH 2019b).	Known	This species is an ecosystem species and does not require targeted survey.	No	Yes
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	-	BioNet, BCAM	Ecosystem	Associated with a variety of forest types containing Allocasuarina species, usually reflecting the poor nutrient status of underlying soils. Intact drier forest types with less rugged landscapes are preferred. Nests in large trees with large hollows (OEH 2019b).	Known	This species is an ecosystem species and does not require targeted survey.	No	Yes
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	BioNet, BCAM	Ecosystem	Distribution includes most of mainland Australia except deserts and open grasslands. Prefers eucalypt forests and	Potential	This species is an ecosystem species and does not	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						woodlands with rough-barked species, or mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods from bark, dead branches, or small branches and twigs (OEH 2019b).		require targeted survey.		
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E	PMST, BioNet	Species	Habitat is characterised by dense, low vegetation and includes sedgeland, heathland, swampland, shrubland, sclerophyll forest and woodland, and rainforest, as well as open woodland with a heathy understorey. In northern NSW occurs in open forest with tussocky grass understorey. All of these vegetation types are fire prone, aside from the rainforest habitat as utilised by the northern population as fire refuge. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously (OEH 2019b).	Unlikely	No suitable habitat recorded within the BCAA. Targeted surveys were conducted by ELA within the adjacent Lake Wollumboola BioBank site and did not require this species.	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
<i>Epthianura albifrons</i>	White-fronted Chat	V	-	BioNet	Ecosystem	The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas (OEH 2019b).	Unlikely	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Gallinago hardwickii</i>	Latham's Snipe		M	BioNet	Ecosystem	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover. Occupies a variety of vegetation around wetlands including wetland grasses and open wooded swamps.	Unlikely	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	BioNet, BCAM	Ecosystem	In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Little Lorikeets mostly occur in dry, open	Potential	This species is an ecosystem species and does not require targeted survey.	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. They feed primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including melaleucas and mistletoes (OEH 2019b).				
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V	-	BioNet	Species	A coastal species that inhabits rock coastlines, coral cays, reefs and occasionally sandy beaches (Marchant & Higgins 1993; Simpson & Day 2004).	Unlikely	This species has been recorded from BioNet records within a 5km radius of the BCAA. The vegetation within the BCAA does not include suitable habitat for this species	No	No
<i>Haematopus longirostris</i>	Pied Oystercatcher	E	-	BioNet	Species	Roosts and forages on sandy beaches, sand banks, mudflats and estuaries (Marchant & Higgins 1993, Simpson & Day 2004).	Unlikely	This species has been recorded from BioNet records within a 5km radius of the BCAA. The vegetation within the BCAA does not	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
								include suitable habitat for this species		
<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle	V	M	PMST, BioNet	Ecosystem and Species (breeding)	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas. Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away.	Known	Note: this species is subject to an assessment under the EPBC Act only. It is not listed under the TSC Act accordingly there is no requirement for offset in accordance with BCAM	Yes (targeted survey not undertaken due to gazettal date occurring post-survey planning)	Yes, ecosystem credit individuals. No breeding pairs or nests recorded for species credit.
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	BCAM, BioNet	Ecosystem	Utilises open eucalypt, sheoak and acacia forest, woodland or open woodland. Uses tall trees for nesting, with a large stick nest being built. Lays eggs in spring, and young fledge in early summer. Preys on birds, reptiles and mammals, and occasionally feeds on large insects or carrion (OEH 2019b).	Potential	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Hirundapus caudacutus</i>	White throated Needletail		M	PMST	Ecosystem	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas. Has been observed roosting in dense foliage of	Unlikely	This species is an ecosystem species and does not require targeted survey.	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						canopy trees and may seek refuge in tree hollows in inclement weather.				
<i>Hydroprogne caspia</i>	Caspian Tern	-	M	BioNet	-	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	Unlikely	Note: this species is subject to an assessment under the EPBC Act only. It is not listed under the TSC Act accordingly there is no requirement for offset in accordance with BCAM	No	No
<i>Lathamus discolor</i>	Swift Parrot	E	CE	BCAM, BioNet, PMST	Ecosystem	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts. Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (<i>Eucalyptus robusta</i>), Spotted Gum (<i>Corymbia maculata</i>), Red Bloodwood (<i>C. gummifera</i>), Mugga Ironbark (<i>E. sideroxylon</i>), and White Box (<i>E. albens</i>) (OEH 2019b).	Potential	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	BCAM, BioNet	Ecosystem	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference	Potential	This species is an ecosystem species and does not	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						for timbered watercourses (OEH 2019b).		require targeted survey.		
<i>Ninox connivens</i>	Barking Owl	V	-	BCAM	Ecosystem	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas (OEH 2019b).	Potential	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Ninox strenua</i>	Powerful Owl	V	-	BCAM, BioNet	Ecosystem	The Powerful Owl is associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes. Large trees with hollows at least 0.5m deep are required for shelter and breeding (OEH 2019b).	Potential	This species is an ecosystem species and does not require targeted survey.	No	No.
<i>Numenius madagascariensis</i>	Eastern Curlew	-	CE; M	BioNet	-	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.	Unlikely	Targeted surveys were conducted along the eastern boundary of the BCAA. It was determined that the BCAA does not contain suitable habitat for this species.	No	No
<i>Pachycephala olivacea</i>	Olive Whistler	V	-	BCAM	Ecosystem	Mostly inhabit wet forests above about 500m. During the winter months they may move to lower altitudes. It has a disjunct distribution in NSW chiefly	Unlikely	This species spends non-breeding season in lower altitude areas.	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range		There are no BioNet records for this species within a 5km radius of BCAA		
<i>Pandion cristatus</i>	Eastern Osprey	V	-	BioNet	Species	Associated with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers (Schodde and Tidemann 1986). Osprey may nest on the ground, on sea cliffs or in trees (Olsen 1995). Osprey generally prefer emergent trees, often dead or partly dead with a broken off crown.	Potential	The BCAA does not contain suitable habitat (open water) for this species.	No	No
<i>Pterodroma leucoptera</i>	Gould's Petrel	V	E	BioNet	Species	The breeding sites of Gould's Petrel are restricted to two islands at the entrance to Port Stephens on the mid-North Coast of New South Wales. Non-breeding habitat includes sub-Antarctic waters between Macquarie Island and Tasmania.	Unlikely	No marine environment recorded within the BCAA. This species has not been predicted to as candidate species from BCAM. Targeted surveys are not required for this species.	No	No
<i>Tringa nebularia</i>	Common Greenshank	-	M	BioNet	-	Wide variety of inland and sheltered coastal wetlands (Morcombe, 2004). On the coast uses sheltered estuaries and bays with extensive mudflats,	Unlikely	Note: this species is subject to an assessment under the EPBC Act only.	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						mangrove swamps, muddy shallows of harbours and lagoons, occasionally rocky tidal ledges (Morcombe, 2004). Away from the coast both temporary and permanent wetlands such as billabongs, swamps, lakes, floodplains, sewage farms and saltworks ponds and flooded irrigated crops (Morcombe, 2004). Generally prefers wet and flooded mud and clay rather than sand		It is not listed under the TSC Act accordingly there is no requirement for offset in accordance with BCAM		
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	BCAM, BioNet	Ecosystem	Associated with forest with sparse, open, understorey, typically dry sclerophyll forest and woodland (OEH 2014) and especially the ecotone between wet and dry forest, and non-forest habitat (Environment Australia 2000). Known to utilise forest margins and isolated stands of trees within agricultural land (Hyem 1979) and heavily disturbed forest where its prey of small and medium sized mammals can be readily obtained).	Unlikely	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Tyto tenebricosa</i>	Sooty Owl	V	-	BioNet	Ecosystem	Sooty Owls are associated with tall wet old growth forest on fertile soil with a dense understorey and emergent tall Eucalyptus species (Environment Australia 2000, Debus 1994). Pairs roost in the daytime amongst dense vegetation, in tree hollows and sometimes in caves. The Sooty Owl is typically associated with an abundant	Unlikely	This species is an ecosystem species and does not require targeted survey.	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						and diverse supply of prey items and a selection of large tree hollows (Debus 1994, Garnett 1993, Hyem 1979).				
Mammals (non-flying)										
Cercartetus nanus	Eastern Pygmy-possum	V	-	BCAM	Species	Found in wet and dry eucalypt forest, subalpine woodland, coastal banksia woodland and wet heath. Pygmy-Possums feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit. Small tree hollows are favoured as day nesting sites, but nests have also been found under bark, in old birds’ nests and in the branch forks of tea-trees (OEH 2019b).	Known	Targeted survey was conducted to define habitat for the species polygon. This is a candidate species for survey	ELA conducted targeted surveys and recorded this species within the BCAA	Yes
Dasyurus maculatus	Spotted-tailed Quoll	V	E	BCAM, PMST	Ecosystem	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests, more frequently recorded near the ecotones of closed and open forest. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (OEH 2019b).	Unlikely	This species is an ecosystem species and does not require targeted survey.	No	No
Dasyurus maculatus maculatus	Spotted-tailed Quoll (SE mainland population)									

