AEP

BIODIVERSITY | BUSHFIRE | ARBORICULTURE

NEWCASTLE SYDNEY

Biodiversity Certification Assessment Report

Planning Proposal

Multiple lots, land off Newcastle Link Road, NSW

Prepared for: Eden Estates (Newcastle) Pty Ltd

9 December 2024

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EXECUTIVE SUMMARY

Anderson Environment & Planning (AEP) was commissioned by Eden Estates (Newcastle) Pty Ltd (the proponent) to undertake a Biodiversity Certification Assessment Report (BCAR) for the proposed rezoning and Biodiversity Certification of lands located to the north and south of the eastern portion of the Newcastle Link Road, NSW, which comprises multiple lots spanning across the Lake Macquarie and Newcastle LGAs.

Field surveys were undertaken in compliance with the requirements of the BAM between 2020 and 2022 and incorporated additional data collected through desktop searches.

The proposed Biodiversity Certification would lead to the determination of an area covering pprox.. 222ha, designated as the Subject Site thereafter, as being rezoned and intended for development, including residential and supporting uses.

The Subject Site comprises pprox.. 222ha of native vegetation proposed to be directly impacted. A 30m buffer drawn along the boundary of the Subject Site, which comprises pprox.. 46ha of native vegetation, may be subjected to indirect impacts as a result of the proposal. The remainder of the Study Area, comprising pprox.. 335.8ha of native vegetation, will be retained, with the majority of such lands proposed to be managed primarily for conservation purposes under a Biodiversity Stewardship Agreement.

This report has been prepared to meet the requirements of the *Biodiversity Assessment Method 2020* (BAM) established under Section 6.7 of the *Biodiversity Conservation Act 2016* (NSW). This assessment utilises methods detailed within the BAM Order 2020 to identify biodiversity values inherent within the site, including known and potentially occurring threatened species and ecological communities, and quantifies impacts of the proposal upon these values. The survey effort described hereafter complies with survey guidelines and species polygon definitions applicable at the time of the first submission of the BCAR to the Consent Authority, i.e. September 2022. Revision 02 of the BCAR presents the significant reduction in the proposed Structure Plan's footprint in comparison with Revision 01 with no other revision to survey or calculation methods being made.

Eastcoast Flora Survey, led by Dr Stephen Bell, were commissioned to undertake vegetation mapping of the Study Area. Nine (9) Plant Community Types (PCTs) were identified within Study Area, in varying conditions, and seven (7) of these PCTs will be impacted to varying degrees by the proposal:

- 1539 – Grey Myrtle sheltered gully dry rainforest in gullies of the Sydney Basin (no impacts);
- 1543 – Rusty Fig – Native Quince – Native Olive dry rainforest of the Central Hunter Valley;
- 1573 – Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment;
- 1584 – White Mahogany – Spotted Gum – Grey Myrtle semi-mesic shrubby open forest, central coast & lower Hunter Valley;
- 1588 – Grey Ironbark-Broad-leaved Mahogany-Forest Red Gum shrubby open forest, Coastal Lowlands, Central Coast;
- 1592 – Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the Lower Hunter. This PCT, as it occurs within the Study Area, is commensurate with BC Act-listed *Lower Hunter Spotted Gum – Ironbark Forest* EEC;
- 1619 – Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands;
- 1621 – Smooth-barked Apple open forest on coastal lowlands of the Central Coast; and
- 1737 – Typha rushland ((no impacts).

Fauna and flora species recorded were typical of those expected in this locality and in this type of remnant habitat with existing connection to larger patches of habitat offsite. The following listed species have been recorded within the Subject Site, and will incur Credits under the Biodiversity Offset Scheme.

- Large-eared Pied-bat (Foraging only) – Detected on Anabat;
- Powerful Owl (Foraging and breeding – three active nests identified) – Detected on Songmeter and three (3) nesting pairs tracked down during extensive spotlighting and stagwatching surveys. All three nest trees are being avoided and the majority of the 100m buffers around each nest tree are being avoided;
- Southern Myotis – Detected on Anabat and observed foraging above dams during spotlighting surveys;
- Squirrel Glider – Recorded on Songmeters and captured on motion-sensing camera traps;
- *Callistemon linearifolius* – Identified in the south of the Study Area. Most of the occurrences of the species are proposed to be avoided and protected under a BSA;
- *Grevillea parviflora subsp. parviflora* – Identified sparsely in the south-west of the Subject Site (only four individuals). Verification of specimens by the National Herbarium of NSW indicated that the species identified was in fact *Grevillea humilis*. Irrespective of this, LMCC indicated that they would expect *Grevillea parviflora* subsp. *parviflora* to occur within the Study Area in the context of the species occurrence in the locality. As such, a precautionary presence of the species was assumed in these four (4) locations. All specimens occur in the Subject Site;
- *Rhodamnia rubescens* – Identified mostly in the north of the site, with additional patches to the north-east and south-west of the Link Road. 99% of the individuals identified are located within lands proposed to be managed under a BSA;
- *Tetratheca juncea* – Identified in the southern half of the Study Area, with higher densities of clumps observed in the south-east and south-west, as well as in proximity to the existing water reservoirs in the centre-south of the Study Area. There will be impacts to pprox.. 41.6ha of identified suitable habitat as well as direct impacts to 41 clumps which represents pprox.. 53.7% of suitable habitat and 13.2% of the population identified on site.

Surveys also resulted in a number of other threatened species being identified within the Study Area, that will be incorporated into Ecosystem Credits. These species include: Little Eagle (*Hieraaetus morphnoides*), Square-tailed Kite (*Lophoictinia isura*), Masked Owl (*Tyto novaehollandiae*) (incidentally recorded with no evidence of breeding on site), Glossy Black-cockatoo (*Calyptorhynchus lathami*), possibly Eastern False-pipistrelle (*Falsistrellus tasmaniensis),* Little Lorikeet (*Glossopsitta pusilla),* Little Bent-winged Bat (*Miniopterus australis*), possibly Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Eastern Coastal Free-tail Bat (*Micronomus norfolkensis*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*). EPBC Act-listed White-throated Needletail (*Hirundapus caudacutus*) was also identified on site. It is to be noted that no Grey-headed flying-fox roost camps were identified on site and no breeding activity was identified for Little Eagle, Square-tailed Kite, Masked Owl, White-bellied Sea-eagle or Glossy Black-cockatoo, hence no Species Credit Species will apply in addition to the encompassing Ecosystem credits.

The Avoid and Minimise hierarchy has been considered through the iterative consultative process between project ecologists, bushfire consultants, town planners, urban designers, LMCC, CON and the proponent between 2020 and 2024. A significant number of meetings and email discussions have occurred between the Proponent and Councils in particular (as illustrated in **Appendix N**), resulting in successive adaptations and reductions to the proposed Structure Plan's impact on biodiversity, such that the version presented herewith represents a major reduction in footprint in comparison with the version initially proposed in December 2020.

This resulted in an increase in the proposed retention of areas of higher biodiversity values within the Study Area in order to achieve environmentally sustainable outcomes while accommodating the economic and social objectives of the Biodiversity Certification proposal in the context of the Hunter Regional Plan 2036 where the site is identified as being the largest and key residential growth area in the Greater Newcastle area.

Consideration was also given to regional fauna corridors, specifically the role played by the Study Area as an interface to other wider extents of remnant vegetation in Greater Newcastle. Key conservation measures to avoid and minimise impacts to biodiversity include:

- Retention and management of pprox.. 60% of the Study Area;
- Retention of pprox.. 75% of Lower Hunter Spotted Gum – Ironbark Forest EEC;
- Retention of pprox.. 99.9% of Critically Endangered flora species *Rhodamnia rubescens*, with only one individual proposed to be removed;
- Retention of pprox.. 82% of occurrences of Vulnerable flora species *Callistemon linearifolius*;
- Retention of pprox.. 86.8% of occurrences of Vulnerable flora species *Tetratheca juncea* (in this particular case, occurrences refer to clumps);
- Avoidance of impacts to pprox.. 99.9% of Powerful Owl nest vegetation buffers;
- Retention of pprox.. 79% of suitable foraging habitat within buffers around suitable waterbodies for Southern Myotis;
- Retention of pprox.. 60% of suitable foraging habitat for Powerful Owl, Masked Owl, Square-tailed Kite, Little Lorikeet, Squirrel Glider, Large-eared Pied-bat and other microbat species;
- Establishment of a Biodiversity Stewardship Site across the majority of retained lands for improved future conservation values;
- Establishment of a requirement for the production and implementation of Construction Environmental Management Plans, Stormwater Management Plans, Vegetation Management Plans and/ or Biodiversity Management Plans, in future stages of development of biodiversity certified lands, within Councils' LEP and DCPs;
- Various impact mitigation measures such as community engagement and fencing of residue lands, as well as rehabilitation of riparian corridors and invasive species management within Stewardship lands.

Remaining residual impacts are proposed to be offset utilising the mechanisms for offsetting available within the NSW BOS, including the establishment of multiple Stewardship sites (including retained conservation lands within the Study Area and within land owned by the proponent in Ellalong) as well as payment into the Biodiversity Conservation Fund for any remaining offsets.

The proposal will require the following Ecosystem credits to be retired to offset the residual impact of the proposed development:

- 1 x PCT 1543;
- 19 x PCT 1573;
- 1225 x PCT 1584;
- 492 x PCT 1588;
- 859 x PCT 1592;
- 2067 x PCT 1619; and

- 365 x PCT 1621;

The following species credits will also be incurred by the proposal:

- 9825 x Large-eared Pied-bat;
- 3 x Powerful Owl;
- 564 x Southern Myotis;
- 6551 x Squirrel Glider;
- 1404 x *Callistemon linearifolius;*
- 54 x *Grevillea parviflora subsp. parviflora;*
- 3 x *Rhodamnia rubescens;* and
- 1702 x *Tetratheca juncea.*

It is considered that the planning and design process undertaken with due reference to generated ecological data has adequately applied Avoid & Minimise measures as required by the BAM. The identified area for Biocertification will be impacted and require the delivery of offsets to address residual impacts as outlined above to enable the proposal to proceed.

Assessments of the proposal under other relevant environmental policy instruments including *Chapter 4 – Koala Habitat Protection 2021* of *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (Biodiversity and Conservation SEPP), *Chapter 2 – Coastal Management* of *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP), the *Water Management Act 2000* (WM Act), the *Fisheries Management Act 1994* (FM Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were undertaken.

With respect to Matters of National Environmental Significance, White-throated Needletail and Large-eared Pied Bat were recorded on site and the site represents foraging habitat for these species. Grey-headed Flying-fox was recorded regularly foraging on site however no roost camp was identified on site. EPBC Act-listed species *Grevillea parviflora subsp. parviflora, Tetratheca juncea* and *Rhodamnia rubescens* were recorded on site and some specimens will be impacted by the proposed Biocertification. Furthermore, whilst not recorded during the surveys, the site represents potential foraging habitat for Spotted-tailed Quoll, Koala, Regent Honeyeater and Swift Parrot. Therefore, referral under the EPBC Act will be undertaken for this proposal.

Relevant permits will be required under the FM Act for impacts within streams, and Controlled Activity Approvals under the WM Act will be required for impacts to waterfront land (which includes streams and other waterways).

Table of Contents

1.0 Stage 1 – Biodiversity Assessment 1
1.1 The Proposal 1
1.2 Consultation and Investigation Process 1
1.3 Site Particulars 1
1.3.1 Assessment Scope 6
1.4 Information Sources 6
1.5 Landscape Features 7
1.5.1 Regional Landscapes 7
1.5.2 Identified Landscape Features 7
1.6 Site Context Components 8
1.6.1 Method 8
1.6.2 Landscape Native Vegetation Cover 8
1.7 Native Vegetation 10
1.7.1 Description of Vegetation Communities 10
1.7.2 Plot Based Floristics Surveys 14
1.7.3 PCT Selection Justification and Description 14
1.7.4 Vegetation Integrity Assessment 16
1.8 Threatened Species 18
1.8.1 Ecosystem Credit Species 18
1.8.2 Species Credit Species 20
1.8.3 Field Survey Methods 36
1.8.4 Habitat Survey Results 38
1.8.5 Species Credit Species Survey Results 41
1.8.6 Other threatened species considerations 54
2.0 Stage 2 – Impact Assessment (Biodiversity Values) 55
2.1 Avoid and Minimise Summary 55
2.2 Impact Avoidance and Mitigation Measures 55
2.2.1 Project Design and Council Consultation 55
2.2.2 Management of Urban Bushland and Parkland 59
2.2.3 General Construction & Operation 60
2.2.4 Management of Myrtle Rust 62
2.2.5 LGA-wide Tree Planting 63
2.2.6 Threatened Entities Habitat Retention 63
2.3 Assessment of Impacts 72
2.3.1 Direct, Indirect, Prescribed and Residual impacts 72
2.3.2 Serious and Irreversible Impacts 77
2.4 Biodiversity Credits to Offset Residual Impacts 87
2.4.1 Ecosystem Credits 87
2.4.2 Species Credits 89
2.4.3 Areas not requiring assessment 90

3.0 Biodiversity Certification Strategy 100
3.1 Lands Proposed for Certification and Conservation 100
3.2 Proposed Conservation Measures 100
3.2.1 Within the Study Area 100
3.2.2 Ellalong Lagoon 100
3.3 Delivery of Proposed Conservation Measures 100
3.4 Biodiversity Certification – Parties and Responsibilities 101
4.0 Conclusion 102
5.0 References 103

Tables

Table 1 – Study Area Lot and DPs 2
Table 2 – Site Details 3
Table 3 – Landscape Feature Assessment 7
Table 4 – Plant Community Types 11
Table 5 – PCT by Condition 12
Table 6 – Level of Retention by PCT based on Structure Plan Version 055.WS.025.09 15
Table 7 – Vegetation Integrity Score Table 17
Table 8 – Predicted Ecosystem Credit Species 19
Table 9 – Potential Species Credit and SAII Species 21
Table 10 – Tree and Hollow Retention 38
Table 11 – Removal and Retention Levels by Hollow Size Class 38
Table 12 – Species Credit Species 42
Table 13: Evolution of the Structure Plan areas 56
Table 14 – Comparison of Structure Plan Versions (2020 v 2024) 57
Table 15 – Summary of development and conservation extent since Dec 2020 58
Table 16 – Threatened Entities Retained Habitat 64
Table 17 – Avoid and Minimise Impacts on Biodiversity Values 65
Table 18 – Prescribed Impact Avoidance and Minimisation 68
Table 19 – Direct Impact Assessment 73
Table 20 – Prescribed Impact Assessment 74
Table 21 – Indirect Impact Assessment 74
Table 22 – Residual Impact Assessment 75
Table 23 – Risk Matrix 76
Table 24 – Assessment Criteria 76
Table 25 – Candidate SAII Species 78
Table 26 – *Rhodamnia rubescens* SAII Assessment 80
Table 27 – Summary of SAII Assessment 83
Table 28 – Ecosystem Credit Requirements 87
Table 29 – Ecosystem Credit Trading Groups and Variation Rules 88

Table 30 – Species Credit Requirements 89
Table 31 – Species Credit Trading Groups and Variation Rules 89

Figures

Figure 1 – Site Map 4
Figure 2 – Current Land zoning 5
Figure 3 – Location Map 9
Figure 4 – Plant Community Types 13
Figure 5 – NSW BioNet Atlas Records 35
Figure 6 – Habitat Features 40
Figure 7 – Direct and Indirect Impact Areas 91
Figure 8 – *Callistemon linearifolius* Species Polygon 92
Figure 9 – *Grevillea parviflora* subsp. *parviflora* Species Polygon 93
Figure 10 – *Rhodamnia rubescens* Species Polygon 94
Figure 11 – *Tetratheca juncea* Species Polygon 95
Figure 12 – Large-eared Pied-bat Species Polygon 96
Figure 13 – Powerful Owl Species Polygon 97
Figure 14 – Southern Myotis Species Polygon 98
Figure 15 – Squirrel Glider Species Polygon 99

Appendices

Appendix A – Structure Plan Versions
Appendix B – Vegetation Mapping by Eastcoast Flora Survey
Appendix C – Flora Survey Methodology and Results
Appendix D – Fauna Survey Methodology and Results
Appendix E – AEP BAM Field Sheets
Appendix F – AEP BAM Plot Data
Appendix G – Biodiversity Credit Reports
Appendix H – Habitat Photographs
Appendix I – Fauna Photographs
Appendix J – Threatened Flora Photographs
Appendix K – Comparison of Impacts by LGA
Appendix L – Other Legislation
Appendix M – BCAR Checklist
Appendix N – History of Consultation with Councils

Study Certification and Licensing

This report was written by Edouard Loisance MMgt and Dip. Cons. & Land Mgt, reviewed by Ian Benson Beng (Civil) & GradDipSc (Ecology) (BAAS 18047) and reviewed and certified by Craig Anderson BappSc (EAM) (BAAS 17002) of Anderson Environment & Planning. Staff listed below were also involved in the biodiversity assessment process.

Current Staff	Title & Qualifications	Tasks
Craig Anderson	Managing Director BappSc (EAM) BAAS: 17002	Scientific and strategic advice, field survey, report review and certification
Ian Benson	Director and Principal Ecologist Beng (Civil) GradDipSc (Ecology) BAAS: 18147	Scientific and strategic advice, field survey, report review
Edouard Loisance	Director and General Manager MMgt; Dip Cons & Land Mmgt	Field survey, report writing, GIS
Natalie Black	Senior Environmental Manager & Works Coordinator BSc (Hons) BAAS 19076	Scientific advice, field survey
Simon Purcell	Senior Ecologist / Works Coordinator BappSc (Wildlife Science) CertIII Animal Care & Mmgt	Field survey
Stevie Kay	Senior Ecologist BSc	Field survey, GIS
Yann Buissiere	Senior Ecologist BenvMgt & Dip Cons & Land Mgmt	Field survey
Frances O'Brien	Senior Ecologist / Lead Botanist Benv LLB GDLP MEL BAAS: 20013	Field survey
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Kathleen Bushell	Ecologist BSc (Hons)	Field survey
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Current Staff	Title & Qualifications	Tasks
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Angela Metcalfe	Ecologist BenvSc (Hons)	Field survey
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Joe May	Ecologist BenvSc MenvMgt (BAAS 18060)	Field survey
Alex McNamara	Ecologist BenvSc Mmgt (undergraduate)	Field survey
Tim Mouton	Senior Ecologist BenvSc MenvSc BAAS: 19083	Field survey, GIS
Ian Simpson	Ecologist / Botanist	Field survey

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence SL101313;
- Animal Research Authority (Trim File No: 14/600(2)) issued by NSW Agriculture; and
- Animal Research Establishment Accreditation Number 53724.

Certification:

As the certifying author, I, Craig Anderson, make the following certification:

- This report has been written to comply with the requirements of the BAM 2020 and obligations outlined within the BAM Assessor Code of Conduct and includes, in the opinion of the writer, a true and accurate account of the species recorded, or considered likely to occur within the Survey Area, and inferences of such for biodiversity credit calculations;
- Anderson Environment and Planning have no actual, potential or perceived conflicts of interest with Eden Estates. Anderson Environment and Planning has received commercial payment for consulting services and assessment by Eden Estates for this project;
- BAM Assessment methodology, as well as Commonwealth, state and local government policies and guidelines formed the basis of project surveying methodology, unless specified departures from industry standard guidelines are justified for scientific and/or animal ethics reasons;
- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995*, *National Parks and Wildlife Act 1974* and the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes.

Principal Author and Certifier:

out of scope

Managing Director

Anderson Environment & Planning

BAAS no. out of scope

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9 December 2024

Glossary of Terms

APZ	Asset Protection Zone
Assessment area	Includes the subject land and the area of land within the 1500 m buffer zone surrounding the subject land (or 500 m buffer zone for linear proposals) that is determined as per Subsection 3.1.2 of the BAM.
BAM	Biodiversity Assessment Method Order (2020) that determines: • Methodology applicable to quantifying biodiversity values inherent within a development site; • Avoid and minimise efforts required to be employed as part of any development proposal; and • Number and class of credits required to offset residual impacts of the proposal upon the biodiversity values therein.
BC Act	*Biodiversity Conservation Act 2016*
Biodiversity Credit Report	Specifies the number and type of biodiversity credits required to offset impacts of development.
BAM Calculator (BAM-C)	The online tool used to interpret site survey data and regional location information to quantify ecosystem and species credits required / generated at a development / stewardship site.
Biodiversity credits	Ecosystem or Species Credits required to offset the loss of biodiversity values on a development site.
Biodiversity offsets	Specific measures that are put in place to compensate for impacts on biodiversity values.
Biodiversity values	The composition, structure and function of ecosystems, and threatened species, populations and ecological communities, and their habitats.
BCAR	Biodiversity Certification Assessment Report
BCD	The NSW DPE Biodiversity Conservation Division
BCF	The NSW Biodiversity Conservation Fund
BCT	The NSW Biodiversity Conservation Trust
BRW	Biodiversity Risk Weighting
BSA	Biodiversity Stewardship Agreement
BSA Lands	The Stewardship Site
BSS	Biodiversity Stewardship Site
BSSAR	Biodiversity Stewardship Site Assessment report
CEEC	Critically Endangered Ecological Community
CON	City of Newcastle Council
CST	The NSW DPE Credit Supply Taskforce
DAWE	The former Commonwealth Department of Agricultural, Water and Environment
DCCEEW	The Commonwealth Department of Climate Change, Energy, the Environment and Water
Development Lands	Land upon which the development is proposed, and within which impacts upon biodiversity are required to be offset. These are shown on **Figure 1**.
DoEE	The former Commonwealth Department of the Environment and Energy
DPE	The former NSW Department of Planning and Environment
DPI	The former NSW Department of Primary Industries
DPIE	The former NSW Department of Planning, Industry and Environment
DPIRD	The NSW Department of Primary Industries and Regional Development

Ecosystem credit	The class of biodiversity credits created or required for the impact on EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur within a vegetation type.
EEC	Endangered Ecological Community (under BC Act)
EPBC Act	The Commonwealth Environment Protection and Biodiversity Conservation Act 1999
IBRA	Interim Biogeographic Regionalisation for Australia
LMCC	Lake Macquarie City Council
NSW DCCEEW	The NSW Department of Climate Change, Energy, the Environment and Water
OEH	The former NSW Office of Environment and Heritage
PFC	Projected Foliage Cover
Conservation lands	The combination of the Stewardship Site and Transition Lands
Species credit	Class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted based on habitat surrogates.
Stewardship Site	The area within the Study Area which will not be subjected to development and will be managed under a BSA (subject to CST approval of BSA application).
Study Area	The entirety of Eden Estates (Newcastle) Pty Ltd land holdings within and adjacent to the Subject Site, as described in displayed in **Figure 1**. The Study Area does not include the area managed by Hunter Water Corporation, located south of Newcastle Link Road roundabouts where two Hunter Water Corporation water tanks are located and where a third water tank is proposed under a separate application.
Subject Site	The Eden Estates (Newcastle) Pty Ltd land holdings subject to development or retention within the Study Area, as described in **Figure 1**.
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community
Transition lands	Lands located in the north of the Study Area which are proposed to be retained but not managed under a BSA.
VIS	Vegetation Integrity Score

1.0 Stage 1 – Biodiversity Assessment

1.1 The Proposal

Eden Estates have submitted a Planning Proposal for their landholdings involving multiple lots north and south of east end of the Link Road. The planning proposal will facilitate the rezoning of the site for development and environmental protection purposes. The subject BCAR is proposed to assess the impacts of the development lands pursuant to the *Biodiversity Conservation Act 2016*. Eden Estates (Newcastle) Pty Ltd Residue lands will be primarily managed for conservation purposes and subjected to a BSA application. The present BCAR considers impact avoidance and minimisation strategies and quantifies the offsets required for a development footprint, including consideration of cumulative impacts of development on biodiversity within the area and its relationship to local and regional corridors.

At the request of the Proponent, Anderson Environment & Planning (AEP) have undertaken the necessary investigations to inform the production of a BCAR addressing the proposed development. More specifically, the present report includes a comprehensive assessment of vegetation and threatened species identified on site, a description of proposed impact avoidance, minimisation and mitigation measures, and a proposed Biodiversity Offsets Package for residual impacts.

This BCAR adheres to the approach outlined in the BAM (DPIE, 2020a) and the BAM Calculator User Guide (DPIE, 2020b).

1.2 Consultation and Investigation Process

A comprehensive survey effort and various consultations have been undertaken throughout the assessment process, across the entirety of the Study Area. Details of the flora and fauna survey methodology and results are included in **Appendix C** and **D** respectively.

Where required, specific consultation was undertaken with the former OEH, the former DPIE, DPE, LMCC, CON, the former DAWE, DCCEEW and other Government organisations to seek clarification and/or validation on survey requirements.

The extent of survey effort required was determined following expert advice from the former DPIE, specifically for Brush-tailed Phascogale and Common Planigale. Furthermore, advice from LMCC was incorporated into survey for threatened flora and Forest Owls, with surveys undertaken to satisfy Council guidelines, beyond the requirements of the BAM.

Evidence of such consultations is included in **Appendix D**.

Furthermore, vegetation mapping was led by local subject matter expert Dr Stephen Bell, and is included in **Appendix B**.

1.3 Site Particulars

Details of subject lots are provided in **Table 1** and site details are provided in **Table 3**. The site location is shown on **Figure 1** and current land zoning is shown in **Figure 2**.

The proposal to rezone the lands includes a Structure Plan whereby lands would be zoned for the purposes of development and public recreation. The majority of residue lands is proposed to be managed under a BSA and zoned for conservation.

The proposal makes provisions for indicative Asset Protection Zones which are proposed to be fully located within the proponent's land holdings and within the development lands, i.e., would not impact lands managed under the BSA.

Table 1 – Study Area Lot and DPs

Street Address	Lot	Deposited Plan	Area (ha)	LGA	Subject Site	Study Area
1 Glendon Crescent, Glendale	31	35580	0.14	LMCC		•
1 Glendon Crescent, Glendale	3051	1202601	0.3	LMCC	•	•
1 Glendon Crescent Glendale	3052	1202601	0.37	LMCC	•	•
144 Boundary Road Wallsend	3057	1208470	166.86	LMCC	•	•
144 Boundary Road Wallsend	1	822151	0.39	CON		•
144 Boundary Road Wallsend	1	192650	0.09	CON		•
144 Boundary Road Wallsend	2	800035	78	CON	•	•
Transfield Avenue Elermore Vale	3	248182	0.83	CON	•	•
Transfield Avenue Elermore Vale	4	248182	0.02	CON		•
Turrama Street Wallsend	350	1167367	0.66	CON	•	•
144 Boundary Road Wallsend	3053	1202601	1.78	CON		•
144 Boundary Road Wallsend	3057	1208470	323.96	CON	•	•
144 Boundary Road Wallsend	A	36897	0.89	CON	•	•
144 Boundary Road Wallsend	B	36897	1.2	CON		•
Residual land not described with a lot/DP (e.g., roads, trails etc.)			18.19	LMCC & CON	•	•
Total Subject Site		**289.2**				
Total Study Area		**593.7**				

Table 2 – Site Details

Detail	Comments
Client	Eden Estates (Newcastle) Pty Ltd
Title(s)	As described in **Table 1**
LGAs	Lake Macquarie, Newcastle
Subject Site Zoning	As per LMCC LEP 2014 and CON LEP 2012, the site is currently zoned C2-Environmental Conservation, R2-Low Density Residential, RU6-Transition, RE1-Public Recreation, SP2-Infrastructure and C4-Environmental Living.
BV Mapped Land	Yes
BV Mapped Explanation	Biodiverse riparian land
Study Area	The Study Area covers pprox.. 593.7ha and comprises titles as described in **Table 1**.
Subject Site	The Subject Site is the subset of the Study Area proposed to be developed, and subject to this BCAR. It covers pprox.. 289ha and comprises titles described in **Table 1**.
Current Land Use	The Study Area comprises undeveloped land which was remediated and then sold, following the closure of a colliery therein. Two (2) powerline easements occur within the site. The site comprises a mix of native and exotic vegetation, as mapped by Bell & Sims (2021), and covers pprox.. 593.7ha.
Surrounding Land Use	The Subject Site is bounded to the north by the Summerhill Waste Management Centre. To the west, it is bounded by remnant vegetation subject to approved development on either side of the Newcastle Link Road, and existing urban development to the south-west. To the south, it is bounded by residential development, urban bushland, the Glendale TAFE and Glendale Technology High School campuses. To the east, it is bounded by urban development, Macquarie College and fragmented patches of disturbed remnant vegetation (proximate to Boundary Road, Wallsend, and Lake Road, Elermore Vale).
Surrounding Land Zoning	C4-Environmental Living, SP2-Infrastructure, R2-Low Density Residential; RU6-Transition; R3-Medium Density Residential; RE1-Public Recreation; and C2-Environmental Conservation.

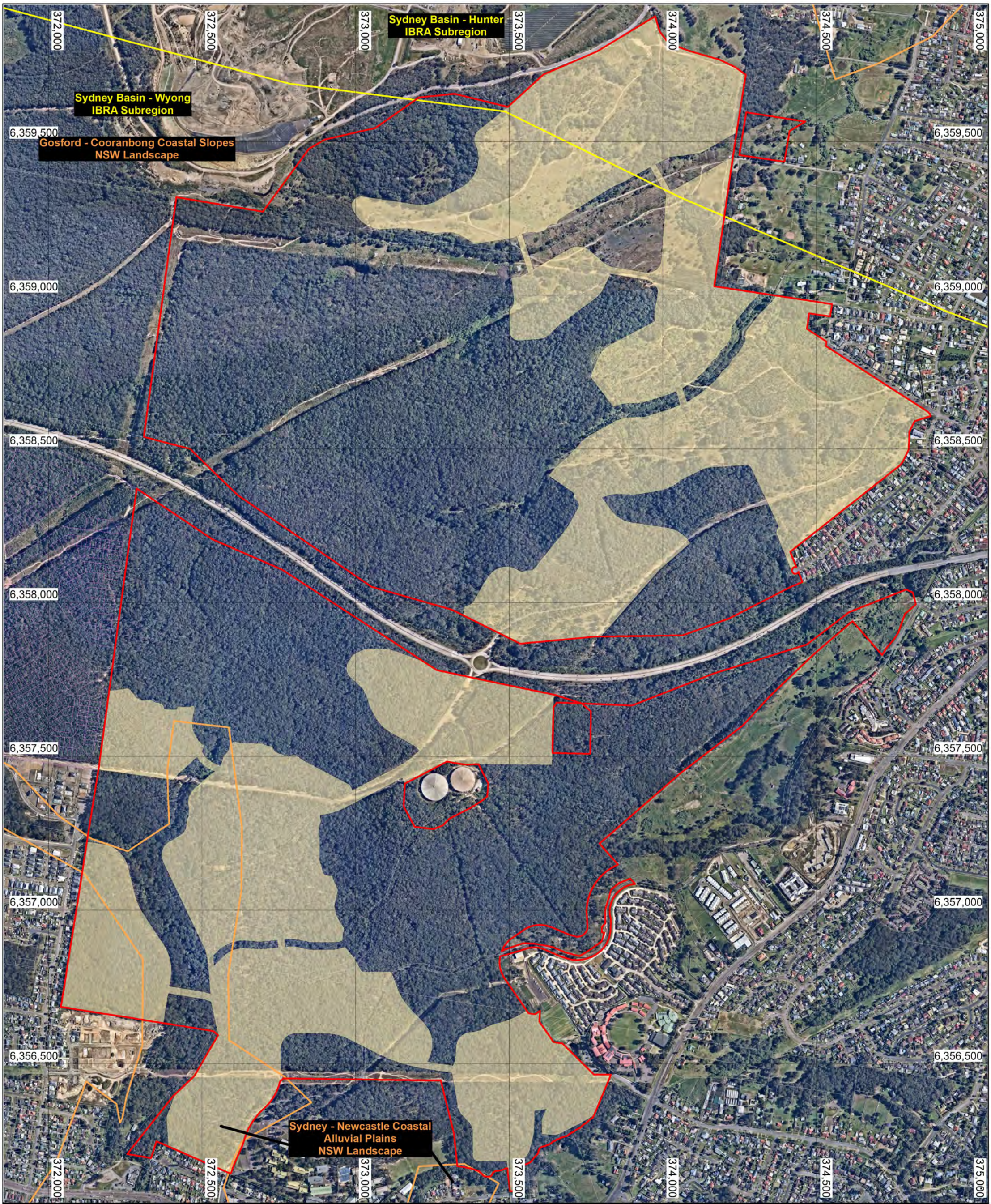

Figure 1 - Site Map

Legend

- Study Area
- Subject Site (BCAR Lands)
- Cadastre
- NSW Landscape boundary
- IBRA Subregion boundary
- Approved future subdivision

0 500
metres
Scale 1:11,000

N W E S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

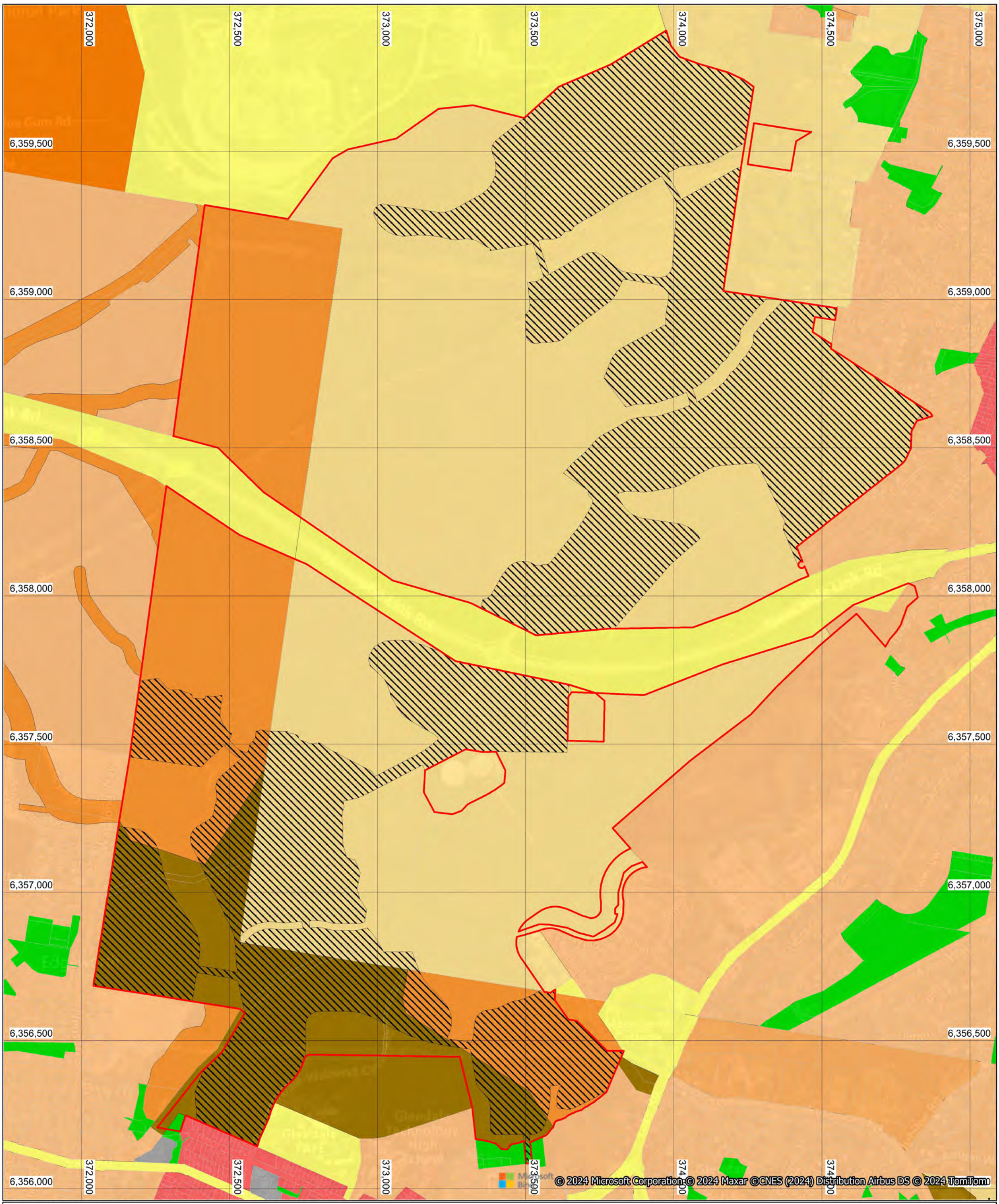

Figure 2 - Zoning Map

Legend

- Study Area
- Subject Site
- Cadastre
- B1 - Neighbourhood Centre
- B2 - Local Centre
- B3 - Commercial Core
- B4 - Mixed Use
- C1 - National Parks and Nature Reserves
- C2 - Environmental Conservation
- C3 - Environmental Management
- C4 - Environmental Living
- IN2 - Light Industrial
- R2 - Low Density Residential
- R3 - Medium Density Residential
- RE1 - Public Recreation
- RE2 - Private Recreation
- RU4 - Primary Production Small Lots
- RU6 - Transition
- SP2 - Infrastructure
- W1 - Natural Waterways

0 500
metres
Scale 1:11,500

N W E S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
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1.3.1 Assessment Scope

The BCAR presented herewith aims to quantify impacts of the proposal upon biodiversity values based upon the methods described within the BAM, including threatened entities listed under the BC Act.

This report includes:

- **Stage 1 – Biodiversity Assessment** – including the mapping of remnant vegetation communities including Endangered Ecological Communities (EECs) within the site, the location of previously identified threatened species and their habitats, and potential contemporary occurrence of threatened species identified within the BAM Calculator; and
- **Stage 2 – Impact Assessment** – identification of impact avoidance and mitigation measures, and the quantifying of offset requirements in the form of biodiversity credits based upon residual impacts of the proposal. Furthermore, conservation measures are proposed and detailed as required under the BAM for Biodiversity Certification proposals.

1.4 Information Sources

Information and spatial data provided within this BCAR has been compiled from various sources including:

- Detailed surveys conducted within the site and surrounding areas by AEP (2020-2022);
- Aerial Photograph Interpretation (API) of the site and surrounding locality (Bing Hybrid 2022; NSW SIX Aerial 2022, Nearmap 2022);
- State survey guidelines (DEC 2004; DECC 2009; DPIE 2020a; DPIE 2020c; DPIE 2020e; DPIE 2020f; OEH 2018; DPE 2022b);
- Relevant Commonwealth assessment guidelines and conservation advices for listed threatened species and communities, including *EPBC Act Referral guidelines for the vulnerable black-eyed susan, Tetratheca juncea*; *Approved Conservation Advice for Grevillea parviflora subsp. parviflora;* and *Threatened Species Scientific Committee – Conservation Advice – Rhodamnia rubescens Scrub Turpentine*;
- Review of vegetation mapping undertaken for the Study Area by Bell and Sims of Eastcoast Flora Survey (2021)*;*
- DPE Threatened Species, Populations and Ecological Communities website https://www.environment.nsw.gov.au/threatenedspeciesapp/);
- Search and review of flora and fauna sighting records in the BioNet Atlas of NSW within 10km of the site (https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet);
- Protected Matters Search within a 5km radius of the site held by DCCEEW, summarising Matters of National Environmental Significance that may occur in, or may relate to the Study Area (https://www.environment.gov.au/epbc/protected-matters-search-tool);
- DPE *BAM – Important Areas Map* to determine whether the site is mapped as containing *Swift Parrot Important Areas, Regent Honeyeater Important Areas* and/or *Migratory Shorebirds Important Areas;*
- Collective knowledge gained from previous ecological survey and assessment in the Lake Macquarie and Newcastle area over the past 25+ years; and
- Anecdotal records.

1.5 Landscape Features

1.5.1 Regional Landscapes

The Subject Site was identified as occurring within the following landscape areas:

- IBRA Bioregion – *Sydney Basin*.
- IBRA Subregion – *Wyong.*
- NSW Landscape – *Sydney-Newcastle Coastal Alluvial Plains* and *Gosford-Cooranbong Coastal Slopes*.

Delineation of NSW Landscape areas are shown in both **Figure 1** and **Figure 3**.

1.5.2 Identified Landscape Features

The BAM Calculator identifies nine (9) landscape features that require assessment for their relevance to the Subject Site. These features are outlined in **Table 3**.

Table 3 – Landscape Feature Assessment

Landscape Feature	Assessment
Rivers and Streams	Within the Subject Site, multiple streams flow into Brush Creek in the south, and Maryland Creek in the north. Stream orders and locations are depicted in **Figure 3**.
Wetlands	A small section of land immediately north of Transfield Avenue within the Subject Site was identified as Freshwater Wetland (Bell & Sims, 2021) but was not deemed to be commensurate with any EEC. The Subject Site does not contain any land mapped as Coastal Wetlands or Proximity Area for Coastal Wetlands under Chapter 2 of SEPP (Resilience and Hazards) 2021.
Native Vegetation Extent	The extent of native vegetation with the Subject Site and Study Area is described in **Table 5** – PCT by Condition.
Connectivity Features	Vegetation within the Subject Site is currently viably connected to other large patches of remnant vegetation to the west, north-east and south. As defined by the BAM, connected native vegetation extends as a patch for more than 100ha. More specifically, under the LMCC Native Vegetation & Corridors Map (2019), large areas along the southern and western boundaries of the Study Area are described as: • *Corridor of Remnant Native Vegetation that contributes significantly to movement & viability of flora & fauna in Lake Macquarie City;* • *Corridor of Partially Cleared Remnant Native Vegetation that contributes significantly to movement & viability of flora & fauna in Lake Macquarie City*; and • *Partially Cleared Remnant Native Vegetation that has a minor role in flora & fauna movement however may contribute to flora & fauna viability in other ways.* Furthermore, approved development is planned along the west boundary of the Study Area, which will reduce connectivity in the locality.

Landscape Feature	Assessment
Karst, Caves, Crevices, Cliffs, Rock and other Geological Features of Significance	There are steep sections along the creek lines in the north of the site near Maryland Creek that contain cervices, but no caves as such. Furthermore, large boulders and exposed rock occur immediately south of the Newcastle Link Road. There are areas of mine subsidence resulting in pothole subsidence and tension cracks at the surface in a small number of locations within the Subject Site. All sub-surface workings have been sealed.
NSW Landscape	The Subject Site is mostly located within the Gosford-Cooranbong Slopes. Location of NSW Landscape areas are shown in the Site Map (**Figure 1**) and Location Map (**Figure 3**).
Soil hazard features	As per the report produced by Douglas Partners (2022), the site has the potential to contain soil hazards as follows. • Potentially unstable ground (slopes greater than 15 degrees); • Erosion; and • Mine subsidence constraints.
Features identified in SEARs	No SEARs apply to the proposal.
Areas of Outstanding Biodiversity Value (AOBV) under the BC Act:	No areas of AOBV are present on the Subject Site or Study Area.

1.6 Site Context Components

1.6.1 Method

Site layout allowed for the landscape values to be determined based upon a site-based method, rather than that of a linear method.

1.6.2 Landscape Native Vegetation Cover

The 1500m buffer placed around the Study Area is approximately 3,063ha in size (including the Subject Site). Of this, approximately 1,310ha comprise native vegetation as per Section 3.2 of the BAM. This equates to approximately 43% native vegetation cover. **Figure 3** depicts the extent of native vegetation within the Assessment Area.

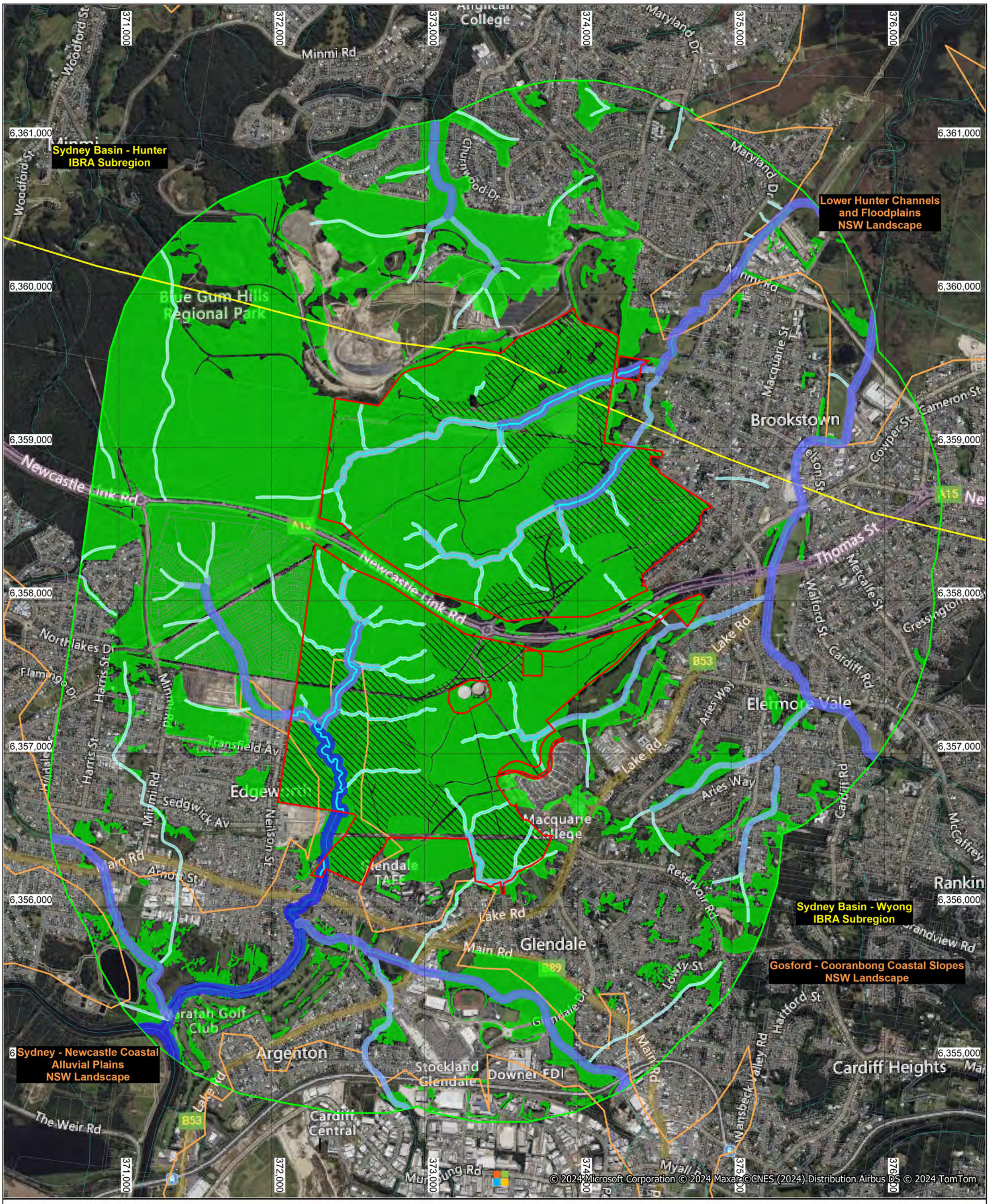

Figure 3 - Location Map

Legend

- Study Area
- Subject Site
- Native Vegetation Extent
- Assessment Area
- NSW Landscape boundary
- IBRA Subregion boundary
- Cadastre
- Approved future subdivision (Approx. location)

Vegetated Riparian Zones

- First-order stream buffer (10m)
- Second-order stream buffer (20m)
- Third-order stream buffer (30m)
- Fourth-order stream buffer (40m)
- Hydroline

0 — 1 kilometres

Scale 1:22,000

N W E S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

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1.7 Native Vegetation

1.7.1 Description of Vegetation Communities

Eastcoast Flora Survey (Dr Stephen Bell), with assistance from Ryan Sims (Key Botany), undertook a comprehensive survey of vegetation communities occurring within the Study Area between May and July 2020. **Table 4** shows the list of vegetation communities and associated Plant Community Types (PCTs) found within the Study Area.

Table 5 provides a detailed description of the extent of occurrence of each PCT by condition, as assessed by Bell & Sims (2021), within the Study Area and Subject Site. **Figure 4** shows the location of each PCT by condition, overlaid with the proposed development footprint.

The report produced by Bell & Sims, which details the survey methodology and the profiles of each vegetation community identified within the Study Area, is included in **Appendix B**.

.

Table 4 – Plant Community Types

Vegetation Community	Plant Community Type	Plant Community Type Code	Associated EEC (if applicable)	Area present within the Subject Site (ha)	Area present within the Study Area (ha)
Lake Macquarie Dry Rainforest	Grey Myrtle sheltered gully dry rainforest in gullies of the Sydney Basin	1539	N/A	0.00	1.12
Permian Gully Rainforest	Rusty Fig – Native Quince – Native Olive dry rainforest of the Central Hunter Valley	1543	N/A	0.01	1.37
Alluvial Tall Moist Forest	Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment	1573	River-Flat Eucalypt Forest on Coastal Floodplains[1]	0.66	6.61
Hunter Valley Moist Spotted Gum – Fergusons Forest	White Mahogany – Spotted Gum – Grey Myrtle semi-mesic shrubby open forest, central coast & lower Hunter Valley	1584	N/A	86.98	203.01
Coastal Foothills Spotted Gum – Ironbark Forest	Grey Ironbark-Broad-leaved Mahogany-Forest Red Gum shrubby open forest, Coastal Lowlands, Central Coast	1588	N/A	15.19	75.96
Hinterland Spotted Gum – Red Ironbark Forest	Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the Lower Hunter	1592	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin Bioregion	24.62	99.79
Coastal Plains Stringybark – Apple Forest	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands	1619	N/A	80.70	136.53
Coastal Sheltered Apple – Peppermint Forest	Smooth-barked Apple open forest on coastal lowlands of the Central Coast	1621	N/A	13.83	32.64
Freshwater Typha Wetland	Typha rushland	1737	Freshwater Wetland[2]	0.00	0.73
Total extent of native vegetation				221.98	557.76
Total extent of cleared or exotic-dominated land				21.82	35.94
Total				**243.8**	**593.7**

(1): Eastcoast Flora Survey (2021) associate PCT 1573 with this EEC. However, the BAM-C does not propose such association. Therefore, it cannot be qualified as an EEC in the calculation of Ecosystem Credits.
(2): Eastcoast Flora Survey (2021) do not associate the occurrence of this PCT on site with any EEC. As such, the vegetation zone where PCT 1737 occurs was not associated with any EEC in the BAM-C.

Table 5 – PCT by Condition

PCT Code	PCT Name	Condition	Condition Acronym (Ref Figure 3)	Total Extent within Study Area (ha)	Total Extent within Subject Site (ha)	Vegetation Integrity Score
1539	Grey Myrtle sheltered gully dry rainforest in gullies of the Sydney Basin	Good	G	1.12	0	N/A
1543	Rusty Fig – Native Quince – Native Olive dry rainforest of the Central Hunter Valley	Good	G	1.37	0.01	86.4
1573	Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment	Good	G	6.61	0.66	75.1
1584	White Mahogany – Spotted Gum – Grey Myrtle semi-mesic shrubby open forest, central coast & lower Hunter Valley	Disturbed – regrowth (low, unstructured)	DiRLU	45.24	29.43	15.5
1584	White Mahogany – Spotted Gum – Grey Myrtle semi-mesic shrubby open forest, central coast & lower Hunter Valley	Disturbed – regrowth (tall, structured)	DiRTS	26.73	21.91	36.9
1584	White Mahogany – Spotted Gum – Grey Myrtle semi-mesic shrubby open forest, central coast & lower Hunter Valley	Good	G	119.38	24.09	83.2
1584	White Mahogany – Spotted Gum – Grey Myrtle semi-mesic shrubby open forest, central coast & lower Hunter Valley	Disturbed – rehabilitation/plantation	Rehab	11.66	11.55	83.2
1588	Grey Ironbark-Broad-leaved Mahogany-Forest Red Gum shrubby open forest, Coastal Lowlands, Central Coast	Good	G	65.71	11.83	79.9
1588	Grey Ironbark-Broad-leaved Mahogany-Forest Red Gum shrubby open forest, Coastal Lowlands, Central Coast	Disturbed – regrowth (low, unstructured)	DiRLU	6.76	1.76	48.6
1588	Grey Ironbark-Broad-leaved Mahogany-Forest Red Gum shrubby open forest, Coastal Lowlands, Central Coast	Disturbed – regrowth (tall, structured)	DiRTS	3.48	1.60	58.7
1588	Grey Ironbark-Broad-leaved Mahogany-Forest Red Gum shrubby open forest, Coastal Lowlands, Central Coast	Disturbed – underscrubbed	DiUS	0.00	0	N/A
1592	Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the Lower Hunter	Disturbed – regrowth (low, unstructured)	DiRLU	1.22	0.86	37.8
1592	Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the Lower Hunter	Disturbed – regrowth (tall, structured)	DiRTS	0.70	0.70	22.9
1592	Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the Lower Hunter	Good	G	97.86	23.06	72.4
1619	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands	Good	G	136.24	80.70	68.3
1619	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands	Disturbed – regrowth (low, unstructured)	DiRLU	0.12	0.00	N/A
1619	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands	Disturbed – underscrubbed	DiUS	0.17	0.01	49.4
1621	Smooth-barked Apple open forest on coastal lowlands of the Central Coast	Good	G	30.97	13.66	70.6
1621	Smooth-barked Apple open forest on coastal lowlands of the Central Coast	Disturbed – regrowth (tall, structured)	DiRTS	0.30	0.09	31.4
1621	Smooth-barked Apple open forest on coastal lowlands of the Central Coast	Riparian Paperbark Peppermint Forest (Good)	RPPF	1.38	0.08	72.5
1737	Typha rushland	Good	G	0.73	0	N/A
			Total	**557.76**	**222**	

(3): The section covered by PCT 1619 “Underscrubbed” was integrated into PCT 1619 “Good” as it was deemed too small to undertake a BAM Plot

(4): No BAM Plot was undertaken in the area covered by PCT 1737, due to the small size. Therefore, it was qualified in the BAM Calculator using benchmark data. This has no impact on the Ecosystem Credit load due to the size of the impact area.

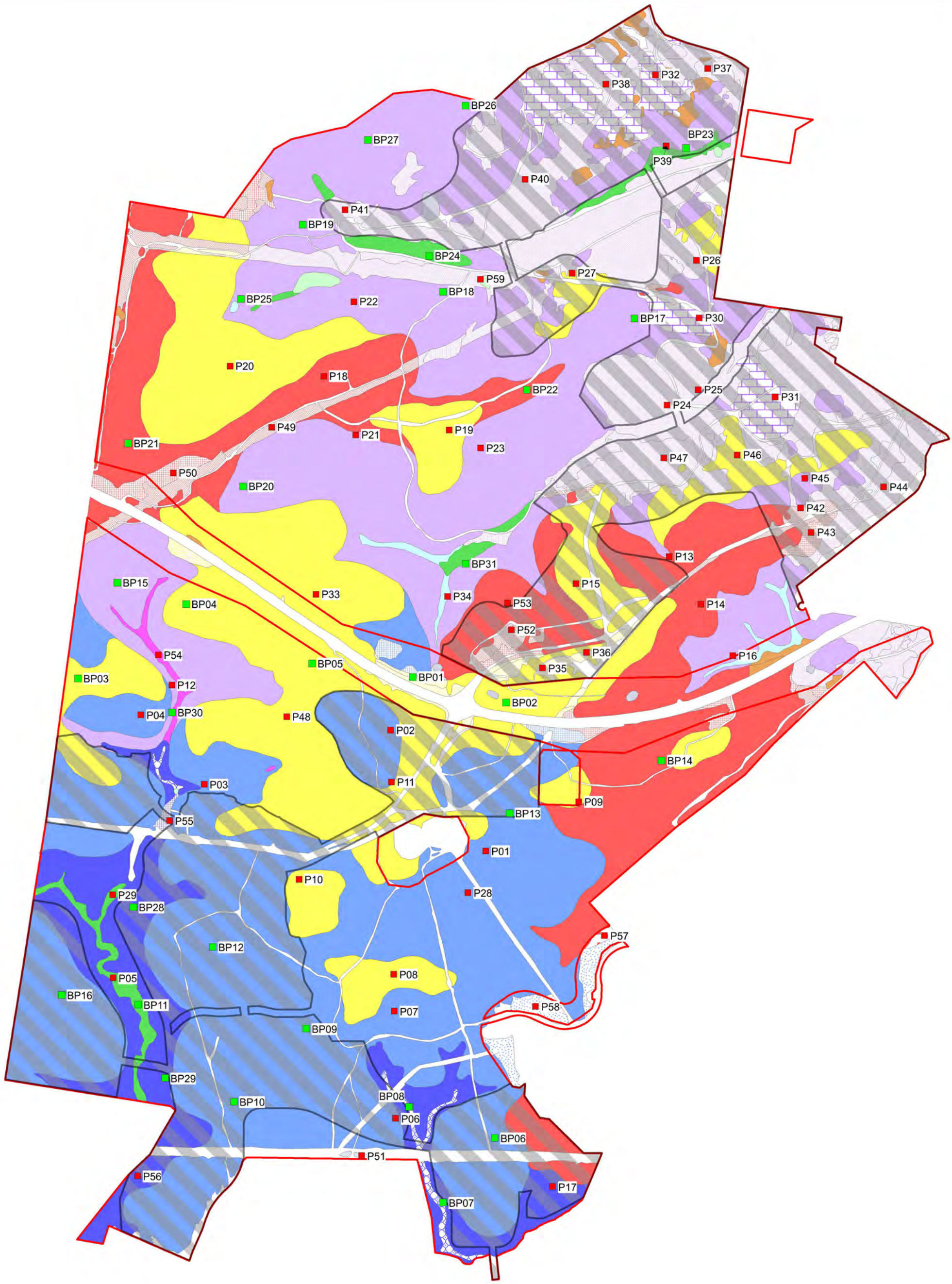

Figure 4 - Plant Community Types

Legend

- Study Area
- Subject Site
- BAM Plots (AEP)
- BAM Plots (Bell & Sims)
- Dam
- Exotic dominance
- R/P
- PCT 1539 - G
- PCT 1543 - G
- PCT 1573 - G
- PCT 1584 - G
- PCT 1584 - DiRLU
- PCT 1584 - DiRTS
- PCT 1588 - G
- PCT 1588 - DiRLU
- PCT 1588 - DiRTS
- PCT 1588 - DiUS
- PCT 1592 - G
- PCT 1592 - DiRLU
- PCT 1592 - DiRTS
- PCT 1619 - G
- PCT 1619 - DiRLU
- PCT 1619 - DiRTS
- PCT 1619 - DiUS
- PCT 1621 - G
- PCT 1621 - RPPF
- PCT 1621 - DiRTS
- 1737 - G

0 500
metres
Scale 1:11,000

N W E S

Location: Land off Newcastle Link Road, Glendale, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

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1.7.2 Plot Based Floristics Surveys

Eastcoast Flora Survey (EFS), led by Dr Stephen Bell, a specialist vegetation botanist, conducted a full review and ground-truthing of the regional mapping within the site. This included:

- A total of 88 BAM plots, including 59 BAM plots by AEP and 29 BAM plots by EFS;
- Ground-truthing regional mapping vegetation communities within the Subject Site and updating as required;
- Determination and justification of each of the identified PCTs;
- Further mapping of communities into vegetation zones within each of the identified PCTs accounting for variants within the PCTs as well as the condition class of the zone;
- Determination of EECs and/or CEECs occurring on site;
- A report detailing the methodology and results of the work (**Appendix B**).

Determination of the PCTs associated with particular habitats has taken into consideration a combination of factors to assign a best fit PCT. Plot data collected in the field by EFS and AEP was analysed using characteristic species presence, IBRA region and subregion and other landscape features (elevation, exposure and soils) to narrow down potential PCTs.

AEP BAM field sheets are provided in Appendix E. A summary of plot data is provided in **Appendix F**. The location of BAM plots is depicted in **Figure 4**.

1.7.3 PCT Selection Justification and Description

The process undertaken by Bell & Sims (2021) which led to the determination of PCTs and vegetation zones on site as listed in **Table 4** and **Table 5** is described in **Appendix B**.

1.7.3.1 Key Findings

- PCT 1592 occurs on site in varying conditions and is associated with a threatened ecological community, being Lower Hunter Spotted Gum – Ironbark Forest, which is a NSW-listed Endangered Ecological Community.
- Other PCTs listed as occurring on site were not deemed to be associated with any threatened ecological community. In particular, PCT 1737 was deemed to be too disturbed to qualify as the equivalent Freshwater Wetland EEC.
- All of the site provides habitat for threatened flora and fauna species.

Table 6 – Level of Retention by PCT based on Structure Plan Version 055.WS.025.09

Entity	Total Extent of occurrence within Study Area (ha)	Development impact extent	Development impact	Retained	EEC (Y/N)
PCT 1539	1.12	0	0%	100%	N
PCT 1543	1.38	0.01	0.7%	99.3%	N
PCT 1573	6.61	0.66	9.9%	90.1%	N
PCT 1584	203.00	86.98	42.8%	57.2%	N
PCT 1588	76.05	15.19	20%	80%	N
PCT 1592	99.78	24.62	24.7%	75.3%	Y
PCT 1619	136.55	80.70	59.1%	40.9%	N
PCT 1621	32.79	13.83	42.4%	57.6%	N
PCT 1737	0.73	0	0%	100%	N
Total	**557.99**	221.99	**39.8%**	**60.2%**	

1.7.4 Vegetation Integrity Assessment

The native vegetation that exists within the Subject Site is connected to vegetation to the west, north and south that, as defined by the BAM, extends as a patch of more than 100ha. The maximum patch size of '≥100ha' is therefore appropriate for each vegetation zone and was entered as such within the Calculator.

Vegetation Integrity Score

Plot data was used to determine the composition, structure and function condition score of the vegetation zones within the Subject Site, which informed the vegetation integrity score. Plot data has been tabulated (refer **Appendix F**) and includes corresponding condition scores along with the overall vegetation integrity score. Vegetation Condition Class has been rated using the following percentage bands associated with the Vegetation Integrity Scores:

- 70 – 100 Good;
- 50 – 69 Moderate;
- 35 – 49 Poor;
- 25-34 Degraded;
- 17-24 Highly Degraded; and
- <17 Severely Degraded.

A summary of vegetation integrity scores by vegetation zone is included in **Table 7**.

Table 7 – Vegetation Integrity Score Table

PCT	Condition	Vegetation Zone Area (ha)	Composition condition score	Structure condition score	Function condition score	Current vegetation integrity score
1543	Good	0.01	77.4	85.2	99.7	86.9
1573	Good	0.66	73.8	58.1	98.8	75.1
1584	Good	24.09	86.9	76.5	86.7	83.2
1584	Disturbed – regrowth (low, unstructured)	29.43	23.6	8.9	17.9	15.5
1584	Disturbed – regrowth (tall, structured)	21.91	39.3	39.2	32.6	36.9
1584	Disturbed – rehabilitation/plantation	11.55	29.7	46.2	43.7	39.2
1588	Good	11.83	81.4	71.1	88.2	79.9
1588	Disturbed – regrowth (low, unstructured)	1.76	81.5	42.7	32.9	48.6
1588	Disturbed – regrowth (tall, structured)	1.60	79.6	55.7	45.6	58.7
1592	Good	23.06	90.6	61.9	67.7	72.4
1592	Disturbed – regrowth (low, unstructured)	0.86	49.8	20	54.3	37.8
1592	Disturbed – regrowth (tall, structured)	0.70	64.5	6.3	29.7	22.9
1619	Good	80.70	65.6	55.1	88	68.3
1619	Disturbed – underscrubbed	0.01	41.5	51.7	56	49.4
1621	Good – (Coastal Sheltered Apple-Peppermint Forest)	13.66	67.4	54.5	95.9	70.6
1621	Good – (Riparian Paperbark – Peppermint Forest)	0.08	69	56	98.8	72.5

1.8 Threatened Species

Under the BAM, threatened species are classified into two types: 'Ecosystem Credit' and 'Species Credit' type species, as detailed within the BioNet Atlas Threatened Species Profile Database (DPE).

A predicted Ecosystem Credit Species assessment is presented in **Table 8**, and a Species Credit Species assessment is presented in **Table 9** and **Table 12**.

Field surveys were undertaken within the Study Area between March 2020 and February 2021 and between May and August 2022 by AEP. A summary of survey effort and results within the Study Area and Subject Site is included in **Appendix C** and **Appendix D.**

1.8.1 Ecosystem Credit Species

Ecosystem Credit species are associated with PCTs and other habitat surrogates that are used to predict their occurrence on a particular site.

The 'biodiversity risk weighting' (BRW) for a species is based on the 'sensitivity to loss' and 'sensitivity to potential gain' score using criteria listed in Appendix I of the BAM, and are used in credit calculations to assess impacts of the proposal on a threatened species. The sensitivity to gain class is listed within the BAM calculator for Ecosystem Credit Species.

Those Ecosystem Credit Species predicted to occur within the Subject Site are provided in **Table 8**.

Table 8 – Predicted Ecosystem Credit Species

Scientific Name	Common Name	Sensitivity to Gain Class	Records within 100km^2 search area (NSW BioNet Atlas)	Recorded by AEP within site or nearby surrounds Y/N
Anthochaera phrygia	Regent Honeyeater	Very High	2	N
Botaurus poiciloptilus	Australasian Bittern	High	5	N
Calidris ferruginea	Curlew Sandpiper	Very High	22	N
Calidris tenuirostris	Great Knot	Very High	1	N
Callocephalon fimbriatum	Gang-gang Cockatoo	Moderate	0	N
Calyptorhynchus lathami	Glossy Black-Cockatoo	Moderate	5	Y
Chthonicola sagittata	Speckled Warbler	Moderate	0	N
Circus assimilis	Spotted Harrier	Moderate	2	N
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Moderate	0	N
Daphoenositta chrysoptera	Varied Sittella	Moderate	25	N
Dasyurus maculatus	Spotted-tailed Quoll	High	1	N
Ephippiorhynchus asiaticus	Black-necked Stork	High	35	N
Epthianura albifrons	White-fronted Chat	High	73	N
Falco subniger	Black Falcon	Moderate	2	N
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Moderate	3	Y[5]
Glossopsitta pusilla	Little Lorikeet	Moderate	106	Y
Grantiella picta	Painted Honeyeater	Moderate	0	N
Haliaeetus leucogaster	White-bellied Sea-Eagle	Moderate	136	N
Hieraaetus morphnoides	Little Eagle	Moderate	24	Y
Hirundapus caudacutus	White-throated Needletail	High	66	Y
Irediparra gallinacea	Comb-crested Jacana	Moderate	3	N
Ixobrychus flavicollis	Black Bittern	Moderate	2	N
Lathamus discolor	Swift Parrot	Very High	11	N
Limicola falcinellus	Broad-billed Sandpiper	Moderate	0	N
Limosa limosa	Black-tailed Godwit	Moderate	4	N
Lophoictinia isura	Square-tailed Kite	Moderate	14	Y
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Moderate	0	N
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Moderate	21	Y
Miniopterus australis	Little Bent-winged Bat	Moderate	99	Y
Miniopterus orianae oceanensis	Large Bent-winged Bat	Moderate	62	Y[5]
Neophema pulchella	Turquoise Parrot	Moderate	0	N
Ninox connivens	Barking Owl	Moderate	1	N

Scientific Name	Common Name	Sensitivity to Gain Class	Records within 100km^2 search area (NSW BioNet Atlas)	Recorded by AEP within site or nearby surrounds Y/N
Ninox strenua	Powerful Owl	Moderate	84	Y
Oxyura australis	Blue-billed Duck	Moderate	1	N
Pandion cristatus	Eastern Osprey	Moderate	15	N
Petaurus australis	Yellow-bellied Glider	Moderate	0	N
Petroica boodang	Scarlet Robin	Moderate	1	N
Petroica phoenicea	Flame Robin	Moderate	0	N
Phoniscus papuensis	Golden-tipped Bat	Moderate	0	N
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Moderate	3	N
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	Moderate	0	N
Pteropus poliocephalus	Grey-headed Flying-fox	Moderate	195	Y
Ptilinopus magnificus	Wompoo Fruit-Dove	Moderate	0	N
Ptilinopus regina	Rose-crowned Fruit-Dove	Moderate	3	N
Ptilinopus superbus	Superb Fruit-Dove	Moderate	1	N
Rostratula australis	Australian Painted Snipe	High	10	N
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Moderate	5	Y
Scoteanax rueppellii	Greater Broad-nosed Bat	Moderate	11	Y
Stagonopleura guttata	Diamond Firetail	Moderate	0	N
Stictonetta naevosa	Freckled Duck	Moderate	4	N
Thylogale stigmatica	Red-legged Pademelon	Moderate	0	N
Tyto novaehollandiae	Masked Owl	Moderate	12	Y
Xenus cinereus	Terek Sandpiper	Moderate	3	N

(5): Species identified as possibly occurring as part of a species group. Refer Attachment A for **Appendix D** for further discussion of species group species

Predicted ecosystem credit species Red-legged Pademelon was excluded from the above list due to the applicable geographic limitation not being met for the species: The species occurs only west of the Sydney to Newcastle freeway, while the Study Area is located to the east of the freeway.

1.8.2 Species Credit Species

Additional threatened fauna species determined by the BAM calculator that have the potential to use the Subject Site area as suitable habitat are identified in **Table 9** and **Table 12**. Details of surveys undertaken by AEP are shown in **Appendix C** and **Appendix E**.

Table 9 – Potential Species Credit and SAII Species

Species Name	BC Act listing	EPBC Act listing	BRW	Candidate SAII (Y/N)	Specific survey period (BAM-C)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Method Undertaken	Date
Fauna									
Burhinus grallarius Bush Stone-curlew	E	-	2	N	All Year	The species has a strong preference for habitats with extensive fallen/standing dead timber including logs. The species is mainly found in western slopes and plains and the Riverina, smaller numbers on Central and North Coast with increasing numbers in Tweed Valley. It may be easier to detect during breeding season, possibly calls all year, but it is unclear how well it responds to playback. The species was allocated to a species credit as experts determined that it cannot be predicted to occur at a site based on vegetation surrogates but can be detected reliably from survey.	Diurnal bird census – Flushing by walking through potential habitat Spotlighting by foot or from a vehicle driven in first gear. Call playback – Sites for Bush Stone-curlew surveys should be 2-4km apart and conducted during the breeding season.	199.25h of spotlighting, 278h of passive acoustic recording. More than 3000 hours of site diurnal fieldwork.	Mar-Sep 2020; Nov 2020; Jan-Feb 2021
Callocephalon fimbriatum Gang-gang Cockatoo	V	-	2	N	Oct-Jan	The species favours tall mountain forests and woodlands (particularly heavily timbered/mature wet sclerophyll forests) in spring and summer. In winter and autumn, the species moves to lower latitudes and occupies drier more open eucalypt forests and woodlands including dry forest in coastal areas and is often found in urban areas.	Area based survey methods	20 hours in-season surveys 126.25h of dawn and dusk survey (out of season). More than 3000 hours of site diurnal fieldwork.	Dec 2019, Oct 2020 – Jan 2021, Nov 2021. Mar-May 2020; Aug-Sep 2020
Calyptorhynchus lathami Glossy Black-Cockatoo	V	-	2	N	Jan-Sep	The species inhabits open forest and woodlands of the coast where stands of She-oak occur. The species is dependent on large hollow-bearing eucalypts for nest sites.	Area based survey methods	Dawn and dusk survey, 33.25h in season and 93h out of season. More than 3000 hours of site diurnal fieldwork.	Mar-May 2020; Aug-Sep 2020
Cercartetus nanus Eastern Pygmy-possum	V	-	2	N	Oct-Mar	The species can be found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Also feeds on insects throughout the year; this feed source may be more important in habitats where flowers are less abundant such as wet forests. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (*Pseudocheirus peregrinus*) dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Appear to be mainly solitary, each individual using several nests, with males having non-exclusive home-ranges of about 0.68 hectares and females about 0.35 hectares. Young can be born whenever food sources are available, however most births occur between late spring and early autumn.	The minimum survey effort for site"unde' 100ha should be 2 per vegetation community or habitat type for 14 consecutive nights. Effort per stratification unit up to 50 hectares: Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights	Camera-trap nights: 703 in season, 1457 out of season Spotlighting: 31.5h in season, 167.75h out of season	Mar-Apr 2020; June-Nov 2020; Dec 2020; Jan-Feb 2021

Species Name	BC Act listing	EPBC Act listing	BRW	Candidate SAII (Y/N)	Specific survey period (BAM-C)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Method Undertaken	Date
Chalinolobus dwyeri Large-eared Pied Bat	V	V	3	Y	Nov-Jan	The species is a full species credit because it cannot be reliably predicted to occur on a site based on vegetation and other landscape features (either foraging or breeding). This species usually gives birth to twins. SAII threshold is potential breeding habitat and presence of breeding individuals. Potential breeding habitat is PCTs associated with the species within 100m of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. Surveys must be undertaken as per the Threatened Bat Survey Guide to confirm breeding habitat. Species mapping polygon for breeding habitat must use high resolution aerial imagery and topographic maps to identify features on the subject land (caves, scarps, cliffs etc). Polygon must be at least 100m wide (or 100m diameter for point locations such as caves) with the breeding habitat features (may be multiple) as the centroid (see Threatened Bat Survey Guide). All breeding habitat on or within 100m of the subject land and the area immediately surrounding the feature must be identified. All habitat on the subject land should also be mapped if present. Use high resolution aerial imagery and topographic maps to identify potential roost habitat features on the subject land within 2km caves, scarps, cliffs etc. Species polygon boundary should align with PCTs on the subject land to which the species is associated that are within 2km of identified potential roost habitat features.	16 trap nights minimum Minimum 4 nights of harp trapping or acoustic detectors placed close to exits of caves, mines or tunnels. Four traps per night over two nights, repeated at least two weeks later is required Roost search as required (Breeding only)	Acoustic detection (Anabat): 77 nights in season, 7 nights out of season; Harp trapping: 27 nights in season	Mar-Apr 2020; Dec 2020; Jan 2021
Crinia tinnula Wallum Froglet	V	-	1.5	N	All year	While found in a range of habitats the species is usually associated with acidic swamps on coastal sand plains. Typically occurs in sedge lands and wet heathlands and can also be found along drainage lines. Breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches.	Combination of tadpole surveys, call surveys and nocturnal searches in suitable weather conditions around swamps, dams and flooded roadside ditches. Minimum of one 200-metre transect per water body or inundated area, repeated on a minimum of two separate nights.	Acoustic detection (songmeter): 82.5 nights in season; Spotlighting and quiet listening: 102.5h in season	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021 Dec 2020-Mar 2021
Haliaeetus leucogaster White-bellied Sea-Eagle	V	-	2	N	Jul-Dec	Terrestrial habitat includes coastal dunes, tidal flats, grassland, heathland, woodland and forest. Requires large emergent eucalypts for nesting. Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	Area based survey methods. Habitat assessment – 30 minutes searching each relevant habitat.	Dawn / Dusk survey: 27.5h in season, 98.75h out of season; Habitat search: 206.5h More than 3000 hours of site diurnal fieldwork.	Mar-Oct 2020
Heleioporus australiacus Giant Burrowing Frog	V	V	1.5	N	Sep-May	Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water in the Sydney Basin.	Minimum of one 200-metre transect per water body repeated on a minimum of two separate nights. All available water bodies, including rainwater pools, ephemeral swamps, slow flowing creeks and rock pools in non-perennial water courses should be examined for tadpoles.	Acoustic detection (songmeter): 82.5 nights in season; Spotlighting and quiet listening: 102.5h in season	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan, Mar 2021

Species Name	BC Act listing	EPBC Act listing	BRW	Candidate SAII (Y/N)	Specific survey period (BAM-C)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Method Undertaken	Date
Hieraaetus morphnoides Little Eagle	V	-	1.5	N	Aug-Oct	Little Eagle are a dual credit species. Foraging habitat is considered an ecosystem credit and breeding is considered a species credit. The species nest in live (occasionally dead) large old trees within vegetation. Paddock trees can provide important breeding habitat (there are examples of nest trees in ACT). Breeding habitat is live (occasionally dead) large old trees within suitable vegetation AND 1. The presence of a male and female; or 2. Female with nesting material; or 3. An individual on a large stick nest in the top half of the tree canopy. Where a breeding site has been identified in accordance with the BAM the species polygon should be established by providing a circular buffer of 300m around the nest tree. The purpose of the buffer is to minimise disturbance/avoid clearing, for a development application, or to conserve and improve habitat, for a biodiversity stewardship agreement, within the area essential for breeding. This includes habitat suitable for feeding/grooming perches and fledgling requirements. It does not account for foraging habitat. Little eagles are less likely than urban-adapted raptors to readily cross urban or peri-urban spaces to hunt. The 300m buffer is in accordance with the ACT offset guidelines for this species.	Habitat assessment – 30 minutes searching each relevant habitat.	Dawn / Dusk survey: 22.25h in season, 104h out of season; Habitat search: 206.5h More than 3000 hours of site diurnal fieldwork.	Mar-Oct 2020
Hoplocephalus bitorquatus Pale-headed Snake	V	-	2	N	Nov-Mar	The species is highly cryptic and can spend weeks at a time hidden in tree hollows. It is found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. Average offspring is 4.7, but females breed only every second or third year or less frequently.	Survey effort require per stratification unit up to 100 hectares. Habitat search – 30-minute search on two separate days targeting specific habitat. Spotlighting – 30-minute search on two separate nights targeting specific habitat November to March. Survey should be undertaken 1-2 days after rainfall and on humid nights.	Spotlighting: 197.25h in season, 34h out of season	Mar-May 2020; Sep 2020; Nov-Dec 2020; Jan-Feb 2021
Hoplocephalus stephensii Stephens' Banded Snake	V	-	2	N	Oct-Mar	The species inhabits rainforest and eucalypt forests and rocky areas up to 950 m in altitude. It is nocturnal, and shelters between loose bark and tree trunks, amongst vines, or in hollow trunks limbs, rock crevices or under slabs during the day.	Survey effort require per stratification unit up to 100 hectares. Habitat search – 30-minute search on two separate days targeting specific habitat. Spotlighting – 30-minute search on two separate nights targeting specific habitat November to March. Survey should be undertaken 1-2 days after rainfall and on humid nights.	Spotlighting: 197.25h in season, 34h out of season	Mar-May 2020; Sep 2020; Nov-Dec 2020; Jan-Feb 2021
Litoria aurea Green and Golden Bell Frog	E	V	2	N	Nov-Mar	Habitat for the species includes semipermanent/ephemeral wet areas, within 1km of swamps, waterbodies or wet areas. In high altitude populations calling seasons are restricted to summer months. While chytrid is a potential threat to some populations of the species, other populations are subject to manageable threats. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.). Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.	Survey: Refer to the 'NSW Survey Guide for Threatened Frogs' published in Sep 2020, for specific survey requirements.	Spotlighting and quiet listening: 82.5h in season, 20h out of season; Acoustic detection (songmeter); 82.5h	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan, Mar 2021
Litoria brevipalmata Green-thighed Frog	V	-	1.5	N	Sep-Apr	The species was allocated to species credit species because presence cannot be predicted from vegetation or landscape surrogates. Experts noted that it is difficult to detect from survey, detection could be optimised by detailed/strict survey guidelines. Survey: reliant on rainfall events for calling/breeding when it is usually detected/surveyed, strongly suggest >75 mm in 24 hrs or 150 mm over 72 hrs as the most probable time to survey and detect the species. Note that tadpole's susceptible to injury during netting, they can be identified from observation. Whilst there is some information on the species ecology little is known about the species response to management. A ground-dwelling frog that inhabits coastal forest and bushland. Calling males gather around temporary or semi-permanent ponds and flooded ditches after	Combination of tadpole surveys, call surveys and nocturnal searches in suitable habitat after heavy rain. Minimum of one 200-metre transect per water body repeated on a minimum of two separate nights	Spotlighting and quiet listening: 82.5h in season, 20h out of season; Acoustic detection (songmeter); 82.5h	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021 Dec 2020-Mar 2021

Species Name	BC Act listing	EPBC Act listing	BRW	Candidate SAII (Y/N)	Specific survey period (BAM-C)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Method Undertaken	Date
						heavy rain. Egg masses are often laid in temporary ponds. Tadpoles are predominately surface dwellers, but feed throughout the water body.			
Lophoictinia isura Square-tailed Kite	V	-	1.5	N	Sep-Jan	Found in a variety of timbered habitats including dry woodlands and open forests. Nesting sites generally located along or near water courses, in a fork or on large horizontal limbs. The species is allocated to dual credit because they tend to be sensitive to disturbance around nests. It will be difficult to identify a Kite nest (there are lots of comparable sized stick nests built by other species), especially given Kites have large territories and other stick nesters will undoubtedly also be nesting where Kites might be recorded. Kites will need to be in attendance to confirm breeding sites.	Habitat assessment – 30 minutes searching each relevant habitat.	Habitat assessment: 2.75h in season, 123.5h out of season More than 3000 hours of site diurnal fieldwork.	Mar-Sep 2020
Macropus parma Parma Wallaby	V	-	2	N	All Year	Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. Typically feed at night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas. During the day they shelter in dense cover.	The minimum survey effort for site under 100ha should be 2 per vegetation community or habitat type for 14 consecutive nights. Effort per stratification unit up to 50 hectares: Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights	2160 camera trap nights, 199.25h of spotlighting More than 3000 hours of site diurnal fieldwork.	Mar-Apr 2020; June-Oct 2020; Dec 2020; Jan-Feb 2021
Miniopterus australis Little Bent-winged Bat	V	-	3	Y	Dec-Feb	The habitat constraint for the species is Cave, tunnel, mine, culvert or other structure known or suspected to be used breeding including species records with microhabitat code “IC – in cave;” observation type code “E nest-roost;” with numbers of individuals >500. Any impacts on breeding habitat could be considered potentially serious and irreversible. This species is retained as dual credit because foraging habitat is broad ranging but breeding habitat is highly specific. At lower altitudes this species is usually more abundant during winter months, the lower numbers of individuals from October to February are due to females moving to maternity sites. Additionally, selected <1 for average number of offspring because females do not give birth every time (often miscarry etc.). All breeding habitat including the cave, or other features, used for breeding and the area immediately surrounding this feature must be mapped. Species polygon boundaries should have a 100m radius buffer around an accurate GPS point location centred on the cave/feature entrance. Only five nursery sites /maternity colonies are known in Australia.	Minimum 4 nights of harp trapping placed close to exits of caves, mines or tunnels. Two traps per night over two nights, repeated at least two weeks later is required	Acoustic detection (Anabat): 49 nights in season, 35 nights out of season Harp trapping: 27 nights in season	Mar-Apr 2020; Dec 2020; Jan 2021

Species Name	BC Act listing	EPBC Act listing	BRW	Candidate SAII (Y/N)	Specific survey period (BAM-C)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Method Undertaken	Date
Miniopterus orianae oceanensis Large Bent-winged Bat	V	-	3	Y	Dec-Feb	The habitat constraint for the species is Cave, tunnel, mine, culvert or other structure known or suspected to be used breeding including species records with microhabitat code "IC – in cave;" observation type code "E nest-roost;" with numbers of individuals >500. Any impacts on breeding habitat could be considered potentially serious and irreversible. This species is retained as dual credit because foraging habitat is broad ranging but breeding habitat is highly specific. At lower altitudes this species is usually more abundant during winter months, the lower numbers of individuals from October to February are due to females moving to maternity sites. Additionally, selected <1 for average number of offspring because females do not give birth every time (often miscarry etc.).All breeding habitat including the cave, or other features, used for breeding and the area immediately surrounding this feature must be mapped. Species polygon boundaries should have a 100m radius buffer around an accurate GPS point location centred on the cave/feature entrance.	Minimum 4 nights of harp trapping placed close to exits of caves, mines or tunnels. Two traps per night over two nights, repeated at least two weeks later is required	Acoustic detection (Anabat): 49 nights in season, 35 nights out of season Harp trapping: 27 nights in season	Mar-Apr 2020; Dec 2020; Jan 2021
Mixophyes balbus Stuttering Frog	E	V	3	Y	Sep-Mar	Usually associated with flowing streams, often in rainforest or wet sclerophyll forest. Males call from beside streams, often well-camouflaged on leaf litter, under banks, or on dry parts of the stream floor or logs just above flowing water midstream. Tadpoles are bottom dwellers and graze among stones in pools of streams. This species has a long larval lifespan and therefore needs streams with permanent water, even if these are just the occasional larger pool. Outside the breeding season, M. balbus may travel thousands of metres away from the stream in which they breed. Adults bury themselves under leaf litter during cool or dry periods and are difficult to detect.	Combination of tadpole surveys, call surveys and nocturnal searches along flowing streams in suitable weather conditions. Minimum of one 200-metre transect per water body repeated on a minimum of two separate nights.	Acoustic detection (songmeter): 82.5 nights Spotlighting and quiet listening: 82.5h in season and 20h out of season	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021 Dec 2020-Mar 2021
Mixophyes iteratus Giant Barred Frog	E	E	2	N	Oct-Mar	Habitat Constraint: Land within 50m of semi permanent and permanent drainages. Survey: shoulder periods of April and September should be accompanied by rainfall within 5 days with the event exceeding greater than 5 mm in 24 hrs. The species was in decline but it appears to have recovered to some degree and management actions are relatively well defined. Giant Barred Frogs are found along freshwater streams with permanent or semi-permanent water, generally (but not always) at lower elevation. Moist riparian habitats such as rainforest or wet sclerophyll forest are favoured for the deep leaf litter that they provide for shelter and foraging, as well as open perching sites on the forest floor. However, Giant Barred Frogs will also sometimes occur in other riparian habitats, such as those in drier forest or degraded riparian remnants, and even occasionally around dams.	Combination of tadpole surveys, call surveys and nocturnal searches along flowing streams in suitable weather conditions. Minimum of one 200-metre transect per stream repeated on a minimum of two separate nights. This species may respond to call playback or a good imitation of their call.	Acoustic detection (songmeter): 82.5 nights Spotlighting and quiet listening: 82.5h in season and 20h out of season	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021 Dec 2020-Mar 2021
Myotis pprox. Southern Myotis	V	-	2	N	Oct-Mar	The species is dependent on waterways with pools of 3m wide or greater for foraging (which will be protected under legislation), habitat surrounding waterways is used for breeding and roosting. The species can be detected via survey using appropriate techniques (see Threatened Bat Survey Guide). Constraints based on information from Campbell Susan (2009) So long as it's near water: variable roosting behaviour of the large-footed myotis (Myotis pprox.). Additionally, selected <1 for ave number of offspring because females do not give birth every (often miscarry etc). All habitat on the subject land where the subject land is within 200m of a waterbody with pools/ stretches 3m or wider including rivers, creeks, billabongs, lagoons, dams and other waterbodies on the subject land must be mapped. Use aerial imagery to map waterbodies with pools/ stretches 3m or wider on or within 200m of the subject land. Species polygon boundaries should align with PCTs on the subject land to which the species is associated that are within 200m of waterbodies mapped.	16 nights minimum Minimum 4 nights of harp trapping or acoustic detectors placed close to exits of caves, mines or tunnels. Four traps per night over two nights, repeated at least two weeks later is required Roost search – 1 per structure (30mins per feature)	Acoustic detection (Anabat):77 nights in season, 7 out of season Harp trapping: 27 nights in season Spotlighting: 12h	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan, Mar 2021

Species Name	BC Act listing	EPBC Act listing	BRW	Candidate SAII (Y/N)	Specific survey period (BAM-C)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Method Undertaken	Date
Ninox connivens Barking Owl	V	-	2	N	May-Dec	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Roosts in shaded portions of tree canopies. Requires large old trees with hollows for nesting. Barking Owl are a dual credit species. Foraging habitat is considered an ecosystem credit and breeding is considered a species credit	Call playback – Sites should be separated by 800 metres – 1km, and each site must have the playback session repeated as follows: at least 5 visits per site, on different nights. Day habitat search: Search habitat for pellets, and likely hollows. Stag-watching: Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset.	Stagwatching and spotlighting: 148.25h in season, 87.75h out of season; Acoustic detection (songmeter): 268 nights in season, 122 nights out of season; Habitat assessment: 12.75h in season, 193.75h out of season More than 3000 hours of site diurnal fieldwork.	Mar-Sep 2020; Nov 2020; Jan-Feb 2021; Jun-Jul 2022
Ninox strenua Powerful Owl	V	-	2	N	May-Aug	The species inhabits a range of vegetation types from woodland and open sclerophyll forest to tall open wet forest and rainforest. Requires large tree hollows (≥0.5m deep) in large eucalypts (DBH 80-240cm) that are at least 150 years old. Powerful Owl are a dual credit species. Foraging habitat is considered an ecosystem credit and breeding is considered a species credit.	Call playback – Sites should be separated by 800 metres – 1km, and each site must have the playback session repeated at least 5 visits per site, on different nights. Day habitat search: Search habitat for pellets, and likely hollows. Stag-watching: Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset.	Stagwatching and spotlighting: 85h in season, 151h out of season; Acoustic detection (songmeter): 311 nights in season, 79 nights out of season; Habitat assessment: 12.75h in season, 193.75h out of season More than 3000 hours of site diurnal fieldwork.	Mar-Sep 2020; Nov 2020; Jan-Feb 2021; Jun-Jul 2022
Pandion cristatus Eastern Osprey	V	-	1.5	N	Apr-Nov	The species favours coastal areas, especially the mouths of large rivers, lagoons and lakes. Requires tall dead trees or dead crowns of tall live trees for nesting (within 1km of the sea). Eastern Osprey are a dual credit species. Foraging habitat is considered an ecosystem credit and breeding is considered a species credit.	Area based survey methods. Habitat assessment – 30 minutes searching each relevant habitat.	Dawn/dusk survey: 113.25h in season, 13h out of season More than 3000 hours of site diurnal fieldwork.	Mar-Sep 2020
Petalura gigantea Giant Dragonfly	E	-	3	Y	Dec-Jan	Live in permanent swamps and bogs with some free water and open vegetation. Adults spend most of their time settled on low vegetation on or adjacent to the swamp. They hunt for flying insects over the swamp and along its margins. Adults fly over the swamp and along its margins hunting for flying insects. Females lay eggs into moss, under other soft ground layer vegetation, and into moist litter and humic soils, often associated with groundwater seepage areas within appropriate swamp and bog habitats. The species does not utilise areas of standing water wetland, although it may utilise suitable boggy areas adjacent to open water wetlands. Larvae dig long branching burrows under the swamp.	Requires surveying within the swamp. Distances that the species disperses to breed are dependent on the elevation of the terrain around the swamp, and are more likely to disperse further if the terrain surrounding the swamps is flat (low elevation).	Major riparian corridors that are likely to provide suitable habitat for the species were surveyed mainly out of season, in November 2020. It is to be noted that such corridors will not be impacted by the proposal. More than 3000 hours of site diurnal fieldwork.	Nov 2020 (Major riparian corridors) Nov 2020 to Jan 2021 (Secondary riparian areas)
Petauroides pprox Greater Glider	-	E	2	N	All Year	Hollow dependent species that will have large trees with hollows within its home range. Home range is < 5 ha and typically 1 to 3 ha.	Effort per stratification unit up to 50 hectares: Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. Stagwatching – Observing potential roost hollows for 30 minutes prior to sunset and 60 minutes following sunset	2160 camera trap nights	Mar-Apr 2020; June-Oct 2020; Dec 2020; Jan-Feb 2021
Petaurus norfolcensis Squirrel Glider	V	-	2	N	All Year	Inhabits Blackbutt-Bloodwood forest with heath understorey in coastal areas. Lives in family groups. Requires abundant tree hollows for refuge and nesting. Survey year round but sites with bi-pinnate acacia, autumn winter flowering trees and shrubs such as Eucalyptus robusta and Banksia sp (integrifolia etc.) should be subject to a more retracted survey period of between March-August. Relies on large old trees with hollows for breeding and nesting. These trees are also critical for movement and typically need to be closely-connected (i.e. no more than 50 m apart). Important known food plants – *Eucalyptus siderophloia/tereticornis/pilularis/robusta, Corymbia maculata/gummifera,*	Effort per stratification unit up to 50 hectares: Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. Stagwatching – Observing potential roost hollows for 30 minutes prior to sunset and 60 minutes following sunset	2160 camera trap nights	Mar-Apr 2020; June-Oct 2020; Dec 2020; Jan-Feb 2021

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						Melaleuca quinquenervia, Acacia pprox. /longifolia, Banksia integrifolia/oblongifolia/serrata/spinulosa and *Xanthorrhoea spp*.			
Phascogale tapoatafa Brush-tailed Phascogale	V	-	2	N	Dec-Jun	The species preferred habitat includes hollow logs, under bark, rocks, cracks in soil, grass tussocks or building debris. The species prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter, however they can also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. They feed mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20 – 40 ha, while males have overlapping territories often greater than 100 ha. They nest and shelter in tree hollows with entrances 2.5 – 4 cm wide and can use many different hollows over a short time span. Mating occurs May – July	Effort per stratification unit up to 50 hectares: Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights	Camera trap nights: 1075 in season and 1085 out of season (Note: survey effort above confirmed by BCD as being sufficient)	Mar-Apr 2020; June-Oct 2020; Dec 2020; Jan-Feb 2021
Phascolarctos cinereus Koala	E	E	2	N	All Year	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	Call playback – 2 sites per stratification unit up to 200 hectares, plus an additional site per 100 hectares above 200 hectares. Each playback site must have the session conducted twice, on separate nights. Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights. Habitat assessment – 30 minutes searching each relevant habitat, including trees for scratch marks.	199.25h of spotlighting; 278 nights of acoustic detection (songmeter); 86.5h of call playback; 94 SAT grid surveys More than 3000 hours of site diurnal fieldwork.	Mar-Sep 2020; Nov 2020; Jan-Feb 2021
Planigale maculata Common Planigale	V	-	2	N	All Year	Inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. They are active at night and during the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks.	Effort per stratification unit up to 50 hectares: Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights	30 pitfall traps set up for 4 nights, equating to a total of 120 nights, complemented with 240 nights of Elliott trapping adjacently to the pitfall traps	May-June 2022
Potorous tridactylus Long-nosed Potoroo	V	V	2	N	All Year	The long-nosed potoroo is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania, including some of the Bass Strait islands. In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. Mainly nocturnal, hiding by day in dense vegetation – however, during the winter months animals may forage during daylight hours. Individuals are mainly solitary, non-territorial and have home range sizes ranging between 2-5 ha. Breeding peaks typically occur in late winter to early summer and a single young is born per litter.	Effort per stratification unit up to 50 hectares: Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights	1080 camera trap nights	Mar-Apr 2020; June-Oct 2020; Dec 2020; Jan-Feb 2021

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Pseudophryne australis Red-crowned Toadlet	V	-	1.5	N	All Year	All available evidence indicates that the Red-crowned Toadlet is restricted to the Triassic Hawkesbury and Narrabeen Sandstones of the Sydney Geological Basin. The principal vegetation community occupied by this species is Sydney Sandstone Ridgetop Woodland (mainly dominated by Eucalyptus gummifera and Eucalyptus haemastoma, although a number of different associations within this community are utilised depending upon the area. Red-crowned Toadlets usually live in the vicinity of permanently moist soaks or areas of dense ground vegetation or leaf litter along or near head-water stream beds. They prefer the first or second order ephemeral drainage lines commonly called 'feeder creeks' which drain the ridges, benches, cliffs and talus slopes. These watercourses are often dry or reduced to ponded areas for much of the year and only sustain flow for short periods. Under natural conditions these feeder creeks have flows of high water quality and low nutrient loads.	Call detection between July and March is the most common method used to locate the Red-crowned Toadlet. Areas of suitable habitat (any pools of water in drainage lines) should be inspected after rain, with active searches following a period of listening for calls. Males are known to respond to call playback or a loud shout. Tadpoles of this species may be surveyed all year	82.5 nights of acoustic detection (songmeter); 102.5 nights of spotlighting and quiet listening More than 3000 hours of site diurnal fieldwork.	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan, Mar 2021
Pteropus poliocephalus Grey-headed Flying-fox	V	V	2	N	Oct-Dec	Grey-headed Flying-fox are a dual credit species. Foraging and occasional roost habitat is considered an ecosystem credit while roost camps are considered a species credit. Survey effort included targeted search for roost camps, during all aspects of fieldwork as well as incidental observations during nocturnal survey works.	Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights	Spotlighting: 53.5h in season, 175.25h out of season More than 3000 hours of site diurnal fieldwork.	Apr-Sep 2020; Nov 2020; Jan-Feb 2021
Tumix maculosus Red-backed Button-quail	V	-	2	N	All Year	Over their Australian range, Red-backed Button-quail inhabit grasslands, open and savannah woodlands with grassy ground layer, pastures and crops of warm temperate areas, typically only in regions subject to annual summer rainfall greater than 400 mm. In NSW, said to occur in grasslands, heath and crops. Said to prefer sites close to water, especially when breeding. The species has been observed associated with the following grasses (in various vegetation formations): speargrass *Heteropogon*, Blady Grass *Imperata cylindrica*, Triodia, Sorghum, and Buffel Grass Cenchrus ciliaris. Observations of populations in other parts of its range suggest the species prefers sites near water, including grasslands and sedgelands near creeks, swamps and springs, and wetlands.	Nocturnal surveys to flush birds from habitat should be used however identification is difficult and may require photos or handling individuals to distinguish from other more common species. Also important to note that call surveys including playback and songmeters not known to be effective as not known whether it responds, in what months it mostly calls, identification from other button-quail species	Spotlighting: 228.75h More than 3000 hours of site diurnal fieldwork.	Apr-Sep 2020; Nov 2020; Jan-Feb 2021; Jun-Jul 2022
Tyto novaehollandiae Masked Owl	V	-	2	N	May-Aug	Lives in dry eucalypt forests and woodlands from sea level to 1100m. Uses large tree hollows or sometimes caves for nesting. Dead stags are used for roosting/breeding habitat Masked Owl can nest in living or dead trees with hollows greater than 20cm diameter. In Tas and Vic Masked owls have been recording nesting in paddock trees. Has been found to nest in caves in Tasmania but there is no evidence to suggest that this occurs in NSW.	Call playback – Sites should be separated by 800 metres – 1km, and each site must have the playback session repeated as follows: · at least 5 visits per site, on different nights. Day habitat search: Search habitat for pellets, and likely hollows. Stag-watching: Observing potential roost hollows for 30mins prior to sunset and 60mins following sunset.	Stagwatching and spotlighting: 85h in season, 151h out of season; Acoustic detection (songmeter): 311 nights in season, 79 nights out of season; Habitat assessment: 12.75h in season, 193.75h out of season More than 3000 hours of site diurnal fieldwork.	Mar-Sep 2020; Nov 2020; Jan-Feb 2021; Jun-Jul 2022
Uperoleia mahonyi Mahony's Toadlet	E	-	2	N	Oct-Mar	Emergency listed species. Observations indicate the species inhabits ephemeral and semi-permanent swamps and swales on the coastal fringe of its range. Commonly associated with acid paperbark swamps, Mahony's Toadlet also is known to occur in wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland. Recent studies suggest intact vegetation adjacent to and within water bodies is an important habitat feature for this species.	Systematic day habitat search – one hour per stratification unit Spotlighting on foot – 2 x 1 hour and 1km up to 200 hectares of stratification unit, walking at approximately 1km per hour on 2 separate nights	82.5 of acoustic detection (songmeter); Spotlighting and quiet listening: 82.5h in season, 20h out of season	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan, Mar 2021