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
<i>Isoodon obesulus</i>	Southern Brown Bandicoot	E	E	PMST	Species	This species is associated with heath, coastal scrub, heathy forests, shrubland and woodland on well drained soils. This species is thought to display a preference for newly regenerating heathland and other areas prone to fire (OEH 2019b).	Unlikely	Previous surveys by BES 2005 did not record this species. There are no BioNet records for this species within a 5 km radius of the BCAA. This species was not predicted as a candidate species for BCAM.	No. ELA did not consider this species a candidate species.	No
<i>Petauroides volans</i>	Greater Glider	-	V	BioNet, PMST	-	This species is restricted to eucalypt forests and woodlands where it forages on eucalyptus leaves and flowers. It prefers areas of un-logged vegetation.	Potential	Note: this species is subject to an assessment under the EPBC Act only. It is not listed under the TSC Act accordingly there is no requirement for offset in accordance with BCAM	No	Yes. This species has been recorded during BES 2005 surveys
<i>Petaurus australis</i>	Yellow-bellied Glider	V	-	BioNet	Ecosystem	This species is restricted to tall mature forests, preferring productive tall open sclerophyll forests with a mosaic of tree species including some that flower in winter (Environment Australia 2000, OEH 2019b). Large hollows within mature trees are required for shelter, nesting and breeding.	Known	This species is an ecosystem species and does not require targeted survey.	No	Yes, this species was recorded during spotlighting within the BCAA

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	BCAM	Species	Associated with dry hardwood forest and woodlands. Habitats typically include gum barked and high nectar producing species, including winter flower species. The presence of hollow bearing eucalypts is a critical habitat value (OEH 2019b).	Potential	There is potential habitat for this species within the BCAA. This species is a candidate species for survey.	ELA conducted targeted surveys in 2016 within the BCAA	No
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V	PMST	Species	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (OEH 2019b).	Unlikely	There are no BioNet records for this species within a 5 km radius of the BCAA. This species was not predicted as a candidate species for BCAM. No additional surveys are required.	No	No
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	BCAM	Species	The Brush-tailed Phascogale preferred habitat is Dry Open forest with a sparse open understorey, however, has been located in heath, swamps and rainforest and wet sclerophyll forest	Potential	There is potential habitat for this species within the BCAA. This species is a candidate species for survey.	ELA conducted targeted surveys in 2016 within the BCAA	No
<i>Phascolarctos cinereus</i>	Koala	V	V	BCAM, BioNet, PMST	Species	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70%, with acceptable Eucalypt food trees. Some preferred Eucalyptus species are:	Unlikely	Previous surveys were conducted by BES in 2006 and did not record this species.	ELA has conducted a review of habitat and literature and determined	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						<i>Eucalyptus tereticornis</i> , <i>E. punctata</i> , <i>E. cypellocarpa</i> , <i>E. viminalis</i> (OEH 2019b)			that this species is unlikely to occur.	
<i>Potorous tridactylus</i>	Long-nosed Potoroo	V	V	BCAM, PMST	Ecosystem	This species can be found in wet eucalypt forests to coastal heaths and scrubs. The main factors would appear to be access to some form of dense vegetation for shelter and the presence of an abundant supply of fungi for food.	Unlikely	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	-	V	PMST	Ecosystem	A small burrowing native rodent with a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid-stages of vegetation succession typically induced by fire (OEH 2019b).	Unlikely	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Sminthopsis leucopus</i>	White-footed Dunnart	V	-	BioNet	Species	Found in a range of different habitats across its distribution, including coastal dune vegetation, coastal forest,	Potential	Targeted surveys conducted to identify possible presence of this	ELA conducted targeted surveys in	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						tussock grassland and sedgeland, heathland, woodland and forest.		species within the BCAA.	2016 within the BCAA.	
Mammal (flying)										
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	PMST	Species	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces. Found in well-timbered areas containing gullies (OEH 2019b).	Unlikely	There are no habitat breeding features recorded within the BCAA. This species was predicted from PMST. There are no BioNet records for this species and it was not predicted to occur from BCAM.	No	No
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	BCAM, BioNet	Ecosystem	Prefers moist habitats with trees taller than 20m. Roosts in tree hollows but has also been found roosting in buildings or under loose bark (OEH 2019b).	Potential	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Miniopterus australis</i>	Little Bentwing Bat	V	-	BCAM	Ecosystem and Species (breeding)	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub (OEH 2019b).	No breeding habitat	No caves, tunnels, mines, culverts or other structures which represents suitable breeding habitat was recorded during	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
								targeted surveys in the BCAA.		
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	V	-	BCAM, BioNet	Ecosystem	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland. It forages above and below the tree canopy on small insects. Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (OEH 2019b).	Potential	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Mormopterus norfolkensis</i>	Eastern Freetail Bat	V	-	BCAM, BioNet	Ecosystem	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range. Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges. Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (OEH 2019b).	Potential	This species is an ecosystem species and does not require targeted survey.	No	No
<i>Myotis macropus</i>	Southern Myotis	V	-	BCAM, BioNet	Ecosystem and Species (breeding)	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Will occupy most habitat types such as mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry	Unlikely	This species is associated with waterbodies which were not recorded within the BCAA.	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						sclerophyll forest, open woodland and River Red Gum woodland, close to water. While roosting (in groups of 10-15) is most commonly associated with caves, this species has been observed to roost in tree hollows, amongst vegetation, in clumps of Pandanus, under bridges, in mines, tunnels and stormwater drains, however with specific roost requirements. Forages over streams and pools catching insects and small fish. In NSW females have one young each year usually in November or December (OEH 2019b).				
<i>Pteropus poliocephalus</i>	Grey-headed Flying-Fox	V	V	BCAM, BioNet, PMST	Ecosystem and Species (breeding)	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (OEH 2019b).	No breeding habitat	No riparian habitats which represents breeding habitat was recorded during targeted surveys in the BCAA	No	No
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat	V	-	BCAM	Ecosystem	Found in almost all habitats, from wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies. Roosts in tree hollows; may also use caves; has also been recorded in a tree hollow in a paddock and in abandoned sugar glider nests. The Yellow-bellied Sheathtail-bat is dependent on suitable hollow-bearing	Potential	This species is an ecosystem species and does not require targeted survey.	No	No