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Vespadelus troughtoni Eastern Cave Bat	V	-	3	Y	Nov-Jan	Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.	Minimum 4 nights of harp trapping placed close to exits of caves, mines or tunnels. Two traps per night over two nights, repeated at least two weeks later is required	Acoustic detection (Anabat): 49 nights in season, 35 nights out of season; 27 nights of harp trapping in potentially suitable breeding habitat	Mar-Apr 2020; Dec 2020; Jan 2021
Flora									
Acacia bynoeana Bynoe's Wattle	E	V	2	N	All Year	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Jun-Jul 2020
Angophora inopina Charmhaven Apple	V	V	1	N	All Year	Grows in dry sclerophyll forest on the coast and adjacent ranges. Occurs most frequently in four main vegetation communities: (i) Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina woodland/forest; (ii) Hakea teretifolia–Banksia oblongifolia wet heath; (iii) Eucalyptus resinifera–Melaleuca sieberi–Angophora inopina sedge woodland; (iv) Eucalyptus capitellata–Corymbia gummifera–Angophora inopina woodland/forest. Flowers Spring to Summer.	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Jun-Jul 2020
Asperula asthenes Trailing Woodruff	V	V	3	N	Oct-Dec	Occurs in damp sites, often along river banks.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Nov-Dec 2020
Astrotricha crassifolia Thick-leaf Star-hair	V	V	3	Y	Jul-Dec	Occurs in dry sclerophyll woodland on sandstone. Resprouter from root suckers or basal stem buds after fire.	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Aug 2020
Caladenia pprox. te Thick Lip Spider Orchid	E	V	3	Y	Sep-Oct	Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. The single leaf regrows each year.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method	Sep-Oct 2020
Callistemon linearifolius Netted Bottle Brush	V	-	2	N	Oct-Jan	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers Spring to Summer	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Nov-Dec 2020
Corunastylis sp. *Charmhaven* (NSW896673)	CE	CE	3	Y	Nov-Apr	It occurs within low woodland to heathland with a shrubby understorey and ground layer. Dominants include Black She-oak (*Allocasuarina littoralis*), Prickly Tea-tree (*Leptospermum juniperinum*), Prickly-leaved Paperbark	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method	Dec 2020

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						(*Melaleuca nodosa*), Narrow-leaved Bottlebrush (*Callistemon linearis*) and Zig-zag Bog-rush (*Schoenus brevifolius*).	potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation		
Cryptostylis hunteriana Leafless Tongue Orchid	V	V	2	N	Nov-Jan	A leafless orchid only undetectable when flowering. Does not appear to have well defined habitat preferences, known from a range of communities including swamp-heath and woodland. Associated with Eucalyptus sclerophylla, E. sieberi, Corymbia gummifera and Allocasuarina littoralis. Often occurs in association with more common C. pprox. and C. erecta which can signify suitable niche habitat within a locale.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. When local reference population is flowering	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method	Nov-Dec 2020
Cymbidium canaliculatum population in the Hunter catchment	E	-	2	N	All Year	Typically grows in the hollows, fissures, trunks and forks of trees in dry sclerophyll forest or woodland, where its host trees typically occur on Permian Sediments of the Hunter Valley floor. It usually occurs singly or as a single clump, which can form large colonies on trees, between two and six metres from the ground. Within the Hunter Catchment, *Cymbidium canaliculatum* is most commonly found in *Eucalyptus albens (*White Box) dominated woodlands (including those dominated by the intergrade *E. albens-moluccana*), much of which may constitute the endangered ecological community (EEC) 'White Box Yellow Box Blakely's Red Gum Woodland'. It has been found, less commonly, to grow on *E. dawsonii* (Slaty Box), *E. crebra* (Narrow-leaved Ironbark), *E. moluccana* (Grey Box), Angophora floribunda (Rough-barked Apple), *Acacia salicina* (Cooba) and on some other species, including dead stags. It is also known to use man-made structures, such as fence posts and wooden bridges as its host.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. When local reference population is flowering	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Dec 2020
Cynanchum elegans White-flowered Wax Plant	E	E	2	N	All Year	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub. Flowering occurs between August and May, with a peak in November. Flower abundance on individual plants varies from sparse to prolific.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method	Dec 2020
Diuris praecox Rough Doubletail	V	V	1.5	N	Aug	Known from between Bateau Bay and Smiths Lake Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter from Jul to early Sep	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation. When local reference population is flow	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method	Aug 2020
Eucalyptus camfieldii Camfield's Stringybark	V	V	2	N	All Year	Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas. Associated species frequently include stunted species of *Eucalyptus oblonga* (Narrow-leaved Stringybark), *E. capitellata* (Brown Stringybark) and *E. haemastoma* (Scribbly Gum).	Parallel walking transects – Maximum distance between transects 40m in open, 20m in dense vegetation. For each hectare of potential habitat average field traverse length 0.5km at 20m separation or 0.25km at 40m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Jun-Jul 2020

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Eucalyptus glaucina Slaty Red Gum	E	-	2	N	All Year	Found only on the north coast of NSW and in separate districts near Casino where it can be locally common and farther south from Taree to Broke west of Maitland. Grows in grassy woodland and dry eucalypt forest, on deep, moderately fertile and well-watered soils.	Parallel walking transects – Maximum distance between transects 40m in open vegetation, 20m in dense vegetation. For each hectare of potential habitat average field traverse length 0.5km at 20m separation or 0.25km at 40m separation.	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Jun-Jul 2020
Eucalyptus parramattensis subsp. decadens Drooping Red Gum	V	V	2	N	All Year	There are two separate meta-populations of *E. parramattensis subsp. decadens.* The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Aberdare in the south. Large aggregations of the subspecies are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south. Generally, occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant.	Parallel walking transects – Maximum distance between transects 40m in open, 20m in dense vegetation For each hectare of potential habitat average field traverse length 0.5km at 20m separation or 0.25km at 40m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Jun-Jul 2020
Genoplesium insigne Variable Midge Orchid	CE	CE	3	Y	Sep-Nov	Grows in patches of *Themeda australis* (Kangaroo Grass) amongst shrubs and sedges in heathland and woodland. The presence of other orchid species and therefore mycorrhiza assemblages can, though not always, be an indication of suitable habitat. Associated vegetation at known populations is described as dry sclerophyll woodland dominated by *Eucalyptus haemastoma* (Scribbly Gum), *Corymbia gummifera* (Red Bloodwood), *Angophora costata* (Smooth-barked Apple) and *Allocasuarina littoralis* (Black She-oak). The species has been recorded in disturbed locations, including in areas lacking upper vegetation strata. Most sites have a mostly native understorey. Flowering period is typically from September to October, but has been recorded flowering in mid to late November to early December. Note, this species is extremely difficult to locate even when in flower and cannot be definitively identified from leaf alone. Local climatic conditions appear to play a key role in flowering events, with rainfall possibly driving flowering. In drier periods, initial signs of above ground activity may emerge (e.g. leaf and spike), though flowers have been observed to wither in the absence of suitable conditions (e.g. soil moisture). Recorded from four localities between Chain Valley Bay and Wyong in Wyong local government area. A small population also occurs within Lake Macquarie LGA.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation When local reference population is flowering.	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method	Sep-Oct 2020
Grevillea parviflora subsp. parviflora Small-flower Grevillea	V	V	2	N	Aug-Nov	Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Sydney region occurrences are usually on Tertiary sands and alluvium, and soils derived from the Mittagong Formation. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. In Sydney it has been recorded from Shale Sandstone Transition Forest and in the Hunter in Kurri Sand Swamp Woodland. However, other communities are occupied in other locations where the species can be found.	Parallel walking transects – Maximum distance between transects 15m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.75km at 15m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Sep-Oct 2020
Maundia triglochinoides Maundia	V	-	2	N	Nov-Mar	Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 – 60 cm deep on heavy clay, low nutrients. Flowering occurs during warmer months. Associated with wetland species e.g. *Triglochin procerum*. Populations expand following flood events and contract to more permanent wetlands in times of low rainfall.	Search the appropriate parts of the water body by using a traverse coverage appropriate for the species' growth form	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Nov-Dec 2020

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Melaleuca biconvexa Biconvex Paperbark	V	V	2	N	All Year	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October. Resprouts following fire.	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Jun-Jul 2020
Melaleuca groveana Grove's Paperbark	V	-	2	N	All Year	Grove's Paperbark grows in heath and shrubland, often in exposed sites, in low coastal hills, escarpment ranges and tablelands on outcropping granite, rhyolite and sandstone on rocky outcrops and cliffs. It also occurs in dry scrubby open forest and woodlands.	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Jun-Jul 2020
Persicaria elatior Tall Knotweed	V	V	2	N	Dec-May	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance	Targeted survey in suitable habitat including damp places, especially beside streams and lakes.	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Dec-2020
Rhizanthella slateri Eastern Australian Underground Orchid	V	E	3	Y	Sep-Nov	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore, usually located only when the soil is disturbed.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method	Sep-Oct 2020
Rhodamnia rubescens Scrub Turpentine	CE	CE	3	Y	All Year	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	Parallel walking transects – Maximum distance between transects 15m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.75km at 15m separation	Parallel transects in areas of suitable habitat More than 3000 hours of site diurnal fieldwork.	Mar-May 2020; Aug 2020; Oct 2020
Rhodomyrtus psidioides Native Guava	CE	CE	3	Y	All Year	Occurs from Broken Bay, approximately 90 km north of Sydney, New South Wales, to Maryborough in Queensland. Populations are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to c. 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges in NSW. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines. Flowering occurs from late spring to early summer. This species is characterised being extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation	Parallel transects in areas of suitable habitat More than 3000 hours of site diurnal fieldwork.	Mar-May 2020; Dec-2020
Rutidosis heterogama Heath Wrinklewort	V	V	2	N	All Year	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides.	Parallel walking transects – Maximum distance between transects 20m in open, 10m in dense vegetation. For each hectare of potential habitat average field traverse length 1km at 10m separation or 0.5km at 20m separation.	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method	Aug-2020
Senna acclinis Rainforest Cassia	E	-	2	N	All Year	Grows on the margins of subtropical, littoral and dry rainforests. Often found as a gap phase shrub. Flowering occurs in spring and summer and the fruit is ripe in summer and autumn.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Dec-2020

Species Name	BC Act listing	EPBC Act listing	BRW	Candidate SAII (Y/N)	Specific survey period (BAM-C)	Habitat Requirements / Habitats Searched / General Notes	Survey Guidelines	Survey Method Undertaken	Date
Tetratheca glandulosa Black-eyed Susan	V	-	2	N	Aug-Nov	Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities correspond broadly to Benson & Howell's Sydney Sandstone Ridgetop Woodland (Map Unit 10ar). Common woodland tree species include: *Corymbia gummifera, C. eximia, Eucalyptus haemastoma, E. punctata, E. racemosa*, and/or *E. sparsifolia*, with an understorey dominated by species from the families Proteaceae, Fabaceae, and Epacridaceae.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method More than 3000 hours of site diurnal fieldwork.	Sep-Oct 2020
Tetratheca juncea Black-eyed Susan	V	V	2	N	Sep-Oct	Cryptic shrub – difficult to distinguish the clumped grass like stems from other vegetation when not in flower. Generally found in low open forest/woodland with a mixed shrub understorey and grassy groundcover, also occurs in heathland and moist forest and is most often associated with low nutrient soils of the Awaba Soil Landscape. Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock.	Parallel walking transects – Maximum distance between transects 10m in open, 5m in dense vegetation. For each hectare of potential habitat average field traverse length 2km at 5m separation or 1km at 10m separation When local reference population is flowering (typically Sep – Oct peak period)	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method	Sep-Oct 2020
Thelymitra pprox. Wyong Sun Orchid	CE	CE	3	Y	Sep-Oct	Occurs from 10-40 m a.s.l. in grassy woodland or occasionally derived grassland in well-drained clay loam or shale derived soils. The vegetation type in which the majority of populations occur (including the largest colony) is a Spotted Gum – Ironbark Forest with a diverse grassy understorey and occasional scattered shrubs. Some reports suggest that the species may also occur within the margin of two other vegetation types where these adjoin or constitute portions of the remnant vegetation areas in which the orchid has been recorded. Alluvial Redgum Footslopes Forest (Bell 2002) adjoins Dooralong Spotted Gum – Ironbark Forest at one population, and may constitute habitat for the species. Alluvial Floodplain Shrub Swamp Forest (Bell 2002) also adjoins Dooralong Spotted Gum – Ironbark Forest at one extant population with a report of a small orchid colony on the margin (B. Branwhite pers. Comm.), and one apparently extinct population occurred in vegetation probably assignable to this type near Warnervale. A number of sites where the species occurs are subject to past and ongoing disturbance, including sites on the edges of roads that contain a mixture of native and introduced species in the understorey, though competition with invasive introduced species is a threat.	Use flowers to identify. Flowering period and abundance vary each year and occurs for 2-4 weeks Sep – Oct. Use a nearby reference population to determine most likely time for flowering. Species is more likely to be detectable on warm sunny days.	Parallel transects across 628 100m-grid intersects, using the two-phase grid-based systematic survey method	Sep-Oct 2020
Zannichellia palustris Zannichellia	E	-	2	N	Oct-Jan	Grows in fresh or slightly saline stationary or slowly flowing water, Flowers during warmer months, NSW populations behave as annuals, dying back completely every summer.	Aquatic plant survey guidelines: Search the appropriate parts of the water body using a diameter survey area that equates to the relevant growth form.	Survey of suitable habitat while undertaking 100m-grid intersect surveys More than 3000 hours of site diurnal fieldwork.	Nov-Dec 2020

The following candidate threatened species did not require further consideration and were ruled out of the above list as habitat or location constraints were not met:

- Regent Honeyeater (*Anthochaera pprox.*) – consultation of DPE's BAM – Important Areas online map (DPE, 2021) revealed that the Subject Site is not located within Regent Honeyeater Important Areas. In accordance with BAM Section 5.2.2.2(a) the development site lacks the listed habitat constraints and as such, does not require survey. Regardless, all avifauna species encountered were recorded during all phases of fieldwork.
- *Eucalyptus oblonga* population at Bateau Bay, Forresters Beach and Tumbi Umbi in the Wyong local government area – The Study Area is not located within Bateau Bay, Forresters Beach and Tumbi Umbi areas in the Central Coast Council LGA. In accordance with BAM Section 5.2.1.2(b) the geographic limitation for the species is not met and as such, does not require survey.
- Swift Parrot (*Lathamus discolor*) – consultation of DPE's BAM – Important Areas online map (DPE, 2021) revealed that the Subject Site is not located within Swift Parrot Important Areas. In accordance with BAM Section 5.2.2.2(a) the development site lacks the listed habitat constraints and as such, does not require survey. Regardless, all avifauna species encountered were recorded during all phases of fieldwork.
- Black-tailed Godwit (*Limosa limosa*), Broad-billed Sandpiper (*Limicola falcinellus*), Curlew Sandpiper (*Calidris ferruginea*), Great Knot (*Calidris tenuirostris*) and Terek Sandpiper (*Xenus cinereus*) – consultation of DPE's BAM – Important Areas online map (DPE, 2022e) revealed that the Subject Site is not located within Migratory Shorebirds Important Areas. In accordance with BAM Section 5.2.2.2(a) the development site lacks the listed habitat constraints and as such, does not require survey.
- Cotton Pygmy-goose (*Nettapus coromandelianus*) – The Study Area does not contain deep permanent fresh waters on floodplains with floating and submergent vegetation. As such, the waterbodies located within the Study Area and Subject Site were not deemed to be suitable for the species and it was removed from the calculator based on habitat constraint not being met. Furthermore, the species is considered a vagrant once further south than 100km of the Queensland border. In accordance with BAM Section 5.2.2.2 I, the species is a vagrant to the IBRA subregion and as such, does not require survey.
- Brush-tailed Rock-wallaby (*Petroga pprox. te ata*) – The Study Area is not located within 1km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines. As such, the species has been removed from the calculator based on habitat constraints not being met. In accordance with BAM Section 5.2.2.2(a) the development site lacks the listed habitat constraints and as such, does not require survey.
- Tranquillity Mintbush (*Prostanthera askania*) – The Study Area is not located South of Wyong River in the Central Coast LGA. In accordance with BAM Section 5.2.1.2(b) the geographic limitation for the species is not met and as such, does not require survey.

NSW BioNet Atlas records of threatened species within the Assessment Area are shown in **Figure 6.**

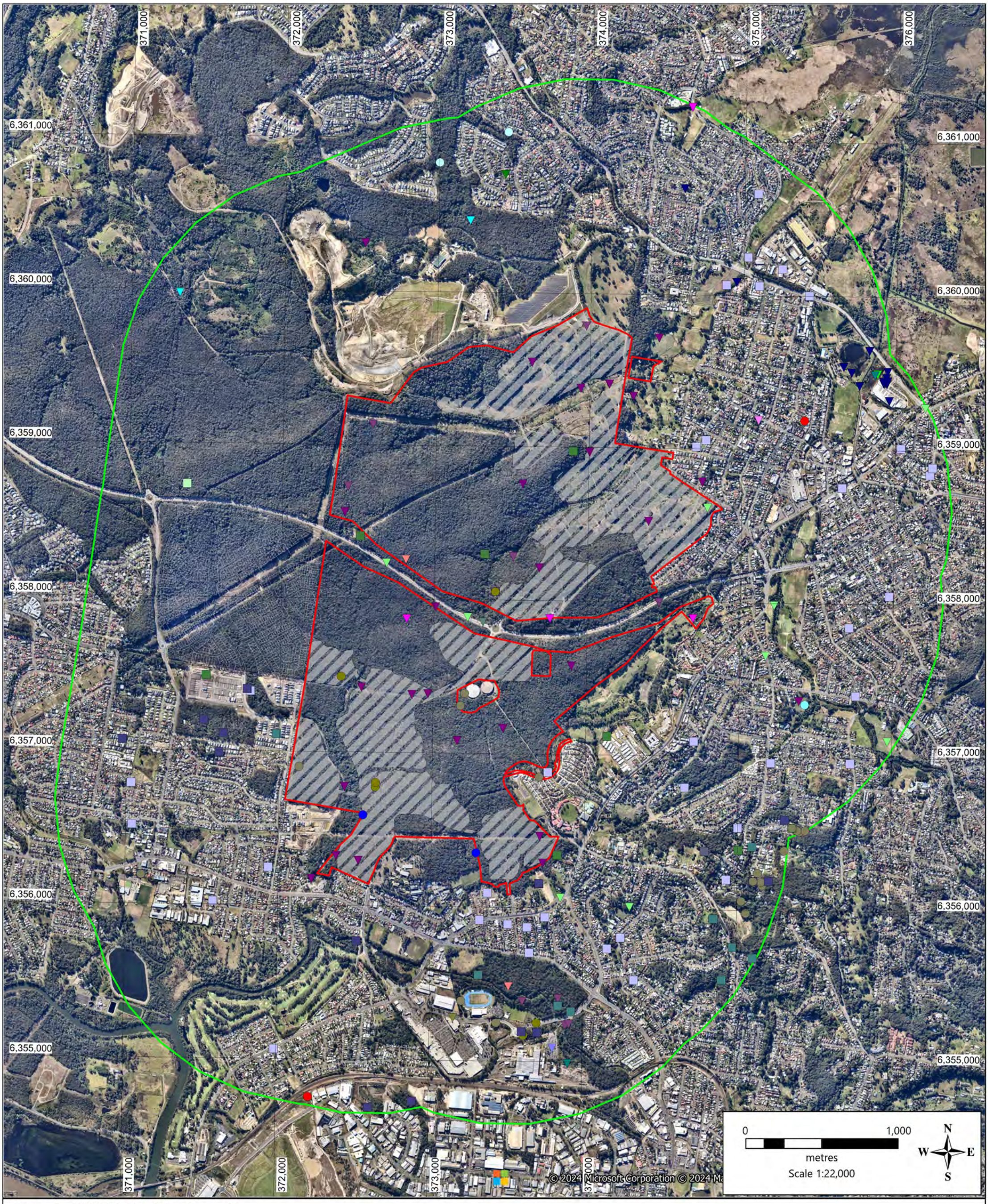

Figure 5 - NSW BioNet Atlas Records

Legend

- Study Area
- Subject Site
- Assessment Area
- Approved future subdivision

- Angophora inopina
- Callistemon linearifolius
- Grevillea parviflora subsp. parviflora
- Melaleuca biconvexa
- Rhodamnia rubescens
- Tetratheca juncea
- Zannichellia palustris
- Anseranas semipalmata
- Calyptorhynchus lathami lathami
- Daphoenositta chrysoptera
- Ephippiorhynchus asiaticus
- Falco subniger
- Gallinago hardwickii
- Glossopsitta pusilla
- Haliaeetus leucogaster
- Hieraaetus morphnoides
- Hirundapus caudacutus
- Ixobrychus flavicollis
- Lathamus discolor
- Lophoictinia isura
- Ninox strenua
- Numenius madagascariensis
- Petroica boodang
- Ptilinopus regina
- Ptilinopus superbus
- Rostratula australis
- Stictonetta naevosa
- Tyto novaehollandiae
- Chalinolobus dwyeri
- Micronomus norfolkensis
- Miniopterus australis
- Miniopterus orianae oceanensis
- Petaurus norfolcensis
- Phascolarctos cinereus
- Pteropus poliocephalus
- Saccolaimus flaviventris
- Scoteanax rueppellii

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

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1.8.3 Field Survey Methods

Surveys are deemed to have fulfilled and exceeded minimum survey requirements for all species. Details of the flora and fauna survey, including species lists, are presented in **Appendix C** and **Appendix D**, and summarised in **Table 9.** Habitat assessment and flora and fauna surveys were undertaken using relevant guidelines, in particular DPIE survey guidelines for threatened plants (2020), fauna (2022, 2019, 2018, 2004) and amphibians (2009).

1.8.3.1 Habitat Features Surveys

An assessment of the relative habitat values present within the Study Area was undertaken. This assessment focused primarily on the identification of specific habitat types and resources within the Study Area favoured by known threatened listed in **Section 1.8.2**. The assessment also considered the potential value of the Subject Site (and surrounding areas) for all major guilds of native flora and fauna. The assessment was based on the specific habitat requirements of each threatened fauna species in regards to home range, feeding, roosting, breeding, movement patterns and corridor requirements.

Consideration was given to contributing factors including topography, soil, light and hydrology for threatened flora and assemblages. In particular, focus was put on documenting the presence of key habitat features such as tree hollows. Hollows are an important resource utilised by a variety of forest fauna, and are particularly relevant for several of the likely key threatened species in this locality.

1.8.3.2 Flora Field Survey

All required flora survey techniques were utilised for targeted survey of the species listed in **Table 9** above and guided by *Surveying threatened plants and their habita–s - NSW survey guide for the Biodiversity Assessment Method* (DPIE, 2020) and the BAM (2020). A detailed description of the flora survey effort is included in **Appendix C**, and summarised as follows.

- Ground-truthing of vegetation mapping to identify all vegetation communities present onsite as well as segregate vegetation zones according to condition and current management practices. This was undertaken by Bell & Sims and AEP.
- Seasonal threatened flora surveys utilising the two-phase grid-based systematic approach, targeting a range of threatened flora, as per DPIE (2020) guidelines. Large areas of suitable habitat can be assessed using a two-phase grid-based systematic survey approach. The approach provides a practical method for designating survey locations and ensures uniform, consistent coverage of the suitable habitat for a target species on the subject land (Krebs 1989; Fewster 2011). Survey locations are positioned on a grid intersect, facilitating planning and enabling rapid assessment across larger areas (McGarvey et al. 2016). The grid-based approach can be used for species assessed as counts of individuals or by area of suitable habitat.

  A grid spaced at 100 square metres is nested within a one-square-kilometre grid from a topographic map image and then overlayed onto the subject land using a geographic information system (GIS). Surveys are undertaken where the 100-square-metre gridlines intersect within suitable habitat for a target species. Survey for multiple target species can occur within the area covered by the 100-square-metre grid, providing they occur in similar habitat, are of the same life form/habit, and have the same optimal survey time as specified by the TBDC.

  At each survey location (grid intersect), a 40-metre diameter area (1256-square-metre circular area) must be systematically surveyed for the target species. Survey locations must be pre-loaded onto a GPS, tablet or georeferenced map.

If a target species is located, finer-scale grid surveys are used to locate population extent, which will help define the species polygon. This subsequent phase ensures a greater intensity of survey effort in locations where the target species occurs (McGarvey et al. 2016). Directing survey effort to areas with a greater probability of hosting the species increases survey efficiency and reduces sampling costs (Guisan et al. 2006). The extent of the area covered by the finer-scale grid should be refined by considering the habitat type, vegetation type and condition and landscape attributes surrounding the locations where the target species was first detected.

- Identification of all vascular plant species encountered during fieldwork. Study Area coverage was both systematic to ensure all key points of the site were checked, and therein the Random Meander Technique (Cropper 1993) was utilised to maximise species encountered.
- 522 Rapid Data Points (RDPs) and 88 BAM plots were undertaken in accordance with BAM 2020.
- In addition to State survey guidelines, Council and Commonwealth survey guidelines for *Tetratheca juncea* were adhered to. Additional surveys were undertaken in the section of the Study Area located within the Lake Macquarie LGA, using belt transects located 50m apart across the entire LGA area. This is in excess of minimum requirements outlined in *Figure 2: Survey guidelines for the Black-eyed Susan* of the *Referral guidelines for the vulnerable Black-eyed Susan, Tetratheca juncea* (DSEWCP, 2011). Where the species was identified, finer belt transec pprox.rox. 5m apart were undertaken within surrounding areas of suitable habitat, and clumps therein were counted and recorded. This survey method was applied in compliance with *Appendix C Lake Macquarie City Council Flora and Fauna Survey Guidelines for T. juncea* of the *Lake Macquarie Tetratheca juncea Planning and Management Guidelines* (LMCC, 2014b), which require surveys for *Tetratheca juncea* to be undertaken in accordance with the Australian Government *Referral guidelines for the vulnerable Black-eyed Susan, Tetratheca juncea* (DSEWCP, 2011).

1.8.3.3 Fauna Field Surveys

All required fauna survey techniques were utilised for targeted survey of the species listed in **Table 9,** and guided by the *Threatened biodiversity survey and assessment – Guidelines for developments and activities (2004 working draft)* (DEC,2004); *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (DECC, 2009); *Koala Habitat Protection Guideli–e - Implementing State Environmental Planning Policy (Koala Habitat Protection) 2019* (DPIE, 2020f); *Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide* (DPE, 2022b); and *'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method Survey* (OEH, 2018). While surveys were being undertaken, a new set of guidelines for amphibians was introduced by NSW DPIE (2020e) and guided the remainder of surveys in conjunction with DECC 2009 guidelines.

Survey effort is described in **Appendix D** and illustrated with maps therein.

1.8.3.4 Incidental Observations

Incidental records of any fauna species observed during all phases of fieldwork were noted. This included opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of any resident or migratory species. Specific searches were also conducted for whitewash, regurgitation pellets and prey remain from Owls, chewed Casuarina cones from Black-Cockatoos, chewed fruit remains from frugivorous birds etc.

1.8.4 Habitat Survey Results

1.8.4.1 Hollow-bearing Trees and Arboreal Nests

Systematic searches for hollow-bearing trees (HBTs) were conducted in March and April 2020, and all HBTs incidentally recorded during other surveys throughout 2020 and 2021 were also added to the survey dataset.

Within the Study Area, approximately 446 HBTs were identified and compris pprox.rox. 1077 hollows of the following sizes:

- 149 extra-small hollows;
- 411 small hollows;
- 308 medium hollows;
- 138 large hollows; and
- 71 extra-large hollows.

It is to be noted that smaller hollows or hollows located outside of visual reach may have been undetected for the count.

Table 10 and **Table 11** detail the levels of proposed retention in terms of trees and hollows and by hollow size.

Table 10 – Tree and Hollow Retention

	Number within development footprint	Number within retained lands	Proportion within development footprint	Proportion within retained lands	Total number within site boundary
Trees	156	290	35%	65%	446
Hollows	377	700	35%	65%	1077

Table 11 – Removal and Retention Levels by Hollow Size Class

Hollow size class	XS	S	M	L	XL
Total cleared	39	162	110	46	20
Total retained	110	249	198	92	51
% Retained	73.8%	60.6%	64.3%	66.7%	71.8%

1.8.4.2 Caves and other Ground Habitat Features

The Study Area contains escarpments, large boulders and small caves which may provide habitat for a variety of fauna species. Rubbish piles were identified in various locations, which may also be suitable for species such as reptiles.

As detailed further in this report, no evidence of use of caves by breeding threatened microbats was found.

1.8.4.3 Water Features

Various waterbodies, being streams, dams and areas of standing water, were identified on site. They have the potential to provide suitable foraging habitat for multiple fauna species. In particular, Southern Myotis was identified on site while foraging in proximity of a dam.

Habitat features identified within the Study Area are shown on **Figure 6.** Photographs of example habitat features are included in **Appendix H**.

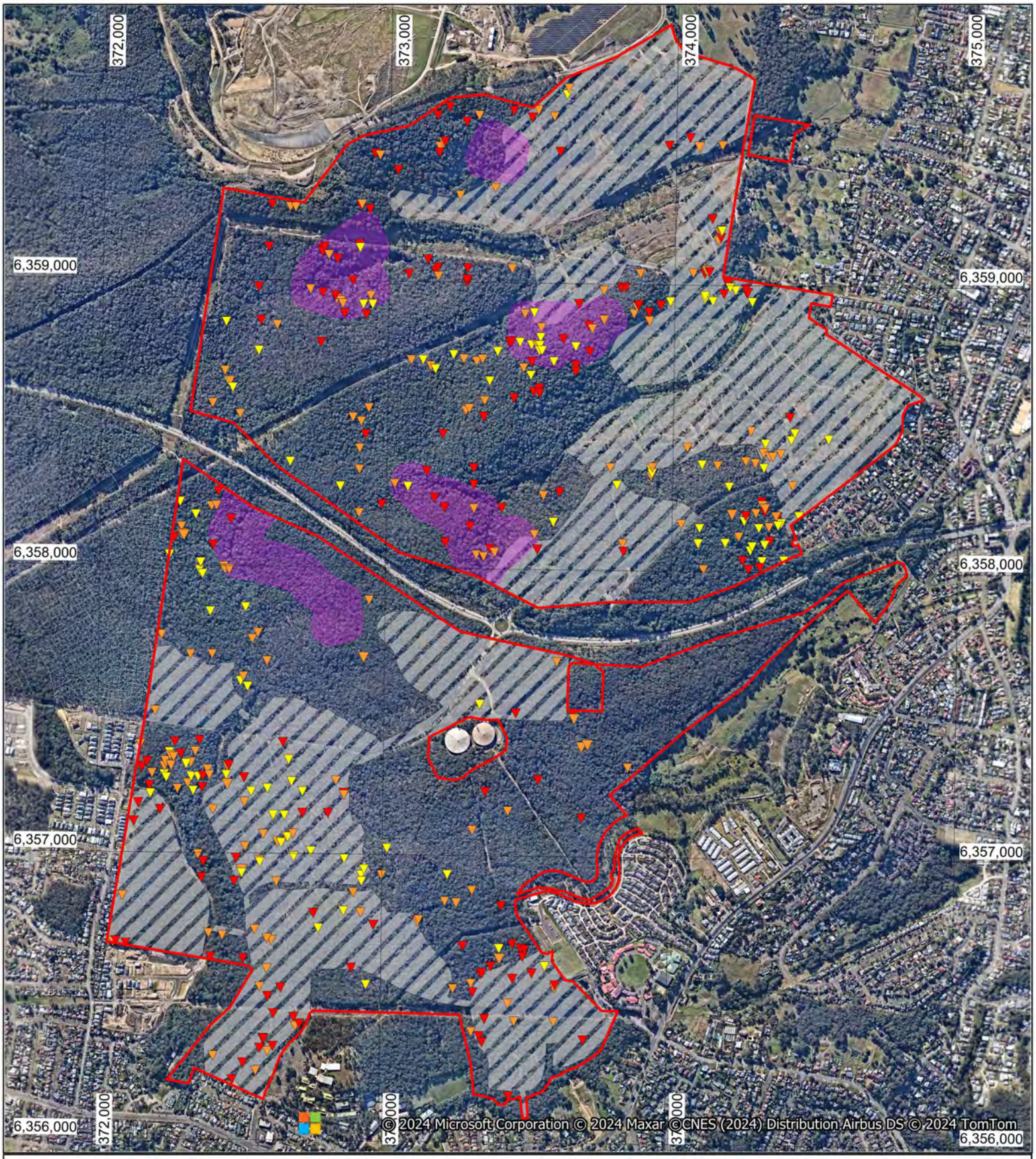

Figure 6 - Habitat Features

Legend

- Study Area
- Subject Site
- Caves and crevices
- Future approved subdivision

Hollow-bearing trees

- Large/Extra-large hollow
- Medium hollow
- Extra-small/Small hollow

0 750
metres
Scale 1:17,500

N W E S

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates (Newcastle) Pty Ltd | September 2024
AEP Ref: 1971

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

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1.8.5 Species Credit Species Survey Results

Surveys for Species Credit Species listed as likely to occur within the site, as per the BAM-C, were undertaken in compliance with recommended survey periods and following applicable guidelines. Comprehensive description of the survey results is provided in **Appendix C** and **Appendix D** for fauna and flora respectively.

Table 12 provides a summary of such results.

Table 12 – Species Credit Species

Species Name	Survey Technique Adhere to Guidelines in Table 11 (Y/N)	Surveyed in Season (Y/N)	BioNet Records (10km)	Details of BioNet Record	Geographical Restrictions	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area	Observed within Subject Site (Y/N)	Species Credits Apply (Y /N)
Fauna										
Burhinus grallarius Bush Stone-curlew	Y	Y	1	Recorded in Blackbutt Reserve from 2014 however this relates to a captive bird. Horseshoe Beach, Newcastle 2010. Single bird reported from Stockland Glendale 2022.	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range.	Marginal habitat is present, and condition varies throughout the site.	N	N	N	N
Callocephalon fimbriatum Gang-gang Cockatoo	Y	Y	1	Recorded in New Lambton Heights in 2007.	The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee.	Suitable habitat is present, and condition varies throughout the site.	N	N	N	N
***Calyptorhynchus lathami* Glossy Black-Cockatoo (Breeding)**	**Y**	**Y**	**4**	**Recorded within the Study Area.**	**The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Recent habitat destruction from bushfires has seen a coastal influx in some areas by the species.**	**Suitable habitat present, in variable condition throughout the site.** **Species identified on site.**	**N**	**Y**	**Y**	**N** **No evidence of breeding on site**
Cercartetus nanus Eastern Pygmy-possum	Y	Y	-	N/A	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes.	Suitable habitat is present, and condition varies throughout the site.	N	N	N	N
***Chalinolobus dwyeri* Large-eared Pied Bat**	**Y**	**Y**	**5**	**Recorded within the Study Area.**	**Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes.**	**Suitable foraging habitat as well potential breeding habitat is present on site. While the species was detected on site using an Anabat detector, surveying using harp traps found no evidence of breeding on site.**	**Y**	**Y**	**Y**	**Y** **Foraging only.** **No evidence of breeding on site**
Crinia tinnula Wallum Froglet	Y	Y	-	N/A	Wallum Froglets are found along the coastal margin from Litabella National Park in south-east Queensland to Kurnell in Sydney.	While dams and waterbodies occur on site, they are generally degraded and constitute sub-optimal habitat for the species.	N	N	N	N

Species Name	Survey Technique Adhere to Guidelines in Table 11 (Y/N)	Surveyed in Season (Y/N)	BioNet Records (10km)	Details of BioNet Record	Geographical Restrictions	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area	Observed within Subject Site (Y/N)	Species Credits Apply (Y /N)
Haliaeetus leucogaster White-bellied Sea-Eagle	Y	Y	192	Multiple locations, with higher counts of individuals near Hexham Swamp, Minmi, Cockle Creek and Blackbutt Reserve	Widespread throughout coastal NSW and inland waterways.	Potentially suitable trees for breeding purposes occur on site, albeit remote from preferred foraging habitat.	N	N	N	N
Heleioporus australiacus Giant Burrowing Frog	Y	Y	-	N/A	The Giant Burrowing Frog is distributed in south eastern NSW and Victoria, and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria.	While dams and waterbodies occur on site, they are in degraded condition and constitute sub-optimal habitat for the species. The geology of the site is also largely unsuitable for the species.	N	N	N	N
Hieraaetus morphnoides **Little Eagle**	**Y**	**Y**	**26**	**Multiple locations. Mostly found near Hexham Swamp, Minmi and Blackbutt Reserve.**	**The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW.**	**Potentially suitable trees for breeding purposes occur on site.** **Two stick nests were observed within the study area but neither were observed to be in use during the surveys.**	**N**	**Y**	**N**	**N** **No nesting identified on site**
Hoplocephalus bitorquatus Pale-headed Snake	Y	Y	-	N/A	A patchy distribution from north-east Queensland to the north-eastern quarter of NSW. In NSW it has historically been recorded from as far west as Mungindi and Quambone on the Darling Riverine Plains, across the north west slopes, and from the north coast from Queensland to Sydney. A small number of historical records are known for the New England Tablelands from Glenn Innes and Tenterfield; however, the majority of records appear to be from sites of relatively lower elevation. Although the Pale-headed snake distribution is very cryptic, it now appears to have contracted to a patchy and fragmented distribution.	Suitable habitat is present on site, in varying conditions.	N	N	N	N
Hoplocephalus stephensii Steph'ns' Banded Snake	Y	Y	-	N/A	Coast and ranges from Southern Queensland to Gosford in NSW.	Suitable habitat is present on site, in varying conditions.	N	N	N	N

Species Name	Survey Technique Adhere to Guidelines in Table 11 (Y/N)	Surveyed in Season (Y/N)	BioNet Records (10km)	Details of BioNet Record	Geographical Restrictions	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area	Observed within Subject Site (Y/N)	Species Credits Apply (Y /N)
Litoria aurea Green and Golden Bell Frog	Y	Y	3	Records from 1984-1990 in and near Hexham Swamp.	Formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. Records from west to Bathurst, Tumut and the ACT region. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands.	While dams and waterbodies occur on site, they are in degraded condition and constitute sub-optimal habitat for the species.	N	N	N	N
Litoria brevipalmata Green-thighed Frog	Y	Y	-	N/A	Isolated localities along the coast and ranges from just north of Wollongong to south-east Queensland.	Breeding occurs following heavy rainfall from spring to autumn, with larger temporary pools and flooded areas preferred. Such habitat occurs on site.	N	N	N	N
***Lophoictinia isura* Square-tailed Kite**	**Y**	**Y**	**18**	**Most records located near Hexham Swamp and Blackbutt Reserve.**	**The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March.**	**Potentially suitable trees for breeding purposes occur on site. Two stick nests were observed within the study area but neither were observed to be in use during the surveys.**	**N**	**Y**	**Y**	**N No nesting identified on site**
Macropus parma Parma Wallaby	Y	Y	-	N/A	Once occurred from north-eastern NSW to the Bega area in the southeast. Their range is now confined to the coast and ranges of central and northern NSW from the Gosford district to the Queensland border.	Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. Such vegetation occurs in patches across the site but it is generally not so thick as to constitute suitable habitat.	N	N	N	N
***Miniopterus australis* Little Bent-winged Bat**	**Y**	**Y**	**112**	**Records are scattered over the entirety of the 10km^2 search area.**	**East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW.**	**Suitable foraging habitat as well potential breeding habitat is present on site. While the species was detected on site using an Anabat detector, comprehensive surveying using harp traps found no evidence of breeding on site.**	**Y**	**Y**	**Y**	**N No breeding identified on site**

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Miniopterus orianae oceanensis **Large Bent-winged Bat**	**Y**	**Y**	**61**	**Records are scattered over the entirety of the 10km^2 search area.**	**Eastern Bentwing-bats occur along the east and north-west coasts of Australia.**	**Suitable foraging habitat as well potential breeding habitat is present on site. While the species was detected on site using an Anabat detector, comprehensive surveying using harp traps found no evidence of breeding on site.**	**Y**	**Y**	**Y**	**N** **No breeding identified on site**
Mixophyes balbus Stuttering Frog	Y	Y	-	N/A	Stuttering Frogs occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Considered to have disappeared from Victoria and to have undergone considerable range contraction in NSW, particularly in south-east NSW. It is the only *Mixophyes* species that occurs in south-east NSW and in recent surveys it has only been recorded at three locations south of Sydney. The Dorrigo region, in north-east NSW, appears to be a stronghold for this species.	The species breeds in streams during summer after heavy rain. Such habitat occurs on site within the main riparian corridors.	N	N	N	N
Mixophyes iteratus Giant Barred Frog	Y	Y	-	N/A	The Giant Barred Frog is distributed along the coast and ranges from Eumundi in south-east Queensland to Warrimoo in the Blue Mountains. Declines appear to have occurred at the margins of the spec'es' range, with no recent records south of the Hawkesbury River and disappearances from a number of streams in QLD. Northern NSW, particularly the Coffs Harbour-Dorrigo area, is a stronghold.	The species is found in freshwater streams with permanent or semi-permanent water, and occasionally around dams. Such habitat occurs i on site within the main riparian corridors.	N	N	N	N
Myot pprox. pus **Southern Myotis**	**Y**	**Y**	**2**	**Records near Wentworth Creek and Cockle Creek.**	**The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100km inland, except along major rivers.**	**Suitable habitat in the form of waterbodies proximate to treed areas are present within the site. The species was detected as part of a Species Group using an Anabat detector, and recorded visually during a spotlighting survey near a dam.**	**Y**	**Y**	**Y**	**Y**

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Ninox connivens Barking Owl	Y	Y	1	Record in Blackbutt Reserve from 1985.	The Barking Owl is found throughout continental Australia except for the central arid regions. Although still common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Many populations crashed as woodland on fertile soils was cleared over the past century, leaving linear riparian strips of remnant trees as the last inhabitable areas. Surveys in 2001 demonstrated that the Pilliga Forest supported the largest population in southern Australia. The owls sometimes extend their home range into urban areas, hunting birds in garden trees and insects attracted to streetlights. Extensive wildfires in 2019-20 reduced habitat quality further, burnt many old, hollow-bearing trees needed as refuge by prey species and reduced the viability of some regional owl populations.	Large hollows are present on site. Potentially suitable habitat occurs in varying conditions.	N	N	N	N
Ninox strenua **Powerful Owl**	**Y**	**Y**	**107**	**Records are scattered over the entirety of the 10km^2 search area, with higher counts around Blackbutt Reserve, the Study Area, , Jesmond Bushland, Blackbutt Reserve and north Lake Macquarie**	**The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover.**	**Large hollows are present on site. Potentially suitable habitat occurs in varying conditions.** **Three (3) nests have been confirmed as being in use.**	**Y**	**Y**	**Y**	**Y**
Pandion cristatus Eastern Osprey	Y	Y	16	Most records proximate to Cockle Creek and the Hunter Wetlands Centre	The Osprey has a global distribution with four subspecies previously recognised throughout its range. However, recent studies have identified that there are two species of Ospr–y - the Western Osprey (*P. haliaetus*) with three subspecies occurring in Europe, Asia and the Americas and the Eastern Osprey (*P. cristatus*) occurring between Sulawesi (in Indonesia) Australia and New Caledonia. Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas.	Potentially suitable trees for breeding purposes occur on site.	N	N	N	N

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Petalura gigantea Giant Dragonfly	Y	Y	-	N/A	The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. It is not found west of the Great Dividing Range. There are known occurrences in the Blue Mountains and Southern Highlands, in the Clarence River catchment, and on a few coastal swamps from north of Coffs Harbour to Nadgee in the south.	Swamps occur on site although in mostly disturbed condition.	N/A	N	N	N
Petauroid pproxans Greater Glider	Y	Y	-	N/A	The Greater Glider (southern and central) occurs in eastern Australia, where it has a broad distribution from around Proserpine in Qld, south through NSW and the ACT, to Wombat State Forest in central Vic. It occurs across an elevational range of 0−1200 m above sea level (DEECCW, 2022).	The species is largely restricted to eucalypt forests and woodlands and is typically found in highest abundance in taller, montane, moist eucalypt forests on fertile soils, with relatively old trees and abundant hollows. Therefore, the Subject Site contains somewhat suitable habitat in varying conditions across the site.	N	N	N	N
Petaurus norfolcensis **Squirrel Glider**	**Y**	**Y**	**65**	**Most records occur north of the Study Area and in the Lake Macquarie LGA section of the 10km^2 search area.** **One record adjacent to the Study Area in 2004.**	**The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria.**	**Suitable habitat occurs in varying conditions across the site.**	**Y**	**Y**	**Y**	**Y**
Phascogale tapoatafa Brush-tailed Phascogale	N[6]	Y	-	N/A	The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide.	Suitable habitat occurs in varying conditions across the site.	N	N	N	N
Phascolarctos cinereus Koala	Y	Y	4	Four (4) records between 1986 and 2015, with the latest occurring in Cameron Park, west of the Study Area. LMCC have indicated a reco pprox.rox. 500m west of the NW corner subject site on "Winten Land"	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In New South Wales, koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range.	Suitable habitat occurs in varying conditions across the site.	N	N	N	N
Planigale maculata Common Planigale	Y	Y	-	N/A	Coastal north-eastern NSW, coastal east Queensland and Arnhem Land. The species reaches its confirmed southern distribution limit on the NSW lower north coast however there are reports of its occurrence as far south as the central NSW coast west of Sydney.	Suitable habitat occurs in varying conditions across the site.	N	N	N	N

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Potorous tridactylus Long-nosed Potoroo	Y	Y	-	N/A	The Long-nosed Potoroo is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania, including some of the Bass Strait islands. There are geographically isolated populations in western Victoria. In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm.	Suitable habitat occurs in varying conditions across the site.	N	N	N	N
Pseudophryne australis Red-crowned Toadlet	Y	Y	-	N/A	The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains.	The species inhabits periodically wet drainage lines below sandstone ridges and breeds beside ephemeral creek sand gutters. Marginal habitat occurs on site.	N	N	N	N
***Pteropus poliocephalus* Grey-headed Flying-fox**	**Y**	**Y**	**154**	**Multiple records scattered across the entirety of the 10km^2 search area, including within the Study Area.**	**Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations.**	**Suitable foraging habitat is present on site, in varying conditions. However, no evidence of breeding was found.**	**Y**	**Y**	**Y**	**N No breeding camp identified on site**
***Tyto novaehollandiae* Masked Owl**	**Y**	**Y**	**10**	**Multiple records across the search area, including evidence of roadkill on Newcastle Link Road, adjacently to the Study Area.**	**Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution.**	**Large hollows are present on site. Potentially suitable habitat occurs in varying conditions.**	**N**	**Y**	**N**	**N No nesting identified on site**
Uperoleia mahonyi Mahony's Toadlet	Y	Y	-	N/A	Mahony's Toadlet is endemic to the mid-north coast of New South Wales (NSW) and to date has been found between Kangy Angy and Seal Rocks.	Species is typically found in swamps or along drainage lines and breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Such habitat occurs on site in a degraded condition in small sections. Known records occur in heath or wallum habitats almost exclusively associated with leached (highly nutrient impoverished) white sand. Commonly associated with acid paperbark swamps.	N	N	N	N
Vespadelus troughtoni Eastern Cave Bat	Y	Y	1	One (1) record in 2001 in Cameron Park.	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT.	Potentially suitable breeding habitat occurs on site. Anabat call detection analysis suggests that the species was possibly recorded as part of a Species Group as it is not possible to reliably identify the species using acoustic detection alone. However, further surveying using harp traps did not find any evidence of site use by the species.	N	N	N	N

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Flora										
Angophora inopina Charmhaven Apple	Y	Y	587	Local populations are limited to two (locations): A precinct between Weir Rd and Cockle Creek, and a small patch south of Cardiff Central.	Endemic to the Central Coast region of NSW. The known northern limit is near Karuah where a disjunct population occurs; to the south populations extend from Toronto to Charmhaven with the main population occurring between Charmhaven and Morisset. There is an unconfirmed record of the species near Bulahdelah. Approximately 1250ha of occupied habitat has been mapped in the Wyong–southern Lake Macquarie area.	Suitable habitat occurs on site. However, BioNet Atlas records illustrate a lack of connectivity between the Study Area and known areas of occurrence in the locality.	N/A	N	N	N
Asperula asthenes Trailing Woodruff	Y	Y	-	N/A	This small herb occurs only in NSW. It is found in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens / Wallis Lakes area / Forster (including Myall Lakes NP, New England NP, Wallingat NP and Darawank NR).	The species typically occurs in damp sites, often along river banks. Such habitat occurs on site, although in a degraded condition.	N/A	N	N	N
Astrotricha crassifolia Thick-leaf Star-hair	Y	Y	-	N/A	Occurs near Patonga (Gosford LGA), and in Royal NP and on the Woronora Plateau (Sutherland and Campbelltown LGAs). There is also a record from near Glen Davis (Lithgow LGA).	Potentially suitable habitat is present. However, geographic limitations for the species are such that it is unlikely to be found in the locality.	N/A	N	N	N
Caladen pprox. teata Thick Lip Spider Orchid	Y	Y	-	N/A	The Thick Lip Spider Orchid is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. It was also recorded in the Huskisson area in the 1930s. The species occurs on the coast in Victoria from east of Melbourne to almost the NSW border.	Potentially suitable habitat is present. However, geographic limitations for the species are such that it is unlikely to be found in the locality.	N/A	N	N	N
Callistemon linearifolius **Netted Bottle Brush**	**Y**	**Y**	**12**	**Sparse records in the area, with notable locations being south of Weir Rd in Barnsley, as well as the Study Area.**	**Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coalcliff in the northern Illawarra. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. The species was more widespread in the past, and there are currently only 5-6 populations remaining from the 22 populations historically recorded in the Sydney area. Three of the remaining populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve and Spectacle Island Nature Reserve. The species has also been recorded from Yengo National Park.**	**Suitable habitat is present and the species was recorded in high numbers in the south of the Study Area, mainly in the Lake Macquarie LGA section of the site.**	**N/A**	**Y**	**Y**	**Y**

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Corunastylis sp. Charmhaven (NSW896673)	Y	Y	-	N/A	*Corunastylis* sp. *Charmhaven* (NSW896673) is currently only known from the Wyong Shire of NSW where it is restricted to a few locations in the Charmhaven, Warnervale and Tooheys Road (Bushells Ridge) areas.	Potentially suitable habitat is present. However, geographic limitations for the species are such that it is unlikely to be found in the locality.	N/A	N	N	N
Cryptostylis hunteriana Leafless Tongue Orchid	Y	Y	-	N/A	The Leafless Tongue Orchid has been recorded from as far north as Gibraltar Range National Park south into Victoria around the coast as far as Orbost. It is known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites). Also recorded at Munmorah State Conservation Area, Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park and Ben Boyd National Park.	Potentially suitable habitat is present in varying conditions across the site.	N/A	N	N	N
Cymbidium canaliculatum population in the Hunter catchment	Y	Y	-	N/A	In the Hunter Catchment *C. canaliculatum* is known to occur within Wollemi and Goulburn River National Parks but it is estimated that about 90% of the population occurs on land not managed for conservation. Although it may be present in other reserves in the Hunter Catchment, recent surveys of Manobalai Nature Reserve, Wingen Maid Nature Reserve, Wallabadah Nature Reserve and Towarri National Park did not detect any occurrences of *C. canaliculatum*. There were no records of *C. canaliculatum* in a survey of Yengo National Park.	Potentially suitable habitat is present. However, geographic limitations for the species are such that it is unlikely to be found in the locality.	N/A	N	N	N
Cynanchum elegans White-flowered Wax Plant	Y	Y	-	N/A	Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. The species has been recorded as far west as Merriwa in the upper Hunter River valley.	Potentially suitable habitat is present in varying conditions across the site.	N/A	N	N	N
Diuris praecox Rough Doubletail	Y	Y	-	N/A	Known from between Bateau Bay and Smiths Lake.	Potentially suitable habitat is present in varying conditions across the site.	N/A	N	N	N
Eucalyptus camfieldii Camfi'ld's Stringybark	Y	Y	-	N/A	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park.	Potentially suitable habitat is present in varying conditions across the site. However, known locations indicate that it is highly unlikely to be found in the locality.	N/A	N	N	N
Eucalyptus glaucina Slaty Red Gum	Y	Y	-	N/A	Found only on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, west of Maitland.	Potentially suitable habitat is present in varying conditions across the site.	N/A	N	N	N

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Eucalyptus parramattensis subsp. Decadens Drooping Red Gum	Y	Y	-	N/A	There are two separate meta-populations of *E. parramattensis subsp. decadens*. The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Aberdare in the south. Large aggregations of the subspecies are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south.	Potentially suitable habitat is present in varying conditions across the site. However, known locations indicate that it is highly unlikely to be found in the locality.	N/A	N	N	N
Genoplesium insigne Variable Midge Orchid	Y	Y	-	N/A	Recorded from four localities between Chain Valley Bay and Wyong in Wyong local government area. A small population also occurs within Lake Macquarie LGA.	Potentially suitable habitat is present in varying conditions across the site. However, known locations indicate that it is highly unlikely to be found in the locality.	N/A	N	N	N
Grevillea parviflora subsp. parviflora **Small-flower Grevillea**	**Y**	**Y**	**35**	**Most records occur in Jesmond Bushland as well as Edgeworth in areas subject to ongoing development.** **Furthermore, the species was identified by AEP within the Study Area.**	**Sporadically distributed throughout the Sydney Basin with sizeable populations around Picton, Appin and Bargo (and possibly further south to the Moss Vale area) and in the Hunter at in the Cessno–k - Kurri Kurri area (particularly Werakata NP). Separate populations are also known from Putty to Wyong and Lake Macquarie on the Central Coast.**	**Suitable habitat is present. The Grevillea species identified on site by AEP was determined to be *Grevillea humilis* by the National Herbarium of New South Wales. However, LMCC requested for *Grevillea parviflora* subsp. *parviflora* to be assumed as present.**	**N/A**	**Y**	**Y**	**Y**
Maundia triglochinoides Maundia	Y	Y	-	N/A	Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct.	Potentially suitable habitat is present in varying conditions across the site.	N/A	N	N	N
Melaleuca biconvexa Biconvex Paperbark	Y	Y	8	Records are limited and scattered throughout the search area, including near Cardiff Oval and bushland off Kotara train station.	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north.	Potentially suitable habitat is present in varying conditions across the site.	N/A	N	N	N
Melaleuca groveana Gr've's Paperbark	Y	Y	-	N/A	Widespread, scattered populations in coastal districts north of Yengo National Park to southeast Queensland. Also found as a disjunct population near Torrington on the Northern Tablelands.	Potentially suitable habitat is present in varying conditions across the site.	N/A	N	N	N
Persicaria elatior Tall Knotweed	Y	Y	-	N/A	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). The species also occurs in Queensland.	Potentially suitable habitat is present in varying conditions across the site. However, known locations indicate that it is highly unlikely to be found in the locality.	N/A	N	N	N

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Rhizanthella slateri Eastern Australian Underground Orchid	Y	Y	-	N/A	Occurs from south-east Queensland to south-east NSW. In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wise'an's Ferry area, Agnes Banks and near Nowra.	Potentially suitable habitat is present in varying conditions across the site. However, known locations indicate that it is highly unlikely to be found in the locality.	N/A	N	N	N
***Rhodamnia rubescens* Scrub Turpentine**	**Y**	**Y**	**9**	**Scattered records throughout the search area, including around Wentworth Creek (north of the Study Area), within the Study Area, and further south in Blackbutt Reserve and Munibung Hill.**	**Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of *R. rubescens* typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm.**	**Suitable habitat is present and species identified on site.**	**N/A**	**Y**	**Y**	**Y**
Rhodomyrtus psidioides Native Guava	Y	Y	1	Recorded near Wentworth Creek, north of the Study Area in 1999.	Occurs from Broken Bay, approximately 90 km north of Sydney, New South Wales, to Maryborough in Queensland. Populations are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to c. 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges in NSW.	Potentially suitable habitat is present in varying conditions across the site. However, known locations indicate that it is highly unlikely to be found in the locality.	N/A	N	N	N
Rutidosis heterogama Heath Wrinklewort	Y	Y	-	N/A	Recorded from near Cessnock to Kurri Kurri with an outlying occurrence at Howes Valley. On the Central Coast it is located north from Wyong to Newcastle. There are north coast populations between Wooli and Evans Head in Yuraygir and Bundjalung National Parks. It also occurs on the New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes.	Potentially suitable habitat is present in varying conditions across the site.	N/A	N	N	N
Senna acclinis Rainforest Cassia	Y	Y	-	N/A	Occurs in coastal districts and adjacent tablelands of NSW from the Illawarra in NSW to Queensland.	Potentially suitable habitat is present in varying conditions across the site.	N/A	N	N	N
Tetratheca glandulosa Black-eyed Susan	Y	Y	1	Recorded in 2014 in Jesmond Bushland.	Restricted to the following Local Government Areas: Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong. There are approximately 150 populations of this plant ranging from Sampons Pass (Yengo NP) in the north to West Pymble (Lane Cove NP) in the south. The eastern limit is at Ingleside (Pittwater LGA) and the western limit is at East Kurrajong (Wollemi NP). There are historical collections of this species south to Manly, Willoughby and Mosman, however these populations are now extinct. The current north-south range is approximately 65km.	Potentially suitable habitat is present in varying conditions across the site.	N/A	N	N	N

Species Name	Survey Technique Adhere to Guidelines in Table 11 (Y/N)	Surveyed in Season (Y/N)	BioNet Records (10km)	Details of BioNet Record	Geographical Restrictions	Habitat (Present / Condition)	Records from Deployed Equipment	Observed Within Study Area	Observed within Subject Site (Y/N)	Species Credits Apply (Y /N)
Tetratheca juncea **Black-eyed Susan**	**Y**	**Y**	**2574**	**The majority of recorded individuals were identified in Blackbutt Reserve and Jesmond Bushland, as well as in the Study Area. Other notable populations were recorded in Elermore Vale, Garden Suburb and Hillsborough.**	**Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock.**	**Suitable habitat is present and species identified on site.**	**N/A**	**Y**	**Y**	**Y**
Thelymitra adorata Wyong Sun Orchid	Y	Y	-	N/A	Currently known from a few localised occurrences in the area bounded by the towns of Wyong, Warnervale and Wyongah on the New South Wales Central Coast, within the Wyong Local Government Area.	Potentially suitable habitat is present in varying conditions across the site. However, known locations indicate that it is highly unlikely to be found in the locality.	N/A	N	N	N
Zannichellia palustris Zannichellia	Y	Y	8	Most recent records located within the Hunter Wetlands Centre in Shortland NSW.	In NSW, known from the lower Hunter and in Sydney Olympic Park.	Potentially suitable habitat is present in varying conditions across the site.	N/A	N	N	N

(6) Deviation from survey guidelines for Brush-tailed Phascogale were approved by Steven Cox of the NSW BCD. Refer to Attachment D of **Appendix D.**

Species identified within the Subject Site

1.8.6 Other threatened species considerations

Upon request from BCD (pers. comms. 10/03/2023), further desktop research was undertaken to inform the likelihood of occurrence of Swift Parrot and *Syzygium paniculatum* (Magenta Lilly Pilly) within the study area.

1.8.6.1 Swift Parrot likelihood of occurrence

As described in **Section 1.8.2**, the Study Area is not mapped as containing Important Habitat for Swift Parrot. Further justification was requested from DPE, specifically in reference to *Swift Parrots and Regent Honeyeaters in the Lake Macquarie City Council area New South Wales* document prepared by Birdlife Australia for LMCC (Birdlife Australia, 2014).

Consultation of Birdlife Australia, 2014, indicates that the Study Area is located in an area of "Low Value" vegetation for Swift Parrot, and as such does not contain areas described as "Swift Parrot habitat at risk". The report further notes that the development-zoned land in the Edgeworth-Minmi-Wallsend precinct, which the Study Area is a part of, comprises vegetation dominated by Spotted Gum-Ironbark Forest. However, it is also acknowledged that the location east of the Sugarloaf Range suggests that these areas may not be "used as often as Cessnock-Kurri forests".

As described above, Lower Hunter Spotted Gum – Ironbark Forest does not constitute the majority of vegetation in the Study Area, and approx. 75% of the EEC is proposed to be retained.

Therefore, it is considered that Swift Parrot is unlikely to be significantly impacted by the proposal and no further assessment is warranted.

1.8.6.2 *Syzygium paniculatum* likelihood of occurrence

A review of local BioNet Atlas records indicate that the species was recorded in two locations, being in the Wallsend Brickworks Park at Victory Parade and near McGregor Park in Rankin Park. It is also noted that the species is commonly planted for hedging and visual amenity purposes.

Furthermore, consultation of the *National Recovery Plan – Magenta Lilly Pilly Syzygium paniculatum* (OEH, 2012) indicates that the Study Area is not located within a precinct of known subpopulations. Furthermore, it is noted that certain known subpopulations in NSW occur within areas of cultural significance to Aboriginal people (OEH, 2012). However, the Study Area is not located in such precincts and as such, no further consultation is required.

2.0 Stage 2 – Impact Assessment (Biodiversity Values)

2.1 Avoid and Minimise Summary

Section 7 of the BAM provides a list of measures that need to be taken into consideration during project planning and design, to minimise impacts upon native vegetation, habitat and other prescribed biodiversity values. Applicable measures taken as part of this project to minimise impacts are provided below.

The avoid and minimise strategy for the development (in accordance with Section 7 of the BAM), is discussed in greater detail in **Table 17** below.

The prescribed impact risk assessment and mitigation measures (in accordance with Section 9 of the BAM) are included in **Table 18, Table 19, Table 20, Table 21** and **Table 22**.

The following measures in **Section 2.2** have been provided to help mitigate the impacts of construction and the ongoing operation of the proposed development on the biodiversity values identified within the Subject Site and surrounds.

2.2 Impact Avoidance and Mitigation Measures

2.2.1 Project Design and Council Consultation

The proposed Structure Plan design as shown in **Appendix A** is the result of an iterative design process involving consultation with project ecologists, traffic engineers, geotechnical engineers, contamination engineers, civil engineers, social engagement consultants, bushfire consultants, urban designers, town planners, LMCC and CON, with the aim of achieving optimal biodiversity conservation outcomes whilst delivering expected development outcomes in accordance with the Regional Strategy.

The multiple plan iterations are shown in **Appendix A.**

A comparison of the current Structure Plan with the iteration proposed in December 2020 shows the extent of efforts made to avoid and minimise impacts throughout the consultative design process have resulted in a reduction of development land area from 376ha to 244ha. This represents an increase of more than 70% in the area to be dedicated to conservation in perpetuity vs the December 2020 Structure Plan version.

Furthermore, the following improvements in impact avoidance as a result of iterative design revisions should be noted:

- Direct impacts to native vegetation reduced from 64.8% in 2020 to 39.8% in the current version;
- Direct impacts to Lower Hunter Spotted Gum – Ironbark Forest EEC reduced from 77.1% to 24.7%;
- Retention of *Callistemon linearifolius* individuals increased from 0.9% to 81.8%;
- Retention of *Tetratheca juncea* suitable habitat increased from 26.8% to 46.3%;
- Retention of Southern Myotis habitat increased from 58.1% to 79.1%;
- Retention of Powerful Owl nest buffer increased from 95.6% to 98.9%.

Plate 1 illustrates the evolution of development and conservation areas over the main iterations of the Structure Plan and **Table 13** provides a summary of the proportion of developed and retained lands for each iteration.

Details of clearing levels by PCT and species for both the December 2020 and September 2024 versions are provided in **Table 14** and s **Table 15**.

Furthermore, a comparison of impacts and retention levels by LGA is provided in **Appendix K**.

Table 13: Evolution of the Structure Plan areas

	December 2020	June 2022	June 2023	August 2023	September 2024
Development area	389ha	338ha	272ha	268ha	244ha
Conservation area	205ha	255ha	321ha	325ha	350ha
Development %	65%	57%	46%	45%	41%
Conservation %	35%	43%	54%	55%	59%

December 2020 June 2022 June 2023 August 2023 September 2024

Plate 1: Evolution of Retained Land Area

Table 14 – Comparison of Structure Plan Versions (2020 v 2024)

			September 2024 – Version 055.WS.025.09		June 2022 - Version 055.WS.25.02		December 2020 - Version 055.WS.010.05		Change in Percentage impact from 2020 to 2024
Entity name	**Unit of measure**	**Total Extent of Occurrence within Study Area**	**Total Extent of Occurrence or Species Polygon Size within Subject Site (ha)**	**Extent within Subject Site as a Proportion of Extent in Study Area**	**Total Extent of Occurrence or Species Polygon Size within Subject Site (ha)**	**Extent within Subject Site as a Proportion of Extent in Study Area**	**Total Extent of Occurrence or Species Polygon Size within Subject Site (ha)**	**Extent within Subject Site as a Proportion of Extent in Study Area**	
PCT 1539 - Grey Myrtle sheltered gully dry rainforest in gullies of the Sydney Basin	Hectare	1.12	0	0%	0.05	4.5%	0.00	0.0%	0%
PCT 1543 - Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley	Hectare	1.38	0.01	0.7%	0.06	4.3%	0.00	0.2%	+250%
PCT 1573 - Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment	Hectare	6.61	0.66	9.9%	0.18	2.7%	1.23	18.7%	-47%
PCT 1584 - White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest, central coast & lower Hunter Valley	Hectare	203	86.98	42.8%	70.62	34.8%	114.07	56.2%	-24%
PCT 1588 - Grey Ironbark-Broad-leaved Mahogany-Forest Red Gum shrubby open forest, Coastal Lowlands, Central Coast	Hectare	76.04	15.19	20%	39.31	51.7%	46.92	61.7%	-68%
PCT 1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Hectare	99.77	24.62	24. 7%	49.97	50.1%	76.89	77.1%	-68%
PCT 1619 - Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Hectare	136.56	80.70	59. 1%	92.18	67.5%	108.51	79.5%	-26%
PCT 1621 - Smooth-barked Apple open forest on coastal lowlands of the Central Coast	Hectare	32.79	13.83	42.4%	16.75	51.1%	13.87	42.3%	0%
PCT 1737 - Typha rushland	Hectare	0.73	0	0%	0.003	0.4%	0.16	21.8%	-100%
Sub-total		**558**	**221.99**	**39.8%**	**269**	**48.2%**	**362**	**64.8%**	**-39%**
Callistemon linearifolius	Count	5151	936	18.2%	866	16.8%	5103	99.1%	-82%
Grevillea parviflora subsp. parviflora	Hectare	1.61	1.6	99.4%	1.61	100%	0.65	40.3%	+147%
Rhodamnia rubescens	Count	2772	1	0.0%	58	2.1%	77	2.8%	-100%
Tetratheca juncea	Hectare	92.4	49.6	53.7%	41.6	49.6%	61.3	73.2%	-27%
Chalinolobus dwyeri	Hectare	558	222	39.8%	269.1	48.2%	361.66	64.8%	-39%
Myotis macropus	Hectare	93.1	19.5	20.9%	19.8	21.3%	39.05	41.9%	-50%
Ninox strenua	Hectare	9.3	0.04	0.4%	0.04	0.4%	0.41	4.4%	-75%
Petaurus norfolcensis	Hectare	558	222	39.8%	269.1	48.2%	361.66	64.8%	-39%

Table 15 – Summary of development and conservation extent since Dec 2020

PCT / species	Total LGA extent	Area impacted Dec 2020	% cleared Dec 2020	Area impacted Jun 2022	% cleared Jun 2022	Conservation extent Jun 2022 vs Dec 2020	Area impacted Jun 2023 (ha or count)	% cleared Jun 2023	Area impacted Aug 2023 (ha or count)	% cleared Aug 2023	Conservation extent Aug 2023 vs June 2023	Area impacted Nov 2023 (ha or count)	% cleared Nov 2023	Conservation extent Nov 2023 vs Jun 2023	Area impacted Sep 2024 (ha or count)	% cleared Sep 2024	Conservation extent Sep 2024 vs Jun 2023
1539	1.1	0	0.0%	0.05	4.5%	↓	0.0	4%	0.0	4%	→	0.0	0%	↑	0.0	0%	↑
1543	1.4	0.003	0.2%	0.06	4.3%	↓	0.0	0%	0.0	0%	→	0.0	0%	→	0.0	1%	→
1573	6.6	1.23	18.7%	0.18	2.7%	↑	0.9	13%	0.9	13%	→	0.8	12%	↑	0.7	10%	↑
1584	203.0	114.07	56.2%	70.62	34.8%	↑	94.7	47%	94.5	47%	↑	91.8	45%	↑	87.0	43%	↑
1588	76.0	46.92	61.7%	39.31	51.7%	↑	15.8	21%	15.6	20%	↑	15.6	20%	↑	15.2	20%	↑
1592	99.8	76.89	77.1%	49.97	50.1%	↑	33.1	33%	28.8	29%	↑	25.2	25%	↑	24.6	25%	↑
1619	136.6	108.51	79.5%	92.18	67.5%	↑	85.2	62%	85.7	63%	↓	81.2	59%	↑	80.7	59%	↑
1621	32.8	13.87	42.3%	16.75	51.1%	↓	17.0	52%	17.0	52%	→	14.7	45%	↑	13.8	42%	↑
1737	0.7	0.16	21.8%	0.003	0.4%	↑	0.1	13%	0.0	0%	↑	0.0	0%	↑	0.0	0%	→
Total	**558.0**	**361.66**	**64.8%**	**269.12**	**48.2%**	↑	**246.8**	**44%**	**242.5**	**43%**	↑	**229.2**	**41%**	↑	**222.0**	**40%**	↑
Grevillea parviflora subsp. parviflora	1.6	1.61	100.0%	1.61	100.0%	→	1.6	100%	1.6	100%	→	1.6	98%	↑	1.6	98%	↑
Callistemon linearifolius*	5151.0	5147	99.9%	1601	31.1%	↑	1602.0	31%	1602.0	31%	→	1390.0	27%	↑	1390.0	27%	↑
Tetratheca juncea	93.4	59.4	63.6%	41.6	44.6%	↑	51.8	55%	52.0	56%	↓	50.9	54%	↑	50.9	54%	↑
Chalinolobus dwyeri	558.0	361.66	64.8%	269.1	48.2%	↑	246.8	44%	242.5	43%	↑	229.2	41%	↑	229.2	41%	↑
Myotis macropus	93.1	35.4	38.0%	19.8	21.3%	↑	23.2	25%	21.9	24%	↑	20.3	22%	↑	20.3	22%	↑
Ninox strenua	9.3	0.38	4.1%	0.04	0.4%	↑	0.1	1%	0.1	1%	→	0.1	1%	→	0.1	1%	→
Petaurus norfolcensis	558.0	361.66	64.8%	269.1	48.2%	↑	246.8	44%	242.5	43%	↑	229.2	41%	↑	229.2	41%	↑
Rhodamnia rubescens*	2275.0	262	11.5%	754	33.1%	↓	674.0	30%	649.0	29%	↑	18.0	1%	↑	18.0	1%	↑

- Riparian Corridor Retention

  Multiple streams occur on site, ranging from first-order to fourth-order. Major riparian corridors are proposed to conserved under a BSA and cover approx. 34.5ha.

- Threatened Ecological Community Avoidance

  Approximately 75% of BC Act-listed *Lower Hunter Spotted Gum – Ironbark Forest* EEC is proposed to be retained and conserved under a BSA, which resulted from several design iterations to limit impacts to the EEC on site.

- Water Quality and Hydrology
  - At construction stage, Erosion and Sedimentation Control Plans (ESCP) should be prepared for the proposals following guidelines from *Landcom* (2004), as well as Stormwater Management Plans (SMP);
  - Best practice erosion and sedimentation controls should be put in place to limit offsite movement of materials into adjacent retained vegetation;
  - Erosion and sedimentation controls should be checked daily and maintained in working order, especially after rain events; and
  - Under the WM Act, any proposed development located within 40m of waterfront land (including rivers) requires a Controlled Activity Approval. The proposed Structure Plan has sought to avoid impacts to major waterways occurring within the Study Area.

- Fencing

  Fencing will be installed across interfaces between development lands and conservation lands and other retained lands in order to prevent incursions of fauna into developed areas, as well as to prevent uncontrolled human access into conservation lands.

2.2.2 Management of Urban Bushland and Parkland

Lands subject to the proposed Biodiversity Certification will undergo development in order to achieve mixed-use areas, consisting of residential, commercial and community service developments. It is also expected that selected areas will be dedicated to urban bushland (e.g. riparian zones) and parkland for public recreation and visual amenity purposes. Furthermore, residential, commercial and mixed-use subdivisions may contain a landscaping element subject to a precinct-specific DCP.

As such, within Biodiversity Certified lands, it will be required to accompany subsequent Development Applications (DAs) with relevant Biodiversity or Vegetation Management Plans (BMPs or VMPs) to ensure sustainable and coherent management of ecosystems within the Subject Site, particularly vegetated riparian zones.

Furthermore, the production and implementation of such BMPs and VMPs will consider the proximity, and at times the adjacency, of proposed Stewardship lands, in order to ensure that outcomes sought under these plans are consistent with management plans in force within proposed BSA lands. In particular, it will be expected that objectives of BMPs and VMPs be consistent with PCTs and threatened species identified within residue lands.

Therefore, the format and purpose of any plan aimed at implementing and managing urban bushland within Biodiversity Certified lands will be prescribed under specific clauses of the relevant Council's DCP.

2.2.3 General Construction & Operation

Site specific Avoid and Minimise measures are discussed in **Table 17** and **Table 18**, while **Table 19**, **Table 20** and **Table 21** outline the direct, prescribed and indirect impacts associated with the development and how they are to be mitigated. The development's 'Avoid and Minimise' strategy (in accordance with Section 8 of the BAM), is discussed in greater detail in **Table 17** below.

The following measures are provided to help mitigate impacts of the proposed rezoning and subsequent developments on the biodiversity values within the Subject Site and immediate surroundings.

- Pre-construction phase
    - Retained vegetation and conservation lands will be delineated by safety bunting flags, fencing and signage indicating environmental protection zones, which will still allow fauna to egress the development areas as needed. Following the completion of clearing works, permanent delineation features such as fencing should be installed to protect the retained vegetation from adjacent urban development;
    - Vegetation clearing is to be timed to avoid cold weather periods where overnight temperatures are forecast to be less than 12°C. Cold weather is likely to make it difficult for resident hollow dependent fauna to successfully relocate. This is particularly relevant for low body-weight species;
    - No clearing within 200m of the Powerful Owl trees during breeding season;
    - Fauna crossing points should be installed at all suitable crossing points including glider poles and rope bridges;
    - Subject to approval from TfNSW, fauna proof fencing should be installed along both sides of the Link Road;
    - All road culverts installed should be designed to allow fauna to pass unencumbered;
    - All culverts and bridges should include fixed microbat habitat;
    - A staged approach to vegetation clearing is to be undertaken to provide fauna the opportunity to disperse outside the area of impact. Staging to include Phase 1 Clearing: Underscrubbing, Phase 2 Clearing: Removal of non-habitat trees, and Phase 3 Clearing: Removal of habitat and connecting trees;
    - All clearing works to be undertaken under the supervision of the Project Ecologist;
    - Clearing should occur in a direction from previously disturbed lands towards retained lands;
    - Implement clearing protocols, including pre-clearance surveys to identify habitat and vegetation to be retained;
    - All clearing works to be attended by a suitable equipped and experienced ecologist to deal appropriately with any displaced fauna species;
    - All hollow-bearing features will be sectionally lowered by tree climbers (where safe to do so);
    - Any fauna rescued during vegetation clearing is to be assessed for injuries, and subsequently released to a suitable nearby location; this may require holding fauna until dusk for release in accordance with relevant animal ethics licencing and standards;
    - If any fauna is injured during vegetation clearing, they are to be taken promptly to a nearby veterinarian or suitable wildlife carer contact;

- In addition, prior to clearing of any vegetation, an ecologist is to inspect the area for any signs of resident fauna requiring attention, and in particular nesting birds. Where such is identified, appropriate strategies are to be developed and instigated to minimise impacts. Pre-clearance surveys to include diurnal surveys, stagwatching and nocturnal surveys as deemed necessary by the Project Ecologist;
- Civil Construction staff to be inducted into pre-clearing and clearing protocols, and to identify environmental features for protection;
- Installation of nest boxes within conservation lands prior to construction to mitigate the removal of HBTs within the development footprint and provide supplementary roosting / nesting habitat for resident fauna species that utilise such features. Such nest boxes should be maintained for a minimum period of 10 years to allow for short to medium term habitat for fauna displaced by the clearing. Conservation lands have the capacity to accept a ratio of two nest boxes for every hollow removed within development lands;
- Suitable large hollows to be relocated into retained vegetation, including APZs and riparian areas. Target of two (2) relocations per stage subject to suitable hollows. The following guidelines should be followed https://cdn.centralcoast.nsw.gov.au/sites/default/files/guidelineforrelocationoflargetreehollows_46.pdf
- Any suitable hollows recovered during clearing works should be reconditioned into suitable hollows and installed in conservation lands in addition to the manufactured nest boxes;
- All manufactured boxes are to be industry best practice including either marine or hardwood plywood with a minimum thickness of 15mm. Boxes will not have hinged lids to ensure longevity of the boxes and installation methods will not inhibit growth of the host tree;
- Any salvageable timber should be reused where feasible;
- There will be a preference for cleared vegetation to be mulched on site and spread to help stabilise any exposed soil and minimise offsite movement of biomass where possible. Fallen timber and hollow logs identified to be retained should be relocated into the conservation lands;
- Live mulch and topsoil of local provenance is an ideal resource to assist rehabilitation of conservation lands;
- Implement hygiene protocols for machinery to prevent the spread of weeds outside the development site;
- Implementation of a plan to manage and control the potential spread of fungal disease Myrtle Rust (*Puccinia psidii*), which was identified on *Rhodamnia rubescens*, as per management guidelines provided by the NSW Department of Primary Industries (DPI, 2022). This is further discussed in **Section 2.2.4**;
- Protocols within the Construction Environmental Management Plan (CEMP) to manage Acid Sulfate Soils; and
- Incorporation of Water Sensitive Urban Design (WSUD) principles within stormwater infrastructure is to occur to minimise downstream hydrology changes.

- Developed (operation) phase
  - Maintain protective fencing around stewardship and other residue lands;

- Nest box inspections and maintenance;
- Monitoring of key threatened species, including Powerful Owl nests and retained threatened flora populations;
- Management of APZs including pruning of trees as required, rather than tree removal;
- Educational signage around protected lands to engage community on possible fauna and flora occurrences of note;
- Management of all retained lands in accordance with applicable Management Plans.

2.2.4 Management of Myrtle Rust

As per DPI guidelines (2022), a specific plan to control the potential spread of Myrtle Rust is recommended, as follows.

Key prevention measures include:

- Identifying and mapping known infected areas for avoidance as much as possible;
- Leaving plants known to be infected with myrtle rust in-situ; laundering clothing, hats and gloves worn during activities in high-risk areas before using them in other areas;
- Keeping records of inspections and plant movements; advising all visitors and workers of biosecurity measures in place; disinfecting equipment and personal effects such as glasses and mobile phones; starting on-site work with clean equipment and vehicles; and
- Complying with risk management and mitigation measures in place at time of operations.

Furthermore, where works are to be located in areas of infected flora, the following measures at to be adhered to:

- Spraying infected and nearby plants with a fungicide to kill spores 3-4 days prior to removal;
- Before being removed, smaller plants and plant parts should be enclosed in a plastic bag;
- Larger plants that do not fit in bags can be cut into smaller pieces and covered with black plastic for 3-4 weeks in a sunny spot;
- When disposing of plants, small plants enclosed in plastic bags can be put in a normal waste bin and larger plants can be taken to the tip.

In addition to Myrtle Rust management practices as part of the Biodiversity Certification process, it is proposed to implement Myrtle Rust control as a key component of management actions included in the BSA which will be entered into to manage the Stewardship Site. Such measures will include:

- Protection of retained *Rhodamnia rubescens* subpopulation from edge effects along tracks;
- Protection from damage relating to adjacent development;
- Reduction and management of weed densities under a Native Vegetation Management Plan;
- Fungicide treatment to control Myrtle Rust at a prescribed frequency over multiple years; and
- Limitation of vehicle movements to defined tracks.

Given the scale of the site and level of retention of *Rhodamnia rubescens,* it is also proposed to fund scientific research into Myrtle Rust spread and management within the site.

2.2.5 LGA-wide Tree Planting

Further compensation of impacts to biodiversity within the Subject Site is proposed through supporting the planting of trees across the Newcastle and Lake Macquarie LGAs in order to contribute to the reduction in urban heat and achieve no net loss of trees.

The actual support plan is in its infancy at time of writing of the present report and further details will be provided as the BCAR consultation process progresses.

2.2.6 Threatened Entities Habitat Retention

A summary of the extent of habitat retention for threatened entities identified within the Study Area is provided in **Table 16.**

Key outcomes of the consultative design process were identified as follows:

- Approx. 60% of native vegetation within the Study Area is proposed to be retained. Furthermore, approx. 75% of BC-Act listed EEC *Lower Hunter Spotted Gum – Ironbark Forest* is proposed to be retained.
- 99.9% of the occurrences of *Rhodamnia rubescens* are proposed to be avoided and protected within BSA lands;
- 98.9% of the extent of suitable breeding habitat for Powerful Owl, located within 100 metres of confirmed breeding nests, will be avoided and retained; and
- 79.1% of suitable foraging habitat for Southern Myotis will be avoided and retained.

Table 16 – Threatened Entities Retained Habitat

Entity	Unit of measure	Total Extent of occurrence within Study Area	Total Extent of occurrence within Subject Site	Total extent of occurrence within conservation lands	Clearing extent (%)	Retention extent (%)
PCT 1539	Hectare	1.1	0.0	1.1	0%	100%
PCT 1543	Hectare	1.4	0.0	1.4	0.7%	99.3%
PCT 1573	Hectare	6.6	0.7	6.0	9.9%	90.1%
PCT 1584	Hectare	203.0	87.0	116.0	42.8%	57.2%
PCT 1588	Hectare	76.0	15.2	60.8	20.0%	80%
PCT 1592 (EEC)	Hectare	99.8	24.6	75.2	24.7%	75.3%
PCT 1619	Hectare	136.5	80.7	55.8	59.1%	40.9%
PCT 1621	Hectare	32.6	13.8	18.8	42.4%	57.6%
PCT 1737	Hectare	0.7	0.0	0.7	0%	100%
Callistemon linearifolius	Count	5151	936	4215.0	18.2%	81.8%
Grevillea parviflora subsp. parviflora	Hectare	1.61	1.6	0.0	99.4%	0.6%
Rhodamnia rubescens	Count	2772	1	2771	0%	100%
Tetratheca juncea	Hectare	92.4	49.6	42.8	53.7%	46.3%
Chalinolobus dwyeri	Hectare	558	222	336.0	39.8%	60.2%
Myotis macropus	Hectare	93.1	19.5	73.6	20.9%	79.1%
Ninox strenua	Hectare	9.3	0.1	9.2	1.1%	98.9%
Petaurus norfolcensis	Hectare	558	222	336.0	39.8%	60.2%

Table 17 – Avoid and Minimise Impacts on Biodiversity Values

Objectives/Requirements	Evidence of compliance
Locating a Project to Avoid and Minimise Impacts on Native Vegetation and Habitat	
Knowledge of biodiversity values should inform decisions about the location of the proposal. The initial assessment of biodiversity values from Stage 1 may be used to inform the early planning of the route or location of a proposal.	The Study Area is located in an area identified as a Growth Area in the Hunter Regional Plan 2036 (NSW Government, 2016) and lies adjacent to urban release areas in Cameron Park and Minmi. As such the proposal aims to support the objectives of the Hunter Regional Plan through the provision of housing, community and business services which will address demographic growth in the Greater Newcastle area. Impacts to the native biodiversity, including threatened entities, have been quantified as part of the present assessment, and ongoing consultation between the proponent, project ecologists, bushfire consultants, NCC, LMCC and town planners, has led to the design of a Structure Plan that seeks to achieve balanced outcomes, from a social, economic and environmental perspective. The proposed Structure Plan presented in **Appendix A** is the materialisation of an extensive and iterative consultation process between the aforementioned parties which commenced in 2020. Under the proposed Structure Plan, approx. 222ha of native vegetation is proposed to be cleared, to enable development lands to achieve viable yield and meet growth objectives for the locality. Corridor and habitat values of remnant vegetation located throughout the Study Area are proposed to managed primarily under a BSA (subject to CST approval), and residue lands adjacent to the Summerhill Waste Management Centre (SWMC), to the north of the Study Area, will be conserved outside of a BSA.
Selecting a final proposal location may be an iterative process. Decisions may need to be revisited after all field surveys have been completed.	As discussed above, the proposed Structure Plan as presented in **Appendix A** is the final iteration resulting from an ongoing consultation between the proponent and the project ecologists, Councils, town planners and bushfire consultants, whereby areas of higher biodiversity values were identified and ultimately excluded from the impact area as surveys progressed. In particular, the identification of areas occupied by high numbers of *Rhodamnia rubescens*, *Callistemon linearifolius* and *Tetratheca juncea*, as lands located within 100m of three (3) confirmed Powerful Owl nests, was considered and led to the reduction of the proposed development footprint in these sections.
Impacts from clearing native vegetation and threatened species habitat can be avoided or minimised by locating the proposal in areas: *a) lacking biodiversity values* *b) where the native vegetation or threatened species, habitat is in the poorest condition (i.e. areas that have a low vegetation integrity score)* *c) that avoid habitat for species with a high biodiversity risk weighting or land mapped on the important habitat map, or native vegetation that is a TEC or a highly cleared PCT.* d) *outside of the buffer area around breeding habitat features such as nest trees or caves.*	a) As reflected in the Biodiversity Values Map, the Site contains mapped biodiversity values, specifically "biodiverse riparian land" along Maryland Creek and Brush Creek. The majority of such riparian lands is proposed to be retained under a BSA. Where impacts are proposed, they are considered unavoidable in order to allow for carriageways to provide connectivity throughout the development and with adjacent urban areas. b) **Table 5** describes the condition and associated VIS for each vegetation zone identified within the Study Area. Vegetation zones described as disturbed by Bell (2021) generally bear a VIS below 40 except of regrowth areas of PCT 1588 (with a VIS between 48.6 and 58.7). Areas of such disturbance were primarily identified for development purposes, as much as viable within the context of the Structure Plan. c) As mentioned previously in the present report, in consideration of the extent of threatened flora occurrences on site, the iterative design process has led to the reduction of impacts to areas of

Objectives/Requirements	Evidence of compliance
	higher biodiversity values. Furthermore, approximately 50% of the only EEC identified on site is proposed to be retained and enhanced under a BSA. d) The presence of three (3) Powerful Owl nests was confirmed during extensive field surveys. Therefore, a 100m impact avoidance buffer was designed around each nest and the Structure Plan proposes to avoid impacts to each buffered area. No additional breeding behaviour by any threatened species was identified on site. In particular, comprehensive surveys for Large-eared Pied-bat and Eastern Cave Bat, involving acoustic detection and harp trapping, found no evidence of breeding within the caves and escarpments located on site.
When selecting a proposal's location, all of the following should be analysed. Justification for the decisions in determining the final location must be based on consideration of: *a) alternative modes or technologies that would avoid or minimise impacts on biodiversity values* *b) alternative routes that would avoid or minimise impacts on biodiversity values* *c) alternative locations that would avoid or minimise impacts on biodiversity values* *d) alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values.*	a) It is expected that at subdivision and subsequent development stage, post-biodiversity certification, alternative modes and technologies will be considered in order to limit impacts to biodiversity during construction processes. In particular, underboring, underpasses and overpasses will be included in proposed infrastructure designs to avoid impacts to fauna and flora, and facility movement of mobile species through conservation lands. b) As above. The existing network of trails and main arteries such as Transfield Avenue are proposed to be leverage in the road network design. Furthermore, interfaces with adjacent approved development to the west will be implemented to ensure consistent route management within the locality. c) As discussed previously, the Study Area is located in a designated Growth Area under the Hunter Regional Plan 2036, adjacent to Urban Release Areas and lands approved for subdivision. As such, impact avoidance and minimisation is proposed within the boundaries of the Study Area and with consideration to regional fauna corridors and the local populations of threatened flora and fauna species. In particular, connectivity to adjacent remnant vegetation is proposed as much as is considered viable within the context of the proposal's social and economic objectives. The Structure Plan was subjected to various iterations, incorporating biodiversity constraints as assessed by the Project Ecologist, until the final version, presented herewith, was developed by the proponent and considered as acceptable by the Project Ecologist. d) As above.
The proposal may also list and map site constraints, such as: *a) bushfire protection requirements, including clearing for asset protection zones* *b) flood planning levels* *c) servicing constraints.*	a) Proposed bushfire protection setbacks in the form of Asset Protection Zones have been incorporated into the proposed Structure Plan, such that they will not impinge on proposed Stewardship lands. Native vegetation clearing resulting from required APZs has been included in the calculations of proposed native vegetation clearing. b) A small amount of flooding occurs within the southern portion of Brush Creek. This area has been avoided by the proposed development lands. c) Servicing constraints will be addressed as part of the planning proposal.
In the BDAR or BCAR, the assessor must document and justify any actions taken to avoid or minimise impacts through careful location of the proposal.	As described above, and illustrated in **Appendix A**, an iterative design process in consultation with project ecologists was undertaken, which led to the determination of the final proposed Structure Plan. This final iteration proposes to avoid areas with higher biodiversity values, and the proponent is proposing to preserve and enhance the majority of residue lands under a BSA.

Objectives/Requirements	Evidence of compliance
Designing a Project to Avoid and Minimise Impacts on Native Vegetation and Habitat	
The BDAR or BCAR must document the reasonable measures taken by the proponent to avoid or minimise clearing of native vegetation and threatened species habitat during proposal design, including placement of temporary and permanent ancillary construction and maintenance facilities. The types of measures that can be used to demonstrate this include: *a) Reducing the proposal's clearing footprint by minimising the number and type of facilities* *b) Locating ancillary facilities in areas that have no biodiversity values* *c) Locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas with the lowest vegetation integrity scores)* *d) Locating ancillary facilities in areas that avoid habitat for species and vegetation that has a high threat status (e.g. an endangered ecological community (EEC) or critically endangered ecological community (CEEC) or is an entity at risk of a serious and irreversible impact (SAII)* *e) Actions and activities that provide for rehabilitation, ecological restoration and/or ongoing maintenance of retained areas of native vegetation, threatened species, threatened ecological communities and their habitat on the subject land.*	a - d) At time of writing of the present report, it is not known exactly where ancillary facilities will be located. The purpose of the present report is to achieve biodiversity certification for the Subject Site and as such, the proposed Structure Plan presents areas to be developed as well as major infrastructure therein (main roads, parks, ovals etc). The proposed rezoning will lead to urban and commercial development which will interface with existing developed areas in the east and south, as well as future residential areas in the west. Therefore, it is expected that these existing developed areas will be leveraged and utilised when it comes locating ancillary facilities for the purposes of construction and maintenance. Areas designated for retention and stewardship will be fenced off and protected during and after construction phases. Furthermore, CEMPs will be produced and implemented during phases of future development, post-biodiversity certification of the site. Therefore, within the boundaries of the Structure Plan, it is expected that ancillary facilities will be located within lands suitable for development within the context of the Biodiversity Certification process. e) The majority of residue lands within the Study Area will be managed under a BSA, with the purpose to protect and enhance native vegetation and related species habitat therein. Furthermore, it is proposed to implement a translocation plan for impacted specimens of threatened flora species *Tetratheca juncea* and *Callistemon linearifolius* to mitigate impacts of the clearing incurred by the proposal. This would involve a literature review to understand successes achieved in the past for similar translocation plans, as well as engagement with subject matter experts to develop a translocation plan suitable and adapted to the site's ecology, geology, hydrology and topography.
The BDAR or BCAR must document and justify efforts to avoid or minimise impacts through design.	Throughout the consultation process between project ecologists and the proponent, biodiversity offset credits retirement has been considered as the last resort, and the proponent has considered various options, in order to avoid and minimise impacts to biodiversity. **Section 1.8.6** of the present report provides extensive information with regards to avoidance and minimisation measures proposed to be implemented before, during and after rezoning and subdivision stages. In particular, efforts to avoid impacts to high biodiversity are evidenced in the iterative Structure Plan design process so far.

Table 18 – Prescribed Impact Avoidance and Minimisation

Objectives/Requirements	Evidence of compliance
Avoiding and Minimising Prescribed Biodiversity Impacts during Project Planning	
The timing and extent of a prescribed impact on the habitat of threatened entities can be difficult to assess and adequately offset through the provision of biodiversity credits. Prescribed impacts may occur on habitat features that are not native vegetation, e.g. caves, rocky outcrops and flyways. Because these types of features cannot be readily replaced or offset, it is important that measures to avoid or minimise impacts are undertaken and are clearly documented in the BDAR or BCAR.	No biodiversity values in addition to those noted in this BCAR were identified for the Subject Site. Direct and indirect impacts to habitat features that are not native vegetation are considered in this BCAR. The following features susceptible to prescribed impacts have been identified within the Subject Site: • Dense patches of the noxious weed *Lantana camara* were identified throughout the Subject Site and may offer habitat values for small birds; • The presence of escarpments, large boulders and rocky outcrops throughout the Subject Site may provide habitat for ground-dwelling species; • Powerline posts located within easements have the potential to provide nesting structures for raptors. These powerline easements are not proposed to be impacted by the proposal; • Various waterways and dams provide habitat for various species and have been considered throughout the iterative design process.
Locating a Project to Avoid and Minimise Prescribed Biodiversity Impacts	
To avoid or minimise prescribed biodiversity impacts, the proponent must consider how to: *a) Locate surface works to avoid direct impacts on the habitat features identified in Chapter 6* *b) Locate subsurface works, in both the horizontal and vertical planes, to avoid and minimise operations beneath the habitat features identified in Chapter 6. For example, locating longwall panels away from geological features of significance, groundwater-dependent plant communities and their supporting aquifers* *c) Locate the proposal to avoid severing or interfering with corridors connecting different areas of habitat and migratory flight paths, to important habitat or local movement pathways* *d) Optimise the proposal layout to minimise interactions with threatened entities; for example, design a wind farm that has:* *i. 100 m turbine-free buffers around features that attract and support aerial species, such as forest edges, riparian corridors, wetlands, ridgetops and gullies* *ii. turbine-free corridors in zones of regular movement for species of concern, to avoid a barrier effect* *e) locate the proposal to avoid impacts on water bodies or hydrological processes*	a) Lands proposed to biodiversity certified will be subjected to various forms of construction and related surface and sub-surface works. Avoidance of potential prescribed impacts resulting from development with the Subject Site have been addressed as follows *i. Karst, caves, crevices, cliffs, rocks and other geological features of significance*: The Study Area includes caves, crevices, escarpments and boulders. These features have been avoided as much as possible within the Subject Site, due to not only the potential habitat values they may provide, but also the natural hindrance they present to development. It is to be noted that no evidence of microbat breeding was found within caves despite a comprehensive survey effort including acoustic detection and harp trapping. *ii. Human-made structures and non-native vegetation*: No human-made structures were identified on site, apart from a few culverts, rubbish piles and other unauthorised makeshift structures. Non-native vegetation of note comprises patches of *Lantana camara* which have the potential to provide habitat for small birds. However, retention of larger extents of native vegetation within residue and stewardship lands are considered to be more conducive to habitat provision for such species. While culverts have the potential to provide habitat for microbats, no evidence of breeding for threatened species has been identified on site. *iii. Habitat connectivity*: Site development will lead to a certain level of interruption in connecting corridors throughout the locality. However, the management of the majority of conservation lands under a BSA will support future ongoing connectivity to remnant vegetation in the north-west towards Minmi and Blue Gum Hills, in the north-east towards vegetated lands adjacent to SWMC, and along major riparian corridors (Brush Creek in the south-west, an unnamed creek in the south-east, and Maryland Creek and its tributaries in the north). *iv. Water bodies, water quality and hydrological processes*: Refer to item e) below;

Objectives/Requirements	Evidence of compliance
	v. Wind farm developments: No such development is proposed within the Subject Site or immediate surrounds. *vi. Vehicle strikes*: Proposed development lands will be subjected to a mixed-use subdivision, with residential areas, commercial zones, schools, playing fields and road networks. As such, vehicle strikes are likely. It is expected that speed limits within the future developed areas will be typical of a high-density urban environment. Furthermore, retained vegetated lands will be fenced off in order to deter any incursions of mobile ground species. b) The design of the Structure Plan has taken into account biodiversity as well as geological constraints and it is expected that future development works will consider potential impacts of sub-surface works and related mitigation measures. CEMPs will be produced and implemented where relevant and required. c) Refer to sub-section **a) iii**. above. d) The proposed layout is seeking to limit interactions with threatened entities by managing the majority of residue lands under a BSA. Furthermore, high-biodiversity value riparian corridors will be retained and fencing will be installed where possible to limit interactions between urbanised lands and areas of retained native vegetation. Buffer zones were considered around key features such as the three (3) Powerful Owl nests, the major riparian corridors and the locations of threatened flora stems (specifically *Callistemon linearifolius* and *Rhodamnia rubescens*). These buffers zones were assessed within the present report as areas potentially subject to indirect impacts as the result of future development occurring within the Subject Site. The proponent has sought to avoid such indirect impacts by incorporating the buffers within the design process that led to the production of the proposed Structure Plan. Following this approach, the majority of *Rhodamnia rubescens* and *Callistemon linearifolius* stems, located within the development lands as well as within 30m of such lands, are proposed to be avoided. Furthermore, Powerful Owl Nest buffers will largely be avoided. e) The proposal is seeking to avoid impacts to major riparian corridors on site by placing them under management with a BSA. Where impacts to smaller streams were considered unavoidable in the context of achieving the objectives of the rezoning proposal, mitigation measures in terms of fauna relocation will be implemented as part of de-watering plans. Controlled Activity Approvals will be sought where development is proposed on waterfront lands, and permits will be sought from DPI Fisheries for any form of impact to streams (including dredging, reclaiming, earthworks, construction of bridges and culverts).
When locating a proposal, the following need to be analysed and justification should be provided for each alternative selected: *a) alternative modes or technologies that would avoid or minimise prescribed impacts* *b) alternative routes that would avoid or minimise prescribed impacts* *c) alternative locations that would avoid or minimise prescribed impacts* d) *alternative sites within a property on which the proposal is located that would avoid or minimise prescribed impacts.*	a) At biodiversity certification stage, consideration was given to areas of higher and lower biodiversity values and the proposed Structure Plan is seeking to achieve balanced outcomes as stated previously. As such, it is expected that works within development lands will be undertaken with due consideration of environmentally-friendly modes and technologies in order to minimise prescribed impacts (such as geological features and water bodies). b) The proposed Structure Plan provides an indication of the location of major roads and collector roads. Such roads have been located in such a way as to avoid potential prescribed impacts. More specifically, major waterways and significant geological features (escarpments and boulders) are proposed to be

Objectives/Requirements	Evidence of compliance
	avoided. Where impacts are considered unavoidable, environmentally-sensitive construction methods will be employed to limit impacts as a result of the construction of roads. c) – d) The proposed Structure Plan is the result of an iterative design process which has incorporated environmental and geological constraints in order to inform the optimal location of development lands within the Study Area. As such, where possible and achievable, site features susceptible to prescribed impacts have been avoided. In particular, major waterways and areas of geological significance will largely be avoided.
Justifications for a proposal's location should identify any other site constraints that the proponent has considered in determining the location and design of the proposal, such as: *a) bushfire protection requirements, including clearing for asset protection zones* *b) flood planning levels* *c) servicing constraints.*	a) The determination of the Structure Plan has incorporated input from bushfire consultants throughout the consultation process. As such, APZs and required setbacks have been incorporated in the area proposed to be subjected to development. b) A small amount of flooding occurs within the southern portion of Brush Creek. This area has been avoided by the proposed development lands. c) The proposed Structure Plan indicates that there will be connections and interfaces with surrounding urbanised areas. Servicing of the proposed development zone will be achieved through such interfaces. Proposed internal networks of major and collector roads has incorporated geological and biodiversity constraints to ensure limited impacts where possible.
The assessor must document and justify in the BDAR or BCAR all efforts to avoid, or the reasonable measures proposed to minimise, prescribed impacts when choosing the proposal's location.	As discussed above, prescribed impacts have been assessed and the proponent has sought to limit such impacts through an iterative design and consultative process. In particular, major riparian corridors and areas of higher geological values (caves, boulders and escarpments) will largely be avoided and managed under a BSA. Connectivity and corridor functions will be impacted by the proposed development. However, interfaces with remnant vegetation offsite will be maintained in the north-west and north-east and through the conservation of major riparian corridors. The risk of vehicle strikes is expected to be comparable to that in neighbouring urbanised land. The implementation of fencing protocols in future CEMPs and around conservation lands will further limit the risk of ground-dwelling fauna incursions into development lands.
Designing a Project to Avoid and Minimise Prescribed Biodiversity Impacts	
Design measures that can avoid or minimise prescribed impacts include: *a) Engineering solutions, such as proven techniques to:* *i. Minimise fracturing of bedrock underlying features of geological significance, or groundwater-dependent communities and their supporting aquifers* *ii. Restore connectivity and movement corridors* *b) Design elements that minimise interactions with threatened entities, such as:* *i. Designing turbines to dissuade perching and minimise the diameter of the rotor swept area*	a) Geological stabilisation works may be required. At time of writing of the present report, further information was pending from Subsidence Advisory NSW. The design and implementation of future remediation works will have consideration of ecological outcomes as appropriate. b) i. No wind turbines are proposed as part of the development; ii. Fauna-proof and safe fencing will be installed around conservation lands and in particular around lands managed under a BSA to minimise the risk of vehicle strikes with resident fauna; iii. Conservation lands will be managed in majority under a BSA. It is expected that any parkland zone and any other landscaped vegetated area within the development lands will be managed under specific landscaping plans consistent with plant community types occurring in the locality. c) – e)

Objectives/Requirements	Evidence of compliance
ii. Designing fencing to prevent animal entry to transport corridors *iii. Providing vegetated buffers rehabilitated with native species* *c) Maintaining environmental processes that are critical to the formation and persistence of habitat features not associated with native vegetation* *d) Maintaining hydrological processes that sustain threatened entities* *e) Controlling the quality of water released from the site, to avoid or minimise downstream impacts on threatened entities.*	The conservation of major riparian corridors and areas of significant geological value will be managed under a BSA, thus supporting the environmental processes that are critical to the sustainability of such areas of non-native vegetation. Furthermore, CEMPs and SWMPs to be implemented during pre-construction and construction phases within the Subject Site will consider downstream impacts of works. It is noted that the Ramsar-listed Hunter Wetlands National Park and Hunter Wetlands Centre are located downstream from Maryland Creek and as such, specific consideration will be provided to impacts on the creek and its hydrological processes.
The proposed measures must be evidence-based and directed towards the threatened entities identified in Chapter 6. The BDAR or BCAR must document the designs that are proposed to avoid or minimise prescribed impacts	Specific measures are discussed in **Section 2.2** of the present report. **Figure 3** illustrates the location of major riparian corridors and caves are presented in **Figure 6**.