Scientific name	Common name	TSC Act	EPBC Act	Data source	BCAM credit	Habitat association	Likelihood	Justification	Additional survey required	Recorded on site
						trees to provide roost sites, which may be a limiting factor on populations in cleared or fragmented habitats (OEH 2019b).				
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	BCAM, BioNet	Ecosystem	Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range, tending to be more frequently located in more productive forests. Within denser vegetation types use is made of natural and man-made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (OEH 2019b).	Potential	This species is an ecosystem species and does not require targeted survey.	No	No

Appendix E Flora species recorded in Biometric plots

Family	Scientific Name	Common Name	Exotic/Native
Acanthaceae	<i>Brunoniella pumilio</i>	Dwarf Blue Trumpet	N
Anthericaceae	<i>Thysanotus juncifolius</i>	Fringe Lily	N
Apiaceae	<i>Hydrocotyle sibthorpioides</i>		N
Apiaceae	<i>Xanthosia tridentata</i>	Rock Xanthosia	N
Apocynaceae	<i>Marsdenia rostrata</i>	Milk Vine	N
Apocynaceae	<i>Parsonsia straminea</i>	Common Silkpod	N
Asparagaceae	<i>Asparagus aethiopicus</i>	Asparagus fern	E
Asteraceae	<i>Euchiton sphaericus</i>		N
Asteraceae	<i>Hypochaeris radicata</i>	Catsear	E
Asteraceae	<i>Lagenophora stipitata</i>	Blue Bottle-daisy	N
Asteraceae	<i>Cyanthillium cinereum</i>	Iron Weed	N
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga Vine	N
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black She-oak	N
Clusiaceae	<i>Hypericum gramineum</i>	Small St John's Wort	N
Colchicaceae	<i>Burchardia umbellata</i>	Milkmaids	N
Convolvulaceae	<i>Polymeria calycina</i>	Bindweed	N
Cyperaceae	<i>Cyathochaeta diandra</i>		N
Cyperaceae	<i>Gahnia radula</i>		N
Cyperaceae	<i>Lepidosperma laterale</i>		N
Cyperaceae	<i>Lepidosperma neesii</i>		N
Cyperaceae	<i>Tetraria capillaris</i>		N
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Common Bracken	N
Dicksoniaceae	<i>Calochlaena dubia</i>	Rainbow Fern	N
Dilleniaceae	<i>Hibbertia aspera</i>	Rough Guinea Flower	N
Dilleniaceae	<i>Hibbertia empetrifolia</i> subsp. <i>empetrifolia</i>		N
Ericaceae Styphelioideae	subf. <i>Leucopogon juniperinus</i>	Prickly Beard-heath	N

Family	Scientific Name	Common Name	Exotic/Native
Fabaceae	<i>Acacia binervata</i>	Two-veined Hickory	N
Fabaceae	<i>Glycine clandestina</i>		N
Fabaceae subf. Faboideae	<i>Hardenbergia violacea</i>	Purple Coral Pea	N
Fabaceae subf. Faboideae	<i>Platylobium formosum</i>	Handsome Flat Pea	N
Fabaceae subf. Faboideae	<i>Pultenaea linophylla</i>		N
Fabaceae subf. Faboideae	<i>Pultenaea retusa</i>	Notched Bush - pea	N
Haloragaceae	<i>Gonocarpus tetragynus</i>		N
Haloragaceae	<i>Gonocarpus teucrioides</i>	Raspwort	N
Iridaceae	<i>Patersonia glabrata</i>	Leafy Purple Flag	N
Iridaceae	<i>Patersonia sericea</i>	Silky Purple-flag	N
Lauraceae	<i>Cassytha glabella</i>		N
Lindsaeaceae	<i>Lindsaea linearis</i>	Screw Fern	N
Lobeliaceae	<i>Pratia purpurascens</i>	Whiteroot	N
Loganiaceae	<i>Logania pusilla</i>		N
Lomandraceae	<i>Lomandra filiformis</i> subsp. <i>filiformis</i>	Wattle Mat-rush	N
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	N
Lomandraceae	<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush	N
Lomandraceae	<i>Lomandra obliqua</i>		N
Myrtaceae	<i>Callistemon linearis</i>	Narrow-leaved Bottlebrush	N
Myrtaceae	<i>Corymbia gummifera</i>	Red Bloodwood	N
Myrtaceae	<i>Eucalyptus globoidea</i>	White Stringybark	N
Myrtaceae	<i>Eucalyptus longifolia</i>	Woollybutt	N
Myrtaceae	<i>Eucalyptus punctata</i>	Grey Gum	N
Myrtaceae	<i>Eucalyptus sclerophylla</i>	Hard-leaved Scribbly Gum	N
Myrtaceae	<i>Kunzea ambigua</i>	Tick Bush	N
Myrtaceae	<i>Leptospermum continentale</i>	Prickly Tea-tree	N
Myrtaceae	<i>Leptospermum trinervium</i>	Flaky-barked Tea-tree	N
Myrtaceae	<i>Melaleuca decora</i>		N

Family	Scientific Name	Common Name	Exotic/Native
Myrtaceae	<i>thymifolia</i>	Thyme Honey-myrtle	N
Orchidaceae	<i>Cryptostylis erecta</i>	Hooded Orchid	N
Orchidaceae	<i>Cryptostylis subulata</i>	Large Tongue Orchid	N
Orchidaceae	<i>Pterostylis</i> sp.		N
Oxalidaceae	<i>Oxalis exilis</i>		N
Phormiaceae	<i>Dianella caerulea</i>	Blue Flax-lily	N
Pittosporaceae	<i>Billardiera scandens</i>	Hairy Apple Berry	N
Pittosporaceae	<i>Rhytidosporum procumbens</i>		N
Poaceae	<i>Andropogon virginicus</i>	Whiskey grass	E
Poaceae	<i>Anisopogon avenaceus</i>	Oat Speargrass	N
Poaceae	<i>Aristida vagans</i>	Threeawn Speargrass	N
Poaceae	<i>Austrostipa pubescens</i>		N
Poaceae	<i>Austrostipa rudis subsp. australis</i>		N
Poaceae	<i>Deyeuxia quadriseta</i>		N
Poaceae	<i>Echinopogon caespitosus</i>	Bushy Hedgehog-grass	N
Poaceae	<i>Entolasia marginata</i>	Bordered Pnic	N
Poaceae	<i>Entolasia stricta</i>	Wiry Panic	N
Poaceae	<i>Imperata cylindrica</i>	Blady Grass	N
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass	N
Poaceae	<i>Panicum simile</i>	Two-colour Panic	N
Poaceae	<i>Paspalidium distans</i>		
Poaceae	<i>Rytidosperma tenuius</i>		N
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass	N
Proteaceae	<i>Banksia spinulosa</i>	Hairpin Banksia	N
Proteaceae	<i>Lomatia ilicifolia</i>	Holly Lomatia/Native Holly	N
Proteaceae	<i>Persoonia linearis</i>	Narrow-leaved Geebung	N
Pteridaceae	<i>Adiantum aethiopicum</i>	Common Maidenhair	N
Restionaceae	<i>Lepyrodia scariosa</i>		N
Rutaceae	<i>Boronia polygalifolia</i>	Dwarf Boronia	N