2.3 Assessment of Impacts

2.3.1 Direct, Indirect, Prescribed and Residual impacts

Section 8 of the BAM states that the BDAR "must assess the impacts of the project on native vegetation and habitat". In addition to this, Sections 9.1.4 and 9.2 require that further assessment be produced for any impact, including biodiversity impacts, expected in land surrounding the Subject Site. **Table 19, Table 20, Table 21** and **Table 22** provide a summary of measures proposed to avoid and minimise direct, prescribed, indirect and residual impacts on biodiversity, respectively.

Table 19 – Direct Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Native vegetation	Pre-development and development	Removal of 222ha of native vegetation including potential habitat for 37 ecosystem credit species.	The majority of native vegetation within the Study Area (60%) is proposed to be retained, with the majority to be managed and enhanced under a BSA. Areas of higher biodiversity values are proposed to be avoided and in particular, major riparian zones will be retained and managed under the aforementioned BSA.	Post-operation	Council Project coordinator Ecologists	MR	LR
Threatened native vegetation	Pre-development and development	Removal of 24.6ha of LHSGIF EEC (clearing of 75.3% of the extent of occurrence within the Study Area); Removal of suitable habitat for threatened flora species *Grevillea parviflora* subsp. *parviflora* (99.4% cleared), and *Tetratheca juncea* (53.7% cleared); Removal of one (1) *Rhodamnia rubescens* stem (0.04% cleared) and 936 *Callistemon linearifolius* stems (18.2% cleared).	Approximately 75% of the occurrence of LHSGIF within the Study Area is proposed to be retained and managed under a BSA. Furthermore, the majority of SAII-candidate species *Rhodamnia rubescens* will be retained, with only one (1) individual proposed to be cleared. Similarly, approx. 46.3% of *Tetratheca juncea* suitable habitat within the Study Area is proposed to be retained and managed under a BSA. Protection measures in the form of fencing and signage will support the viability of retained threatened flora populations within Stewardship lands.	Pre-operation	Project coordinator Ecologists	HR	LR
Foraging habitat for threatened fauna	Pre-development and development	Removal of 222ha of suitable foraging habitat for Large-eared Pied-bat (39.8% cleared); Removal of 19.5ha of suitable habitat for Southern Myotis (20.9% cleared); Removal of 0.1ha of breeding habitat for Powerful Owl (1.1% cleared); and Removal of 222ha of suitable foraging habitat for Squirrel Glider (39.8% cleared).	The majority of threatened fauna species habitat within the Study Area will be retained. Furthermore, Stewardship lands and residue lands will be fenced off to prevent human incursions into vegetated lands and reversely deter ground-dwelling species from entering developed lands. Compensatory habitat in the form of nest boxes and artificial hollows are proposed to be installed in conservation lands. Where relevant, overpasses such as Glider poles, and underpasses such as culverts, will further support safe mobility of fauna through the landscape. Southern Myotis habitat supplementation is also proposed, with the creation of detention basins and parkland ponds which will provide suitable foraging habitat for the species. At a LGA level, it is proposed to fund the planting of trees across the Newcastle and Lake Macquarie LGAs to achieve no net loss of trees as a result of the proposal.	Pre-operation and Operation	Project coordinator Ecologists	HR	LR
Habitat in the form of tree hollows	Pre-development and development	Approx. 446 hollow-bearing trees containing approx. 1,077 hollows were identified within the Subject Site.	The sizable extent of conservation lands proposed to be managed under a BSA will allow for hollow-bearing trees proposed to be removed during the clearing process to be replaced at a ratio of 2 to 1 hollow, with a salvaged hollow or nest box in order to ensure no net loss of hollow resources. The nest boxes are to be installed within remnant vegetation within conservation lands by qualified ecologists and according to the Habisure system (Franks & Franks 2006) or similar.	Pre-operation	Project coordinator Ecologists	HR	LR
Fauna home range and connectivity	Pre-development and development	Reduction in connectivity by removal of 222ha of native vegetation and fragmentation of areas of suitable fauna habitat.	Retention of 335.8ha of native vegetation within residue lands and Stewardship lands. Connectivity will be maintained in the north-west and north-east, with a vegetated interface which will support mobility throughout a wider corridor towards Blue Gum Hills. Where relevant, connectivity will be supported by infrastructure such as culverts, Glider poles and overpasses where developments lands intersect with residue lands.	Pre, during and post-operation	Project coordinator Construction staff Site manager Project Ecologist	MR	LR
Reduction of biodiversity values	Pre-development, development and post-development	Removal of approx. 222ha of remnant vegetation present on site	As stated above, the biodiversity certification under the proposed Structure Plan will lead to the retention of approx. 335.8ha of native vegetation and related fauna and flora habitat. This equates to over 60% of native vegetation occurring within the proponent's land holdings. The majority of such conservation lands will be managed under a BSA, thus supporting and enhancing biodiversity values in the Study Area.	Pre- and during-operation	Project coordinator Construction staff Site manager Project Ecologist	HR	LR

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
	Development and post-development	Sediment run-off into retained vegetation area	At subdivision and subsequent construction stage, CEMPs and SWMPs will be required to be produced and implemented in order to control environmental impacts of construction works as well as infrastructure once the new communities are established. Erosion and sedimentation controls will be implemented to ensure direct impacts from the development and operation of new residential and commercial estates are minimised.	During development	Project coordinator Construction staff Site manager Project Ecologist	HR	LR

Table 20 – Prescribed Impact Assessment

Subject of Prescribed Impact	Project Phase	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Impacts to threatened species or ecological communities associated with: (i) Karst, caves, crevices, cliffs and other geological features of significance or (ii) Human-made structures and non-native vegetation, or (iii) Habitat connectivity, or (iv) Water bodies, water quality and hydrological processes, or (v) Wind farm developments, or (vi) Vehicle strikes.	Pre-operation and operation	Impacts to threatened species as a result of loss of non-native vegetation, habitat connectivity, modified hydrological processes and vehicle strikes are considered likely to occur. Proposed mitigation measures include: • Retention and conservation of residue lands under a BSA which will provide sustainable outcomes for threatened entities known to occur within the Study Area. In particular, connectivity with offsite areas of remnant vegetation in the north-west and north-east will be maintained. • Major waterways and related riparian corridors will be retained and managed under a BSA. Where land reclamation and urban development will lead to partial or full filling of waterways, Controlled Activity Approvals (under the WM Act) and other permits under the FM Act will be sought to ensure compliance and sustainable conversation outcomes. • The risk of vehicle strikes during construction and operation (i.e., once the communities are established within the newly subdivided lands) is proposed to be mitigated by the enforcement of low vehicular speed limits typical of high-density urban environments. Furthermore, retained vegetated areas will be fenced off to minimise the risk of fauna incursions into development lands.	Pre-operation and operation	Project coordinator Project ecologists	HR	MR

Table 21 – Indirect Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
Noise	Pre-operation and Operation	Noise during construction due to clearing works and related vehicular traffic. Potential disturbance to threatened species or reduced viability of adjacent retained habitat zone.	The production and implementation of CEMPs at time of subdivision and construction will include provisions and recommendations for the mitigation of indirect impacts to native fauna as a result of noise, light spill, vibration and dust. Mitigation measures will be required to be implemented both during construction phases and operational phases, to ensure both temporary and permanent sources of disturbance are managed to an environmentally acceptable level.	Pre-operation and Operation	Project coordinator Construction staff Site manager	HR	MR
	Operation	Noise due to traffic. Potential disturbance to threatened species within the surrounding area.		During operations and Operational	Civil Contractor	MR	MR
Vibration	Construction	Disturbance to fauna which may lead to displacement to adjacent areas.		During construction	Project coordinator Site manager Construction staff	HR	MR
Dust	Construction	Dust deposits on native flora and fauna habitat, resulting in disturbance to and reduced viability of adjacent habitat.		During construction	Project coordinator Site manager Construction staff	LR	LR
Light spill	Construction	Disturbance to nocturnal fauna, thus reducing viability of the adjacent habitat.		During construction	Project coordinator Site manager Construction staff	LR	LR

Aspect	Project Phase	Potential Impact	Mitigation	Timing	Responsibility	Risk before mitigation	Risk after mitigation
	Operation	Disturbance to nocturnal fauna, thus reducing viability of adjacent retained habitat zone.		During operations	Civil Contractor	LR	LR
Non-native vegetation	Construction	Soil disturbance may lead to proliferation of exotic flora (including invasive weeds) through seeds and vegetation fragments.	Biodiversity Management Plans (BMPs) will be required to be implemented at subdivision and development stages, to ensure that areas of urban bushland and parkland are managed in an environmentally sustainable way, with consideration being given to adjacent stewardship lands. Furthermore, measures relating to safe handling of weeds to reduce propagation risks will be implemented. These may include: • Appropriate handling of mulch created from the removal of exotic vegetation; • Appropriate cleaning of all construction equipment to limit the risk of weed seed and fragments to adjacent retained areas; • Chemical and manual treatment of weeds where applicable; and • Appropriate management of weeds within landscaping areas.	During construction	Project coordinator Site manager Construction staff	MR	LR
Visual amenity	Construction	Rubbish and waste retained onsite attracting native fauna.	Activities on the Site will be managed in accordance with approved CEMPs and designed to limit the amount of rubbish and waste onsite through good housekeeping practices.	During construction	Project coordinator Site manager Construction staff	LR	LR
	Operation	Rubbish and waste retained onsite attracting native fauna.	Suitable fencing to be installed and maintained between development and surrounding natural areas to prevent access and degradation of surrounding vegetation.	During operations	Civil Contractor	LR	LR

Table 22 – Residual Impact Assessment

Aspect	Project Phase	Potential Impact	Mitigation / Minimisation	Residual Impact Description	Impact to be offset (see Section 2.3.2)
Reduction of biodiversity values	Pre-operation and Operation	Clearing of native vegetation, including one (1) BC Act listed EEC (LHSGIF), and related habitat for threatened species including *Callistemon linearifolius*, *Grevillea parviflora* subsp. *parviflora, Rhodamnia rubescens, Tetratheca juncea,* Large-eared Pied-bat, Southern Myotis, Squirrel Glider and Powerful Owl. Clearing of areas containing non-native vegetation or other non-vegetated features which may habitat futures for threatened entities (such as waterways, geological features and human-made structures).	Retention and enhancement of residue lands under a BSA; Conservation of lands qualified as “Transition Lands” in the Structure Plan, interfacing with SWMC; Compensation of lost hollow-bearing tree habitat through the installation of nest boxes at a ratio of two (2) nest boxes to one (1) lost hollow, within conservation lands; Supplementation of lost Southern Myotis habitat via the creation of detention basins and parkland ponds; Requirement to produce and implement CEMPs, SWMPs, BMPs and/or VMPs where relevant, at future DA stages; Supporting the planting of trees across the Newcastle and Lake Macquarie LGAs to achieve no net loss of trees as a result of the proposal.	**Table 6** provides details of proposed native vegetation clearing by PCT; **Table 16** provides details of residual impacts to threatened species.	Yes
Noise, dust, light spill	Pre-operation and Operation		Application of CEMPs and SWMPs as mentioned above.	Noise, dust and light spill will still occur but at a managed magnitude, thus keeping the impact on local fauna to a low level.	No

Table 23 – Risk Matrix

		Probability				
		A	B	C	D	E
Maximum reasonable consequence	1	CR	CR	HR	HR	MR
	2	CR	HR	HR	MR	LR
	3	HR	HR	MR	LR	LR
	4	HR	MR	LR	LR	LR
	5	MR	LR	LR	LR	LR

CRITICAL	CR
HIGH RISK	HR
MEDIUM RISK	MR
LOW RISK	LR

Table 24 – Assessment Criteria

Consequence criteria: Impacts on threatened species and/or threatened species habitat
1. CRITICAL Impact – Severe; Spatial scale – Widespread; Time scale – Long-term. Requires consideration of whether impacts may result in a Serious and Irreversible Impact that may lead to local extinction. **2. MAJOR** Impact – Moderate; Spatial scale – Moderate to widespread; Time scale – Mid- to long-term. May result in temporary or long-term damage. **3. MODERATE** Impact – Moderate; Spatial scale – Local to moderate; Time scale – Short- to mid-term. May result in a moderate, temporary impact. However, it may be difficult to rehabilitate impact and may have negative implications on the ecosystem **4. MINOR** Impact – Minor; Spatial scale – Local; Time scale – Short-term. May result in minor impacts that are relatively easily rehabilitated. Not likely to have negative implications on the ecosystem. **5. NEGLIGIBLE** Impact – Minor; Time scale – Short-term with no lasting effect.
Likelihood criteria
A. ALMOST CERTAIN Very high or certain probability that impact will occur, or event is of a continuous nature. **B. LIKELY** Likely probability that impact will occur, or event is frequent (frequency 1-5 years). **C. MODERATE** Moderate probability that impact will occur, or event is infrequent (frequency 5-20 years). **D. UNLIKELY** Low probability that impact will occur, or event is very infrequent (frequency 100 years). **E. REMOTE** Very low probability that impact will occur or may occur under extenuating circumstances. Event is very rare or stochastic in nature (frequency 1000 years)

2.3.2 Serious and Irreversible Impacts

Candidate SAII species are determined by the Department of Planning and Environment following the application of four (4) principles listed within the *Guidance and criteria to assist a decision maker to determine a serious and irreversible impact* (DPIE 2019).

Table 25 provides an initial assessment of candidate SAII species predicted by the BAM-C as potentially occurring within the Subject Site. The potential for these species to occur within the Subject Site was based on both the candidate species predicted by the BAM-C for the PCTs present on site as well as NSW BioNet Atlas records from the locality and where potential habitat was present within or near the Subject Site.

As per **Table 25**, *Rhodamnia rubescens* requires further assessment for potential SAII as a result of the proposed rezoning.

Table 26 presents the assessment that is required as per Section 9.1.2 of BAM 2020 for entities for which an impact could be considered a Serious and Irreversible. **Table 27** addresses Appendix B of *Guidance to assist a decision-maker to determine a serious and irreversible impact* for impacts to *Rhodamnia rubescens*.

Table 25 – Candidate SAII Species

Scientific name	Common name	Targeted survey commentary	Assessment for SAII required (Y/N)	Justification
Fauna				
Anthochaera phrygia	Regent Honeyeater	No survey required. Geographic limitation of the species not met.	N	N/A
Calidris ferruginea	Curlew Sandpiper	No survey required. Geographic limitation of the species not met.	N	N/A
Lathamus discolor	Swift Parrot	No survey required. Geographic limitation of the species not met.	N	N/A
Chalinolobus dwyeri	Large-eared Pied-bat	Survey undertaken for within areas of potentially suitable breeding habitat.	N	The species was confirmed as foraging on site. However, a comprehensive harp-trapping survey effort found no evidence of the site used for breeding purposes. Therefore, no further assessment is required as SAII to this species have the potential to occur where breeding habitat is likely to be impacted by development.
Miniopterus australis	Little Bent-winged Bat	Survey undertaken for within areas of potentially suitable breeding habitat.	N	Breeding colonies for this species are known and limited to a few numbers through NSW. Furthermore, comprehensive harp-trapping survey effort found no evidence of the site used for breeding purposes. Therefore, no further assessment is required as SAII to this species have the potential to occur where breeding habitat is likely to be impacted by development.
Miniopterus orianae oceanensis	Large Bent-winged Bat	No survey required. Habitat constraint not met.	N	Breeding colonies for this species are known and limited to a few numbers through NSW. Furthermore, comprehensive harp-trapping survey effort found no evidence of the site used for breeding purposes. Therefore, no further assessment is required as SAII to this species have the potential to occur where breeding habitat is likely to be impacted by development.

Scientific name	Common name	Targeted survey commentary	Assessment for SAII required (Y/N)	Justification
Vespadelus troughtoni	Eastern Cave Bat	No survey required. Habitat constraint not met.	N	The species was identified as part of species group as foraging on site, because the species cannot reliably be identified solely from echolocation call analysis. However, a comprehensive harp-trapping survey effort found no evidence of the site used for breeding purposes. Therefore, no further assessment is required as SAII to this species have the potential to occur where breeding habitat is likely to be impacted by development.
Flora				
Rhodamnia rubescens	**Scrub Turpentine**	**Species identified on site**	**Y**	**One (1) individual or 0.04% of the Study Area's population is located within the Subject Site and thus is proposed to be cleared.**

Table 26 – *Rhodamnia rubescens* SAII Assessment

BAM s9.1.2 Sub Clause	BAM s9.1.2 Provision	Assessment
2.a.	*Evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:* *i. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or* *ii. decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites*	Consultation of the TBDC indicates that *Rhodamnia rubescens* has been subject to a population reduction of more than 80% in 10 years or three generations. As described by NSW DPE (2022), *Rhodamnia rubescens "Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of R. rubescens typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm."* Further information garnered from the NSW Threatened Species Scientific Committee (TSSC) (2018) states that: "*The effect of Austropuccinia psidii (Myrtle Rust) infection on R. rubescens is severe across the species entire range based on quantitative evidence from field surveys. An > 80% reduction in the population of R. rubescens across Australia over the three generations is projected given documented levels of mortality due to A. psidii infection and high susceptibility to A. psidii in both mature individuals and seedlings.*"
2.b.	*Evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:* *i. an estimate of the species' current population size in NSW, and* *ii. an estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and* *iii. where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations*	Not applicable.
2.c.	*Evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:* *i. extent of occurrence* *ii. area of occupancy* *iii. number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and*	Not applicable.

BAM s9.1.2 Sub Clause	BAM s9.1.2 Provision	Assessment
	iv. whether the species' population is likely to undergo extreme fluctuations	
2.d.	*Evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:* *i. known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g., species is clonal) on, a biodiversity stewardship site* *ii. the species is reliant on abiotic habitats which cannot be restored or replaced (e.g., karst systems) on a biodiversity stewardship site, or* *iii. life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus).*	As detailed in the TSSC's Conservation Assessment (OEH, 2018), "*The 'Introduction and establishment of Exotic Rust Fungi of the order Austropucciniales pathogenic on plants of the family Myrtaceae' is listed as a Key Threatening Process under the NSW BC Act. (…) Rhodamnia rubescens is a known host of A. psidii (…) and is characterised as 'Highly to Extremely Susceptible' to infection."* Assessment of the *Rhodamnia rubescens* population within the Study Area is included in **Attachment B** of **Appendix C** and concluded that, at the time of the surveys, all sub-populations present onsite were affected by Myrtle Rust (*Puccinia psidii*) to a certain extent. However, it appeared that individuals presented lighter loads of Myrtle Rust and generally looked healthier than other populations surveyed in the last few years by AEP in the Lower Hunter region.
3.	*Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2.), the assessor must record this in the BDAR or BCAR.*	Not applicable
4.a.	*The impact on the species' population (Principles 1 and 2) presented by:* *i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and* *ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or* *iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal*	According to the NSW BioNet Atlas, there are 5,454 known locations of *Rhodamnia rubescens* across NSW. However, the number of individuals is not accurately described in the database. Therefore, an estimate of the number of individuals on the subject land as a percentage of the total NSW population cannot reliably be calculated. Approx. 2772 individuals were identified within the Study Area, and one (1) is proposed to be removed, which equates to approx. 0.04% of the subpopulation within the Study Area.
4.b.	*Impact on geographic range (Principles 1 and 3) presented by:* *i. the area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW* *ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and*	The TSSC's Conservation Assessment (OEH, 2018) provides information as follows: *i. "Rhodamnia rubescens has a large geographic distribution. The extent of occurrence (EOO) was estimated to be 147,340 km2. The EOO is estimated based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2017).*

BAM s9.1.2 Sub Clause	BAM s9.1.2 Provision	Assessment
	habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted *iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species* *iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.*	*The area of occupancy (AOO) was estimated to be 3,360 km2. This calculation was based on the species occupying 840 (2 km x 2 km) grid cells, the spatial scale of assessment recommended by IUCN (2017)."* The extent of occurrence of *Rhodamnia rubescens* within the Study Area is commensurate with the vegetation zones in "Good" condition of PCTs 1584 and 1573, as well as PCTs 1539 and 1543 to a lesser extent. As such, the area of potential suitable habitat within the Study Area comprises approx. 128.49ha. Of this, approx. 29.26ha are proposed to be cleared within development lands. This equates to a clearing proportion of 22.8% of the Study Area's extent of suitable habitat, and 0.0002% of the AOO of the species in NSW. *ii.* The number of individuals proposed to be impacted will be limited to approx. 58 out of 2772 identified within the Study Area, or 2.6% of the subpopulation within the Study Area. Based on the assessment of vegetation zones occurring on site, it is expected that up to 22.8% of *Rhodamnia rubescens* suitable habitat will be impacted by the proposal. *iii.* The majority of the subpopulation as it occurs on site will not be incrementally fragmented to a notable degree, considering that the majority of areas where the species occurs will managed under a BSA. It is also to be noted that the subpopulation is currently subjected to a high level of fragmentation, due to the dispersion of areas of suitable habitat across the Study Area (see **Figure 4** for the location of PCTs). *iv.* Direct and indirect impacts to threatened species, including *Rhodamnia rubescens*, are considered in **Section 2.2** of the present report. In particular for this species, the establishment of a Stewardship Site within the Study Area, which will comprise 99.9% of identified individuals, will protect the subpopulation from potential edge effects from surrounding development. Management actions aimed at enhancing biodiversity will further support the subpopulations' health. It is to be noted that the large majority of individuals were found to be infected with Myrtle Rust and the presence of such fungus cannot reliably be controlled or eradicated.
5.	The assessor may also provide new information that can be used to demonstrate that the principle identifying the species as at risk of an SAII, is inaccurate.	Not applicable.

Table 27 – Summary of SAII Assessment

Appendix B – Information required	Commentary
(a) the action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII	Impact avoidance and minimisation measures include: • Avoidance of 99.9% of the subpopulation: 99.9% of individuals identified on site are located on land proposed to be managed under a BSA. • Implementation of CEMPs at relevant stages of subdivision and construction, to limit any risk of weed and pathogen propagation to areas of suitable habitat where the species occurs or has potential to occur; • Implementation of VMPs across urban bushland proposed to be featured within development lands, especially where such bushland interfaces with Stewardship lands; • Fencing of conservation lands to prevent anthropogenic disturbance.
(b) the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification	The subpopulation of *Rhodamnia rubescens* within the Study Area totals 2772 individuals, of which only one (1) is proposed to be directly impacted by clearing of lands zoned for development under the proposed Biodiversity Certification process. A further 13 individuals are located within 30m of the boundary of such development lands, and may be indirectly impacted by development.
(c) the extent to which the impact exceeds any threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact	No threshold identified within the TBDC.
(d) the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to: (i) an estimate of the change in habitat available to the local population as a result of the proposed development (ii) the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and (iii) modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development. BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long	(d) (i) – (ii) As stated above, available habitat was assessed as covering approx. 128.49ha within the Study Area, of which approx. 30ha are proposed to be subjected to biodiversity certification, thus leading to a potential decrease of 23.3% of available habitat within the Study Area. This is considered to be an over-estimation of suitable habitat, considering the relative concentration of individuals within the Study Area, being in the centre-north of the Study Area, immediately north-east of the Link Road, and immediately south-west of the Link Road. (iii) The subpopulation of *Rhodamnia rubescens* within the Study Area, as assessed by AEP in September and October 2020, did not show any evidence of reproductive material (fruit or flowers). As such it is not expected that the clearing of 0.04% of the subpopulation will impede any germination of seed dispersal process.

Appendix B – Information required	Commentary
term within the IBRA subregion due to the direct and indirect impacts of the development	
(e) the likely impact on the ecology of the local population. At a minimum, address the following: (i) for fauna: – breeding – foraging – roosting, and – dispersal or movement pathways (ii) for flora, address how the proposal is likely to affect the ecology and biology of any residual plant population that will remain post development including where information is available: – pollination cycle – seedbanks – recruitment, and – interactions with other species (e.g., pollinators, host species, mycorrhizal associations)	(e) (i) Not applicable; (ii) As stated above, the reproductive cycle of the species within the Study Area is affected, as evidenced by the absence of flowering or fruiting, and the contamination by Myrtle Rust. As such, with only 0.04% of the local subpopulation proposed to be cleared and the remaining 99.9% located within lands proposed to be managed under a BSA, it is considered that the impact of the proposal on the ecology and biology of the residual plant population will be minimal.
(f) a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development	(f) The proposal will lead to increased fragmentation across the Study Area. However, connectivity will remain via major riparian corridors retained under a BSA, and which constitute preferred habitat for the species.
(g) the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	(g) A review of NSW BioNet Atlas records of *Rhodamnia rubescens* in the locality indicates that the site is not connected to lands that are host to other populations of the species. In particular, within a 10km^2 search area, sightings of note are located within the Wentworth Creek precinct, north of the Summerhill Waste Management Centre, as well as further south in scattered locations including Blackbutt Nature Reserve, Kotara South and Speers Point. Furthermore, the majority of the species' population within the Study Area is proposed to be retained and conserved under a BSA.
(h) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	h) The subsequent development of proposed biodiversity certified lands into mixed-use areas (for residential, commercial and/or recreational purposes) may lead to the increase in invasive flora presence throughout such lands, mainly as a consequence of the multiplication of private gardens and urban parkland therein, and human movement in and out of the area. Proposed mitigation measures include:

Appendix B – Information required	Commentary
	• Production and implementation of VMPs where urban bushland and parkland is proposed to be established within biodiversity certified lands; • Community education regarding the benefits of garden practices that are beneficial to native ecosystems; • Retention and management of the majority of residue lands under a BSA, whereby weed management and control will be listed as a required action.
(i) an estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion	No such information was found.
(j) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion.	The establishment of a BSA within the majority of conservation lands and the implementation of CEMPs, VMPs and/or BMPs at various stages of the future subdivision and construction will support the recovery of the species. Furthermore, BSA lands will be fenced off and management actions therein will contribute to enhancements to biodiversity, through selective weeding and other targeted practices. At Commonwealth level, consultation of the Commonwealth Threatened Species Scientific Committee established under the EPBC Act (DAWE, 2020) indicates that no recovery plan is recommended "*because the Approved Conservation Advice provides sufficient direction to implement priority actions and mitigate against key threats.*" At State level, the NSW TSSC's Conservation Assessment (OEH, 2018) proposes conservation and management actions as follows: *"Habitat loss, disturbance and modification* • *Develop hygiene protocols to minimise spread of Myrtle Rust.* *Invasive species* • *Weed control measures at known sites must ensure adequate hygiene protocols to minimise spread of Myrtle Rust.* *Ex situ conservation* • *Support continued seed storage enablement study in train at NSW PlantBank.* • *Secure germplasm (high quantity, geographically and genetically representative).* • *Secure germplasm of any detected or suspected resistant individuals.* *Stakeholder Management*

Appendix B – Information required	Commentary
	• *Inform land owners and managers of sites, particularly private land holders, mining and State Forests, where there are known populations and consult with these groups regarding options for conservation management and protection of the species and identification of occurrence of myrtle rust.* • *Provide up to date information on best phytosanitary practices for reducing risk of spread of myrtle rust."*

2.4 Biodiversity Credits to Offset Residual Impacts

2.4.1 Ecosystem Credits

As per Section 10.3 of the BAM, the removal of native vegetation within the site will require offsetting to achieve the 'no net loss standard' detailed within Section 11 of the BAM. To calculate the required offsets in the form of ecosystem credits, the BAM Calculator has taken into consideration the impact area and the projected loss in vegetation integrity score along with the biodiversity risk weighting of the PCT. Details of each along with the required credit outputs is provided in **Table 28.** A total of 7166 ecosystem credits are required to offset the proposed development.

Table 29 provides information regarding ecosystem credit offsets trading groups and variation rules, should the proponent choose to apply the variation rule for credit retirement.

Table 28 – Ecosystem Credit Requirements

Vegetation Zone	Impact Area (ha)	Future VIS	VIS Loss	BRW	Credit Requirements
1543 - Good	0.01	0	86.4	1.75	1
1573 - Good	0.66	0	75.1	1.5	19
1584 - Good	29.43	0	83.2	1.5	752
1584 - Disturbed - regrowth (low, unstructured)	21.91	0	15.5	1.5	0
1584 - Disturbed - regrowth (tall, structured)	24.09	0	36.9	1.5	303
1584 - Disturbed - rehabilitation/plantation	11.55	0	83.2	1.5	170
1588 - Good	11.83	0	79.9	1.75	414
1588 - Disturbed - regrowth (low, unstructured)	1.76	0	48.6	1.75	37
1588 - Disturbed - regrowth (tall, structured)	1.6	0	58.7	1.75	41
1592 - Good	0.86	0	72.4	2	835
1592 - Disturbed - regrowth (low, unstructured)	0.7	0	37.8	2	16
1592 - Disturbed - regrowth (tall, structured)	23.06	0	22.9	2	8
1619 - Good	80.7	0	68.3	1.5	2066
1619 - Disturbed - underscrubbed	0.01	0	49.4	1.5	1
1621 - Good - (Coastal Sheltered Apple-Peppermint Forest)	13.66	0	70.6	1.5	362
1621 - Disturbed - regrowth (tall, structured)	0.09	0	31.4	1.5	1
1621 - Good - (Riparian Paperbark - Peppermint Forest)	0.08	0	72.5	1.5	2
Total	**222**				**5028**

Table 29 – Ecosystem Credit Trading Groups and Variation Rules

Entity	Like for like offset trading group	Like for like IBRA region option	Variation option	Variation IBRA region option
PCT 1543	Dry Rainforests >=50% and <70%	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.	Rainforests – Tier 3 or higher threat status	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100km of the outer edge of the impacted site.
PCT 1573	North Coast Wet Sclerophyll Forests <50%	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.	Wet Sclerophyll Forests (Shrubby sub-formation) – Tier 4 or higher threat status	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100km of the outer edge of the impacted site.
PCT 1584	Northern Hinterland Wet Sclerophyll Forests <50%	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.	Wet Sclerophyll Forests (Grassy sub-formation) – Tier 4 or higher threat status	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100km of the outer edge of the impacted site.
PCT 1588	Hunter-Macleay Dry Sclerophyll Forests >=50% and <70%	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.	Dry Sclerophyll Forests (Shrub/grass sub formation) – Tier 3 or higher threat status	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100km of the outer edge of the impacted site.
PCT 1592 (EEC)	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.	Dry Sclerophyll Forests (Shrub/grass sub formation) – Tier 3 or higher threat status	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100km of the outer edge of the impacted site.
PCT 1619	Sydney Coastal Dry Sclerophyll Forests <50%	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.	Dry Sclerophyll Forests (Shrubby sub-formation) – Tier 4 or higher threat status	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100km of the outer edge of the impacted site.
PCT 1621	Sydney Coastal Dry Sclerophyll Forests <50%	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.	Dry Sclerophyll Forests (Shrubby sub-formation) – Tier 4 or higher threat status	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100km of the outer edge of the impacted site.

2.4.2 Species Credits

If a Species Credit species is either identified on the site during survey, assumed to be present, or confirmed present within an expert report, a 'species polygon' is required to be produced for the area of suitable habitat within the site for the species. In the case where a threatened species is assessed in terms of number of individuals, the species polygon consists of all the locations of such species within the Subject Site. **Table 30** outlines the credits and **Figures 8** to **15** show the species polygons. The size of this polygon or number of individuals is entered into the BAM Calculator, which determines the number of credits required to offset the removal of suitable habitat or individuals based upon the quality of habitat and biodiversity risk weighting of the species.

Table 31 provides information regarding species' offsets trading groups and variation rules, should the proponent choose to apply the variation rule for credit retirement.

Table 30 – Species Credit Requirements

Species Name	Impact Area (ha) or Count	Biodiversity Risk Weighting	Credit Requirements
Large-eared Pied Bat	222ha	3	9825
Southern Myotis	19.5ha	2	564
Powerful Owl	0.1ha	2	3
Squirrel Glider	222ha	2	6551
Callistemon linearifolius	936	1.5	1404
Grevillea parviflora subsp. parviflora	1.6ha	2	54
Rhodamnia rubescens	1	3	3
Tetratheca juncea	49.6ha	2	1702
Total			**20100**

Table 31 – Species Credit Trading Groups and Variation Rules

Species Name	Like for like option	Like for like IBRA region option	Variation option	Variation IBRA region option
Large-eared Pied Bat	Large-eared Pied Bat	Any in NSW	Fauna listed as Vulnerable or higher under Part 4 of the BC Act	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.
Powerful Owl	Powerful Owl	Any in NSW	Fauna listed as Vulnerable or higher under Part 4 of the BC Act	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.
Southern Myotis	Southern Myotis	Any in NSW	Fauna listed as Vulnerable or higher under Part 4 of the BC Act	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.
Squirrel Glider	Squirrel Glider	Any in NSW	Fauna listed as Vulnerable or higher under Part 4 of the BC Act	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.
Callistemon linearifolius	*Callistemon linearifolius*	Any in NSW	Flora listed as Vulnerable or higher under Part 4 of the BC Act	Wyong, Hunter, Pittwater and Yengo. or

Species Name	Like for like option	Like for like IBRA region option	Variation option	Variation IBRA region option
				Any IBRA subregion that is within 100km of the outer edge of the impacted site.
Grevillea parviflora subsp. parviflora	*Grevillea parviflora subsp. parviflora*	Any in NSW	Flora listed as Vulnerable or higher under Part 4 of the BC Act	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.
Rhodamnia rubescens	*Rhodamnia rubescens*	Any in NSW	Variation rules do not apply for Critically Endangered species and impacts on Commonwealth listed entities that are a controlled action.	
Tetratheca juncea	*Tetratheca juncea*	Any in NSW	Flora listed as Vulnerable or higher under Part 4 of the BC Act	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100km of the outer edge of the impacted site.

The Biodiversity Credit Report generated within the BAM Calculator is provided in **Appendix G** and includes potential offset variations that are applicable to the proposal.

2.4.3 Areas not requiring assessment

The Subject Site covers 243.8ha, comprising 222ha of native vegetation, 2.8ha of exotic-dominated vegetation and dams, and 19ha of cleared or developed land (trails and powerline easements). Cleared and developed lands were deemed as not requiring assessment, and lands qualified as exotic-dominated will not be subjected to residual impact offsetting as a result of clearing.

Areas not requiring assessment are illustrated in **Figure 7**.

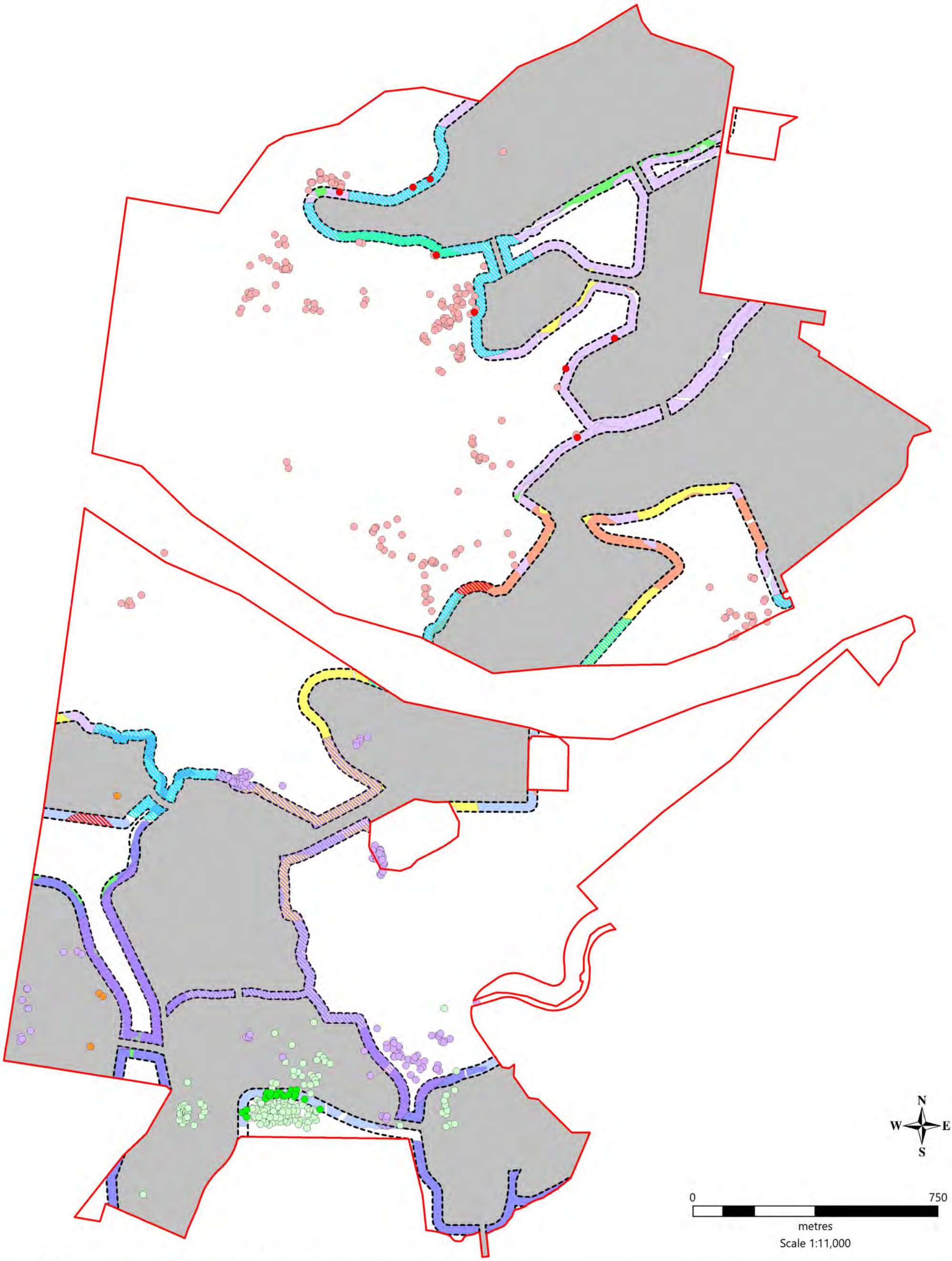

Figure 7 - Potential Indirect Impacts within 30m of Subject Site

Legend

- Study Area
- Subject Site
- 30m buffer around Subject Site (indirect impacts)

Threatened species occurrences / polygons

within Study Area

- Callistemon linearifolius
- Grevillea parviflora subsp. parviflora
- Tetratheca juncea
- Rhodamnia rubescens

within 30m buffer

- Callistemon linearifolius
- Rhodamnia rubescens
- Powerful Owl species polygon
- Southern Myotis species polygon
- Tetratheca juncea species polygon

Plant Community Types within 30m buffer

- PCT 1543
- PCT 1588
- PCT 1621
- PCT 1573
- PCT 1592
- PCT 1737
- PCT 1584
- PCT 1619

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

Figure 8 - Callistemon linearifolius Species Polygon

Legend

- Study Area
- Subject Site
- Callistemon linearifolius (cleared)
- Callistemon linearifolius (retained)

0 500
metres
Scale 1:11,000

N W E S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

Figure 9 - Grevillea parviflora subsp. parviflora Species Polygon

Legend

- Study Area
- Subject Site
- Grevillea parviflora subsp. parviflora species polygon
- Grevillea parviflora subsp. parviflora occurrence

0 500
metres
Scale 1:11,000

N W E S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

Figure 10 - Rhodamnia rubescens Species Polygon

Legend

- Study Area
- Subject Site
- Rhodamnia rubescens occurrence (cleared)
- Rhodamnia rubescens occurrence (retained)

0 500
metres
Scale 1:11,000

N W E S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

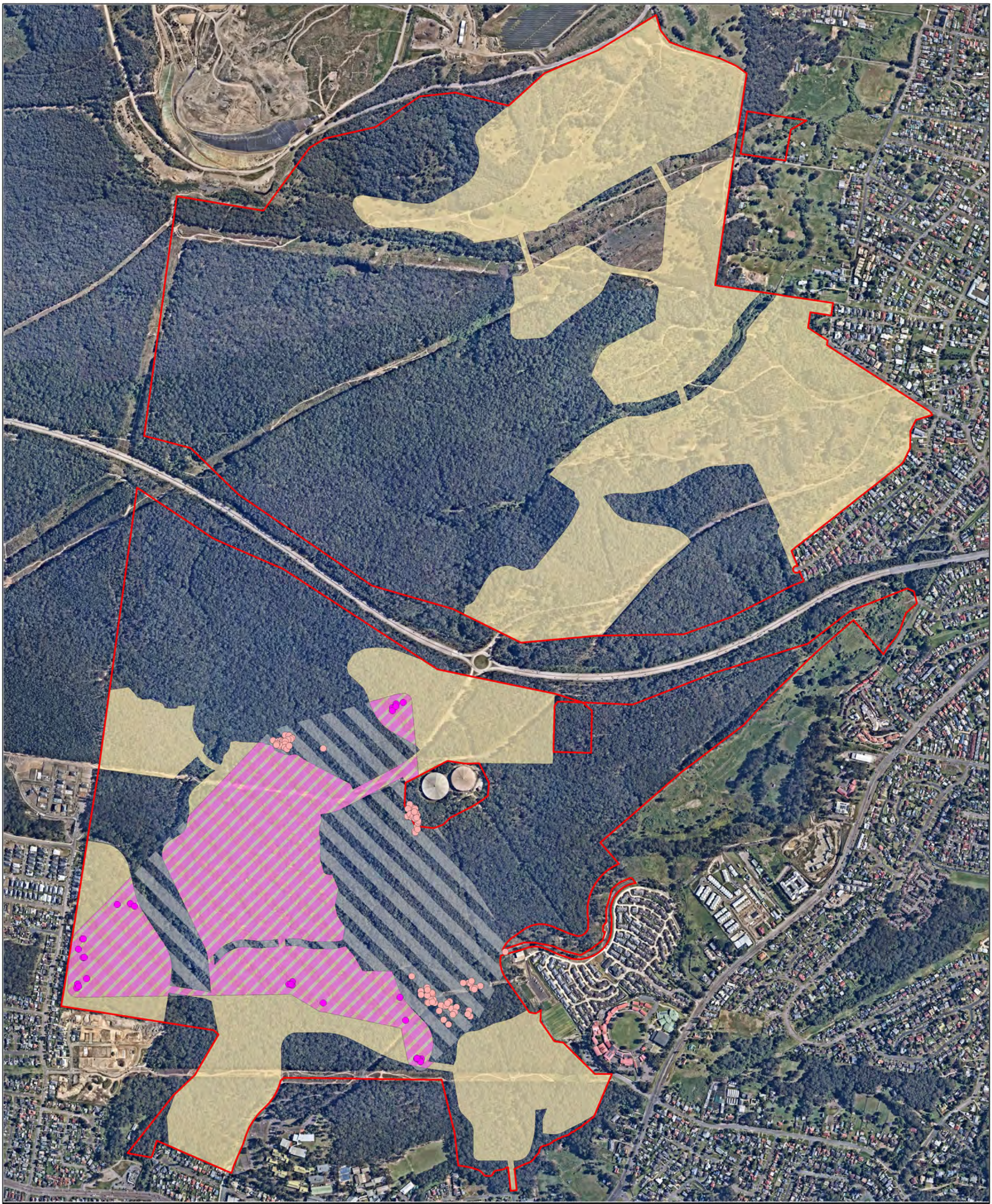

Figure 11 - Tetratheca juncea Species Polygon

Legend

- Study Area
- Subject Site
- Tetratheca juncea species polygon
- Tetratheca juncea extent of occurrence
- Tetratheca juncea occurrence (cleared)
- Tetratheca juncea occurrence (retained)

0 500
metres
Scale 1:11,000

N W E S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

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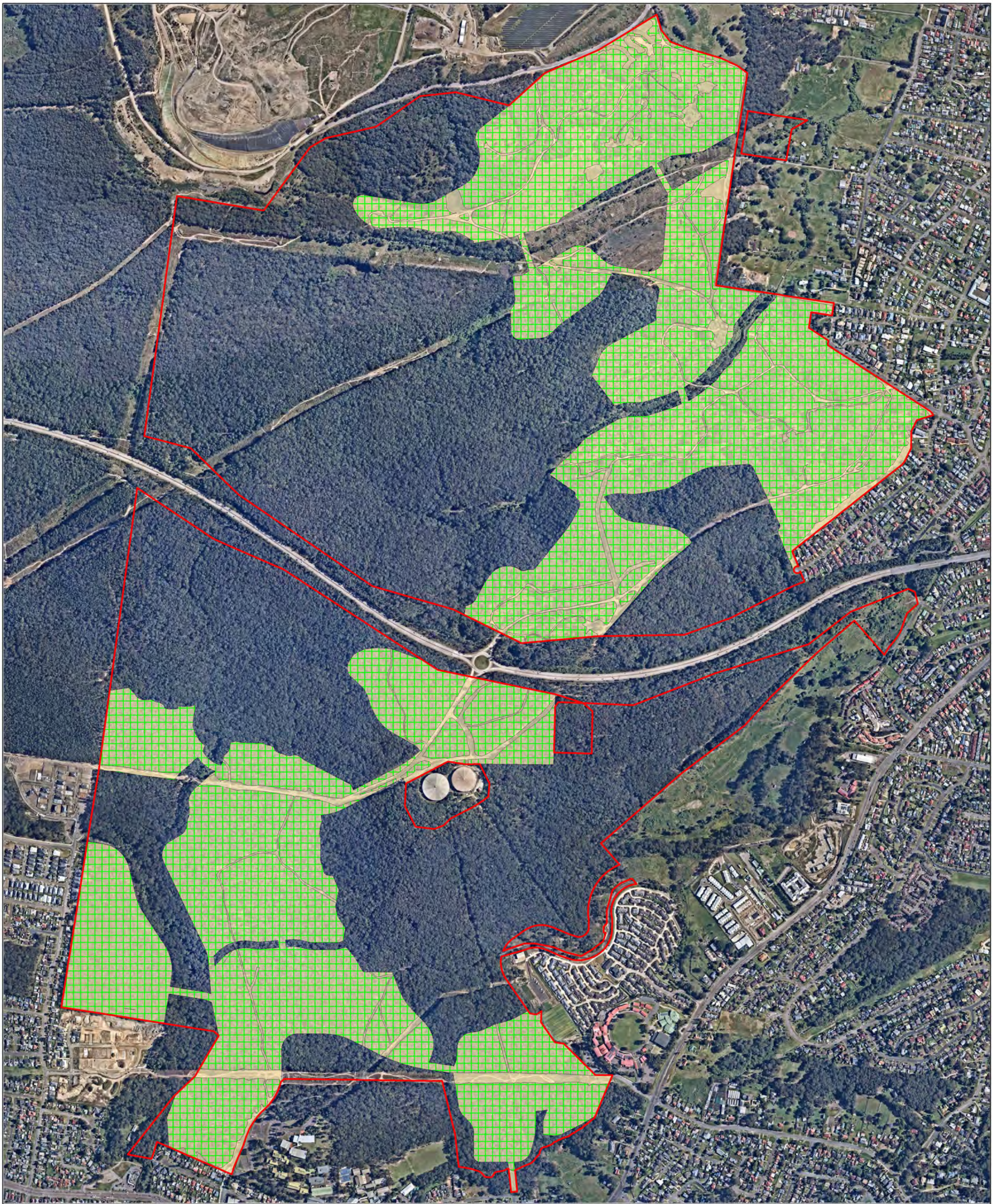

Figure 12 - Large-eared Pied-bat Species Polygon

Legend

- Study Area
- Subject Site
- Large-eared Pied-bat species polygon

0 500
metres
Scale 1:11,000

N W E S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

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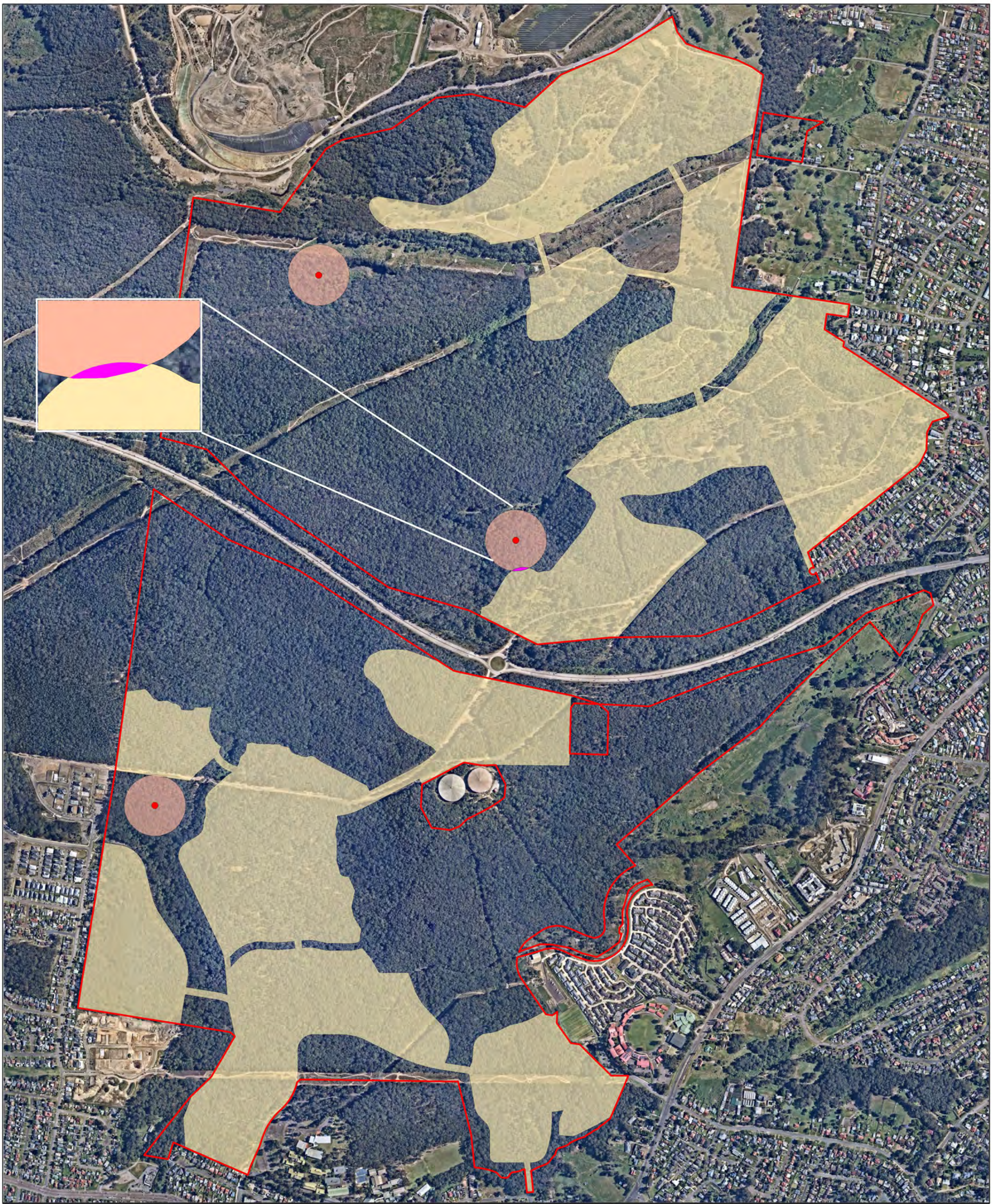

Figure 13 - Powerful Owl Species Polygon

Legend

- Study Area
- Subject Site
- Powerful Owl nest buffer
- Powerful Owl species polygon
- Powerful Owl nest

0 — 500
metres
Scale 1:11,000

N W E S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
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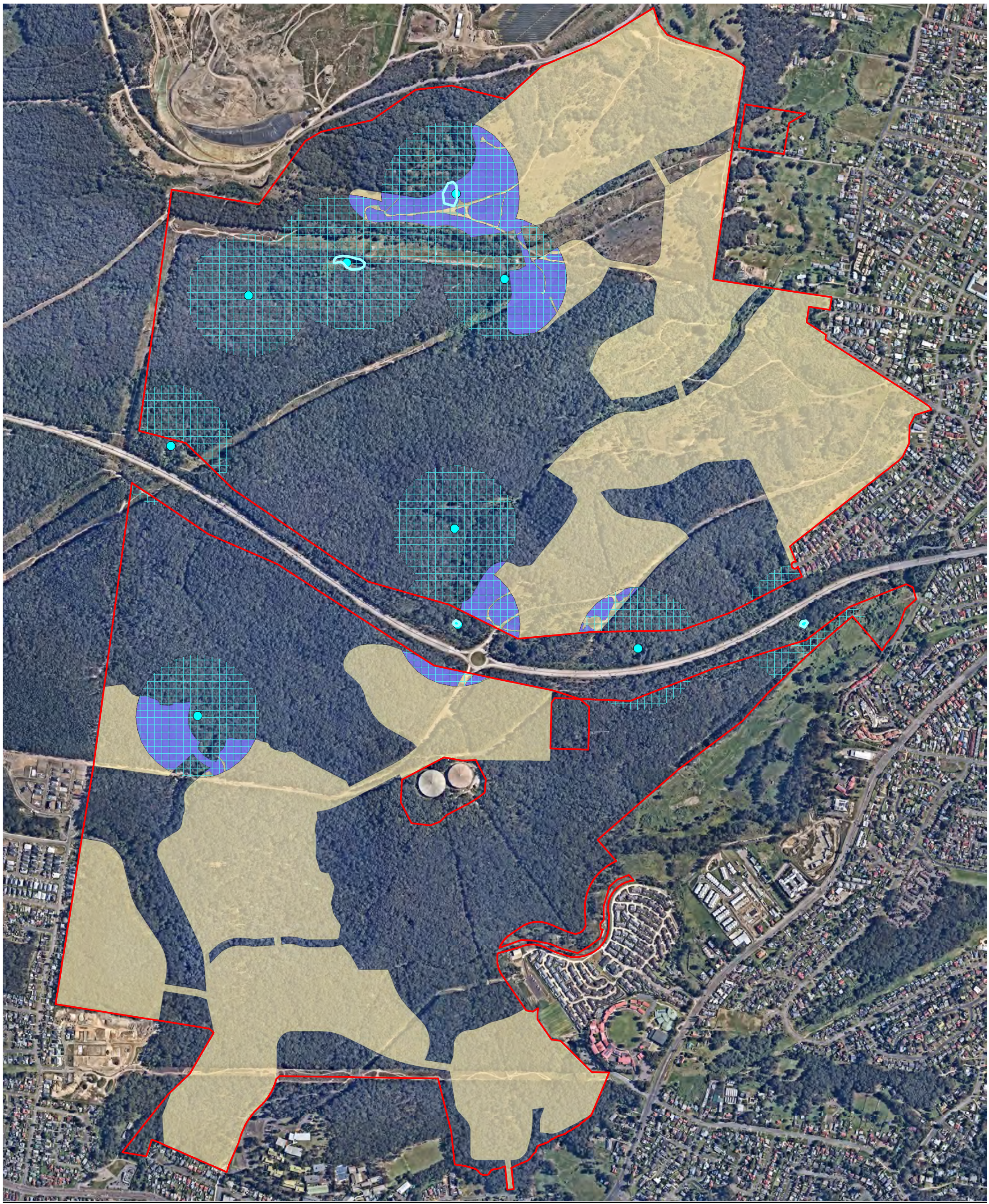

Figure 14 - Southern Myotis Species Polygon

Legend

- Study Area
- Subject Site
- Southern Myotis suitable waterbody
- Southern Myotis suitable waterbody

0 500
metres
Scale 1:11,000

N W E S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates Pty Ltd | AEP Ref: 1971.01 | July 2022

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
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AEP

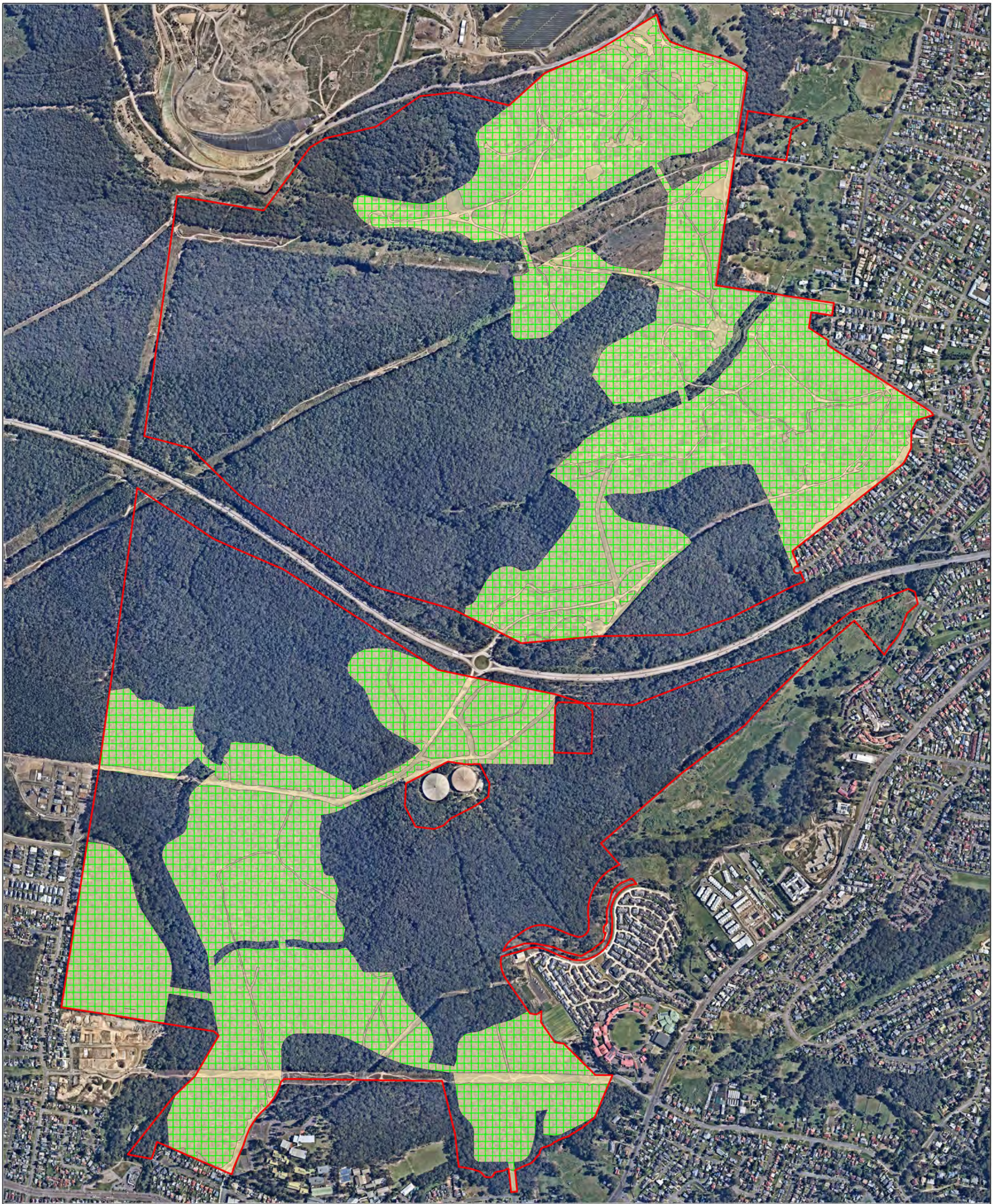


Figure 15 - Squirrel Glider Species Polygon

Legend

- Study Area
- Subject Site
- Squirrel Glider species polygon

0 500
metres
Scale 1:11,000

N
W E
S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates (Newcastle) Pty Ltd | AEP Ref: 1971
September 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

3.0 Biodiversity Certification Strategy

3.1 Lands Proposed for Certification and Conservation

As presented in this report, lands proposed for certification are described as the Subject Site and depicted on **Figure 1**. Description of ecological features therein is provided in **Section 1.0**.

Lands proposed for conservation are depicted in **Figure 1** and comprise of two types of lands:

- The Stewardship Site, also described as BSA Lands, which will be managed under a BSA;
- Transition Lands, which are not proposed to be certified and will not be managed under a BSA.

Furthermore, a parcel of land owned by the proponent adjacently to Ellalong lagoon in the Cessnock LGA, is proposed to be established as a Stewardship Site to partly offset impacts incurred within the Subject Site.

3.2 Proposed Conservation Measures

3.2.1 Within the Study Area

Conservation measures proposed for lands subject to the BSA and adjacent to the Subject Site are incorporated into a Stewardship Site Management Plan which is detailed in the BSSAR relating to the BSA lands. The Management Plan includes the following proposed measures:

- Fire management;
- Grazing management;
- Native vegetation management;
- Threatened species habitat management;
- Integrated pest animal control;
- Integrated weed management and control of high threat weeds;
- Management of human disturbance; and
- Monitoring.

Furthermore, conservation measures within the Subject Site will be dictated by a site-specific DCP which will legislate the type of biodiversity conservation measures enforced in order to deliver environmentally-friendly landscaping and urban bushland management.

3.2.2 Ellalong Lagoon

The property located at 39 Congewai Road, Congewai, NSW and known on title as Lot 1 DP1168335, was acquired by the proponent with a view to establish a Stewardship Site. Several opportunities of Biodiversity Offsets Credits generation are presented within the site, such as for PCT 1592 (Lower Hunter Spotted Gum – Ironbark Forest) and for multiple threatened species.

A BSSAR is in process of being drafted at time of writing of the present report.

3.3 Delivery of Proposed Conservation Measures

The timing, funding and implementation framework of conversation measures within BSA lands are detailed in each BSSAR.

Further conservation measures within the Subject Site were in discussion at time of writing of the BCAR and will be specified upon finalisation of the lodgement process.

3.4 Biodiversity Certification – Parties and Responsibilities

While details of the conservation measures are not yet fully established, the likely key parties and responsibilities are identified as follows:

- Proponent (Eden Estates (Newcastle) Pty Ltd): Funding and establishment of Stewardship Lands;
- Councils: Definition and implementation of site-specific DCP; and
- NSW DCCEEW / NMO: Validation of BSSARs.

4.0 Conclusion

The application of the BAM against the proposal has quantified current biodiversity values within the site and calculated offset requirements for residual impacts following avoid and mitigation efforts.

The vegetation within the Subject Site was found to be commensurate with PCTs listed in **Table 4**.

The proposal will require the clearing of 222ha of native vegetation. As a result, credit requirements were calculated within the BAM Calculator to offset the residual impacts of the proposed rezoning and subsequent development on native vegetation and related threatened species habitat, and to achieve a no-net loss standard.

5.0 References

Auld, B A and Medd, R W, (1992) Weeds, An Illustrated Botanical Guide to the Weeds of Australia. Inkata Press, Sydney NSW.

Australian Government Department of Agriculture, Water and the Environment (2021) *Conservation Advice for Chalinolobus dwyeri (Large-eared Pied Bat)*. November 2021. DAWE, Canberra, ACT.

Australian Government Department of Agriculture, Water and the Environment (2020) *Conservation Advice – Rhodamnia rubescens – Scrub Turpentine*. December 2020. DAWE, Canberra, ACT.

Australian Government Department of Sustainability, Environment, Water, Population and Communities (2011) *Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the vulnerable black-eyed susan, Tetratheca juncea.* May 2011. DSEWCP, Canberra, ACT.

Australian Government Department of the Environment, Water, Heritage and the Arts (2008) *Approved Conservation Advice for Tetratheca juncea*. October 2008. DEWHA, Canberra, ACT.

Australian Government Department of the Environment, Water, Heritage and the Arts (2008) *Approved Conservation Advice for Grevillea parviflora subsp. parviflora (Small-flower Grevillea)*. March 2008. DEWHA, Canberra, ACT.

Australian Government Department of Climate Change, Energy, the Environment and Water (2022) *Protected Matters Search Tool.* Accessed August 2022. DCCEEW, Canberra, ACT.
Australian Government Department of Agriculture, Water and the Environment

Churchill, S (2008) Australian Bats (2nd ed.). Allen & Unwin Publishers.

DECC (2009) Threatened Species Survey and Assessment Guidelines: Field Survey Methods for fauna – Amphibians. NSW Department of Environment and Climate Change, Sydney NSW.

Harden, G (ed.) (2000) *Flora of New South Wales, Volume 1* (rev. ed.). UNSW, Kensington NSW.

Harden, G (ed.) (2000) *Flora of New South Wales, Volume 1* (rev. ed.). UNSW, Kensington NSW.

Harden, G (ed.) (2002) *Flora of New South Wales, Volume 2* (rev. ed.). UNSW, Kensington NSW.

Harden, G (ed.) (1992) *Flora of New South Wales, Volume 3*. UNSW, Kensington NSW.

Harden, G (ed.) (1993) *Flora of New South Wales, Volume 4*. UNSW, Kensington NSW.

Keith D (2004) *Ocean Shores to Desert Dunes*. DEC, Sydney NSW.

Lake Macquarie City Council (2012) *Flora and Fauna Survey Guidelines Version 4.2*. December 2012. LMCC, Speers Point, NSW.

Lake Macquarie City Council (2013) *Interim Lake Macquarie Grevillea parviflora subsp. parviflora Planning and Management Guidelines*. June 2013. LMCC, Speers Point, NSW.

Lake Macquarie City Council (2014a) *Interim Lake Macquarie Large Forest Owl Planning and Management Guidelines*. October 2014. LMCC, Speers Point, NSW.

Lake Macquarie City Council (2014b) *Lake Macquarie Tetratheca juncea Planning and Management Guidelines*. March 2014. LMCC, Speers Point, NSW.

Lake Macquarie City Council (2018) *Guide to Native Orchids in Lake Macquarie City*. August 2018. LMCC, Speers Point, NSW.

Lake Macquarie City Council (2019) LMCC Native Vegetation and Corridors Map, https://hub.arcgis.com/maps/180d9f546e7f4b89ae0781b93f155a4c/explore?location=-32.914570%2C151.650253%2C14.76. Accessed August 2022.

Landcom (2004) *Managing Urban Stormwater: Soils and Construction* 4th edition. New South Wales Government, Parramatta, NSW.

NSW Department of Environment and Conservation (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (working draft, November 2004). DEC, Sydney NSW.

NSW Department of Environment and Climate Change (2009) *Field survey methods for amphibians – Threatened species survey and assessment guidelines*. DECC. April 2009.

NSW Department of Planning and Environment (2022a) *Atlas of NSW Wildlife*. Accessed August 2022. NSW DPE. https://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx

NSW Department of Planning and Environment (2022b) *Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide*. DPE. June 2022.

NSW Department of Planning and Environment (2022c) *Threatened Species, Populations and Ecological Communities* website https://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx.

NSW Department of Planning and Environment (2022d), *NSW State Vegetation Type Map*. Sydney, NSW.

NSW Department of Planning and Environment (2022e), *Important Areas Map.* Accessed August 2022. DPE. Sydney, NSW.

NSW Department of Planning, Industry and Environment (2019) *Guidance to assist a decision-maker to determine a serious and irreversible impact*. DPIE. August 2019.
NSW Department of Planning, Industry and Environment (2021) Threatened Species, Populations and Ecological Communities website. https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species.

NSW Department of Planning, Industry and Environment (2020a) *Biodiversity Assessment Methodology*. August 2020. DPIE, Sydney NSW.

NSW Department of Planning, Industry and Environment (2020b) *Biodiversity Assessment Method (BAM) Calculator User Guide*. August 2020. DPIE, Sydney NSW.

NSW Department of Planning, Industry and Environment (2020c) *Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method*. April 2020. DPIE, Sydney NSW.

NSW Department of Planning, Industry and Environment (2020d) *Natural Resources Access Regulator Waterfront land tool* https://www.dpe.nsw.gov.au/nrar/how-to-apply/controlled-activities/tools accessed October 2021.

NSW Department of Planning, Industry and Environment (2020e) *NSW Survey Guide for Threatened Frogs – A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method*. September 2020. DPIE, Sydney, NSW.

NSW Department of Planning, Industry and Environment (2020f) *Koala Habitat Protection Guideline - Implementing State Environmental Planning Policy (Koala Habitat Protection) 2019*. March 2020. DPIE, Sydney, NSW.

NSW Department of Primary Industries (2022) *Myrtle Rust* information page. https://www.dpi.nsw.gov.au/biosecurity/plant/insect-pests-and-plant-diseases/myrtle-rust. Accessed August 2022. DPI, NSW.

NSW Government (2018) Determining Stream Order Fact Sheet; https://www.industry.nsw.gov.au/__data/assets/pdf_file/0020/172091/Determining-Strahler-stream-order-fact-sheet.pdf accessed October 2021.

NSW Office of Environment and Heritage (2018) 'Species credit' threatened bats and their habitats - NSW survey guide for the Biodiversity Assessment Method. OEH. September 2018.

NSW Threatened Species Scientific Committee (2018) *Conservation Assessment of Rhodamnia rubescens.* April 2018. NSW TSSC, Sydney, NSW.

Pizzey, G (2012) *The Field Guide to the Birds of Australia* (9th ed.). Harper Collins Publishers, Sydney NSW.

Robinson, L (1991) *Field Guide to the Native Plants of Sydney* (rev. 2nd ed.). Kangaroo Press.

Roderick, M., Ingwersen, D.A. and Tzaros, C.L. (2013). *Swift Parrots and Regent Honeyeaters in the Lower Hunter Region of New South Wales: an assessment of status, identification of high priority habitats and recommendations for conservation*. Report for Sustainable Regional Development Program. Department of Sustainability, Environment, Water, Population and Communities. BirdLife Australia, Melbourne.

Saunders, D.L. and Tzaros, C.L. 2011. *National Recovery Plan for the Swift Parrot Lathamus discolor*, Birds Australia, Melbourne.

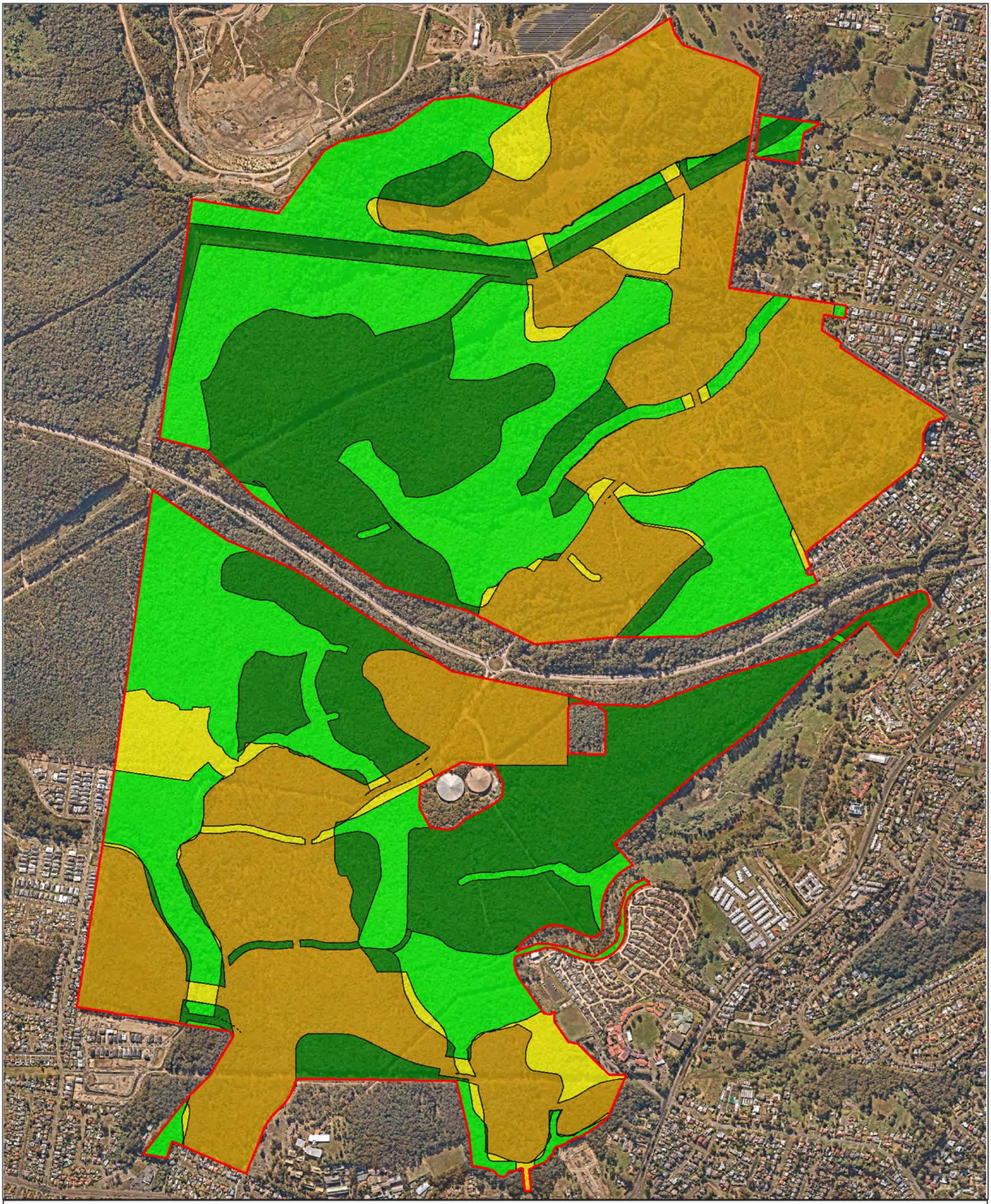
Strahan, R (2004) *The Mammals of Australia*. New Holland Publishers, Chatswood NSW.

Wilson, S and Swan, G (2003) *A Complete Guide to Reptiles of Australia*. Reed New Holland Publishers, Chatswood NSW.

Appendix A – Structure Plan Versions

The evolution of Structure Plans as a result of an iterative consultation process between the Proponent, Council, BCD, Project Ecologist, Bushfire Consultants, Town Planners and Civil Engineers is presented herewith.

Structure Plan versions are shown from the most recent version (i.e., the Structure Plan forming the basis for the present BCAR) to the oldest version. **Appendix A – Figure A** depicts the evolution of the footprint between the initial version (December 2020) and the current Structure Plan (September 2024).



Appendix A - Figure A - Comparison of Structure Plans (Sep 2024 vs. Dec 2020)

Legend

- Study Area
- Dec 2020 - retained area
- Sep 2024 - additional retained area
- Sep 2024 - additional development area
- Unchanged development extent

0 500
metres
Scale 1:11,000

N
W E
S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates Pty Ltd | AEP Ref: 1971 | Nov 2024

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
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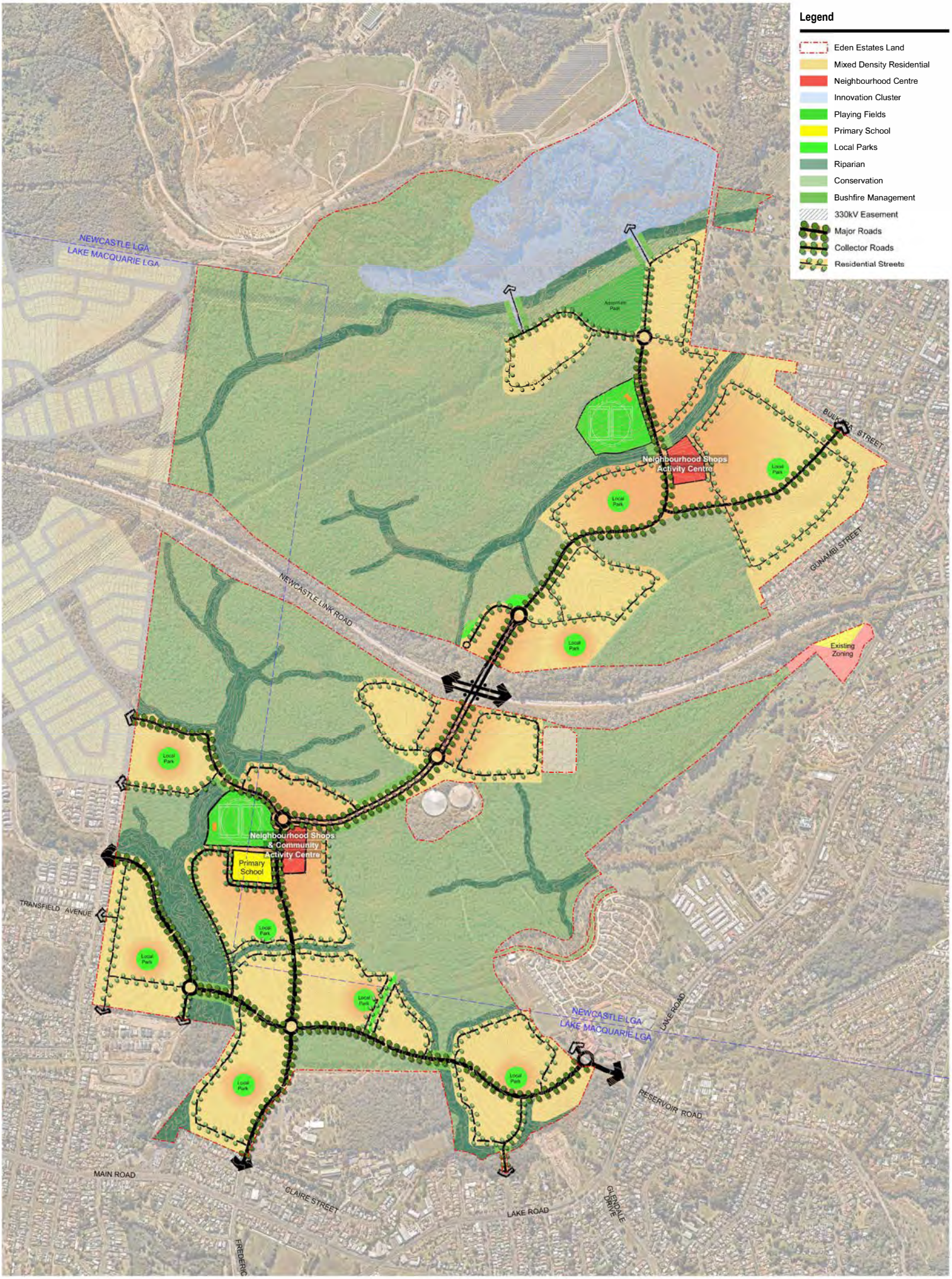
AEP



Structure Plan

Link Road, Wallsend

Client: Eden Estates Pty Ltd

0 125 250m

scale: 1:6000@A1 | 1:12000@A3

plan: 055.WS.025

date: 20/11/2023

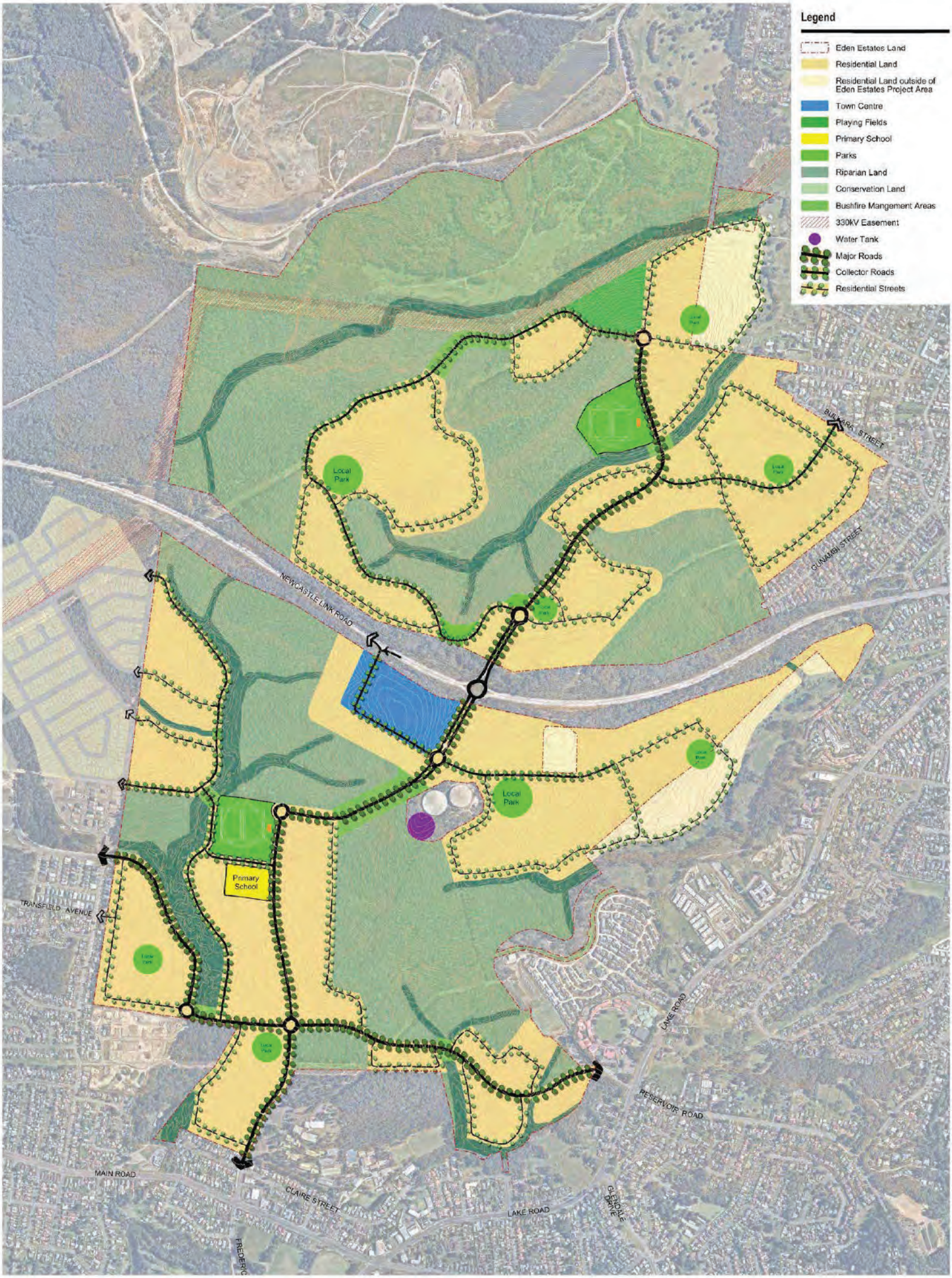
aerial: May 2023

revision: 09

proj: MGA94-56

drawn: BR

urbanco



Preliminary Structure Plan

Link Road, Wallsend

Client: Eden Estates Pty Ltd

0 125 250m

scale: 1:6000@A1 | 1:12000@A3

plan: 055.WS.025

date: 25/06/2022

aerial: Nov 2021

revision: 02

proj: MGA94-56

drawn: BR

urbanco

DEVELOPMENT AREA
LINK ROAD, WALLSEND

NOTES

Base data supplied by NSW LPI
Projection MGA Zone 56

Areas and dimensions shown are subject to final survey calculations.
All carriageways are shown for illustrative purposes only and are subject to detailed engineering design.

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CLIENT : Eden Estates Pty Ltd
SCALE : Not to Scale
DATE : 15/09/2021
PLAN No : 055.WS.016
REVISION : 06

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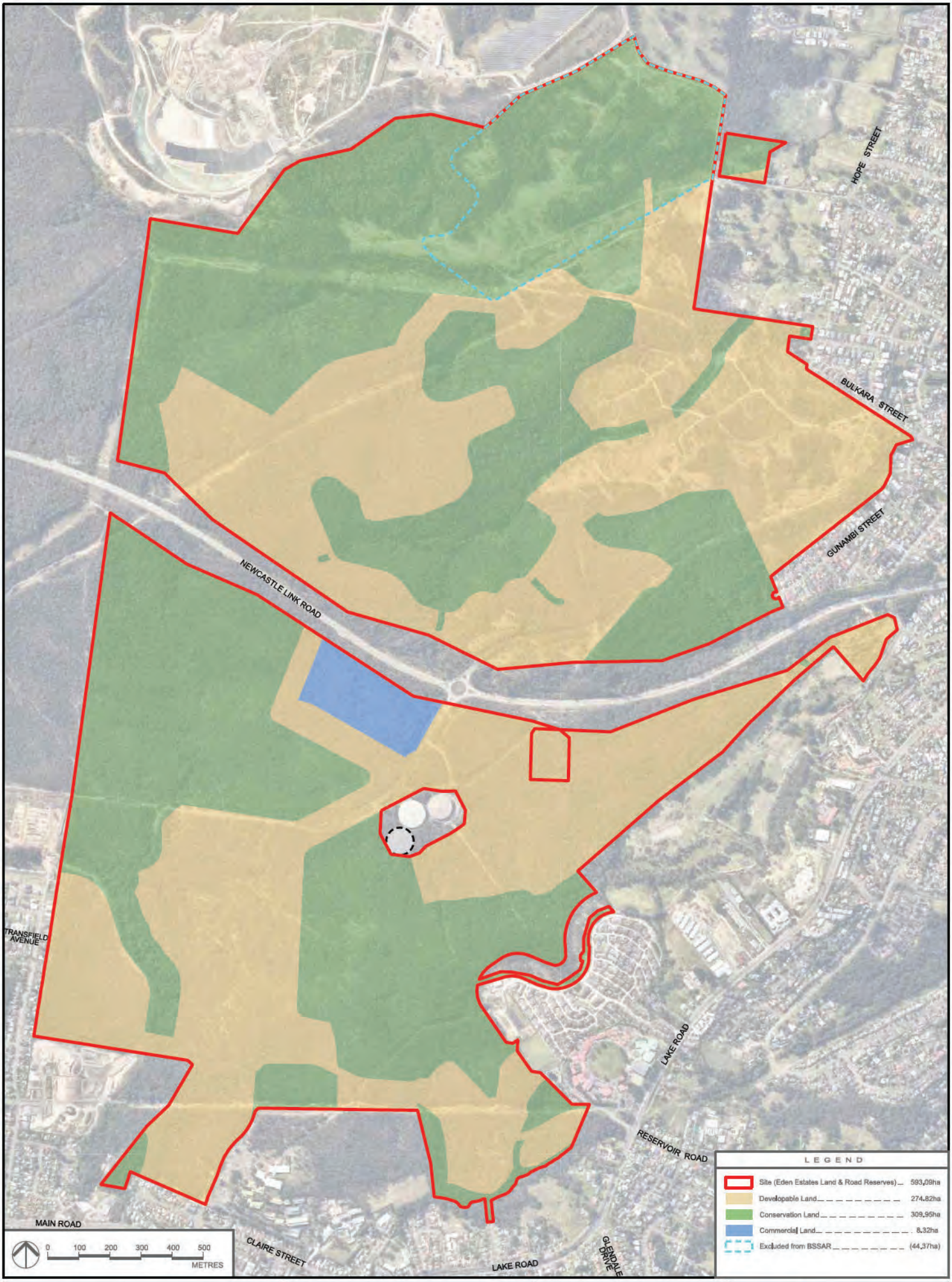
Suite 3.03 55 Miller Street PYRMONT NSW 2009
PO Box 546 PYRMONT NSW 2009 | 02 9051 9333
hello@urbanco.com.au | www.urbanco.com.au



DEVELOPMENT AREA
LINK ROAD, WALLSEND

NOTES

Base data supplied by NSW LPI
Projection MGA Zone 56

Areas and dimensions shown are subject to final survey calculations.
All carriageways are shown for illustrative purposes only and are subject to detailed engineering design.

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SCALE : Not to Scale
DATE : 23/08/2021
PLAN No : 055.WS.016
REVISION : 04

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Suite 3.03 55 Miller Street PYRMONT NSW 2009
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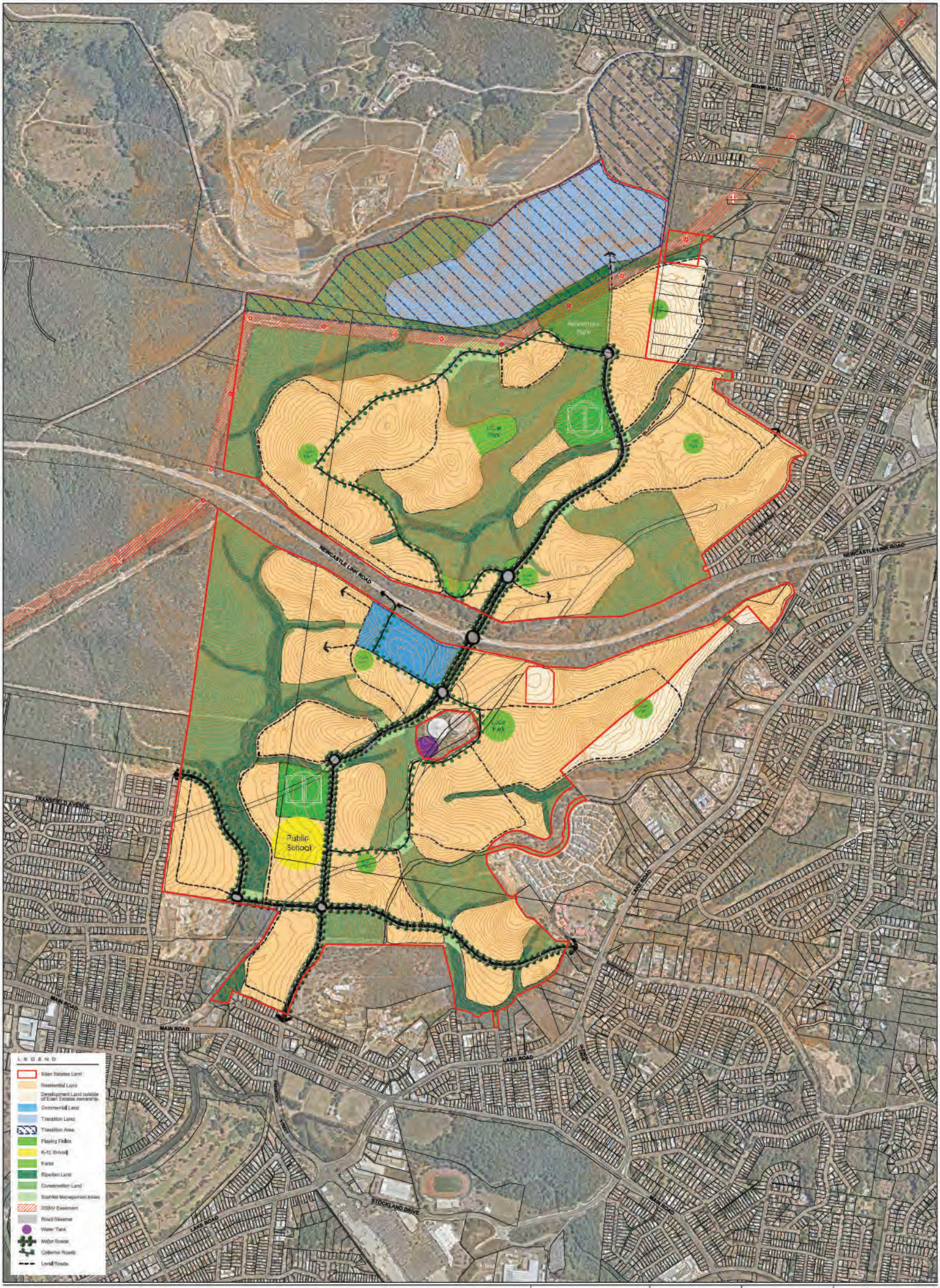

PRELIMINARY STRUCTURE PLAN
LINK ROAD
WALLSEND

NOTES

CLIENT : Eden Estates Pty Ltd
SCALE : A0@1:1,000
DATE : 3/08/2021
PLAN No : 055JVR010
REVISION : 07

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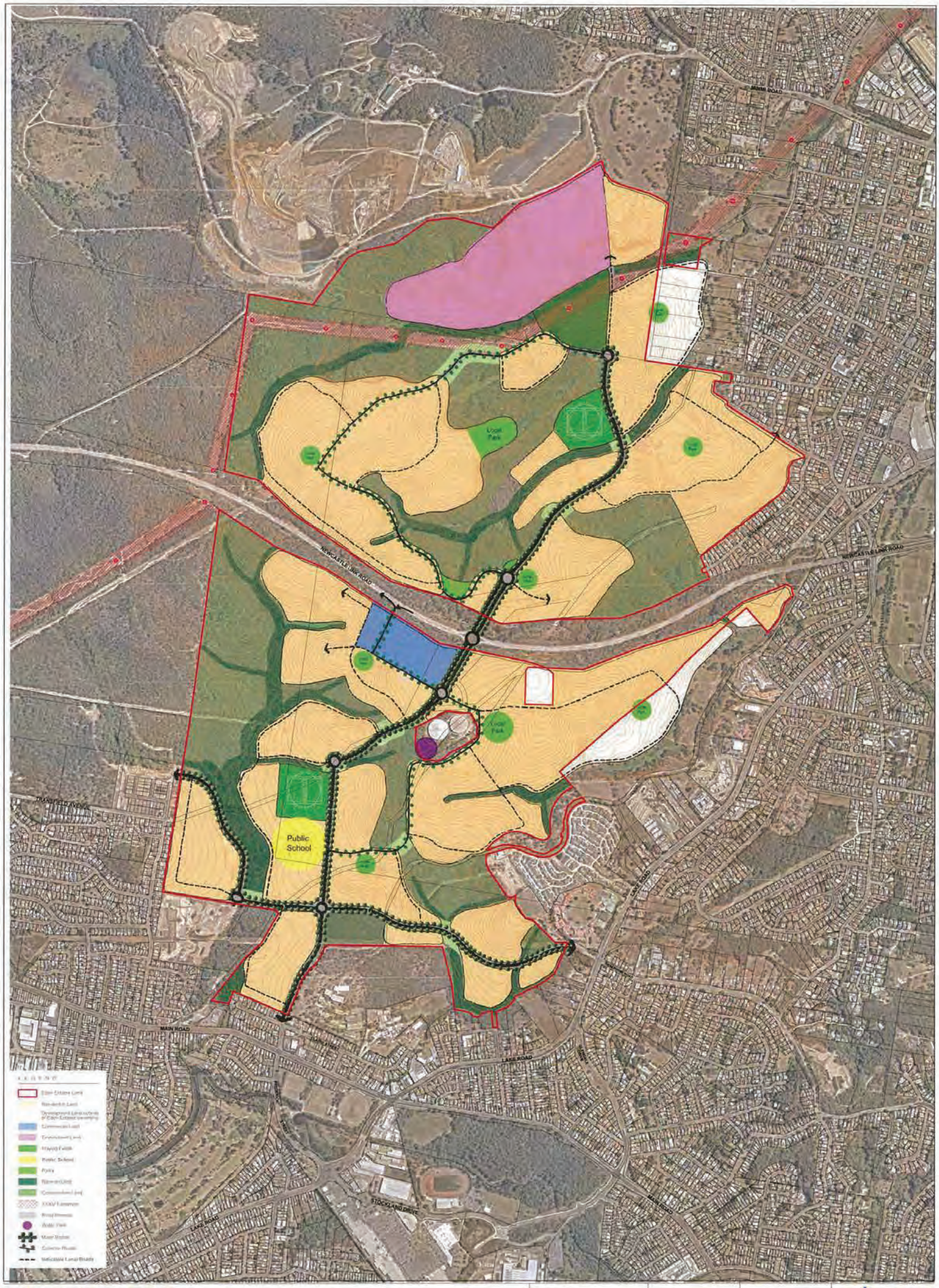

PRELIMINARY STRUCTURE PLAN
LINK ROAD
WALLSEND

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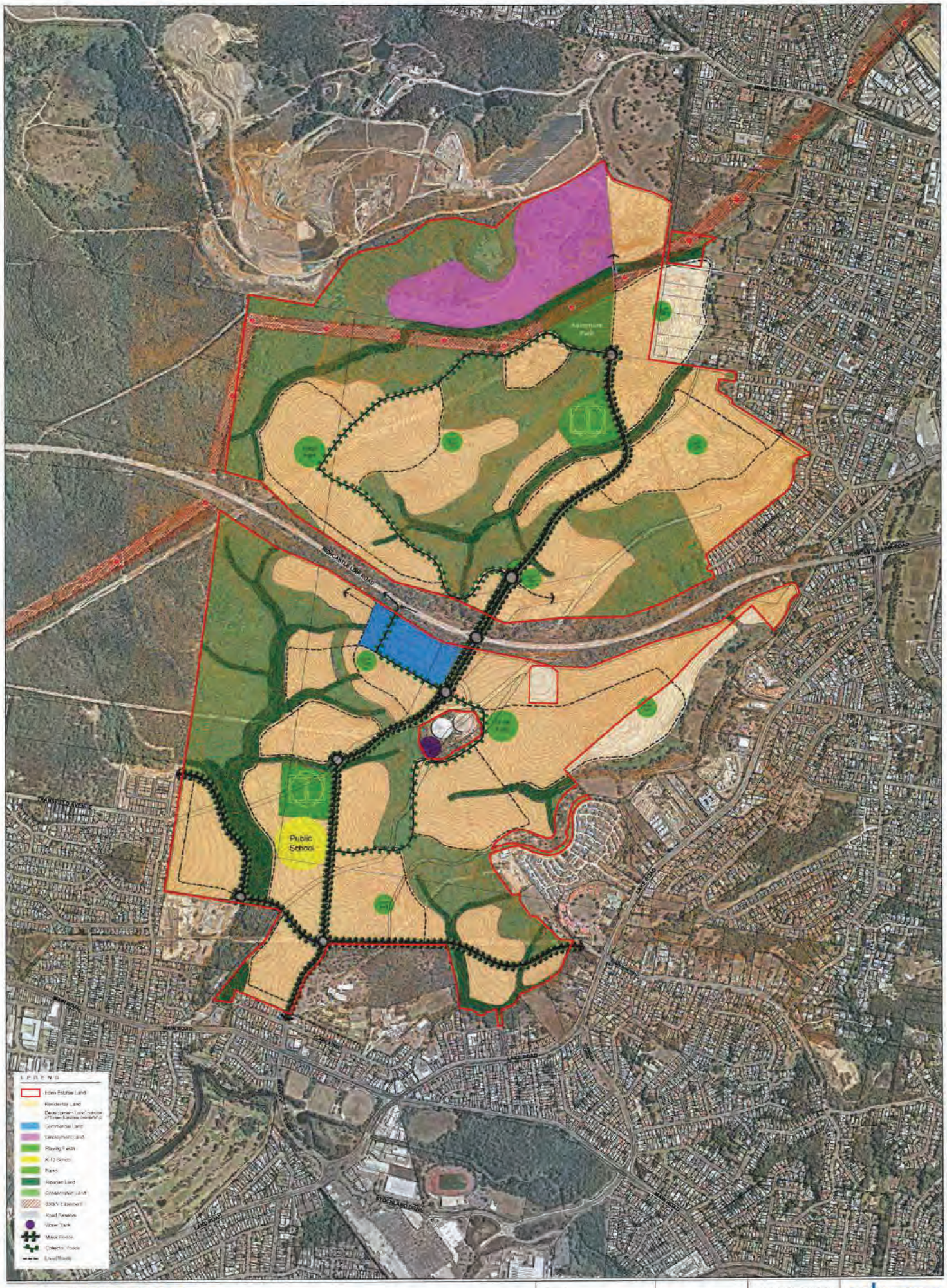

PRELIMINARY STRUCTURE PLAN
LINK ROAD
WALLSEND

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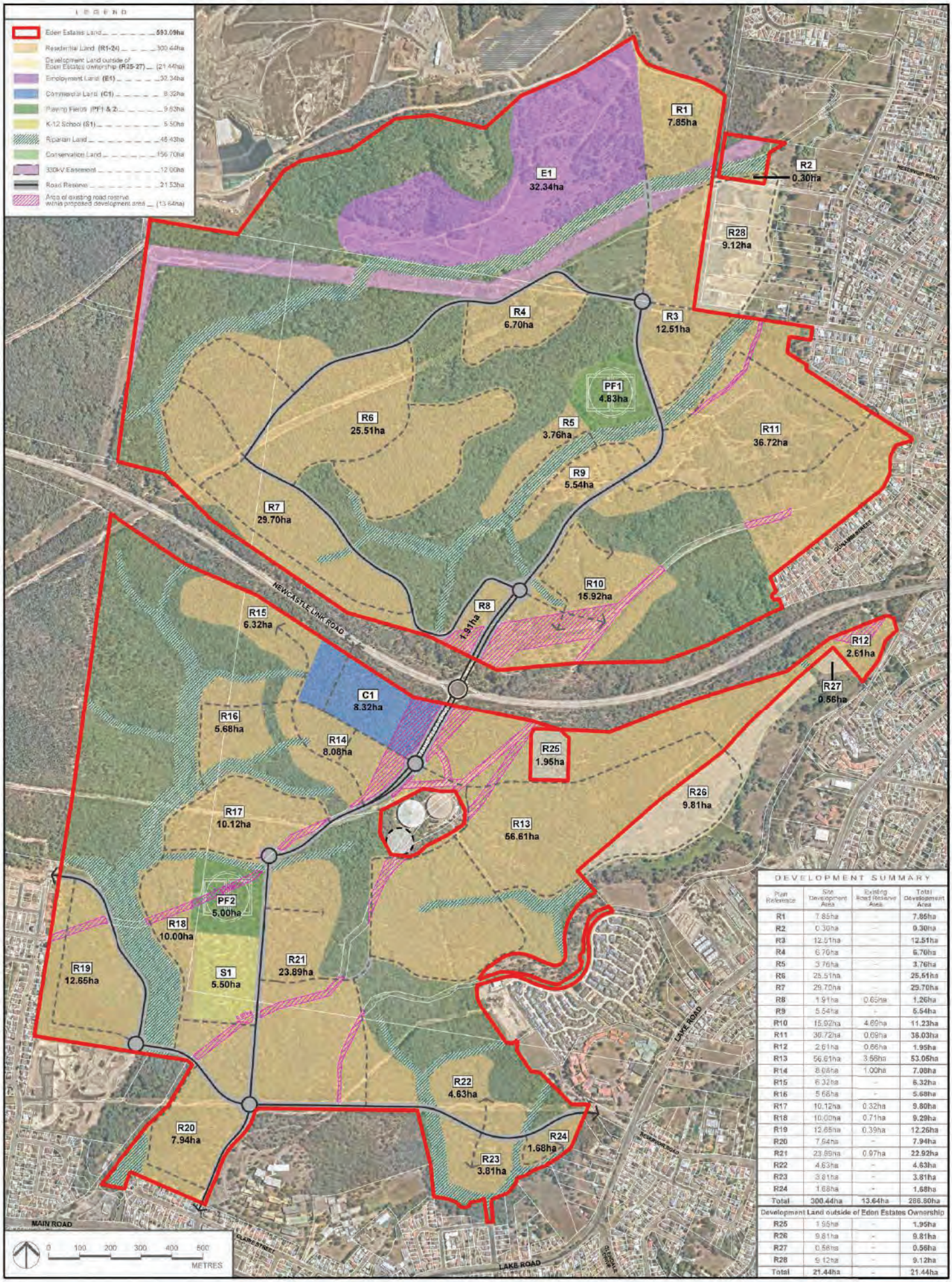

DEVELOPMENT SUMMARY

Plan Reference	Site Development Area	Existing Road Reserve Area	Total Development Area
R1	7.85ha	-	7.85ha
R2	0.30ha	-	0.30ha
R3	12.51ha	-	12.51ha
R4	6.70ha	-	6.70ha
R5	3.76ha	-	3.76ha
R6	25.51ha	-	25.51ha
R7	29.70ha	-	29.70ha
R8	1.91ha	0.65ha	1.26ha
R9	5.54ha	-	5.54ha
R10	15.92ha	4.69ha	11.23ha
R11	36.72ha	0.69ha	36.03ha
R12	2.61ha	0.66ha	1.95ha
R13	56.61ha	3.56ha	53.05ha
R14	8.08ha	1.00ha	7.08ha
R15	6.32ha	-	6.32ha
R16	5.68ha	-	5.68ha
R17	10.12ha	0.32ha	9.80ha
R18	10.00ha	0.71ha	9.29ha
R19	12.65ha	0.39ha	12.26ha
R20	7.94ha	-	7.94ha
R21	23.89ha	0.97ha	22.92ha
R22	4.63ha	-	4.63ha
R23	3.81ha	-	3.81ha
R24	1.68ha	-	1.68ha
Total	300.44ha	13.64ha	286.80ha
Development Land outside of Eden Estates Ownership			
R25	1.95ha	-	1.95ha
R26	9.81ha	-	9.81ha
R27	0.56ha	-	0.56ha
R28	9.12ha	-	9.12ha
Total	21.44ha	-	21.44ha

DEVELOPMENT AREAS SUMMARY

LINK ROAD, WALLSEND

NOTES

Base data supplied by NSW LPI
Projection MGA Zone 56

Areas and dimensions shown are subject to final survey calculations.
All carriageways are shown for illustrative purposes only and are subject to detailed engineering design.