Family	Scientific Name	Common Name	Exotic/Native
Thymeleaceae	<i>Pimelea linifolia</i>	Slender Rice Flower	N
Violaceae	<i>Viola sieberiana</i>		N
Xanthorrhoeaceae	<i>Xanthorrhoea concava</i>		N

Appendix F Fauna species recorded in Callala BCAA by ELA 2016-2017

Scientific name	Common name	Observation type	Date	Conservation status
Amphibian				
<i>Limnodynastes peronii</i>	Striped marsh frog	Pitfall traps	15/12/2016	-
<i>Pseudophryne bibronii</i>	Bibron's toadlet	Pitfall traps	15/12/2016	-
Aves				
<i>Collocephalon fimbriatum</i>	Gang-gang Cockatoo	Veg surveys	2016	V (TSC)
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	Veg surveys	2016	V (TSC)
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Veg surveys	2016	M (EPBC)
<i>Ninox novaeseelandiae</i>	Southern Boobook Owl	Spotlighting	7/12/2016	-
Mammals				
<i>Acrobates pygmaeus</i>	Feather-tail Glider	Remote sensor camera	January 2017	-
<i>Antechinus stuartii</i>	Brown Antechinus	Pitfall traps	7/02/2017	-
<i>Canis sp.</i>	Domesticated dog	Remote sensor camera	January 2017	Introduced
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Pitfall traps	13/12/2016	V (TSC)
<i>Macropus giganteus</i>	Eastern Grey Kangaroo	Remote sensor camera	January 2017	-
<i>Petauroides volans</i>	Greater Glider	Spotlighting	27/06/1905	V (EPBC)
<i>Petaurus australis</i>	Yellow-bellied Glider	Spotlight and call playback	10/01/2017	V (TSC)
<i>Petaurus breviceps</i>	Sugar Glider	Spotlight and call playback	7/12/2016	-
<i>Rattus fuscipes</i>	Bush Rat	Pitfall traps	13/01/2017	-
<i>Wallabia bicolor</i>	Swamp Wallaby	Spotlight and call playback	7/12/2016	-
Reptile				
<i>Eulamprus tenuis</i>	Bar-sided forest-skink	Pitfall traps	14/12/2016	-
<i>Lampropholis delicata</i>	Delicate Skink	Pitfall traps	13/12/2016	-
<i>Saproscincus musculinus</i>	Weasel Skink	Pitfall traps	15/12/2016	-

Appendix G Transect/plot data

Vegetation Zone 1: SR592-Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion

Plot Name	NPS	NOS	NMS	NGCG	NGCS	NGCO	EPC	NTH	OR	FL	Easting	Northing	Zone
Z1VP4	55	45	4	74	6	50	0	3	1	68	290883	6125322	56
Z1VP23	45	39.5	26.5	74	2	86	0	1	1	77	290627	6125327	56
Z1VP22*	50	27	21	92	2	80	0	2	1	34	291500	6125907	56

* PLOT FROM THE ADJOINING LAKE WOLLUMBOOLA BIOBANK SITE (BA364) USED FOR CREDIT CALCULATIONS TO MEET MINIMUM REQUIREMENTS

Appendix H Lake Wollumboola BioBank Site Credit Assessment Report

ZONES 1 TO 7

BioBanking credit report



This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 18/01/2019

Time: 12:26:34PM

Calculator version: v4.0

Biobank details

Proposal ID:	0092/2017/4450B
Proposal name:	Lake Wollumboola Biobank Site
Proposal address:	453 Culburra Rd Culburra Beach NSW 2540
Proponent name:	Sealark Pty Limited
Proponent address:	GPO Box 2678 Sydney NSW 2001
Proponent phone:	02 9283 3399
Assessor name:	Jennie Powell
Assessor address:	Level 1, 101 Sussex Street SYDNEY NSW 2000
Assessor phone:	02 8536 8656
Assessor accreditation:	0092