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CLIENT Eden Estates Pty Ltd
SCALE Not to Scale
DATE 25/11/2020
PLAN No 355 WS 010
REVISION 04

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Appendix B – Vegetation Mapping by Eastcoast Flora Survey

Vegetation and Floristics of Bushland around the Wallsend Link Road, Lower Hunter Valley, NSW

February 2021

FINAL REPORT

Stephen A.J. Bell

Eastcoast Flora Survey
PO Box 216
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Cover image: *Daviesia ulicifolia* subsp. *ulicifolia* (top), *Rhodamnia rubescens* and *Indigofera australis* (middle), and regularly burnt Coastal Plains Stringybark – Apple Forest (bottom).

Report produced for:

Anderson Environment and Planning
PO Box 210 ADAMSTOWN NSW 2289

Project Manager: Ian Benson (Principal Ecologist)

Abstract

Ten vegetation communities have been delineated, described and mapped for bushland areas between Wallsend, Glendale, Edgeworth and the Summerhill Waste Management Centre at Fletcher, within Newcastle and Lake Macquarie LGAs (the Study Area). Classification of communities used multivariate clustering and nMDS ordination techniques on 31 full floristic sample plots in support of field observations across 477 ground validation points. The 653 ha parcel of land shows good diversity of vegetation, ranging from small pockets of warm temperate rainforest and wet sclerophyll forest on alluvial soils in the deeper gullies, to dryer open forests on sandy loams and clays on slopes and ridges. Open forest of two main forms characterizes the bulk of the area, with those typified by Apple, Bloodwood, Stringybark and Peppermint (Coastal Plains Stringybark – Apple Forest, Coastal Sheltered Apple – Peppermint Forest) predominating in the south, while Spotted Gum with various Ironbarks, Grey Gums and Mahoganies (Hunter Valley Moist Spotted Gum – Fergusons Forest, Coastal Foothills Spotted Gum – Ironbark Forest, Hinterland Spotted Gum – Red Ironbark Forest) occurs in the north. Restricted areas of rainforest occur within protected rocky gullies of Maryland Creek and tributaries (Permian Gully Rainforest), while shallow drainage lines within the gentler catchment of Brush Creek support a form of dry rainforest (Lake Macquarie Dry Rainforest). Deeper alluvial soils carry remnant tall forest of Sydney Bluegum, Turpentine and Rough-barked Apple in the larger creeks (Alluvial Tall Moist Forest), or Paperbark and Cheesetree forest under Red Mahogany and Sydney Peppermint (Riparian Paperbark – Peppermint Forest) in smaller creek systems. Disused water bodies now support a reedland of Cumbungi (Freshwater Typha Wetland).

In total, two-hundred and fifty-five (255) native plant species and twenty-one (21) weeds were recorded within the Study Area. The threatened shrubs *Rhodamnia rubescens* (critically endangered) and *Callistemon linearifolius* (vulnerable) were recorded during general field investigations, however AEP have conducted more indepth targeted searches for these and other species. Additionally, the rare ironbark *Eucalyptus fergusonii* subsp. *fergusonii* was recorded at several locations. Diversity in eucalypts (*Angophora*, *Corymbia*, *Eucalyptus*) within the Study Area is impressive, with eighteen (18) naturally occurring species recorded over 587 ha of vegetated land (non-plantation or exotic). This equates to one newly encountered species every 33 ha, and is consistent with trends evident in other parts of the Hunter Valley.

The vegetation present within the Study Area is representative of other areas in the lower Hunter Valley. All vegetation types present are known from other localities, and most are included in the formal conservation reserve network. Reserves known to support these vegetation types include Blue Gum Hills Regional Park, Lake Macquarie State Conservation Area, Sugarloaf State Conservation Area, Stockrington State Conservation Area, Tingira Heights Nature Reserve, and Glenrock State Conservation Area. Two of the ten defined vegetation communities fall within Threatened Ecological Communities (TECs) as listed under the *Biodiversity Conservation Act 2016*. Alluvial Tall Moist Forest (Unit 5), typified by tall emergent trees of *Eucalyptus saligna* and *Syncarpia glomulifera* on deep alluvial soils, is included in *River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions EEC*. Hinterland Spotted Gum – Red Ironbark Forest (Unit 17o), characterized by *Corymbia maculata* and *Eucalyptus fibrosa*, falls within the *Lower Hunter Spotted Gum Ironbark Forest EEC*.

Acknowledgements: Thanks to Ian Benson (AEP) for project support and comments on a draft report.

Table of Contents

Abstract i

1.0 Background 1
1.1 Location and Environmental Setting 1
1.2 Previous Botanical Studies 2

2.0 Methods 4
2.1 Rapid Data Collection 4
2.2 Floristic Survey 4
2.3 Data Analysis & Community Definition 5
2.4 Mapping 5

3.0 Results 6
3.1 Mapping Data 6
3.2 Sampling Intensity & Species Diversity 6
3.3 Data Analysis 7
3.4 Summary of Vegetation Communities 10
3.5 Vegetation Mapping 12

4.0 Discussion 15
4.1 Summary 15
4.2 Conservation Significance 15
4.3 Fire Ecology 16

5.0 References 18

Appendix 1 Species List 20

Appendix 2 Vegetation Community Profiles 27

Permian Gully Rainforest Unit 1g 28
Lake Macquarie Dry Rainforest Unit 3e 31
Alluvial Tall Moist Forest Unit 5 35
Coastal Sheltered Apple – Peppermint Forest Unit 11 38
Riparian Paperbark - Peppermint Forest Unit 11a 41
Hunter Valley Moist Spotted Gum – Fergusons Forest Unit 12d 41
Coastal Foothills Spotted Gum - Ironbark Forest Unit 15 48
Hinterland Spotted Gum - Red Ironbark Forest Unit 17o 52
Coastal Plains Stringybark - Apple Forest Unit 30e 56
Freshwater Typha Wetland Unit 46a 60

1.0 Background

Anderson Environment and Planning (AEP), operating on behalf of their client Eden Estates Pty Ltd, have requested detailed vegetation mapping for a large parcel of land on the western outskirts of Newcastle, in the lower Hunter Valley. This land predominantly supports native bushland in varying levels of condition, however some portions in the north-east and north have previously supported a quarry and associated activities and is largely disturbed. Prior to proposing partial development of this land, biocertification is being sought to streamline the biodiversity assessment process. Biocertification is allowed for under the NSW Biodiversity Conservation Act 2016 (BC Act), and permits identification of developable and offset lands before planning begins. As part of this process, a Biodiversity Certification Assessment Report (BCAR) will be prepared by AEP.

Eastcoast Flora Survey has been commissioned to undertake a vegetation classification and mapping project across these bushland areas, with a view to informing preparation of the BCAR. The principal objectives are to:

- collect full floristic survey data across the range of communities present in each offset, and perform numerical classification analysis to assist in classifying the vegetation;
- map the distribution of vegetation communities so defined;
- collect incidental records of significant plant species during the course of survey work, targeting threatened species which may be expected the area;
- prepare a report outlining the findings of the study.

This report outlines the results of this survey, classification and mapping project. Note that a targeted threatened species survey was not a requirement of the supplied brief, however where significant species were encountered these were relayed to AEP.

1.1 Location and Environmental Setting

The land under study (the Study Area: 653 ha) straddles both the Newcastle and Lake Macquarie local government areas (LGAs) between Wallsend, Glendale, Edgeworth and the Summerhill Waste Management Centre at Fletcher (Figure 1). It is bissected by the Newcastle Link Road which heads west out of Wallsend to ultimately become the Hunter Expressway at Cameron Park. The land comprises a divide between two major catchments. Maryland Creek drains the northern portion of the site in a north-easterly direction, joining Ironbark Creek at Maryland to then flowing to the Hunter River. The southern portion of land is mostly drained by Brush Creek and its tributaries in a southerly direction into Cockle Creek and then Lake Macquarie, although the extreme east drains easterly into Ironbark Creek and the Hunter River.

Topography of the land is generally hilly to undulating, with the northern portion of the site more rugged than the south. The underlying geology is predominantly of Permian age, consisting of conglomerate, sandstone, siltstone, coal and tuff from the Newcastle Coal Measures, with some Quaternary alluvium associated with Maryland Creek and Ironbark Creek in the north-east and east (DMR 1999; Colquhoun et al. 2020). Soil landscapes have been mapped by Matthei (1995) and show the land to be largely of the Killingworth (ki) landscape, with smaller areas of Warners Bay (wa) and Gateshead (ga) in the south, and cedar creek (ce) in the north. Soils are predominantly colluvial in nature, derived from the underlaying sedimentary bedrock, with minor amounts of alluvium in major gullies such as Maryland Creek. Elevation ranges from 10 m ASL in the east on Maryland Creek, rising to 90 m ASL in the north adjacent to Summerhill Waste Management Centre.

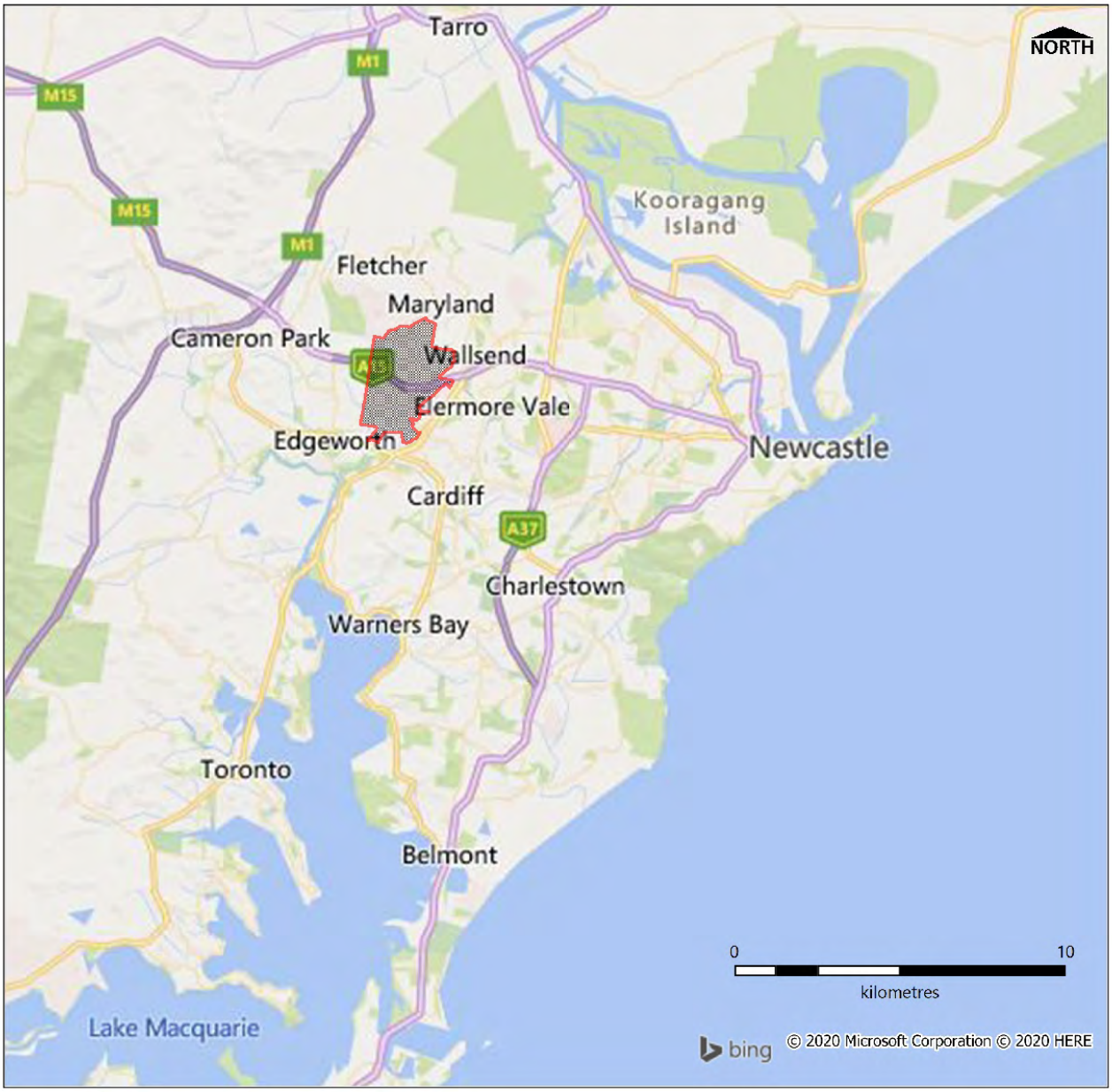


Figure 1 Location of the Study Area, lower Hunter Valley.

The Hunter Valley falls within a warm temperate climatic zone, with a maritime influence near the coast, and experiences warm wet summers and cool dry winters. Rainfall generally peaks in late Summer and early Autumn, although local variations due to topography are evident. Annual average rainfall is 1155 mm at the Edgeworth Waste Water Treatment Plant (station number 61393, c. 2 km to the south-west). Temperatures range from a daily average low of 16.6° C in July, to a high of 32.8 ° C in January (Bureau of Meteorology 2020).

1.2 Previous Botanical Studies

Few detailed floristic studies are known for the Study Area. Two floristic survey plots were placed within these lands during development of the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) in 1999-2000, which produced a regional classification and modelled vegetation communities (NPWS 2000). That study showed the

occurrence of large areas of Coastal Plains Smooth-barked Apple Woodland (Unit 30) and Coastal Foothills Spotted Gum-Ironbark Forest (Unit 15) across the area, with more localized patches of Coastal Wet Gully Forest (Unit 1), Coastal Narrabeen Moist Forest (Unit 5), Alluvial Tall Moist Forest (Unit 6) and Coastal Sheltered Apple Forest (Unit 11).

Vegetation showing affinities to the Lower Hunter Spotted Gum-Ironbark Forest (LHSGIF) Threatened Ecological Community (TEC) were targeted and mapped in the Lower Hunter Valley by Bell (2010), including parts of the Study Area. Around a dozen separate polygons of LHSGIF, comprising 83 ha, were mapped at that time. For the Lake Macquarie LGA component (the western and southern fringes; 178 ha), mapping of all vegetation communities was included in the LGA-wide study of Bell and Driscoll (2016). This study, which incorporated less than one day of field investigation within the Study Area, identified and mapped six communities, including:

- Coastal Sheltered Apple-Peppermint Forest (Unit 11)
- Hunter Valley Moist Spotted Gum – Fergusons Forest (Unit 12d)
- Coastal Foothills Spotted Gum – Ironbark Forest (Unit 15)
- Hinterland Spotted Gum – Red Ironbark Forest (Unit 17o)
- Coastal Plains Stringybark – Apple Forest (Unit 30e)
- Red Mahogany – Apple Paperbark Forest (Unit 42)

No other classification and/or mapping projects are known to have been completed for the area over the last 20 years.

2.0 Methods

2.1 Rapid Data Collection

Classification and mapping for this project followed the technique described in Bell (2013) and Bell and Driscoll (in press). In that method (D-iSM), numerous ground control data points tied to a specific point in the landscape are used firstly to inform the selection of full floristic sample plots, and then a numerical classification and map. Central to this method is the recognition that variability in vegetation distribution cannot be predicted blindly using computer GIS modelling programs, and that documenting what actually occurs on the ground is an essential component of producing a reliable vegetation map. Many recent mapping programs have relied heavily on GIS capabilities to predict where certain vegetation communities occur, with often disappointing results (eg: the LHCCREMS vegetation modelling, NPWS 2000; the Greater Hunter Vegetation Mapping, reviewed by Hunter 2016). D-iSM is particularly applicable to small-scale investigations within an urban or semi-urban context, but has been used in much larger projects (e.g. Lake Macquarie LGA: Bell & Driscoll 2016).

A key component of D-iSM is the use of Rapid Data Points (RDP). As indicated above, RDPs are two-fold in their application:

1. they are used to stratify the positioning of full floristic survey plots to ensure that all observed floristic variation within an area of interest is sampled for numerical classification;
2. following numerical classification, they assist in the creation and population of a vegetation map layer to show the geographical distribution of defined types.

RDPs are essentially summaries of floristic information recorded at numerous points in the field. At specific and regular locations, summaries of the vegetation are noted and waypointed in a GPS (positional accuracy of 3-5m in most situations) and later transferred to the GIS. Information recorded includes:

- Canopy layer dominant species
- Shrub layer dominant species
- Ground layer dominant species
- Draft or field-recognised vegetation unit
- Suitability for a full floristic sampling plot
- Miscellaneous notes

Initially, all trafficable paths across a Study Area are driven in 4WD vehicle recording RDPs. Those areas lacking extensive trail networks, including poorly maintained fire trails and selected remote gullies, are then walked on foot with GPS units recording the same information. In this way, a large dataset of summary information can be rapidly collected to use in vegetation mapping procedures.

2.2 Floristic Survey

Vegetation survey was conducted within the Study Area predominantly between May and July 2020. Five pre-existing sample plots from previous studies (NPWS 2000; Bell 2010) were incorporated into the sampling design. New sampling locations were chosen in areas that best represented the floristic type requiring numerical testing, ideally replicated in at least three locations but ultimately determined by available budgeting. Heavily weed infested areas and former quarry lands now supporting rehabilitation were not sampled. All sample plots were of 0.04ha (nominally 20 x 20m, or 40 x 10m in some riparian areas) and located within homogeneous stands of vegetation. Modified

(1-6 scale) Braun-Blanquet cover abundance scores (Braun Blanquet 1928), together with estimates of percentage cover and abundance as required under the Biodiversity Assessment Method (BAM) (OEH 2017), were applied to all vascular plant species recorded within each quadrat. Additionally, other habitat structure data (e.g. trees with hollows, litter cover, tree stem size etc) as required under BAM was also collected. Plant nomenclature followed that adopted by the National Herbarium of NSW and shown on NSW FloraOnline (http://plantnet.rbgsyd.nsw.gov.au/floraonline.htm).

2.3 Data Analysis & Community Definition

Cluster analysis and non-metric multidimensional scaling (nMDS) on the dataset was performed using *Primer* V6 (Clarke & Gorley 2006), utilizing the group averaging strategy, the Bray-Curtis association measure and a Beta value of -0.1. The SIMPER routine was used to generate diagnostic species lists for each defined floristic group, while the SIMPROF procedure was used to examine the significance of defined groups.

2.4 Mapping

Within Mapinfo© GIS, observable photo-patterns from orthorectified colour aerial photographs (digital on-demand aerial images from BING Imagery) were initially scrutinised and polygons representing likely different vegetation communities digitally prepared prior to field work. After the collection of field data and the designation of community units through numerical analysis, polygon alignment and attribution was amended where necessary, and cross-referenced to RDP data to determine final identity.

3.0 Results

3.1 Mapping Data

Four hundred and sixty-six (477) Rapid Data Points (RDPs; 1 point per 1.4 ha) were collected within the Study Area, including data from previous investigations (Figure 2). At each of these points, information on dominant plant species in each stratum was recorded and incorporated directly into the sampling stratification and vegetation mapping process. All points were attributed a draft vegetation community code in the field, which was reviewed after classification analysis of full floristic data.

3.2 Sampling Intensity & Species Diversity

Thirty-one (31) full floristic sampling plots were surveyed as part of this study (Figure 2), representing approximately one sample per 16 hectares of mapped native vegetation (excluding rehabilitation, plantation and heavily weed infested areas). All floristic plot data is housed within the Department of Planning, Industry and Environment Vegetation Iinformation System (VIS) Database (http://www.environment.nsw.gov.au/atlasapp/Default.aspx?a=1), under the survey names 'WALLLINK' (24 plots), 'REMSNE' (2 plots), and 'SPOTTEDGUM', 'SPOTLAKE', and 'SPOTDEC' (all 1 plot each).

In total, two-hundred and fifty-five (255) taxa were recorded from the Study Area, including twenty-one (21) weeds (Appendix 1). The majority of weeds are associated with previously disturbed areas, such as around the former quarry areas in the north, and along most fire trails and easements. The total flora list will likely be considerably larger, as that shown in Appendix 1 is based almost exclusively on plot-based survey only. The most common native species recorded across all sampling plots were the trees *Corymbia maculata, Angophora costata, Eucalyptus acmenoides, Eucalyptus fibrosa* and *Eucalyptus punctata,* the shrubs *Notelaea longifolia f. longifolia, Acacia ulicifolia* and *Pultenaea euchila*, the forbs *Lobelia purpurascens, Gonocarpus tetragynus, Pseuderanthemum variabile,* and *Dichondra repens,* the sedges *Dianella caerulea* var. *assera* and *Lomandra multiflora* subsp. *multiflora*, and the grasses *Entolasia stricta*, *Microlaena stipoides* var. *stipoides*, *Themeda triandra*, *Panicum simile*, *Imperata cylindrica* and *Aristida vagans*. *Pteridium esculentum* was the most commonly recorded fern, and *Glycine clandestina, Eustrephus latifolius* and *Hardenbergia violacea* the most frequent vines.

Significant plant species encountered during field studies included *Rhodamnia rubescens* (Critically Endangered), *Callistemon linearifolius* (Vulnerable), and *Eucalyptus fergusonii* subsp. *fergusonii* (rare). Most plants of *Rhodamnia* observed showed only minor damage from Myrtle Rust infection (Figure 3), with one plant bearing fruit. It is understood that AEP have undertaken a more thorough survey for this species across the Study Area. A number of individuals of *Callistemon* were observed in the southern portions of the site, and although not all were sampled several showed morphological features consistent with *Callistemon linearifolius*. This species and its close relatives (*Callistemon rigidus, C. linearis*) can be difficult to distinguish north of the Hawkesbury River, and careful examination of leaf characters and habit are required.

The rare ironbark *Eucalyptus fergusonii* subsp. *fergusonii* is common across most of the northern sections of the Study Area, and this is consistent with other areas of the lower Hunter Valley along the coastal zone. This taxon superficially resembles *Eucalyptus paniculata* subsp. *paniculata* (and some taxonomists consider them the one entity: Klaphake 2010). However, clear ribbing of buds and fruit, and extended pedicels on both, distinguish these two taxa. Although considered rare,

Eucalyptus fergusonii subsp. *fergusonii* is common in both Newcastle and Lake Macquarie LGAs and is not considered of significance.

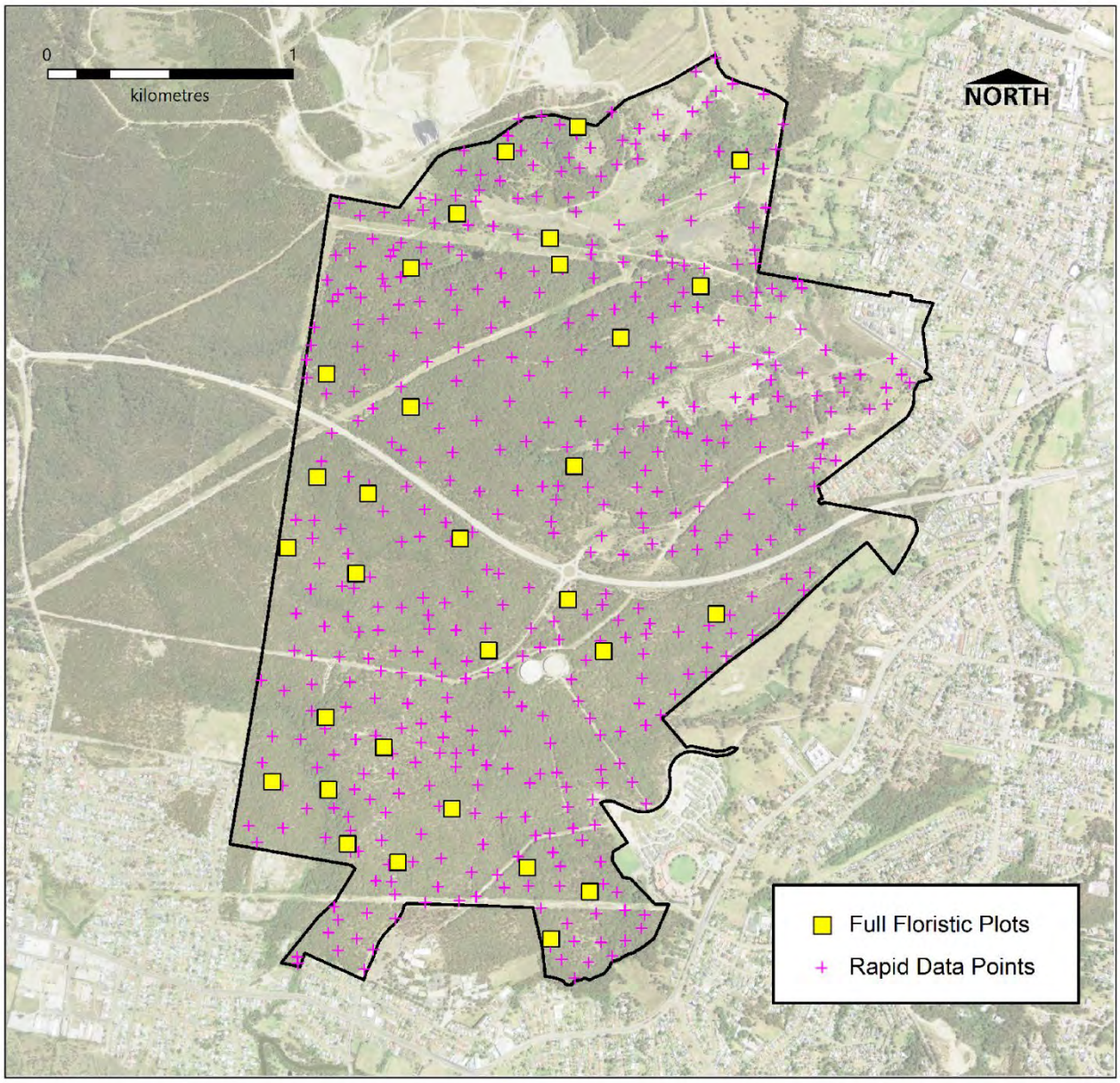


Figure 2 Distribution of Rapid Data Points (n = 477) and Full Floristic Plots (n = 31) across the Study Area.

3.3 Data Analysis

Multivariate cluster analysis of 31 sample plots and 232 native plant taxa resulted in the definition of 2 major groups at 10% similarity (Figure 4). These two groups (Groups A & B) represent moist forest and rainforest (Group A: *Permian Gully Rainforest; Alluvial Tall Moist Forest*), and all other dry and sheltered forest types (Group B). Group B can be further subdivided into Subgroup B1 (*Riparian Paperbark – Peppermint Forest; Coastal Sheltered Apple – Peppermint Forest; Coastal Plains Stringybark – Apple Forest;* and part *Hinterland Spotted Gum – Red Ironbark Forest*) and Subgroup B2 (part *Hinterland Spotted Gum – Red Ironbark Forest; Coastal Foothills Spotted Gum – Ironbark Forest,* dry and moist forms*; Hunter Valley Moist Spotted Gum – Fergusons Ironbark Forest; Lake Macquarie Dry Rainforest*). Note that Hinterland Spotted Gum – Red Ironbark Forest transcends the

boundaries of Subgroup B1 and B2 due to its variable composition relative to proximate adjoining communities, but in the nMDS ordination this effect is less pronounced (see following).

Figure 3 Healthy individual of *Rhodamnia rubescens* growing within the Study Area.

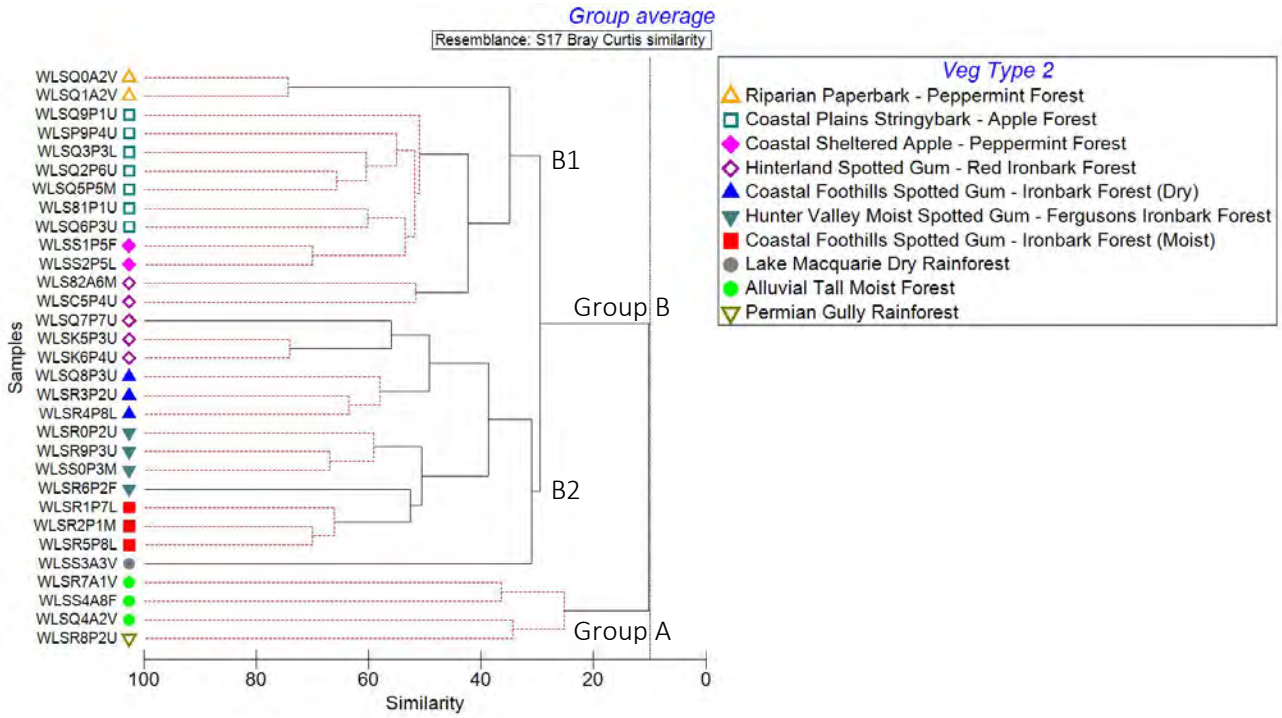


Figure 4 Site dendrogram showing the relationship between all sample plots (Bray-Curtis association measure). Significant groups of samples ($p<0.01$) are those linked by solid horizontal lines. Group A = 'moister' vegetation; Group B = 'dryer' vegetation.

Within Group A, all four component plots were significantly differentiated (p<0.01) from the remainder of the dataset. This is as expected for Permian Gully Rainforest (plot WLSR8P2U), but for the three plots comprising Alluvial Tall Moist Forest, variation in condition (two relatively undisturbed, WLSQ4A2V & WLSS4A8F; the other heavily disturbed, WLSR7A1V) can help explain why there was little differentiation from the Permian Gully Rainforest. Both communities share a number of key species (particularly WLSQ4A2V and WLSR8P2U), but occur in different habitats: Permian Gully Rainforest in rocky gullies in elevated topography, Alluvial Tall Moist Forest on valley flats in deep alluvium.

Differentiation within Group B was more complex. Subgroup B1 was significantly (p<0.01) divided into Riparian Paperbark – Peppermint Forest (WLSQ0A2V, WLSQ1A2V), and two further clusters. The first comprised Coastal Sheltered Apple – Peppermint Forest (WLSS1P5F, WLSS2P5L) and Coastal Plains Stringybark – Apple Forest (WLSQ9P1U, WLSP9P4U, WLSQ3P3L, WLSQ2P6U, WLSQ5P5M, WLS81P1U, WLSQ6P3U), while the second comprised two plots (WLS82A6M, WLSC5P4U) forming part of the Hinterland Spotted Gum – Red Ironbark Forest. Subgroup B2 displayed several significant (p<0.01) splits, but not all could be rationalized with field observations. The remainder of the Hinterland Spotted Gum – Red Ironbark Forest (WLSQ7P7U, WLSK5P3U, WLSK6P4U) was significantly different to the dry form of Coastal Foothills Spotted Gum – Ironbark Forest (WLSQ8P3U, WLSR3P2U, WLSR4P8L), and together both were significantly differentiated from the moist form of Coastal Foothills Spotted Gum – Ironbark Forest (WLSR1P7L, WLSR2P1M, WLSR5P8L) and Hunter Valley Moist Spotted Gum – Fergusons Ironbark Forest (WLSR0P2U, WLSR9P3U, WLSS0P3M, WLSR6P2F).

Non-metric multidimensional scaling strongly supported and clarified the groupings evident in the cluster analysis, with a low stress level of 0.1 and strong congruence with the cluster analysis groups (Figure 5). The five plots comprising Hinterland Spotted Gum – Red Ironbark Forest are more sensibly aligned in this analysis (more so than in the cluster diagram), while all other groups are relatively tightly grouped. Artefacts of past disturbance (partial clearing, logging, weed invasion) explain the wide spacing in the three plots comprising Alluvial Tall Moist Forest.

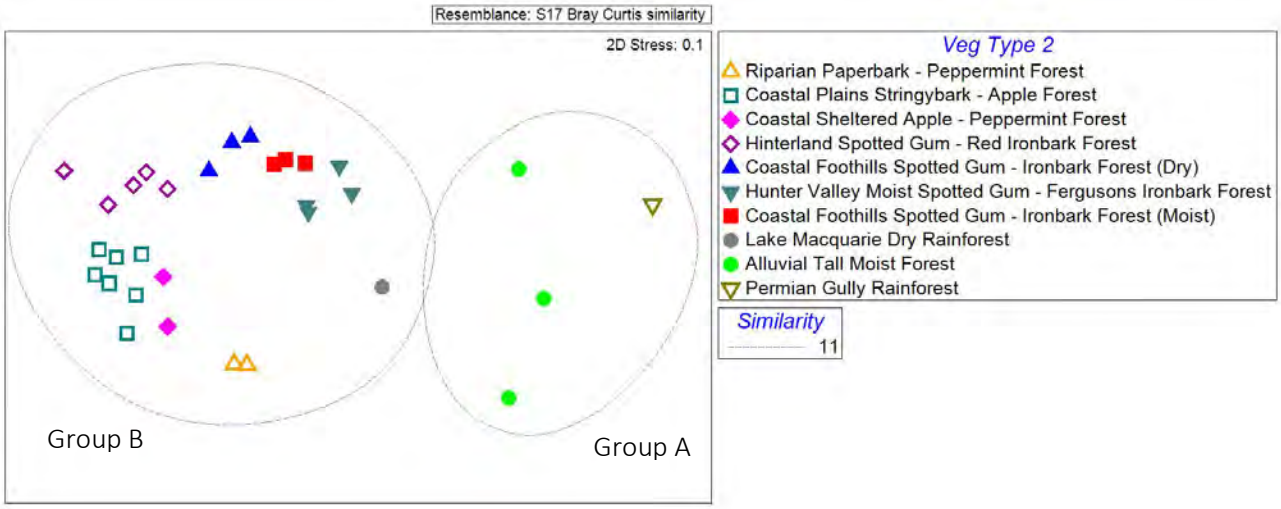


Figure 5 **nMDS plot showing the spatial relationship between all sample plots, overlain with main cluster analysis groups (10% similarity, Bray-Curtis association measure) from Figure 4.** Group A = 'moister' vegetation; Group B = 'dryer' vegetation.

3.4 Summary of Vegetation Communities

Brief descriptions of the communities defined for the study ares are shown below. Table 1 summarises best-fit PCT equivalencies with the locally-defined vegetation communities, although in some instances there are no appropriate PCTs within the current State classification. Descrepancies such as this are not unusual when trying to equate locally observed vegetation types at fine resolution to a broader classification. Appendix 2 provides profiles of all communities, including lists of those diagnostic species contributing the top 99% of diversity for each, as obtained through the SIMPER procedure in *Primer*.

Note that community nomenclature used for the locally defined units follows that developed for Lake Macquarie local government area (Bell & Driscoll 2016), hence unit numbers may appear inconsistently applied for the present study.

Table 1 Locally defined vegetation types and their 'best-fit' NSW Plant Community Types (PCT.

Unit	Community	Plant Community Type	PCT Match Confidence
1g	Permian Gully Rainforest	PCT1543: Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley	low
3e	Lake Macquarie Dry Rainforest	PCT1539: Grey Myrtle sheltered gully dry rainforest in gullies of the Sydney Basin	moderate
5	Alluvial Tall Moist Forest	PCT1573: Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment	good
11	Coastal Sheltered Apple – Peppermint Forest	PCT1621: Smooth-barked Apple open forest on coastal lowlands of the Central Coast	moderate
12d	Hunter Valley Moist Spotted Gum – Fergusons Forest	PCT1584: White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest, central & lower Hunter Valley	low
15	Coastal Foothills Spotted Gum - Ironbark Forest	PCT1588: Grey Ironbark-Broad-leaved Mahogany-Forest Red Gum shrubby open forest, Coastal Lowlands, Central Coast	moderate
17o	Hinterland Spotted Gum - Red Ironbark Forest	PCT1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	good
30e	Coastal Plains Stringybark - Apple Forest	PCT1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy Open Forest, coastal lowlands	good
32	Riparian Paperbark - Peppermint Forest	PCT1621: Smooth-barked Apple open forest on coastal lowlands of the Central Coast	low
46a	Freshwater Typha Wetland	PCT1737: Typha rushland	low

1g. Permian Gully Rainforest: Occurs in a single location in the Study Area, near the headwaters of Maryland Creek and below a small rocky cliffline. A relatively diverse range of species are present here, although because of its very limited areal extent it may be considered a poor form of the Permian Gully Rainforest present in other parts of the lower Hunter Valley. *Ficus rubiginosa* is the most obvious canopy species present, with other species such as *Cryptocarya rigida*, *Acmena smithii*, *Schizomeria ovata* and *Eupomatia laurina* common. An abundance of epiphytic and lithophytic fern species are also evident, including *Pyrrosia rupestris, Asplenium australasicum, Microscorum*

scandens and *Notogrammits billardierei*. Vines include *Parsonsia straminea*, *Cissus antactica* and *Smilax glyciphylla*.

3e. Lake Macquarie Dry Rainforest: A few small gullies show a dominance of *Backhousia myrtifolia* and *Melaleuca styphelioides* within the wider open forest of *Corymbia maculata*, *Eucalyptus umbra* and *Eucalyptus punctata*. These riparian 'bands' are barely 10 m wide in places, yet carry a range of mesic plant species otherwise absent from adjacent slopes. Frequent fire events have likely impacted on this vegetation type, constraining it to the immediate creekline environment. Co-occurring species within this type include *Glochidion ferdinandi* and *Rhodamnia rubescens*, with *Lomandra longifolia*, *Adiantum aethiopicum*, *Oplismenus imbecillus* and *Dichondra repens* on the ground.

5. Alluvial Tall Moist Forest: Present predominantly on alluvial soils in low relief parts of Maryland Creek, where remnant tall forest dominated by *Eucalyptus saligna*, *Syncarpia glomulifera* and *Angophora floribunda* occur. Very little of this vegetation remains within the Study Area, most having being cleared as part of previous ground disturbance in the area. Common associated species include *Wilkea huegeliana, Acmena smithii, Cryptocarya microneura, Alphitonia excelsa* and *Notelaea longifolia*, with *Calochlaena dubia*, *Oplismenus imbecillus* and *Adiantum aethiopicum* on the ground.

11. Coastal Sheltered Apple – Peppermint Forest: Open forest on the lower slopes in low relief areas in the south are characterized by tall *Eucalyptus piperita* with *Angophora costata* and *Corymbia gummifera*. This vegetation type is widespread in Lake Macquarie, possibly reaching its northern limit in the Study Area. *Pteridium esculentum, Polyscias sambuccifolia, Leptospermum polygalifolium subsp. cistmontanum, Acacia longifolia* and *Banksia collina* are common in the mid-storey, over a ground layer dominated by *Imperata cylindrica*, *Themeda triandra*, *Microlaena stipoides* var. *stipoides* and *Lobelia purpurascens*. Topographically, this vegetation type is positioned between the dominant Coastal Plains Stringybark – Apple Forest of the gentle hills and slopes, and riparian communities.

12d. Hunter Valley Moist Spotted Gum – Fergusons Forest: Sheltered slopes (southerly- to easterly-facing) in the northern parts of the Study Area support a moist forest characterized by *Eucalyptus acmenoides, Eucalyptus punctata, Corymbia maculata* and *Eucalyptus fergusonii* subsp. *fergusonii*, and in some areas *Eucalyptus placita* and *Allocasuarina torulosa*. Frequent fire has likely reduced the extent of mesic elements originally in this type, however representatives are still evident including *Clerodendrum tomentosum, Rhodamnia rubescens, Notelaea longifolia, Denhamia silvestris* and *Breynia oblongifolia*. Ground layer vegetation is dominated by grasses, forbs and herbs, such as *Desmodium gunnii, Dichondra repens, Lobelia purpurascens, Poa affinis, Microlaena stipoides* var. *stipoides*, *Oplismenus imbecillus* and *Pseuderanthemum variabile*. Climbers too are common, including *Cayratia clematidea, Clematis glycinoides, Dioscorea transversa* and *Hibbertia scandens*.

15. Coastal Foothills Spotted Gum - Ironbark Forest: Past logging, partial clearing and frequent fire have altered both the structural and floristic composition of this community, such that most areas now support only relatively young regrowth vegetation. This level of disturbance has also contributed to the development of two forms of this community within the Study Area: a drier one where mesic elements have been reduced, and a moister form where they still remain. Common canopy species shared by both forms include *Corymbia maculata, Eucalyptus propinqua* and *Eucalyptus acmenoides*, while *Eucalyptus siderophloia, Eucalyptus fergusonii* subsp*. fergusonii*, *Eucalyptus placita* are less common. Understorey composition varies, but may include *Pultenaea villosa* and *Acacia ulicifolia* in the moist form, and *Notelaea longifolia, Denhamia silvestris* and *Acacia irrorata* subsp. *irrorata* in the drier form. Ground layer composition also differs, with *Imperata cylindrica*, *Desmodium gunnii*,

Dichondra repens, *Lobelia purpurascens* and *Microlaena stipoides* var. *stipoides* dominating the moist form, while *Entolasia stricta* and *Gonocarpus tetragynus* are more evident in the drier form.

17o. Hinterland Spotted Gum - Red Ironbark Forest: Characteristic canopy species in this community include *Corymbia maculata* and *Eucalyptus fibrosa*, however other species also occur sparingly, of which the most common is *Eucalyptus umbra*. This vegetation is typically a grassy open forest, although localized ares dominated by the tall dense shrub *Melaleuca nodosa* do occur over a less-grassy ground layer. Across most of its distribution, common grasses include *Themeda triandra*, *Entolasia stricta*, *Panicum simile*, *Aristida vagans* and *Rytidosperma pallidum*. Shrub species including *Bursaria spinosa, Daviesia ulicifolia* subsp. *ulicifolia*, *Pultenaea euchila* and *Acacia ulicifolia* may be locally common, but are dependent on past fire history.

30e. Coastal Plains Stringybark - Apple Forest: This community is widespread particularly in the southern portions of the Study Area, and is dominated in the canopy by *Angophora costata*, *Corymbia gummifera* and *Eucalyptus globoidea*, and other species may include *Eucalyptus umbra* and *Eucalyptus capitellata* in some locations. Frequent fire across the site has reduced understorey structure and the abundance of individuals, but the most common species include *Acacia longifolia, Pultenaea euchila, Daviesia squarrosa, Acacia ulicifolia* and *Banksia collina*. *Themeda triandra* is the most frequently encountered grass species, along with *Entolasia stricta*, *Microlaena stipoides* var. *stipoides*, *Aristida vagans*, *Rytidosperma pallidum* and *Imperata cylindrica*. A variety of forbs and herbs are also present, and *Xanthorrhora latifolia* subsp. *latifolia* and *Xanthorrhoea macronema* can be locally common.

32. Riparian Paperbark - Peppermint Forest: Restricted to a few narrow drainage lines in the south of the Study Area, this community supports *Eucalyptus piperita* and *Eucalyptus resinifera* as key canopy species, over a sub-canopy of *Glochidion ferdinandi* and *Melaleuca linariifolia*, and a shrub layer of scattered *Banksia collina*, *Gompholobium latifolium*, *Polyscias sambuccifolia* and *Leptospermum polygalifolium* subsp. *cistmontanum*. Drainage channels are dominated by *Gahnia clarkei* and *Lomandra longifolia*, with several herbs, climbers and ferns. This community almost always occurs within a surrounding matrix of Coastal Sheltered Apple – Peppermint Forest.

46a. Freshwater Typha Wetland: All occurences of this community within the Study Area comprise old, disused water bodies and dams where *Typha orientalis* has colonized. Few other species are evident, although *Phragmites australis*, *Persicaria* spp. and other herbs may also be present.

3.5 Vegetation Mapping

A vegetation map has been prepared for the Study Area (Figure 6), and supplied to AEP in GIS format. Mapping layers contain fields identifying their map unit, community name, PCT and equivalent regional communities and Keith classes (Table 2). Table 3 provides the areal extent of each community within the Study Area.

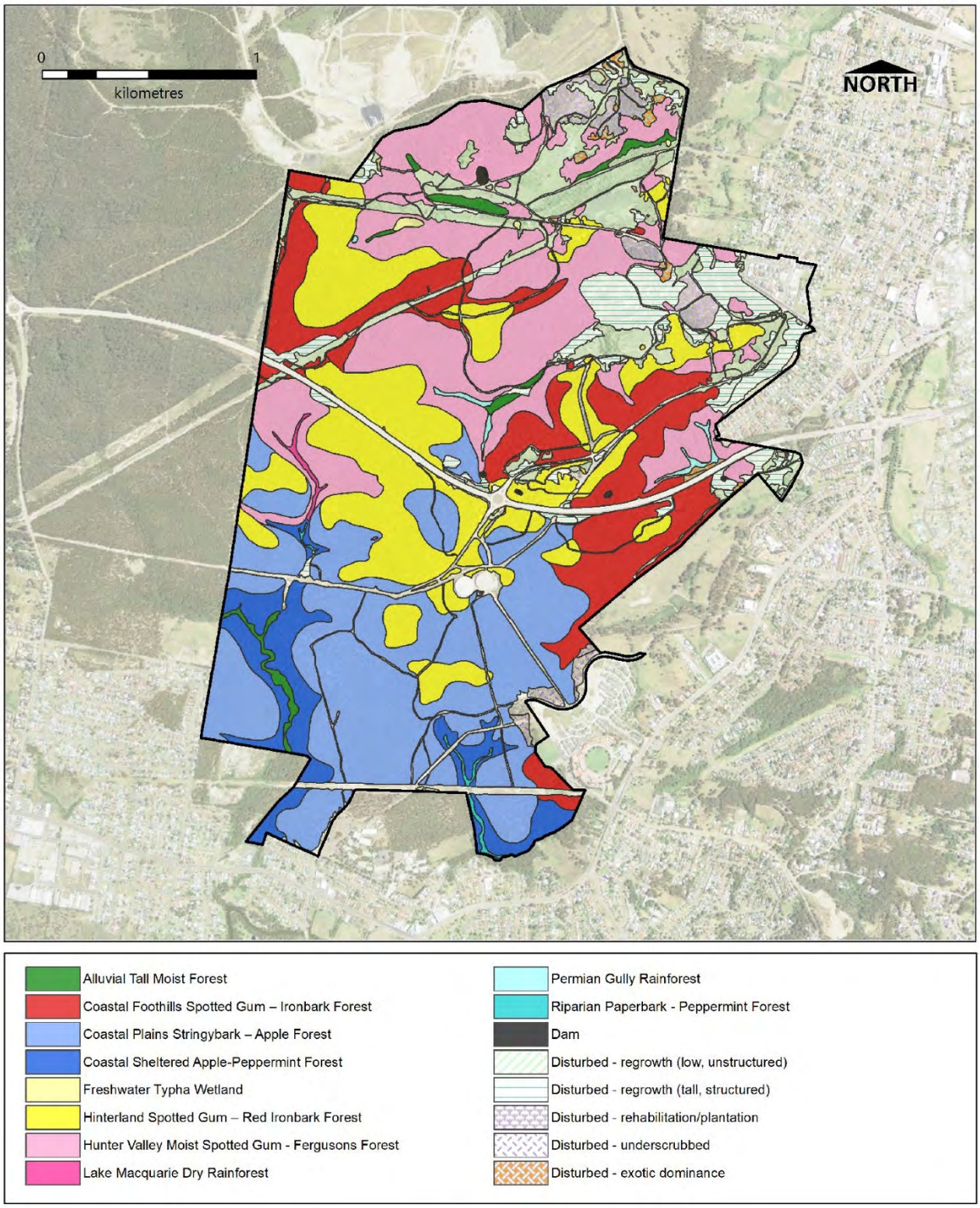


Figure 6 Vegetation map of the Study Area.

Table 2 GIS layer attributes.

Attribute	Example polygon
Map_Status	29July2020
Local_MU	17o
Local_Name	Hinterland Spotted Gum – Red Ironbark Forest
PCT_No	1592
PCT_Name	Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the lower Hunter
Keith_Formation	Dry Sclerophyll Forests
Keith_Class	Hunter-Macleay Dry Sclerophyll Forests
LHCCREMS_MU	17
LHCCREMS_Name	Lower Hunter Spotted Gum-Ironbark Forest
TEC_Equiv	Lower Hunter Spotted Gum Ironbark Forest EEC
GHV_Equiv	74 – Spotted Gum/ Red Ironbark/ Large-fruited Grey Gum shrub/grass open forest of the Hunter
Area_ha	3.2982559
Notes	dominated by Melaleuca nodosa in some parts

Table 3 Vegetation community extent.

Unit	Community	PCT	Extent (ha	% Study Area
1g	Permian Gully Rainforest	1543	2.03	0.31
3e	Lake Macquarie Dry Rainforest	1539	1.12	0.17
5	Alluvial Tall Moist Forest	1573	6.61	1.01
11	Coastal Sheltered Apple – Peppermint Forest	1621	31.11	4.76
11a	Riparian Paperbark - Peppermint Forest	1621	1.38	0.21
12d	Hunter Valley Moist Spotted Gum – Fergusons Forest	1584	123.82	18.96
15	Coastal Foothills Spotted Gum - Ironbark Forest	1588	74.60	11.42
17o	Hinterland Spotted Gum - Red Ironbark Forest	1592	111.20	17.03
30e	Coastal Plains Stringybark - Apple Forest	1619	140.16	21.46
46a	Freshwater Typha Wetland	1737	0.73	0.11
Total			492.76	75.44

4.0 Discussion

4.1 Summary

Ten vegetation communities have been delineated, described and mapped for the Study Area, using multivariate clustering and nMDS ordination techniques on 31 full floristic sample plots coupled with field observations. The 653 ha parcel of land shows good diversity of vegetation, ranging from small pockets of warm temperate rainforest and wet sclerophyll forest on alluvial soils in the deeper gullies, to dryer open forests on sandy loams and clays on slopes and ridges. Open forest of two main forms characterizes the bulk of the area, with those typified by Apple, Bloodwood, Stringybark and Peppermint (Coastal Plains Stringybark – Apple Forest, Coastal Sheltered Apple – Peppermint Forest) predominating in the south, while Spotted Gum with various Ironbarks, Grey Gums and Mahoganies (Hunter Valley Moist Spotted Gum – Fergusons Forest, Coastal Foothills Spotted Gum – Ironbark Forest, Hinterland Spotted Gum – Red Ironbark Forest) occurs in the north. Restricted areas of rainforest occur within protected rocky gullies of Maryland Creek and tributaries (Permian Gully Rainforest), while shallow drainage lines within the gentler catchment of Brush Creek support a form of dry rainforest (Lake Macquarie Dry Rainforest). Deeper alluvial soils carry remnant tall forest of Sydney Bluegum, Turpentine and Rough-barked Apple in the larger creeks (Alluvial Tall Moist Forest), or Paperbark and Cheesetree forest under Red Mahogany and Sydney Peppermint (Riparian Paperbark – Peppermint Forest) in smaller creek systems. Disused water bodies now support a reedland of Cumbungi (Freshwater Typha Wetland).

The bulk of the Study Area has been impact upon by regular fire, partical clearing and selective logging over a long period of time, and consequently structure and flrositic composition has been altered significantly. There are few old growth trees in any areas, the best occurring on higher slopes in the north of the Study Area. High frequency of fire, particularly in the southern portions, has resulted in the loss of obligate seeder and resprouting species as limited numbers of individuals are able to attain an age where they are protected from regular burns. Weed invasion too is widespread, particularly in areas where previous clearing has occurred, and/or rehabilitation has been implemented.

In total, two-hundred and fifty-five (255) native plant species and twenty-one (21) weeds were recorded within the Study Area. The threatened shrubs *Rhodamnia rubescens* (critically endangered) and *Callistemon linearifolius* (vulnerable) were recorded during general field investigations, however AEP have conducted more indepth targeted searches for these and other species. Additionally, the rare ironbark *Eucalyptus fergusonii* subsp. *fergusonii* was recorded at several locations. Diversity in eucalypts (*Angophora, Corymbia, Eucalyptus*) within the Study Area is impressive, with eighteen (18) naturally occurring species recorded over 587 ha of vegetated land (non-plantation or exotic). This equates to one newly encountered species every 33 ha, and is consistent with trends evident in other parts of the Hunter Valley (Bell in prep.).

4.2 Conservation Significance

4.2.1 Vegetation Communities

The vegetation present within the Study Area is representative of other areas in the lower Hunter Valley. All vegetation types present are known from other localities, and most are included in the formal conservation reserve network. Reserves known to support these vegetation types include Blue Gum Hills Regional Park, Lake Macquarie State Conservation Area, Sugarloaf State Conservation

Area, Stockrington State Conservation Area, Tingira Heights Nature Reserve, and Glenrock State Conservation Area.

Two of the ten defined vegetation communities fall within Threatened Ecological Communities (TECs) as listed under the *Biodiversity Conservation Act 2016*.

1. Alluvial Tall Moist Forest (Unit 5) - typified by tall emergent trees of *Eucalyptus saligna*, is included in **River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions EEC**. The alluvial soils on which this EEC occur have been largely cleared for agriculture over many decades, and most remnants that remain are small, fragmented and in low condition (Keith & Scott 2005). The few remnants in the Study Area are mostly in a similar state of condition, with the exception of that shown for Brush Creek which is in reasonable condition (but has been logged).

2. Hinterland Spotted Gum – Red Ironbark Forest (Unit 17o) – characterized by *Corymbia maculata* and *Eucalyptus fibrosa*, this community falls within the concept of **Lower Hunter Spotted Gum Ironbark Forest EEC.** Although centred in the Cessnock and Beresfield areas (DECC 2008), recent additions to knowledge have extended the range of this EEC to Columbey National Park and environs on the lower North Coast, and in the Newcastle, Lake Macquarie and Wyong areas (Bell 2009a, 2009b, 2013, 2016; Sims & Bell 2017). All of these areas support *Eucalyptus umbra* as an important co-associated species, and represent the near-coastal form of this EEC between Warnervale and Karuah. Within the Study Area, areas supporting this EEC have been moderately impacted upon by previous logging, particularly in the south. However, good stands remain in the north, with some including dense thickets of *Melelauca nodosa* which is otherwise rare in near-coastal forms of this community (but characteristic around Cessnock).

4.2.2 Plant Species

Two plant species currently listed as threatened in New South Wales are present within the Study Area. The first of these, *Rhodamnia rubescens* (critically endangered), has in recent years undergone a dramatic fall in population size across its geographical range due to Myrtle Rust (Carnegie et al. 2016), and all plants inspected during field activites supported mimimal signs of infection from this fungus. *Callistemon linearifolius* (vulnerable) was also recorded at several locations in the southern portions of the Study Area. Additionally, the rare taxon *Eucalyptus fergusonii* subsp. *fergusonii* is common across much of the northern portions, and co-dominates one vegetation community with other ironbarks *Eucalyptus placita* and *Eucalyptus siderophloia*. This species is relatively common in the lower Hunter Valley (e.g. Bell & Driscoll 2006, 2012), and is often confused with *Eucalyptus paniculata*.

4.3 Fire Ecology

Field observations suggest that the majority of the Study Area has experienced regular fire over many years, which is not surprising given the proximity to urban areas on the south and east of the site. This is most evident in the southern portions, where high frequency fire has resulted in the loss of shrubs and a predominance of grasses and other fire-resilient species. Coastal Plains Stringybark – Apple Forest, for example, should ordinarily support a well-developed shrub layer of *Banksia collina* and several species of wattles and peas, but with regular fire seed banks have been exhausted without replenishment due to limited maturing of shrubs. A high fire frequency here has been exacerbated by the dense trail network, which although necessary to control fire outbreaks also permits incursions by vandals and arsonists. Frequent fire is less evident in the northern parts of the

Study Area, and the combination of moister vegetation types and greater distance to urban areas there appears to have resulted in less frequent fire.

For the critically endangered *Rhodamnia rubescens*, there is limited information available on the response of this species to fire events. Clarke et al (2009) include it in the Gill fire response category of IV (resprouting from root buds), implying that damage inflicted by wildfire is only temporary. However, Carnegie et al (2016) suggest that resprouting leaf material following a fire event may lead to high infection rates of Myrtle Rust, so low fire frequencies or exclusion would be the preferred option for habitat supporting this species. The vulnerable *Callistemon linearifolius* is capabale of continual resprouting following fire, however as with all serotinous species appropriate fire-free periods will be required occasionally to allow young plants to attain a size that will be able to resprout following the next fire event.

5.0 References

Bell, S. (2009a) Defining and mapping an endangered ecological community within Lake Macquarie Local Government Area, New South Wales. *Australasian Plant Conservation* 18(3): 18-19.

Bell, S.A.J. (2009b) Vegetation and floristics of Columbey National Park, lower Hunter Valley, New South Wales. *Cunninghamia* 11(2): 241-275.

Bell, S.A.J. (2010) *Lower Hunter Spotted Gum – Ironbark Forest: Distribution and composition in Cessnock, Maitland, Newcastle & Wyong LGAs*. Report to Department of Environment & Climate Change (Coffs Harbour). Eastcoast Flora Survey.

Bell, S.A.J. (2013) *Defining and mapping rare vegetation communities: improving techniques to assist land-use planning and conservation*. Unpublished PhD Thesis, University of Newcastle.

Bell, S.A.J. (2016) *Vegetation and floristics of the Columbey Conservation Lands (NP & SCA), lower Hunter Valley, New South Wales*. Unpublished Report to Office of Environment & Heritage (Gloucester). January 2016. Eastcoast Flora Survey.

Bell, S.A.J. & Driscoll, C. (2006) *Vegetation Mapping of Watagans National Park and Jilliby State Conservation Area*. Summary Report to Parks & Wildlife Division, Department of Environment and Conservation. January 2006.

Bell, S.A.J. & Driscoll, C. (2012) *Vegetation and floristics of Sugarloaf State Conservation Area, Lake Macquarie, New South Wales*. Report to Office of Environment and Heritage. Eastcoast Flora Survey, September 2012.

Bell, S.A.J. & Driscoll, C. (2016) *Volume 1: Vegetation Mapping Report, Lake Macquarie Local Government Area. Stages 1 - 6*. Unpublished Report to Lake Macquarie City Council. March 2016. Eastcoast Flora Survey.

Bell, S.A.J. & Driscoll, C. (in press) Data-informed Sampling and Mapping: an approach to ensure plot-based classifications locate, classify and map rare and restricted vegetation types. *Australian Journal of Botany* (in press)

Bell, S.A.J. (in prep) Notes on the distribution and diversity of eucalypts (*Angophora*, *Corymbia*, *Eucalyptus*: Myrtaceae) in the Hunter Region of New South Wales, Australia.

Braun-Blanquet J (1928) *Pflazensoziologie: Grundzuge der Vegetationskunde*. Springer, Berlin.

Bureau of Meteorology (2020) http://www.bom.gov.au/climate/data

Carnegie, A.J., Kathuria, A., Pegg, G.S., Entwistle, P., Nagel, M., & Giblin, F.R. (2016) Impact of the invasive rust *Puccinia psidii* (myrtle rust) on native Myrtaceae in natural ecosystems in Australia. *Biological Invasions* 18: 127–144.

Clarke, K.R. & Gorley, R.N. (2006) *PRIMER v6: User Manual/ Tutorial*. PRIMER-E: Plymouth.

Clarke, P.J., Knox, K.J.E., Campbell, M.L., & Copeland, L.M. (2009) Post-fire recovery of woody plants in the New England Tableland Bioregion. *Cunninghamia* 11(2): 221-240.

Colquhoun G.P., Hughes K.S., Deyssing L., Ballard J.C., Folkes C.B, Phillips G., Troedson A.L. & Fitzherbert J.A. (2020) *New South Wales Seamless Geology dataset, version 2.0* [Digital Dataset]. Geological Survey of New South Wales, Department of Regional NSW, Maitland.

Department of Environment & Climate Change (2008) *Vegetation of the Cessnock-Kurri Region: Survey, Classification & Mapping, Cessnock LGA, New South Wales*. Department of Environment and Climate Change (NSW), Sydney.

Department of Mineral Resources (1999) *Lower North East Region 1:250,000 scale equivalent geology [lner5ge_p (polygons) and lner5ge_l (lines or arcs)] geological coverage comprising the area covered by parts of the Dorrigo, Tamworth, Hastings, Singleton and Newcastle 1:250 000 sheet areas, Hunter Coalfield and Newcastle Coalfield Regional Geology 1:100 000 sheet areas and part Sydney 1:250 000 sheet area*. CRA project Lower North East. NSW Department of Mineral Resources.

Hunter, J. (2016) Validation of the Greater Hunter Native Vegetation Mapping as it pertains to the Upper Hunter region of New South Wales. *Ecological Management & Restoration* 17(1): 40-46.

Keith, D.A. & Scott, J. (2005) Native vegetation of coastal floodplains – a diagnosis of the major plant communities in New South Wales. *Pacific Conservation Biology* 11(2): 81-104.

Klaphake, V. (2010) *Eucalypts of the Sydney Region*. Second edition.

Matthei, L.E. (1995) *Soil landscapes of the Newcastle 1:100 000 sheet - map*. Department of Land and Water Conservation: Sydney.

National Parks and Wildlife Service (2000) *Vegetation survey, classification and mapping: Lower Hunter and Central Coast region*. A project undertaken for the Lower Hunter and Central Coast Regional Environmental Management Strategy by CRA Unit, Sydney Zone, NPWS. April 2000.

Office of Environment and Heritage (OEH) (2017) *Biodiversity Assessment Method*. Office of Environment and Heritage, Sydney.

Sims, R. & Bell, S. (2017) *Vegetation of the Branch (Stage One)*. Unpublished Report to Mid Coast Council.

Appendix 1 Species List

Class	Family	Species	CommonName
Cycadopsida (Cycads)	Zamiaceae	*Macrozamia reducta*	
Filicopsida (Ferns)	Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair
		Adiantum hispidulum	Rough Maidenhair
		Cheilanthes sieberi subsp. sieberi	Rock Fern
		Pellaea falcata	Sickle Fern
		Pellaea paradoxa	
	Aspleniaceae	*Asplenium australasicum*	Bird's Nest Fern
	Blechnaceae	*Blechnum cartilagineum*	Gristle Fern
		Doodia aspera	Prickly Rasp Fern
	Davalliaceae	*Nephrolepis cordifolia* *	Fishbone Fern *
	Dennstaedtiaceae	*Pteridium esculentum*	Bracken
	Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern
	Grammitidaceae	*Grammitis billardierei*	Finger Fern
	Lindsaeaceae	*Lindsaea linearis*	Screw Fern
	Polypodiaceae	*Microsorum scandens*	Fragrant Fern
		Platycerium bifurcatum	Elkhorn Fern
		Pyrrosia rupestris	Rock Felt Fern
	Thelypteridaceae	*Christella dentata*	Binung
Magnoliopsida (Flowering plants) Dicotyledons	Acanthaceae	*Brunoniella australis*	Blue Trumpet
		Pseuderanthemum variabile	Pastel Flower
	Apiaceae	*Centella asiatica*	Indian Pennywort
		Daucus glochidiatus	Native Carrot
		Hydrocotyle laxiflora	Stinking Pennywort
	Apocynaceae	*Parsonsia straminea*	Common Silkpod
		Tylophora barbata	Bearded Tylophora
	Araliaceae	*Polyscias sambucifolia subsp. sambucifolia*	
	Asteraceae	*Ageratina adenophora* *	Crofton Weed *
		Hypochaeris radicata *	Catsear *
		Lagenophora stipitata	Common Lagenophora
		Senecio madagascariensis *	Fireweed *
		Sigesbeckia orientalis subsp. orientalis	Indian Weed
		Sonchus oleraceus *	Common Sowthistle *
		Taraxacum officinale *	Dandelion *
		Vernonia cinerea var. cinerea	
	Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine

Class	Family	Species	CommonName
	Campanulaceae	*Lobelia purpurascens*	Whiteroot
	Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak
		Allocasuarina torulosa	Forest Oak
	Celastraceae	*Denhamia silvestris*	Narrow-leaved Orangebark
	Convolvulaceae	*Dichondra repens*	Kidney Weed
		Polymeria calycina	
	Cunoniaceae	*Callicoma serratifolia*	Black Wattle
		Schizomeria ovata	Crabapple
	Dilleniaceae	*Hibbertia aspera subsp. aspera*	
		Hibbertia dentata	Twining Guinea Flower
		Hibbertia empetrifolia subsp. empetrifolia	
		Hibbertia pedunculata	
		Hibbertia scandens	Climbing Guinea Flower
	Ebenaceae	*Diospyros australis*	Black Plum
	Elaeocarpaceae	*Elaeocarpus obovatus*	Hard Quandong
	Ericaceae	*Epacris pulchella*	Wallum Heath
		Monotoca scoparia	
	Euphorbiaceae	*Claoxylon australe*	Brittlewood
		Croton verreauxii	Green Native Cascarilla
		Omalanthus nutans	
	Eupomatiaceae	*Eupomatia laurina*	Bolwarra
	Fabaceae (Caesalpinioideae)	*Senna pendula var. glabrata **	
	Fabaceae (Faboideae)	*Daviesia squarrosa*	
		Daviesia ulicifolia subsp. ulicifolia	
		Desmodium gunnii	Slender Tick-trefoil
		Desmodium rhytidophyllum	
		Dillwynia retorta	
		Glycine clandestina	Twining glycine
		Glycine microphylla	Small-leaf Glycine
		Glycine tabacina	Variable Glycine
		Gompholobium latifolium	Golden Glory Pea
		Hardenbergia violacea	False Sarsaparilla
		Indigofera australis	Australian Indigo
		Kennedia rubicunda	Dusky Coral Pea
		Mirbelia rubiifolia	Heathy Mirbelia
		Oxytes brachypoda	Large Tick-trefoil
		Pultenaea euchila	
		Pultenaea paleacea	
		Pultenaea retusa	
		Pultenaea villosa	Hairy Bush-pea
	Fabaceae (Mimosoideae)	*Acacia falcata*	
		*Acacia fimbriata **	Fringed Wattle *

Class	Family	Species	CommonName
		Acacia implexa	Hickory Wattle
		Acacia irrorata subsp. irrorata	Green Wattle
		Acacia longifolia subsp. longifolia	Sydney Golden Wattle
		Acacia maidenii	Maiden's Wattle
		Acacia myrtifolia	Red-stemmed Wattle
		Acacia stricta	Straight Wattle
		Acacia terminalis subsp. longiaxialis	
		Acacia ulicifolia	Prickly Moses
	Geraniaceae	*Geranium homeanum*	
		Geranium solanderi var. solanderi	
	Goodeniaceae	*Goodenia hederacea subsp. hederacea*	
		Goodenia heterophylla subsp. heterophylla	
		Goodenia ovata	Hop Goodenia
	Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort
		Gonocarpus teucrioides	Germander Raspwort
	Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum
		Plectranthus parviflorus	
	Lauraceae	*Cassytha glabella f. glabella*	
		*Cinnamomum camphora **	Camphor Laurel *
		Cryptocarya microneura	Murrogun
		Cryptocarya rigida	Forest Maple
	Loganiaceae	*Logania albiflora*	
	Loranthaceae	*Dendrophthoe vitellina*	
	Malvaceae	*Hibiscus heterophyllus subsp. heterophyllus*	Native Rosella
		Hibiscus pedunculatus	Wild Hibiscus
		*Sida rhombifolia **	Paddy's Lucerne *
	Meliaceae	*Synoum glandulosum subsp. glandulosum*	Scentless Rosewood
	Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine
		Stephania japonica var. discolor	Snake Vine
	Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea
	Moraceae	*Ficus coronata*	Creek Sandpaper Fig
		Ficus rubiginosa	Port Jackson Fig
	Myrsinaceae	*Embelia australiana*	
		Myrsine howittiana	Brush Muttonwood
		Myrsine variabilis	
	Myrtaceae	*Acmena smithii*	Lilly Pilly
		Angophora costata	Sydney Red Gum
		Angophora floribunda	Rough-barked Apple
		Backhousia myrtifolia	Grey Myrtle
		Callistemon linearifolius	Netted Bottle Brush
		Callistemon linearis	Narrow-leaved Bottlebrush
		*Corymbia citriodora **	Lemon-scented Gum *

Class	Family	Species	CommonName
		Corymbia gummifera	Red Bloodwood
		Corymbia maculata	Spotted Gum
		Eucalyptus acmenoides	White Mahogany
		Eucalyptus capitellata	Brown Stringybark
		Eucalyptus fergusonii subsp. fergusonii	
		Eucalyptus fibrosa	Red Ironbark
		Eucalyptus globoidea	White Stringybark
		Eucalyptus piperita	Sydney Peppermint
		Eucalyptus placita	A Grey Ironbark
		Eucalyptus propinqua	Small-fruited Grey Gum
		Eucalyptus punctata	Grey Gum
		Eucalyptus resinifera subsp. resinifera	
		Eucalyptus saligna	Sydney Blue Gum
		Eucalyptus siderophloia	Grey Ironbark
		Eucalyptus tereticornis	Forest Red Gum
		Eucalyptus umbra	Bastard Mahogany
		Leptospermum polygalifolium subsp. cismontanum	
		Leptospermum trinervium	Slender Tea-tree
		Melaleuca linariifolia	Flax-leaved Paperbark
		Melaleuca nodosa	
		Melaleuca styphelioides	Prickly-leaved Tea Tree
		Melaleuca thymifolia	Thyme Honey-myrtle
		Rhodamnia rubescens	Scrub Turpentine
		Sannantha pluriflora	
		Syncarpia glomulifera subsp. glomulifera	
	Ochnaceae	*Ochna serrulata* *	Mickey Mouse Plant *
	Oleaceae	*Ligustrum sinense* *	Small-leaved Privet *
		Notelaea longifolia f. longifolia	
	Oxalidaceae	*Oxalis perennans*	
	Peperomiaceae	*Peperomia tetraphylla*	Four-leaved Peperomia
	Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush
		Glochidion ferdinandi var. ferdinandi	Cheese Tree
		Phyllanthus hirtellus	Thyme Spurge
	Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry
		Bursaria spinosa	Native Blackthorn
		Pittosporum multiflorum	Orange Thorn
		Pittosporum revolutum	Rough Fruit Pittosporum
		Pittosporum undulatum	Sweet Pittosporum
	Plantaginaceae	*Plantago debilis*	Shade Plantain
		Veronica plebeia	Trailing Speedwell
	Proteaceae	*Banksia collina*	
		Persoonia levis	Broad-leaved Geebung
		Persoonia linearis	Narrow-leaved Geebung
	Ranunculaceae	*Clematis glycinoides var. glycinoides*	
	Rhamnaceae	*Alphitonia excelsa*	Red Ash

Class	Family	Species	CommonName
	Rosaceae	*Rubus moluccanus var. trilobus*	Molucca Bramble
		Rubus rosifolius	Rose-leaf Bramble
	Rubiaceae	*Galium binifolium*	
		Galium propinquum	Maori Bedstraw
		Morinda jasminoides	Sweet Morinda
		Opercularia diphylla	Stinkweed
		Opercularia varia	Variable Stinkweed
		Psychotria loniceroides	Hairy Psychotria
	Rutaceae	*Boronia polygalifolia*	Dwarf Boronia
		Citrus x taitensis *	Rough Lemon *
		Sarcomelicope simplicifolia subsp. simplicifolia	Big Yellow Wood
		Zieria smithii	Sandfly Zieria
	Sapindaceae	*Alectryon subcinereus*	Wild Quince
		Dodonaea triquetra	Large-leaf Hop-bush
		Guioa semiglauca	Guioa
	Solanaceae	*Duboisia myoporoides*	Corkwood
		Solanum brownii	Violet Nightshade
		Solanum mauritianum *	Wild Tobacco Bush *
		Solanum nigrum *	Black-berry Nightshade *
		Solanum prinophyllum	Forest Nightshade
		Solanum stelligerum	Devil's Needles
	Sterculiaceae	*Brachychiton populneus subsp. populneus*	
	Stylidiaceae	*Stylidium graminifolium*	Grass Triggerplant
	Thymelaeaceae	*Pimelea linifolia subsp. linifolia*	
	Verbenaceae	*Lantana camara* *	Lantana *
	Violaceae	*Viola hederacea*	Ivy-leaved Violet
	Vitaceae	*Cayratia clematidea*	Native Grape
		Cissus antarctica	Water Vine
Magnoliopsida (Flowering plants) Monocotyledons	Anthericaceae	*Arthropodium sp. B*	
	Araceae	*Gymnostachys anceps*	Settler's Twine
	Arecaceae	*Livistona australis*	Cabbage Palm
	Asparagaceae	*Asparagus aethiopicus* *	Asparagus Fern *
	Commelinaceae	*Commelina cyanea*	Native Wandering Jew
	Cyperaceae	*Carex longebrachiata*	
		Cyperus gracilis	Slender Flat-sedge
		Cyperus laevis	
		Gahnia clarkei	Tall Saw-sedge
		Lepidosperma laterale	Variable Sword-sedge
		Ptilothrix deusta	

Class	Family	Species	CommonName
		Schoenus melanostachys	
		Scleria mackaviensis	
	Dioscoreaceae	*Dioscorea transversa*	Native Yam
	Lomandraceae	*Lomandra confertifolia subsp. pallida*	Matrush
		Lomandra cylindrica	
		Lomandra filiformis subsp. coriacea	Wattle Matt-rush
		Lomandra filiformis subsp. filiformis	
		Lomandra longifolia	Spiny-headed Mat-rush
		Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush
		Lomandra obliqua	
	Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry
		Geitonoplesium cymosum	Scrambling Lily
	Orchidaceae	*Acianthus fornicatus*	Pixie Caps
		Caladenia catenata	White Caladenia
		Calochilus spp.	
		Pterostylis alveata	Coastal Greenhood
		Pterostylis longifolia	Tall Greenhood
		Pterostylis nutans	Nodding Greenhood
	Phormiaceae	*Dianella caerulea var. assera*	
		Dianella caerulea var. caerulea	
		Dianella revoluta var. revoluta	A Blue Flax Lily
	Poaceae	*Aristida vagans*	Threeawn Speargrass
		Capillipedium parviflorum	Scented-top Grass
		*Cenchrus clandestinus **	Kikuyu Grass *
		*Cortaderia selloana **	Pampas Grass *
		Cymbopogon refractus	Barbed Wire Grass
		Dichelachne micrantha	Shorthair Plumegrass
		Digitaria diffusa	Open Summer-grass
		Digitaria parviflora	Small-flowered Finger Grass
		Echinopogon caespitosus var. caespitosus	Tufted Hedgehog Grass
		Echinopogon ovatus	Forest Hedgehog Grass
		Entolasia stricta	Wiry Panic
		Eragrostis alveiformis	
		Imperata cylindrica	Blady Grass
		Lachnagrostis aemula	Blowngrass
		*Megathyrsus maximus var. maximus **	
		Microlaena stipoides var. stipoides	Weeping Grass
		Oplismenus imbecillis	
		Panicum simile	Two-colour Panic
		Paspalidium distans	
		Paspalum orbiculare	Ditch Millet
		Poa affinis	
		Poa labillardierei var. labillardierei	Tussock
		Rytidosperma pallidum	Silvertop Wallaby Grass
		Rytidosperma tenuius	
		*Sorghum halepense **	Johnson Grass *
		Themeda triandra	
	Smilacaceae	*Smilax australis*	Lawyer Vine
		Smilax glyciphylla	Sweet Sarsparilla

Class	Family	Species	CommonName
	Uvulariaceae	*Schelhammera undulata*	
	Xanthorrhoeaceae	*Xanthorrhoea latifolia subsp. latifolia* *Xanthorrhoea macronema*	

* = exotic or locally non-endemic species

Appendix 2 Vegetation Community Profiles

Community profiles of each vegetation community present within the Study Area have been developed following the general format used by *Eastcoast Flora Survey* over several years. The rationale behind the profiles is to assist end-users in the interpretation of delineated map units, and to allow the general reader with at least some basic knowledge of common plant species to identify the different vegetation types.

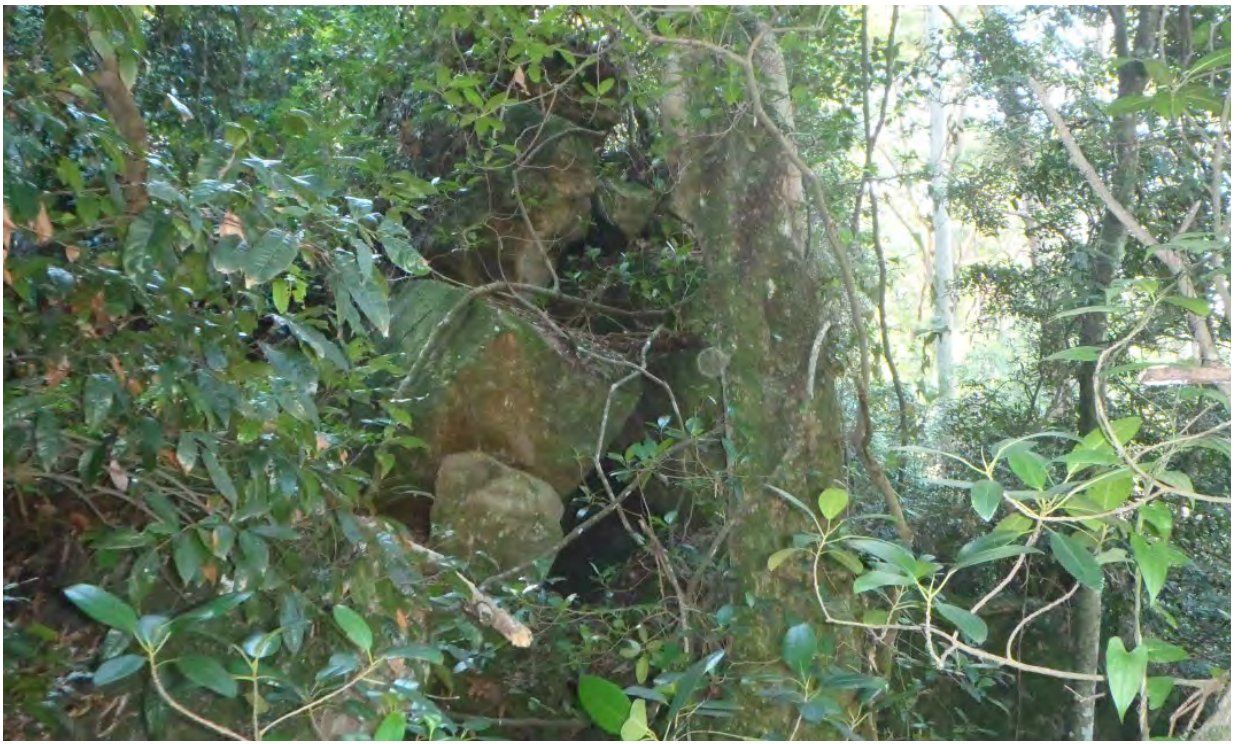
A summary map showing the distribution of each community within the offset is provided with each profile. For each vegetation community, a summary of the basic structural makeup of that unit is given. The accuracy of structural information presented with each profile is governed by the sample size of each community (shown as "n" in the structural tables). Where possible, the equivalent vegetation classification within other regional assessments have been provided under the community name, to assist in regional comparisons and significance assessments. A question mark in these situations signifies uncertainty in equivalence.

The derivation of diagnostic species for each community has been defined using the SIMPER routine in *Primer* on full floristic plot data. SIMPER analysis provides the relative contributions of each species to the Bray-Curtis similarity within each of the defined vegetation communities. Only those species contributing to a total cumulative contribution of 99% of the average similarity (ie: the value shown at the top of each floristic table) for each community are listed. These species can be described of as *typical* of that community, and have a consistently large presence within the data as reflected in the ratio of their contribution to the standard deviation (the Sim/SD field in each table) across the within-group similarities (the average similarity). Community groups with less than two samples (ie: Permian Gully Rainforest, Lake Macquarie Dry Rainforest) cannot be analysed in this way. Instead, the full species list from the single plot in that community is shown, in decreasing Braun-Blanquet (BB) cover abundance value.

In the *Key Diagnostic Species* tables in each profile:

- Average similarity — is the within-group similarity for all pairs of sample plots comprising the community. Higher average similarity indicates a better defined community.
- Av.Abund — is the average cover abundance of that species within sample plots comprising the community
- Av.Sim — is the average similarity (contribution) made by each species to the within-group similarity (the overall average similarity).
- Sim/SD — is the ratio of average similarity to standard deviation for each species across all pairs of samples. A high ratio represents a good discriminating species. At least three samples are required for this ratio to be calculated (not available for four communities).
- Contrib % — is the percentage contribution of each species to the overall average similarity for the community.

Permian Gully Rainforest Unit 1g



Keith Formation:	Rainforests
Keith Class:	Northern Warm Temperate Rainforests
PCT	PCT1543: Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley (?)
LHCCREMS	MU1: Coastal Wet Gully Forest
GHV	8: Lily Pilly/ Grey Myrtle/ Rasp Fern warm temperate rainforest on ranges, Central & lower North Coast
Floristic Sample Plots	WLSR8P2U

General Description:

Occurs in a single location in the Study Area, near the headwaters of Maryland Creek and below a small rocky cliffline. A relatively diverse range of species are present here, although because of its very limited areal extent it may be considered a poor form of the Permian Gully Rainforest present in other parts of the lower Hunter Valley. *Ficus rubiginosa* is the most obvious canopy species present, with other species such as *Cryptocarya rigida, Acmena smithii, Schizomeria ovata* and *Eupomatia laurina* common. An abundance of epiphytic and lithophytic fern species are also evident, including *Pyrrosia rupestris, Asplenium australasicum, Microscorum scandens* and *Notogrammits billardierei*. Vines include *Parsonsia straminea*, *Cissus antactica* and *Smilax glyciphylla*.

Characteristic Features:

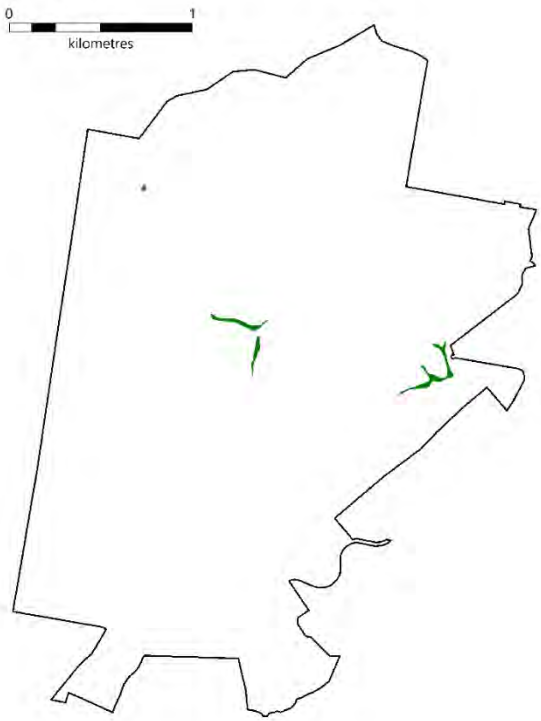
- nestled within the head of a rocky section of Maryland Creek below a small escarpement where protected from fire
- canopy characterised by Rusty Fig (*Ficus rubiginosa*), but Lily Pily (*Acmena smithii*) and other rainforest trees also present, but in low numbers
- mid-storey of various mesic tree and large shrub species, growing amongst rocky boulders
- vines common, scrambling over rocks and other plants
- epiphytic and lithophytic ferns abundant

Known Floristic/ Structural Variations:

Occurring only in a single location, so no floristic or structural variations evident.

Relationship to Other Communities:

Alluvial Tall Moist Forest (Unit 5) shares a number of mesic species with this community, however that community occurs only on deeper alluvial soils associated with major creeks. It is characterised by *Eucalyptus saligna*, *Syncarpia glomulifera* and/or *Angophora floribunda* in the canopy, which do not occur in this community. Permian Gully Rainforest also supports several epiphytic and lithophytic fern species which are not present in Unit 5.



Distribution:

Total area: 2.03 ha (0.31 % of Study Area)

Significant Species:

- Undescribed species – *none recorded*
- Threatened (EPBC Act) – *none recorded*
- Threatened (BC Act) – *none recorded*
- Rare (ROTAP) – *none recorded*

Species Richness:

Number of plots:	1
Total native species:	40
Mean spp / plot (+/- SD):	40 (+/- n/a)

Community Conservation Status:

EPBC Act (1999) Status:	not currently listed
BC Act (2016) Status:	not currently listed

Vegetation Structure [based on 1 plot]:

Stratum	Mean height (m)	Min height (m)	Max height (m)	Cover (mean %)	Cover (Sdev)	n
Tallest	-	12	20	80.00	-	1
Middle	-	3	10	30.00	-	1
Lower	-	-	-	-	-	-
Ground	-	0.1	0.7	5.00	-	1

Key Diagnostic Species [based on 1 plot]:

Permian Gully Rainforest					Average similarity: n/a
Habit	**Species**	**Av.Abund**	**Av.Sim**	**Sim/SD**	**C/A**
Small Tree	*Ficus rubiginosa*	-	-	-	5
	Acmena smithii	-	-	-	3
	Cryptocarya rigida	-	-	-	3

Permian Gully Rainforest					Average similarity: n/a
Habit	Species	Av.Abund	Av.Sim	Sim/SD	C/A
	Schizomeria ovata	-	-	-	3
	Alectryon subcinereus	-	-	-	1
	Claoxylon australe	-	-	-	1
	Guioa semiglauca	-	-	-	1
	Sarcomelicope simplicifolia subsp. simplicifolia	-	-	-	1
Shrub	*Eupomatia laurina*	-	-	-	3
	Diospyros australis	-	-	-	2
	Homalanthus populifolius	-	-	-	2
	Breynia oblongifolia	-	-	-	1
	Embelia Australiana	-	-	-	1
	Myrsine variabilis	-	-	-	1
	Notelaea longifolia forma longifolia	-	-	-	1
	Pittosporum revolutum	-	-	-	1
	Psychotria loniceroides	-	-	-	1
	Synoum glandulosum subsp. glandulosum	-	-	-	1
	Wilkea huegeliana	-	-	-	1
Ground Fern	*Adiantum hispidulum*	-	-	-	2
	Doodia aspera	-	-	-	2
	Blechnum cartilagineum	-	-	-	1
	Calochlaena dubia	-	-	-	1
	Pellaea paradoxa	-	-	-	1
Epiphytic Fern	*Asplenium australasicum*	-	-	-	2
	Notogrammitis billardierei	-	-	-	2
	Pyrrosia rupestris	-	-	-	2
	Microsorum scandens	-	-	-	1
Forb	*Peperomia tetraphylla*	-	-	-	2
Twiner	*Cissus antartica*	-	-	-	1
	Dioscorea transversa	-	-	-	1
	Geitonoplesium cymosum	-	-	-	1
	Morinda jasminoides	-	-	-	1
	Parsonsia straminea	-	-	-	1
	Smilax australis	-	-	-	1
	Smilax glyciphylla	-	-	-	1
	Stephania japonica var. discolor	-	-	-	1
Grass	*Oplismenus imbecillus*	-	-	-	2

Lake Macquarie Dry Rainforest Unit 3e

Keith Formation:	Rainforests
Keith Class:	Dry Rainforests
PCT	PCT1539: Grey Myrtle sheltered gully dry rainforest in gullies of the Sydney Basin
LHCCREMS	MU3: Hunter Valley Dry Rainforest
GHV	21: Grey Myrtle sheltered gully dry rainforest in gullies of the Sydney Basin
Floristic Sample Plots	WLSS3A3V

General Description:

A few small gullies show a dominance of *Backhousia myrtifolia* and *Melaleuca styphelioides* within the wider open forest of *Corymbia maculata*, *Eucalyptus umbra* and *Eucalyptus punctata*. These riparian 'bands' are barely 10 m wide in places, yet carry a range of mesic plant species otherwise absent from adjacent slopes. Frequent fire events have likely impacted on this vegetation type, constraining it to the immediate creekline environment. Co-occurring species within this type include *Glochidion ferdinandi* and *Rhodamnia rubescens*, with *Lomandra longifolia*, *Adiantum aethiopicum*, *Oplismenus imbecillus* and *Dichondra repens* forming the ground layer.

Characteristic Features:

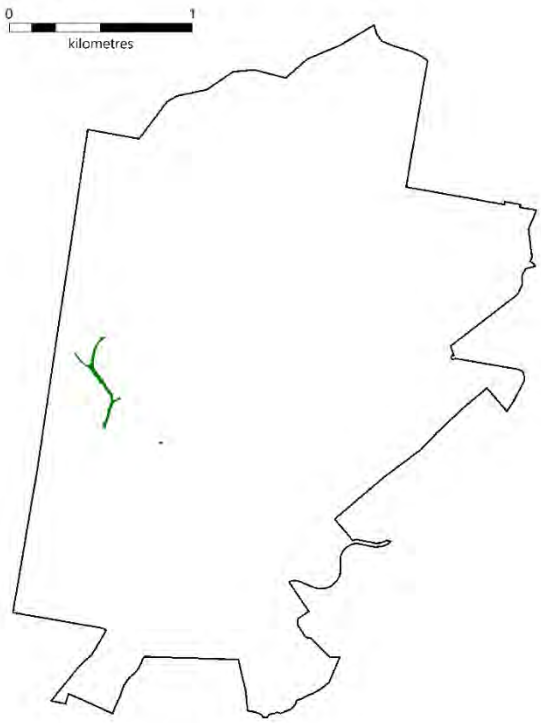
- low relief drainage lines
- canopy of Grey Myrtle (*Backhousia myrtifolia*) and Prickly-leaved Tea-tree (*Melaleuca styphelioides*) with Cheesetree (*Glochidion ferdinandi*)
- mid-layer of scattered shrubs, including Scrub Myrtle (*Rhodamnia rubescens*) in some parts
- well developed ground cover ferns, herbs or grasses, with *Lomandra longifolia* prominent along drainage channels

Known Floristic/ Structural Variations:

Structural and floristic variation is determined primarily by fire history; frequent fire events have simplified both over many years.

Relationship to Other Communities:

The dominance of *Backhousia myrtifolia* with *Melaleuca styphelioides* and *Glochidion ferdinandi* in the small tree layer distinguishes this community from similar riparian units. All three species may be present in Permian Gully Rainforest (Unit 1g) or Alluvial Tall Moist Forest (Unit 5), however the former supports a much more diverse suite of mesic/rainforest species, and the latter occurs on deeper alluvial soils where *Eucalyptus saligna* and *Syncarpia glomulifera* subsp. *glomulifera* are prominent. Riparian Paperbark – Peppermint Forest (Unit 11a) is also similar, but *Melaleuca linariifolia* replaces *Melaleuca styphelioides*, *Eucalyptus piperita* and *Angophora costata* are common emergents, and *Gahnia clarkei* dominates the ground layer.



Distribution:

Total area: 1.12 ha (0.17 % of Study Area)

Significant Species:

- Undescribed species – *none recorded*
- Threatened (EPBC Act) – *none recorded*
- Threatened (BC Act) – *Rhodamnia rubescens* (critically endangered)
- Rare (ROTAP) – *none recorded*

Species Richness:

Number of plots: 1
Total native species: 48
Mean species / plot (+/- SD): 48.0 (+/- n/a)

Community Conservation Status:

EPBC Act (1999) Status: not currently listed
BC Act (2016) Status: not currently listed

Vegetation Structure [based on 1 plot]:

Stratum	Mean height (m)	Min height (m)	Max height (m)	Cover (mean %)	Cover (Sdev)	n
Tallest	-	20	25	35	n/a	1
Middle	-	10	18	60	n/a	1
Lower	-	1	1.5	2	n/a	1
Ground	-	0.1	0.8	90	n/a	1

Key Diagnostic Species [based on 1 plot]:

Lake Macquarie Dry Rainforest					Average similarity: n/a
Habit	Species	Av.Abund	Av.Sim	Sim/SD	BB Cover
Tree	*Backhousia myrtifolia*	-	-	-	3
	Eucalyptus umbra	-	-	-	3
	Melaleuca styphelioides	-	-	-	3
	Glochidion ferdinandi var. ferdinandi	-	-	-	3
	Allocasuarina torulosa	-	-	-	1
	Corymbia maculata	-	-	-	1
	Eucalyptus punctata	-	-	-	1
Shrub	*Acacia irrorata subsp. irrorata*	-	-	-	2
	Zieria smithii	-	-	-	2
	Acacia longifolia subsp. longifolia	-	-	-	1
	Clerodendrum tomentosum	-	-	-	1
	Goodenia ovata	-	-	-	1
	Leptospermum polygalifolium subsp. cistmontanum	-	-	-	1
	Logania albiflora	-	-	-	1
	Myrsine howittiana	-	-	-	1
	Pultenaea villosa	-	-	-	1
	Synoum glandulosum subsp. glandulosum	-	-	-	1
Ground Fern	*Adiantum aethiopicum*	-	-	-	4
	Doodia aspera	-	-	-	1
Grass	*Oplismenus imbecillus*	-	-	-	3
	Digitaria parviflora	-	-	-	2
	Entolasia stricta	-	-	-	2
	Microlaena stipoides var. stipoides	-	-	-	2
	Panicum simile	-	-	-	2
Graminoid	*Lomandra longifolia*	-	-	-	3
	Gymnostachys anceps	-	-	-	2
Herb	*Dichondra repens*	-	-	-	3
	Galium propinquum	-	-	-	2
	Hydrocotyle laxiflora	-	-	-	2
	Lagenophora stipitata	-	-	-	2
	Lobelia purpurascens	-	-	-	2
	Plantago debilis	-	-	-	2
	Pseuderanthemum variabile	-	-	-	2
	Sigesbeckia orientalis	-	-	-	2
	Veronica plebeia	-	-	-	2
	Viola hederacea	-	-	-	2
	Gonocarpus tetragynus	-	-	-	1
Sedge	*Gahnia clarkei*	-	-	-	1
	Carex longebrachtiata	-	-	-	1
Twiner	*Dioscorea transversa*	-	-	-	2

Lake Macquarie Dry Rainforest					Average similarity: n/a
Habit	Species	Av.Abund	Av.Sim	Sim/SD	BB Cover
	Geitonoplesium cymosum	-	-	-	2
	Polymeria calycina	-	-	-	2
	Cayratia clematidea	-	-	-	1
	Clematis glycinoides var. glycinoides	-	-	-	1
	Glycine clandestina	-	-	-	1
	Pandorea pandorana	-	-	-	1
	Smilax australis	-	-	-	1
	Sarcopetalum harveyanum	-	-	-	1

Alluvial Tall Moist Forest Unit 5

Keith Formation:	Wet Sclerophyll Forests
Keith Class:	North Coast wet Sclerophyll Forests
PCT	PCT1573: Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment
LHCCREMS	MU5: Alluvial Tall Moist Forest
GHV	50: Blackbutt/ Turpentine/ Sydney Blue Gum mesic tall open forest on ranges of the Central Coast
Floristic Sample Plots	WLSQ4A2V; WLSR7A1V; WLSS4A8F

General Description:

Present predominantly on alluvial soils in low relief parts of Maryland Creek, where remnant tall forest dominated by *Eucalyptus saligna, Syncarpia glomulifera* and *Angophora floribunda* occur. Very little of this vegetation remains within the Study Area, most having being cleared as part of previous ground disturbance in the area. Common associated species include *Wilkea huegeliana, Acmena smithii, Cryptocarya microneura, Alphitonia excelsa, Glochidion ferdinandi* and *Notelaea longifolia*, with *Calochlaena dubia*, *Oplismenus imbecillus* and *Adiantum aethiopicum* on the ground.

Characteristic Features:

- occurs on alluvial soil in gully situations
- characterised by emergent Sydney Blue Gum (*Eucalyptus saligna*), Turpentine (*Syncarpia glomulifera*) and/or Rough-barked Apple (*Angophora floribunda*), although much of the suitable habitat has been previously cleared
- mid-layer dominated by mesic species, including Red Ash (*Alphitonia excelsa*), Lily Pily (*Acmena smithii*), Murrogun (*Cryptocarya microneura*) and Cheese tree (*Glochidion ferdinandi*)
- ground cover of ferns, herbs or grasses, although can be sparse dependent on recent flooding history
- vines common in higher strata

Known Floristic/ Structural Variations:

Variation within this community is linked to disturbance history. Along the main part of Maryland Creek, which has been largely previously cleared, a narrow weed-infested band is present where species diversity is low, although the essence of the community remains. Conversely, more intact examples occur along Brush Creek where both structure and floristic diversity is markedly better (evident in the widely positioned plots in the ordination plot). There are few *Eucalyptus saligna* along Brush Creek, which is suspected to have been logged heavily.

Relationship to Other Communities:

Alluvial Tall Moist Forest is floristically most similar to Permian Gully Rainforest (Unit 1g), through the sharing of several mesic species. However, that community does not support an emergent canopy of *Eucalyptus saligna*, *Syncarpia glomulifera* or *Angophora floribunda*, and occurs not on alluvial soils but on colluvium associated with a rocky escarpment.

Distribution:

Total area: 6.61 ha (1.01 % of Study Area)

Significant Species:

- Undescribed species – *none recorded*
- Threatened (EPBC Act) – *none recorded*
- Threatened (BC Act) – *none recorded*
- Rare (ROTAP) – *none recorded*

Species Richness:

Number of plots:	3
Total native species:	63
Mean species / plot (+/- SD):	31.0 (+/- 4.58)

Community Conservation Status:

EPBC Act (1999) Status:	not currently listed
BC Act (2016) Status:	included in: *River-Flat Eucalypt Forest on Coastal Floodplains* EEC

Vegetation Structure [based on 3 plots]:

Stratum	Mean height (m)	Min height (m)	Max height (m)	Cover (mean %)	Cover (Sdev)	n
Tallest	25.17	18	35	30.00	5.00	3
Middle	14.17	5	20	75.00	8.66	3
Lower	3.67	1	10	26.67	5.77	3
Ground	0.50	0.1	1.0	31.67	2.89	3

Key Diagnostic Species [based on 3 plots]:

Alluvial Tall Moist Forest					Average similarity: 30.81
Habit	Species	Av.Abund	Av.Sim	Sim/SD	BB Cover
Tree	*Eucalyptus acmenoides*	2.00	1.54	0.58	4.99
	Acmena smithii	2.00	1.03	0.58	3.33
	Eucalyptus punctata	0.67	0.67	0.58	2.19
	Angophora floribunda	1.33	0.57	0.58	1.85
Small Tree	*Glochidion ferdinandi var. ferdinandi*	3.00	2.69	0.58	8.74
	Melaleuca styphelioides	2.33	2.02	0.58	6.56
	Wilkiea huegeliana	1.33	1.76	7.19	5.70
Shrub	*Notelaea longifolia f. longifolia*	1.00	1.76	7.19	5.70
	Omalanthus nutans	1.00	0.51	0.58	1.66
Ground Fern	*Adiantum aethiopicum*	1.67	1.03	0.58	3.33
	Pteridium esculentum	0.67	0.57	0.58	1.85
	Calochlaena dubia	1.33	0.51	0.58	1.66
	Doodia aspera	1.00	0.51	0.58	1.66
Grass	*Oplismenus imbecillis*	2.67	4.08	3.98	13.25
	Poa affinis	1.33	1.14	0.58	3.70
Herb	*Dichondra repens*	1.33	1.03	0.58	3.33
Sedge	*Carex longebrachiata*	1.67	1.35	0.58	4.37
Twiner	*Morinda jasminoides*	1.67	2.27	3.16	7.36
	Cissus antarctica	1.00	1.76	7.19	5.70
	Geitonoplesium cymosum	1.33	1.76	7.19	5.70
	Stephania japonica var. discolor	0.67	0.67	0.58	2.19
	Cayratia clematidea	1.00	0.57	0.58	1.85
	Dioscorea transversa	1.00	0.51	0.58	1.66
	Smilax australis	0.67	0.51	0.58	1.66

Coastal Sheltered Apple – Peppermint Forest Unit 11

Keith Formation:	Dry Sclerophyll Forests
Keith Class:	Sydney Coastal Dry Sclerophyll Forests
PCT	PCT1621: Smooth-barked Apple open forest on coastal lowlands of the Central Coast
LHCCREMS	MU11: Coastal Sheltered Apple – Peppermint Forest
GHV	103: Smooth-barked Apple open forest on coastal lowlands of the Central Coast
Floristic Sample Plots	WLSS1P5F; WLSS2P5L

General Description:

Open forest on the lower slopes in low relief areas in the south are characterized by tall *Eucalyptus piperita* with *Angophora costata* and *Corymbia gummifera*. This vegetation type is widespread in Lake Macquarie, possibly reaching its northern limit in the Study Area. *Pteridium esculentum, Polyscias sambuccifolia, Leptospermum polygalifolium* subsp. *cistmontanum*, *Acacia longifolia* and *Banksia collina* are common in the mid-storey, over a ground layer dominated by *Imperata cylindrica, Themeda triandra, Microlaena stipoides* var. *stipoides* and *Lobelia purpurascens*. Topographically, this vegetation type is positioned between the dominant Coastal Plains Stringybark – Apple Forest of the gentle hills and slopes, and riparian communities.

Characteristic Features:

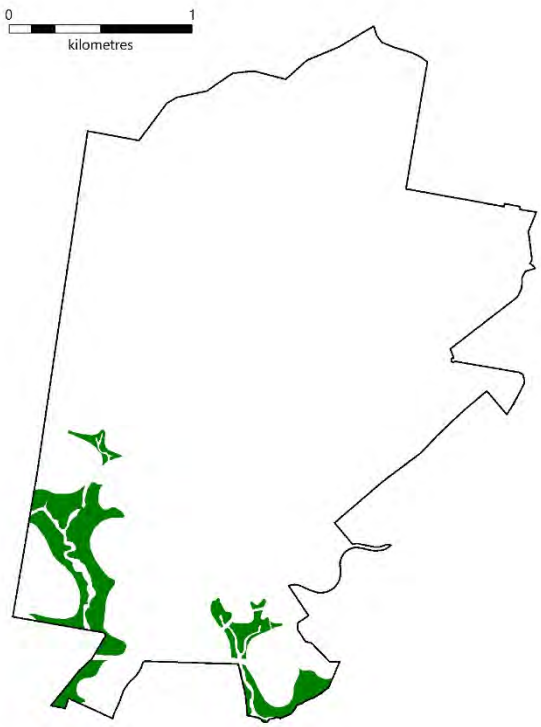
- occurs on gentle slopes and flats near to drainage lines
- canopy of Sydney Peppermint (*Eucalyptus piperita*) and Smooth-barked Apple (*Angophora costata*), with Red Bloodwood (*Corymbia gummifera*) prominent in most areas
- mid-layer of scattered shrubs, including Hairpin Banksia (*Banksia collina*), Elderberry Panax (*Polyscias sambuccifolia*) and wattles (*Acacia* spp.). Bracken Fern (*Pteridium esculentum*) is generally also obvious in the low shrub layer
- well developed ground layer of grasses, including Kangaroo Grass (*Themeda triandra*), Blady Grass (*Imperata cylindrica*) and Wiry Panic (*Entolasia stricta*)

Known Floristic/ Structural Variations:

Variation in this community is related to previous disturbance events. Regular fire has opened up most areas, allowing the proliferation of *Pteridium esculentum* and grasses at the expense of wood shrubs. The extent of *Eucalyptus piperita* in the canopy is normally consistent, however other species are variable in their relative abundance and may have been altered by partial clearing or logging.

Relationship to Other Communities:

The canopy characterised by *Eucalyptus piperita* clearly distinguishes this community from most others, although this species does occur in Riparian Paperbark – Peppermint Forest (Unit 11a). However, the dominance of *Melaleuca linariifolia* and *Glochidion ferdinandi* in the sub-canopy of that community differentiates the two. *Eucalyptus piperita* may also occur sporadically in Coastal Plains Stringybark – Apple Forest (Unit 30e), but the dominance of other canopy species and low abundance of *Pteridium esculentum* sufficiently separates it from this community.



Distribution:

Total area: 31.11 ha (4.76 % of Study Area)

Significant Species:

- Undescribed species – *none recorded*
- Threatened (EPBC Act) – *none recorded*
- Threatened (BC Act) – *Callistemon linearifolius* (vulnerable)
- Rare (ROTAP) – *none recorded*

Species Richness:

Number of plots:	2
Total native species:	62
Mean species / plot (+/- SD):	46.5 (+/- 6.36)

Community Conservation Status:

EPBC Act (1999) Status:	not currently listed
BC Act (2016) Status:	not currently listed

Vegetation Structure [based on 2 plots]:

Stratum	Mean height (m)	Min height (m)	Max height (m)	Cover (mean %)	Cover (Sdev)	n
Tallest	22.00	18	26	35.00	0.00	2
Middle	2.38	1	4	2.50	0.71	2
Lower	1.03	0.4	1.5	27.50	3.54	2
Ground	0.38	0.1	0.7	77.50	3.54	2

Key Diagnostic Species [based on 2 plots]:

Coastal Sheltered Apple – Peppermint Forest					Average similarity: 70.00
Habit	Species	Av.Abund	Av.Sim	Sim/SD	Contrib%
Tree	*Angophora costata*	3.00	3.75	-	5.36
	Corymbia gummifera	3.00	3.75	-	5.36
	Eucalyptus piperita	3.00	3.75	-	5.36
	Eucalyptus globoidea	2.00	1.25	-	1.79
Small Tree	*Glochidion ferdinandi var. ferdinandi*	1.00	1.25	-	1.79
Shrub	*Acacia longifolia subsp. longifolia*	2.00	2.50	-	3.57
	Polyscias sambucifolia subsp. sambucifolia	2.00	2.50	-	3.57
	Epacris pulchella	1.50	1.25	-	1.79
Shrub	*Leptospermum polygalifolium subsp. cismontanum*	1.50	1.25	-	1.79
	Notelaea longifolia f. longifolia	1.00	1.25	-	1.79
	Persoonia linearis	1.00	1.25	-	1.79
Low Shrub	*Hibbertia pedunculata*	2.00	2.50	-	3.57
Ground Fern	*Pteridium esculentum*	3.00	3.75	-	5.36
Grass	*Themeda triandra*	4.00	5.00	-	7.14
	Entolasia stricta	3.00	3.75	-	5.36
	Microlaena stipoides var. stipoides	3.00	3.75	-	5.36
	Aristida vagans	2.00	2.50	-	3.57
	Imperata cylindrica	2.00	2.50	-	3.57
	Panicum simile	2.00	2.50	-	3.57
	Echinopogon caespitosus var. caespitosus	1.50	1.25	-	1.79
Graminoid	*Lomandra cylindrica*	2.00	2.50	-	3.57
	Lomandra obliqua	2.00	2.50	-	3.57
	Dianella caerulea var. assera	1.50	1.25	-	1.79
	Lomandra longifolia	1.50	1.25	-	1.79
	Lomandra multiflora subsp. multiflora	1.00	1.25	-	1.79
Herb	*Lobelia purpurascens*	2.00	2.50	-	3.57
	Phyllanthus hirtellus	2.00	2.50	-	3.57
	Desmodium rhytidophyllum	1.50	1.25	-	1.79
Sedge	*Lepidosperma laterale*	1.00	1.25	-	1.79
Twiner	*Billardiera scandens*	1.00	1.25	-	1.79
	Eustrephus latifolius	1.50	1.25	-	1.79

Riparian Paperbark - Peppermint Forest Unit 11a

Keith Formation:	Dry Sclerophyll Forests
Keith Class:	Sydney Coastal Dry Sclerophyll Forests
PCT	PCT1621: Smooth-barked Apple open forest on coastal lowlands of the Central Coast
LHCCREMS	MU11: Coastal Sheltered Apple-Peppermint Forest
GHV	103: Smooth-barked Apple open forest on coastal lowlands of the Central Coast
Floristic Sample Plots	WLSQ0A2V; WLSQ1A2V

General Description:

Restricted to a few narrow drainage lines in the south of the Study Area, this community supports *Eucalyptus piperita* and *Eucalyptus resinifera* as key canopy species, over a sub-canopy of *Glochidion ferdinandi* and *Melaleuca linariifolia*, and a shrub layer of scattered *Banksia collina, Gompholobium latifolium, Polyscias sambuccifolia* and *Leptospermum polygalifolium* subsp. *cistmontanum*. Drainage channels are dominated by *Gahnia clarkei* and *Lomandra longifolia*, with several herbs, climbers and ferns. This community almost always occurs within a surrounding matrix of Coastal Sheltered Apple – Peppermint Forest.

Characteristic Features:

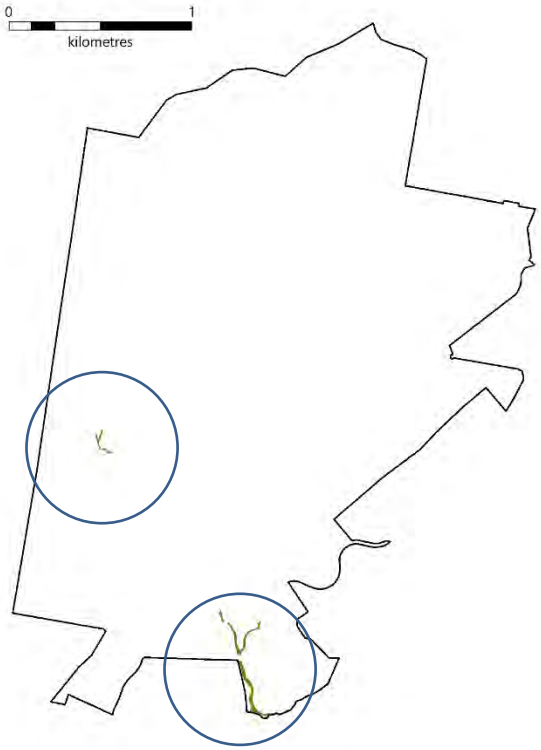
- occurs in narrow riparian zones on minor creeklines in the south, often in small incised channels
- canopy co-dominated by over-hanging Sydney Peppermint (*Eucalyptus piperita*) and Red Mahogany (*Eucalyptus resinifera*)
- mid-layer typically of Cheese Tree (*Glochidion ferdinandi*) and Flax-leaved Paperbark (*Melaleuca linariifolia*)
- ground layer of Tall Saw-sedge (*Gahnia clarkei*) and Spiny Matt-Rush (*Lomandra longifolia*)

Known Floristic/ Structural Variations:

The exent of *Gahnia clarkei* development within creeklines is dependent on channel structure and levels of water flow impedence, with best occurences in near-level stretches where water accumulates. In more free-flowing streams, *Lomandra longifolia* tends to dominate with ground ferns and grasses.

Relationship to Other Communities:

The dominance of *Gahnia clarkei* with *Lomandra longifolia*, beneath a mid-layer of *Glochidion ferdinandi* and *Melaleuca linariifolia*, distinguishes this community from all others. However, the characteristic canopy species *Eucalyptus piperita* is also prominent in Coastal Sheltered Apple – Peppermint Forest (Unit 11) which adjoins this community, but that unit supports a mid-layer of ferns and shrubs.



Distribution:

Total area: 1.38 ha (0.21 % of Study Area)

Significant Species:

- Undescribed species – *none recorded*
- Threatened (EPBC Act) – *none recorded*
- Threatened (BC Act) – *none recorded*
- Rare (ROTAP) – *none recorded*

Species Richness:

Number of plots:	2
Total native species:	57
Mean species / plot (+/- SD):	45.5 (+/- 0.71)

Community Conservation Status:

EPBC Act (1999) Status:	not currently listed
BC Act (2016) Status:	not currently listed

Vegetation Structure [based on 2 plots]:

Stratum	Mean height (m)	Min height (m)	Max height (m)	Cover (mean %)	Cover (Sdev)	n
Tallest	21.50	18	24	35.00	0.00	2
Middle	10.00	8	12	52.50	31.82	2
Lower	1.34	0.5	3	17.50	10.61	2
Ground	0.55	0.1	1	75.00	7.07	2

Key Diagnostic Species [based on 2 plots]:

Riparian Paperbark - Peppermint Forest					Average similarity: 74.36
Habit	*Species*	Av.Abund	Av.Sim	Sim/SD	Contrib%
Tree	*Eucalyptus piperita*	3.00	3.85	-	5.17
	Eucalyptus resinifera subsp. resinifera	3.00	3.85	-	5.17
	Angophora costata	2.00	1.28	-	1.72

	Corymbia gummifera	1.00	1.28	-	1.72
Small Tree	*Glochidion ferdinandi var. ferdinandi*	4.00	3.85	-	5.17
	Allocasuarina littoralis	1.00	1.28	-	1.72
	Melaleuca linariifolia	2.00	1.28	-	1.72
Shrub	*Banksia collina*	2.00	2.56	-	3.45
	Gompholobium latifolium	2.00	2.56	-	3.45
	Leptospermum polygalifolium subsp. cismontanum	2.00	2.56	-	3.45
	Leptospermum trinervium	1.00	1.28	-	1.72
	Polyscias sambucifolia subsp. sambucifolia	1.00	1.28	-	1.72
Ground Fern	*Adiantum aethiopicum*	2.00	2.56	-	3.45
	Lindsaea linearis	2.00	2.56	-	3.45
	Pteridium esculentum	2.00	2.56	-	3.45
Grass	*Entolasia stricta*	2.00	2.56	-	3.45
	Imperata cylindrica	2.00	2.56	-	3.45
	Microlaena stipoides var. stipoides	2.00	2.56	-	3.45
	Oplismenus imbecillis	2.00	2.56	-	3.45
	Themeda triandra	2.00	2.56	-	3.45
Graminoid	*Lomandra obliqua*	2.00	2.56	-	3.45
	Dianella caerulea var. assera	1.00	1.28	-	1.72
	Lomandra longifolia	1.50	1.28	-	1.72
Herb	*Dichondra repens*	2.00	2.56	-	3.45
	Lobelia purpurascens	2.00	2.56	-	3.45
	Phyllanthus hirtellus	2.00	2.56	-	3.45
Ground Orchid	*Pterostylis spp.*	2.00	2.56	-	3.45
Sedge	*Gahnia clarkei*	3.50	3.85	-	5.17
	Lepidosperma laterale	1.00	1.28	-	1.72
	Schoenus melanostachys	2.00	1.28	-	1.72
Twiner	*Billardiera scandens*	1.50	1.28	-	1.72
	Eustrephus latifolius	1.50	1.28	-	1.72
	Parsonsia straminea	1.00	1.28	-	1.72
Grasstree	*Xanthorrhoea macronema*	1.00	1.28	-	1.72

Hunter Valley Moist Spotted Gum – Fergusons Forest Unit 12d

Keith Formation:	Dry Sclerophyll Forests
Keith Class:	Hunter-Macleay Dry Sclerophyll Forests
PCT	PCT1584: White M'gany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest, central & lower HV
LHCCREMS	MU12: Hunter Valley Moist Forest
GHV	66: White M'gany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest, central & lower HV
Floristic Sample Plots	WLSR0P2U; WLSR6P2F; WLSR9P3U; WLSS0P3M

General Description:

Sheltered slopes (southerly- to easterly-facing) in the northern parts of the Study Area support a moist forest characterized by *Eucalyptus acmenoides, Eucalyptus punctata, Corymbia maculata* and *Eucalyptus fergusonii* subsp. *fergusonii*, and in some areas *Eucalyptus placita* and *Allocasuarina torulosa*. Frequent fire has likely reduced the extent of mesic elements originally in this type, however representatives are still evident including *Clerodendrum tomentosum, Rhodamnia rubescens, Notelaea longifolia, Denhamia silvestris* and *Breynia oblongifolia*. Ground layer vegetation is dominated by grasses, forbs and herbs, such as *Desmodium gunnii, Dichondra repens, Lobelia purpurascens, Poa affinis, Microlaena stipoides* var. *stipoides*, *Oplismenus imbecillus* and *Pseuderanthemum variabile*. Climbers too are common, including *Cayratia clematidea, Clematis glycinoides, Dioscorea transversa* and *Hibbertia scandens*.

Characteristic Features:

- occurs on sheltered slopes protected from drying westerly aspects
- characterised by the dominance of White Mahogany (*Eucalyptus acmenoides*) and Grey Gum (*Eucalyptus punctata*) with Spotted Gum (*Corymbia maculata*) and Ironbarks (*Eucalyptus fergusonii* subsp. *fergusonii*, *Eucalyptus placita*)

- a mid-layer of mesic species including Hairy Clerodendrum (*Clerodendrum tomentosum*), Mock Olive (*Notelaea longifolia*) and Breynia (*Breynia oblongifolia*). Scrub Myrtle (*Rhodamnia rubescens*) may also be present in some areas
- diverse ground layer of various grasses, forbs and herbs

Known Floristic/ Structural Variations:

Variation in this community is related both to previous disturbances through fire or selective logging, or weed invasion. Regular fire in some parts has limited the growth of mesic shrub elements which characterise this community, while in other areas *Lantana camara* has invaded slopes and displaced many native species.

Relationship to Other Communities:

Some areas of this community are difficult to differentiate from Coastal Foothills Spotted Gum – Ironbark Forest (Unit 15), particularly on slopes where the two meet. However, *Eucalyptus acmenoides* and *Eucalyptus punctata* are generally sparse or absent from Unit 5 (*Eucalyptus punctata* often replaced by *Eucalyptus propinqua* there), and shrub species are more sclerophyllous and include *Pultenaea villosa* and *Acacia ulicifolia*.

Distribution:

Total area: 123.82 ha (18.96 % of Study Area)

Significant Species:

- Undescribed species – *none recorded*
- Threatened (EPBC Act) – *none recorded*
- Threatened (BC Act) – *Rhodamnia rubescens* (critically endangered)
- Rare (ROTAP) – *Eucalyptus fergusonii* subsp. *fergusonii*

Species Richness:

Number of plots:	4
Total native species:	95
Mean species / plot (+/- SD):	51.75 (+/- 8.06)

Community Conservation Status:

EPBC Act (1999) Status:	not currently listed
BC Act (2016) Status:	not currently listed

Vegetation Structure [based on 4 plots]:

Stratum	Mean height (m)	Min height (m)	Max height (m)	Cover (mean %)	Cover (Sdev)	n
Tallest	23.25	18	28	36.25	2.50	4
Middle	7.17	1	15	11.67	7.64	3
Lower	1.70	0.6	3	9.33	6.03	3
Ground	0.41	0.1	0.8	65.00	20.41	4

Key Diagnostic Species [based on 4 plots]:

Hunter Valley Moist Spotted Gum – Fergusons Forest					Average similarity: 54.76
Habit	Species	Av.Abund	Av.Sim	Sim/SD	Contrib%
Tree	*Eucalyptus acmenoides*	2.75	2.79	4.92	5.10
	Eucalyptus punctata	2.25	1.64	0.91	2.99
	Angophora floribunda	2.00	1.50	1.61	2.74
	Corymbia maculata	1.50	0.78	0.78	1.43
	Syncarpia glomulifera subsp. glomulifera	1.25	0.57	0.91	1.05
	Eucalyptus placita	1.25	0.39	0.41	0.71
Shrub	*Clerodendrum tomentosum*	1.00	1.12	12.42	2.05
	Notelaea longifolia f. longifolia	1.25	1.12	12.42	2.05
	Breynia oblongifolia	0.75	0.59	0.91	1.09
	Denhamia silvestris	0.75	0.57	0.91	1.05
	Myrsine variabilis	0.50	0.18	0.41	0.34
Ground Fern	*Doodia aspera*	1.25	0.74	0.79	1.35
	Adiantum aethiopicum	1.00	0.38	0.41	0.69
	Pteridium esculentum	1.00	0.37	0.41	0.67
Cycad	*Macrozamia reducta*	0.75	0.18	0.41	0.34
Grass	*Imperata cylindrica*	3.00	2.79	4.92	5.10
	Microlaena stipoides var. stipoides	2.25	2.25	12.42	4.10
	Oplismenus imbecillis	2.00	2.25	12.42	4.10
	Poa affinis	2.50	2.25	12.42	4.10
	Themeda triandra	2.75	1.64	0.91	2.99
	Panicum simile	1.25	0.70	0.84	1.28
	Poa labillardierei var. labillardierei	1.50	0.50	0.41	0.91
	Entolasia stricta	1.00	0.36	0.41	0.65
	Digitaria parviflora	1.00	0.33	0.41	0.61
	Echinopogon ovatus	0.75	0.19	0.41	0.36
	Cymbopogon refractus	0.50	0.19	0.41	0.34
Graminoid	*Lomandra confertifolia subsp. pallida*	2.00	2.25	12.42	4.10
	Dianella caerulea var. assera	1.25	1.12	12.42	2.05
	Lomandra longifolia	0.50	0.18	0.41	0.34
Herb	*Desmodium gunnii*	2.00	2.25	12.42	4.10
	Dichondra repens	2.00	2.25	12.42	4.10
	Lobelia purpurascens	2.00	2.25	12.42	4.10
	Pseuderanthemum variabile	2.00	2.25	12.42	4.10
	Sigesbeckia orientalis subsp. orientalis	1.50	1.29	3.64	2.36
	Daucus glochidiatus	1.50	1.09	0.91	1.99
	Solanum prinophyllum	0.75	0.55	0.91	1.00
	Viola hederacea	1.00	0.42	0.41	0.77
	Hydrocotyle laxiflora	1.00	0.38	0.41	0.69
	Brunoniella australis	1.00	0.33	0.41	0.61
	Geranium solanderi var. solanderi	1.00	0.33	0.41	0.61
	Oxalis perennans	1.00	0.33	0.41	0.61
	Vernonia cinerea var. cinerea	1.00	0.33	0.41	0.61

	Gonocarpus tetragynus	0.50	0.19	0.41	0.34
Sedge	*Cyperus gracilis*	1.00	0.33	0.41	0.61
	Gymnostachys anceps	0.75	0.17	0.41	0.30
Twiner	*Cayratia clematidea*	2.00	2.25	12.42	4.10
	Clematis glycinoides var. glycinoides	1.50	1.30	3.10	2.38
	Glycine clandestina	1.25	1.12	12.42	2.05
	Glycine tabacina	1.00	1.12	12.42	2.05
	Dioscorea transversa	1.25	0.81	0.79	1.47
	Geitonoplesium cymosum	1.25	0.78	0.78	1.43
	Hibbertia scandens	0.75	0.57	0.91	1.05
	Hardenbergia violacea	0.75	0.55	0.91	1.00
	Oxytes brachypoda	0.75	0.55	0.91	1.00
	Eustrephus latifolius	1.00	0.53	0.91	0.97

Coastal Foothills Spotted Gum - Ironbark Forest Unit 15

Keith Formation:	Dry Sclerophyll Forests
Keith Class:	Hunter-Macleay Dry Sclerophyll Forests
PCT	PCT1588: Grey Ironbark-Broad-leaved M'gany-Forest Red Gum shrubby open forest, Coastal Lowlands, CC
LHCCREMS	MU15: Coastal Foothills Spotted Gum -Ironbark Forest
GHV	72: Spotted Gum/ Broad-leaved Mahogany/ Red ironbark moist shrubby open forest
Floristic Sample Plots	WLSQ8P3U; WLSR1P7L; WLSR2P1M: WLSR3P2U; WLSR4P8L; WLSR5P8C

General Description:

Past logging, partial clearing and frequent fire have altered both the structural and floristic composition of this community, such that most areas now support only relatively young regrowth vegetation. This level of disturbance has also contributed to the development of two forms of this community within the Study Area: a drier one where mesic elements have been reduced, and a moister form where they still remain. Common canopy species shared by both forms include *Corymbia maculata, Eucalyptus propinqua* and *Eucalyptus acmenoides*, while *Eucalyptus siderophloia*, *Eucalyptus fergusonii* subsp. *fergusonii* and *Eucalyptus placita* are less common. Understorey composition varies, but may include *Pultenaea villosa* and *Acacia ulicifolia* in the moist form, and *Notelaea longifolia, Denhamia silvestris* and *Acacia irrorata* subsp. *irrorata* in the drier form. Ground layer composition also differs, with *Imperata cylindrica, Desmodium gunnii, Dichondra repens, Lobelia purpurascens* and *Microlaena stipoides* var. *stipoides* dominating the moist form, while *Entolasia stricta* and *Gonocarpus tetragynus* are more evident in the drier form.

Characteristic Features:

- widespread on ridgelines and associated slopes, particularly in the north of the site
- commonly composed of closely-packed young trees in response to past logging

- canopy co-dominated by Spotted Gum (*Corymbia maculata*) and various Ironbarks (*Eucalyptus siderophloia*, *Eucalyptus fergusonii* subsp. *fergusonii*, *Eucalyptus placita*), often with Small-fruited Grey Gum (*Eucalyptus propinqua*)
- dry or moist shrubby mid-layer predominantly of wattles (*Acacia ulicifolia, Acacia irrorata*) and peas (*Daviesia ulicifolia, Pultenaea villosa*), often dominated by one species in a patch due to past fire patterns
- ground layer of grasses such as Wiry Panic (*Entolasia stricta*) and Blady Grass (*Imperata cylindrica*), with Lomandras and herbs

Known Floristic/ Structural Variations:

Two variations are recognised within the Study Area, attributed here as 'dry' or 'moist' although they may also be a response to past disturbances. In the dry form, understorey vegetation tends to be more open and support sclerophyllous species rather than mesophyllic species. This distinction is clouded by regular fire and past selective logging or partial clearing in many areas, which may have opened up the structure of this community allowing the proliferation of 'dry' species at the expense of 'moist' species.

Relationship to Other Communities:

The characteristic presence of *Corymbia maculata* in the canopy of this community is also shared with Hinterland Spotted Gum – Red Ironbark Forest (Unit 17o), but that community almost always supports only *Eucalyptus fibrosa* as the co-occurring Ironbark. The ground layer of Unit 17o also tends to be dominated by *Themeda triandra* and *Rytidosperma pallidum*, and an open understorey of sclerophyllous shrubs.

Distribution:

Total area: 74.60 ha (11.42 % of Study Area)

Significant Species:

- Undescribed species – *none recorded*
- Threatened (EPBC Act) – *none recorded*
- Threatened (BC Act) – *none recorded*
- Rare (ROTAP) – *Eucalyptus fergusonii* subsp. *fergusonii*

Species Richness:

Number of plots:	6
Total native species:	90
Mean species / plot (+/- SD):	42.3 (+/- 7.39)

Community Conservation Status:

EPBC Act (1999) Status:	not currently listed
BC Act (2016) Status:	not currently listed

Vegetation Structure [based on 6 plots]:

Stratum	Mean height (m)	Min height (m)	Max height (m)	Cover (mean %)	Cover (Sdev)	n
Tallest	24.25	20	30	35.83	2.04	6
Middle	8.00	3	15	7.00	2.74	5
Lower	1.28	0.5	3	19.00	28.08	6
Ground	0.41	0.1	0.9	36.67	24.01	6

Key Diagnostic Species [based on 3 plots each in 'dry' and 'moist' forms]:

Coastal Foothills Spotted Gum - Ironbark Forest (dry form)					Average similarity: 59.89
Habit	*Species*	Av.Abund	Av.Sim	Sim/SD	Contrib%
Tree	*Corymbia maculata*	3.00	4.42	20.21	7.38
	Eucalyptus acmenoides	1.67	1.98	2.17	3.30
	Eucalyptus fergusonii subsp. fergusonii	2.00	1.52	0.58	2.53
	Eucalyptus propinqua	2.00	1.52	0.58	2.53
	Eucalyptus punctata	1.33	0.46	0.58	0.77
Small Tree	*Glochidion ferdinandi var. ferdinandi*	0.67	0.51	0.58	0.84
Shrub	*Acacia ulicifolia*	2.00	2.95	20.21	4.92
	Pultenaea villosa	3.00	2.95	20.21	4.92
	Pittosporum revolutum	0.67	0.51	0.58	0.84
Grass	*Entolasia stricta*	3.00	3.45	3.61	5.76
	Microlaena stipoides var. stipoides	2.67	3.41	5.20	5.69
	Poa affinis	2.33	2.95	20.21	4.92
	Aristida vagans	1.67	1.98	2.17	3.30
	Digitaria parviflora	1.33	1.01	0.58	1.69
	Panicum simile	1.33	0.93	0.58	1.55
Graminoid	*Dianella caerulea var. assera*	2.00	2.95	20.21	4.92
	Lomandra confertifolia subsp. pallida	2.00	2.95	20.21	4.92
	Lomandra longifolia	1.67	1.47	20.21	2.46
Herb	*Gonocarpus tetragynus*	2.00	2.95	20.21	4.92
	Lobelia purpurascens	2.00	2.95	20.21	4.92
	Pseuderanthemum variabile	2.00	2.95	20.21	4.92
	Vernonia cinerea var. cinerea	2.00	2.95	20.21	4.92
	Brunoniella australis	1.33	0.93	0.58	1.55
	Lagenophora stipitata	1.33	0.93	0.58	1.55
	Arthropodium sp. B	1.00	0.51	0.58	0.84
	Oxalis perennans	0.67	0.51	0.58	0.84
Twiner	*Eustrephus latifolius*	2.00	2.95	20.21	4.92
	Glycine clandestina	2.00	2.95	20.21	4.92
	Cassytha glabella f. glabella	1.00	0.51	0.58	0.84
	Hibbertia scandens	0.67	0.51	0.58	0.84

Coastal Foothills Spotted Gum - Ironbark Forest (moist form)					Average similarity: 67.47
Habit	*Species*	Av.Abund	Av.Sim	Sim/SD	Contrib%
Tree	*Corymbia maculata*	3.00	3.80	24.30	5.63
	Eucalyptus placita	3.00	3.80	24.30	5.63
	Eucalyptus acmenoides	2.67	2.97	3.51	4.41
	Eucalyptus siderophloia	2.67	2.94	4.85	4.36
	Eucalyptus propinqua	1.67	0.85	0.58	1.26
Small Tree	*Acacia irrorata subsp. irrorata*	0.67	0.42	0.58	0.63
Shrub	*Clerodendrum tomentosum*	1.33	1.27	24.30	1.88
	Denhamia silvestris	1.33	1.27	24.30	1.88
	Indigofera australis	0.67	0.44	0.58	0.65
	Notelaea longifolia f. longifolia	0.67	0.42	0.58	0.63
	Acacia implexa	1.33	0.40	0.58	0.60
	Breynia oblongifolia	0.67	0.40	0.58	0.60
	Hibbertia aspera subsp. aspera	0.67	0.40	0.58	0.60
Grass	*Microlaena stipoides var. stipoides*	2.67	2.96	3.92	4.39
	Entolasia stricta	2.33	2.53	24.30	3.76
	Imperata cylindrica	2.33	2.53	24.30	3.76
	Oplismenus imbecillis	2.00	2.53	24.30	3.76
	Poa affinis	2.00	2.53	24.30	3.76
	Paspalidium distans	1.67	1.69	2.28	2.51
	Digitaria parviflora	1.33	0.88	0.58	1.30
	Aristida vagans	1.33	0.81	0.58	1.20
	Cymbopogon refractus	1.33	0.81	0.58	1.20
Graminoid	*Lomandra confertifolia subsp. pallida*	2.00	2.53	24.30	3.76
	Dianella caerulea var. assera	1.67	1.67	2.56	2.48
	Lomandra longifolia	1.00	0.44	0.58	0.65
Herb	*Desmodium gunnii*	2.00	2.53	24.30	3.76
	Dichondra repens	2.00	2.53	24.30	3.76
	Lobelia purpurascens	2.00	2.53	24.30	3.76
	Pseuderanthemum variabile	2.00	2.53	24.30	3.76
	Vernonia cinerea var. cinerea	2.00	2.53	24.30	3.76
	Arthropodium sp. B	1.33	1.27	24.30	1.88
	Oxalis perennans	0.67	0.42	0.58	0.63
	Desmodium rhytidophyllum	0.67	0.40	0.58	0.60
	Lagenophora stipitata	1.00	0.40	0.58	0.60
	Opercularia diphylla	1.00	0.40	0.58	0.60
Sedge	*Lepidosperma laterale*	1.00	1.27	24.30	1.88
Twiner	*Geitonoplesium cymosum*	1.67	1.71	2.13	2.53
	Clematis glycinoides var. glycinoides	1.67	1.69	2.28	2.51
	Eustrephus latifolius	1.67	1.69	2.28	2.51
	Cayratia clematidea	1.33	1.27	24.30	1.88
	Glycine clandestina	1.00	1.27	24.30	1.88
	Hardenbergia violacea	0.67	0.42	0.58	0.63
	Hibbertia scandens	0.67	0.42	0.58	0.63
	Pandorea pandorana	0.67	0.42	0.58	0.63

Hinterland Spotted Gum - Red Ironbark Forest Unit 17o

Keith Formation:	Dry Sclerophyll Forests
Keith Class:	Hunter-Macleay Dry Sclerophyll Forests
PCT	PCT1592: Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter
LHCCREMS	MU17: Lower Hunter Spotted Gum- Ironbark Forest
GHV	74: Spotted Gum/ Red Ironbark/ Large-fruited Grey Gum shrub/ grass open forest of the Lower Hunter
Floristic Sample Plots	WLS82Q6M; WLSC5P4U; WLSK5P3U; WLSK6P4U; WLSQ7P7U

General Description:

Characteristic canopy species in this community include *Corymbia maculata* and *Eucalyptus fibrosa*, however other species also occur sparingly, of which the most common is *Eucalyptus umbra*. This vegetation is typically a grassy open forest, although localized ares dominated by the tall dense shrub *Melaleuca nodosa* do occur over a less-grassy ground layer. Across most of its distribution, common grasses include *Themeda triandra*, *Entolasia stricta*, *Panicum simile*, *Aristida vagans* and *Rytidosperma pallidum*. Shrub species including *Bursaria spinosa, Daviesia ulicifolia* subsp. *ulicifolia*, *Pultenaea euchila* and *Acacia ulicifolia* may be locally common, but are dependent on past fire history.

Characteristic Features:

- localised on ridgelines and associated slopes, typically in low relief areas
- canopy co-dominated by Spotted Gum (*Corymbia maculata*) and Red Ironbark (*Eucalyptus fibrosa*), often with Bastard Mahogany (*Eucalyptus umbra*) and occasionally with Smooth-barked Apple (*Angophora costata*) or White Stringybark (*Eucalyptus globoidea*)
- shrubby or open mid-layer predominantly of Prickly Shaggy Pea (*Daviesia ulicifolia*), Blackthorn (*Bursaria spinosa*) or wattles (*Acacia ulicifolia, Acacia falcata*). Localised dominance of Prickly-leaved Ti-tree (*Melaleuca nodosa*) in some areas

- ground layer of grasses dominated by Kangaroo Grass (*Themeda triandra*),Silvertop Wallaby Grass (*Rytidosperma pallidum*), and Wiry Panic (*Entolasia stricta*)

Known Floristic/ Structural Variations:

This community is generally consistent across its distribution, although past logging or clearing events have promoted denser regrowth of canopy trees. In some parts, dense stands of *Melaleuca nodosa* limit the amount of ground vegetation that can develop, particularly notable in the low abundance of grass species. In areas of close proximity to Coastal Plains Stringybark – Apple Forest (Unit 30e), the canopy may include *Angophora costata, Corymbia gummifera* or *Eucalyptus globoidea* in addition to *Corymbia maculata* and *Eucalyptus fibrosa*.

Relationship to Other Communities:

The dominance of *Eucalyptus fibrosa* with *Corymbia maculata* is not repeated elsewhere within the Study Area, and hence no other community should be confused with this unit. Superficially, Coastal Foothills Spotted Gum – Ironbark Forest (Unit 15) does appear similar, but *Eucalyptus fibrosa* is replaced there by *Eucalyptus siderophloia*, *Eucalyptus placita* or *Eucalyptus fergusonii*. Unit 17o also supports a more obvious ground layer of *Themeda triandra* and *Rytidosperma pallidum*.

Distribution:

Total area: 111.20 ha (17.03 % of Study Area)

Significant Species:

- Undescribed species – *none recorded*
- Threatened (EPBC Act) – *none recorded*
- Threatened (BC Act) – *none recorded*
- Rare (ROTAP) – *none recorded*

Species Richness:

Number of plots:	5
Total native species:	84
Mean species / plot (+/- SD):	38.2 (+/- 4.27)

Community Conservation Status:

EPBC Act (1999) Status:	not currently listed
BC Act (2016) Status:	included in: *Lower Hunter Spotted Gum Ironbark Forest* EEC

Vegetation Structure [based on 5 plots]:

Stratum	Mean height (m)	Min height (m)	Max height (m)	Cover (mean %)	Cover (Sdev)	n
Tallest	19.80	15	23	32.00	6.71	5
Middle	5.25	2	10	15.75	22.85	4
Lower	1.45	1	3	27.40	33.26	5
Ground	0.43	0.1	0.8	80.00	18.37	5

Key Diagnostic Species [based on 5 plots]:

Hinterland Spotted Gum - Red Ironbark Forest					Average similarity: 51.81
Habit	*Species*	Av.Abund	Av.Sim	Sim/SD	Contrib%
Tree	*Corymbia maculata*	2.80	3.07	2.17	5.93
	Eucalyptus fibrosa	2.60	2.16	1.08	4.17
	Eucalyptus umbra	1.20	0.44	0.32	0.86
	Angophora costata	0.80	0.42	0.62	0.80
	Eucalyptus fergusonii subsp. fergusonii	0.80	0.14	0.32	0.28
	Eucalyptus acmenoides	0.60	0.14	0.32	0.27
	Eucalyptus globoidea	0.60	0.14	0.32	0.27
	Eucalyptus punctata	0.40	0.13	0.32	0.26
Shrub	*Acacia ulicifolia*	2.20	1.83	2.73	3.52
	Bursaria spinosa	1.20	1.01	1.02	1.94
	Pultenaea euchila	1.40	0.96	1.02	1.85
	Daviesia squarrosa	1.20	0.28	0.32	0.54
	Pultenaea paleacea	0.80	0.28	0.32	0.54
	Acacia falcata	0.80	0.16	0.32	0.30
	Acacia longifolia subsp. longifolia	0.40	0.14	0.32	0.28
	Dillwynia retorta	0.60	0.14	0.32	0.27
Grass	*Themeda triandra*	3.80	5.07	6.21	9.79
	Entolasia stricta	3.20	3.77	4.74	7.27
	Panicum simile	2.60	3.23	4.86	6.24
	Aristida vagans	2.00	2.82	18.46	5.44
	Rytidosperma pallidum	2.40	2.03	1.12	3.92
	Paspalidium distans	1.60	1.63	1.16	3.15
	Microlaena stipoides var. stipoides	1.20	0.85	0.62	1.63
	Imperata cylindrica	0.80	0.41	0.62	0.79
	Oplismenus imbecillis	0.80	0.40	0.62	0.77
	Poa affinis	1.20	0.40	0.32	0.77
Graminoid	*Lomandra multiflora subsp. multiflora*	2.00	2.82	18.46	5.44
	Dianella caerulea var. assera	1.20	0.96	1.06	1.86
	Lomandra filiformis subsp. coriacea	1.20	0.85	0.62	1.63
	Lomandra filiformis subsp. filiformis	0.80	0.31	0.32	0.60
	Lomandra confertifolia subsp. pallida	0.80	0.29	0.32	0.56
	Lomandra obliqua	0.80	0.29	0.32	0.56
Herb	*Gonocarpus tetragynus*	1.60	1.63	1.16	3.15
	Brunoniella australis	1.40	1.26	1.02	2.42
	Lobelia purpurascens	1.40	1.26	1.02	2.42
	Opercularia diphylla	1.40	1.23	1.06	2.37
	Lagenophora stipitata	1.20	0.85	0.62	1.63
	Phyllanthus hirtellus	1.20	0.85	0.62	1.63
	Goodenia heterophylla subsp. heterophylla	0.80	0.40	0.62	0.77
	Pseuderanthemum variabile	0.80	0.31	0.32	0.60
	Desmodium rhytidophyllum	0.40	0.15	0.32	0.29
Sedge	*Lepidosperma laterale*	1.40	1.56	2.88	3.02

Twiner	*Glycine clandestina*	1.80	2.27	2.91	4.38
	Hardenbergia violacea	1.40	1.55	3.33	2.99
	Eustrephus latifolius	1.00	0.56	0.58	1.07

Coastal Plains Stringybark - Apple Forest Unit 30e

Keith Formation:	Dry Sclerophyll Forests
Keith Class:	Sydney Coastal Dry Sclerophyll Forests
PCT	PCT1619: Smooth-barked Apple - Red Bl'dw'd - Brown Str'bark - Hairpin Banksia heathy OF, coastal lowlands
LHCCREMS	MU30: Coastal Plains Smooth-barked Apple Woodland
GHV	101: Smooth-barked Apple/ Red Bl'dw'd/ Brown Str'bark/ Hairpin Banksia heathy OF, coastal lowlands
Floristic Sample Plots	WLS81Q1U; WLSP9P4U; WLSQ2P6U; WLSQ3P3L; WLSQ5P5M; WLSQ6P3U; WLSQ9P1U

General Description:

This community is widespread particularly in the southern portions of the Study Area, and is dominated in the canopy by *Angophora costata, Corymbia gummifera* and *Eucalyptus globoidea*, and other species may include *Eucalyptus umbra* and *Eucalyptus capitellata* in some locations. Frequent fire across the site has reduced understorey structure and the abundance of individuals, but the most common species include *Acacia longifolia*, *Pultenaea euchila*, *Daviesia squarrosa*, *Acacia ulicifolia* and *Banksia collina*. *Themeda triandra* is the most frequently encountered grass species, along with *Entolasia stricta, Microlaena stipoides* var. *stipoides*, *Aristida vagans, Rytidosperma pallidum* and *Imperata cylindrica*. A variety of forbs and herbs are also present, and *Xanthorrhora latifolia* subsp. *latifolia* and *Xanthorrhoea macronema* can be locally common.

Characteristic Features:

- widespread on low relief ridgelines and associated slopes, particularly in the south of the Study Area
- canopy co-dominated by White Stringybark (*Eucalyptus globoidea*), Smooth-barked Apple (*Angophora costata*), Red Bloodwood (*Corymbia gummifera*) and Bastard Mahogany (*Eucalyptus umbra*), and Brown Stringybark (*Eucalyptus capitellata*) may also occur in some parts
- mid-layer generally very open due to regular fire events, usually with scattered individuals of Hairpin Banksia (*Banksia collina*), wattles (*Acacia ulicifolia, Acacia longifolia*) and peas (*Pultenaea euchila, Daviesia squarrosa*)

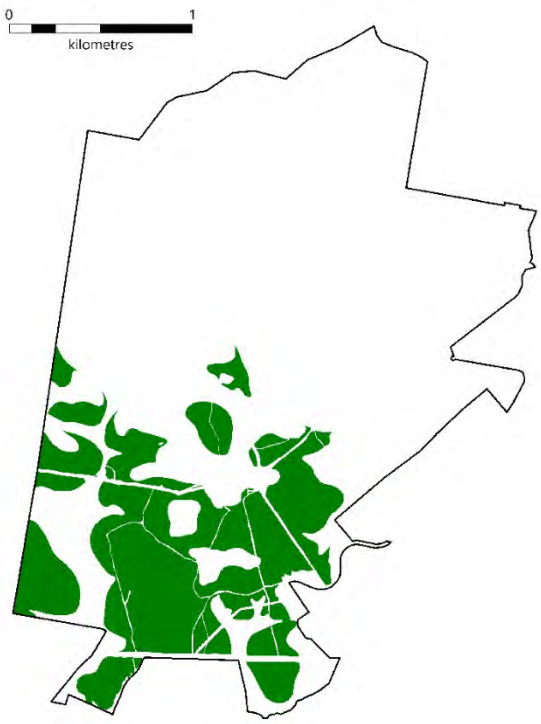
- ground layer of grasses including Kangaroo Grass (*Themeda triandra*), Wiry Panic (*Entolasia stricta*) and Blady Grass (*Imperata cylindrica*), Grasstrees (*Xanthorrhoea latifolia, Xanthorrhoea macronema*) are common

Known Floristic/ Structural Variations:

Regular fire and other disturbance events have simplified the original structure and floristic composition of this community, such that there are now few observable variations. In some locations, dense thickets of some shrub species may occur, such as *Callistemon linearifolius* or *Acacia* spp., but this is rare.

Relationship to Other Communities:

Coastal Sheltered Apple – Peppermint Forest (Unit 11) is perhaps the most similar community to this unit within the Study Area, but the clear dominance of *Eucalyptus piperita* in that community separates it from Unit 30e. These two communities adjoin each other in most areas, hence there are some zones where differentiating both may be difficult. Additionally, where Unit 30e merges with Hinterland Spotted Gum – Red Ironbark Forest (Unit 17o) there is some cross-over in canopy species, but understorey composition generally remains distinct.



Distribution:

Total area: 140.16 ha (21.46 % of Study Area)

Significant Species:

- Undescribed species – *none recorded*
- Threatened (EPBC Act) – *Tetratheca juncea* (vulnerable) (?)
- Threatened (BC Act) – *Callistemon linearifolius* (vulnerable); *Tetratheca juncea* (vulnerable) (?)
- Rare (ROTAP) – *none recorded*

Species Richness:

Number of plots:	7
Total native species:	102
Mean species / plot (+/- SD):	43.6 (+/- 3.95)

Community Conservation Status:

EPBC Act (1999) Status:	not currently listed
BC Act (2016) Status:	not currently listed

Vegetation Structure [based on 7 plots]:

Stratum	Mean height (m)	Min height (m)	Max height (m)	Cover (mean %)	Cover (Sdev)	n
Tallest	20.50	18	24	34.29	3.45	7
Middle	5.00	2	8	10.00	-	1
Lower	1.34	0.5	3	19.71	19.85	7
Ground	0.42	0.1	0.8	67.86	23.25	7

Key Diagnostic Species [based on 7 plots]:

Coastal Plains Stringybark - Apple Forest					Average similarity: 54.44
Habit	*Species*	Av.Abund	Av.Sim	Sim/SD	Contrib%
Tree	*Angophora costata*	2.86	3.52	5.45	6.47
	Corymbia gummifera	2.57	2.81	1.54	5.16
	Eucalyptus globoidea	1.71	1.11	0.62	2.04
	Eucalyptus umbra	0.71	0.17	0.40	0.32
	Eucalyptus capitellata	0.71	0.12	0.22	0.23
Small Tree	*Allocasuarina littoralis*	0.57	0.06	0.22	0.11
Shrub	*Acacia longifolia subsp. longifolia*	1.00	0.93	1.54	1.71
	Pultenaea euchila	1.14	0.82	0.83	1.51
	Daviesia squarrosa	1.29	0.75	0.62	1.38
	Acacia ulicifolia	1.14	0.65	0.88	1.19
	Daviesia ulicifolia subsp. ulicifolia	1.29	0.53	0.40	0.97
	Notelaea longifolia f. longifolia	0.71	0.39	0.62	0.71
	Persoonia linearis	0.57	0.38	0.62	0.69
	Banksia collina	0.57	0.37	0.62	0.68
	Polyscias sambucifolia subsp. sambucifolia	0.71	0.36	0.62	0.67
	Leptospermum polygalifolium subsp. cismontanum	0.71	0.36	0.62	0.66
	Bursaria spinosa	0.57	0.19	0.40	0.35
	Dillwynia retorta	0.57	0.18	0.40	0.34
	Pimelea linifolia subsp. linifolia	0.43	0.18	0.40	0.33
	Pultenaea paleacea	0.71	0.11	0.22	0.21
	Leptospermum trinervium	0.29	0.06	0.22	0.12
	Acacia falcata	0.43	0.06	0.22	0.11
	Hibbertia empetrifolia subsp. empetrifolia	0.43	0.06	0.22	0.11
	Persoonia levis	0.29	0.06	0.22	0.11
Low Shrub	*Hibbertia pedunculata*	0.29	0.06	0.22	0.11
Ground Fern	*Pteridium esculentum*	0.57	0.18	0.40	0.34
Grass	*Themeda triandra*	4.14	4.61	3.33	8.47
	Entolasia stricta	2.57	2.78	5.55	5.11
	Microlaena stipoides var. stipoides	2.29	2.65	9.06	4.88
	Aristida vagans	2.00	2.59	19.62	4.77
	Rytidosperma pallidum	2.00	2.20	4.04	4.05
	Imperata cylindrica	2.00	1.87	1.50	3.44
	Panicum simile	1.71	1.83	1.54	3.36
	Echinopogon ovatus	0.86	0.36	0.40	0.66
	Paspalidium distans	0.86	0.36	0.40	0.66
	Dichelachne micrantha	0.71	0.26	0.37	0.47
	Echinopogon caespitosus var. caespitosus	0.57	0.11	0.22	0.21
	Cymbopogon refractus	0.43	0.06	0.22	0.12
	Rytidosperma tenuius	0.29	0.06	0.22	0.11
Graminoid	*Dianella caerulea var. assera*	1.71	1.90	3.00	3.50
	Lomandra obliqua	1.86	1.88	1.54	3.45

	Lomandra filiformis subsp. filiformis	1.43	1.21	0.93	2.22
	Lomandra multiflora subsp. multiflora	1.00	0.91	1.54	1.66
	Dianella revoluta var. revoluta	0.43	0.19	0.40	0.35
	Lomandra filiformis subsp. coriacea	0.57	0.19	0.40	0.34
	Lomandra confertifolia subsp. pallida	0.43	0.07	0.22	0.12
Herb	*Lobelia purpurascens*	2.00	2.59	19.62	4.77
	Gonocarpus tetragynus	1.57	1.53	1.39	2.82
	Brunoniella australis	1.29	1.01	0.85	1.86
	Opercularia diphylla	0.86	0.37	0.40	0.69
	Phyllanthus hirtellus	0.86	0.37	0.40	0.69
	Oxalis perennans	0.43	0.18	0.40	0.34
	Goodenia heterophylla subsp. heterophylla	0.57	0.18	0.40	0.33
	Boronia polygalifolia	0.57	0.13	0.22	0.24
	Desmodium rhytidophyllum	0.43	0.07	0.22	0.12
	Stylidium graminifolium	0.29	0.07	0.22	0.12
Sedge	*Ptilothrix deusta*	1.57	1.27	0.93	2.34
	Lepidosperma laterale	0.71	0.24	0.38	0.44
Twiner	*Billardiera scandens*	1.71	1.91	2.98	3.50
	Glycine clandestina	1.57	1.65	3.16	3.02
	Hardenbergia violacea	0.86	0.59	0.93	1.09
	Polymeria calycina	0.71	0.25	0.37	0.47
	Cassytha glabella f. glabella	0.29	0.06	0.22	0.12
Grasstree	*Xanthorrhoea latifolia subsp. latifolia*	1.14	0.82	0.84	1.50

Freshwater Typha Wetland — Unit 46a

Keith Formation:	Freshwater Wetlands
Keith Class:	Coastal Freshwater Lagoons
PCT	PCT1737: Typha rushland
LHCCREMS	MU46: Freshwater Wetland Complex
GHV	219: Typha rushland
Floristic Sample Plots	-

General Description:

All occurences of this community within the Study Area comprise old, disused water bodies and dams where *Typha orientalis* has colonized. Few other species are evident, although *Phragmites australis*, *Persicaria* spp. and other herbs may also be present.

Characteristic Features:

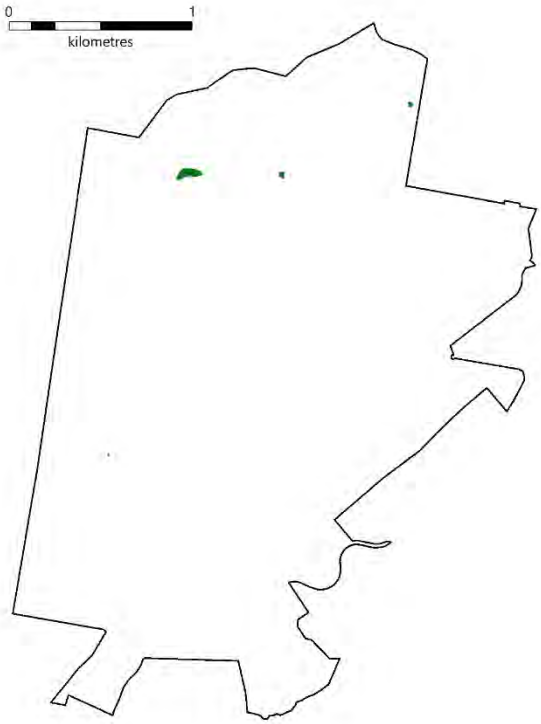
- occurs in disused water impoundments and dams
- no emergent canopy or shrubs, but dominated by Cumbungi (*Typha orientalis*) with few other species

Known Floristic/ Structural Variations:

No known variations, although floristic diversity increases in shallower areas close to edges.

Relationship to Other Communities:

Clearly distinguished from all other defined communities by the almost monospecific stands of *Typha orientalis*.



Distribution:

Total area: 0.73 ha (0.11 % of Study Area)

Significant Species:

- Undescribed species – *none recorded*
- Threatened (EPBC Act) – *none recorded*
- Threatened (BC Act) – *Rhodamnia rubescens* (critically endangered)
- Rare (ROTAP) – *none recorded*

Species Richness:

Number of plots: 0
Total native species: n/a
Mean species / plot (+/- SD): n/a (+/- n/a)

Community Conservation Status:

EPBC Act (1999) Status: not currently listed
BC Act (2016) Status: not currently listed

Vegetation Structure [based on 0 plots; indicative only]:

Stratum	Mean height (m)	Min height (m)	Max height (m)	Cover (mean %)	Cover (Sdev)	n
Tallest	-	1	2	80.00	-	0
Middle	-	-	-	-	-	0
Lower	-	-	-	-	-	0
Ground	-	0.1	1	10.00	-	0

Key Diagnostic Species [based on 0 plots; indicative only]:

Freshwater Typha Wetland					Average similarity: n/a
Habit	Species	Av.Abund	Av.Sim	Sim/SD	BB Cover
Sedge	*Typha orientalis*	-	-	-	-
Grass	*Phragmites australis*	-	-	-	-
Herb	*Persicaria spp.*	-	-	-	-

Appendix C – Flora Survey Methodology and Results

Contents

1.0 Introduction 1
2.0 Survey Methodology 2
2.1 Two-phase Grid-based Systematic Survey 2
2.2 Tetratheca juncea – Survey Methodology 2
2.3 Callistemon linearifolius – Note on Survey Methodology 3
2.4 Grevillea parviflora subsp. parviflora – Note on Survey Methodology 3
2.5 Biodiversity Assessment Method (BAM) Plots 3
2.6 Incidental Observations 3
2.7 Plant Community Type (PCT) Determination 4
3.0 Species Survey Effort 5
4.0 Survey Results 9

Tables

Table 1 – Target Species List 1
Table 2 – Survey Effort 6
Table 3 – Survey Methods and Times 8
Table 4 – Species List 9
Table 5 – Threatened Species Identified on Site 22

Figures

Figure 1 - Survey effort for *Rhodamnia rubescens* and *Rhodomyrtus psidioides* 23
Figure 2 – Habitat assessment and canopy survey 24
Figure 3 – August survey effort 25
Figure 4 – September/October survey effort 26
Figure 5 – November/December/January survey effort 27
Figure 6 – BAM Plots 28

Appendices

Attachment A – Royal Botanic Gardens Correspondence
Attachment B – Assessment of *Rhodamnia rubescens* Condition

1.0 Introduction

The Subject Site is currently subject to a rezoning proposal and as such, a Biodiversity Stewardship Site Assessment Report and two Biodiversity Certification Assessment Reports are due to be delivered to accompany the lodgement of the proposal.

The identification of Plant Community Types on site by Bell & Sims (2021) and the entry of the related impacted native vegetation zones in the BAM Calculator led to the production of the following candidate species list needing survey. **Table 1** lists such species.

Table 1 – Target Species List

Scientific name	Common name
Acacia bynoeana	Bynoe's Wattle
Angophora inopina	Charmhaven Apple
Asperula asthenes	Trailing Woodruff
Astrotricha crassifolia	Thick-leaf Star-hair
Caladenia tessellata	Thick Lip Spider Orchid
Callistemon linearifolius	Netted Bottlebrush
Corunastylis subsp. *Charmhaven (NSW896673)*	
Cryptostylis hunteriana	Leafless Tongue Orchid
Cymbidium canaliculatum	Tiger Orchid
Cynanchum elegans	White-flowered Wax Plant
Diuris praecox	Rough Doubletail
Eucalyptus camfieldii	Camfield's Stringybark
Eucalyptus glaucina	Slaty Red Gum
Eucalyptus parramattensis subsp. *decadens*	Drooping Red Gum
Genoplesium insigne	Variable Midge Orchid
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea
Maundia triglochinoides	Maundia
Melaleuca biconvexa	Biconvex Paperbark
Melaleuca groveana	Grove's Paperbark
Persicaria elatior	Tall Knotweed
Rhizanthella slateri	Eastern Australian Underground Orchid
Rhodamnia rubescens	Scrub Turpentine
Rhodomyrtus psydioides	Native Guava
Rutidosis heterogama	Heath Wrinklewort
Senna acclinis	Rainforest Cassia
Tetratheca glandulosa	Black-eyed Susan
Tetratheca juncea	Black-eyed Susan
Thelymitra adorata	Wyong Sun Orchid
Zannichellia palustris	Zannichellia

2.0 Survey Methodology

All required flora survey techniques were utilised for targeted survey of the species listed in Section 1.0 above and guided by the Threatened Species Survey and Assessment Guidelines (2004) and Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method (2020).

2.1 Two-phase Grid-based Systematic Survey

Large areas of suitable habitat can be assessed using a two-phase grid-based systematic survey approach. The approach provides a practical method for designating survey locations and ensures uniform, consistent coverage of the suitable habitat for a target species on the subject land (Krebs 1989; Fewster 2011). Survey locations are positioned on a grid intersect, facilitating planning and enabling rapid assessment across larger areas (McGarvey et al. 2016). The grid-based approach can be used for species assessed as counts of individuals or by area of suitable habitat.

A grid spaced at 100 square metres is nested within a one-square-kilometre grid from a topographic map image and then overlayed onto the subject land using a geographic information system (GIS). Surveys are undertaken where the 100-square-metre gridlines intersect within suitable habitat for a target species. Survey for multiple target species can occur within the area covered by the 100-square-metre grid, providing they occur in similar habitat, are of the same life form/habit, and have the same optimal survey time as specified by the TBDC.

At each survey location (grid intersect), a 40-metre diameter area (1256-square-metre circular area) must be systematically surveyed for the target species. Survey locations must be pre-loaded onto a GPS, tablet or georeferenced map.

If a target species is located, finer-scale grid surveys (Table 4) are used to locate population extent, which will help define the species polygon. This subsequent phase ensures a greater intensity of survey effort in locations where the target species occurs (McGarvey et al. 2016). Directing survey effort to areas with a greater probability of hosting the species increases survey efficiency and reduces sampling costs (Guisan et al. 2006). The extent of the area covered by the finer-scale grid should be refined by considering the habitat type, vegetation type and condition and landscape attributes surrounding the locations where the target species was first detected.

A total of approx. 628 grid intersects were identified within the Subject Site and surveyed.

2.2 *Tetratheca juncea* – Survey Methodology

As the development area occurs across both Lake Macquarie and Newcastle LGAs, the survey methodology has been followed to meet each of the local Council requirements. Surveys were conducted in the peak flowering period for *Tetratheca juncea*, being mid-September to mid-October (Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the vulnerable Black-eyed Susan, *Tetratheca juncea*, 2011).

The two-phase grid-based system which is outlined in Section 2.1 was used to survey the entire development area, encompassing both Lake Macquarie and Newcastle LGAs. This included the 100m intersection surveys and a refined search (5m belt transects) where *Tetratheca juncea* was located and within the surrounding area where undetected individuals may be found, considering habitat suitability.

Additionally, the area located within Lake Macquarie LGA was surveyed using 50m belt transects to determine a coarse distribution to cover a minimum 10% of the development area (Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the vulnerable Black-eyed Susan, *Tetratheca juncea*, 2011; Lake Macquarie *Tetratheca juncea* Planning and Management Guidelines 2014). This was then followed by a refined search where plants were located.

Where plants were located for both Newcastle and Lake Macquarie LGAs (during the refined search) individuals were counted and distinguished if clumps were greater than 30cm apart (Payne, R.J., Stevenson D.A. and Wellington R., 2002. A standardised method for counting Black-Eyed Susan populations. Unpublished technical note).

All transects and plant locations were recorded and are included in Figure 4.

2.3 *Callistemon linearifolius* – Note on Survey Methodology

The recommended survey season for *Callistemon linearifolius* is October to January. Targeted surveys using a grid-based systematic survey method were undertaken in November and December, and secondary finer surveys in areas where the species was found were undertaken in late December and early January.

Furthermore, it is to be noted that finer surveys for *Tetratheca juncea* (5-metre parallel transects in areas of suitable habitat) were undertaken in October. As such, it was considered that finer surveys were not required to be undertaken for *Callistemon linearifolius* outside the areas surveyed using the grid-based systematic method, as note was also kept of any *Callistemon spp.* encountered.

Therefore, the survey effort for *Callistemon linearifolius* was deemed comprehensive, and is shown on Figure 4 (finer survey between grid intersects) and Figure 5 (grid-based survey and finer *Callistemon linearifolius* count survey).

2.4 *Grevillea parviflora subsp. parviflora* – Note on Survey Methodology

Grevillea parviflora subsp. parviflora was identified as potentially occurring in four (4) locations as shown on Figure 4. Due to the uncertainty regarding species identity, a specimen was sent to the Royal Botanic Gardens and Domain Trust – National Herbarium of New South Wales for definite identification.

Furthermore, it is to be noted that the 5-metre parallel transects were undertaken in areas deemed suitable for *Tetratheca juncea* in October. Three (3) of the four (4) *Grevillea parviflora subsp. parviflora* suspected specimens were located in this fashion (see Figure 4) and further finer surveys did not identify additional potential *Grevillea parviflora subsp. parviflora* specimens.

Therefore, it was considered that the survey effort for *Grevillea parviflora subsp. parviflora* was comprehensive.

2.5 Biodiversity Assessment Method (BAM) Plots

The total area of each vegetation zone was used to determine the minimum number of plots required for each vegetation zone in accordance with Table 3 from the BAM. A combined total of 80 plots were undertaken across 21 vegetation zones by AEP and Bell & Sims (2020). If the broad condition state of the vegetation varied across the zone, additional plots were undertaken to ensure that a representative sample was taken for the vegetation within each zone.

Methods used to locate plots within vegetation zones to provide a representative assessment of the vegetation integrity of the vegetation zone included the random location of waypoints and bearings, and establishing plots at all or some of these waypoints as well as walking random distances into the vegetation zone and establishing the plot on a random bearing.

Plots were undertaken in accordance with the Biodiversity Assessment Method (2017 & 2020).

2.6 Incidental Observations

Incidental records of any flora species observed during fieldwork were noted.

Given the amount of field survey time spent in the Subject Site, survey intensity coverage was high, which led to several additions to site records via incidental observations.

2.7 Plant Community Type (PCT) Determination

Eastcoast Flora Survey (EFS), led by Dr Stephen Bell, a specialist vegetation botanist, conducted a full review and ground-truthing of the vegetation within the site. This included:

- Ground-truthing regional mapping vegetation communities within the Subject Site and updating as required;
- Determination and justification of each of the identified PCTs;
- Further map communities into vegetation zones within each of the identified plant community types accounting for variants within the PCTs as well as the condition class of the zone;
- Determination of Endangered Ecological Communities occurring on site;
- A report detailing the methodology and results of the work.

Determination of the PCTs associated with particular habitats has taken into consideration a combination of factors to assign a best fit PCT. Plot data collected in the field by EFS and AEP was analysed using characteristic species presence, IBRA region and subregion and other landscape features (elevation, exposure and soils) to narrow down potential PCTs.

3.0 Species Survey Effort

All targeted flora surveys were conducted within the required survey period for each species. Table 2 details such survey periods in grey, and “x” denotes when the survey was undertaken.

Table 3 details the survey techniques and timings for each target species.

Table 2 – Survey Effort

Scientific name	Common name	BAM Prescribed survey period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Survey effort figure number
Acacia bynoeana	Bynoe's Wattle	All year						x	x	x					2
Angophora inopina	Charmhaven Apple	All year			x	x		x	x						2
Asperula asthenes	Trailing Woodruff	Oct-Dec										x	x		4-5
Astrotricha crassifolia	Thick-leaf Star-hair	Jul-Dec								x					3
Caladenia tessellata	Thick Lip Spider Orchid	Sep-Oct									x	x			4
Callistemon linearifolius	Netted Bottlebrush	Oct-Jan										x	x	x	4-5
Corunastylis subsp. *Charmhaven*		Nov-Apr												x	5
Cryptostylis hunteriana	Leafless Tongue Orchid	Nov-Jan											x	x	5
Cymbidium canaliculatum	Tiger Orchid	All year						x	x					x	5
Cynanchum elegans	White-flowered Wax Plant	All year												x	5
Diuris praecox	Rough Doubletail	Aug								x					3
Eucalyptus camfieldii	Camfield's Stringybark	All year			x	x		x	x						2
Eucalyptus glaucina	Slaty Red Gum				x	x		x	x						2
Eucalyptus parramattensis subsp. *decadens*	Drooping Red Gum	All year			x	x		x	x						2
Genoplesium insigne	Variable Midge Orchid	Sep-Nov									x	x			4
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	Aug-Nov									x	x			4
Maundia triglochinoides	Maundia	Nov-Mar												x	5

Scientific name	Common name	BAM Prescribed survey period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Survey effort figure number
Melaleuca biconvexa	Biconvex Paperbark	All year			x	x		x	x						2
Melaleuca groveana	Grove's Paperbark	All year			x	x		x	x						2
Persicaria elatior	Tall Knotweed	Dec-May												x	5
Rhizanthella slateri	Eastern Australian Underground Orchid	Sep-Nov									x	x			4
Rhodamnia rubescens	Scrub Turpentine	All year			x	x	x			x		x			1
Rhodomyrtus psidioides	Native Guava	All year			x	x	x			x		x		x	1
Rutidosis heterogama	Heath Wrinklewort	All year								x					2
Senna acclinis	Rainforest Cassia	All year												x	5
Tetratheca glandulosa	Black-eyed Susan	Aug-Nov									x	x			4
Tetratheca juncea	Black-eyed Susan	Sep-Oct									x	x			4
Thelymitra adorata	Wyong Sun Orchid	Sep-Oct									x	x			4
Zannichellia palustris	Zannichellia	Oct-Jan												x	5

Table 3 – Survey Methods and Times

Scientific name	Common name	BAM Prescribed survey period	Survey type	Actual survey period	Survey UOM	Survey effort quantity / executed
Acacia bynoeana	Bynoe's Wattle	All year	Parallel transects	Jun-Jul 2020	100m grid survey	628
Angophora inopina	Charmhaven Apple	All year	Parallel transects	Jun-Jul 2020	100m grid survey	628
Asperula asthenes	Trailing Woodruff	Oct-Dec	Parallel transects	Oct-Nov 2020	100m grid survey	628
Astrotricha crassifolia	Thick-leaf Star-hair	Jul-Dec	Parallel transects	Aug 2020	100m grid survey	628
Caladenia tessellata	Thick Lip Spider Orchid	Sep-Oct	Parallel transects	Sep-Oct 2020	100m grid survey	628
Callistemon linearifolius	Netted Bottlebrush	Oct-Jan	Parallel transects	Nov-Dec 2020	100m grid survey	628
Corunastylis subsp. Charmhaven		Nov-Apr	Parallel transects	Dec 2020	100m grid survey	628
Cryptostylis hunteriana	Leafless Tongue Orchid	Nov-Jan	Parallel transects	Nov-Dec 2020	100m grid survey	628
Cymbidium canaliculatum	Tiger Orchid	All year	Parallel transects	Dec 2020	100m grid survey	628
Cynanchum elegans	White-flowered Wax Plant	All year	Parallel transects	Dec 2020	100m grid survey	628
Diuris praecox	Rough Doubletail	Aug	Parallel transects	Aug 2020	100m grid survey	628
Eucalyptus camfieldii	Camfield's Stringybark	All year	Parallel transects	Jun-Jul 2020	100m grid survey	628
Eucalyptus glaucina	Slaty Red Gum	All year	Parallel transects	Jun-Jul 2020	100m grid survey	628
Eucalyptus parramattensis subsp. decadens	Drooping Red Gum	All year	Parallel transects	Jun-Jul 2020	100m grid survey	628
Genoplesium insigne	Variable Midge Orchid	Sep-Nov	Parallel transects	Sep-Oct 2020	100m grid survey	628
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Aug-Nov	Parallel transects	Sep-Oct 2020	100m grid survey	628
Maundia triglochinoides	Maundia	Nov-Mar	Parallel transects	Dec-2020	100m grid survey	628
Melaleuca biconvexa	Biconvex Paperbark	All year	Parallel transects	Jun-Jul 2020	100m grid survey	628
Melaleuca groveana	Grove's Paperbark	All year	Parallel transects	Jun-Jul 2020	100m grid survey	628
Persicaria elatior	Tall Knotweed	Dec-May	Parallel transects	Dec-2020	100m grid survey	628
Rhizanthella slateri	Eastern Australian Underground Orchid	Sep-Nov	Parallel transects	Sep-Oct 2020	100m grid survey	628
Rhodamnia rubescens	Scrub Turpentine	All year	Parallel transects	Mar-May 2020; Aug 2020; Oct 2020	Suitable habitat surveyed (Y/N)	Y
Rhodomyrtus psidioides	Native Guava	All year	Parallel transects	Mar-May 2020; Dec-2020	Suitable habitat surveyed (Y/N)	Y
Rutidosis heterogama	Heath Wrinklewort	All year	Parallel transects	Aug-2020	100m grid survey	628
Senna acclinis	Rainforest Cassia	All year	Parallel transects	Dec-2020	100m grid survey	628
Tetratheca glandulosa	Black-eyed Susan	Aug-Nov	Parallel transects	Sep-Oct 2020	100m grid survey	628
Tetratheca juncea	Black-eyed Susan	Sep-Oct	Parallel transects	Sep-Oct 2020	100m grid survey	628
Thelymitra adorata	Wyong Sun Orchid	Sep-Oct	Parallel transects	Sep-Oct 2020	100m grid survey	628
Zannichellia palustris	Zannichellia	Oct-Jan	Parallel transects	Dec-2020	Suitable habitat surveyed (Y/N)	Y

4.0 Survey Results

Flora surveys to date have identified 559 species within the Subject Site. A full species list for flora recorded on the site is provided in **Table 4**.

Table 4 – Species List

Family	Scientific Name	Common name
Acanthaceae	*Brunoniella australis*	Blue Trumpet
Acanthaceae	*Brunoniella pumilio*	Dwarf Blue Trumpet
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair
Adiantaceae	*Adiantum hispidulum*	Rough Maidenhair
Amaranthaceae	*Alternanthera brasiliana*	
Amaranthaceae	*Amaranthus cruentus*	Red Amaranth
Amaranthaceae	*Amaranthus sp.*	Amaranth
Amaryllidaceae	*Allium sativum*	
Anthericaceae	*Arthropodium milleflorum*	Pale Vanilla Lily
Anthericaceae	*Arthropodium minus*	Small Vanilla Lily
Anthericaceae	*Arthropodium sp.*	
Anthericaceae	*Caesia parviflora*	Pale Grass Lily
Anthericaceae	*Tricoryne elatior*	Yellow Rush Lily
Anthericaceae	*Tricoryne simplex*	Yellow Rush-lily
Apiaceae	*Centella asiatica*	Swamp Pennywort
Apiaceae	*Cyclospermum leptophyllum**	Slender Celery
Apiaceae	*Daucus carota**	Wild Carrot
Apiaceae	*Daucus glochidiatus*	Native Carrot
Apiaceae	*Hydrocotyle laxiflora*	Stinking Pennywort
Apiaceae	*Hydrocotyle peduncularis*	Pennywort
Apiaceae	*Hydrocotyle sibthorpioides*	
Apiaceae	*Hydrocotyle sp.*	
Apiaceae	*Petroselinum crispum var. neapolitanum*	
Apiaceae	*Platysace lanceolata*	Lance-leaf Platysace
Apocynaceae	*Gomphocarpus fruiticosus**	Narrow Leaf Cotton Bush
Apocynaceae	*Marsdenia rostrata*	Common Milk Vine
Apocynaceae	*Parsonsia straminea*	Common Silkpod
Apocynaceae	*Tylophora barbata*	Bearded Tylophora
Apocynaceae	*Tylophora paniculata*	Thin-leaved Tylophora
Araceae	*Gymnostachys anceps*	Settlers Flax
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax
Araliaceae	*Polyscias sambucifolia* subsp. *sambucifolia*	
Arecaceae	*Phoenix canariensis**	Canary Island Date Palm
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern
Aspleniaceae	*Asplenium australasicum*	Birds Nest Fern
Asteraceae	*Ageratina adenophora**	Crofton Weed
Asteraceae	*Argyranthemum**	

Family	Scientific Name	Common name
Asteraceae	*Aster sp.**	
Asteraceae	*Aster subulatus**	Wild Aster
Asteraceae	*Bidens pilosa var. pilosa*	Bidens
Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Asteraceae	*Chondrilla juncea**	Skeleton Weed
Asteraceae	*Chrysanthemoides monilifera* subsp. *rotundata**	Bitou Bush
Asteraceae	*Cirsium vulgare**	Spear Thistle
Asteraceae	*Conyza bilbaoana**	
Asteraceae	*Conyza bonariensis**	Flax-leaf Fleabane
Asteraceae	*Conyza sp.**	A Fleabane
Asteraceae	*Conyza sumatrensis**	
Asteraceae	*Cyanthillium cinereum var. cinereum**	Purple Fleabane
Asteraceae	*Euchiton gymnocephalus*	
Asteraceae	*Euchiton involucratus*	Star Cudweed
Asteraceae	*Euchiton sphaericus*	
Asteraceae	*Facelis retusa**	Annual Trampweed
Asteraceae	*Gamochaeta americana**	Cudweed
Asteraceae	*Gamochaeta pensylvanica**	Cudweed
Asteraceae	*Gamochaeta sp.**	
Asteraceae	*Hypochaeris glabra**	Smooth Catsear
Asteraceae	*Hypochaeris radicata**	Flatweed
Asteraceae	*Hypochaeris albiflora**	
Asteraceae	*Lactuca saligna**	Willow-leaved Lettuce
Asteraceae	*Lactuca sativa*	Lettuce
Asteraceae	*Lagenophora gracilis*	Slender Lagenophora
Asteraceae	*Lagenophora stipitata*	
Asteraceae	*Leontodon saxatilis*	
Asteraceae	*Ozothamnus diosmifolius*	Ball Everlasting
Asteraceae	*Senecio diaschides*	
Asteraceae	*Senecio madagascariensis**	Fireweed
Asteraceae	*Senecio pterophorus**	African Daisy
Asteraceae	*Sigesbeckia orientalis* subsp. *orientalis*	Indian Weed
Asteraceae	*Solenogyne bellioides*	
Asteraceae	*Soliva sessilis**	Bindii
Asteraceae	*Sonchus oleraceus**	Common Sow-thistle
Asteraceae	*Sonchus sp.**	Sowthistle
Asteraceae	*Tagetes sp.**	
Asteraceae	*Taraxacum officinale**	Dandelion
Asteraceae	*Gamochaeta purpurea*	
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	Wonga Wonga Vine
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern
Blechnaceae	*Doodia caudata*	Small Rasp Fern
Brassicaceae	*Brassica sp.**	Brassica

Family	Scientific Name	Common name
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell
Campanulaceae	*Wahlenbergia gracilis*	Australian Bluebell
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle
Caryophyllaceae	*Petrorhagia dubia**	
Caryophyllaceae	*Silene gallica var. gallica**	French Catchfly
Caryophyllaceae	*Silene gallica**	French Catchfly
Caryophyllaceae	*Vaccaria hispanica**	Cow Soapwort
Casuarinaceae	*Allocasuarina littoralis*	Black She-oak
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Celastraceae	*Denhamia silvestris*	
Celastraceae	*Denhamia sp.*	
Celastraceae	*Maytenus silvestris*	Orange Bush
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush
Colchicaceae	*Burchardia umbellata*	Milkmaids
Commelinaceae	*Commelina cyanea*	Scurvy Weed, Native Wandering Jew
Convolvulaceae	*Dichondra repens*	Kidney Weed
Convolvulaceae	*Polymeria calycina*	Bindweed
Crassulaceae	*Kalanchoe blossfeldiana*	
Cucurbitaceae	*Cucumis sativus*	
Cunoniaceae	*Callicoma serratifolia*	Black Wattle
Cunoniaceae	*Schizomeria ovata*	Crab Apple
Cyperaceae	*Carex longebrachiata*	Bergalia Tussock
Cyperaceae	*Cyperus brevifolius**	Mullumbimby Couch
Cyperaceae	*Cyperus gracilis*	Slender Flat Sedge
Cyperaceae	*Cyperus laevis*	
Cyperaceae	*Cyperus polystachyos*	
Cyperaceae	*Cyperus sphaeroideus*	
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-rush
Cyperaceae	*Gahnia aspera*	Saw Sedge
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge
Cyperaceae	*Gahnia erythrocarpa*	Saw Sedge
Cyperaceae	*Gahnia microstachya*	
Cyperaceae	*Gahnia sp.*	
Cyperaceae	*Lepidosperma elatius*	Tall Sword-sedge
Cyperaceae	*Lepidosperma gunnii*	
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge
Cyperaceae	*Lepidosperma sp.*	
Cyperaceae	*Ptilothrix deusta*	
Cyperaceae	*Schoenus apogon*	Fluke Bog-rush
Cyperaceae	*Schoenus melanostachys*	Black Bog Rush
Davalliaceae	*Nephrolepis cordifolia**	Fish-bone Fern
Dennstaedtiaceae	*Hypolepis muelleri*	Harsh Ground Fern
Dennstaedtiaceae	*Pteridium esculentum*	Bracken

Family	Scientific Name	Common name
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower
Dilleniaceae	*Hibbertia aspera* subsp. *aspera*	
Dilleniaceae	*Hibbertia dentata*	Twining Guinea Flower
Dilleniaceae	*Hibbertia empetrifolia* subsp. *empetrifolia*	
Dilleniaceae	*Hibbertia obtusifolia*	Grey Guinea Flower
Dilleniaceae	*Hibbertia pedunculata*	
Dilleniaceae	*Hibbertia riparia*	Erect Guinea Flower
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower
Dioscoreaceae	*Dioscorea transversa*	Native Yam
Ebenaceae	*Diospyros australis*	Black Plum
Elaeocarpaceae	*Elaeocarpus obovatus*	Hard Quandong
Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Elaeocarpaceae	*Tetratheca juncea*	Black-eyed Susan
Epacridaceae	*Epacris microphylla*	Coral Heath
Epacridaceae	*Epacris pulchella*	Wallum Heath
Epacridaceae	*Leucopogon juniperinus*	Prickly Beard-heath
Epacridaceae	*Leucopogon lanceolatus*	Lance-leaf Beard-heath
Epacridaceae	*Monotoca scoparia*	Prickly Broom-heath
Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Euphorbiaceae	*Claoxylon australe*	Brittlewood
Euphorbiaceae	*Croton verreauxii*	Native Cascarilla
Euphorbiaceae	*Euphorbia graminea*	
Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart
Euphorbiaceae	*Phyllanthus hirtellus*	Thyme Spurge
Euphorbiaceae	*Phyllanthus tenellus**	Hen and Chicken
Euphorbiaceae	*Poranthera microphylla*	Small Poranthera
Eupomatiaceae	*Eupomatia laurina*	Bolwarra
Fabaceae	*Acacia brownii*	Heath Wattle
Fabaceae	*Acacia decurrens*	Black Wattle
Fabaceae	*Acacia falcata*	Sickle Wattle
Fabaceae	*Acacia fimbriata*	Fringed Wattle
Fabaceae	*Acacia floribunda*	
Fabaceae	*Acacia implexa*	Hickory Wattle
Fabaceae	*Acacia irrorata*	
Fabaceae	*Acacia irrorata* subsp. *irrorata*	Sydney Green Wattle
Fabaceae	*Acacia linifolia*	White Wattle
Fabaceae	*Acacia longifolia*	
Fabaceae	*Acacia longifolia var. longifolia*	Sydney Golden Wattle
Fabaceae	*Acacia longifolia var. sophorae*	Coastal Wattle
Fabaceae	*Acacia longissima*	Long-leaf Wattle
Fabaceae	*Acacia maidenii*	Maiden's Wattle
Fabaceae	*Acacia myrtifolia*	Red Stem Wattle
Fabaceae	*Acacia parvipinnula*	Silver-stemmed Wattle

Family	Scientific Name	Common name
Fabaceae	*Acacia saligna**	Orange Wattle
Fabaceae	*Acacia sp.*	Wattle
Fabaceae	*Acacia stricta*	Straight Wattle
Fabaceae	*Acacia terminalis*	Sunshine Wattle
Fabaceae	*Acacia terminalis* subsp. *longiaxialis*	
Fabaceae	*Acacia ulicifolia*	Prickly Moses
Fabaceae	*Bossiaea obcordata*	Spiny Bossiaea
Fabaceae	*Chorizema parviflorum*	Eastern Flame Pea
Fabaceae	*Daviesia squarrosa*	
Fabaceae	*Daviesia ulicifolia*	Gorse Bitter Pea
Fabaceae	*Daviesia ulicifolia* subsp. *ulicifolia*	
Fabaceae	*Desmodium brachypodum*	Large Tick-trefoil
Fabaceae	*Desmodium gunii*	Slender Tick-trefoil
Fabaceae	*Desmodium rhytidophyllum*	
Fabaceae	*Desmodium sp.*	Tick-trefoil
Fabaceae	*Desmodium varians*	Slender Tick-trefoil
Fabaceae	*Dillwynia floribunda var. floribunda*	Parrot Pea
Fabaceae	*Dillwynia retorta*	Eggs and Bacon
Fabaceae	*Glycine clandestina*	Twining Glycine
Fabaceae	*Glycine microphylla*	Small-leaf Glycine
Fabaceae	*Glycine tabacina*	Twining Glycine
Fabaceae	*Gompholobium latifolium*	Broad-leaf Wedge-pea
Fabaceae	*Hardenbergia violacea*	False Sarsparilla
Fabaceae	*Hovea linearis*	
Fabaceae	*Indigofera australis*	Native Indigo
Fabaceae	*Kennedia rubicunda*	Dusky Coral Pea
Fabaceae	*Medicago orbicularis**	Button Medic
Fabaceae	*Medicago polymorpha**	Burr Medic
Fabaceae	*Medicago sp.**	A Medic
Fabaceae	*Melilotus indicus**	Hexham Scent
Fabaceae	*Mirbelia rubiifolia*	Heathy Mirbelia
Fabaceae	*Podolobium ilicifolium*	
Fabaceae	*Pultenaea daphnoides*	Large-leaf Bush Pea
Fabaceae	*Pultenaea euchila*	
Fabaceae	*Pultenaea flexilis*	Graceful Bush Pea
Fabaceae	*Pultenaea gunnii* subsp. *gunnii*	
Fabaceae	*Pultenaea linophylla*	
Fabaceae	*Pultenaea microphylla*	
Fabaceae	*Pultenaea paleacea*	Chaffy Bush-pea
Fabaceae	*Pultenaea retusa*	
Fabaceae	*Pultenaea spinosa*	
Fabaceae	*Pultenaea villosa*	Hairy Bush-pea
Fabaceae	*Senna pendula var. glabrata**	
Fabaceae	*Swainsona galegifolia*	Smooth Darling Pea

Family	Scientific Name	Common name
Fabaceae	*Trifolium arvense**	Haresfoot Clover
Fabaceae	*Trifolium campestre**	Hop Clover
Fabaceae	*Trifolium dubium**	Yellow Suckling Clover
Fabaceae	*Trifolium repens**	White Clover
Fabaceae	*Vicia sativa**	Common vetch
Gentianaceae	*Centaurium erythraea**	Common Centaury
Gentianaceae	*Centaurium tenuiflorum*	Branched Centaury, Slender centaury
Geraniaceae	*Geranium homeanum*	Northern Cranesbill
Geraniaceae	*Geranium molle* subsp. *molle**	Cranesbill Geranium
Geraniaceae	*Geranium solanderi*	Cutleaf Cranesbill
Geraniaceae	*Geranium solanderi var. solanderi*	
Geraniaceae	*Pelargonium australe*	Coastal Geranium, Native Storksbill
Geraniaceae	*Geranium gardneri*	
Goodeniaceae	*Goodenia bellidifolia*	Daisy-leaved Goodenia
Goodeniaceae	*Goodenia bellidifolia* subsp. *bellidifolia*	
Goodeniaceae	*Goodenia hederacea* subsp. *hederacea*	Ivy-leaved Goodenia
Goodeniaceae	*Goodenia heterophylla*	
Goodeniaceae	*Goodenia heterophylla* subsp. *eglandulosa*	
Goodeniaceae	*Goodenia heterophylla* subsp. *heterophylla*	Variable Leaved Goodenia
Goodeniaceae	*Goodenia ovata*	Hop Goodenia
Goodeniaceae	*Goodenia rotundifolia*	
Grammitidaceae	*Grammitis billardierei*	Finger Fern
Haloragaceae	*Gonocarpus micranthus*	
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort
Haloragaceae	*Gonocarpus teucrioides*	Raspwort
Hypoxidaceae	*Hypoxis hygrometrica*	Golden Star
Hypoxidaceae	*Hypoxis hygrometrica var. hygrometrica*	
Iridaceae	*Sisyrinchium iridifolium**	Blue Pigroot
Iridaceae	*Sisyrinchium micranthum*	
Juncaceae	*Juncus bufonius*	Juncus plebeius
Juncaceae	*Juncus cognatus**	
Juncaceae	*Juncus continuus*	
Juncaceae	*Juncus subsecundus*	Finger Rush
Juncaceae	*Juncus usitatus*	Common Rush
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum
Lamiaceae	*Clerodendrum tomentosum var. tomentosum*	
Lamiaceae	*Lavandula sp.**	
Lamiaceae	*Mentha sp.**	
Lamiaceae	*Plectranthus parviflorus*	Cockspur Flower
Lamiaceae	*Ocimum basilicum*	
Lauraceae	*Cassytha glabella f. glabella*	Slender Devil's Twine
Lauraceae	*Cassytha pubescens*	Common Devil's Twine
Lauraceae	*Cinnamomum camphora**	Camphor Laurel

Family	Scientific Name	Common name
Lauraceae	*Cryptocarya glaucescens*	Jackwood
Lauraceae	*Cryptocarya microneura*	Murrogun
Lauraceae	*Cryptocarya rigida*	Forest Maple
Linaceae	*Linum trigynum**	French Flax
Lindsaeaceae	*Lindsaea linearis*	Screw Fern
Lobeliaceae	*Lobelia purpurascens*	Whiteroot
Lomandraceae	*Lomandra brevis*	
Lomandraceae	*Lomandra confertifolia* subsp. *pallida*	
Lomandraceae	*Lomandra cylindrica*	
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush
Lomandraceae	*Lomandra filiformis* subsp. *coriacea*	Wattle Mat-rush
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush
Lomandraceae	*Lomandra longifolia*	Spiky-headed Mat-rush
Lomandraceae	*Lomandra micrantha* subsp. *tuberculata*	Small-flowered Mat-rush
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush
Lomandraceae	*Lomandra obliqua*	Twisted Mat-rush
Lomandraceae	*Lomandra sp.*	Mat-rush
Loranthaceae	*Amyema sp.*	Mistletoe
Loranthaceae	*Dendrophthoe vitellina*	Mistletoe
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily
Malvaceae	*Hibiscus heterophyllus* subsp. *heterophyllus*	Native Rosella
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne
Malvaceae	*Hibiscus pedunculatus*	
Meliaceae	*Melia azedarach*	White Cedar
Meliaceae	*Synoum glandulosum* subsp. *glandulosum*	Scentless Rosewood
Menispermaceae	*Stephania japonica*	Snake vine
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine
Menispermaceae	*Stephania japonica var. discolor*	Snake Vine
Monimiaceae	*Hedycarya angustifolia*	Native Mulberry
Monimiaceae	*Wilkiea huegeliana*	Wilkiea, Veiny Wilkiea
Moraceae	*Ficus coronata*	Sandpaper Fig
Moraceae	*Ficus rubiginosa*	Port Jackson Fig
Myrsinaceae	*Embelia australiana*	
Myrsinaceae	*Myrsine variabilis*	Muttonwood
Myrtaceae	*Acmena smithii*	Lillypilly
Myrtaceae	*Acmena sp.*	A Lilly Pilly
Myrtaceae	*Angophora costata*	Smooth-barked Apple
Myrtaceae	*Angophora floribunda*	Rough-barked Apple
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle
Myrtaceae	*Callistemon linearis*	Narrow-leaved Bottlebrush
Myrtaceae	*Callistemon linearifolius*	Netted Bottlebrush
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush

Family	Scientific Name	Common name
Myrtaceae	*Corymbia citriodora*	Lemon-scented Gum
Myrtaceae	*Corymbia gummifera*	Red Bloodwood
Myrtaceae	*Corymbia maculata*	Spotted Gum
Myrtaceae	*Corymbia sp.*	
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany
Myrtaceae	*Eucalyptus capitellata*	Brown Stringybark
Myrtaceae	*Eucalyptus eugenioides*	Thin-leaved Stringybark
Myrtaceae	*Eucalyptus fergusonii* subsp. *fergusonii*	
Myrtaceae	*Eucalyptus fibrosa*	Broad Leaved Ironbark
Myrtaceae	*Eucalyptus globoidea*	White Stringybark
Myrtaceae	*Eucalyptus paniculata*	Grey Ironbark
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint
Myrtaceae	*Eucalyptus placita*	Grey Ironbark
Myrtaceae	*Eucalyptus propinqua*	Small Fruited Grey Gum
Myrtaceae	*Eucalyptus punctata*	Grey Gum
Myrtaceae	*Eucalyptus resinifera*	Red Mahogany
Myrtaceae	*Eucalyptus resinifera* subsp. *resinifera*	Red Mahogany
Myrtaceae	*Eucalyptus siderophloia*	Northern Grey Ironbark
Myrtaceae	*Eucalyptus sp.*	
Myrtaceae	*Eucalyptus umbra*	Broad-leaved White Mahogany
Myrtaceae	*Leptospermum polyanthum*	
Myrtaceae	*Leptospermum polygalifolium*	Tantoon
Myrtaceae	*Leptospermum polygalifolium* subsp. *cismontanum*	Tantoon
Myrtaceae	*Leptospermum polygalifolium* subsp. *polygalifolium*	Tantoon
Myrtaceae	*Leptospermum sp.*	Tea-tree
Myrtaceae	*Leptospermum trinervium*	Slender Tea-tree
Myrtaceae	*Melaleuca linariifolia*	Snow in Summer
Myrtaceae	*Melaleuca nodosa*	Ball Honey Myrtle
Myrtaceae	*Melaleuca sieberi*	
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree
Myrtaceae	*Melaleuca thymifolia*	Thyme Honey Myrtle
Myrtaceae	*Rhodamnia rubescens*	Scrub Turpentine
Myrtaceae	*Sannantha plurifolia*	
Myrtaceae	*Syncarpia glomulifera*	Turpentine
Myrtaceae	*Syncarpia glomulifera* subsp. *glomulifera*	
Nandinaceae	*Nandina sp.**	
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Oleaceae	*Ligustrum sinense**	Small-leaved Privet
Oleaceae	*Notelaea longifolia*	Mock Olive, Large Mock-olive
Oleaceae	*Notelaea longifolia f. glabra*	
Oleaceae	*Notelaea longifolia f. longifolia*	
Oleaceae	*Notelaea ovata*	Mock Olive
Oleaceae	*Notelaea venosa*	Veined Mock Olive
Orchidaceae	*Acianthus fornicatus*	Pixie Caps

Family	Scientific Name	Common name
Orchidaceae	*Acianthus sp.*	Mosquito Orchid
Orchidaceae	*Caladenia carnea*	Pink Finger Orchid
Orchidaceae	*Caladenia catenata*	White Finger Orchid
Orchidaceae	*Caladenia picta*	Painted Fingers Orchid
Orchidaceae	*Caladenia sp.*	
Orchidaceae	*Calochilus campestris*	Copper Beard Orchid
Orchidaceae	*Calochilus paludosus*	Red Beard Orchid
Orchidaceae	*Calochilus robertsonii*	Purplish Beard Orchid
Orchidaceae	*Calochilus sp.*	
Orchidaceae	*Chiloglottis formicera*	Ant Orchid
Orchidaceae	*Corybas fimbriatus*	Fringed Helmet Orchid
Orchidaceae	*Cryptostylis erecta*	Bonnet Orchid
Orchidaceae	*Cryptostylis subulata*	Large Tongue Orchid
Orchidaceae	*Dipodium punctatum*	Hyacinth Orchid
Orchidaceae	*Dipodium variegatum*	Blotched Hyacinth Orchid
Orchidaceae	*Lyperanthus suaveolens*	Brown Beak Orchid
Orchidaceae	*Microtis parviflora*	Slender Onion Orchid
Orchidaceae	*Microtis sp.*	
Orchidaceae	*Prasophyllum brevilabre*	Short-lipped Leek Orchid
Orchidaceae	*Pterostylis acuminata*	Pointed Greenhood
Orchidaceae	*Pterostylis alveata*	Coastal Greenhood
Orchidaceae	*Pterostylis alveata*	Coastal Greenhood
Orchidaceae	*Pterostylis baptistii*	King Greenhood
Orchidaceae	*Pterostylis bicolor*	Black-tip Greenhood
Orchidaceae	*Pterostylis curta*	Blunt Greenhood
Orchidaceae	*Pterostylis erecta*	Erect Maroonhood
Orchidaceae	*Pterostylis longifolia*	Tall Greenhood
Orchidaceae	*Pterostylis nutans*	Nodding Greenhood
Orchidaceae	*Pterostylis pedunculata*	Maroonhood
Orchidaceae	*Pterostylis sp.*	Greenhood
Orchidaceae	*Thelymitra ixioides*	Spotted Sun Orchid
Orchidaceae	*Thelymitra pauciflora*	Slender Sun Orchid
Oxalidaceae	*Oxalis compressa*	
Oxalidaceae	*Oxalis corniculata**	Yellow Wood Sorrel, Creeping Oxalis
Oxalidaceae	*Oxalis exilis*	
Oxalidaceae	*Oxalis perrenans*	Yellow-flowered Wood Sorrel
Oxalidaceae	*Oxalis sp.*	
Passifloraceae	*Passiflora suberosa**	Cork Passionflower
Peperomiaceae	*Peperomia tetraphylla*	Four-leaved Peperomia
Phormiaceae	*Dianella caerulea*	Blue Flax-lily
Phormiaceae	*Dianella caerulea var. assera*	Flax Lily
Phormiaceae	*Dianella caerulea var. caerulea*	Flax Lily
Phormiaceae	*Dianella caerulea var. producta*	Blue Flax Lily
Phormiaceae	*Dianella longifolia*	Blue Flax Lily

Family	Scientific Name	Common name
Phormiaceae	*Dianella longifolia var. longifolia*	A Blue Flax Lily
Phormiaceae	*Dianella revoluta var. revoluta*	Spreading Flax Lily
Phyllanthaceae	*Glochidion ferdinandi var. ferdinandi*	Cheese Tree
Pittosporaceae	*Billardiera scandens*	Hairy Appleberry
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa*	Native Blackthorn
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Plantaginaceae	*Plantago debilis*	Slender Plantain
Plantaginaceae	*Plantago lanceolata**	Ribwort
Plantaginaceae	*Plantago myosuros* subsp. *myosuros**	
Plantaginaceae	*Plantago varia*	
Poaceae	*Aira cupaniana**	Silvery Hairgrass
Poaceae	*Andropogon virginicus**	Whisky Grass
Poaceae	*Aristida vagans*	Three-awn Speargrass
Poaceae	*Aristida warburgii*	
Poaceae	*Austrostipa sp.*	A Speargrass
Poaceae	*Axonopus fissifolius**	
Poaceae	*Briza maxima**	Quaking Grass
Poaceae	*Briza minor**	Shivery Grass
Poaceae	*Briza subaristata**	
Poaceae	*Capillipedium parviflorum*	Scented-top Grass
Poaceae	*Capillipedium spicigerum*	Scented-top Grass
Poaceae	*Cenchrus clandestinum**	Kikuyu
Poaceae	*Chloris gayana**	Rhodes Grass
Poaceae	*Cortaderia selloana**	Pampas Grass
Poaceae	*Cymbopogon ambiguus*	Lemon Grass
Poaceae	*Cymbopogon refractus*	Barbwire Grass
Poaceae	*Cynodon dactylon*	Common Couch
Poaceae	*Dichelachne crinita*	Long-hair Plume Grass
Poaceae	*Dichelachne inaequiglumis*	
Poaceae	*Dichelachne micrantha*	Short-hair Plume Grass
Poaceae	*Digitaria ciliaris**	Summer Grass
Poaceae	*Digitaria diffusa*	Open Summer-grass
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass
Poaceae	*Echinopogon caespitosus var. caespitosus*	Tufted Hedgehog Grass
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass
Poaceae	*Entolasia marginata*	Bordered Panic
Poaceae	*Entolasia sp.*	
Poaceae	*Entolasia stricta*	Wiry Panic
Poaceae	*Eragrostis alveiformis*	
Poaceae	*Eragrostis brownii*	Brown's Lovegrass

Family	Scientific Name	Common name
Poaceae	*Eragrostis curvula**	African Lovegrass
Poaceae	*Eragrostis elongata*	Clustered Lovegrass
Poaceae	*Hyparrhenia hirta**	Coolatai Grass
Poaceae	*Imperata cylindrica*	Blady Grass
Poaceae	*Lachnagrostis filiformis*	Blown Grass
Poaceae	*Melinus repens**	Red Natal Grass
Poaceae	*Microlaena stipoides*	Weeping Grass
Poaceae	*Microlaena stipoides var. stipoides*	Weeping Rice Grass
Poaceae	*Oplismenus aemulus*	Basket Grass
Poaceae	*Oplismenus imbecillis*	
Poaceae	*Panicum effusum*	Hairy Panic
Poaceae	*Panicum gilvum**	
Poaceae	*Panicum simile*	Two Colour Panic
Poaceae	*Paspalidium distans*	
Poaceae	*Paspalum dilatatum**	Paspalum
Poaceae	*Paspalum orbiculare*	Ditch Millet
Poaceae	*Paspalum sp.**	
Poaceae	*Paspalum urvillei**	Vasey Grass
Poaceae	*Pennisetum clandestinum**	
Poaceae	*Poa affinis*	
Poaceae	*Poa annua**	Winter Grass
Poaceae	*Poa labillardierei var. labillardierei*	Tussock Grass
Poaceae	*Poa sieberiana*	Tussock Grass
Poaceae	*Poa sp.**	
Poaceae	*Rytidosperma tenuius*	Wallaby Grass
Poaceae	*Setaria gracilis**	Slender Pigeon Grass
Poaceae	*Setaria palmifolia**	Palm Grass
Poaceae	*Setaria parviflora**	Slender Pigeon Grass
Poaceae	*Setaria sphacelata**	South African Pigeon Grass
Poaceae	*Sorghum halpense**	Johnson Grass
Poaceae	*Sporobolus africanus**	Parramatta Grass
Poaceae	*Sporobolus creber*	Slender Rat’s Tail Grass
Poaceae	*Themeda triandra*	Kangaroo Grass
Poaceae	*Vulpia bromoides**	Squirrel Tail Fescue
Poaceae	*Vulpia myuros**	Rat's Tail Fescue
Poaceae	*Panicum maximum var. maximum*	
Poaceae	*Poaceae sp.*	
Poaceae	*Rytidosperma pallidum*	Silvertop Wallaby Grass
Polygonaceae	*Persicaria capitata**	Knotweed
Polygonaceae	*Persicaria decipiens*	Slender Knotweed
Polypodiaceae	*Microsorum scandens*	Fragrant Fern
Polypodiaceae	*Pyrrosia rupestris*	Rock Felt Fern
Primulaceae	*Lysimachia arvensis var. caerulea**	
Primulaceae	*Lysimachia arvensis**	

Family	Scientific Name	Common name
Proteaceae	*Banksia spinulosa*	Hairpin Banksia
Proteaceae	*Banksia spinulosa var. collina*	Hairpin Banksia
Proteaceae	*Grevillea parviflora* subsp. *parviflora*	Small-flower Grevillea
Proteaceae	*Hakea salicifolia*	Willow Hakea
Proteaceae	*Hakea sericea*	Needlebush
Proteaceae	*Hakea teretifolia*	Dagger Hakea
Proteaceae	*Persoonia levis*	Broad-leaved Geebung
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung
Pteridaceae	*Cheilanthes austrotenuifolia*	Rock Fern
Pteridaceae	*Cheilanthes sieberi*	Rock Fern
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*	Poison Rock Fern
Ranunculaceae	*Clematis aristata*	Old Man's Beard
Ranunculaceae	*Clematis glycinoides var. glycinoides*	Headache Vine
Ranunculaceae	*Ranunculus sp.*	
Restionaceae	*Empodisma minus*	Spreading Rope-rush
Rhamnaceae	*Alphitonia excelsa*	Red Ash
Rhamnaceae	*Pomaderris ferruginea*	Rusty Pomaderris
Rosaceae	*Rubus moluccanus var. trilobus*	Native Raspberry
Rosaceae	*Rubus rosifolius*	Forest Bramble
Rosaceae	*Rubus rosifolius var. rosifolius*	
Rubiaceae	*Galium binifolium*	
Rubiaceae	*Galium proquinquum*	
Rubiaceae	*Morinda jasminoides*	Sweet Morinda
Rubiaceae	*Opercularia diphylla*	
Rubiaceae	*Pomax umbellata*	Pomax
Rubiaceae	*Psychotria loniceroides*	Hairy Psychotria
Rubiaceae	*Richardia brasiliensis**	White Eye
Rubiaceae	*Richardia humistrata**	
Rubiaceae	*Galium binifolium* subsp. *binifolium*	
Rubiaceae	*Galium leiocarpum*	
Rutaceae	*Boronia polygalifolia*	Dwarf Boronia
Rutaceae	*Citrus x taitensis**	Rough Lemon
Rutaceae	*Melicope micrococca*	
Rutaceae	*Sarcomelicope simplicifolia* subsp. *simplicifolia*	Big Yellow Wood
Rutaceae	*Zieria smithii*	Low growing form of Z. smithii, Diggers Head
Santalaceae	*Exocarpos sp.*	
Sapindaceae	*Alectryon subcinereus*	Native Quince
Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo
Sapindaceae	*Diploglottis australis*	
Sapindaceae	*Dodonaea triquetra*	Hop-bush
Sapindaceae	*Guioa semiglauca*	Guioa
Scrophulariaceae	*Gratiola pedunculata*	
Scrophulariaceae	*Veronica plebeia*	Creeping Speedwell
Selaginellaceae	*Selaginella sp.*	

Family	Scientific Name	Common name
Sinopteridaceae	*Pellaea falcata*	Sickle Fern
Sinopteridaceae	*Pellaea paradoxa*	
Smilacaceae	*Smilax australis*	Lawyer Vine
Smilacaceae	*Smilax glyciphylla*	Sarsaparilla
Solanaceae	*Duboisia myoporoides*	Corkwood
Solanaceae	*Solanum brownii*	Violet Nightshade
Solanaceae	*Solanum chenopodioides**	Whitetip Nightshade
Solanaceae	*Solanum mauritianum**	Wild Tobacco
Solanaceae	*Solanum nigrum**	Black Nightshade, Black-berry Nightshade
Solanaceae	*Solanum prinophyllum*	Forest Nightshade
Solanaceae	*Solanum stelligerum*	Devil's Needles
Solanaceae	*Solanum lycopersicum*	
Sterculiaceae	*Lasiopetalum ferrugineum var. cordatum*	
Stylidiaceae	*Stylidium graminifolium*	Grass Trigger Plant
Thelypteridaceae	*Christella dentata*	Binung
Thymelaeaceae	*Pimelea linifolia*	Slender Rice Flower
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	Slender Rice Flower
Tropaeolaceae	*Tropaeolum majus**	Nasturtium
Typhaceae	*Typha orientalis*	Cumbungi
Ulmaceae	*Trema tomentosa var. aspera*	Trema aspera
Uvulariaceae	*Schelhammera undulata*	Lilac Lily
Verbenaceae	*Lantana camara**	Lantana
Verbenaceae	*Verbena bonariensis**	Purpletop
Verbenaceae	*Verbena incompta**	
Verbenaceae	*Verbena officinalis**	Common Verbena
Verbenaceae	*Verbena rigida var. rigida**	Veined Verbena
Verbenaceae	*Verbena sp.**	
Violaceae	*Viola hederacea*	Ivy-leaved Violet
Violaceae	*Viola hederacea* subsp. *perreniformis*	
Violaceae	*Viola silicestris*	
Vitaceae	*Cayratia clematidea*	Native Grape
Vitaceae	*Cissus antarctica*	Kangaroo Vine
Vitaceae	*Cissus hypoglauca*	Water Vine
Vitaceae	*Clematicissus opaca*	Pepper Vine
Vitaceae	*Tetrastigma nitens*	
Xanthorrhoeaceae	*Xanthorrhoea latifolia* subsp. *latifolia*	
Xanthorrhoeaceae	*Xanthorrhoea macronema*	
Xanthorrhoeaceae	*Xanthorrhoea media*	Forest Grass Tree
Xanthorrhoeaceae	*Xanthorrhoea sp.*	
Zamiaceae	*Macrozamia flexuosa*	
Zamiaceae	*Macrozamia reducta*	

Table 5 shows the list of threatened flora species identified on site.