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	596.02	7,887.00
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	102.51	1,104.00
Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	19.02	214.00
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	8.64	96.00
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	7.32	77.00
Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	52.65	687.00
Total	786.16	10,065

Credit profiles

1. Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion, (SR592)

Number of ecosystem credits created	7,887
IBRA sub-region	Jervis

2. Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion, (SR669)

Number of ecosystem credits created	687
IBRA sub-region	Jervis

3. Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion, (SR648)

Number of ecosystem credits created	1,104
IBRA sub-region	Jervis

4. Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion, (SR649)

Number of ecosystem credits created	214
IBRA sub-region	Jervis

5. Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion, (SR650)

Number of ecosystem credits created	96
IBRA sub-region	Jervis

6. Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion, (SR651)

Number of ecosystem credits created	77
IBRA sub-region	Jervis

Species credits summary

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Exclude commercial apiaries
Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Exclude miscellaneous feral species
Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Fox control
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude commercial apiaries
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species

Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	Exclude commercial apiaries
Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	Fox control

ZONES 8 TO 17

BioBanking credit report

This report identifies the number and type of credits required at a **BIOBANK SITE**

Date of report: 18/01/2019

Time: 12:07:05PM

Calculator version: v4.0

Biobank details

Proposal ID: 0092/2017/4450B
Proposal name: Lake Wollumboola Biobank Site
Proposal address: 453 Culburra Rd Culburra Beach NSW 2540

Proponent name: Sealark Pty Limited
Proponent address: GPO Box 2678 Sydney NSW 2001
Proponent phone: 02 9283 3399

Assessor name: Jennie Powell
Assessor address: Level 1, 101 Sussex Street SYDNEY NSW 2000
Assessor phone: 02 8536 8656
Assessor accreditation: 0092

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	13.58	176.00
Blackbutt - Turpentine - Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin Bioregion	10.40	143.00
Coast Banksia - Coast Tea-tree low moist forest on coastal sands and headlands, Sydney Basin Bioregion and South East Corner Bioregion	7.24	79.00
Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion	7.19	88.00
Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	31.36	365.00
Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion	51.67	541.00
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	6.09	64.00
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	15.05	157.00
Total	142.58	1,613

Credit profiles

1. Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion, (SR592)

Number of ecosystem credits created	365
IBRA sub-region	Jervis

2. Blackbutt - Turpentine - Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin Bioregion, (SR516)

Number of ecosystem credits created	143
IBRA sub-region	Jervis

3. Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion, (SR512)

Number of ecosystem credits created	176
IBRA sub-region	Jervis

4. Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion, (SR594)

Number of ecosystem credits created	541
IBRA sub-region	Jervis

5. Coast Banksia - Coast Tea-tree low moist forest on coastal sands and headlands, Sydney Basin Bioregion and South East Corner Bioregion, (SR530)

Number of ecosystem credits created	79
IBRA sub-region	Jervis

6. Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion, (SR531)

Number of ecosystem credits created	88
IBRA sub-region	Jervis

7. Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion, (SR648)

Number of ecosystem credits created	64
IBRA sub-region	Jervis

8. Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion, (SR651)

Number of ecosystem credits created	157
IBRA sub-region	Jervis

Species credits summary

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Exclude commercial apiaries
Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Blackbutt - Turpentine - Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin Bioregion	Exclude commercial apiaries
Blackbutt - Turpentine - Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin Bioregion	Exclude miscellaneous feral species
Blackbutt - Turpentine - Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Blackbutt - Turpentine - Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin Bioregion	Fox control
Coast Banksia - Coast Tea-tree low moist forest on coastal sands and headlands, Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Coast Banksia - Coast Tea-tree low moist forest on coastal sands and headlands, Sydney Basin Bioregion and South East Corner Bioregion	Exclude commercial apiaries
Coast Banksia - Coast Tea-tree low moist forest on coastal sands and headlands, Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Coast Banksia - Coast Tea-tree low moist forest on coastal sands and headlands, Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Coast Banksia - Coast Tea-tree low moist forest on coastal sands and headlands, Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude commercial apiaries

Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Exclude commercial apiaries
Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Exclude miscellaneous feral species
Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	Fox control
Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion	Exclude commercial apiaries
Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion	Exclude miscellaneous feral species
Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion	Fox control
Red Bloodwood - Hard-leaved Scribbly Gum - Silvertop Ash heathy open forest on sandstone plateaux of the lower Shoalhaven Valley, Sydney Basin Bioregion	Slashing
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude commercial apiaries
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs

Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Fox control

ZONES 18 TO 35

BioBanking credit report

This report identifies the number and type of credits required at a **BIOBANK SITE**

Date of report: 18/01/2019

Time: 12:08:50PM

Calculator version: v4.0

Biobank details

Proposal ID: 0092/2017/4450B
Proposal name: Lake Wollumboola Biobank Site
Proposal address: 453 Culburra Rd Culburra Beach NSW 2540

Proponent name: Sealark Pty Limited
Proponent address: GPO Box 2678 Sydney NSW 2001
Proponent phone: 02 9283 3399

Assessor name: Jennie Powell
Assessor address: Level 1, 101 Sussex Street SYDNEY NSW 2000
Assessor phone: 02 8536 8656
Assessor accreditation: 0092

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
 ■ Eastern Pygmy-possum Cercartetus nanus
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Banksia - Red Bloodwood - Hard-leaved Scribbly Gum heathy open woodland on sandstone plateaux, southern Sydney Basin Bioregion	27.42	304.00
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	2.30	26.00
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion	57.28	595.00
Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion	24.56	290.00
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	12.76	131.00
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	9.51	114.00
Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion	9.02	99.00
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	4.80	49.00
Total	147.65	1,608

Credit profiles

1. Red Bloodwood - Blackbutt - Spotted Gum shrubby open forest on coastal foothills, southern Sydney Basin Bioregion, (SR592)

Number of ecosystem credits created	290
IBRA sub-region	Jervis

2. Banksia - Red Bloodwood - Hard-leaved Scribbly Gum heathy open woodland on sandstone plateaux, southern Sydney Basin Bioregion, (SR513)

Number of ecosystem credits created	304
IBRA sub-region	Jervis

3. Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion, (SR557)

Number of ecosystem credits created	595
IBRA sub-region	Jervis

4. Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion, (SR536)

Number of ecosystem credits created	26
IBRA sub-region	Jervis

5. Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion, (SR648)

Number of ecosystem credits created	114
IBRA sub-region	Jervis

6. Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion, (SR649)

Number of ecosystem credits created	99
IBRA sub-region	Jervis

7. Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion, (SR651)

Number of ecosystem credits created	49
IBRA sub-region	Jervis

8. Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion, (SR614)

Number of ecosystem credits created	131
IBRA sub-region	Jervis

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Bauer's Midge Orchid	<i>Genoplesium baueri</i>	126.00	895
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	807.69	5,735
White-footed Dunnart	<i>Sminthopsis leucopus</i>	807.69	5,735

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Banksia - Red Bloodwood - Hard-leaved Scribbly Gum heathy open woodland on sandstone plateaux, southern Sydney Basin Bioregion	Exclude commercial apiaries
Banksia - Red Bloodwood - Hard-leaved Scribbly Gum heathy open woodland on sandstone plateaux, southern Sydney Basin Bioregion	Exclude miscellaneous feral species
Banksia - Red Bloodwood - Hard-leaved Scribbly Gum heathy open woodland on sandstone plateaux, southern Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Banksia - Red Bloodwood - Hard-leaved Scribbly Gum heathy open woodland on sandstone plateaux, southern Sydney Basin Bioregion	Fox control
Banksia - Red Bloodwood - Hard-leaved Scribbly Gum heathy open woodland on sandstone plateaux, southern Sydney Basin Bioregion	Slashing
Bauer's Midge Orchid	Feral and/or over-abundant native herbivore control
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Control exotic pest fish species (within dams)
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion	Maintain or re-introduce natural flow regimes
Eastern Pygmy-possum	Fox control
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion	Control of feral pigs
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion	Exclude commercial apiaries

Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion	Exclude miscellaneous feral species
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion	Fox control
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Control exotic pest fish species (within dams)
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion	Maintain or re-introduce natural flow regimes
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude commercial apiaries
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Fox control
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Control of feral pigs
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Exclude miscellaneous feral species
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	Fox control
White-footed Dunnart	Exclude miscellaneous feral species
White-footed Dunnart	Feral and/or over-abundant native herbivore control
White-footed Dunnart	Fox control