Table 5 – Threatened Species Identified on Site

Scientific Name	Common Name	Method of Identification
Callistemon linearifolius	Netted Bottlebrush	Parallel transects using 100m systematic grid survey
Grevillea parviflora subsp. *parviflora**	Small-flower Grevillea	Parallel transects using 100m systematic grid survey
Rhodamnia rubescens	Scrub Turpentine	Targeted parallel transects in suitable vegetation zone
Tetratheca juncea	Black-eyed Susan	Parallel transects using 100m systematic grid survey

*A specimen collected on site was sent to the Royal Botanic Gardens for identification. It was concluded that the species was *Grevillea humilis* subsp. *humilis* (see **Attachment A**). However, discussion with LMCC led to the adoption of the precautionary principle and the determination of *Grevillea parviflora* subsp. *parviflora* as probably occurring on site.

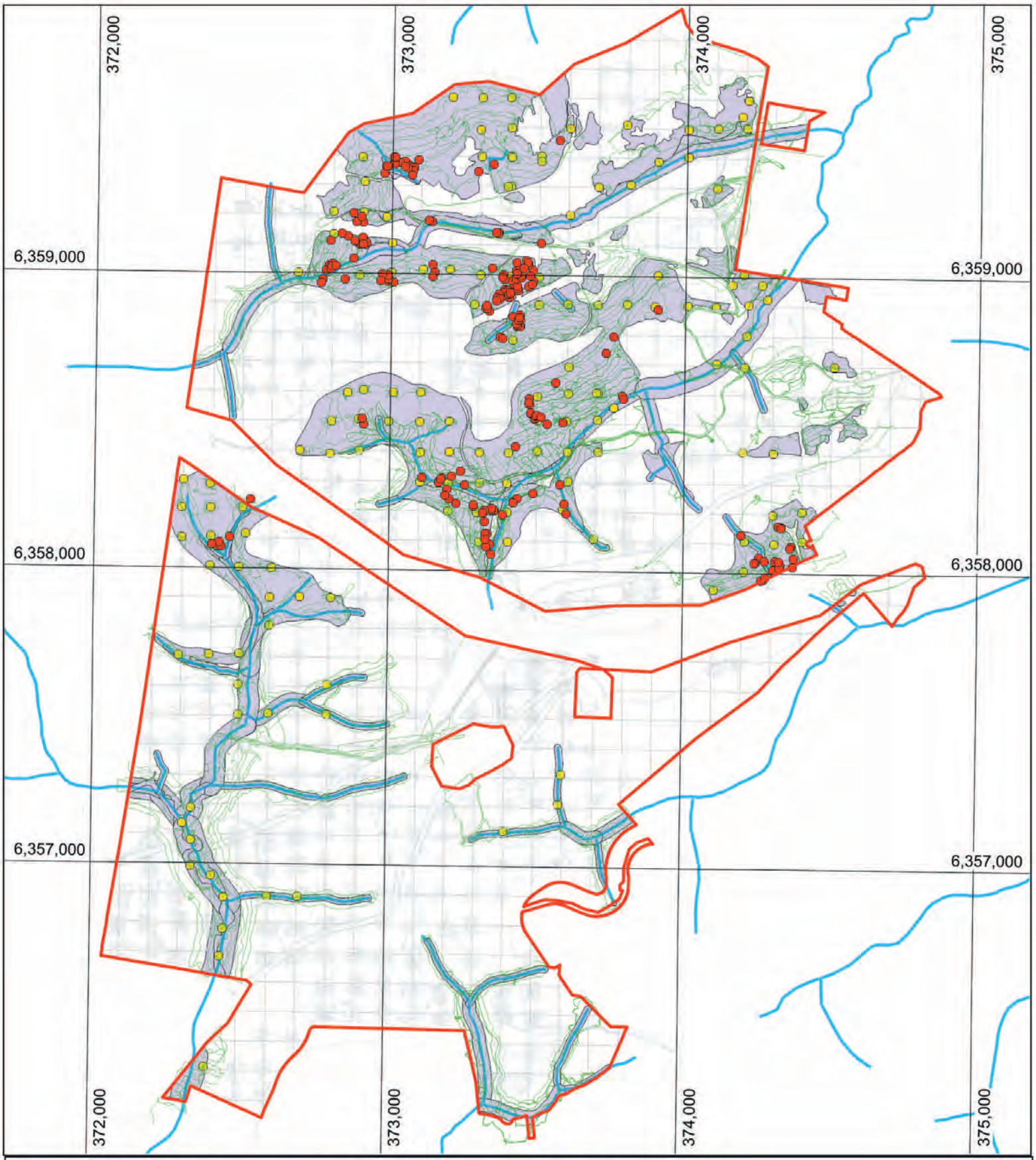


Figure 1 - Rhodamnia rubescens and Rhodomyrtus psidioides Survey Effort

Legend

- Subject Site
- Suitable habitat
- Targeted survey track
- Other survey tracks
- Mapped hydroline
- Target grid intersect survey
- Rhodamnia rubescens locations

0 750
metres
Scale 1:17,000

N W E S

AEP

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | June 2021
AEP Ref: 1971.01

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

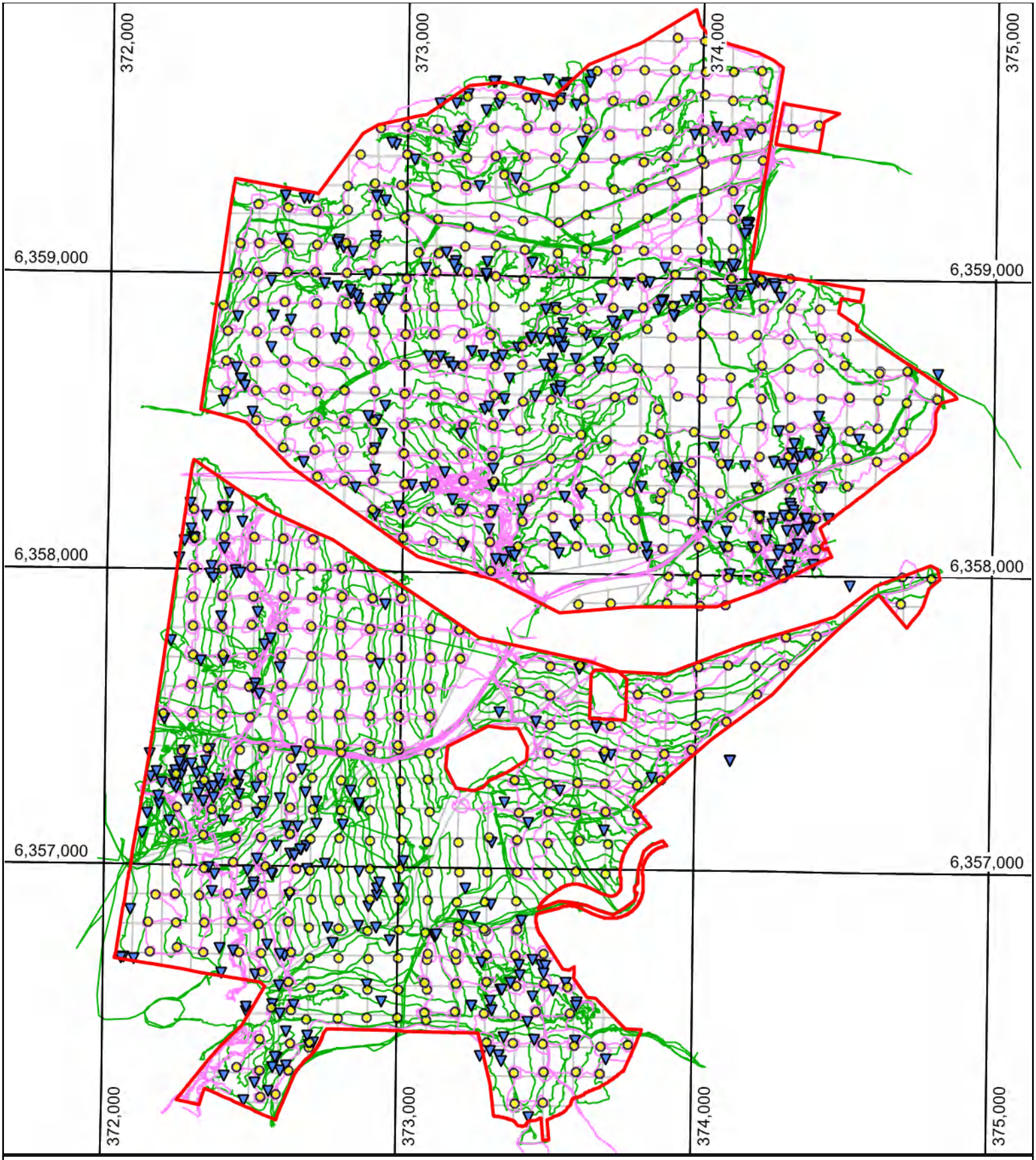


Figure 2 - Upper Stratum Survey Effort

Legend

- Subject Site
- Survey grid
- HBT survey track
- June-July 2020 survey tracks
- Grid intersect survey
- Hollow-bearing Tree

Centroid waypoints were captured at all grid intersects during surveys and are shown on the map. However, in some instances, GPS track files may have failed or been corrupt, thus preventing their conversion to mapping files.

0 750
metres
Scale 1:17,000

N W E S

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | June 2021
AEP Ref: 1971.01

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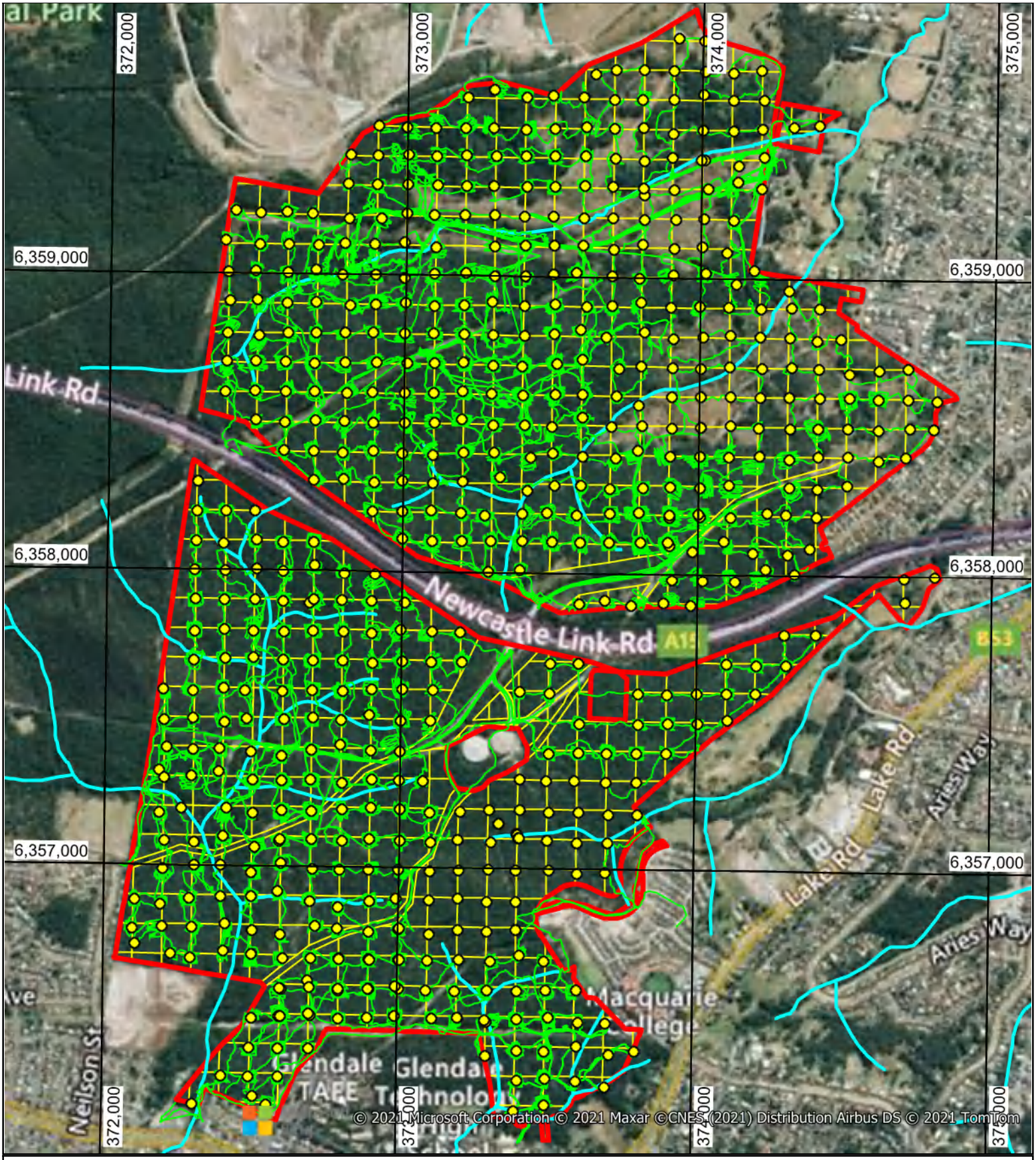

Figure 3 - August Flora Survey

Legend

- Subject Site
- Grid (100m)
- Grid intersect survey
- Survey track
- Lake Macquarie and City of Newcastle Hydroline

All grid intersects were surveyed. However, where tracks are missing on the map, this is due to GPS data corruption or download issues

0 750
metres
Scale 1:17,000

N W E S

AEP

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | June 2021
AEP Ref: 1971.01

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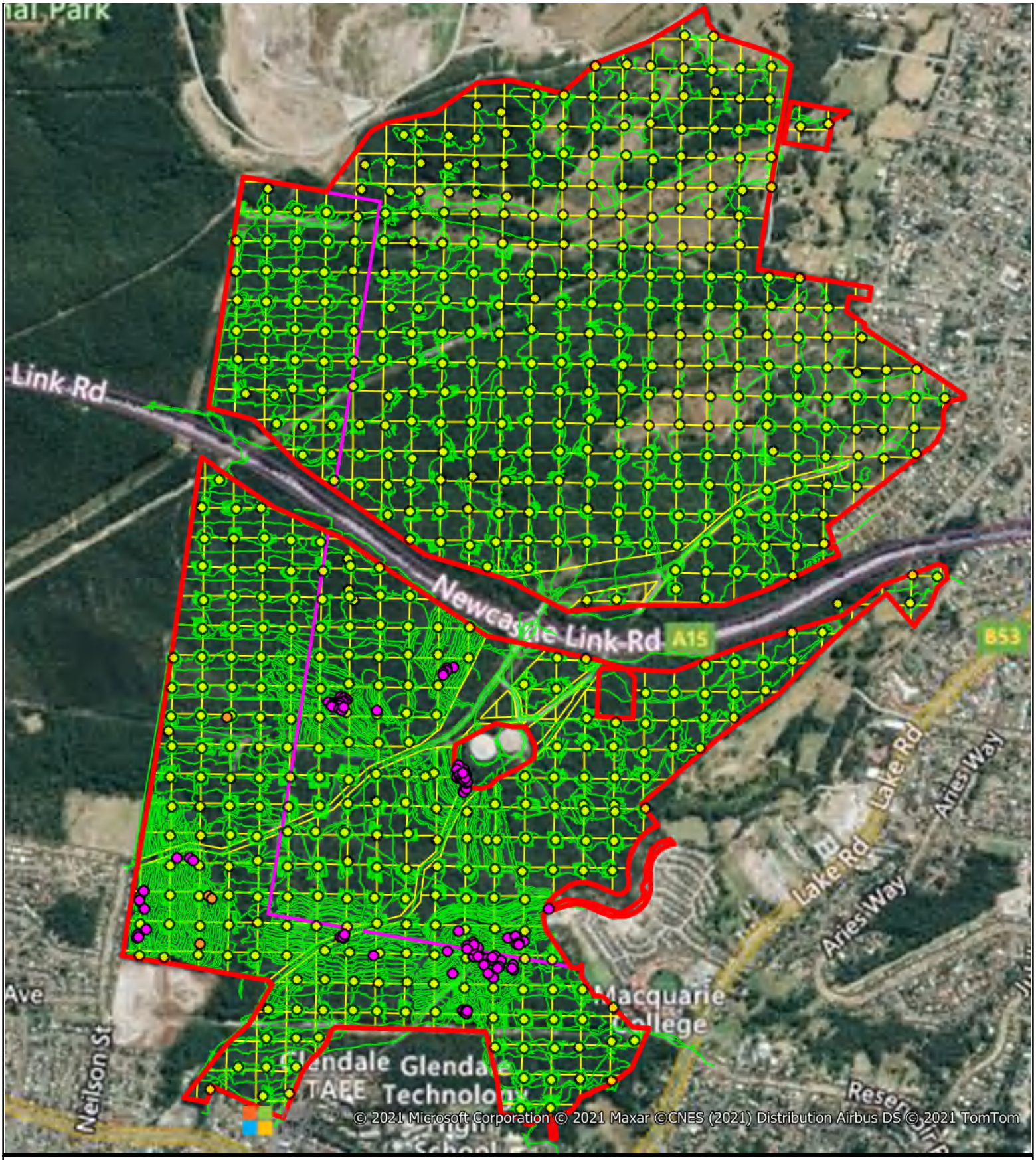

Figure 4 - September & October Flora Survey

Legend

- Subject Site
- Grid (100m)
- Grid intersect survey
- Survey track
- LGA boundary
- Tetratheca juncea
- Grevillea parviflora subsp. parviflora

0 750
metres
Scale 1:17,000

N W E S

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | June 2021
AEP Ref: 1971.01

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AEP

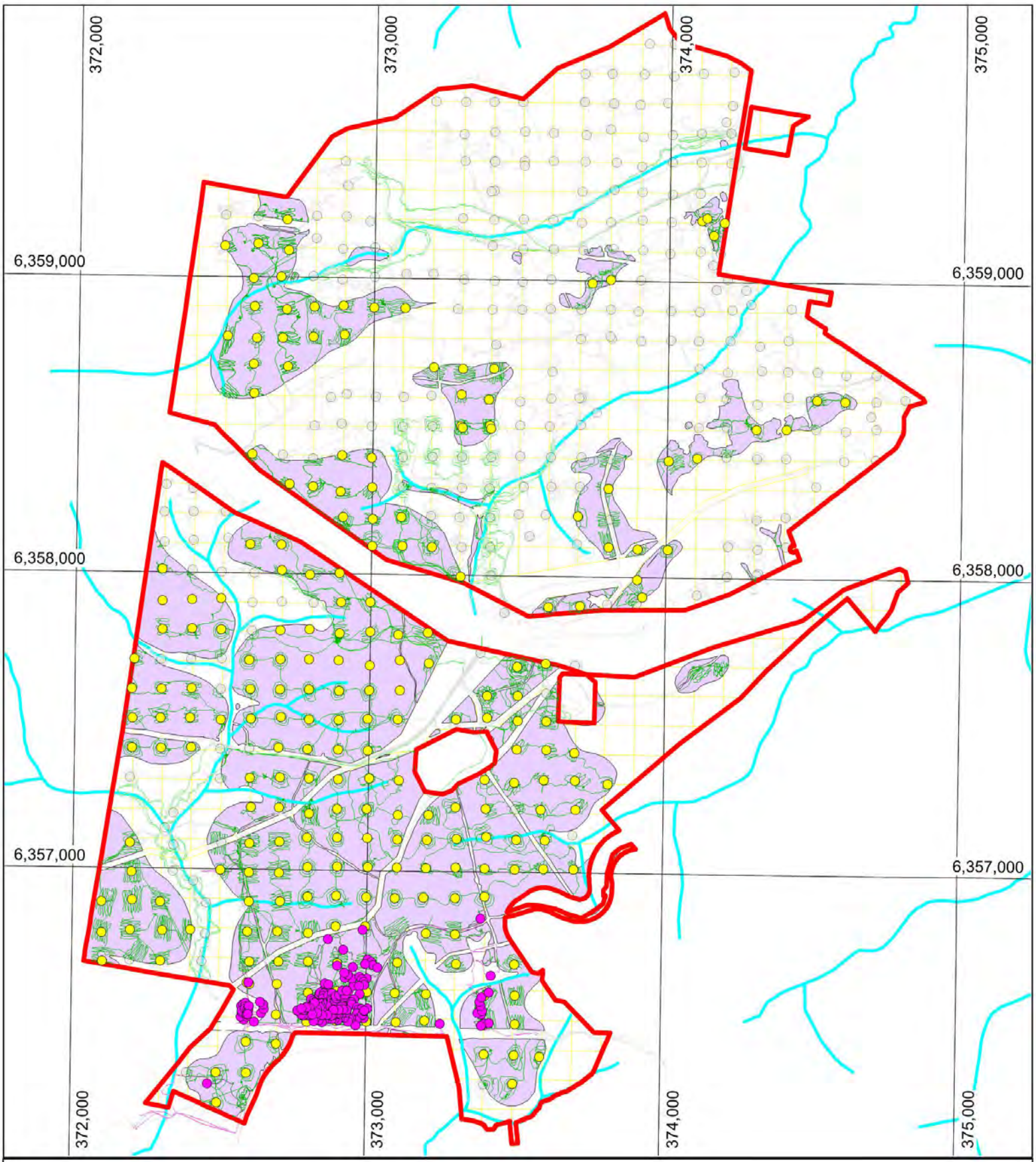

Figure 5 - November, December & January Flora Survey

Legend

- Subject Site
- Grid (100m)
- Grid intersect survey
- Targeted survey track
- Other survey track
- Mapped hydroline
- Callistemon linearifolius
- Suitable habitat / Target PCTs

0 750
metres
Scale 1:17,000

N W E S

AEP

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | June 2021
AEP Ref: 1971.01

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

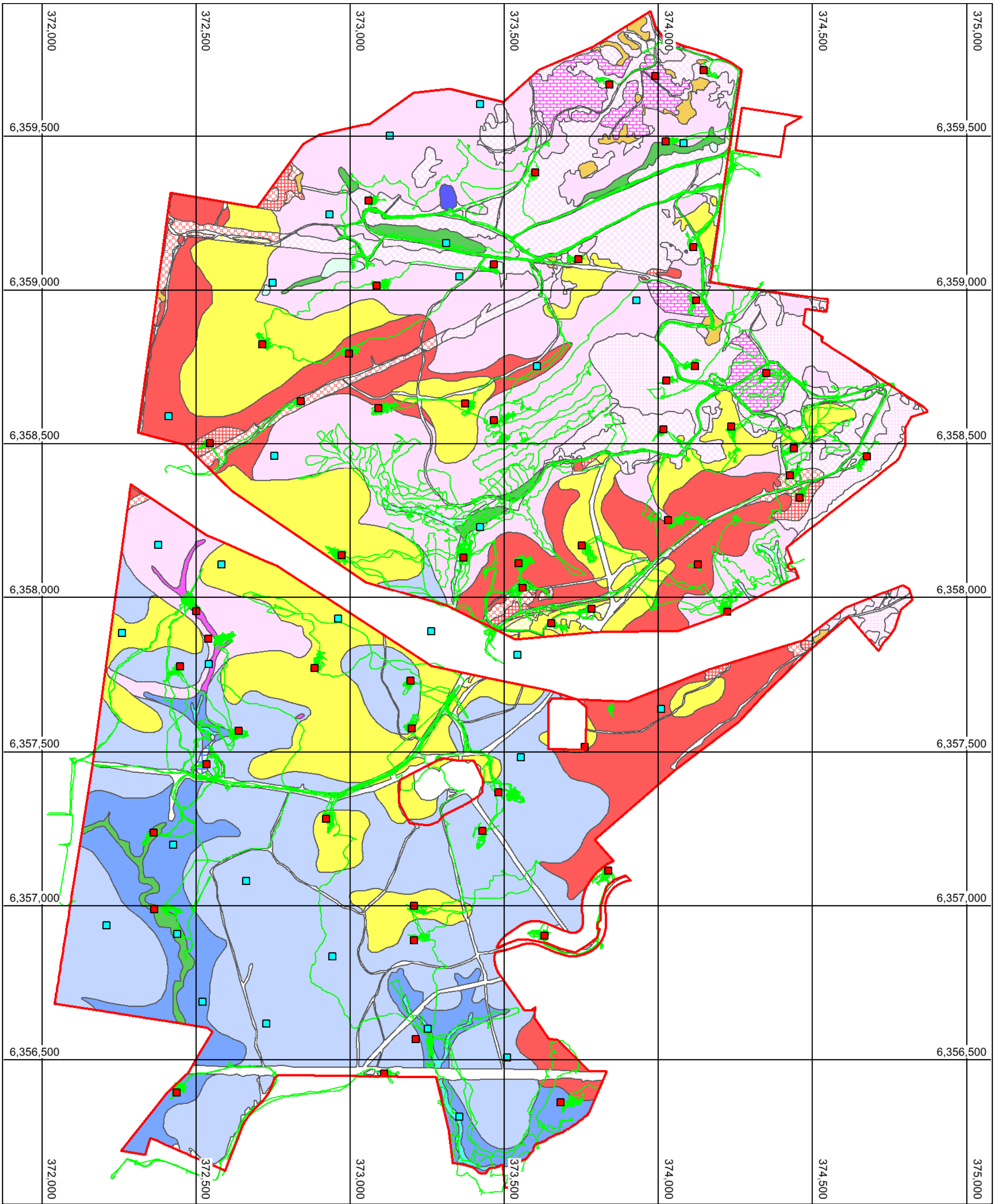

Figure 6 - BAM Plots

Legend

- Subject Site
- BAM Plots (AEP)
- BAM Plots (Eastcoast Flora Survey)
- BAM Plot tracks (AEP)

- R/P
- Exotic dominance
- 1539 - G
- 1543 - G
- 1573 - G
- 1584
- 1584 - DiRLU
- 1584 - DiRTS
- 1588 - G
- 1588 - DiRLU
- 1588 - DiRTS
- 1588 - DiUS
- 1592 - G
- 1592 - DiRLU
- 1592 - DiRTS
- 1619 - G
- 1619 - DiUS
- 1619 - DiRLU
- 1621 - RPPF
- 1621 - G
- 1621 - DiRTS
- 1737 - G

0 500
metres
Scale 1:11,000

N W E S

Location: Land off Newcastle Link Road, Wallsend, NSW
Client: Eden Estates Pty Ltd | AEP Ref: 1971.01 | June 2021

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AEP

Attachment A – Royal Botanic Gardens Correspondence

The Royal
BOTANIC GARDENS
& Domain Trust

National Herbarium of New South Wales

out of scope
Anderson Environment and Planning
PO Box 210
Adamstown, NSW 2289

BIS Enquiry No: 21488
Botanical.Is@rbgsyd.nsw.gov.au
Ph. No: (02) 9231 8111
Date: 12 March 2021

Dear Yann,

Re: plant identification – *Callistemon* and *Grevillea* from Wallsend

Your plant specimens have been determined as the following:

Sample 1: *Callistemon linearifolius* - det. Peter G. Wilson, 10th Feb 2021 – specimen retained for the herbarium collection.

Sample 2: *Grevillea humilis* subsp. *humilis* - det. A.E. Orme, 12th Feb 2021 – specimen retained for the herbarium collection.

Thank you for your enquiry.

Yours sincerely

out of scope

Identification Technical Officer
Botanical Information Service

Attachment B – Assessment of *Rhodamnia rubescens* Condition

Rhodamnia rubescens (Scrub Turpentine)

Survey methodology

Several individuals of *Rhodamnia rubescens* (Scrub Turpentine) have been recorded in the locality (Bionet Atlas 10km search, 2020). The species was surveyed extensively throughout PCT 1584, along riparian corridors and in areas deemed suitable habitat for the species such as sheltered gullies with a mesic understorey. 10-15m parallel field traverses were undertaken within these areas. Note that areas of suitable habitat surveyed included steep terrain, areas of thick vegetation including vines and large areas of *Lantana camara*.

Survey results

Over a thousand individuals of *R. rubescens* were detected within the Subject Site, most of them located north of the Newcastle Link Road. The subpopulation in the south of the Subject Site has recently been affected by bushfire and all individuals had coppiced at the time of the Survey.

Most individuals found were growing in groves and seemed smothered by either Lantana or native vines. No seedlings were detected and most individuals were sapling to small trees with DBH (Diameter at Breast Height) of 1cm to 8cm. It was noted at the time of the surveys that all sub-populations present onsite are affected by Myrtle Rust (*Puccinia psidii*) to a certain extent. However, it appears that individuals presented lighter loads of Myrtle Rust and generally looked healthier than other populations surveyed in the lower Hunter.

Individuals of *R. rubescens* were inspected for reproductive material in September to December 2020 during other phases of fieldwork but no flowers or fruits were present.

Appendix D – Fauna Survey Methodology and Results

Contents

1.0 Introduction 1
2.0 Survey methodology 2
2.1 Habitat assessment 2
2.1.1 Hollow-bearing Tree Survey 2
2.1.2 Mapping of Waterbodies 3
2.1.3 Mapping of Cliffs, Caves, Mine-shafts and Man-made Structures 3
2.1.4 Stick Nests 5
2.1.5 Incidental Observations and Secondary Indications 5
2.1.6 Site Stratification 5
2.2 Threatened Species Survey Methodology 7
2.2.1 Microbat Survey 10
2.2.2 Camera Trapping 10
2.2.3 Songmeters 12
2.2.4 Koala Survey 12
2.2.5 Frog Survey 13
2.2.6 Herpetofauna Survey 13
2.2.7 Diurnal Avifauna Survey 13
2.2.8 Nocturnal Avifauna Survey 14
2.2.9 Incidental Observations and Secondary Indications 14
2.3 Species Survey Effort 15
3.0 Survey Results 24
3.1 Species List 24
3.2 Habitat Features 32

Tables

Table 1 – Candidate Species 1
Table 2 – Species Credit Species Survey Periods 8
Table 3 – Camera Trapping Days per Stratification Unit 12
Table 4 – Survey Times 15
Table 5 – Fauna Survey Techniques, Times and Quantity 16
Table 6 – Species List 25

Figures

Figure 1 – Habitat Assessment 4
Figure 2 – Site Stratification 6
Figure 3 – Fixed Point Assessments 19
Figure 4 – Koala Survey Effort 20
Figure 5 – Nocturnal Survey Effort 21
Figure 6 – Avifauna Survey Effort 22
Figure 7 – NSW BioNet Atlas Records 23

Attachments

Attachment A – Anabat Analysis Report
Attachment B – Microbat Harp Trapping Report
Attachment C – Songmeter Methodology and Results
Attachment D – Brush-tailed Phascogale Survey Methodology Validation
Attachment E – Common Planigale Survey Methodology and Results
Attachment F – LMCC Threatened Species Records
Attachment G – Rainfall Data

1.0 Introduction

The Subject Site is currently subject to a rezoning proposal and as such, a Biodiversity Stewardship Site Assessment Report, and two Biodiversity Certification Assessment Reports are due to be delivered to accompany the lodgement of the proposal.

The identification of Plant Community Types on site by Bell & Sims (2021) and the entry of the related impacted native vegetation zones in the BAM Calculator led to the production of a candidate fauna species list requiring survey, as detailed in **Table 1**.

Also afforded consideration were Bionet Atlas records within the Assessment Area, data provided by LMCC for records held within 2km of the subject site and the Commonwealth Protected Matters Search.

The NSW BioNet Atlas records are presented in **Figure 7**. The LMCC records are displayed in **Attachment F** and the Protected Matters search is included in **Attachment H**.

Table 1 – Candidate Species

Scientific name	Common name
Anthochaera phrygia	Regent Honeyeater
Burhinus grallarius	Bush Stone-curlew
Callocephalon fimbriatum	Gang-gang Cockatoo
Calyptorhynchus lathami	Glossy Black-cockatoo
Cercartetus nanus	Eastern Pygmy-possum
Chalinolobus dwyeri	Large-eared Pied-bat
Crinia tinnula	Wallum Froglet
Haliaeetus leucogaster	White-bellied Sea-eagle
Heleioporus australiacus	Giant Burrowing Frog
Hieraaetus morphnoides	Little Eagle
Hoplocephalus bitorquatus	Broad-headed Snake
Hoplocephalus stephensii	Stephen's Banded Snake
Lathamus discolor	Swift Parrot
Litoria aurea	Green and Golden Bell Frog
Litoria brevipalmata	Green-thighed Frog
Lophoictinia isura	Square-tailed Kite
Macropus parma	Parma Wallaby
Miniopterus australis	Little Bent-winged Bat
Miniopterus orianae oceanensis	Large Bent-winged Bat
Mixophyes balbus	Stuttering Frog
Mixophyes iteratus	Giant Barred Frog
Myotis macropus	Southern Myotis
Ninox connivens	Barking Owl
Ninox strenua	Powerful Owl
Pandion cristatus	Eastern Osprey
Petalura gigantea	Giant Dragonfly
Petauroides volans	Greater Glider
Petaurus norfolcensis	Squirrel Glider
Phascogale tapoatafa	Brush-tailed Phascogale
Phascolarctos cinereus	Koala
Planigale maculata	Common Planigale
Potorous tridactylus	Long-nosed Potoroo

Scientific name	Common name
Pseudophryne australis	Red-crowned Toadlet
Pteropus poliocephalus	Grey-headed Flying-fox
Tyto novaehollandiae	Masked Owl
Tyto tenebricosa	Sooty Owl
Uperoleia mahonyi	Mahony's Toadlet
Vespadelus troughtoni	Eastern Cave Bat

Furthermore, it was agreed with Lake Macquarie City Council (LMCC) that based on local records and suitable habitat present, *Tyto tenebricosa* (Sooty Owl) would also be surveyed.

2.0 Survey Methodology

All required fauna survey techniques were utilised for targeted survey of the species listed in **Section 1.**

Fauna survey effort was informed by the following guidelines:

- Department of Environment and Conservation (2004) Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities. Working Draft;
- NSW Office of Environment and Heritage (2018) 'Species credit' threatened bats and their habitats' - NSW survey guide for the Biodiversity Assessment Method;
- Department of Planning, Industry and Environment (2020) 'NSW Survey Guide for Threatened Frogs' – A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method;
- Specific survey requirements for threatened species as listed within the Threatened Biodiversity Data Collection, namely:
    - Brush-tailed Phascogale;
    - Common Planigale.
- Koala Survey Guidelines as per *SEPP (Koala Habitat Protection) 2019.* It is to be noted that SEPP 2019 has since been repealed and replaced by SEPP (Biodiversity and Conservation) 2021.

2.1 Habitat Assessment

2.1.1 Hollow-bearing Tree Survey

The entirety of the subject site was surveyed for hollow-bearing trees (HBTs). HBTs were marked with an individual tree tag, with the location recorded with a handheld GPS.

HBTs were mapped within the Subject Site utilising the methodology of tree hollow identification set by OEH in the BioBanking field plot methodology (Feb 2009), namely:

> *"A hollow is only recorded if: (a) the entrance can be seen; (b) the minimum entrance width is at least 5 cm across; (c) the hollow appears to have depth (i.e., you cannot see solid wood beyond the entrance); and (d) the hollow is at least 1 m above the ground (this omits hollows in cut stumps or at the base of trees)".*

Particular emphasis was placed on recording the location of larger hollows suitable for Forest Owls and Glossy Black-Cockatoo, facilitating targeted survey effort during the relevant survey periods. Given that

field surveys focused on the search for large and extra-large hollows, it is expected that more medium and smaller hollows occur on site than shown on **Figure 1**.

2.1.2 Mapping of Waterbodies

Creek lines, pools, dams and other features were mapped and recorded during the habitat assessment for the site. Waterbodies are shown on Figure 1.

2.1.3 Mapping of Cliffs, Caves, Mine-shafts and Man-made Structures

Mapping of cliffs, caves, mine-shafts and man-made structures was undertaken during the habitat assessment for the site and subsequently closer to microbat survey period. The potential for fauna to utilise such features is assessed in this report.

Given the history of mining in the area, a plan was requested from the project engineers/surveyors overlaying the record traces from any mining activities that were known to occur on the site. The locations of any drifts, vent shafts and mine shafts were inspected and the potential for fauna to utilise such features was assessed. Areas deemed to constitute potentially suitable habitat are shown on Figure 1.

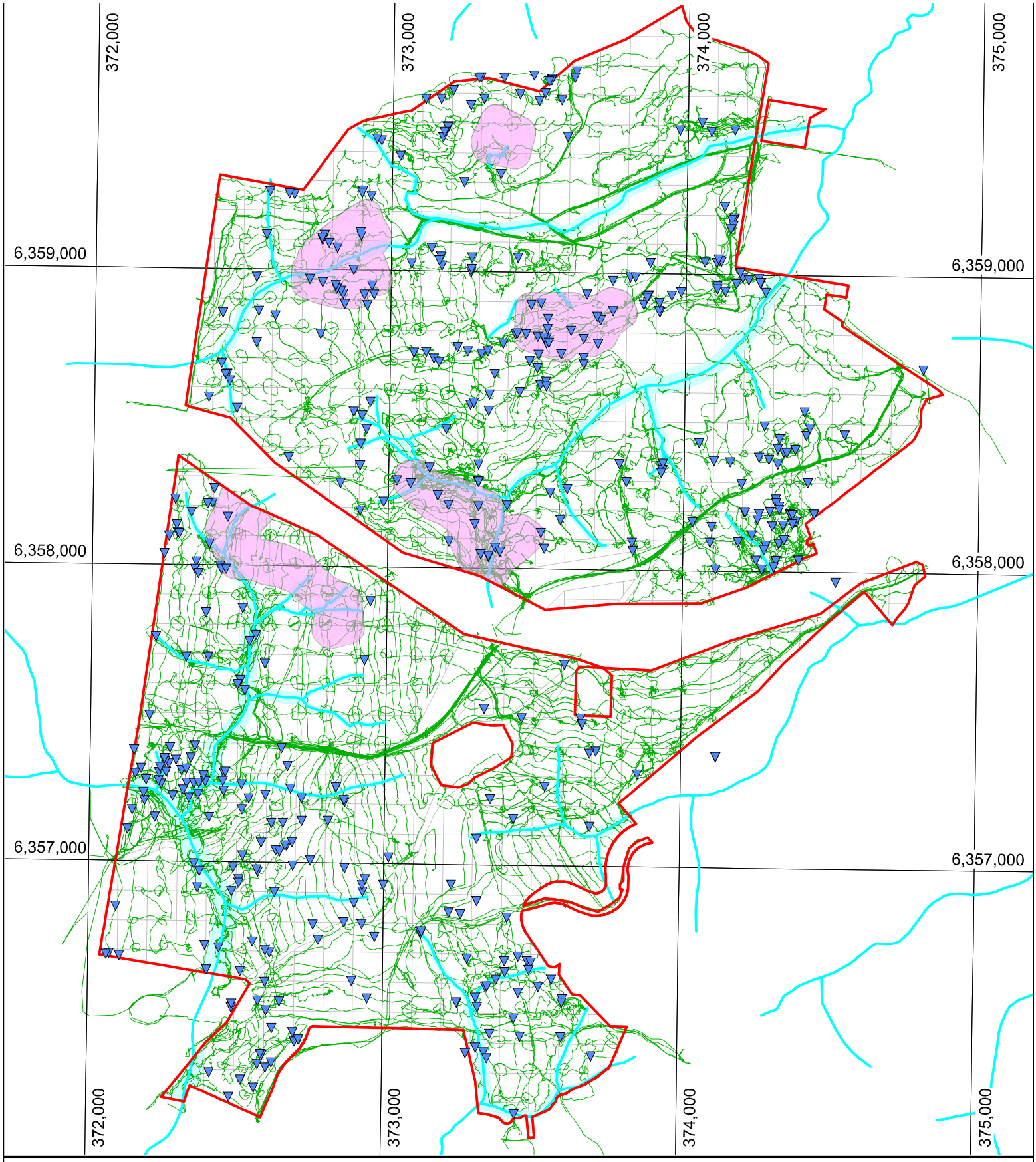

Figure 1 - Habitat Assessment

Legend

- Study Area
- Cave or crevice
- Riparian buffer
- Hydroline
- HBT and canopy survey track
- Hollow-bearing Tree

0 750
metres
Scale 1:17,000

N W E S

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | August 2022
AEP Ref: 1971.01

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AEP

2.1.4 Stick Nests

During habitat assessment (and all other phases of field work), notation was made of all stick nests greater than approx. 50cm diameter. Locations of such nests was recorded using hand-held GPS for subsequent inspection to try and determine the inhabitant species of the nest.

2.1.5 Incidental Observations and Secondary Indications

Incidental records of any fauna species observed during fieldwork was noted. This included opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of any resident or migratory species. Searches were also be conducted for whitewash, regurgitation pellets and prey remains from Owls, chewed *Allocasuarina* cones from Black-Cockatoos, chewed fruit remains from frugivorous birds etc.

2.1.6 Site Stratification

With reference to the 2004 DECC guidelines, the site has broadly been stratified based on Keith Vegetation Class.

Reference to the DECC guidelines varies between guilds. However, it broadly correlates to one (1) survey unit per 50ha, plus an additional survey unit for every additional 100ha. The site has been stratified into four (4) units for a total of eight (8) survey units, thus ensuring the minimum standards were well exceeded.

Based on these eight (8) survey units, the site was then divided up with due reference to the likely vegetation community boundaries with an attempt to evenly distribute the survey across the spatial area of the subject site. Some vegetation communities/classes are subset within a stratification. However, in general, it was determined that there was not sufficient variation amongst these communities for the subset areas to form separate stratifications.

Note that Stratification 1 and 2 were commenced prior to the Stratification units being finalised. This is due to the fact that it was understood that a prescribed burn by the NSW RFS was planned for the vegetation surrounding Glendale TAFE and the priority was to survey these areas prior to the prescribed burn.

The site stratification is shown in **Figure 2**.

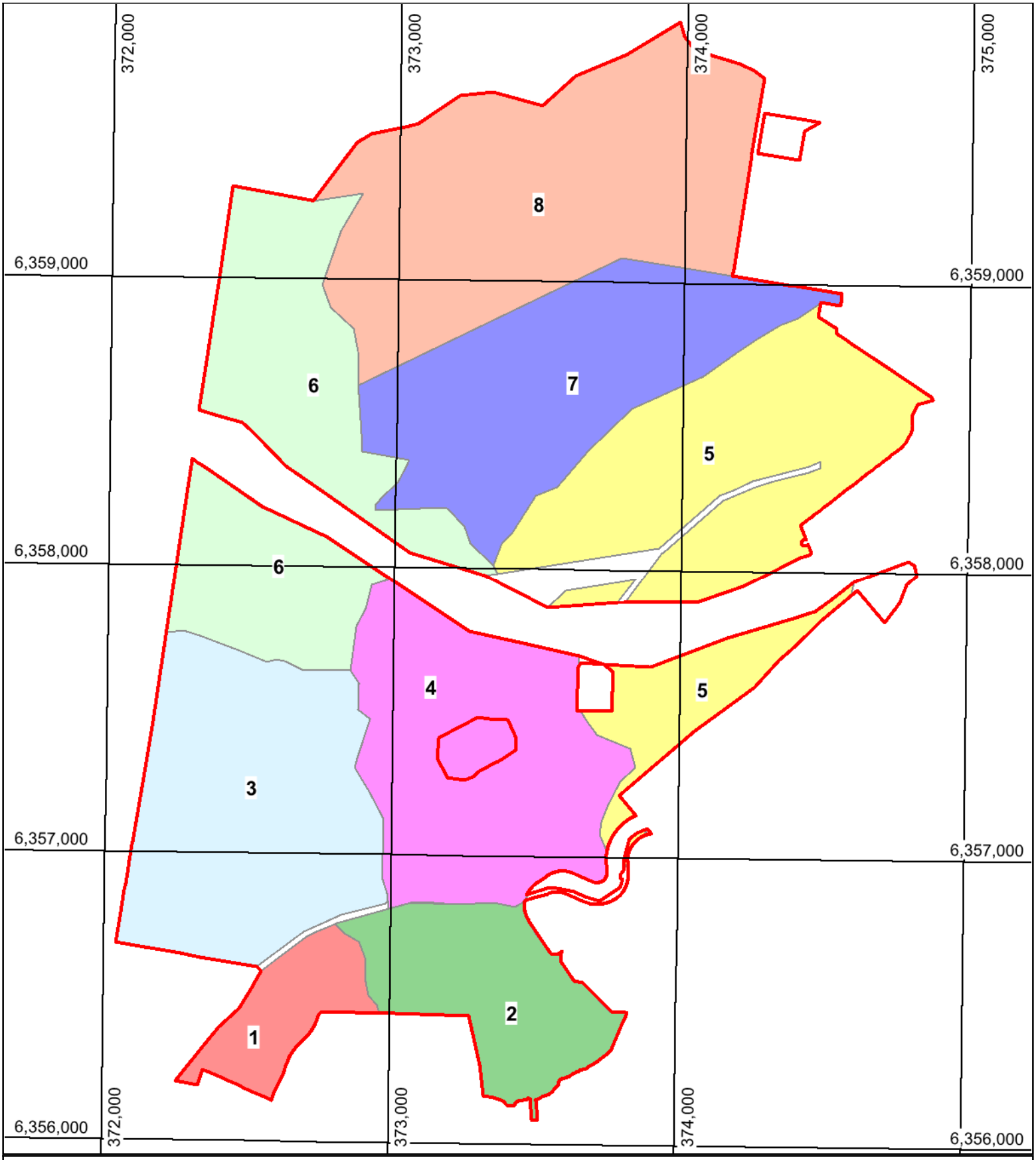

Figure 2 - Stratification Units

Legend

Subject Site

Stratification Units

01
02
03
04
05
06
07
08

0 750
metres
Scale 1:17,500

N
W E
S

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | June 2021
AEP Ref: 1971.01

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

2.2 Threatened Species Survey Methodology

Under the BAM, threatened species are classified into two types; 'Ecosystem Credit' and 'Species Credit' type species, as detailed within the BioNet Atlas Threatened Biodiversity Data Collection (OEH). Ecosystem Credit species are associated with PCTs and other habitat surrogates that are used to predict their occurrence on a particular site.

In addition to Ecosystem Credit Species, the calculator identifies Species Credit Species that require survey as these species cannot be reliably predicted by the Plant Community Type.

Table 2 – Species Credit Species Survey Periods

Scientific name	Common name	BAM Prescribed survey period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Anthochaera phrygia	Regent Honeyeater	Mapped Important habitat												
Burhinus grallarius	Bush Stone-curlew	All year												
Callocephalon fimbriatum	Gang-gang Cockatoo	Oct-Jan												
Calyptorhynchus lathami	Glossy Black-cockatoo	Apr-Aug												
Cercartetus nanus	Eastern Pygmy-possum	Oct-Mar												
Chalinolobus dwyeri	Large-eared Pied-bat	Sep-Mar												
Crinia tinnula	Wallum Froglet	All year												
Haliaeetus leucogaster	White-bellied Sea-eagle	Jul-Dec												
Heleioporus australiacus	Giant Burrowing Frog	Sep-May												
Hieraaetus morphnoides	Little Eagle	Aug-Oct												
Hoplocephalus bitorquatus	Broad-headed Snake	Nov-Mar												
Hoplocephalus stephensii	Stephen's Banded Snake	Oct-Mar												
Lathamus discolor	Swift Parrot	Mapped Important habitat												
Litoria aurea	Green and Golden Bell Frog	Nov-Mar												
Litoria brevipalmata	Green-thighed Frog	Oct-Mar												
Lophoictinia isura	Square-tailed Kite	Sep-Jan												
Macropus parma	Parma Wallaby	All year												
Miniopterus australis	Little Bent-winged Bat	Dec-Feb												
Miniopterus orianae oceanensis	Large Bent-winged Bat	Dec-Feb												
Mixophyes balbus	Stuttering Frog	Sep-Mar												
Mixophyes iteratus	Giant Barred Frog	Oct-Mar												
Myotis macropus	Southern Myotis	Oct-Mar												
Ninox connivens	Barking Owl	May-Dec												
Ninox strenua	Powerful Owl	May-Aug												

Scientific name	Common name	BAM Prescribed survey period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pandion cristatus	Eastern Osprey	Apr-Nov												
Petalura gigantea	Giant Dragonfly	Dec-Jan												
Petauroides Volans	Greater Glider	All year												
Petaurus norfolcensis	Squirrel Glider	All year												
Phascogale tapoatafa	Brush-tailed Phascogale	Dec-Jun												
Phascolarctos cinereus	Koala	All year												
Planigale maculata	Common Planigale	All year												
Potorous tridactylus	Long-nosed Potoroo	All year												
Pseudophryne australis	Red-crowned Toadlet	All year												
Pteropus poliocephalus	Grey-headed Flying-fox	Oct-Dec												
Tyto novaehollandiae	Masked Owl	May-Aug												
Tyto tenebricosa	Sooty Owl	Apr-Aug												
Uperoleia mahonyi	Mahony's Toadlet	Oct-Mar												
Vespadelus troughtoni	Eastern Cave Bat	Nov-Jan												

It is noted that under the BAM neither Regent Honeyeater or Swift Parrot require survey as species credits are determined by Mapped Important Habitat. However appropriate survey effort for these species is required to satisfy EPBC Act requirements.

2.2.1 Microbat Survey

Bat echolocation calls were recorded using Anabat Express and Anabat Swift detectors to undertake bat acoustic monitoring across the site, utilising both Zero Crossing and Full Spectrum recording. Call recording was undertaken by stationary units set for all night recording over a minimum of four nights. Transformed calls were analysed by AEP Ecologists using Anabat Insight software. The location of each Anabat detector location is shown in **Figure 3**. Results of echolocation call analysis are provided in **Attachment A**.

The following microbats are Species Credit Species and required specific survey:

- Large-eared Pied Bat (*Chalinolobus dwyeri*);
- Southern Myotis (*Myotis macropus*); and
- Eastern Cave Bat (*Vespadelus troughtoni*).

Little Bent-winged Bat (*Miniopterus australis*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis*) are also Species Credit Species. However, these species only breed at a small number of known locations.

With the exception of Southern Myotis, the habitat constraints for the other Species Credit microbat species are caves and cave-like structures. As suitable caves and mine shafts were recorded within the site, harp-trapping was undertaken with Dr Anna McConville of Echo Ecology to identify species utilising such habitat.

Survey for Southern Myotis involved a minimum of four (4) nights of ultrasonic bat detection for a total survey effort of 16 nights per 2.5km of suitable riparian habitat within the recommended survey months. Potential habitat includes riparian areas (including dry river/creek beds) within the PCTs associated with the species (as per the TBDC), as well as any other suitable waterbodies (dams etc). Survey sampled such features and the available range of suitable vegetation along riparian areas on the site.

Survey for Large-eared Pied Bat involved a minimum of four (4) nights of ultrasonic bat detection for a total survey effort of 16 nights per 50ha of suitable breeding habitat.

Survey for Large-eared Pied Bat and Eastern Cave Bat also involved a minimum of four (4) nights of harp trapping (or mist net) within the recommended survey months, within harp traps placed in areas of potential breeding habitat on the Subject Site. Age, sex and reproductive status of captured bats was assessed and recorded. It is to be noted that acoustic detectors may be used; however, this method does not allow for reproductive status to be determined. If acoustic detectors are the only survey method used and the target species is detected, breeding must be assumed and mapped accordingly.

Potential breeding habitat for Large-eared Pied-bat and Eastern Cave Bat includes the PCTs associated with the species (as per the TBDC) within 100m of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. Therefore, traps were set in woodlands, valley floors, riparian areas and relatively fertile parts of the subject land where possible. The area of the site determined to be potential/marginal breeding habitat for cave dwelling species was 13ha and is shown on **Figure 3**.

The methodology and results of the harp trapping surveys undertaken by Dr Anna McConville of Echo Ecology are presented in **Attachment B**.

2.2.2 Camera Trapping

The preferred camera model used by AEP is Scout-guard White-flash Camera Traps (SG 562-C). The use of white flash cameras generally allows for a more confident identification of species recorded. All cameras were mounted on a bracket approximately one metre from a standardised bait station

containing universal bait. Each bait tube was constructed with a 90mm PVC pipe. Each bait tube had a honey dripper mounted above (inverted plastic PET bottle with small hole in the cap and the bottle attached to the tree). Terrestrial cameras were baited with a combination of universal bait and tuna or sardines.

While the DECC 2004 guidelines do not make reference to camera trapping, the technique has been previously acknowledged as a suitable mammal survey method (S. Lewer, OEH pers. comm.). Reference to Table 3 of the Lake Macquarie Council Flora & Fauna Survey guidelines indicates the minimum survey effort for a site under 100ha should be two (2) per vegetation community or habitat type for 14 consecutive nights. Furthermore, the former Wyong Shire Council Flora and Fauna Survey guidelines indicate that remote camera survey technique is preferred over trapping.

Given the target species from the camera surveys have much smaller home ranges than the “100ha” survey unit, survey effort was increased to the following:

- Six (6) arboreal cameras and six (6) terrestrial cameras per survey unit for a minimum of 14 survey nights; and
- Additional targeted cameras in areas of suitable habitat (Banksia groves) for Eastern Pygmy Possum. Two (2) cameras per area for a minimum of 14 nights.

Table 3 below summarises the survey dates for each stratification unit. The location of each camera trap is shown in **Figure 3**.

Correspondence with the Biodiversity Conservation Division confirms that the camera trapping methodology undertaken for the site is suitable for Brush-tailed Phascogale (see **Attachment D**).

Table 3 – Camera Trapping Days per Stratification Unit

Strat unit / location	Deployment date	Retrieval date	Month	Number of cameras	Camera trap nights	Total
1	13/03/2020	29/03/2020	3	12	16	192
6 / Cave 1	17/03/2020	17/04/2020	3	1	31	31
2	2/04/2020	18/04/2020	4	12	16	192
3	19/04/2020	6/05/2020	4	12	17	204
3	8/01/2021	22/01/2021	1	6	14	84
3 / PP3	22/01/2021	3/02/2021	1	2	12	24
4	23/06/2020	7/07/2020	6	12	14	168
5	29/07/2020	14/08/2020	7	12	16	192
6	18/08/2020	2/09/2020	8	12	15	180
6 / PP4	22/12/2020	8/01/2021	12	6	17	102
5 / L14	3/08/2020	25/09/2020	8	1	53	53
7	3/09/2020	18/09/2020	9	12	15	180
8	22/09/2020	9/10/2020	9	12	17	204
2 / PP1	25/09/2020	9/10/2020	9	6	14	84
1-2-3-4 / PP2	14/10/2020	15/11/2020	10	6	32	192
Total						**2160**

2.2.3 Songmeters

Songmeter methodology is addressed in **Attachment C** and the location of each songmeter is shown in **Figure 3**.

2.2.4 Koala Survey

Koala surveys were initially scoped with reference to DECC 2004 draft guidelines and SEPP44. Subsequently following commencement of surveys, State Environmental Planning Policy (SEPP) (Koala Habitat Protection) 2019 (SEPP 2019) came into effect on 1 March 2020 and replaced SEPP No 44 – Koala Habitat Protection (SEPP 44). Survey for the species was rescoped on the basis on the new SEPP and accompanying survey guidelines. However, SEPP (Koala Habitat Protection) 2020 was introduced in November, replacing SEPP 2019 and largely reinstating SEPP 44. In March 2021, SEPP (Koala Habitat Protection) 2021 came into effect, replacing SEPP 2020 but maintaining the essence of SEPP 44.

The Biodiversity and Conservation SEPP began on 1 March 2022 which includes Chapter 4 – Koala Habitat Protection 2021. The current SEPP continues to reference the Koala SEPP 2019 survey guidelines. Furthermore, Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide (DPE, 2022) were released on 17 June 2022. For the most part these are commensurate with the Koala SEPP 2019 survey guidelines.

Survey methods included:

- Identification and mapping of Plant Community Types (undertaken by Bell and Sims from Eastcoast Flora Survey);
- Review of NSW BioNet records;
- Spot Assessment Technique (SAT) surveys following Phillips & Callaghan (2011), using a grid-based systematic approach, with a grid spacing of 250m;

- Passive acoustic recording using songmeters, during peak breeding season (September to November);
- Passive acoustic recording using songmeters, outside of peak breeding season;
- Spotlighting on sets of two (2) consecutive nights in areas of suitable habitat which were not fully covered by the radius of songmeter recording, during peak breeding season (September to November);
- Call playback during peak breeding season (September to November);
- Opportunistic observations during all other field work.

As such, the survey effort for Koala within the Subject Site is compliant both with SEPP 2019, DPE 2022 and SEPP 2021, since SEPP 2019 survey guidelines were more comprehensive than those referred to in SEPP 2021 and DPE guidelines are for the most part commensurate with SEPP 2019.

Koala survey effort is shown on **Figure 4.**

2.2.5 Frog Survey

Frog surveys were conducted with reference to the Department of Planning, Industry and Environment (2020) 'NSW Survey Guide for Threatened Frogs' – A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method.

Specific frog searches were carried out in each of the habitat units present following suitable weather (rainfall) events. Surveys included nocturnal searches in areas of appropriate habitat. Such habitat included areas of thicker vegetation, in ground litter, near and under fallen timber, around piles of refuse, and wet / damp areas such as drainage lines, dams, wetland edges and areas of poor infiltration capacity and / or periodic inundation.

Physical frog searches were augmented by call recognition. Any calls unable to be determined in the field were recorded for later comparison with commercially available recordings.

Nocturnal field survey effort is shown in **Figure 5**.

Targeted field surveys were supplemented with passive acoustic monitoring (see **Attachment C** and **Figure 3**).

Opportunistic encounters during all other phases of fieldwork were also noted.

2.2.6 Herpetofauna Survey

The threatened reptile species requiring survey on the site are cryptic and specialised species.

Pale-headed Snake and Stephen's Banded Snake are highly cryptic and can spend weeks at a time hidden in tree hollows. They are found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. As per the DECC guidelines a 30min habitat search on two separate days is required per survey unit and 30mins of spotlighting on two separate nights is required per survey unit. Surveys are to be undertaken between November and March.

Detailed habitat assessment and targeted searches were undertaken as described in **Table 4** and survey effort is shown in **Figure 5**.

2.2.7 Diurnal Avifauna Survey

Targeted survey for diurnal avifauna species included Regent Honeyeater and Swift Parrot as well as nesting activity for Eastern Osprey, White-bellied Sea-Eagle, Square-tailed Kite, Little Eagle, Glossy

Black-Cockatoo and Gang-gang Cockatoo. Targeted survey included one to two surveys per survey unit per season (i.e. summer, autumn, winter, spring).

The assessment of presence of avifauna on site was carried out via targeted seasonal survey as well as incidental observations during all other phases of fieldwork. A total of more than 126 person-hours were spent on targeted diurnal avifauna surveys as well as over 1680 person-hours recording incidental observations. **Figure 6** displays the extent of bird surveys undertaken on site.

As the Glossy Black-Cockatoo was recorded on site, additional surveys were undertaken to attempt to identify the presence of an occupied nest or potential nest sites in the areas of noted activity (trees with potential nest hollows).

Additional targeted surveys were undertaken on stick nests identified on site.

2.2.8 Nocturnal Avifauna Survey

Nocturnal surveys and spotlighting attempted to identify any nocturnal avifauna. Pre-recorded calls of *Ninox strenua* (Powerful Owl), *N. connivens* (Barking Owl), *Tyto novaehollandiae* (Masked Owl) and *T. tenebricosa* (Sooty Owl) were broadcasted through an amplification system designed to project the sound for at least 1km under still night conditions. The calls were repeated in the four compass directions for five minutes from suitable positions, with a listening period of five minutes after broadcast, followed by short periods of spotlighting for owls that may have flown in following the calls.

Spotlighting was undertaken by ecologists on foot using suitable hand-held spotlights and head-lamps. All suitable hollows were inspected in recommended survey season.

Nocturnal field survey effort is shown in **Figure 5**.

Nocturnal survey was augmented via passive listening using songmeters as per **Attachment C**.

Additional targeted surveys and monitoring of nest trees were undertaken as Powerful Owl & Masked Owl were recorded within the site.

Burhinus grallarius (Bush Stone-curlew) is considered a vagrant to the northern part of the Wyong IBRA subregion and a vagrant to the adjacent Hunter IBRA subregion. Call playback was not undertaken the for the species. However, the species was surveyed opportunistically during nocturnal surveys and songmeter surveys.

2.2.9 Incidental Observations and Secondary Indications

Incidental records of any fauna species observed during fieldwork were noted. This included opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of any resident or migratory species. Searches were also conducted for whitewash, regurgitation pellets and prey remains from Owls, chewed (*Allo) Casuarina* cones from Black-Cockatoos, chewed fruit remains from frugivorous birds etc.

Given the amount of field survey time spent in the study area, survey intensity coverage was high, which led to several additions to site records via incidental observations.

2.3 Species Survey Effort

Table 4 below details the survey times for each target species. Survey times are shown with a “x”, and recommended survey times are highlighted in grey.

Table 4 – Survey Times

Scientific name	Common name	BAM Prescribed survey period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Anthochaera phrygia	Regent Honeyeater	Mapped Important Habitat	x	x	x	x	x	x	x	x	x	x	x	x
Burhinus grallarius	Bush Stone-curlew	All year	x	x		x	x	x	x	x	x		x	
Callocephalon fimbriatum	Gang-gang Cockatoo	Oct-Jan	x		x	x	x			x	x	x	x	x
Calyptorhynchus lathami	Glossy Black-cockatoo	Jan-Sep			x	x	x			x	x			
Cercartetus nanus	Eastern Pygmy-possum	Oct-Mar	x	x	x	x		x	x	x	x	x	x	x
Chalinolobus dwyeri	Large-eared Pied-bat	Sep-Mar	x		x	x								x
Crinia tinnula	Wallum Froglet	All year	x	x	x	x			x				x	x
Haliaeetus leucogaster	White-bellied Sea-eagle	Jul-Dec			x	x	x	x	x	x	x	x		
Heleioporus australiacus	Giant Burrowing Frog	Sep-May	x	x	x	x			x		x	x	x	x
Hieraaetus morphnoides	Little Eagle	Aug-Oct			x	x	x	x	x	x	x	x		
Hoplocephalus bitorquatus	Broad-headed Snake	Nov-Mar	x	x	x	x	x				x		x	x
Hoplocephalus stephensii	Stephen's Banded Snake	Oct-Mar	x	x	x	x	x				x		x	x
Lathamus discolor	Swift Parrot	Mapped Important Habitat			x	x	x			x	x			
Litoria aurea	Green and Golden Bell Frog	Nov-Mar	x	x	x	x			x				x	x
Litoria brevipalmata	Green-thighed Frog	Oct-Mar	x	x	x	x			x				x	x
Lophoictinia isura	Square-tailed Kite	Sep-Jan			x	x	x	x	x	X	x			
Macropus parma	Parma Wallaby	All year	x	x	x	x		x	x	x	x	x	x	x
Miniopterus australis	Little Bent-winged Bat	Dec-Feb	x		x	x								x
Miniopterus orianae oceanensis	Large Bent-winged Bat	Dec-Feb	x		x	x								x
Mixophyes balbus	Stuttering Frog	Sep-Mar	x	x	x	x			x				x	x
Mixophyes iteratus	Giant Barred Frog	Oct-Mar	x	x	x	x			x				x	x
Myotis macropus	Southern Myotis	Oct-Mar	x		x	x								x
Ninox connivens	Barking Owl	May-Dec	x	x	x	x	x	x	x	x	x		x	
Ninox strenua	Powerful Owl	May-Aug	x	x	x	x	x	x	x	x	x		x	
Pandion cristatus	Eastern Osprey	Apr-Nov			X	X	X	X	X	X	X			
Petalura gigantea	Giant Dragonfly	Dec-Jan											x	x
Petauroides volans	Greater Glider	All year	x	x	x	x		x	x	x	x	x	x	x
Petaurus norfolcensis	Squirrel Glider	All year	x	x	x	x		x	x	x	x	x	x	x
Phascogale tapoatafa	Brush-tailed Phascogale	Dec-Jun	x	x	x	x		x	x	x	x	x	x	x
Phascolarctos cinereus	Koala	All year	x	x	x	x	x	x	x	x	x		x	
Planigale maculata	Common Planigale	All year					x	x						
Potorous tridactylus	Long-nosed Potoroo	All year	x	x	x	x		x	x	x	x	x	x	x
Pseudophryne australis	Red-crowned Toadlet	All year	x	x	x	x			x				x	x
Pteropus poliocephalus	Grey-headed Flying-fox	Oct-Dec	x	x	x	x	x	x	x	x	x		x	x
Tyto novaehollandiae	Masked Owl	May-Aug	x	x	x	x	x	x	x	x	x		x	
Tyto tenebricosa	Sooty Owl	Apr-Aug	x	x	x	x	x	x	x	x	x		x	
Uperoleia mahonyi	Mahony's Toadlet	Oct-Mar	x	x	x	x			x				x	x
Vespadelus troughtoni	Eastern Cave Bat	Nov-Jan	x		x	x								x

Table 5 details the survey techniques and timings for each target species.

Table 5 – Fauna Survey Techniques, Times and Quantity

Scientific name	Common name	Credit type	BAM Prescribed survey period	Survey type	Actual survey period	Survey UOM	Survey effort in season	Survey effort outside season	Total effort
Anthochaera phrygia	Regent Honeyeater	Important habitat	Important habitat	Dawn / Dusk survey	Mar-May 2020; Aug-Sep 2020	Person-hour	126.25		126.25
Burhinus grallarius	Bush Stone-curlew	Foraging	All year	Spotlighting	Apr-Sep 2020; Nov 2020; Jan-Feb 2021	Person-hour	199.25		199.25
Burhinus grallarius	Bush Stone-curlew	Foraging	All year	Songmeter	Mar-Sep 2020	Night	278		278
Callocephalon fimbriatum	Gang-gang Cockatoo	Breeding	Oct-Jan	Dawn / Dusk survey	Dec 2019, Oct 2020 – Jan 2021, Nov 2021. Mar-May 2020; Aug-Sep 2020	Person-hour	0	126.25	126.25
Calyptorhynchus lathami	Glossy Black-cockatoo	Breeding	Apr-Aug	Dawn / Dusk survey	Mar-May 2020; Aug-Sep 2020	Person-hour	33.25	93	126.25
Cercartetus nanus	Eastern Pygmy-possum	Foraging	Oct-Mar	Camera trap	Mar-Apr 2020; June-Oct 2020; Dec 2020; Jan-Feb 2021	Night	703	1457	2160
Cercartetus nanus	Eastern Pygmy-possum	Foraging	Oct-Mar	Spotlighting	Apr-Sep 2020; Nov 2020; Jan-Feb 2021	Person-hour	31.5	167.75	199.25
Chalinolobus dwyeri	Large-eared Pied-bat	Foraging	Sep-Mar	Anabat	Mar-Apr 2020; Dec 2020; Jan 2021	Night	77	7	84
Chalinolobus dwyeri	Large-eared Pied-bat	Breeding	Nov-Jan	Harp trapping	Dec-20	Harp trap night	27		27
Crinia tinnula	Wallum Froglet	Foraging	All year	Songmeter	Dec 2020-Mar 2021	Night	82.5		82.5
Crinia tinnula	Wallum Froglet	Foraging	All year	Spotlighting	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021	Person-hour	102.5		102.5
Haliaeetus leucogaster	White-bellied Sea-eagle	Breeding	Jul-Dec	Dawn / Dusk survey	Mar-May 2020; Aug-Oct 2020	Person-hour	27.5	98.75	126.25
Haliaeetus leucogaster	White-bellied Sea-eagle	Breeding	Jul-Dec	Habitat search	Mar-Apr 2020; Jun-Jul 2020	Person-hour	8.5	198	206.5
Heleioporus australiacus	Giant Burrowing Frog	Foraging	Sep-May	Spotlighting	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021	Person-hour	82.5	20	102.5
Heleioporus australiacus	Giant Burrowing Frog	Foraging	Sep-May	Songmeter	Dec 2020-Mar 2021	Night	82.5		82.5
Hieraaetus morphnoides	Little Eagle	Breeding	Aug-Oct	Dawn / Dusk survey	Mar-May 2020; Aug-Oct 2020	Person-hour	22.25	104	126.25
Hieraaetus morphnoides	Little Eagle	Breeding	Aug-Oct	Habitat search	Mar-Apr 2020; Jun-Jul 2020	Person-hour	0	206.5	206.5
Hoplocephalus bitorquatus	Broad-headed Snake	Foraging	Nov-Mar	Spotlighting	Mar-May 2020; Sep 2020; Nov-Dec 2020; Jan-Feb 2021	Person-hour	197.25	34	231.25
Hoplocephalus stephensii	Stephen's Banded Snake	Foraging	Oct-Mar	Spotlighting	Mar-May 2020; Sep 2020; Nov-Dec 2020; Jan-Feb 2021	Person-hour	197.25	34	231.25
Lathamus discolor	Swift Parrot	Important habitat	Important habitat	N/A	N/A	N/A	N/A	N/A	126.25
Litoria aurea	Green and Golden Bell Frog	Foraging	Nov-Mar	Songmeter	Dec 2020-Mar 2021	Night	82.5		82.5
Litoria aurea	Green and Golden Bell Frog	Foraging	Nov-Mar	Spotlighting	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021	Person-hour	82.5	20	102.5
Litoria brevipalmata	Green-thighed Frog	Foraging	Oct-Mar	Songmeter	Dec 2020-Mar 2021	Night	82.5		82.5

Scientific name	Common name	Credit type	BAM Prescribed survey period	Survey type	Actual survey period	Survey UOM	Survey effort in season	Survey effort outside season	Total effort
Litoria brevipalmata	Green-thighed Frog	Foraging	Oct-Mar	Spotlighting	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021	Person-hour	82.5	20	102.5
Lophoictinia isura	Square-tailed Kite	Breeding	Sep-Jan	Dawn / Dusk survey	Mar-Sep 2020	Person-hour	2.75	123.5	126.25
Macropus parma	Parma Wallaby	Foraging	All year	Camera trap	Mar-Apr 2020; June-Oct 2020; Dec 2020; Jan-Feb 2021	Night	2160		2160
Miniopterus australis	Little Bent-winged Bat	Breeding	Dec-Feb	Anabat	Mar-Apr 2020; Dec 2020; Jan 2021	Night	49	35	84
Miniopterus orianae oceanensis	Large Bent-winged Bat	Breeding	Dec-Feb	Anabat	Mar-Apr 2020; Dec 2020; Jan 2021	Night	84		84
Mixophyes balbus	Stuttering Frog	Foraging	Sep-Mar	Songmeter	Dec 2020-Mar 2021	Night	82.5		82.5
Mixophyes balbus	Stuttering Frog	Foraging	Sep-Mar	Spotlighting	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021	Person-hour	82.5	20	102.5
Mixophyes iteratus	Giant Barred Frog	Foraging	Oct-Mar	Songmeter	Dec 2020-Mar 2021	Night	82.5		82.5
Mixophyes iteratus	Giant Barred Frog	Foraging	Oct-Mar	Spotlighting	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021	Person-hour	82.5	20	102.5
Myotis macropus	Southern Myotis	Foraging	Oct-Mar	Anabat	Mar-Apr 2020; Dec 2020; Jan 2021	Night	77	7	84
Myotis macropus	Southern Myotis	Foraging	Oct-Mar	Spotlighting	Mar 2020	Person-hour	12		12
Ninox connivens	Barking Owl	Breeding	May-Dec	Spotlighting	Apr-Sep 2020; Nov 2020; Jan-Feb 2021; Jun-Jul 2022	Person-hour	148.25	87.75	236
Ninox connivens	Barking Owl	Breeding	May-Dec	Songmeter	Mar-Sep 2020; Jun-Jul 2022	Night	268	122	390
Ninox connivens	Barking Owl	Breeding	May-Dec	Habitat search	Mar-Apr 2020; Jun-Jul 2020	Person-hour	12.75	193.75	206.5
Ninox strenua	Powerful Owl	Breeding	May-Aug	Spotlighting	Apr-Sep 2020; Nov 2020; Jan-Feb 2021; Jun-Jul 2022	Person-hour	85	151	236
Ninox strenua	Powerful Owl	Breeding	May-Aug	Songmeter	Mar-Sep 2020; Jun-Jul 2022	Night	311	79	390
Ninox strenua	Powerful Owl	Breeding	May-Aug	Habitat search	Mar-Apr 2020; Jun-Jul 2020	Person-hour	12.75	193.75	206.5
Pandion cristatus	Eastern Osprey	Breeding	Apr-Nov	Dawn / Dusk survey	Mar-Sep 2020	Person-hour	113.25	13	126.25
Petalura gigantea	Giant Dragonfly	Foraging	Dec-Jan	Diurnal survey in swamp	Dec-20	Person-hour	237		237
Petauroides volans	Greater Glider	Foraging	All year	Camera trap	Mar-Apr 2020; June-Oct 2020; Dec 2020; Jan-Feb 2021	Night	2160		2160
Petauroides Volans	Greater Glider	Foraging	All year	Spotlighting	Apr-Sep 2020; Nov 2020; Jan-Feb 2021	Person-hour	199.25		199.25
Petaurus norfolcensis	Squirrel Glider	Foraging	All year	Camera trap	Mar-Apr 2020; June-Oct 2020; Dec 2020; Jan-Feb 2021	Night	2160		2160
Petaurus norfolcensis	Squirrel Glider	Foraging	All year	Spotlighting	Apr-Sep 2020; Nov 2020; Jan-Feb 2021	Person-hour	199.25		199.25

Scientific name	Common name	Credit type	BAM Prescribed survey period	Survey type	Actual survey period	Survey UOM	Survey effort in season	Survey effort outside season	Total effort
Phascogale tapoatafa	Brush-tailed Phascogale	Foraging	Dec-Jun	Camera trap	Mar-Apr 2020; June-Oct 2020; Dec 2020; Jan-Feb 2021	Night	1075	1085	2160
Phascolarctos cinereus	Koala	Foraging	All year	Songmeter	Mar-Sep 2020	Night	278		278
Phascolarctos cinereus	Koala	Foraging	All year	Spotlighting	Apr-Sep 2020; Nov 2020; Jan-Feb 2021	Person-hour	199.25		199.25
Phascolarctos cinereus	Koala	Foraging	All year	Call playback	Apr-Sep 2020	Person-hour	86.5		86.5
Phascolarctos cinereus	Koala	Foraging	All year	SAT survey	May-Jun 2020	250m grid survey	94		94
Planigale maculata	Common Planigale	Foraging	All year	Pitfall trapping	May-Jun 2022	Pitfall trap night	120		120
Potorous tridactylus	Long-nosed Potoroo	Foraging	All year	Camera trap	Mar-Apr 2020; June-Oct 2020; Dec 2020; Jan-Feb 2021	Night	1080		1080
Pseudophryne australis	Red-crowned Toadlet	Foraging	All year	Songmeter	Dec 2020-Mar 2021	Night	82.5		82.5
Pseudophryne australis	Red-crowned Toadlet	Foraging	All year	Spotlighting	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021	Person-hour	102.5		102.5
Pteropus poliocephalus	Grey-headed Flying-fox	Breeding	Oct-Dec	Spotlighting	Apr-Sep 2020; Nov 2020; Jan-Feb 2021; Jun-Jul 2022	Person-hour	53.5	175.25	228.75
Turnix maculosus	Red-backed Button-quail	Foraging	All year	Spotlighting	Apr-Sep 2020; Nov 2020; Jan-Feb 2021; Jun-Jul 2022	Person-hour	236		236
Tyto novaehollandiae	Masked Owl	Breeding	May-Aug	Spotlighting	Apr-Sep 2020; Nov 2020; Jan-Feb 2021; Jun-Jul 2022	Person-hour	85	151	236
Tyto novaehollandiae	Masked Owl	Breeding	May-Aug	Songmeter	Mar-Sep 2020; Jun-Jul 2022	Night	284	106	390
Tyto novaehollandiae	Masked Owl	Breeding	May-Aug	Habitat search	Mar-Apr 2020; Jun-Jul 2020	Person-hour	12.75	193.75	206.5
Tyto tenebricosa	Sooty Owl	Breeding	Apr-Aug	Spotlighting	Apr-Sep 2020; Nov 2020; Jan-Feb 2021; Jun-Jul 2022	Person-hour	102	134	236
Tyto tenebricosa	Sooty Owl	Breeding	Apr-Aug	Songmeter	Mar-Sep 2020; Jun-Jul 2022	Night	347	43	390
Tyto tenebricosa	Sooty Owl	Breeding	Apr-Aug	Habitat search	Mar-Apr 2020; Jun-Jul 2020	Person-hour	42.5	164	206.5
Uperoleia mahonyi	Mahony's Toadlet	Foraging	Oct-Mar	Songmeter	Dec 2020-Mar 2021	Night	82.5		82.5
Uperoleia mahonyi	Mahony's Toadlet	Foraging	Oct-Mar	Spotlighting	Mar-Apr 2020; Jul 2020; Nov-Dec 2020; Jan 2021	Person-hour	82.5	20	102.5
Vespadelus troughtoni	Eastern Cave Bat	Foraging	Nov-Jan	Anabat	Mar-Apr 2020; Dec 2020; Jan 2021	Night	49	35	84
Vespadelus troughtoni	Eastern Cave Bat	Breeding	Nov-Jan	Harp trapping	Dec-20	Harp trap night	27		27

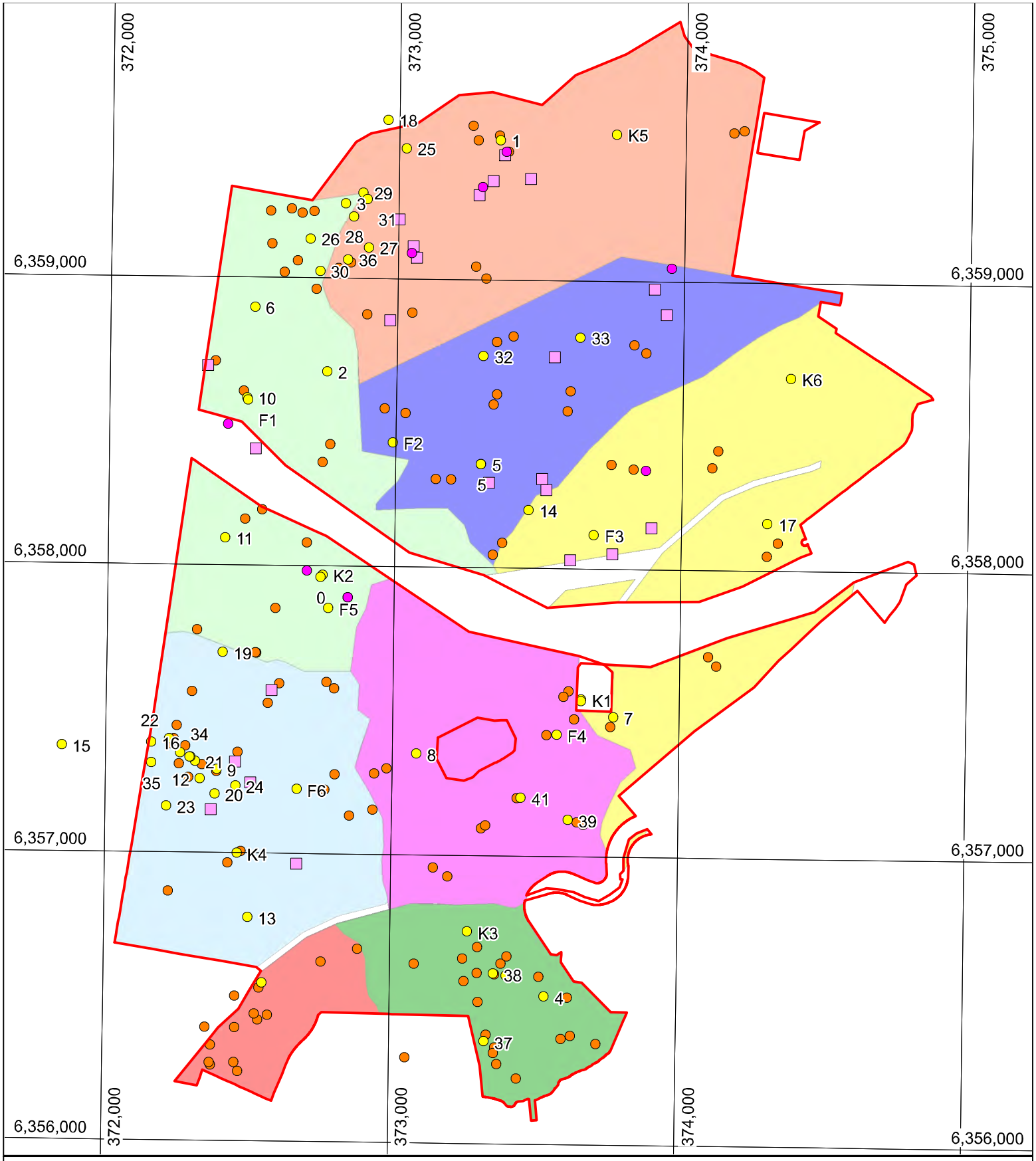

Figure 3 - Fixed Point Assessments

Legend

- Study Area
- Songmeter
- Anabat
- Harp trap
- Camera trap

Stratification Units

01	05
02	06
03	07
04	08

0 750
metres
Scale 1:17,500

N W E S

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | August 2022
AEP Ref: 1971.01

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

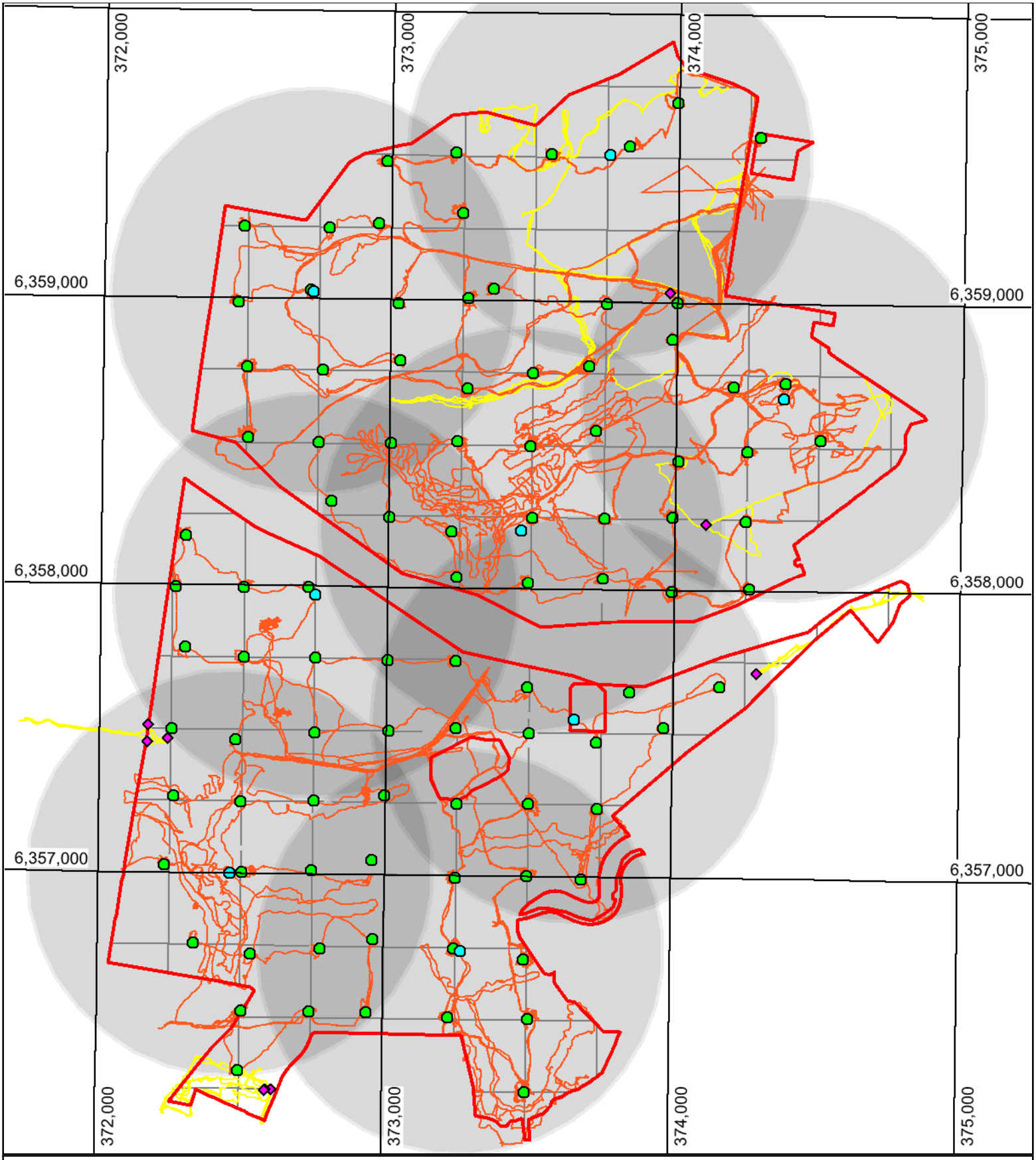

Figure 4 - Koala Survey

Legend

- Subject Site
- SAT survey grid
- SAT survey track
- Nocturnal survey track
- SAT central tree
- Call playback
- Songmeter
- Songmeter recording radius

0 750
metres
Scale 1:17,500

N W E S

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | June 2021
AEP Ref: 1971.01

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

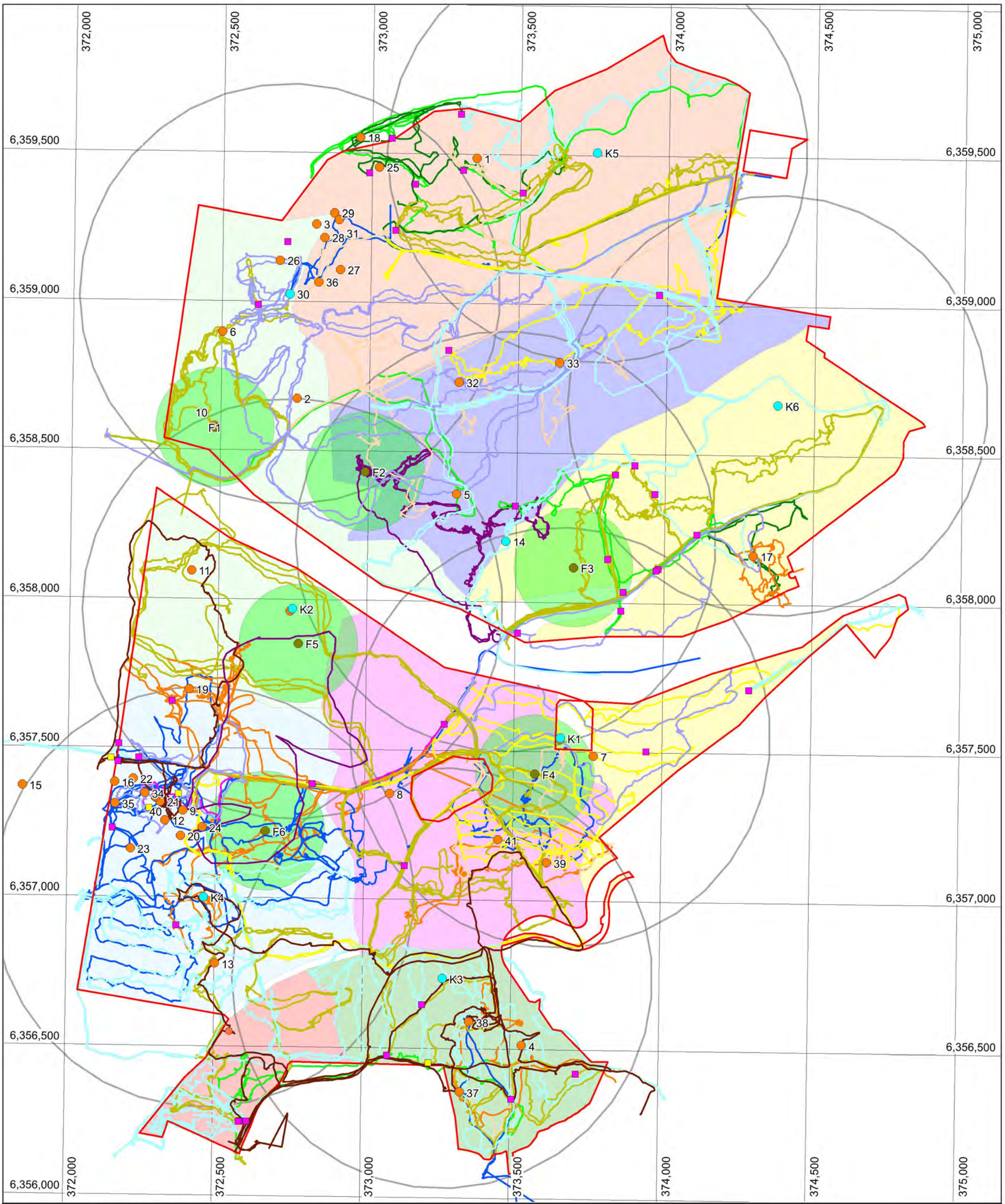

Figure 5 - Nocturnal Fauna Survey

Legend

- Subject Site
- Koala survey - songmeter
- Songmeter recording radius (for Koala)
- Frog survey - songmeter
- Songmeter recording radius (for frogs)

Stratification Units

01, 02, 03, 04, 05, 06, 07, 08

Survey tracks

March 2020
April 2020
May 2020
June 2020
July 2020
August 2020
September 2020
November 2020
December 2020
January 2021
February 2021
July 2022

- Other songmeter
- Call playback
- Quiet listening / Stagwatching

0 500
metres
Scale 1:11,500

N W E S

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | August 2022
AEP Ref: 1971.01

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

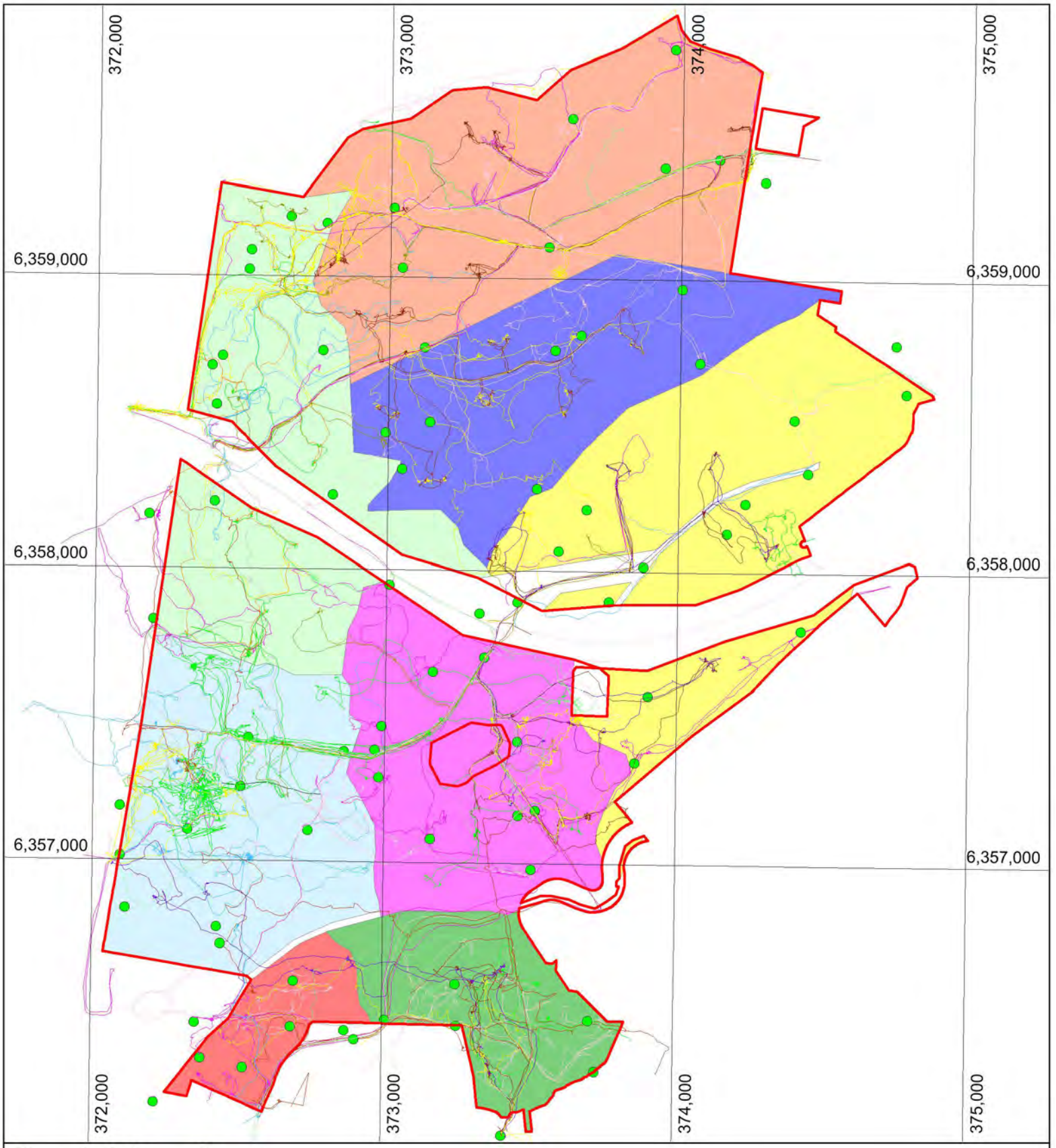

Figure 6 - Avifauna Survey

Legend

Study Area

Stratification Units

01
02
03
04
05
06
07
08

Survey Tracks

March 2020
April 2020
May 2020
June 2020
July 2020
August 2020
September 2020
October 2020
November 2020
December 2020
January 2021
July 2022

Centroid of survey location

0 750
metres
Scale 1:17,500

N
W E
S

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | August 2022
AEP Ref: 1971.01

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

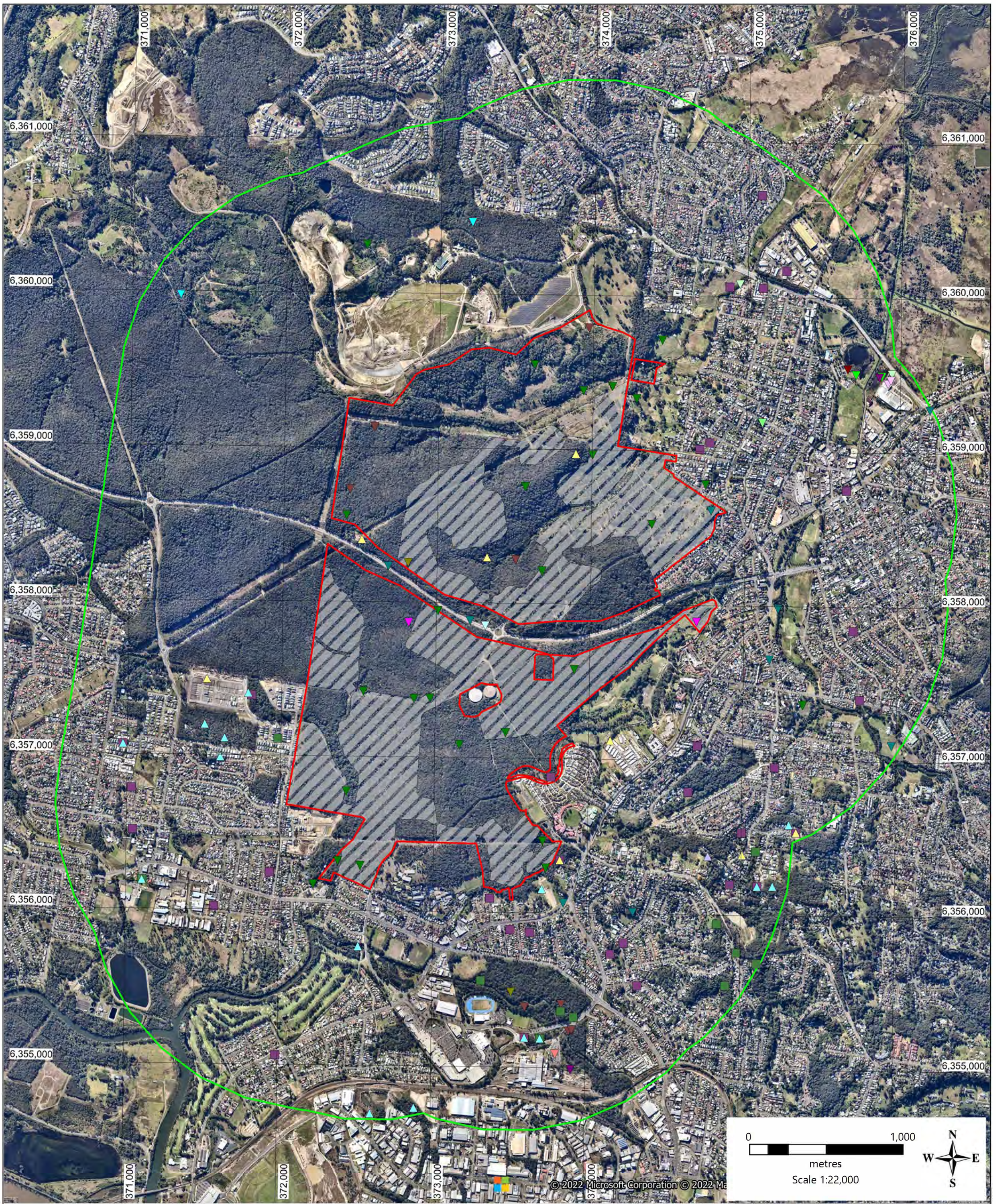

Figure 7 - NSW BioNet Atlas Records

Legend

- Study Area
- Subject Site
- Assessment Area
- Anseranas semipalmata
- Calyptorhynchus lathami
- Chalinolobus dwyeri
- Daphoenositta chrysoptera
- Ephippiorhynchus asiaticus
- Glossopsitta pusilla
- Haliaeetus leucogaster
- Hieraaetus morphnoides
- Hirundapus caudacutus
- Ixobrychus flavicollis
- Lathamus discolor
- Micronomus norfolkensis
- Miniopterus australis
- Miniopterus orianae oceanensis
- Ninox strenua
- Petaurus norfolcensis
- Petroica boodang
- Pteropus poliocephalus
- Ptilinopus regina
- Ptilinopus superbus
- Rostratula australis
- Scoteanax rueppellii
- Stictonetta naevosa
- Tyto novaehollandiae

Location: Land off Newcastle Link Road, Glendale, NSW
Client: Eden Estates Pty Ltd | AEP Ref: 1971.01 | July 2022

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

3.0 Survey Results

3.1 Species List

Fauna surveys to date have identified 170 species within the Subject Site consisting of 14 amphibian, six (6) reptile, 29 mammal and 121 bird species. A full species list for fauna recorded on the site (AEP) or in the locality (NSW BioNet Atlas) is provided in **Table 6**. Songmeter analysis is attached in **Attachment C**.

Table 6 – Species List

Family Name	Scientific Name	Common Name	Bionet Sighting within 10km	AEP Sighting
Fish				
Poeciliidae	*Gambusia holbrooki*	Mosquito Fish	B	
Amphibians				
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet	B	x
Myobatrachidae	*Limnodynastes peronii*	Brown-striped Frog	B	x
Myobatrachidae	*Limnodynastes tasmaniensis*	Spotted Grass Frog	B	x
Myobatrachidae	*Pseudophryne bibronii*	Bibron's Toadlet	B	
Myobatrachidae	*Pseudophryne coriacea*	Red-backed Toadlet	B	x
Myobatrachidae	*Uperoleia fusca*	Dusky Toadlet	B	x
Myobatrachidae	*Uperoleia laevigata*	Smooth Toadlet	B	x
Myobatrachidae	*Uperoleia tyleri*	Tyler's Toadlet	B	x
Hylidae	*Litoria caerulea*	Green Tree Frog	B	x
Hylidae	*Litoria quiritatus*	Screaming Tree Frog	B	x
Hylidae	*Litoria fallax*	Eastern Dwarf Tree Frog	B	x
Hylidae	*Litoria freycineti*	Freycinet's Frog	B	
Hylidae	*Litoria jervisiensis*	Jervis Bay Tree Frog	B	
Hylidae	*Litoria latopalmata*	Broad-palmed Frog	B	x
Hylidae	*Litoria nasuta*	Rocket Frog	B	x
Hylidae	*Litoria peronii*	Peron's Tree Frog	B	x
Hylidae	*Litoria tyleri*	Tyler's Tree Frog	B	x
Hylidae	*Litoria verreauxii*	Verreaux's Frog	B	
Reptiles				
Chelidae	*Chelodina longicollis*	Eastern Snake-necked Turtle	B	
Scincidae	*Bellatorias major*	Land Mullet	B	
Scincidae	*Cryptoblepharus virgatus*	Cream-striped Shinning-skink	B	
Scincidae	*Ctenotus robustus*	Robust Ctenotus	B	
Scincidae	*Cyclodomorphus michaeli*	Mainland She-oak Skink	B	
Scincidae	*Eulamprus quoyii*	Eastern Water-skink	B	
Scincidae	*Eulamprus tenuis*	Three-toed Earless Skink	B	
Scincidae	*Hemiergis decresiensis*	Dark-flecked Garden Sunskink	B	
Scincidae	*Lampropholis delicata*	Dark-flecked Garden Sunskink	B	x
Scincidae	*Lampropholis guichenoti*	Pale-flecked Garden Sunskink	B	
Scincidae	*Saiphos equalis*	Three-toed Skink	B	
Scincidae	*Tiliqua scincoides scincoides*	Blue-tongued Lizard	B	

Family Name	Scientific Name	Common Name	Bionet Sighting within 10km	AEP Sighting
Agamidae	*Amphibolurus muricatus*	Jacky Lizard	B	x
Agamidae	*Diporiphora nobbi*	Nobbi Dragon	B	
Agamidae	*Intellagama lesueurii*	Eastern Water Dragon	B	x
Agamidae	*Pogona barbata*	Bearded Dragon	B	
Agamidae	*Rankinia diemensis*	Mountain Dragon	B	
Varanidae	*Varanus gouldii*	Gould's Goanna	B	
Varanidae	*Varanus varius*	Lace Monitor	B	x
Typhlopidae	*Anilios nigrescens*	Blackish Blind Snake	B	x
Typhlopidae	*Anilios proximus*	Proximus Blind Snake	B	
Colubridae	*Dendrelaphis punctulatus*	Common Tree Snake	B	
Elapidae	*Cacophis squamulosus*	Golden-crowned Snake	B	
Elapidae	*Demansia psammophis*	Yellow-faced Whip Snake	B	
Elapidae	*Furina diadema*	Red-naped Snake	B	
Elapidae	*Hemiaspis signata*	Black-bellied Swamp Snake	B	
Elapidae	*Pseudechis porphyriacus*	Red-bellied Black Snake	B	x
Elapidae	*Pseudonaja textilis*	Eastern Brown Snake	B	
Birds				
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	B	x
Acanthizidae	*Acanthiza lineata*	Striated Thornbill	B	x
Acanthizidae	*Acanthiza nana*	Yellow Thornbill	B	x
Acanthizidae	*Acanthiza pusilla*	Brown Thornbill	B	x
Acanthizidae	*Acanthiza reguloides*	Buff-rumped Thornbill	B	
Acanthizidae	*Gerygone mouki*	Brown Gerygone	B	x
Acanthizidae	*Gerygone olivacea*	White-throated Gerygone	B	
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren	B	x
Accipitridae	*Accipiter fasciatus*	Brown Goshawk	B	x
Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk	B	x
Accipitridae	*Accipiter novaehollandiae*	Grey Goshawk	B	
Accipitridae	*Aquila audax*	Wedge-tailed Eagle	B	x
Accipitridae	*Aviceda subcristata*	Pacific Baza	B	
Accipitridae	*Circus approximans*	Swamp Harrier	B	
Accipitridae	***Haliaeetus leucogaster***	**White-bellied Sea-Eagle**	B	**x**
Accipitridae	*Haliastur sphenurus*	Whistling Kite	B	x
Accipitridae	***Hieraaetus morphnoides***	**Little Eagle**	B	**x**
Accipitridae	*Elanus axillaris*	Black-shouldered Kite	B	x
Accipitridae	*Milvus migrans*	Black Kite	B	x

Family Name	Scientific Name	Common Name	Bionet Sighting within 10km	AEP Sighting
Accipitridae	***Lophoictinia isura***	**Square-tailed Kite**	B	**x**
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar	B	x
Alcedinidae	*Ceyx azureus*	Azure Kingfisher	B	
Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra	B	x
Alcedinidae	*Todiramphus sanctus*	Sacred Kingfisher	B	x
Anatidae	*Anas platyrhynchos*	Mallard	B	
Anatidae	*Anas superciliosa*	Pacific Black Duck	B	x
Anatidae	*Aythya australis*	Hardhead	B	
Anatidae	*Chenonetta jubata*	Australian Wood Duck	B	x
Anatidae	*Anas castanea*	Chestnut Teal	B	x
Anatidae	*Cygnus atratus*	Black Swan	B	
Anatidae	*Dendrocygna arcuata*	Wandering Whistling-Duck	B	
Anatidae	*Dendrocygna eytoni*	Plumed Whistling-Duck	B	
Apodidae	*Apus pacificus*	Fork-tailed Swift	B	
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	B	x
Ardeidae	*Ardea ibis*	Cattle Egret	B	x
Ardeidae	*Egretta novaehollandiae*	White-faced Heron	B	
Ardeidae	*Ardea intermedia*	Intermediate Egret	B	
Ardeidae	*Ardea modesta*	Eastern Great Egret	B	
Ardeidae	*Ardea pacifica*	White-necked Heron	B	
Ardeidae	*Egretta garzetta*	Little Egret	B	
Ardeidae	*Nycticorax caledonicus*	Nankeen Night Heron	B	x
Artamidae	***Artamus cyanopterus cyanopterus***	**Dusky Woodswallow**	B	
Artamidae	*Artamus leucorynchus*	White-breasted Woodswallow	B	x
Artamidae	*Artamus superciliosus*	White-browed Woodswallow	B	
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird	B	x
Artamidae	*Cracticus tibicen*	Australian Magpie	B	x
Artamidae	*Cracticus torquatus*	Grey Butcherbird	B	x
Artamidae	*Strepera graculina*	Pied Currawong	B	x
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	B	x
Cacatuidae	*Cacatua tenuirostris*	Long-billed Corella	B	
Cacatuidae	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo	B	x
Cacatuidae	***Calyptorhynchus lathami***	**Glossy Black-Cockatoo**	B	**x**
Cacatuidae	*Eolophus roseicapillus*	Galah	B	x

Family Name	Scientific Name	Common Name	Bionet Sighting within 10km	AEP Sighting
Cacatuidae	*Cacatua sanguinea*	Little Corella	B	x
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	B	x
Campephagidae	*Coracina tenuirostris*	Cicadabird	B	x
Campephagidae	*Lalage sueurii*	White-winged Triller	B	
Caprimulgidae	*Eurostopodus mystacalis*	White-throated Nightjar	B	x
Centropodidae	*Centropus phasianinus*	Pheasant Coucal	B	x
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel	B	
Charadriidae	*Erythrogonys cinctus*	Red-kneed Dotterel	B	
Charadriidae	*Vanellus miles*	Masked Lapwing	B	x
Climacteridae	*Cormobates leucophaea*	White-throated Treecreeper	B	x
Columbidae	*Columba leucomela*	White-headed Pigeon	B	
Columbidae	*Geopelia humeralis*	Bar-shouldered Dove	B	x
Columbidae	*Geopelia striata*	Peaceful Dove	B	
Columbidae	*Leucosarcia melanoleuca*	Wonga Pigeon	B	x
Columbidae	*Macropygia amboinensis*	Brown Cuckoo-Dove	B	x
Columbidae	*Ocyphaps lophotes*	Crested Pigeon	B	x
Columbidae	*Streptopelia chinensis**	Spotted Turtle-Dove	B	x
Columbidae	*Columba livia*	Rock Dove	B	x
Columbidae	*Lopholaimus antarcticus*	Topknot Pigeon	B	x
Coraciidae	*Eurystomus orientalis*	Dollarbird	B	x
Corcoracidae	*Corcorax melanorhamphos*	White-winged Chough	B	x
Corvidae	*Corvus coronoides*	Australian Raven	B	x
Corvidae	*Corvus orru*	Torresian Crow	B	x
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	B	x
Cuculidae	*Cacomantis pallidus*	Pallid Cuckoo	B	
Cuculidae	*Cacomantis variolosus*	Brush Cuckoo	B	x
Cuculidae	*Chalcites basalis*	Horsfield's Bronze-Cuckoo	B	
Cuculidae	*Chalcites lucidus*	Shining Bronze-Cuckoo	B	x
Cuculidae	*Eudynamys orientalis*	Eastern Koel	B	x
Cuculidae	*Scythrops novaehollandiae*	Channel-billed Cuckoo	B	x
Dicruridae	*Dicrurus bracteatus*	Spangled Drongo	B	x
Estrildidae	*Neochmia temporalis*	Red-browed Finch	B	x
Estrildidae	*Lonchura castaneothorax*	Chestnut-breasted Mannikin	B	x
Falconidae	*Falco berigora*	Brown Falcon	B	x
Falconidae	*Falco cenchroides*	Nankeen Kestrel	B	
Falconidae	*Falco longipennis*	Australian Hobby	B	x

Family Name	Scientific Name	Common Name	Bionet Sighting within 10km	AEP Sighting
Falconidae	*Falco peregrinus*	Peregrine Falcon	B	x
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	B	x
Hirundinidae	*Petrochelidon ariel*	Fairy Martin	B	
Hirundinidae	*Petrochelidon nigricans*	Tree Martin	B	
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	B	x
Maluridae	*Malurus lamberti*	Variegated Fairy-wren	B	x
Megaluridae	*Megalurus gramineus*	Little Grassbird	B	
Megaluridae	*Megalurus timoriensis*	Tawny Grassbird	B	x
Megapodiidae	*Alectura lathami*	Australian Brush-turkey	B	x
Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill	B	x
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird	B	x
Meliphagidae	*Anthochaera chrysoptera*	Little Wattlebird	B	x
Meliphagidae	*Caligavis chrysops*	Yellow-faced Honeyeater	B	x
Meliphagidae	*Manorina melanocephala*	Noisy Miner	B	x
Meliphagidae	*Manorina melanophrys*	Bell Miner	B	x
Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater	B	x
Meliphagidae	*Melithreptus brevirostris*	Brown-headed Honeyeater	B	x
Meliphagidae	*Melithreptus lunatus*	White-naped Honeyeater	B	x
Meliphagidae	*Myzomela sanguinolenta*	Scarlet Honeyeater	B	x
Meliphagidae	*Philemon corniculatus*	Noisy Friarbird	B	x
Meliphagidae	*Phylidonyris niger*	White-cheeked Honeyeater	B	x
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater	B	x
Meliphagidae	*Entomyzon cyanotis*	Blue-faced Honeyeater	B	x
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater	B	x
Meliphagidae	*Lichenostomus melanops*	Yellow-tufted Honeyeater	B	
Meliphagidae	*Ptilotula fuscus*	Fuscous Honeyeater	B	x
Menuridae	*Menura novaehollandiae*	Superb Lyrebird	B	
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	B	x
Monarchidae	*Myiagra rubecula*	Leaden Flycatcher	B	x
Monarchidae	*Monarcha melanopsis*	Black-faced Monarch	B	x
Nectariniidae	*Dicaeum hirundinaceum*	Mistletoebird	B	x
Neosittidae	***Daphoenositta chrysoptera***	**Varied Sittella**	B	
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole	B	x
Oriolidae	*Sphecotheres vieilloti*	Australasian Figbird	B	x
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush	B	x
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler	B	x
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	B	x

Family Name	Scientific Name	Common Name	Bionet Sighting within 10km	AEP Sighting
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	B	x
Pardalotidae	*Pardalotus striatus*	Striated Pardalote	B	x
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican	B	x
Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin	B	x
Petroicidae	*Microeca fascinans*	Jacky Winter	B	
Petroicidae	*Petroica rosea*	Rose Robin	B	x
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant	B	x
Phasianidae	*Coturnix ypsilophora*	Brown Quail	B	x
Podargidae	*Podargus strigoides*	Tawny Frogmouth	B	x
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe	B	
Psittacidae	*Alisterus scapularis*	Australian King-Parrot	B	x
Psittacidae	*Glossopsitta concinna*	Musk Lorikeet	B	x
Psittacidae	***Glossopsitta pusilla***	**Little Lorikeet**	B	**x**
Psittacidae	***Lathamus discolor***	**Swift Parrot**	B	
Psittacidae	*Platycercus elegans*	Crimson Rosella	B	x
Psittacidae	*Platycercus eximius*	Eastern Rosella	B	x
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet	B	x
Psittacidae	*Trichoglossus chlorolepidotus*	Scaly-breasted Lorikeet	B	x
Psophodidae	*Psophodes olivaceus*	Eastern Whipbird	B	x
Ptilonorhynchidae	*Ptilonorhynchus violaceus*	Satin Bowerbird	B	x
Ptilonorhynchidae	*Sericulus chrysocephalus*	Regent Bowerbird	B	
Rallidae	*Fulica atra*	Eurasian Coot	B	
Rallidae	*Gallinula tenebrosa*	Dusky Moorhen	B	x
Rallidae	*Gallirallus philippensis*	Buff-banded Rail	B	
Rallidae	*Porphyrio porphyrio*	Purple Swamphen	B	
Rallidae	*Porzana fluminea*	Australian Spotted Crake	B	
Rallidae	*Porzana pusilla*	Baillon's Crake	B	
Rallidae	*Porzana tabuensis*	Spotless Crake	B	
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail	B	x
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail	B	x
Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail	B	x
Strigidae	*Ninox novaeseelandiae*	Southern Boobook	B	x
Strigidae	***Ninox strenua***	**Powerful Owl**	B	**x**
Sturnidae	*Sturnus tristis**	Common Myna	B	x
Sturnidae	*Sturnus vulgaris**	Common Starling	B	x
Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill	B	
Threskiornithidae	*Platalea regia*	Royal Spoonbill	B	

Family Name	Scientific Name	Common Name	Bionet Sighting within 10km	AEP Sighting
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis	B	x
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis	B	x
Timaliidae	*Zosterops lateralis*	Silvereye	B	x
Turnicidae	*Turnix varius*	Painted Button-quail	B	
Tytonidae	*Tyto javanica*	Eastern Barn Owl	B	
Tytonidae	***Tyto novaehollandiae***	**Masked Owl**	B	**x**
Tytonidae	*Tyto tenebricosa*	Sooty Owl	B	
Mammals				
Ornithorhynchidae	*Ornithorhynchus anatinus*	Platypus	B	
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna	B	x
Dasyuridae	*Antechinus stuartii*	Brown Antechinus	B	x
Dasyuridae	*Sminthopsis murina*	Common Dunnart	B	x
Peramelidae	*Isoodon macrourus*	Northern Brown Bandicoot	B	
Peramelidae	*Perameles nasuta*	Long-nosed Bandicoot	B	
Phascolarctidae	***Phascolarctos cinereus***	**Koala**	B	
Vombatidae	*Vombatus ursinus*	Common Wombat	B	
Petauridae	*Petaurus breviceps*	Sugar Glider	B	x
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	B	x
Pseudocheiridae	*Pseudocheirus peregrinus*	Common Ringtail Possum	B	x
Acrobatidae	*Acrobates pygmaeus*	Feathertail Glider	B	x
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum	B	x
Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo	B	x
Macropodidae	*Macropus rufogriseus*	Red-necked Wallaby	B	
Macropodidae	*Wallabia bicolor*	Swamp Wallaby	B	x
Pteropodidae	*Pteropus alecto*	Black Flying- fox	B	
Pteropodidae	***Pteropus poliocephalus***	**Grey-headed Flying-fox**	B	**x**
Pteropodidae	*Pteropus scapulatus*	Little Red Flying- fox	B	
Rhinolophidae	*Rhinolophus megaphyllus*	Eastern Horseshoe-bat	B	x
Emballonuridae	*Saccolaimus flaviventris*	Yellow- bellied Sheathtail-bat	B	x
Molossidae	*Austronomus australis*	White-striped Freetail-bat	B	x
Molossidae	***Mormopterus norfolkensis***	**Eastern Freetail-bat**	B	**x**
Molossidae	*Mormopterus ridei*	Eastern Free-tailed Bat	B	x
Vespertilionidae	***Chalinolobus dwyeri***	**Large-eared Pied Bat**	**B**	**x**
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	B	x
Vespertilionidae	*Chalinolobus morio*	Chocolate Wattled Bat	B	x
Vespertilionidae	***Falsistrellus tasmaniensis***	**Eastern False Pipistrelle**	B	

Family Name	Scientific Name	Common Name	Bionet Sighting within 10km	AEP Sighting
Vespertilionidae	***Miniopterus australis***	**Little Bentwing-bat**	B	**x**
Vespertilionidae	***Miniopterus schreibersii oceanensis***	**Eastern Bentwing-bat**	B	**x**
Vespertilionidae	*Nyctophilus geoffroyi*	Lesser Long-eared Bat	B	x
Vespertilionidae	*Nyctophilus gouldi*	Gould's Long-eared Bat	B	x
Vespertilionidae	*Nyctophilus sp.*	long-eared Bat	B	x
Vespertilionidae	***Scoteanax rueppellii***	**Greater Broad-nosed Bat**	B	**x**
Vespertilionidae	*Scotorepens orion*	Eastern Broad-nosed Bat	B	x
Vespertilionidae	*Vespadelus darlingtoni*	Large Forest Bat	B	
Vespertilionidae	*Vespadelus pumilus*	Eastern Forest Bat	B	
Vespertilionidae	*Vespadelus regulus*	Southern Forest Bat	B	
Vespertilionidae	***Vespadelus troughtoni***	**Eastern Cave Bat**	B	
Vespertilionidae	*Vespadelus vulturnus*	Little Forest Bat	B	x
Muridae	*Mus musculus**	House Mouse	B	
Muridae	*Rattus fuscipes*	Bush Rat	B	
Muridae	*Rattus lutreolus*	Swamp Rat	B	
Muridae	*Rattus rattus**	Black Rat	B	x
Muridae	*Rattus sp.*	rat	B	x
Canidae	*Canis lupus**	Dingo, domestic dog	B	
Canidae	*Vulpes vulpes**	Fox	B	x
Felidae	*Felis catus**	Cat	B	
Leporidae	*Lepus capensis**	Brown Hare	B	
Leporidae	*Oryctolagus cuniculus**	Rabbit	B	x

There were 13 threatened fauna species identified on site, of which four (4) incur Species Credit, thus requiring the creation of a Species polygon.

3.2 Habitat Features

Approximately 446 hollow-bearing trees (HBTs) containing a total of 1077 hollows were identified within the Subject Site as listed in **Table 8**. It is expected that approx. 644 hollows will be retained. Where hollow presence is assumed, it is due to the height and orientation of the hollow, which in some cases made definite identification not possible. Despite thorough surveying, hollows may also have gone unnoticed that would be suitable for a range of species. Other hollows may have gone unobserved due to the height and orientation of potential hollows. HBTs are mapped in **Figure 1**.

Attachment A – Anabat Analysis Report

1.0 Method

Analysis of bat echolocation calls was undertaken using Anabat Insight and AnalookW software. Identification was carried out utilising Pennay et al. (2004) along with comparison from recorded reference calls associated with the Sydney Basin.

Reference calls used were obtained from the NSW database and AEP confirmed bat call collection.

The majority of calls were viewed, with unique calls tagged and identified where relevant. Calls that were too short (three pulses or less) or were of poor call quality were not analysed and tagged as unknown.

Certain microbat species have similar call frequencies, call shape and other characteristics which can make identification to species impossible using just call analysis. Where it was not possible to differentiate calls due to similar call characteristics the call was marked as species group.

Table 1 – Confidence ratings of bat call sequences

Confidence	Description
Definite	Call has been identified to a particular species and could not be confused with another species.
Probable	Call has been identified to a particular species, with a low chance that it could be confused with another species.
Possible	Call has been identified to a particular species, but there is a moderate chance of confusion with another species.
Species group	Call could not be identified as a particular species due to call characteristics (poor quality/short sequence, bat species with overlapping frequencies, etc).
Unknown	Call sequences that are too short or of very poor quality.

2.0 Differentiation of species with similar calls

Separation of species with similar calls is possible using particular call characteristics, a short description of characteristics used to distinguish species is included in **Table 2**. Note that it is not always possible to separate similar calls and is affected by the length and quality of recorded calls.

Species names are based on the Australian Chiroptera taxonomic list (Reardon et al. 2015) with changes made to keep the naming conventions in line with DPIE.

Table 2 – Call characteristics used to differentiate species

Species	Characteristic
Austronomus australis	Differentiated using characteristic frequency.
Chalinolobus gouldii	Differentiated from other species by frequency and presence of curved alternating calls.
Chalinolobus morio/ Vespadelus sp.	Presence of a down-sweeping tail on majority of calls indicated *C.morio*.
Falsistrellus tasmaniensis	Can be differentiated within good call sequences from *Scotorepens orion* / *Scoteanax rueppellii* based on length of pre-characteristic.
Miniopterus australis/ Vespadelus pumilus	Differences in frequency or presence of a down-sweeping tail indicating *M.australis*.
Miniopterus orianae oceanensis/ Vespadelus sp.	*M.orianae oceanensis* differentiated based on call timing, shape and frequency.
Myotis macropus/ Nyctophilus spp.	*M.macropus* differentiated based on high quality calls with initial slope >400 OPS and pulse intervals <75ms. Secondary characters used include central kink and slope variances between pulses.
Ozimops ridei / Micronomus norfolkensis	Call frequency and alternation of pulses within the call indicates *M.norfolkensis*.
Ozimops ridei / Ozimops planiceps	Differentiated using characteristic frequency.
Rhinolophus megaphyllus	Differentiated using characteristic frequency and shape.
Saccolaimus flaviventris	Differentiated using characteristic frequency.
Scotorepens orion / Scoteanax rueppellii	Calls from these species are very similar. Differentiation is based on the characteristic frequency and the frequency of the knee when compared to the characteristic frequency.
Vespadelus troughtoni / Vespadelus vulturnus / Vespadelus pumilus	It is not currently possible to differentiate between *V.vulturnus* and *V.troughtoni* on call characteristics alone though with high quality calls there is potential to say that one may be more likely. *V. pumilus* can be differentiated only when call frequency is above 54khz or below 50khz.
Vespadelus regulus / Vespadelus darlingtoni	These species are not differentiated from each other by call by AEP.

It should be noted that the number of call sequences for specific species does not allow for a quantitative understanding of the numbers present on site. Instead, it should be taken as an idea of activity within the site for that particular species. It is not possible to compare activity levels between species due to differences in species detectability, foraging strategies and call characteristics.

3.0 Results

41,236 call sequences were recorded of which 6,395 were analysable (not short calls, low quality or noise files). Species that were identified (definite or probable) include:

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Chalinolobus gouldii* (Gould's Wattled Bat)
- *Chalinolobus morio* (Chocolate Wattled Bat)
- *Micronomus norfolkensis* (Eastern coastal Free-tailed Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- *Ozimops ridei* (Ride's Free-tailed Bat)
- *Rhinolophus megaphyllus* (Eastern Horseshoe Bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Ozimops planiceps* (Southern Free-tailed Bat)

Bats that are likely to be on site but could not be definitively identified (i.e. those that were classified as possible or within a species group) include:

- *Austronomus australis* (White-striped Free-tailed Bat)
- *Falsistrellus tasmaniensis* (Eastern Falsistrelle)[1]
- *Myotis macropus* (Large-footed Myotis)[1]
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat)[1]
- *Nyctophilus geoffroyi* (Lesser Long-eared Bat)[1]
- *Nyctophilus gouldi* (Gould's Long-eared Bat)
- *Scotorepens orion* (Eastern Broad-nosed Bat)[1]
- *Vespadelus darlingtoni* (Large Forest Bat)[1]
- *Vespadelus pumilus* (Eastern Forest Bat)[1]
- *Vespadelus regulus* (Southern Forest Bat)[1]
- *Vespadelus troughtoni* (Eastern Cave Bat)[1]
- *Vespadelus vulturnus* (Little Forest Bat)[1]

[1] Species identified as possibly occurring as part of a species group. Refer to **Section 4.0** for further discussion of species group species.

While all care has been taken, it should be noted that certain bat species are difficult to identify by bat call and others may not have been recorded by the detectors. It is therefore recommended that a habitat assessment should be used in conjunction with this analysis to determine the likely occurrence of other bat species.

4.0 Species Group Species

Several species could not be definitively identified solely by analysing echolocation calls. However, their calls share similarities which allows them to be grouped under species groups. A review of such species is proposed as follows:

- *Falsistrellus tasmaniensis* (Eastern Falsistrelle): The species' call could not be distinguished from *Scoteanax rueppellii* (Greater Broad-nosed Bat) and *Scotorepens Orion* (Eastern Broad-nosed Bat) calls. However, *Scoteanax rueppellii* calls were identified on site.

- *Nyctophilus geoffroyi* (Lesser Long-eared Bat): The species' call could not be distinguished from *Nyctophilus gouldi* (Gould's Long-eared Bat) and *Myotis macropus* (Southern Myotis) calls. However, all three species were identified, through harp trapping (*N. geoffroyi* and *N. gouldi*) and spotlighting (*M. macropus*).

- *Vespadelus spp.*: *Vespadelus pumilus* (Eastern Forest Bat) and *V. vulturnus* (Little Forest Bat) were identified on site using harp traps. However, *V. troughtoni* (Eastern Cave Bat) was not caught. Therefore, it is considered unlikely that *V. troughtoni* occurs within the Subject Site.

- *Vespadelus regulus* (Southern Forest Bat): Echolocation calls from this species may not always be distinguished from *Miniopterus orianae oceanensis*. Therefore, they are considered as possibly occurring on site.

5.0 Sample Time vs Frequency graphs

A sample call for each unique bat species that was identified (definitive/probable) is included below.

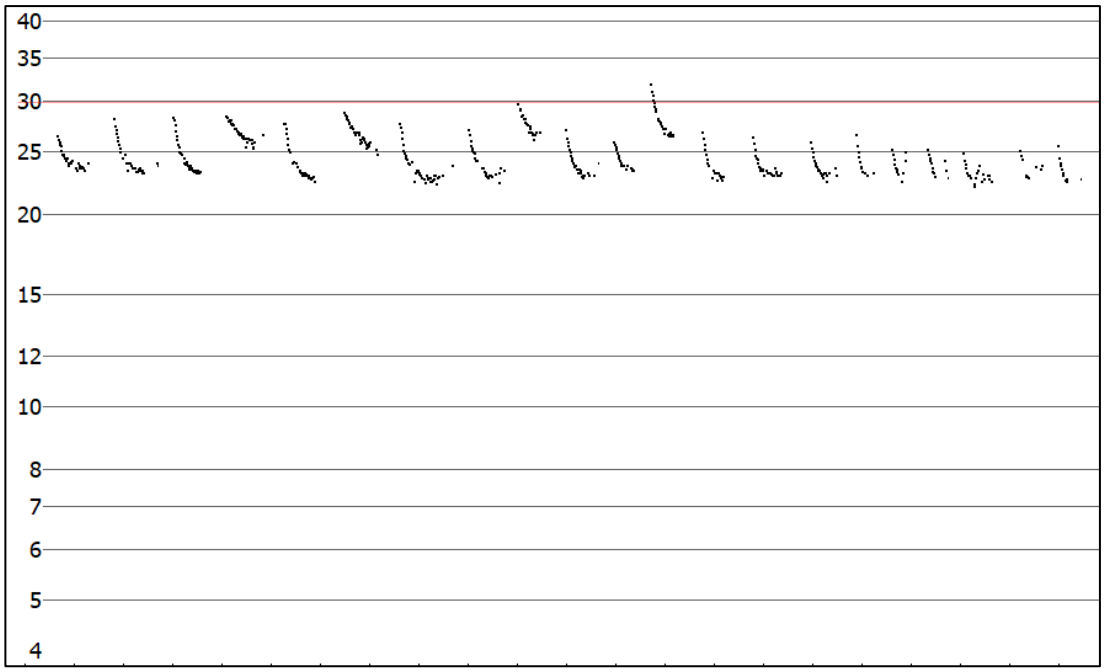

Figure 1 – *Chalinolobus dwyeri* definite call

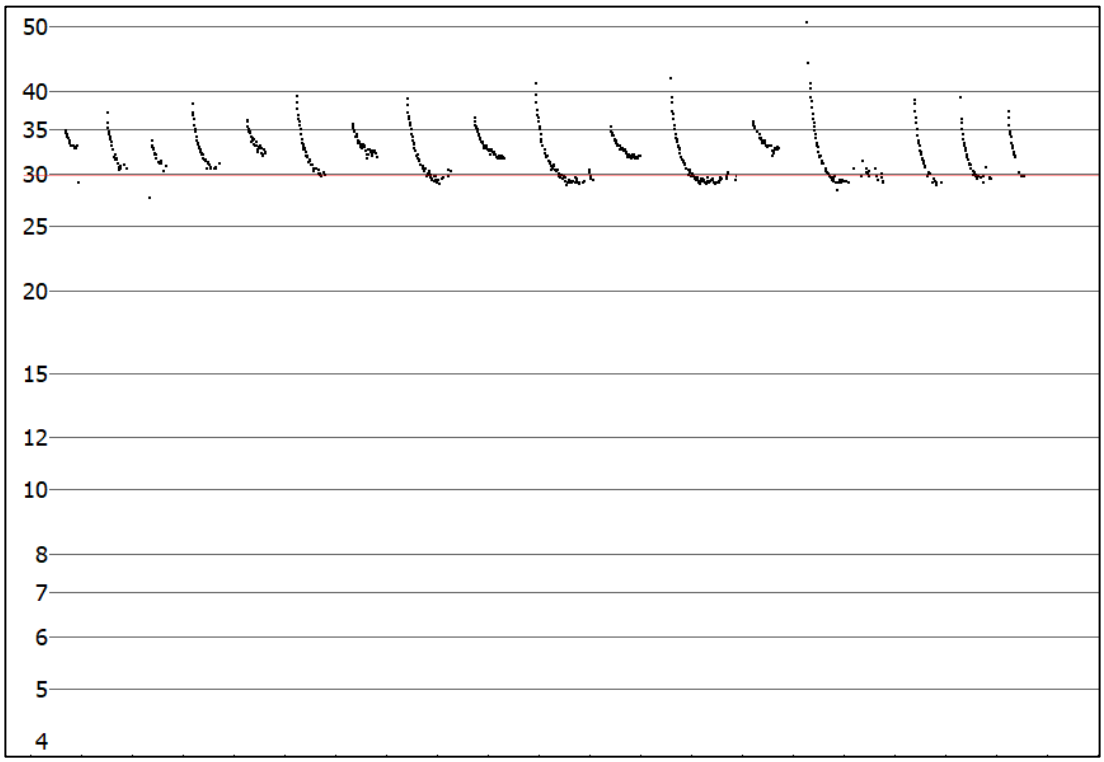

Figure 2 – *Chalinolobus gouldii* definite call

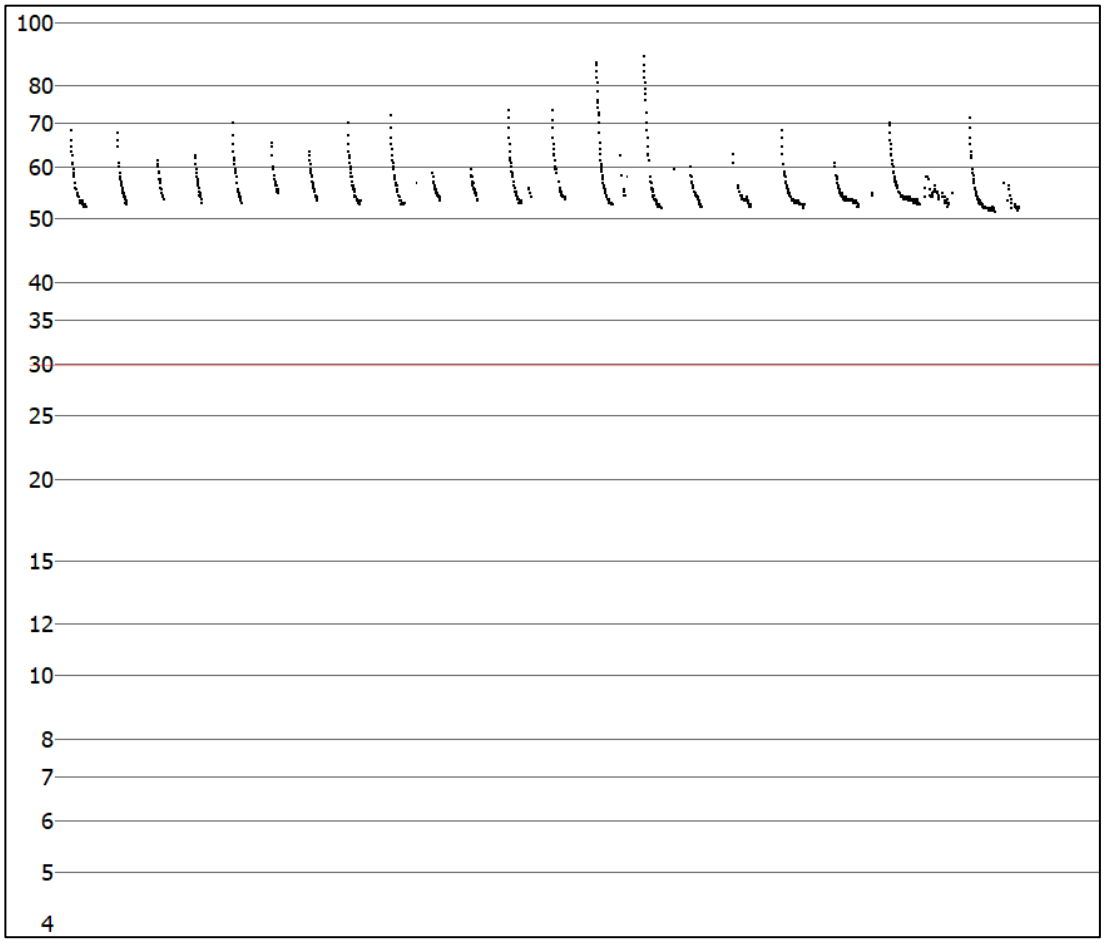

Figure 3 – *Chalinolobus morio* definite call

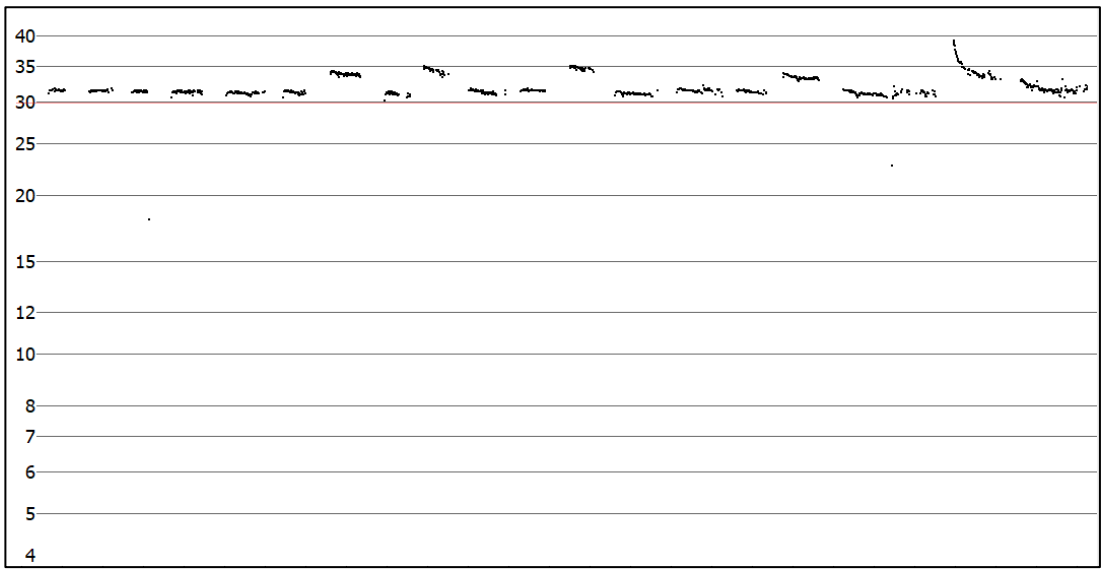

Figure 4 – *Micronomus norfolkensis* definite call

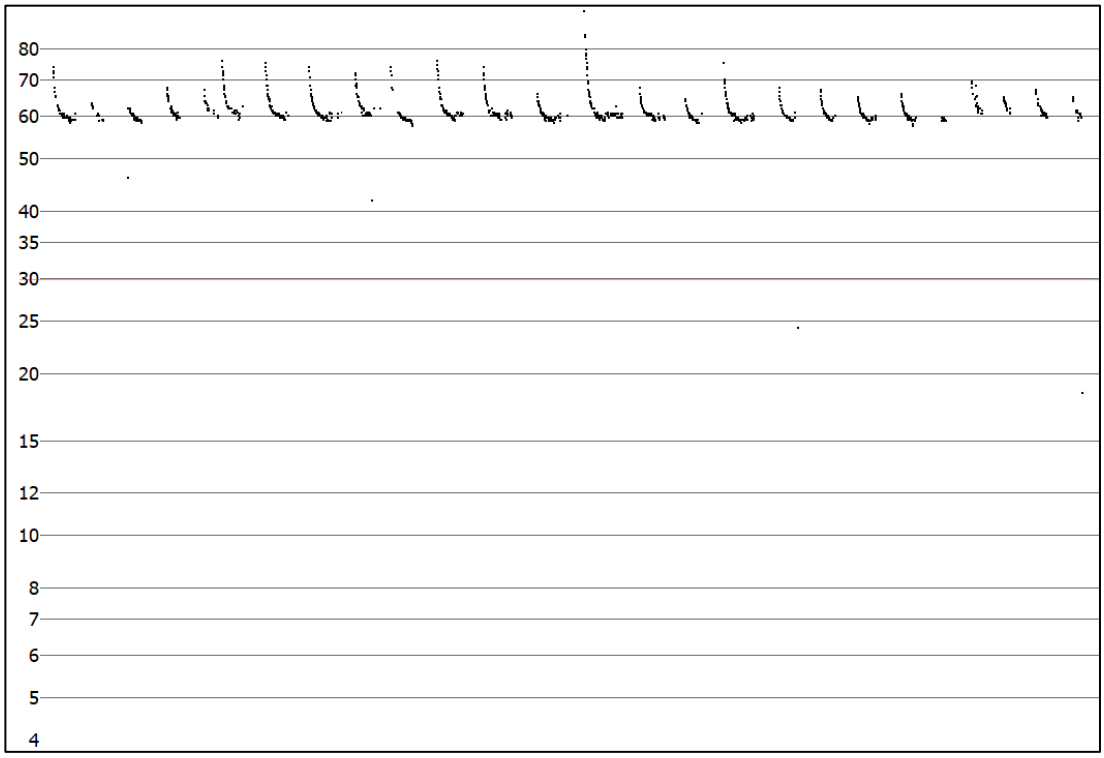

Figure 5 – *Miniopterus australis* definite call

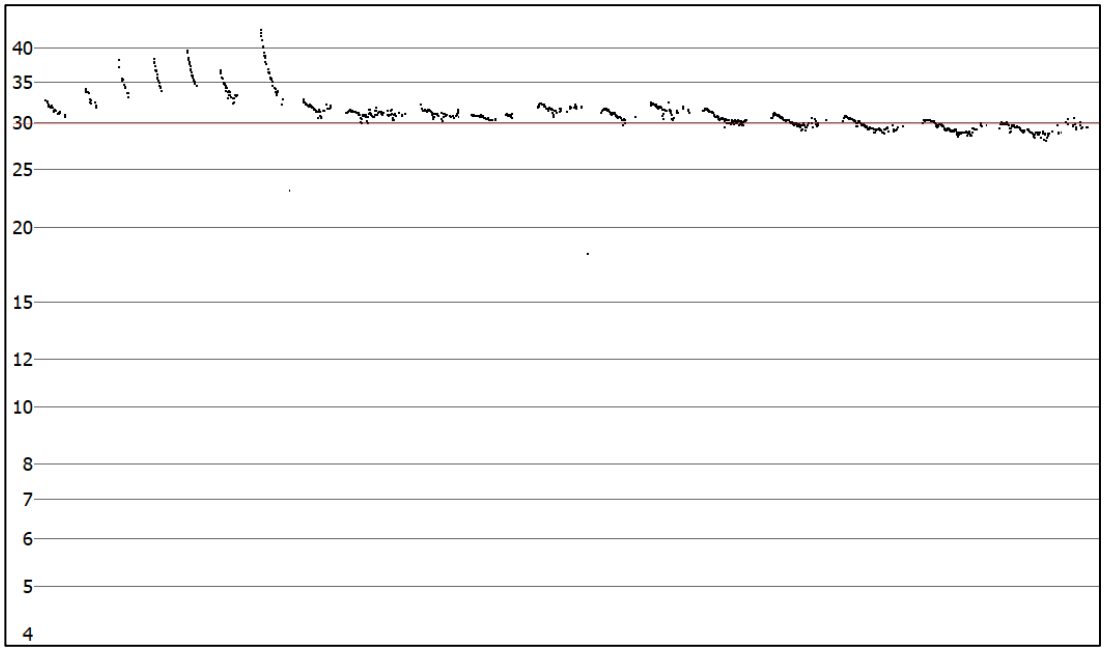

Figure 6 – *Ozimops ridei* definite call

Figure 7 – *Rhinolophus megaphyllus* definite call

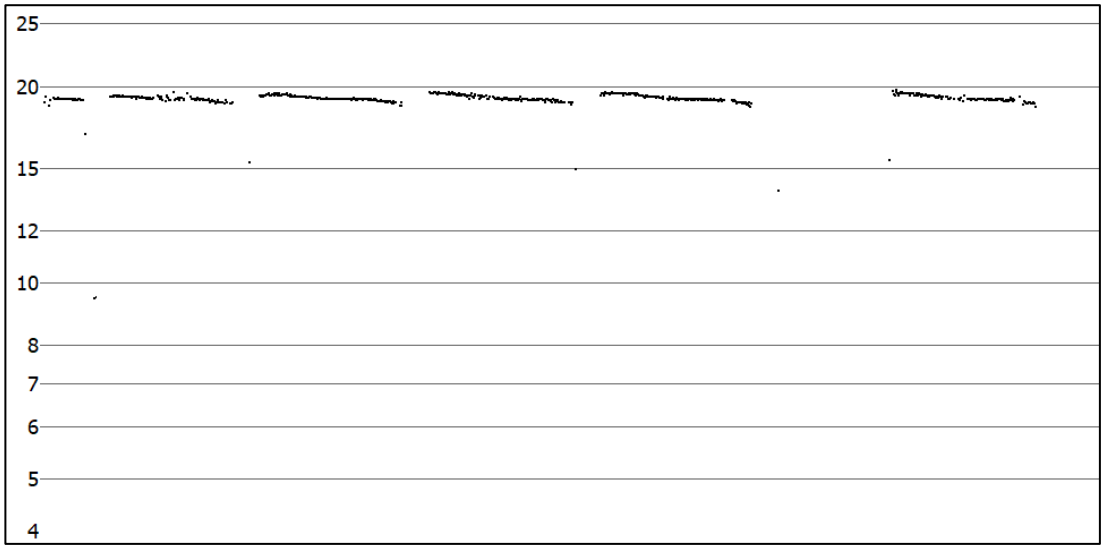

Figure 8 – *Saccolaimus flaviventris* definite call

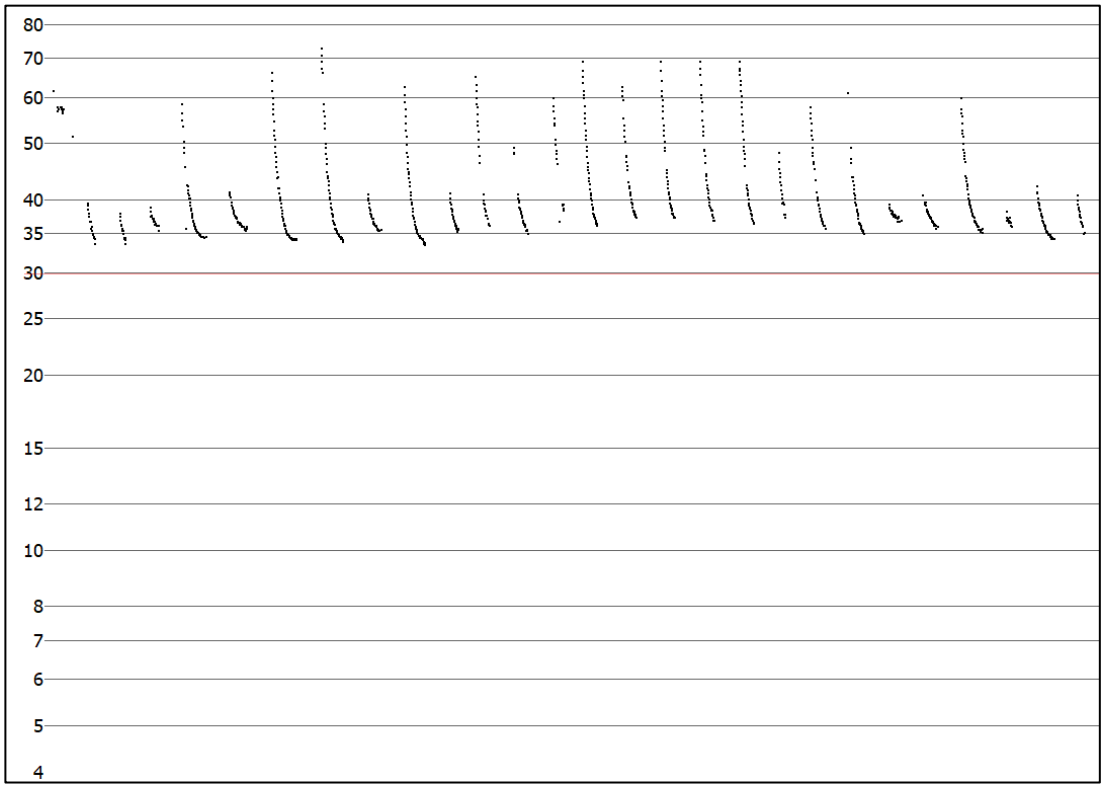

Figure 9 – *Scoteanax rueppellii* definite call

Figure 10 – *Ozimops planiceps* probable call

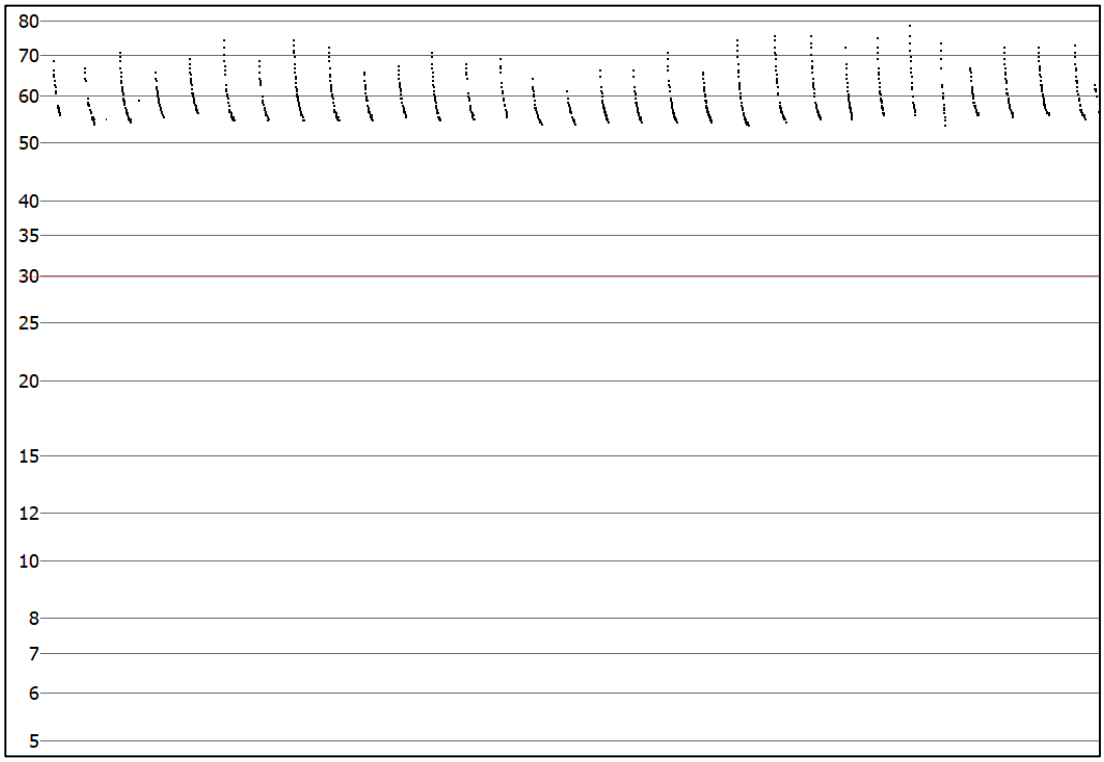

Figure 11 – *Vespadelus pumilus* probable call

Attachment B – Microbat Harp Trapping Report

ECHO
ECOLOGY AND SURVEYING

BAT SURVEY REPORT

Link Rd, Wallsend, NSW

Prepared for
Anderson Environment and Planning
2/10 Darvall Street,
Carrington, NSW, 2294

Job Reference 140 – March 2021

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Document Control

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Prepared by	out of scope (PhD, B.Env.Sc.) Ecologist / Director
Status	FINAL
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Date	25 March 2021

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Certification

As the principal author, I, Anna McConville make the following certification:

- The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the site;
- Commonwealth, state and local government policies and guidelines formed the basis of project surveying methodology, or where the survey work has been undertaken with specified departures from industry standard guidelines, details of which are discussed and justified in Section 2;
- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995*, *National Parks and Wildlife Act 1974* and the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes*.

Signature of Principal Author and Certifier:

out of scope

PhD, B.Env.Sc.)

Ecologist / Director

Executive Summary

Introduction

Echo Ecology and Surveying has been engaged by Anderson Environment and Planning (AEP) to undertake a bat survey on a large property at the Link Rd, Wallsend, NSW.

Background

AEP have undertaken ultrasonic bat detector surveys of the subject land previously and recorded a call from *Chalinolobus dwyeri* (Large-eared Pied Bat). *Vespadelus troughtoni* (Eastern Cave Bat) was assumed as having the potential to be present by AEP based on habitat assessment and possible echolocation call recordings. In this region, *Vespadelus troughtoni* cannot be reliably identified from *Vespadelus vulturnus* (Little Forest Bat) or *Vespadelus pumilus* (Eastern Forest Bat) using echolocation calls alone and possible calls were assigned to the *Chalinolobus morio / Vespadelus vulturnus / Vespadelus pumilus / Vespadelus troughtoni* species group. *Vespadelus troughtoni* (Eastern Cave Bat) and *Chalinolobus dwyeri* (Large-eared Pied Bat) are listed as Vulnerable under the *Biodiversity Conservation Act 2016* and are Species Credit species under the Biodiversity Offsets Scheme. As the removal of breeding habitat for these species is a potential Serious and Irreversible Impact (SAII) under the Biodiversity Offsets Scheme, targeted surveys were recommended to determine whether breeding habitat would be impacted by the development proposal. AEP engaged Echo Ecology and Surveying to undertake a targeted trapping survey for *Chalinolobus dwyeri* (Large-eared Pied Bat) and *Vespadelus troughtoni* (Eastern Cave Bat) and, if captured, to radio-track these species to locate roosts.

Methods

The field survey methodology was developed with reference to the *NSW 'Species credit' threatened bats Biodiversity Assessment Method guidelines* (Office of Environment and Heritage 2018). A total of eight harp traps (two-bank; Ausbat) were set over four nights 7 – 10 December 2020 within the subject land resulting in a total of 27 trap nights at 24 different trap sites. A mine subsidence crack (LR Sub; Figure 2-2) was inspected and monitored on 8 December 2020 using an infrared video camera with infrared illuminators.

Results

A total of 26 records of *Chalinolobus dwyeri* (Large-eared Pied Bat) and 25 records of *Vespadelus troughtoni* (Eastern Cave Bat) were found within 10 km of the subject land via a Bionet Atlas search.

A total of 74 bat captures of six different species were made during the survey. Neither of the target species (*Chalinolobus dwyeri* or *Vespadelus troughtoni*) were captured during the survey. The following species were captured within the subject land:

- *Chalinolobus gouldii* (Gould's wattled bat)
- *Chalinolobus morio* (Chocolate wattled bat)
- *Miniopterus australis* (Little bentwing bat)

- *Nyctophilus geoffroyi* (Lesser long-eared bat)
- *Nyctophilus gouldi* (Gould's long-eared bat)
- *Vespadelus vulturnus* (Little forest bat)

No bats were recorded leaving either of the subsidence entrances during the survey.

Abbreviations and Definitions

BC Act NSW *Biodiversity Conservation Act 2016*

EPBC Act *Commonwealth Environment Biodiversity Conservation Act 1999*

GIS geographic information system

SAII Serious and Irreversible Impact under the NSW *Biodiversity Conservation Act 2016*

sp. species (singular)

spp. species (plural)

subsp. subspecies

Subject land is the property boundary and any additional areas which were considered by the assessment (Figure 1-1)

threatened a term used to describe a species, population or community listed under the *NSW Biodiversity Conservation Act 2016* and / or *Commonwealth Environment Protection Biodiversity Conservation Act 1999*

Potential habitat the area(s) of the subject land that support any listed habitat constraints and plant community type(s) associated with the target species as per the Threatened Biodiversity Data Collection.

Habitat all areas of potential habitat on the subject land where the species is determined to be present.

Potential breeding habitat These are habitat features that are used, or presumed likely to be used, by threatened bat species as maternity sites.

Breeding habitat all areas of potential breeding habitat on the subject land where breeding individuals of a threatened bat species are determined to be present.

Breeding individuals at least one female bat of the target species that is pregnant, carrying pups or lactating; or a juvenile bat of the target species present or has been previously recorded, or is assumed to be present (development and biocertification only), on the subject land.

Roost/ Camp a place where bats shelter during the day. Some species roost only in tree hollows, others only in caves, and others in a mixture of natural and artificial structures. For

flying-foxes the term ‘camp’ is used to describe the place where individuals congregate and rest during the day, it also refers to the animals in the camp. At different times of the year or life stages bats may use different roosts or camps.

Nursery colony a group of female bats that have congregated at a specific roost or camp (a ‘maternity site’) to raise young bats until they are weaned and old enough to fly independently.

Maternity site a maternity site (also known as maternity roosts or maternity camps) is a location (a roost or camp) where female bats give birth and form nursery colonies.

Table of Contents

1.0 Introduction 1

1.1 Site Details 1

1.2 Background 3

1.3 Scope of the Study 3

1.4 Scientific Licensing and Ethics 3

2.0 Methods 4

2.1 Literature and Database Review 4

2.2 Field Survey 4

2.2.1 Harp Trapping 7

2.2.2 Subsidence crack survey 7

2.3 Mapping 10

2.4 Limitations 10

3.0 Results 10

3.1 Literature and database review 10

3.2 Weather Conditions 12

3.3 Trapping 13

3.4 Subsidence crack survey 13

4.0 Personnel Experience 13

5.0 References 14

Appendix A Species List

Appendix B Field Data Sheets

Appendix C Curriculum Vitae

List of Tables

Table 1-1: Subject land description 1

Table 3-1: Summary of Bionet Atlas Records for *Chalinolobus dwyeri* and *Vespadelus troughtoni* (records with Source Codes 5 and 6 removed)..... 11

List of Figures

Figure 1-1: Subject site location 2

Figure 2-1: Potential breeding habitat for *Chalinolobus dwyeri* and *Vespadelus troughtoni* (source: AEP)..... 6

Figure 2-2: Bat survey methodology..... 9

Figure 3-1: Temperature recorded during field surveys (Bureau of Meteorology) survey dates in red..... 12

Figure 3-2: Rainfall recorded during field surveys (Bureau of Meteorology) survey dates in red 12

1.0 INTRODUCTION

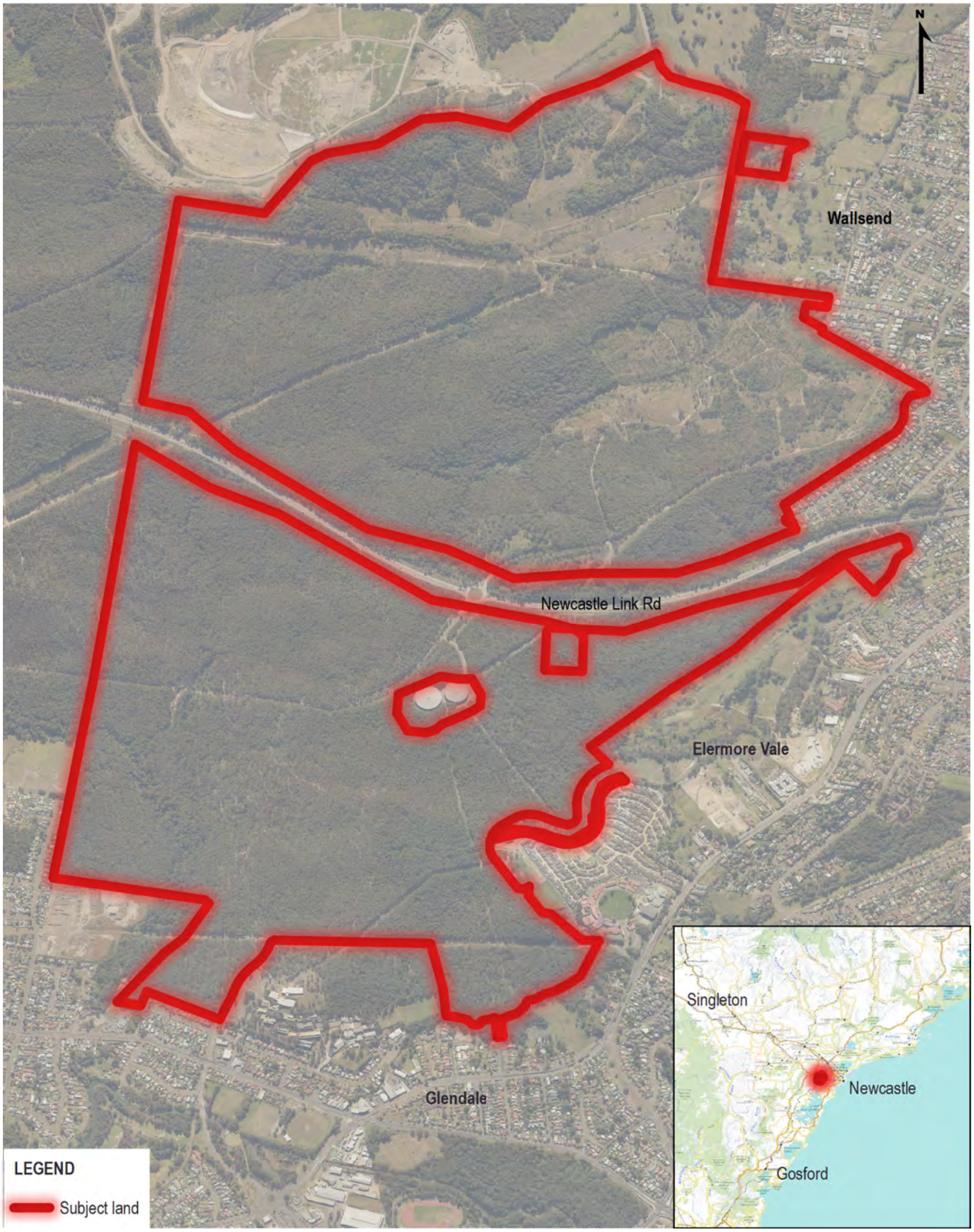
Echo Ecology and Surveying has been engaged by Anderson Environment and Planning (AEP) to undertake a bat survey on a large property at the Link Rd, Wallsend, NSW, hereafter referred to as the 'subject land' (Figure 1-1). This report provides the findings of a literature review, database searches, field survey and addresses relevant statutory considerations associated with the proposal.

1.1 Site Details

The subject land includes both the subject site and additional areas which were considered by the assessment. The subject land is shown in Figure 1-1 and relevant details are provided in Table 1-1.

Table 1-1: Subject land description

Item	Description
Locality	Link Rd, Wallsend, NSW
Local Government Area	Newcastle City Council and Lake Macquarie City Council
Address	Lot 3057, DP1208470 and Lot 2, DP800035
Area	598 hectares



0 0.2 0.4 0.6 0.8 km

BACKGROUND SOURCE: NSW Base Map © DFSI
DISCLAIMER: Indicative only. All boundaries, scale and points are approximate only

EDEN LINK RD		
Job No: 140	**Rev:** A **Date:** 13 Jan 2021	A4
BAT SURVEY REPORT	**Figure 1-1:** Locality	

Echo Ecology and Surveying PO Box 4132 Crescent Head, NSW 2440 Australia
Ecology: 0423801779 **E:** anna@echoecology.com.au **W:** echoecology.com.au

1.2 Background

AEP have undertaken ultrasonic bat detector surveys of the subject land previously and recorded a call from *Chalinolobus dwyeri* (Large-eared Pied Bat). *Vespadelus troughtoni* (Eastern Cave Bat) was assumed as having the potential to be present by AEP based on habitat assessment and possible echolocation call recordings. In this region, *Vespadelus troughtoni* cannot be reliably identified from *Vespadelus vulturnus* (Little Forest Bat) or *Vespadelus pumilus* (Eastern Forest Bat) using echolocation calls alone and possible calls were assigned to the *Chalinolobus morio / Vespadelus vulturnus / Vespadelus pumilus / Vespadelus troughtoni* species group. *Vespadelus troughtoni* (Eastern Cave Bat) and *Chalinolobus dwyeri* (Large-eared Pied Bat) are listed as Vulnerable under the *Biodiversity Conservation Act 2016* and are Species Credit species under the Biodiversity Offsets Scheme. As the removal of breeding habitat for these species is a potential Serious and Irreversible Impact (SAII) under the Biodiversity Offsets Scheme, targeted surveys were recommended to determine whether breeding habitat would be impacted by the development proposal. AEP engaged Echo Ecology and Surveying to undertake a targeted trapping survey for *Chalinolobus dwyeri* (Large-eared Pied Bat) and *Vespadelus troughtoni* (Eastern Cave Bat) and, if captured, to radio-track these species to locate roosts.

1.3 Scope of the Study

The scope of the study was to undertake a targeted survey for *Chalinolobus dwyeri* (Large-eared Pied Bat) and *Vespadelus troughtoni* (Eastern Cave Bat) to meet the *NSW 'Species credit' threatened bats Biodiversity Assessment Method guidelines* (Office of Environment and Heritage 2018) to determine:

- whether the subject land constitutes breeding habitat; and
- whether the development of the subject land would constitute a SAII under the BC Act 2016.

The specific objectives of this survey include the following:

- Undertake a background review of relevant literature and a review of relevant databases;
- Conduct a targeted trapping survey within the subject land during the maternity season; and
- Radio-track any target species captured to identify roost locations.

1.4 Scientific Licensing and Ethics

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence SL101055 (Valid 30 November 2021);

- Animal Research Authority (CSB 18/340) issued by NSW Agriculture (Valid 8 October 2021); and
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 18/340) issued by NSW Agriculture (Valid 8 October 2021).

2.0 METHODS

2.1 Literature and Database Review

The literature review included the following information sources:

- NSW Office of Environment and Heritage's Atlas of NSW Wildlife, which holds data from a number of custodians (http://www.bionet.nsw.gov.au) - 10 km radius search, accessed 11 January 2021;
    - Records with source codes > 4 (ie those with probable and possible identification confidence rankings) were removed
- Topographic maps; and
- Aerial photography.

2.2 Field Survey

The field survey methodology was developed with reference to the *NSW 'Species credit' threatened bats Biodiversity Assessment Method guidelines* (Office of Environment and Heritage 2018).

The survey requirements for bat species where breeding habitat is a potential SAII (Office of Environment and Heritage 2018) are as follows:

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
    - Breeding habitat is defined as "the PCTs associated with the species (as per TBDC) within 100m of rocky areas containing caves, or overhangs, or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings. Traps should be set in woodlands, valley floors, riparian areas and relatively fertile parts of the subject land where possible.".
    - Potential breeding habitat ≤ 50 ha
        - 16 harp trap nights (minimum 4 nights)
- *Vespadelus troughtoni* (Eastern Cave Bat)
    - Breeding habitat is defined as "the PCTs associated with the species (as per the TBDC) within 100m of rocky areas, caves, overhangs crevices, cliffs and escarpments, or old mines or tunnels, old buildings and sheds within the potential habitat. Traps should be

set in woodlands, valley floors, riparian areas and relatively fertile parts of the subject land where possible.

- Potential breeding habitat ≤ 50 ha
  - 16 harp trap nights (minimum 4 nights)

AEP ecologists have located and mapped potential breeding habitat within the subject land (Figure 2-1) as approximately 13 ha. This requires 16 harp trap nights (minimum 4 nights) according to Office of Environment and Heritage (2018) guidelines.

ECHO ECOLOGY AND SURVEYING

0 0.2 0.4 0.6 0.8 km

BACKGROUND SOURCE: NSW Base Map © DFSI
DISCLAIMER: Indicative only. All boundaries, scale and points are approximate only

EDEN LINK RD		
Job No: 140	**Rev:** A **Date:** 22 Jan 2021	A4
BAT SURVEY REPORT	**Figure 2-1:** Potential Habitat	

Echo Ecology and Surveying PO Box 4132 Crescent Head, NSW 2440 Australia
Ecology: 0423801779 **E:** anna@echoecology.com.au **W:** echoecology.com.au

2.2.1 Harp Trapping

A total of eight harp traps (two-bank; Ausbat) were set over four nights 7 – 10 December 2020 within the subject land (Figure 2-2). The locations of harp traps were recorded using a hand held GPS (Garmin GPSMap66ST) with site details and photographs recorded using a digital form (Fulcrum).

Harp traps were set on flyways along tracks and adjacent to water sources. One or two harp traps were set at each site and most traps were moved every night (three trap sites were set for two consecutive nights). Usually one harp trap was set at each site; however, two harp traps were set at three sites where flyways were too wide to accommodate one trap. Where two harp traps were placed < 20 m apart these were considered to be the same sample site as per Office of Environment and Heritage (2018) guidelines. More trap sites were located to the north of the Link Rd as this area was found to have more potential roosting habitat by AEP compared to bushland to the south of the Link Rd.

Harp traps were located as close to potential roosting habitat as possible. However, suitable harp trap sites are limited and traps were placed in locations most likely to capture bats.

As the trapping survey was undertaken during the maternity season of many species of echolocating bats, two trap checks were undertaken. The first trap check was undertaken 1-3 hours after dusk and the second was undertaken at dawn. Lactating females were released as a priority. A small number of non-lactating bats were held during the day when traps could not be completely cleared before daylight. These bats were released at each capture site on dusk.

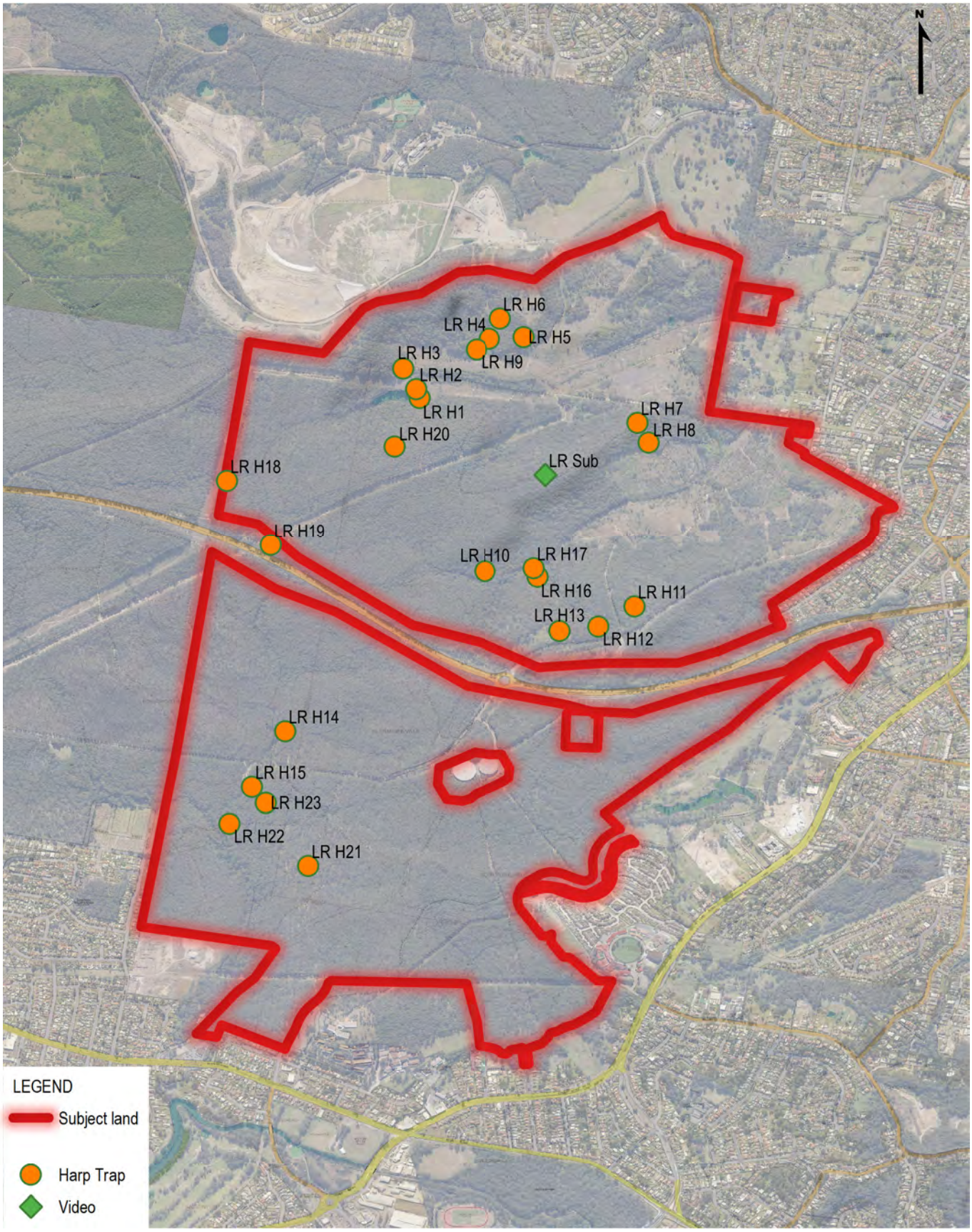
Captured bats were measured as necessary to ensure accurate identification with reference to the identification keys provided in Churchill (2008). *Chalinolobus dwyeri* (Large-eared Pied Bat) is quite distinctive and we are able to confidently identify it from other species without specific measurements. *Vespadelus troughtoni* (Eastern Cave Bat) may be confused with other *Vespadelus* sp. and so careful inspection and measurement was undertaken of all *Vespadelus* sp. captured. As a minimum, this included forearm length, penis morphology, glans penis morphology, tragus colour and wing bone measurements. Sex, age and breeding status was also recorded for target species and where time permitted for non-target species.

A total of 24 harp trap sites were sampled during the 4 consecutive night survey period.

2.2.2 Subsidence crack survey

A mine subsidence crack (LR Sub; Figure 2-2) was inspected and monitored on 8 December 2020 using an infrared video camera (SANNCE CCTV) with infrared illuminators. One subsidence crack was observed with two entrances and a camera (and illuminator) was

placed on each entrance. The video was set to record for 30 mins prior to sunset until 1hr after sunset. The video footage was later downloaded and reviewed in the office.



ECHO ECOLOGY AND SURVEYING

0 0.2 0.4 0.6 0.8 km

BACKGROUND SOURCE: NSW Base Map © DFSI
DISCLAIMER: Indicative only. All boundaries, scale and points are approximate only

EDEN LINK RD		
Job No: 140	**Rev:** A **Date:** 22 Jan 2021	A4
BAT SURVEY REPORT	**Figure 2-2:** Methods	

Echo Ecology and Surveying PO Box 4132 Crescent Head, NSW 2440 Australia
Ecology: 0423801779 **E:** anna@echoecology.com.au **W:** echoecology.com.au

2.3 Mapping

Maps for this report were prepared using QGIS, a geographic information system (version 3.10.8; QGIS Development Team 2021)

2.4 Limitations

All ecological surveys are limited in their ability to fully document all flora and fauna species that occur within a particular area. Our surveys are designed to meet relevant survey guidelines under the Biodiversity Assessment Method (Office of Environment and Heritage 2018) as far as possible.

The limitations of this particular survey are mostly related to the open forest vegetation type which had a relatively open shrub-layer in many areas. This is likely to have reduced the efficiency of harp traps as forest bats are not as restricted to flyways as tends to occur in more closed forest types. We tried to place traps as close as possible to potential roosting habitat areas previously identified by AEP ecologists or close to water sources and riparian areas. However, suitable harp trap locations were not always present nearby and so our survey was limited to flyways where harp traps could be placed. These limitations are common to most harp trap surveys in the region and are not unexpected. To quantify how much these limitations have affected our survey, we calculated capture rates for our survey (see Section 3.3) and found similar results to those presented by Office of Environment and Heritage (2018). We also undertook more sample sites than were required by the guidelines. Therefore, despite these limitations, we believe that our survey adequately meets the BAM survey guidelines (Office of Environment and Heritage 2018).

Locations of objects (threatened species and survey sites on the ground were collected using a handheld GPS (Garmin GPSMap66ST) and as such are not survey accurate. All standard handheld GPS may have errors of up to 30 m even if high accuracy settings are used (e.g. 5 m accuracy). Locations presented in our field data sheets were collected using a smart phone (Apple Iphone X) and should be viewed as a rough indication of site location only. This has been taken into account when preparing this report and mapping. However, it is important for readers to view mapping with these potential errors in mind.

3.0 RESULTS

3.1 Literature and database review

A total of 26 records of *Chalinolobus dwyeri* (Large-eared Pied Bat) and 25 records of *Vespadelus troughtoni* (Eastern Cave Bat) were found within 10 km of the subject land via a Bionet Atlas search.

A total of 18 records of *Chalinolobus dwyeri* (Large-eared Pied Bat) were from ultrasonic recording (those assigned Acoustic Recording, Ultrasonic Recording or Heard Call), with a further eight observation or trapping records. The low number and scattered distribution of these records for an easily identifiable species indicate a low density but persistent occurrence of *Chalinolobus dwyeri* (Large-eared Pied Bat) within 10 km of the subject land.

Vespadelus troughtoni (Eastern Cave Bat) is difficult to identify from bat call recordings as it overlaps in call characteristics with other species in this region. Yet almost half of the Bionet Atlas records were from ultrasonic recordings (those assigned Acoustic Recording, Ultrasonic Recording or Heard Call) and no trapping records occur (Table 3-1). *Vespadelus troughtoni* (Eastern Cave Bat) may also be difficult to identify in the hand for inexperienced ecologists. The assignment of observation codes in the Bionet Atlas for bat records also often contains errors (pers obs.) and as such some of the records assigned as 'Observed' may actually be misidentified individuals or records from ultrasonic recordings. Therefore, there is a moderate – high level of uncertainty regarding Bionet Atlas records in this area and it is difficult to comment on how common or rare *Vespadelus troughtoni* (Eastern Cave Bat) is surrounding the subject land. For example, it may be more common than reported due to the difficulty in identifying the species or it may be more rare than reported due to misidentification.

Table 3-1: Summary of Bionet Atlas Records for *Chalinolobus dwyeri* and *Vespadelus troughtoni* (records with Source Codes 5 and 6 removed)

Observation Code		*Chalinolobus dwyeri*	*Vespadelus troughtoni*
AR	Acoustic Recording	3	1
M	Miscellaneous	-	1
O	Observed	2	13
T	Trapped	6	-
U	Ultrasonic Recording	14	9
W	Heard Call	1	1
TOTAL		**26**	**25**

3.2 Weather Conditions

Daily rainfall, minimum and maximum temperatures during surveys sourced from the Bureau of Meteorology weather station located at The University of Newcastle, Callaghan is shown in Figure 3-1 and Figure 3-2.

The weather was generally overcast, dry and mild with one cool evening on 9 December 2020 (Figure 3-1). Overnight wind was usually low, with wind usually easing on dusk, except for the evening of 10 December 2020 where moderate winds and some light rain was experienced.

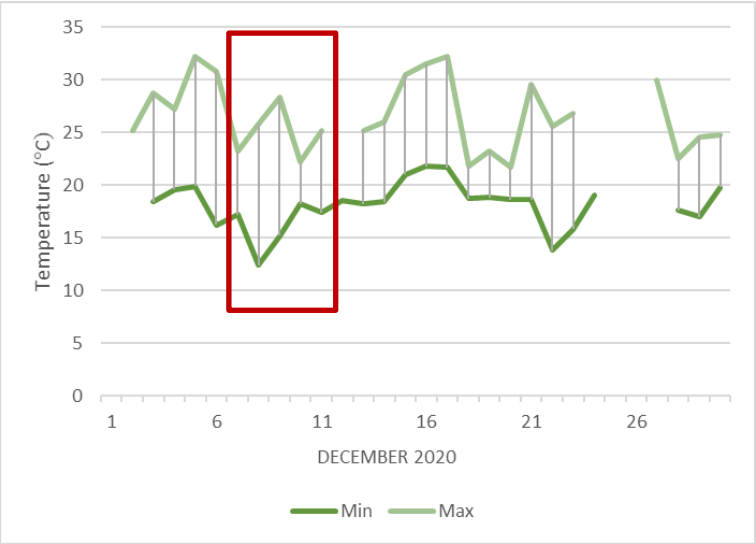


Figure 3-1: Temperature recorded during field surveys (Bureau of Meteorology) survey dates in red

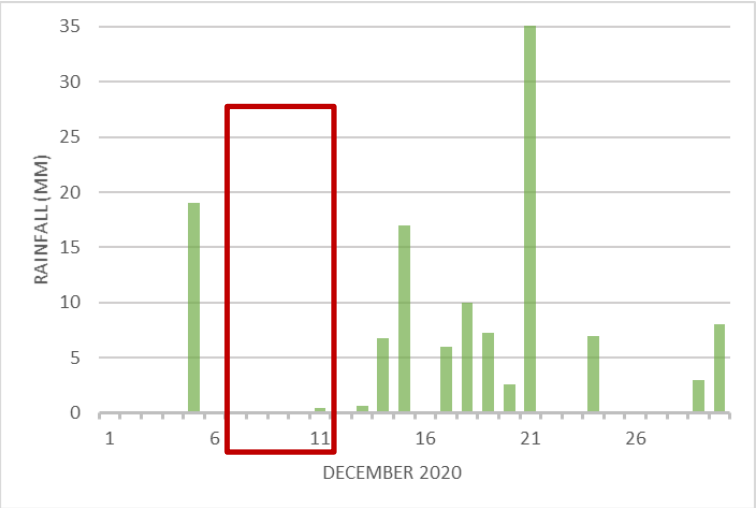


Figure 3-2: Rainfall recorded during field surveys (Bureau of Meteorology) survey dates in red

3.3 Trapping

A total of 74 bat captures of six different species were made during the survey. Neither of the target species (*Chalinolobus dwyeri* or *Vespadelus troughtoni*) were captured during the survey.

Our survey had a capture rate of 2.7 bats / night. While this capture rate is relatively low for NSW, in our experience it is typical of the open forest vegetation communities that are found on most of the subject land. While no comparison capture rates are provided for the Sydney Basin, similar capture rates (2.6 bats / night) are reported for harp trapping in south-east forests (Mills et al 1996, reported in Office of Environment and Heritage 2018).

The following species were captured within the subject land:

- *Chalinolobus gouldii* (Gould's wattled bat)
- *Chalinolobus morio* (Chocolate wattled bat)
- *Miniopterus australis* (Little bentwing bat)
- *Nyctophilus geoffroyi* (Lesser long-eared bat)
- *Nyctophilus gouldi* (Gould's long-eared bat)
- *Vespadelus vulturnus* (Little forest bat)

Capture details are provided in Appendices A and B.

3.4 Subsidence crack survey

The inspection found a mine subsidence crack with two entrances (LR_Sub; Figure 2-2). The crack was estimated to be at least 1 m deep, but visibility into the crack was poor. The potential gaps for bats to exit were quite small (10cm diameter at the widest) and it didn't look like there was a clear exit path that would be easy for bat flight. However, as there was some potential for the crack to open up further down, we set the video cameras to monitor it as a precautionary measure.

No bats were recorded leaving either of the subsidence entrances during the survey. Small mammals (likely *Mus musculus* House Mouse) were very active in the area during the survey and entered the subsidence cracks.

4.0 PERSONNEL EXPERIENCE

This targeted bat survey was undertaken and overseen by Dr Anna McConville, a senior ecologist with over 15 years of experience in fauna surveys across NSW. Anna completed her PhD on the ecology of a threatened microbat species in the Hunter Region which included extensive trapping and radio-tracking microbats in the area. Anna was responsible

for the field survey design, trap positioning, mapping and reporting. Various personnel from AEP assisted in the field with setting and checking traps. AEP personnel identified and provided maps of potential roost areas. Anna's curriculum vitae is provided in Appendix C.

5.0 REFERENCES

Churchill, S. 2008. Australian Bats. Second edition. Allen & Unwin, Crows Nest.

Office of Environment and Heritage. 2018. 'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method. Office of Environment and Heritage, Sydney, NSW.

QGIS Development Team. 2021. QGIS Geographic Information System. Open Source Geospatial Foundation Project, http://qgis.osgeo.org.

APPENDIX A SPECIES LIST

Table A1: Number of bat captures per species per site

Family	Scientific Name	Common Name	BC Act	EPBC Act	LR_H1	LR_H2	LR_H1-2	LR_H3	LR_H4	LR_H5	LR_H6	LR_H7	LR_H8	LR_H9	LR_H10	LR_H11	LR_H12	LR_H13	LR_H14	LR_H15	LR_H16	LR_H17	LR_H18	LR_H19	LR_H20	LR_H21	LR_H22	LR_H23	TOTAL
Number of sample nights					1	1	1	2	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Number of harp traps					1	1	2	1	1	1	1	1	1	2	2	1	1	1	1	2	1	1	1	1	1	1	1	1	
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	3	-	**4**
	Chalinolobus morio	Chocolate Wattled Bat	P	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
	Nyctophilus gouldi	Gould's Long-eared Bat	P	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46	-	**47**
	Vespadelus vulturnus	Little Forest Bat	P	-	-	-	-	-	-	-	4	3	-	-	4	-	-	-	-	-	-	-	-	-	-	-	1	-	**12**
	Vespadelus sp.	Unidentified Eptesicus	P	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
	Nyctophilus geoffroyi	Lesser Long-eared Bat	P	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5**
Miniopteridae	*Miniopterus australis*	Little Bent-winged Bat	V,P	-	-	-	-	-	-	-	-	1	-	-	2	-	-	-	-	-	-	-	-	1	-	-	-	-	**4**
TOTAL					**-**	**-**	**-**	**-**	**-**	**-**	**4**	**11**	**-**	**-**	**7**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**50**	**-**	**74**

APPENDIX B FIELD DATA SHEETS

140, LR H1

Project	140 - Eden Link Rd
Created	2020-12-07 14:27:51 AEDT by Anna McConville
Updated	2021-01-11 12:30:27 AEDT by Anna McConville
Location	-32.8991447529, 151.642415431
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H1

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-07
Start_Time	14:28
End_Date	2020-12-08
End_Time	07:05
Additional Notes	Next to dam
Site Photo	

140, LR H1-2

Project	140 - Eden Link Rd
Created	2020-12-08 07:05:33 AEDT by Anna McConville
Updated	2021-01-11 12:29:44 AEDT by Anna McConville
Location	-32.8990024282, 151.642816253
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H1-2

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
GearNotes	Double trap
Start_Date	2020-12-08
Start_Time	07:06
End_Date	2020-12-09
End_Time	09:28
Additional Notes	Next to dam near H1 and H2
Site Photo	

140, LR H2

Project	140 - Eden Link Rd
Created	2020-12-07 14:51:12 AEDT by Anna McConville
Updated	2021-01-11 12:31:13 AEDT by Anna McConville
Location	-32.899266542, 151.64269614
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H2

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-07
Start_Time	14:51
End_Date	2020-12-08
End_Time	07:05
Additional Notes	Dam nearby
Site Photo	

140, LR H3

Project	140 - Eden Link Rd
Created	2020-12-07 15:17:57 AEDT by Anna McConville
Updated	2021-01-11 12:29:19 AEDT by Anna McConville
Location	-32.8979244735, 151.64213514
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H3

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-07
Start_Time	15:18
End_Date	2020-12-09
End_Time	09:29
Additional Notes	Up hill from the dam
Site Photo	

140, LR H4

Project	140 - Eden Link Rd
Created	2020-12-07 16:00:45 AEDT by Anna McConville
Updated	2021-01-11 12:29:26 AEDT by Anna McConville
Location	-32.8969560704, 151.645677667
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H4

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-07
Start_Time	16:01
End_Date	2020-12-09
End_Time	09:29
Additional Notes	Adjacent to dam

Site Photo

140, LR H5

Project	140 - Eden Link Rd
Created	2020-12-07 16:37:28 AEDT by Anna McConville
Updated	2021-01-11 12:30:03 AEDT by Anna McConville
Location	-32.8964726441, 151.646594983
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H5

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-07
Start_Time	16:38
End_Date	2020-12-08
End_Time	08:09
Site Photo	

140, LR H6

Project	140 - Eden Link Rd
Created	2020-12-07 16:55:15 AEDT by Anna McConville
Updated	2021-01-11 12:29:36 AEDT by Anna McConville
Location	-32.8959043091, 151.646120316
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H6

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-07
Start_Time	16:55
End_Date	2020-12-09
End_Time	09:28
Site Photo	

140, LR H7

Project	140 - Eden Link Rd
Created	2020-12-07 17:31:54 AEDT by Anna McConville
Updated	2021-01-11 12:29:54 AEDT by Anna McConville
Location	-32.9000573326, 151.651621778
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rdr her red
Observer Name	Anna
Site ID	LR H7

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-07
Start_Time	17:32
End_Date	2020-12-08
End_Time	08:48
Additional Notes	Ridge top
Site Photo	

POWERED BY Fulcrum
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140, LR H8

Project	140 - Eden Link Rd
Created	2020-12-07 18:08:14 AEDT by Anna McConville
Updated	2021-01-11 12:30:11 AEDT by Anna McConville
Location	-32.9009129573, 151.653160527
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H8

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-07
Start_Time	18:08
End_Date	2020-12-08
End_Time	07:46
Site Photo	

140, LR H9

Project	140 - Eden Link Rd
Created	2020-12-08 08:46:36 AEDT by Anna McConville
Updated	2021-01-11 12:29:10 AEDT by Anna McConville
Location	-32.8848613283, 151.64301071
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H9

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
GearNotes	Double trap
Start_Date	2020-12-08
Start_Time	08:47
End_Date	2020-12-09
End_Time	09:28
Additional Notes	On dam near H4

Site Photo

140, LR H10

Project	140 - Eden Link Rd
Created	2020-12-09 08:33:54 AEDT by Anna McConville
Updated	2021-01-11 12:28:21 AEDT by Anna McConville
Location	-32.9062263295, 151.645283131
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rdr her red
Observer Name	Anna
Site ID	LR H10

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
GearNotes	Double trap near creek
Start_Date	2020-12-09
Start_Time	08:34
End_Date	2020-12-10
End_Time	05:57
Site Photo	

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140, LR H11

Project	140 - Eden Link Rd
Created	2020-12-09 09:13:10 AEDT by Anna McConville
Updated	2021-01-11 12:28:30 AEDT by Anna McConville
Location	-32.9076115229, 151.651406447
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rdr her red
Observer Name	Anna
Site ID	LR H11

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-09
Start_Time	09:13
End_Date	2020-12-10
End_Time	05:57
Site Photo	

140, LR H12

Project	140 - Eden Link Rd
Created	2020-12-09 09:27:52 AEDT by Anna McConville
Updated	2021-01-11 12:28:39 AEDT by Anna McConville
Location	-32.9075849103, 151.65151516
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rdr her red
Observer Name	Anna
Site ID	LR H12

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-09
Start_Time	09:28
End_Date	2020-12-10
End_Time	05:57
Site Photo	

140, LR H13

Project	140 - Eden Link Rd
Created	2020-12-09 09:39:18 AEDT by Anna McConville
Updated	2021-01-11 12:28:47 AEDT by Anna McConville
Location	-32.9084702907, 151.649930393
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rdr her red
Observer Name	Anna
Site ID	LR H13

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-09
Start_Time	09:39
End_Date	2020-12-10
End_Time	05:57
Site Photo	

140, LR H14

Project	140 - Eden Link Rd
Created	2020-12-09 10:17:55 AEDT by Anna McConville
Updated	2021-01-11 12:28:54 AEDT by Anna McConville
Location	-32.9202270348, 151.614547728
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rdr her red
Observer Name	Anna
Site ID	LR H14

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-09
Start_Time	10:18
End_Date	2020-12-10
End_Time	05:57
Additional Notes	Wetland / dam nearby
Site Photo	

140, LR H15

Project	140 - Eden Link Rd
Created	2020-12-09 11:00:37 AEDT by Anna McConville
Updated	2021-01-11 12:29:02 AEDT by Anna McConville
Location	-32.9150525155, 151.635720721
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rdr her red
Observer Name	Anna
Site ID	LR H15

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-09
Start_Time	11:01
End_Date	2020-12-10
End_Time	05:57
Additional Notes	I small harp trap on off shoot and 1 normal trap over track
Site Photo	

140, LR H16

Project	140 - Eden Link Rd
Created	2020-12-10 07:08:23 AEDT by Anna McConville
Updated	2021-01-11 12:26:59 AEDT by Anna McConville
Location	-32.9066079995, 151.647608522
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H16

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-10
Start_Time	07:08
End_Date	2020-12-11
End_Time	10:14

140, LR H17

Project	140 - Eden Link Rd
Created	2020-12-10 07:14:12 AEDT by Anna McConville
Updated	2021-01-11 12:27:09 AEDT by Anna McConville
Location	-32.9064212926, 151.647596453
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H17

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-10
Start_Time	07:14
End_Date	2020-12-11
End_Time	10:14

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140, LR H18

Project	140 - Eden Link Rd
Created	2020-12-10 07:51:08 AEDT by Anna McConville
Updated	2021-01-11 12:27:20 AEDT by Anna McConville
Location	-32.9025022919, 151.635115044
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H18

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-10
Start_Time	07:51
End_Date	2020-12-11
End_Time	10:14
Site Photo	

140, LR H19

Project	140 - Eden Link Rd
Created	2020-12-10 08:10:18 AEDT by Anna McConville
Updated	2021-01-11 12:27:46 AEDT by Anna McConville
Location	-32.9026198481, 151.635008259
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H19

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-10
Start_Time	08:10
End_Date	2020-12-11
End_Time	10:14
Site Photo	

140, LR H20

Project	140 - Eden Link Rd
Created	2020-12-10 08:32:51 AEDT by Anna McConville
Updated	2021-01-11 12:27:37 AEDT by Anna McConville
Location	-32.9052176513, 151.636805507
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H20

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-10
Start_Time	08:33
End_Date	2020-12-11
End_Time	10:14
Site Photo	

140, LR H21

Project	140 - Eden Link Rd
Created	2020-12-10 18:21:47 AEDT by Anna McConville
Updated	2021-01-11 12:27:55 AEDT by Anna McConville
Location	-32.9162127804, 151.638126159
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H21

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-10
Start_Time	18:22
End_Date	2020-12-11
End_Time	10:13
Site Photo	

140, LR H22

Project	140 - Eden Link Rd
Created	2020-12-10 18:41:54 AEDT by Anna McConville
Updated	2021-01-11 12:28:03 AEDT by Anna McConville
Location	-32.9182419973, 151.638292289
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H22

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-10
Start_Time	18:42
End_Date	2020-12-11
End_Time	10:13
Site Photo	

140, LR H23

Project	140 - Eden Link Rd
Created	2020-12-10 19:03:38 AEDT by Anna McConville
Updated	2021-01-11 12:28:13 AEDT by Anna McConville
Location	-32.9152395157, 151.63652773
Survey Year	2020
Fauna Gear Sample Site Form	
Job Number	140
Job Name	Link Rd
Observer Name	Anna
Site ID	LR H23

Harp Trap

SurveyGear	Harp Trap
Lure/Baits	None
Start_Date	2020-12-10
Start_Time	19:04
End_Date	2020-12-11
End_Time	10:13
Site Photo	

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 7/12
Recorder(s) AM + CW	Date Removed: ~~8/1~~ 8/12/20
Name of Site: LR H1	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Near Dam	
Plant Community: —	GPS (GDA) : —

Weather details:

Night 1: wind Still cloud____ moon____ min. temp 20C windy on dusk then still

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc): Combined w/ H2 after 8/12 AM check

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	7/12	No captures											
AM	8/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult

Repro Female: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO TECHNOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 7/12/20
Recorder(s) AM + CW	Date Removed: 8/12/20

Name of Site: LR - H2	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Near Dam	
Plant Community: —	GPS (GDA) : —

Weather details:

Night 1: wind still cloud____ moon____ min. temp 20°C windy on dusk then still

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc): Combined in H1 after 8/12 AM check

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	7/12	No captures											
AM	8/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 8/12/20
Recorder(s) AM + CW	Date Removed: 9/12/20

Name of Site: LR-H1-2	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Dam where H1 + H2 were set	
Plant Community: —	GPS (GDA) : —

Weather details:

Night 1: wind still cloud____ moon____ min. temp ~17°C

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc):

Double trap

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	8/12	No captures											
AM	9/12	NO CAPTURE											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 7/12/20
Recorder(s) AM + CW	Date Removed: 9/12/20

Name of Site: LR H3	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Of hill window to dam next to track	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind still cloud____ moon____ min. temp 20°C windy on dusk then still

Night 2: wind still cloud____ moon____ min. temp 17°C

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc): Trap moved slightly to on track on 8/12/20

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	7/12	No captures											
AM	8/12	No captures											
PM	8/12	No captures											
AM	9/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

HARP TRAPPING PROFORMA

Project: Eden Linear Rd
Recorder(s): AM & CW

Date Set: 7/12/20
Date Removed: 9/12/20

Name of Site: LR_H4
Location Description: Next to dam

Ground / Canopy Forest / Open Forest / Paddock T

Plant Community:

GPS (GDA):

Weather details:
Night 1: wind still cloud____ moon____ min. temp 20°C windy on dusk then still
Night 2: wind still cloud____ moon____ min. temp 17°C
Night 3: wind____ cloud____ moon____ min. temp____
Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc): smaller trap

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	7/12	No captures											
AM	8/12	NO CAPTURES											
PM	8/12	NO CAPTURE	FOR	YOU									
AM	9/12	NO CAPTURES											

Age = J - Juvenile; SA - Subadult; A - Adult
Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended
Repro Female: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 7/12/20
Recorder(s) AM + CW	Date Removed: 8/12/20

Name of Site: LR-H5	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: motorbike circuit near road.	
Plant Community:	GPS (GDA) :

Weather details:
Night 1: wind Slite cloud____ moon____ min. temp 20C windy on dusk then still
Night 2: wind____ cloud____ moon____ min. temp____
Night 3: wind____ cloud____ moon____ min. temp____
Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc): moved after 8/12 AM Check

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	7/12	No captures											
AM	8/12	No captures											

J - Juvenile; SA - Subadult; A - Adult
R - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

Repro Female: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

ECHO ECOLOGY

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HARP TRAPPING PROFORMA

Project: Eden Link Road	Date Set: 7/12/20
Recorder(s) AM + CW	Date Removed: 9/12/20

Name of Site: LR 46	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Motorbike circuit next to boulders	
Plant Community: —	GPS (GDA) : —

Weather details:

Night 1: wind still cloud____ moon____ min. temp 20°C windy on dusk then still

Night 2: wind still cloud____ moon____ min. temp 17°C

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc):

Plastic bag = 2g

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	7/12	No captures											
AM	8/12	V. vulturus	M	1		28.1	5.6	8.4	1.03	2.35		19.5 in cloth bag	White tragus, pend P3/P2 = 0.68 P1/3M = 0.44
AM	8/12	V. vulturus	M	A	NR	28.1	6.5	8	1.11	2.09		7.5g in bag	non white tragus, pendu P3/P2 = 0.81 P1/3M = 0.53
AM	8/12	V. vulturnus	M	A	Poss E distend	27.4	6.9	8.7	1.05	2.42		6.5g in bag	white tragus, pend P3/P2 = 0.79 P1/3M = 0.43
PM	8/12	NO CAPTURE											
AM	9/12	V. vulturus	M	A		27.8							Non white tragus, pend

Age = J - Juvenile; SA - Subadult; A - Adult

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

Repro Female: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 7/12/20
Recorder(s) AM + CW	Date Removed: 9/12/20

Name of Site: Ch - 47	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Ridge track eastern end.	
Plant Community:	GPS (GDA) :

Weather details:
Night 1: wind Still cloud____ moon____ min. temp 20°C - windy on dusk then still
Night 2: wind Still cloud____ moon____ min. temp 17°C
Night 3: wind____ cloud____ moon____ min. temp____
Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	7/12	NO CAPTURES											
AM	8/12	M. australis	F	Ad	NB	38.8						8.5	AR
	"	N. geoffroyi	F	Ad	L								x 2
	"	C. morio	M										
	"	V. vulturnus	M	Ad	NR	27.1							Light tragus, pend
PM	8/12	No captures											
AM	9/12	V. vulturnus	F	Ad	L	29.7	6.8	8.7	10.4	25.6			Light tragus P3/P2 = 0.78 P1/3M = 0.41
	"	V. vulturnus	M	Ad		29.1							pend, light tragus
	"	N. gouldi	M										
	"	N. geoffroyi	F	A	L								x 3

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed
Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 7/12/20
Recorder(s) AM + CW	Date Removed: 8/12/20

Name of Site: LR_H8	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: on old track near open area	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind still cloud____ moon____ min. temp 20°C windy on dusk then still

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc): TAKEN DOWN After 8/12 AM check

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	7/12	No captures											
AM	8/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 8/12/20
Recorder(s) AM + CW	Date Removed: 9/12/20

Name of Site: LR-H9	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Aft dam near H4 in window next to dam	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind still cloud____ moon____ min. temp 17°C

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc): Double trap

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	8/12	No capture											
AM	9/12	NO CAPTURE											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Link Road/Eden	Date Set: 9/12/2020 PM
Recorder(s) AM + CW	Date Removed: 10/12/20

Name of Site: Eden - LR H10	Ground / Canopy (Forest) / Open Forest / Paddock T
Location Description: Creek Double trap - along track adjacent to creek	
Plant Community:	GPS (GDA) :

Weather details:
Night 1: wind still cloud____ moon____ min. temp 16°C
Night 2: wind____ cloud____ moon____ min. temp____
Night 3: wind____ cloud____ moon____ min. temp____
Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	9/12	V. vulturnus	M	J ~~SA~~	NR	28.0							non commital white tragus pendulus
	"	V. sp. ~~pumilus (prob)~~	F	A	L	29.0	7.8 / 7.4	8.4 / 8.8	11.6	24.4			Light tragus 2 readings P3/P2 = 0.92 P1/3M = 0.49
	"	V. vulturnus	F	A	L	28.8	7.4 / 7.2	9.4 / 9.0	11.9	25.2			P3/P2 = 0.8 P1/3M = 0.47
AM	10/12	M. Australis	M	A		39.7							
	"	M. Australis	F	A	NR	38.7							
	"	V. Vulturnis	F	A	L	28.1	6.6	9.2	13.6	25.5			P3/P2 = 0.72 P1/3M = 0.53
	"	V. Vulturnis	F	A	L	27.9	6.6	8.8	11.5	24.2			P3/P2 = 0.75 P1/3M = 0.48

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed
Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 9/12/20
Recorder(s) AM + CW	Date Removed: 10/12/20

Name of Site: LR_Hill	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Along small track	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind still cloud____ moon____ min. temp 16

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	9/12	No captures											
AM	10/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 9/12/20
Recorder(s) AM + CW	Date Removed: 10/12/20

Name of Site: LR-H12	(Ground) / Canopy Forest / (Open Forest) / Paddock T
Location Description: Along track	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind Still cloud____ moon____ min. temp 16°C

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	9/12	No captures											
AM	10/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 9/12/20
Recorder(s)	Date Removed: 10/12/20

Name of Site: LK_H13	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Along entry track	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind Still cloud____ moon____ min. temp 16°C

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	9/12	No captures											
AM	10/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed
Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 9/12/20
Recorder(s)	Date Removed: 10/12/20

Name of Site: LK-H14	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Link Rd Sth wetland / dam nearby	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind still cloud____ moon____ min. temp 16°C

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	9/12	No captures											
AM	10/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult

Repro Female: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

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HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 9/12/20
Recorder(s) AM + CW	Date Removed: 10/12/20

Name of Site: LR_H15	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Motorbike jumps LINK RD STH adjacent to creek/swampy area	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind Still cloud____ moon____ min. temp 16°C

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc): 2 traps < 20m apart

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
9/12	C. Gouldii	M	A									in track trap
AM 10/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 10/12/20
Recorder(s) AM	Date Removed: 11/12/20

Name of Site: LR-H16	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Near creekline	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind Windy cloud Cloudy moon____ min. temp 18C Light shower on dusk

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	10/12	NO CAPTURES.											
AM	11/12	NO CAPTURES											

Age = J - Juvenile; SA - Subadult; A - Adult

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

Repro Female: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 10/12/20
Recorder(s)	Date Removed: 11/12/20

Name of Site: LR_H17	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Creek line nearby	
Plant Community: ?	GPS (GDA) :

Weather details:
Night 1: wind Windy cloud Cloudy moon_____ min. temp 18C light shower on dusk
Night 2: wind_____ cloud_____ moon_____ min. temp_____
Night 3: wind_____ cloud_____ moon_____ min. temp_____
Night 4: wind_____ cloud_____ moon_____ min. temp_____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	10/12	No captures											
AM	11/12	No captures											

J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed
NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 10/12/20
Recorder(s)	Date Removed: 11/12/20

Name of Site: LR-H18	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Along steep track adjacent to creekline	
Plant Community:	GPS (GDA):

Weather details:

Night 1: wind Windy cloud Cloudy moon_____ min. temp 18C shower on dusk

Night 2: wind_____ cloud_____ moon_____ min. temp_____

Night 3: wind_____ cloud_____ moon_____ min. temp_____

Night 4: wind_____ cloud_____ moon_____ min. temp_____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	10.12	No catches											
AM	11/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

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HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 10/12/20
Recorder(s) AM + EW	Date Removed: 11/12/20

Name of Site:	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: LR-H19 - Start of entrance track nr Link Rd.	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind Windy cloud Cloudy moon____ min. temp 18°C shower on dusk

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	10.12	No catches											
AM	11/12	Mini owst	M	A		38.8							

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed
Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 10/12/20
Recorder(s) AM + CW	Date Removed: 11/12/20

Name of Site: LL-1120	Ground / Canopy Forest / Open Forest / Paddock T
Location Description:	
Plant Community:	GPS (GDA) :

Weather details:
Night 1: wind Windy cloud Cloudy moon_____ min. temp 18°C showers on dusk
Night 2: wind_____ cloud_____ moon_____ min. temp_____
Night 3: wind_____ cloud_____ moon_____ min. temp_____
Night 4: wind_____ cloud_____ moon_____ min. temp_____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
Pm	10.12	No catches											
am	11/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed
Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 10/12/20
Recorder(s) AM + CW	Date Removed: 11/12/20

Name of Site: LR-H21	Ground / Canopy (Forest) / Open Forest / Paddock T
Location Description: Link Rd Stn - Paperbark shrubbery near creek	
Plant Community:	GPS (GDA):

Weather details:

Night 1: wind Windy cloud Cloudy moon____ min. temp 18°C showers on creek

Night 2: wind____ cloud____ moon____ min. temp____

Night 3: wind____ cloud____ moon____ min. temp____

Night 4: wind____ cloud____ moon____ min. temp____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
PM	10.12	No catches											
AM	11/12	No captures.											

Age = J - Juvenile; SA - Subadult; A - Adult

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

Repro Female: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

ECHO ECOLOGY

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HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 10/12/20
Recorder(s) AM + CW	Date Removed: 11/12/20

Name of Site: LH - H22	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: ~~Dense~~ Motorbike track near swampy creek.	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind Windy cloud Cloudy moon_____ min. temp 19°C light shower on dusk

Night 2: wind_____ cloud_____ moon_____ min. temp_____

Night 3: wind_____ cloud_____ moon_____ min. temp_____

Night 4: wind_____ cloud_____ moon_____ min. temp_____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

	Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
–	10.12	N. gouldii	M	~~SA~~ J									
✓	10.12	N. sp.	?	?									escaped prob N. gouldii
1	10.12	N. gouldii	F	A	L								
2	10.12	N. gouldii	F	A	L								
3	10.12	N. gouldii	F	A	L								
–	10.12	N. gouldii	~~M~~	~~SA~~ J									
4	10.12	N. gouldii	F	A	L								
✓	"	— "	?	J									attached to
7	"	— "	?	A+J	L								X ♂ Lactating females and juveniles
✓ AM	11/12	N. gouldi											~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ II X 32
✓ AM	11/12	C. gouldii	M										
✓ AM	11/12	C. gouldii	F										" X2
AM	11/12	V. vulturnus	M		TE								Light tragus, penal

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

ECHO ECOLOGY

HARP TRAPPING PROFORMA

Project: Eden Link Rd	Date Set: 10/12/20
Recorder(s)	Date Removed: 11/12/20

Name of Site: LR_H23	Ground / Canopy Forest / Open Forest / Paddock T
Location Description: Motorbike track over 8m creek w/ water pool	
Plant Community:	GPS (GDA) :

Weather details:

Night 1: wind Windy cloud Cloudy moon_____ min. temp 19°C Light shower on dusk

Night 2: wind_____ cloud_____ moon_____ min. temp_____

Night 3: wind_____ cloud_____ moon_____ min. temp_____

Night 4: wind_____ cloud_____ moon_____ min. temp_____

Comments (no traps etc):

NOTE: Please date and initial each trap day to verify that all traps have been checked (even if all empty)

Date	Species	Sex	Age	Re	Fa (mm)	P3 (mm)	P2 (mm)	P1 (mm)	3M (mm)	HL (mm)	Wgt (g)	Comments (type of marking; PIT tag number, measurements; recaptures; breeding status)
10.12	No catches											
11/12	No captures											

Age = J - Juvenile; SA - Subadult; A - Adult **Repro Female**: SA - subadult; L - lactating; PL - post-lactating; AR - Adult regressed

Male: NR - non-reproductive; TE - testes enlarged; TEE - testes enlarged & epididymis distended; TR - testes regressed & epididymis distended

APPENDIX C CURRICULUM VITAE

Curriculum vitae

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Curriculum vitae

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Attachment C – Songmeter Methodology and Results

1.0 Field Survey

1.1 Rationale

Given the large area and habitat types present within the Subject Site, there is a high potential for Large Forest Owls to be present within the site. Table 5.6 from the draft DECC 2004 guidelines details the number of sampling sessions required to find an owl species with a given probability. The table is reproduced below.

Table 1 - Number of sampling sessions required to find an owl species (that was in fact present on site) with a given probability (Debus 1995)

Scientific name	Common Name	50% Probability	90% Probability
Ninox strenua	Powerful Owl	3	7
Tyto novaehollandiae	Masked Owl	4	9
Tyto tenebricosa	Sooty Owl	3	8

Most birds, frogs, bats, insects and, to a lesser extent, mammals, create sounds that are often species-specific and can be readily recorded using automated recording systems. Automatic recording devices allow acoustic surveys for extended periods of time and are useful to detect specific acoustically conspicuous species (Frommolt et al. 2008; Obrist et al. 2010). Large Forest Owls are known to make relatively distinct contact and territorial calls. Large Forest Owls are difficult to study because they are nocturnal, wide-ranging and naturally uncommon throughout their distributions (DEC 2006).

None of the relevant guidelines for Large Forest Owl surveys (DECC 2004, LMCC 2014) make reference to acoustic monitoring for any fauna species. Given the large number of visits required to gain a 90% probability of detection and the large size of site, passive acoustic monitoring was adopted for the survey of this Biocertification project.

LMCC 2014 details methods for “quiet listening” for which Passive Acoustic Monitoring is akin.

Utilising Passive Acoustic Monitoring for survey of Large Forest Owls affords the opportunity to opportunistically survey for other threatened species include Koala, Squirrel Glider, Glossy Black-cockatoo etc.

1.2 Use of Passive Acoustic Monitoring by Others

1.2.1 Large Forest Owls

There is limited published survey techniques for Passive Acoustic Monitoring (PAM) for Large Forest Owls (LFOs). As previously noted, there is no reference to PAM within the relevant State or Local Fauna Survey Guidelines.

The Victorian Department of Sustainability and Environment have published an *Approved Survey Standards: Masked Owl Tyto novaehollandiae* dated 2 May 2011. Version 1.0 makes reference to Songmeters where it states; “*Recent technological advances in automated recording systems (e.g., Songmeter) may prove useful for assessing the use of specific sites by Masked Owls and nocturnal birds in general, allowing data to be collected efficiently over many nights*”.

Section 9.14 of the *Terrestrial Vertebrate Fauna Survey Guidelines for Queensland* (Eyre et al. 2018) directly discuss the use of Automated Acoustic Recording, however the document does not directly describe required survey effort.

Analysing recordings manually to identify all species recorded is time consuming and requires highly skilled personnel, very familiar with the target group of animals (e.g., birds).

Van Gaal (2019) describes the survey methods used to record Powerful Owl and the sounds that they make within his Citizen Science paper titled “*Method Report & Lessons Learnt – Sounds made by Powerful Owls, Consolidation of Data Gathered by Paul Van Gaal*”.

There are also a number of other active large-scale monitoring programs for LFOs utilising songmeter technology, including:

- Nature Conservation Council – Large Forest Owl Project. The project is working across the Richmond-Clarence Lowlands in Northern NSW to ensure the survival of three Vulnerable species: the Barking Owl (*Ninox connivens*), Masked Owl (*Tyto novaehollandiae*) and the Powerful Owl (*Ninox strenua*). Within the project area there is a priority zone in the north, that is focusing on protecting nest sites of the Barking Owl.
- BirdLife Australia – Powerful Owl Acoustic Monitoring Brisbane.
- Owl Friendly Margaret River Region – Survey for Masked Owl.

In general, automatic recording systems are non-invasive and far less intrusive than other survey methods.

1.2.2 Koala

The use of PAM for the detection of Koala has been the subject of recent research. Law et al. 2018 concluded that based on PAM, "*Extrapolation of occupancy across modelled habitat indicates that the hinterland forests of north-east NSW support a widespread, though likely low-density koala population that is considerably larger than previously estimated*".

1.2.3 Squirrel Glider

While the Species profile for Squirrel Gliders https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10604 suggests that the species is less vocal than Sugar Glider, the species is still regularly recorded on PAM in Northern NSW (P. Knock pers comms).

1.2.4 Glossy Black-Cockatoo

This species is locally uncommon and was not expected to be recorded with PAM. However, following the 2019/2020 bushfires, a large number of Glossy Black-Cockatoos have been recorded in sub-coastal locations far more frequently.

Teixeria et al. 2020 have recent published research on the effectiveness of Bioacoustic monitoring of Glossy Black-Cockatoo breeding activities.

2.0 Passive Songmeters

2.1 Equipment

The majority of the songmeters used for the surveys were Songmeter SM4 produced by Wildlife Acoustics (https://www.wildlifeacoustics.com/products/song-meter-sm4). The device is fully programmable. The duration that the recorders were active is shown in **Table 2** below. The SM4 records .WAV files. Waveform Audio File Format is an audio file format standard, developed by Microsoft and IBM, for storing an audio bitstream on PCs. Recordings were trialled with and without a 220hz noise filter and trialled with and without compression of the audio WAV file. The SM4 features two second-generation built-in microphones that create higher quality recordings than previous generations of Song Meter microphones. The low-noise microphones have a good signal-to-noise ratio. Files were saved compressed as W4V files.

A Songmeter Mini also produced by Wildlife Acoustics was used for a small number of the surveys. https://www.wildlifeacoustics.com/products/song-meter-mini.

2.2 Deployment

The survey locations are shown in **Figure A3-1** below.

2.2.1 First Phase

The first phase of the songmeter deployments involved the deployment of songmeters at nine locations distributed across the site between 23 March 2020 and 26 April 2020.

During this time Powerful Owls are particularly vocal, whereby they are re-establishing territories and pair bonds. They are tending to call/be heard calling from many parts of their territory.

During these surveys, Glossy Black-Cockatoos were also recorded calling at a number of locations. This led to targeted diurnal surveys as well as targeted PAM.

2.2.2 Second Phase

Following the wide ranging calling in March and April, Powerful Owl continued to call frequently. However, the calling tended to be centred around the core part of the pair's territory, and was recorded 28 May 2020 to 18 June 2020.

On 18 June 2020 the first breeding hollow was confirmed.

2.2.3 Third Phase

Following identification of the first breeding hollow, other territories were then targeted to attempt to identify other territories and located further breeding hollows.

2.2.4 Fourth Phase

Once a breeding hollow was confirmed a PAM was placed adjacent to that location to monitor the progress of the breeding attempt.

2.3 Analysis

While *Kaleidoscope Pro* has the ability to undertake both cluster analysis and basic and advanced classifiers, given the broad range of species being targeted it was determined that manual review of the calls was the most suitable way of detecting the broadest range of species as well as atypical vocalisations such as young birds begging.

Manual review of the recordings involves reviewing the sonograms on a 5-minute time-scale and selecting call sequences based on their visual representation within *Kaleidoscope Pro.*

In general, nocturnal recordings were analysed manually using Kaleidoscope software. However, the dawn chorus and dusk recordings were also reviewed. It should be noted that there were numerous sounds and calls that were unable to be positively identified.

Samples that were considered potential to be threatened species or a significant record that were unable to be identified were sent to third parties for review.

Table 2 – Songmeter Survey Dates and Operating Times

Location	Strata	Start	Finish	Total nights	Start Time	Finish Time	Total duration
1	8	23/03/2020	29/03/2020	6	18:30	7:00	75
2	6	23/03/2020	4/04/2020	12	18:30	7:00	150
3	6	29/03/2020	5/04/2020	7	18:30	7:00	87.5
4	2	3/04/2020	10/04/2020	7	18:30	7:00	87.5
5	7	5/04/2020	11/04/2020	6	17:00	7:00	84
6	6	11/04/2020	18/04/2020	7	17:00	7:30	101.5
7	5	19/04/2020	26/04/2020	7	17:00	7:00	98
8	4	19/04/2020	26/04/2020	7	17:00	7:00	98
9	3	19/04/2020	26/04/2020	7	17:00	7:00	98
10	6	28/05/2020	11/06/2020	14	17:00	7:00	196
11	6	28/05/2020	11/06/2020	14	17:00	7:00	196
12	3	28/05/2020	11/06/2020	14	17:00	7:00	196
13	3	28/05/2020	11/06/2020	14	17:00	7:00	196
14	5	15/06/2020	25/06/2020	10	17:00	7:00	140
14	5	25/06/2020	30/06/2020	6	17:00	7:00	84
14	5	1/07/2020	31/07/2020	31	17:00	7:00	434
14	5	1/08/2020	31/08/2020	31	17:00	7:00	434
14	5	1/09/2020	13/09/2020	12	17:00	7:00	168
14	5	18/09/2020	29/09/2020	11	17:00	7:00	168
15	Outside boundary	23/06/2020	29/06/2020	6	16:00	8:00	96
16	3	23/06/2020	29/06/2020	6	16:00	8:00	96
17	5	23/06/2020	1/07/2020	8	16:00	8:00	128
18	Outside boundary	25/06/2020	3/07/2020	8	17:00	8:00	120
19	3	6/07/2020	8/07/2020	2	16:00	8:00	32
20	3	8/07/2020	18/07/2020	10	17:00	8:00	150
21	3	3/08/2020	6/08/2020	3	0:00	7:00	21
22	3	5/08/2020	11/08/2020	6	17:00	7:00	84

Location	Strata	Start	Finish	Total nights	Start Time	Finish Time	Total duration
23	3	5/08/2020	11/08/2020	6	17:00	7:00	84
24	3	5/08/2020	11/08/2020	6	17:00	7:00	84
25	8	11/08/2020	14/08/2020	3	17:00	7:00	42
26	6	11/08/2020	14/08/2020	3	17:00	7:00	42
27	8	11/08/2020	14/08/2020	3	17:00	7:00	42
28	8	11/08/2020	14/08/2020	3	17:00	7:00	42
29	8	12/08/2020	14/08/2020	2	0:00	7:00	14
30	6	14/08/2020	21/08/2020	7	17:00	7:00	98
30	6	26/08/2020	29/09/2020	34	17:00	7:00	476
31	8	14/08/2020	21/08/2020	7	17:00	7:00	98
32	7	14/08/2020	16/08/2020	2	17:00	7:00	28
33	7	14/08/2020	18/08/2020	4	17:00	7:00	56
34	3	14/08/2020	20/08/2020	6	0:00	7:00	42
35	3	14/08/2020	21/08/2020	7	17:00	7:00	98
36	8	21/08/2020	26/08/2020	5	17:00	7:00	70
37	2	26/08/2020	2/09/2020	7	17:00	7:00	98
38	2	26/08/2020	2/09/2020	7	17:00	7:00	98
39	4	26/08/2020	2/09/2020	7	17:00	7:00	98
40	3	4/09/2020	10/09/2020	6	17:00	7:00	84
41	4	4/09/2020	10/09/2020	6	17:00	7:00	84
		Total		**403**			**5,582.5**

Table 3 – Koala Songmeter Survey Dates and Operating Times

Location	Survey unit	Date		Nights (Sept to Nov only)	Time		Hours (Sept to Nov only)
		Start	Finish		Start	Finish	
K1	4	22/10/2020	20/11/2020	29	18:00	6:00	348
K2	6	22/10/2020	20/11/2020	29	18:00	6:00	348

Location	Survey unit	Date		Nights (Sept to Nov only)	Time		Hours (Sept to Nov only)
		Start	Finish		Start	Finish	
K3	2	29/10/2020	16/11/2020	18	18:00	6:00	216
K4	3	29/10/2020	16/11/2020	18	18:00	6:00	216
K5	8	16/11/2020	22/11/2020	6	18:00	6:00	72
K6	5	16/11/2020	9/12/2020	14	18:00	6:00	168
14	5	1/09/2020	13/09/2020	12	17:00	7:00	168
14	5	18/09/2020	29/09/2020	11	17:00	7:00	168
30	6	26/08/2020	29/09/2020	29	17:00	7:00	406
		Total		**166**			**2,110**

Table 4 – Frog Songmeter Survey Dates and Operating Times

Location	Survey unit	Date		Nights	Time		Hours
		Start	Finish		Start	Finish	
F1	6	19/12/2020	08/01/2021	20	18:00	06:00	240
F2	7	19/12/2020	08/01/2021	20	18:00	06:00	240
F3	5	19/12/2020	08/01/2021	20	18:00	06:00	240
F4	6	18/02/2021	24/02/2021	16	18:00	06:00	75
F4	4	05/03/2021	06/03/2021	1	18:00	01:00	5
F6	3	19/12/2020	05/01/2021	17	18:00	06:00	204
			Total	**82.5**			**1,004**

3.0 Results

A total of 74 fauna species were recorded using PAM. This includes four (4) amphibians, seven (7) mammals and 63 bird species.

A total of 21 call sequences from Glossy Black-Cockatoo were recorded.

Grey-headed Flying-fox were recorded at most locations. Increased activity was associated with flowering *Corymbia maculata*. Where there was an absence of blossom, instances of Grey-headed Flying-fox being recorded during PAM was low.

A small number of screeches thought to be that of Masked Owl were recorded on site. Around nine (9) call sequences were recorded. However, each time the calls were distant and typically only a single screech. Additional placement of Songmeters in these areas and physical searches including call playback failed to positively identify the species on site.

More than 550 call sequences of Powerful Owl were recorded across the site. Vocalisations included typical male and female calls including duetting, females trilling during mating, food drop coos, 'hoarse" single and double hoots, and juveniles trilling.

A single call of what was thought to be a Squirrel Glider was recorded. Sugar Gliders were recorded calling at most locations.

White-throated Nightjar was recorded calling in mid-August. This record is interesting both in terms of location (very few records for Newcastle LGA) and the date, being an early return for this migratory species.

Unexpected nocturnal calls included Black-winged Stilts and Silver Gulls flying over the site.

Numerous anthropogenic sounds were recorded during the analysis. Some of these included:

- Owl call playback;
- Traffic noise including vehicles accelerating, skidding, honking horns and car alarms;
- Trains;
- Domestic dogs;
- Roosters
- Trail bikes;
- Voices.

4.0 References

Law, B.S, Brassil, T, Gonsalves, L, Roe, P, Truskinger, A, McConville, A (2018) 'Passive acoustics and sound recognition provide new insights on status and resilience of an iconic endangered marsupial (koala Phascolarctos cinereus) to timber harvesting', PLoS One, 13(10)

Teixeris, D., Hill, R., Barth, M., & Maron, M. Nest-associated vocal behaviours of the south-eastern red-tailed black cockatoo, Calyptorhynchus banksii graptogyne , and the Kangaroo Island glossy black cockatoo, C. lathami halmaturinus: Nesting vocal behaviours of black cockatoos

Eyre TJ, Ferguson DJ, Hourigan CL, Smith GC, Mathieson MT, Kelly, AL, Venz MF, Hogan, LD & Rowland, J. 2018. Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland. Department of Environment and Science, Queensland Government, Brisbane.

Obrist, M. K., Pavan, G., Sueur, J., Riede, K., Llusia, D., and Marquez, R. (2010). Bioacoustics approaches in biodiversity inventories. In 'Manual on field recording techniques and protocols for all taxa biodiversity inventories'.(Eds J. Eymann, J. Degreef, C. Häuser, J. C. Monje, Y. Samyn and D. VandenSpiegel) Issue:5, pp 68-99. Abc taxa: Brussells, Belgium.

Debus, S. J. S. (1995). Surveys of large forest owls in northern New South Wales: methodology, calling behaviour and owl responses. Corella 19, 38-50.

Attachment D – Brush-tailed Phascogale Survey Methodology Validation

-------- Original message --------
From: Steven Cox <Steven.Cox@environment.nsw.gov.au>
Date: 23/3/21 6:33 pm (GMT+10:00)
To: out of scope
Cc: out of scope
Subject: RE: HPE CM: Eden Estates Ecology - Phascogale Survey

Hi out of scope

Thank you for contacting BCD to check the suitability of the brush-tailed phascogale methodology for the Eden Estate project.

We have reviewed the phascogale survey methodology provided and determined that the survey effort undertaken was reasonable in this instance. No further survey is required for the brush-tailed phascogale.

Let me know if you have any questions.

Regards
Steven

Steven Cox
Senior Team Leader Planning, Hunter Central Coast Branch

Biodiversity and Conservation Division | Department of Planning, Industry and Environment
T 02 4927 3140 | **M** 0472 800 088 | **E** steven.cox@environment.nsw.gov.au
Level 4/26, Honeysuckle Drive Newcastle NSW 2309
Locked Bag 1002, Dangar NSW 2309
www.dpie.nsw.gov.au

Please note our branch email address has changed. Please send all new planning requests to huntercentralcoast@environment.nsw.gov.au where they will be entered into our document management system and be forwarded to me, or an acting Senior Team Leader if I'm on leave.

Currently working from home and can be contacted on both above phone numbers.

NSW GOVERNMENT | Planning, Industry & Environment

Our Vision: Together, we create thriving environments, communities and economies.
We work flexibly. *I'm sending this message now because it's a good time for me. I don't expect that you will read, respond to, or action this message outside of your own regular hours.*
The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Our Ref: 1971.01

Date: 5/01/2021

EDEN ESTATES PTY LTD

ATTENTION: out of scope

Via Email: out of scope

Dear out of scope

RE: EDEN ESTATES – BRUSH-TAILED PHASCOGALE SURVEYS

This letter is to seek advice from Lake Macquarie City Council (LMCC) and Newcastle City Council (NCC) regarding the minimum survey effort required to assess the site for the presence of Brush-tailed Phascogale. It is noted that the New South Wales (NSW) Department of Planning, Industry and Environment (DPIE) has recently amended the survey guidelines for the Brush-tailed Phascogale.

Previous schedule:

This letter refers to the previous ecology scope of works shared with and commented on by LMCC and NCC in March 2020 and entitled *Ecological Scope of Works for Biodiversity Certification Assessment Report Land off Newcastle Link Road - Various Lots - Wallsend, NSW,* dated 19 February 2020. At time of production of the ecology scope of works, and in the absence of specific survey guidelines for this species, the survey effort for Brush-tailed Phascogale was proposed as follows:

The preferred camera model used by AEP is Scout-guard White-flash Camera Traps (SG 562-C). The use of white flash cameras generally allows for a more confident identification of species recorded. Arboreal cameras will be baited with universal bait (rolled oats, honey and peanut butter) in a standardised bait holder and terrestrial cameras will be baited with a combination of universal bait and tuna or sardines. While the DECC 2004 guidelines do not make reference to camera trapping, the technique has been previously acknowledged as a suitable mammal survey method (S. Lewer, OEH pers. comm.). Reference to the Lake Macquarie Council Flora & Fauna Survey guidelines, Table 3 indicates the minimum survey effort for a site under 100ha should be 2 per vegetation community or habitat type for 14 consecutive nights. Furthermore, the former Wyong Shire Council Flora and Fauna Survey guidelines indicate that remote camera survey technique is preferred over trapping. Given the target species from the camera surveys have much smaller home ranges than the "100ha" survey unit, survey effort will be increased to (...) six (6) arboreal cameras and six (6) terrestrial cameras per survey unit for a minimum of 14 survey nights. (AEP, 2020).

New survey guidelines:

As per the new survey guidelines, the optimal survey period for this species is between December and June.

- Main dispersal period of juveniles occurring between December and February;

- Peak mating season occurring between May and June, where males are most likely to be detected.

The survey method is as follows:

- Baited camera stations as per **Table 1**.
- Cameras to be checked and bait to be replaced frequently during the survey period (depending on bait selection – approximately every two weeks).
- Cameras to remain in place for a minimum of four weeks with malfunctioning cameras to be replaced. Additional cameras and time must be invested to address any lost survey effort within the optimal survey period.
- Cameras are to be evenly spaced across the site. Where potential habitat is disconnected by 50 m or more, each patch of habitat should have a minimum of four (4) cameras for the first hectare and two (2) cameras for every hectare thereafter.
- Camera surveys required to be carried out within all impact areas.

Table 1: Camera density

Subject Site	Required Cameras	Survey Duration
Sites up to 1 ha	4 cameras	4 weeks
Sites > 1 ha -10 ha	• Minimum 4 cameras for initial 1 ha; • 2 cameras for every hectare thereafter.	4 weeks
Sites > 10 ha	Contact DPIE for a modified camera survey approach and provide relevant data to assist in determining modified camera survey approach.	TBD

The Site being over 10ha, advice from DPIE, LMCC and NCC is sought.

Survey effort and results to date:

Surveys for Brush-tailed Phascogale were undertaken between March and December 2020 in accordance with the guidelines that were in place and agreed upon prior to commencement of the surveys. A total of approximately 2040 motion-sensing camera trap nights was undertaken across eight (8) stratification units which, combined, cover the entirety of the Subject Site.

The survey recorded the presence of several mammal species, including Squirrel Glider, Sugar Glider, Feathertail Glider, Brown Antechinus, Common Brushtail Possum, Swamp Wallaby and Eastern Grey Kangaroo.

No Brush-tailed Phascogale was recorded on site.

Furthermore, a search on the NSW BioNet Atlas returned no results for Brush-tailed Phascogale records in the 100km^2 area around the site.

Our recommendation:

Given a search in the NSW BioNet Atlas for Brush-tailed Phascogale records did not return any records, and considering the results of our extensive camera trapping surveys to date undertaken in accordance with survey guidelines applicable at time of engagement, we do not believe there is potential for the species to be on site.

Therefore, we seek agreement on the fact that the survey effort undertaken to date for nocturnal mammals, combined with the nature of habitat on site, is sufficient to conclude that Brush-tailed Phascogale does not occur on site and that further survey effort specifically targeting this species is unwarranted in this instance.

Should you have any comments or questions, please do not hesitate to contact Craig Anderson.

Yours faithfully,
Anderson Environment & Planning

out of scope

Director
out of scope
Biodiversity Accredited Assessor BAAS: out of scope

Attachment E – Common Planigale Survey Methodology and Results

1.0 Introduction

Following correspondence with DPIE provided on 22 November 2021 and 18 January 2022, AEP undertook surveys for Common Planigale within the Study Area. A review of the survey methodology and results is included herewith.

2.0 Survey Methodology

The pitfall trapping methodology complied with the survey methods outlined in correspondence with DPIE and which are listed within the TBDC.

Each location consisted of a pitfall trap array comprising a 10m drift fence and a pitfall at each end. Leaf litter and a sponge were placed in the bottom of each pitfall to provide shelter and safety should rainfall occur. Locations were chosen based on suitable habitat within the Subject Site, being within 200m of ecotonal boundaries of PCT 1592 and PCT 1619, which Common Planigale is associated with, as identified in the TBDC.

Pitfall trapping was undertaken at 30 locations from 16 May 2022 to 18 June 2022. The number of pitfall arrays installed was based on advice from DPIE which stated that if the total suitable habitat is over 50ha then 22 arrays are required plus an additional array for every 10ha of suitable habitat. Given there is approximately 130ha of habitat within the Subject site, 30 pitfall arrays were deployed.

In addition, two (2) Elliot traps were placed within 5m of each of the pitfall trap lines and baited with universal bait (honey, peanut butter, oats and vanilla) in line with recommendations from the TBDC.

Each pitfall array was left in place for four (4) nights, being checked at first light each morning, closed and then re-opened just before sunset.

Table A details the coordinates (GDA) of each pitfall trap as well as the deployment dates, and **Figure A** displays their location. **Plates 1** and **2** show examples of pitfall traps set on site.

Table A – Survey Times

Pitfall trap ID	Easting	Northing	Deployment date
A01	372232	6358063	16/05/2022
A02	372235	6357809	16/05/2022
A03	372194	6357626	16/05/2022
A04	372208	6357331	16/05/2022
A05	372242	6356824	16/05/2022
B01	372490	6356362	16/05/2022
B02	372416	6356803	16/05/2022
B03	372874	6356576	16/05/2022
B04	373079	6356556	16/05/2022
B05	373389	6356509	16/05/2022
C01	374140	6359265	30/05/2022
C02	373711	6359045	30/05/2022
C03	373755	6358971	30/05/2022
C04	373339	6358682	30/05/2022
C05	373342	6358545	30/05/2022
D01	373198	6358682	30/05/2022
D02	372925	6358362	30/05/2022
D03	372982	6358236	30/05/2022
D04	373124	6358152	30/05/2022
D05	373275	6358011	30/05/2022
E01	374479	6358527	10/06/2022
E02	374263	6358599	10/06/2022
E03	373763	6358380	10/06/2022
E04	373839	6358215	10/06/2022
E05	373736	6358191	10/06/2022
F01	372667	6357353	10/06/2022
F02	373027	6357878	10/06/2022
F03	373140	6357591	10/06/2022
F04	372801	6357333	14/06/2022
F05	373412	6357220	13/06/2022

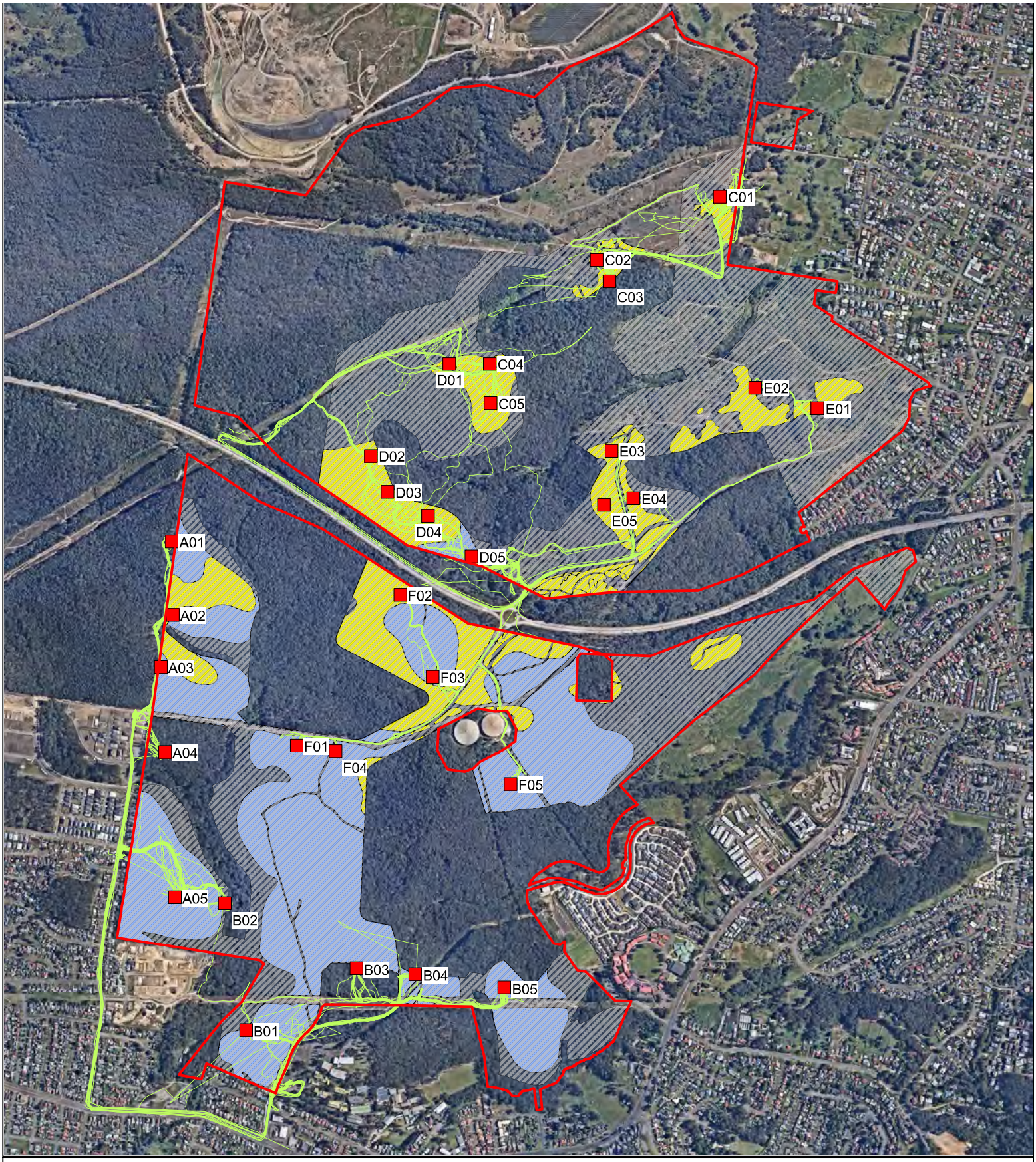


Figure 1 - Common Planigale Survey Effort

Legend

- Study Area
- Subject Site
- Pitfall trap
- Survey tracks
- PCT 1619
- PCT 1592

0 750
metres
Scale 1:17,500

N W E S

Location: Land Off Newcastle Link Road, Wallsend, NSW | Client: Eden Estates Pty Ltd | July 2022
AEP Ref: 1971.01

Disclaimer: Boundaries are not survey accurate. Do not scale off this plan.
While all reasonable care has been taken to ensure the information shown on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

AEP

Plate 1 – Pitfall trap

Plate 2 – Pitfall trap

3.0 Survey Results

A total of one (1) amphibian and three (3) mammals were captured during the survey. A Striped Marsh Frog (*Limnodynastes peronii*) was captured in the pitfall traps along with one (1) Common Dunnart (*Sminthopsis murina*). A single Brown Antechinus (*Antechinus stuartii*) and a Black Rat (*Rattus rattus*) were caught in the Elliot traps. Trap locations and species captured are shown in **Table B**. **Plates 3** and **4** display captured Brown Antechinus and Common Dunnart.

Table B – Capture Results

Date	Trap Location	Species
17/5/2022	B01 - Pitfall	Striped Marsh Frog
01/06/2022	D04 - Pitfall	Common Dunnart
02/06/2022	C01 – Elliot Trap	Black Rat
02/06/2022	C03 – Elliot Trap	Brown Antechinus

Plate 3 – Brown Antechinus

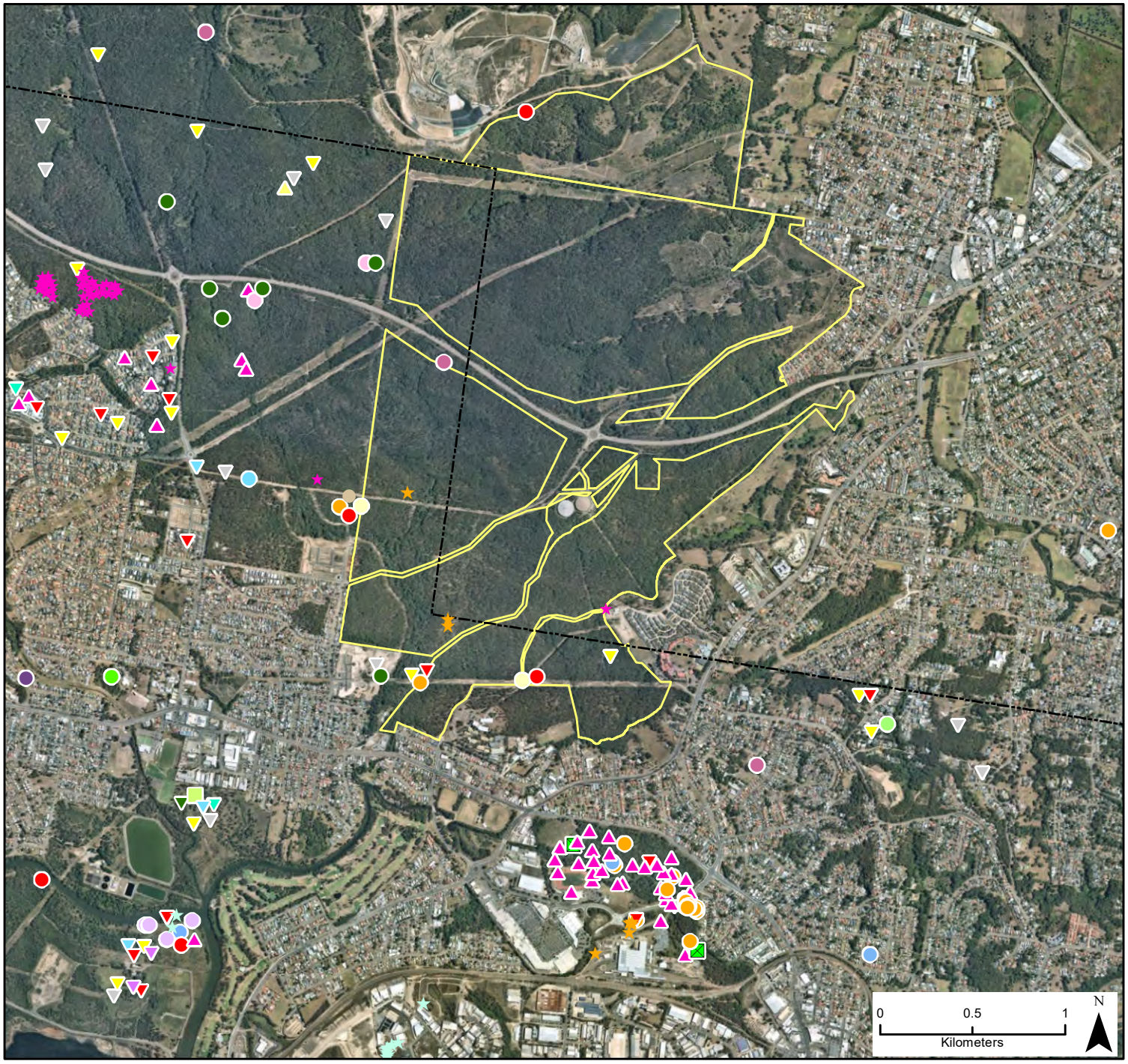
Plate 4 – Common Dunnart

4.0 Conclusion

Given the extent of survey undertaken and absence of capture of Common Planigale, it is considered that the species does not occur on site. It is to be noted that unusually wet weather during the survey period may have limited the efficacy of the method employed. However, the combination of extensive camera-trapping undertaken in 2020 and 2021, and the pitfall-trapping survey described herewith, further supports the conclusion that the species is unlikely to occur within the Subject Site.

Therefore, biodiversity offsets credits are not incurred as a result of the proposal.

Attachment F – LMCC Threatened Species Records



LMCC Threatened Flora & Fauna records* within 2km of site boundary

Threatened Flora

- Angophora inopina
- Grevillea parviflora subsp. parviflora
- Tetratheca juncea

Threatened Fauna**

- Australasian Bittern
- Barking Owl
- Dusky Woodswallow
- Eastern Bentwing-bat
- Eastern False Pipistrelle
- Eastern Freetail-bat
- Eastern Osprey
- Forest Owl High Priority Tree
- Gang-gang Cockatoo
- Greater Broad-nosed Bat
- Green and Golden Bell Frog
- Grey-headed Flying-fox
- Koala
- Large-eared Pied Bat
- Little Bentwing-bat
- Little Eagle
- Little Lorikeet
- Masked Owl
- Powerful Owl
- Sooty Owl
- Southern Myotis
- Squirrel Glider
- Swift Parrot
- Varied Sittella
- White-bellied Sea-Eagle
- White-throated Needletail
- LGA boundary
- Eden Estates (site) boundary

** BioNet Data is excluded from the map and should be sourced by the consultant/applicant under their own licence*
*** Some points have been dispersed for viewing at this scale*

Date Saved: 6/04/2020 11:49:10 AM
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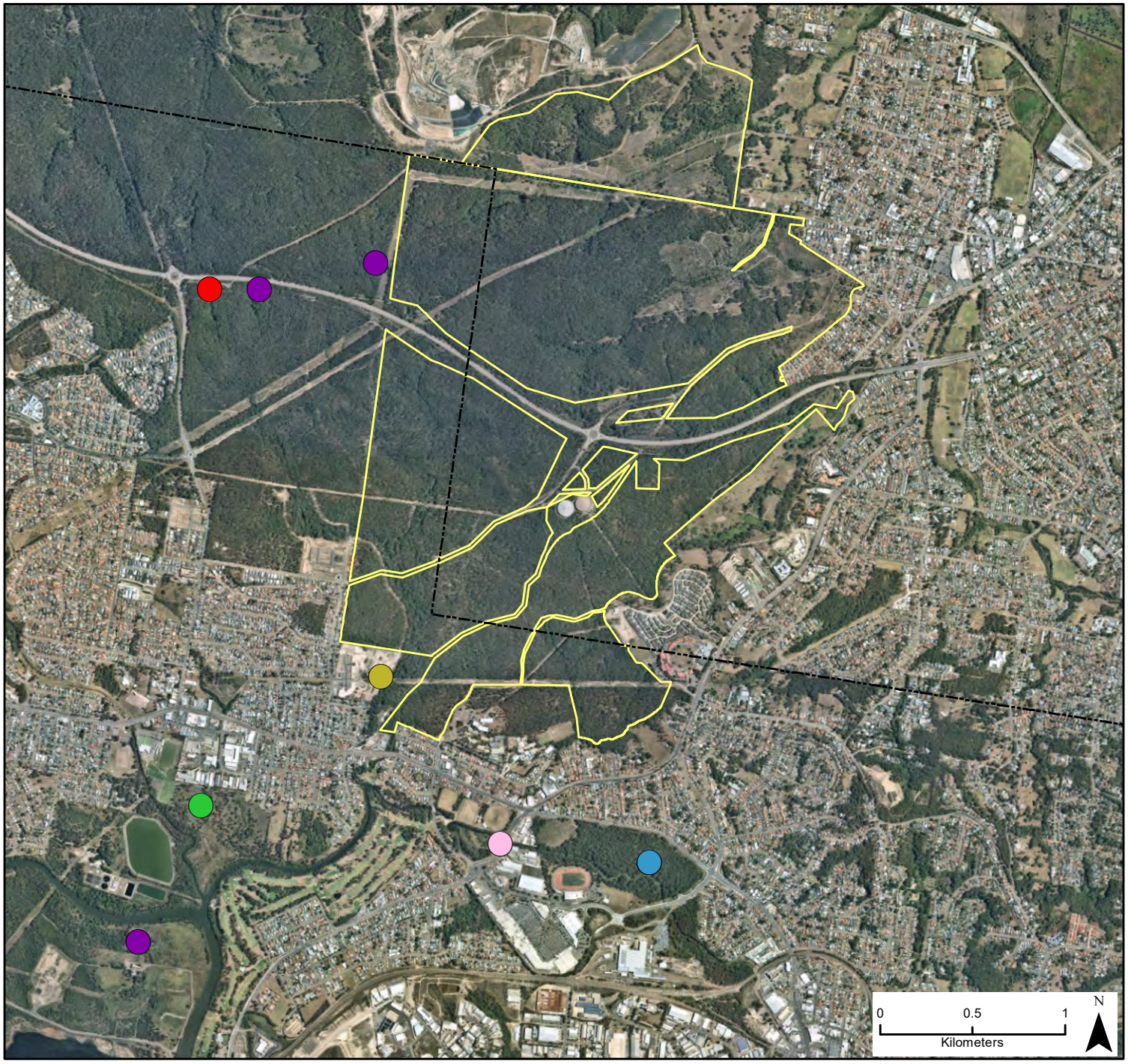

LMCC 'Species of Concern' records* within 2km of site boundary

- Bibron's Toadlet
- Brown Antechinus
- Feathertail Glider
- Land Mullet
- Platypus
- Southern Emu-wren
- LGA boundary
- Eden Estates (site) boundary

Additional 'Species of Concern' recorded between 2km and 5km of the site boundary:
Flora - Eucalyptus fergusonii subsp. fergusonii, Thelymitra branwhitei ms, Typhonium eliosurum
Fauna - Brush Bronzewing, Red-capped Plover, Freycinet's Frog, Jervis Bay Tree Frog

* *BioNet Data is excluded from the map and should be sourced by the consultant/applicant under their own licence*

Date Saved: 6/04/2020 11:54:14 AM
Document Path: V:\GIS\ESRI\Projects\SUST\2020\General\Robbie\EdenEstateLinkRd\LMCC_SpeciesOfConcern_EdenEstate.mxd

Attachment G – Rainfall Data

Daily Rainfall (millimetres)

BOLTON POINT (THE RIDGE WAY)

Station Number: 061133 · State: NSW · Opened: 1962 · Status: Open · Latitude: 32.99°S · Longitude: 151.61°E · Elevation: 48 m

2020	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	0	0	0	0	9.8	0	0	0	0	0	0	0
2nd	0.6	0	0	0	0	0	0	0	0	0	0	22.0
3rd	0	8.6	1.6	5.4	0	0	0	0	0	0	0	0
4th	0	0.2	10.2	8.8	0	0	0	0	0	0	0	0
5th	0	0	1.0	0	0	0	0	0	7.6	0	0	0
6th	0	1.0	31.2	0	0	0	0	0	0	0	0	0
7th	0	19.0		4.2	0	0	0		0	0	0	0
8th	0	40.2	0	0	0		0	5.6	0	0	27.2	0
9th	3.0	76.6	0	5.4	0	24.4	0	0	0	0	0	0
10th	0	28.6	0	2.4	0	31.6	0	12.4	10.8	0	0	0
11th	0.2	3.2	0	0	0	0	1.0	15.2	0	0	0	0
12th	0.4	0	5.6	0	0	13.0	0	0	1.0	0	0	0
13th	2.0	0	0	0	0	0	0	5.2	0	0	3.0	0
14th	0	0	0	0	0	13.0	0	0	0	0	0	2.0
15th	0	0	9.8	0	9.4	0	0	0	0	0	0	9.4
16th	0	0	2.4	0	4.2	0	0	0	0	0	0	0
17th	3.4	2.2	0	0	0		0	0	0	0	2.8	0
18th	8.8	0	0	0	2.4	8.2	0	0	0	1.0	0	0
19th	2.2	26.2	0	0	0	0	0	0	0	41.4	0	5.4
20th	0	0	0	0	0	0	0	0	0	1.6	0	16.0
21st	0	0	0	0	2.2	0	0	0	2.0	0	0	
22nd	0	0	0	0	8.6	0	0	0	0	0	0	57.4
23rd	0	0	0	0	1.0	0	0	6.0	0	0	0	0
24th	0.2	0	0	0	0	0	0	0	0	9.2	0	0
25th	3.4	0	0	0	0	0	0	0	0	29.2	0	1.6
26th	1.4	0		0	49.2	0	33.0	0	6.2	44.6	0	0
27th	0	10.4	92.0	5.0	8.4	0	139.2	0	0	32.0	0	0
28th	0	0	1.4	0	0	0	22.0	0	0	0	0	0
29th	1.4	0	12.2	0	0	0	17.2	0	0	0	0	19.0
30th	0		0		2.2	9.6	0	0	0	0	0	4.2
31st	0		0		0		0	0		0		14.6
Highest daily	8.8	76.6	92.0	8.8	49.2	31.6	139.2	15.2	10.8	44.6	27.2	57.4
Monthly Total	27.0	216.2			97.4		212.4		27.6	159.0	33.0	

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Australian Government
Bureau of Meteorology

Daily Rainfall (millimetres)

BOLTON POINT (THE RIDGE WAY)

Station Number: 061133 · State: NSW · Opened: 1962 · Status: Open · Latitude: 32.99°S · Longitude: 151.61°E · Elevation: 48 m

Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	110.9	117.6	142.9	105.5	87.6	112.7	53.8	54.5	61.7	74.4	85.3	80.0
Median	84.0	88.7	126.0	77.8	81.6	85.6	51.2	37.8	47.8	70.2	64.8	77.6
Highest daily	158.4	292.6	145.6	135.0	117.0	110.7	84.0	*90.0*	102.1	97.0	85.0	81.8
Date of highest daily	6th 2016	3rd 1990	22nd 2018	20th 2015	18th 1974	10th 1964	6th 1988	31st 2019	2nd 1970	19th 1976	8th 1984	9th 1970

1) Calculation of statistics

Summary statistics, other than the Highest and Lowest values, are only calculated if there are at least 20 years of data available.

2) Gaps and missing data

Gaps may be caused by a damaged instrument, a temporary change to the site operation, or due to the absence or illness of an observer.

3) Further information

http://www.bom.gov.au/climate/cdo/about/about-rain-data.shtml.

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Daily Rainfall (millimetres)

BOLTON POINT (THE RIDGE WAY)

Station Number: 061133 · State: NSW · Opened: 1962 · Status: Open · Latitude: 32.99°S · Longitude: 151.61°E · Elevation: 48 m

2021	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	3.4	0	0	2.2	0	0	1.6	0	0	0.2	0	1.0
2nd	5.6	7.4	0	0	0	0	3.2	0	0	0	0	↓
3rd	0	0	0	0	0	0	0.2	0	0	0	0	↓
4th	0	0	16.2	0	0	17.4	0	0	0	0	0	↓
5th	12.6	0	0	0	5.4	0	0	0	21.6	0	0	↓
6th	0	0	0	0	13.0	0	0	0	0		0	↓
7th	0	7.2	0	9.8	4.0	0	0	0	0	↓	0	38.0
8th	1.4	0	0	0	0	0	0	0	0	↓	18.0	4.0
9th	0	0	0	0	0	8.6	0	0	0	↓	0	0
10th	0	1.0	6.4	0	0	0	3.2	0	0	↓	0	0
11th	0	0	0	0	0	4.2	1.8	0	0	↓	14.2	0
12th	0	0	0	0	3.8	0	12.8	0	0	↓	0	0
13th	0	4.0	0	0	0	0	0	3.0	0	85.6	0	0
14th	0	25.2		0	0	0	0	0	29.2	2.0	0	0
15th	6.2	0	57.0	0	0	0	0.6	0	0	0	0	0
16th	0	10.8	0	0	0	1.8	1.4	0	0	0.4	0	0
17th	0	14.0	10.0	2.4	0	0	0	0	0	0	0	0
18th	0	0	17.6	4.4	0	0	0	0	0	0	0	0
19th	0	20.8	98.8	0	0	0	0	0	0	0	0	0
20th	2.8	2.8	41.0	0	0	9.6	0	0	0	3.6	1.4	6.2
21st	0	2.0	54.4	0	0	8.6	0	1.0	0	0	15.4	0
22nd	0	0	57.0	0	3.2		0	0	4.0	0	50.2	0
23rd	0	5.2	28.0	0	0		0.8	0	0	0	4.2	0
24th	0	11.8	6.8	0	0		0	38.6	0	3.0	4.0	0
25th	0	0	0	0	0		0	0	0	0	4.6	0
26th	0	0	0	0	0		0	0	8.0	0	↓	0
27th	0	0	0	0	0		0	0	0	0	39.0	6.4
28th	30.2	0	0	0	0		0	0	0	0	15.0	22.0
29th	25.8		4.4	0	0	0	0.6	0	0	0	0.2	19.4
30th	5.6		7.2	0	0	0	0	0	5.2	0		0
31st	39.8		2.8		0		0	0		5.4		0
Highest daily	39.8	25.2	98.8	9.8	13.0	17.4	12.8	38.6	29.2	5.4	50.2	22.0
Monthly Total	133.4	112.2		18.8	29.4		26.2	42.6	68.0		166.2	97.0

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Australian Government
Bureau of Meteorology

Daily Rainfall (millimetres)

BOLTON POINT (THE RIDGE WAY)

Station Number: 061133 · State: NSW · Opened: 1962 · Status: Open · Latitude: 32.99°S · Longitude: 151.61°E · Elevation: 48 m

Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	110.9	117.6	142.9	105.5	87.6	112.7	53.8	54.5	61.7	74.4	85.3	80.0
Median	84.0	88.7	126.0	77.8	81.6	85.6	51.2	37.8	47.8	70.2	64.8	77.6
Highest daily	158.4	292.6	145.6	135.0	117.0	110.7	84.0	*90.0*	102.1	97.0	85.0	81.8
Date of highest daily	6th 2016	3rd 1990	22nd 2018	20th 2015	18th 1974	10th 1964	6th 1988	31st 2019	2nd 1970	19th 1976	8th 1984	9th 1970

1) Calculation of statistics

Summary statistics, other than the Highest and Lowest values, are only calculated if there are at least 20 years of data available.

2) Gaps and missing data

Gaps may be caused by a damaged instrument, a temporary change to the site operation, or due to the absence or illness of an observer.

3) Further information

http://www.bom.gov.au/climate/cdo/about/about-rain-data.shtml.

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Daily Rainfall (millimetres)

BOLTON POINT (THE RIDGE WAY)

Station Number: 061133 · State: NSW · Opened: 1962 · Status: Open · Latitude: 32.99°S · Longitude: 151.61°E · Elevation: 48 m

2022	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	0	0	17.4	10.4		0	0					
2nd	0	0	25.2	0.2	↓	0	6.4					
3rd	0	36.0	22.6	0	↓	0	37.0					
4th	0	19.6	28.6	0	↓	0	40.0					
5th	18.0	5.2	0.8	0	↓	0	47.6					
6th	7.2	0	8.6	0	8.6	0						
7th	0	10.2	13.6	0	0	0						
8th	14.2	3.4	0	69.0	0	0						
9th	7.4	0	17.8	8.2	0	0						
10th	0	0	0	3.4	3.6	0						
11th	0	0	0	0	8.2	0						
12th	0	21.0	0	1.0	17.6	0						
13th	0	0	0.2	25.2	0	0						
14th	0	0	0	23.0	0	0						
15th	0	0	0.6	0	3.6	0						
16th	0	0	2.6	0	0	0						
17th	0	0	0	0	0	0						
18th	0	9.0	0	0	0	0						
19th	↓	0	10.0	0	0	↓						
20th	40.0	4.6	0	0	0	20.0						
21st	0	0	0	0	21.0	0.6						
22nd	0.6	1.6	0	17.6	10.2	0						
23rd	0	7.0	0	0	15.2	0						
24th	2.0	0	21.0	22.0	18.4	0						
25th	0	3.0	20.8	0	8.6	0						
26th	0	4.0	0	0	0	0						
27th	0	5.0	5.0	0	0	0						
28th	0	1.2	4.1	0	0	3.2						
29th	0		27.8		0	0						
30th	0		28.2		0	0						
31st	1.6		26.0		7.6							
Highest daily	18.0	36.0	28.6	69.0	21.0	3.2	47.6					
Monthly Total	91.0	130.8	280.9			23.8	131.0					

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Australian Government
Bureau of Meteorology

Daily Rainfall (millimetres)

BOLTON POINT (THE RIDGE WAY)

Station Number: 061133 · State: NSW · Opened: 1962 · Status: Open · Latitude: 32.99°S · Longitude: 151.61°E · Elevation: 48 m

Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	110.9	117.6	142.9	105.5	87.6	112.7	53.8	54.5	61.7	74.4	85.3	80.0
Median	84.0	88.7	126.0	77.8	81.6	85.6	51.2	37.8	47.8	70.2	64.8	77.6
Highest daily	158.4	292.6	145.6	135.0	117.0	110.7	84.0	*90.0*	102.1	97.0	85.0	81.8
Date of highest daily	6th 2016	3rd 1990	22nd 2018	20th 2015	18th 1974	10th 1964	6th 1988	31st 2019	2nd 1970	19th 1976	8th 1984	9th 1970

1) Calculation of statistics

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Attachment H – Commonwealth Protected Matters Search

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 31-Aug-2022

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	80
Listed Migratory Species:	64

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	45
Commonwealth Heritage Places:	None
Listed Marine Species:	71
Whales and Other Cetaceans:	1
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	5
Regional Forest Agreements:	1
Nationally Important Wetlands:	3
EPBC Act Referrals:	40
Key Ecological Features (Marine):	None
Biologically Important Areas:	4
Bioregional Assessments:	1
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands)		[Resource Information]
Ramsar Site Name	Proximity	Buffer Status
Hunter estuary wetlands	Within Ramsar site	In feature area

Listed Threatened Ecological Communities			[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area	In feature area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area	In feature area
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	Endangered	Community likely to occur within area	In feature area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area	In feature area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area	In buffer area only

Listed Threatened Species			[Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anthochaera phrygia			
Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Botaurus poiciloptilus			
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area	In feature area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area	In feature area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat known to occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In feature area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In buffer area only
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area	In feature area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pycnoptilus floccosus Pilotbird [525]	Vulnerable	Species or species habitat may occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area	In feature area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche steadi			
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
FISH			
Epinephelus daemelii			
Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Thunnus maccoyii			
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area	In buffer area only
FROG			
Litoria aurea			
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area	In feature area
Mixophyes balbus			
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Mixophyes iteratus			
Giant Barred Frog, Southern Barred Frog [1944]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Uperoleia mahonyi			
Mahony's Toadlet [89189]	Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
Chalinolobus dwyeri			
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area	In feature area
Dasyurus maculatus maculatus (SE mainland population)			
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area	In feature area
Petauroides volans			
Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Petaurus australis australis			
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat known to occur within area	In feature area
Petrogale penicillata			
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In feature area
Potorous tridactylus tridactylus			
Long-nosed Potoroo (northern) [66645]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pseudomys novaehollandiae			
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area	In feature area
PLANT			
Acacia bynoeana			
Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Angophora inopina			
Charmhaven Apple [64832]	Vulnerable	Species or species habitat known to occur within area	In feature area
Caladenia tessellata			
Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Commersonia prostrata			
Dwarf Kerrawang [87152]	Endangered	Species or species habitat may occur within area	In buffer area only
Cryptostylis hunteriana			
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat known to occur within area	In feature area
Diuris praecox Newcastle Doubletail [55086]	Vulnerable	Species or species habitat known to occur within area	In feature area
Eucalyptus camfieldii Camfield's Stringybark [15460]	Vulnerable	Species or species habitat may occur within area	In feature area
Eucalyptus glaucina Slaty Red Gum [5670]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Eucalyptus parramattensis subsp. decadens Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat may occur within area	In feature area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area	In feature area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area	In feature area
Grevillea shiressii [19186]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat known to occur within area	In feature area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pomaderris brunnea Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area	In feature area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area	In feature area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Rutidosis heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area	In feature area
Tetratheca juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat known to occur within area	In feature area
REPTILE			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
SHARK			
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area	In buffer area only

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area	In buffer area only
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat likely to occur within area	In buffer area only
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area	In buffer area only
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In buffer area only
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area	In buffer area only
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area	In buffer area only
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche impavida			
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris			
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche salvini			
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi			
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Migratory Marine Species			
Caretta caretta			
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In buffer area only
Chelonia mydas			
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Dermochelys coriacea			
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In buffer area only
Eretmochelys imbricata			
Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Lamna nasus			
Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area	In buffer area only
Mobula alfredi as Manta alfredi			
Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Mobula birostris as Manta birostris			
Giant Manta Ray [90034]		Species or species habitat may occur within area	In buffer area only
Natator depressus			
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Sousa sahulensis as Sousa chinensis			
Australian Humpback Dolphin [87942]		Species or species habitat likely to occur within area	In buffer area only
Migratory Terrestrial Species			
Cuculus optatus			
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundapus caudacutus			
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Monarcha melanopsis			
Black-faced Monarch [609]		Species or species habitat known to occur within area	In feature area
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat known to occur within area	In feature area
Myiagra cyanoleuca			
Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
Rhipidura rufifrons			
Rufous Fantail [592]		Species or species habitat known to occur within area	In feature area
Symposiachrus trivirgatus as Monarcha trivirgatus			
Spectacled Monarch [83946]		Species or species habitat known to occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area	In feature area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area	In feature area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area	In feature area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area	In feature area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area	In buffer area only
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area	In feature area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In feature area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area	In buffer area only
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In feature area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area	In feature area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area	In feature area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area	In feature area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area	In feature area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Xenus cinereus			
Terek Sandpiper [59300]		Roosting known to occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Communications, Information Technology and the Arts - Australian Postal Corporation		
Commonwealth Land - Australian Postal Commission [11653]	NSW	In buffer area only
Commonwealth Land - Australian Postal Commission [11710]	NSW	In buffer area only
Commonwealth Land - Australian Postal Commission [11669]	NSW	In buffer area only
Commonwealth Land - Australian Postal Corporation [11633]	NSW	In buffer area only
Commonwealth Land - Australian Postal Corporation [11690]	NSW	In buffer area only
Communications, Information Technology and the Arts - Telstra Corporation Limited		
Commonwealth Land - Australian Telecommunications Commission [11632]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [11656]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [11631]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [11672]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [11671]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [11700]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [11658]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [11657]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Australian Telecommunications Commission [11708]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [11643]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [11655]	NSW	In buffer area only
Commonwealth Land - Telstra Corporation Limited [11711]	NSW	In buffer area only
Commonwealth Land - Telstra Corporation Limited [11689]	NSW	In buffer area only
Defence		
Commonwealth Land - Defence Service Homes Corporation [11673]	NSW	In feature area
Commonwealth Land - Defence Service Homes Corporation [11670]	NSW	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [11699]	NSW	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [11640]	NSW	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [11697]	NSW	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [11696]	NSW	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [11695]	NSW	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [11694]	NSW	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [11698]	NSW	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [11693]	NSW	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [11691]	NSW	In buffer area only
Commonwealth Land - Defence Service Homes Corporation [11692]	NSW	In buffer area only
Defence - Defence Housing Authority		
Commonwealth Land - Defence Housing Authority [16173]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16172]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16171]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16165]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16166]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16167]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16169]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Defence Housing Authority [16168]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16170]	NSW	In buffer area only
Commonwealth Land - Director of War Service Homes [11652]	NSW	In buffer area only
Commonwealth Land - Director of War Service Homes [11639]	NSW	In buffer area only
Commonwealth Land - Director of War Service Homes [11664]	NSW	In buffer area only
Commonwealth Land - Director of War Service Homes [11654]	NSW	In buffer area only
Unknown		
Commonwealth Land - [15660]	NSW	In buffer area only
Commonwealth Land - [11709]	NSW	In buffer area only

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area	In buffer area only
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Ardenna grisea as Puffinus griseus Sooty Shearwater [82651]		Species or species habitat likely to occur within area	In buffer area only
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Breeding likely to occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area	In feature area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area	In feature area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area overfly marine area	In feature area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area	In buffer area only
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area overfly marine area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area	In feature area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area	In feature area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Diomedea antipodensis gibsoni as Diomedea gibsoni			
Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea epomophora			
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea exulans			
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Diomedea sanfordi			
Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area	In buffer area only
Fregata ariel			
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area	In buffer area only
Fregata minor			
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area	In buffer area only
Gallinago hardwickii			
Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area overfly marine area	In feature area
Gallinago megala			
Swinhoe's Snipe [864]		Roosting likely to occur within area overfly marine area	In buffer area only
Gallinago stenura			
Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area	In buffer area only
Haliaeetus leucogaster			
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area overfly marine area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area overfly marine area	In feature area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In feature area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area overfly marine area	In feature area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
Neophema chrysostoma Blue-winged Parrot [726]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area overfly marine area	In buffer area only
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area	In feature area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area	In buffer area only
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In feature area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area	In buffer area only
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area overfly marine area	In feature area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area overfly marine area	In feature area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area overfly marine area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat known to occur within area overfly marine area	In feature area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche bulleri platei as Thalassarche sp. nov. Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche melanophris			
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche salvini			
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi			
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Tringa brevipes as Heteroscelus brevipes			
Grey-tailed Tattler [851]		Roosting known to occur within area	In feature area
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area overfly marine area	In feature area
Tringa stagnatilis			
Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area overfly marine area	In feature area
Xenus cinereus			
Terek Sandpiper [59300]		Roosting known to occur within area overfly marine area	In feature area
Reptile			
Caretta caretta			
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area	In buffer area only
Chelonia mydas			
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Dermochelys coriacea			
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only

Whales and Other Cetaceans [Resource Information]

Current Scientific Name	Status	Type of Presence	Buffer Status
Mammal			
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat likely to occur within area	In buffer area only

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State	Buffer Status
Blue Gum Hills	Regional Park	NSW	In feature area
Glenrock	State Conservation Area	NSW	In buffer area only
Hexham Swamp	NRS Addition - Gazettal in Progress	NSW	In buffer area only
Hunter Wetlands	National Park	NSW	In buffer area only
Pambalong	Nature Reserve	NSW	In buffer area only

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

RFA Name	State	Buffer Status
North East NSW RFA	New South Wales	In feature area

Nationally Important Wetlands [Resource Information]

Wetland Name	State	Buffer Status
Hexham Swamp	NSW	In buffer area only
Kooragang Nature Reserve	NSW	In buffer area only
Shortland Wetlands Centre	NSW	In buffer area only

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
F3 to Branxton Link Electricity Adjustments	2007/3814	Controlled Action	Post-Approval	In buffer area only
Gas Transmission Pipeline	2011/5917	Controlled Action	Completed	In buffer area only
Kooragang Wetland Rehabilitation Project	2007/3220	Controlled Action	Post-Approval	In buffer area only
Kurri Kurri Lateral Pipeline Project	2021/9113	Controlled Action	Assessment Approach	In buffer area only
Newcastle inner city bypass Rankin Park to Jesmond NSW	2015/7550	Controlled Action	Post-Approval	In buffer area only
New dual carriageway from F3 Fwy to Branxton Link	2007/3431	Controlled Action	Post-Approval	In buffer area only
Port Site and Materials Handling Development	2001/242	Controlled Action	Completed	In feature area
Protech Cold Mill Facility	2001/274	Controlled Action	Post-Approval	In feature area
Remediation Works, Kooragang island waste facility emplacement facility NSW	2011/5920	Controlled Action	Completed	In buffer area only
Residential development, Hillsborough, NSW	2014/7217	Controlled Action	Further Information Request	In buffer area only
River Dredging Operations	2001/249	Controlled Action	Completed	In feature area
Terminal 4 Coal Export Terminal Project, Kooragang Island	2011/6029	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
Abel Coal Project	2007/3695	Not Controlled Action	Completed	In buffer area only
Blue Gum Vista Estate Residential development off Minmi Road	2004/1507	Not Controlled Action	Completed	In buffer area only
Controlling Water Levels in Shortland Wetlands	2010/5468	Not Controlled Action	Completed	In buffer area only
Expansion of Marmong Point Marina	2008/4277	Not Controlled Action	Completed	In buffer area only
Fort Scratchley refurbishment works	2005/2283	Not Controlled Action	Completed	In buffer area only
Geological exploration and historical research of convict coal mines beneath For	2004/1421	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Green & Golden Bell Frog Habitat Enhancement Project	2004/1795	Not Controlled Action	Completed	In feature area
Hexam Train Support Facility	2012/6285	Not Controlled Action	Completed	In buffer area only
Hexham Relief Roads Project	2012/6309	Not Controlled Action	Completed	In buffer area only
Hunter Natural Gas Pipeline	2004/1902	Not Controlled Action	Completed	In feature area
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Industrial and Residential Subdivision, Minmi and Black Hill, Lower Hunter	2008/4603	Not Controlled Action	Completed	In feature area
Newcastle Inner City Bypass - Sandgate to Shortland	2007/3633	Not Controlled Action	Completed	In buffer area only
Northlakes Estate Residential Subdivision	2009/5111	Not Controlled Action	Completed	In buffer area only
Proposed Residential Subdivision	2005/2127	Not Controlled Action	Completed	In buffer area only
Queensland Hunter Gas Pipeline, approximately 833 km in length	2008/4620	Not Controlled Action	Completed	In buffer area only
Revised alignment Hunter Natural Gas Pipeline	2005/2470	Not Controlled Action	Completed	In feature area
Richmond Vale Rail Trail	2019/8568	Not Controlled Action	Completed	In buffer area only
RTA Five Islands Road Upgrade	2000/44	Not Controlled Action	Completed	In buffer area only
sale of property located at 96, Hunter Street	2003/1097	Not Controlled Action	Completed	In buffer area only
Sandgate Rail Grade Separation	2005/1948	Not Controlled Action	Completed	In feature area
Tomago to Tomaree Electricity Supply Upgrade	2003/1023	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Extensions to the north and south of an existing quarry and proposed transmission lines	2011/5988	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
Kooragang Island coal export terminal	2006/2987	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Kooragang Island Waste Emplacement Facility Closure Works	2012/6464	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Rehabilitation of Hexham Swamp	2003/1244	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
TransGrid 132kV Power Transmission Line	2002/794	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Referral decision				
Residential Development and 132kV Sub-transmission Line Relocation	2008/4574	Referral Decision	Completed	In buffer area only

Biologically Important Areas			
Scientific Name	Behaviour	Presence	Buffer Status
Dolphins			
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Foraging	Known to occur	In buffer area only
Seabirds			
Ardenna grisea Sooty Shearwater [82651]	Foraging	Likely to occur	In buffer area only
Ardenna pacifica Wedge-tailed Shearwater [84292]	Foraging	Likely to occur	In buffer area only
Ardenna tenuirostris Short-tailed Shearwater [82652]	Foraging	Likely to occur	In buffer area only

Bioregional Assessments			
SubRegion	BioRegion	Website	Buffer Status
Hunter	Northern Sydney Basin	BA website	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix E – AEP BAM Field Sheets

GPS 7

PLOT 1

Date: 11.5.20	Job number: 1971.01	Site: Eden	Plot ID: P01	Bearing: 110°	Observers: YB

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
A. costata	30	20	Acacia longi. var long	1.5	20	Imperata cylindrica	35	100	Lobelia purpurascens	0.3	100
Stringy	20	6	Pultenaea retusa ~~Fabaceae~~ sp.	2	50	Themeda triandra	10	500	~~Lomandra~~	~~0.1~~	~~2~~
↳ E. globoidea			Daviesia ulicifolia	0.3	5	Entolasia stricta	12	500	Lomandra obliqua	0.2	50
Pultenaea linophylla		←	Pultenaea sp. cuneata	0.1	5	Gonocarpus teuc.	0.5	100	Billardiera scandens	0.1	20
			Leptospermum polyga	0.2	10	Microlaena stip	0.1	20	Dianella caerulea var producta	0.2	20
			Epacris pulchella	2.5	30	Austrodanthonia vaginata	2	100	Daucus carota Apiaceae weed	0.1	1
			Pimelea linifolia	0.1	3	Paspalidium distans	0.5	20	Lomandra filiformis	0.1	5
			Acacia ulicifolia	0.1	1	Poa ~~Pytdospermum~~ pallidum	5	100	Lomandra multiflora	0.2	5
			Acacia falcata	0.1	3	Panicum simile	0.5	50	Brunonia australis	0.1	50
						Echinopogon caespi.	0.2	25	Cassytha glabella var glabrata	0.1	2
						Lepidosperma laterale	0.2	5	~~Asteraceae sp.~~		
						Eragrostis brownii	0.2	20	Oxalis sp. perennans	0.1	1
						Hardenbergia vio.	0.1	2	Liliaceae sp.?	0.1	1
						Acanthus sp.	0.1	20	Xanthorrhoea latifolia	0.1	5
									Hypochaeris radicata	0.1	2
									Setaria parviflora	0.1	1
Total Cover DO FIRST	50			30					← 75 →		

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

GPS 7

PLOT 1

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 11/05/20	Job number: 1971-01	Site: Eden Est	Plot ID: P01	Bearing: 110	Observers: YB

Arrival time: 9.15 **Departure time:** 12.43 **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	95	
10 – 19 cm	P / A	Total	2	100	
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length	3	100	
30 – 49cm	P / A	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ III	4	100	
50 -79cm	# IIII		5	95	
>80cm	#	Total metres 23m	Average	98	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

slight weed cover / clearing white age / fire 3-5 years ago

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

GPS 7

PLOT 2

Done

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 11.05.20	Job number: 1971.01	Site: Edm	Plot ID: P02	Bearing: 215°	Observers: YB

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
A. costata	20	10	Daviesia ulicifolia	2	4	Imperata	1	100	Aristida vagans	2	100
E. fibrosa	5	5	Acacia ulicifolia	0.2	5	~~Poa sieb?~~ 4	35	100	Acanthus	0.1	20
E. punctata	2	2	Acacia myrtifolia	0.1	5	Themeda triandra	3	100	Hardenbergia vioa	0.1	2
E. globoidea	10	1	Parallel veined shrub	0.1	3	Entolasia stricta	10	500	Pseudoraphis variabile	0.1	50
E. capitellata	25	5	Glochidion ferdi	0.1	5	Goodenia ferac	1	100	Xanthorrhoea latifolia	0.1	1
C. gummifera	1	1	Pavonsia strom	0.1	5	Lobelia purpurascens	0.5	100	Microdaena stricta	0.5	20
1 Brunonella australis	✓		Pultenaea linophylla sp.	0.1	5	Lomandra obliqua	5	100	Dianella caerulea var producta	0.1	10
2 Lagenophora stipitata			Epacris pulchella	0.1	10	Lepidosperma laterale	0.5	10	Paspalidium distans	0.2	20
3 Leucopogon lanceolatus var. lanceolatus			Dillwynia sp. retorta	0.1	5	Native asteraceae 2	0.1	10	Glycine tabacina	0.1	5
4 Rytidosperma pallidum			Bursaria spinosa	0.1	2	Lopercularia (no smell)	0.1	5	Arthropodium milleflorum	0.1	5
			Pultenaea pedunculata	0.1	5	Lopercularia diphylla	0.1	20	~~Lepidosperma longi~~ Lp glaucus		
			Leucopogon sp.	0.1	1	Polymeria calycina	0.1	10	Pterostylis sp.	0.1	20
			Acacia falcata	0.1	1	Tiny grass poaceae sp.	0.1	20	Desmodium Rytidosp.	0.1	1
Pultenaea euchilla			Pultenaea ~~daphnoides~~	0.1	2	Billardiera scandens	0.1	5	Lomandra multi	0.2	10
			Polyscias sambucifolia	0.1	1	Desmodium varians	0.1	2	Pteridium esculentum	0.1	5
						Brunonella australis	0.1	10			
						Hydrocotyle laxiflora	0.1	5			
						Lomandra filiformis	0.1	10			
Total Cover DO FIRST	65			5			60				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

GPS 7

PLOT 2

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 11.5.20	Job number: C9710.01	Site: Eden	Plot ID: P02	Bearing: 215	Observers: YB

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	95	
10 – 19 cm	P / A	Total	2	100	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	95	
30 – 49cm	P / A	2, 1, 1, 1, 3, 5, 1, 4, 1	4	100	
50 -79cm	# III		5	95	
>80cm	#	Total metres 16	Average	97	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 3

GPS 7

Date: 12.5.20	Job number: 1971.01	Site: Eden	Plot ID: P03	Bearing: 91°	Observers: YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. gummifera	15	5	Glochidion fer	20	30	Pteridium esculentum	2	50	Imperata	2	500
E. umbra	30	8	Lepto. poly	10	50	Lomandra longi	3	20	Pseudoanthemum	0.2	50
A. costa	10	10	Acacia terminalis	15	50	Hardenbergia violacea	0.2	20	Oplismenus imbecilus	20	1000
E. ~~piperita~~ sideroxylon	2	1	Acacia myrtifolia	1	20	Panicum simile	5	1000	Desmodium varians	0.1	20
Acacia ulicifolia	0.1	5	Banksia spin	0.5	10	Microlaena stip	3	100	Glycine clandestina	0.2	50
Dodonaea tri	0.1	20	Breynia oblong	0.2	10	Lomandra obliqua	0.5	50	Acianthus sp.	0.1	20
1 Brunonella australis	✓		Daviesia squarrosa ssp squ	0.2	20	Entolasia stricta	0.1	20	Pterostylis (not stirling)	0.1	20
2 Euphorbia mimos		✓	Pultenaea linophylla	0.5	50	Dianella caerulea var prod	0.2	50	Lobelia purpurascens	0.5	100
3 Pomaderris ferruginea		✓	Pandorea pando	0.5	20	Entolasia marginata	10	100	Billardiera scandens	0.1	5
4 Pultenaea villosa			Pultenaea pedunculata	0.5	50	Eustrephus latifolius	0.1	20	Goodenia ovata	0.5	100
5 Rytidosperma pallidum			Acacia longi var. long	0.2	5	Poa sp. 5	0.1	5	Lepidosperma laterale	0.1	2
			Pimelea linifolia	0.2	20	Hibbertia scandens	0.1	10	Goodenia sp rotundifolia	0.1	10
			Polyscias sambucifolia	0.1	5	Themeda triandra	2	50	Dichondra repens	0.5	100
			Gamphobium latifolium	0.1	3	Funny shrub Hibbertia aspera	0.5	20	Desmodium rhytidophyllum	0.1	10
			Hairy daviesia 4	0.1	20	Adiantum aethiopicum	15	1000	Polymeria calycina	0.2	50
			Epacris paludosa	0.1	2	Grania ~~sieb~~ clavhei	2	20	Ageratina adenophora	0.1	2
			Acacia falcata	0.1	5	Restionaceae sp-2	2	50	Conyza bonar	0.1	5
Pultenaea euchilla		←	~~Pultenaea daphno~~	0.1	10	Glycine tenuiflora	0.1	5	Cymbonotus	0.1	2
Total Cover DO FIRST	60		←			70			→		

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 3

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 12/5	Job number: 1971.10	Site: P031 Eden	Plot ID: P03	Bearing: 91°	Observers: WM EL XB

Arrival time: 9:30 **Departure time:** **Weather:** Sunny 10°C

1000m² plot **Mapped Vegetation community:** 1649 **Transect photos and GPS points taken** ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.		
< 5 cm	(P) / A	0		Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A		1	10%	80% bare
10 – 19 cm	(P) / A	Total	2	95%	
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length	3	10%	
30 – 49cm	(P) / A	𝍸 𝍸 𝍸	4	95%	
50 -79cm	# 11		5	95%	
>80cm	#	Total metres 15.5	Average	60%	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Evidence of fire, dry creek running along 50m transect; higher weed cover; good post-fire regeneration

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

GPS 7

PLOT 4

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 12.5.20	Job number: 1971-01	Site: Edm	Plot ID: P04	Bearing: 238°	Observers: MB

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
A. costa	15	10	Daviesia squarrosa	5	100	Entolasia stricta	2	100	Paspalidium distans	0.5	20
C. gunii	10	5	Hairy shrub (smooth P2)	0.5	20	Microlaena stipoides	0.5	50	Panicum simile	6	100
E. umbra	5	5	Pultenea pedunculata	10	100	Imperata	0.2	100			
E. pilo	2	1	Acacia ulicifolia	10	50	Lobelia purpurascens	0.1	10			
1 Pultenaea villosa	✓		Pimelea linifolia	0.5	50	Lomandra filiformis	0.2	100			
			Hardenbergia vio.	1	100	Lepidosperma laterale (twistin leaf)	0.5	50			
			Acacia myrtifolia	0.1	10	Gonocarpus teucrioides	0.5	20			
			Leucopogon lanceolatus	0.1	2	Dianella revoluta	0.1	20			
			Banksia spinulosa	0.1	2	Dianella caerulea var producta	0.2	20			
			Mirbelia rubiifolia	0.1	1	~~Hairy grass~~					
Goodenia heterophylla subsp eglandulosa		←	Hairy leaved subshrub	0.1	5	Themeda triandra	5	100			
			Epacris pulchella	0.1	5	Lomandra sp (hard/naspy bluish)	0.5	10	→ multiflora		
			Acacia longifolia var longi.	2	50	Pteridosperma pallidum	0.5	20			
						Lomandra obliqua	0.2	20			
						Billardiera scandens	0.1	5			
						Opercularia diphylla	0.1	10			
						Desmodium rhytidophyllum	0.1	1			
Total Cover DO FIRST	35		←			60			→		

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 4

AEP
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Date: 12.5.2020	Job number: 1971	Site: Eden	Plot ID: P04	Bearing:	Observers: YB, E.L. Y.C

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	95	
10 – 19 cm	P / A	Total	2	98	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	95	
30 – 49cm	P / A		4	98	
50 -79cm	#		5	98	
>80cm	#	Total metres 31	Average	97	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

fire 2 years ago

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 5

Done

AEP
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Date: 12.05.20	Job number: 1971	Site: Eden	Plot ID: P05	Bearing: 82°	Observers: MB

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Syncarpia glomu	45	5	acmena sp. Syzygium sp.	5	5	Dioscorea transversa	1	100	Lantana	20	50
E. acmenoides	5	5	Wilkiea huegelana	5	20	Doodia aspera	5	500	Ligustrum sinense	0.2	50
E. punctata	15	3	Notelaea ovata	0.5	2	Cayratia clematidea	1	20	Cometina cyanea	0.1	5
E. pip.	15	1	Eupomatia laurina	1	5	Adiantum aethio	2	500	Dichondra repens	0.2	100
Melaleuca Styph	3	15	Melicope micrococca	0.2	5	Gymnostachys anceps	0.8	20	Veronica plebeia	0.1	10
~~Melaleuca sp.~~ Callistemon salignus	3	1	Cissus antarctica	0.5	5	Oplismenus imbecillis	10	500	Imperata	0.2	50
A. costa	0.1	1	Peltate climber	0.1	5	Gentanopleurum	0.2	20	Glycine clandestina	0.1	2
			Cissus hypoglauca	1	10	Smilax australis	0.5	10	Tuckeroo seedling	0.1	1
Marsdenia 20 strands			← Milky sap moth vine lbl	0.5	20	Microlaena stip.	10	500	Pandorea pando	0.2	5
1 Morinda jasminoides	✓		4 whorled leaf shrub.	0.5	2	Hydrocotyle laxi.	0.5	100	Cyanthillium cinereum	0.1	1
2 stephania japonica	✓		~~Clematicissus opaca~~	0.5	5	Pteridium esc.	0.5	20	Geranium homeanum	0.1	5
3 cryptocarya micro.											
4 Dubasia myoporoides	✓		Denhamia celas	0.1	2	Fine green fleshy vine 1	1	10	Oxalis perennans spp.	0.1	1
5 Viola silicestris			Notelaea longi	0.1	1	Prominent veined shrub	10	20	Euskephus lati	0.1	2
			Trema aspera	0.1	1	Hypolepis muelleri	0.2	20	Lobelia purpurea	0.5	100
			Desmodium rhytido	0.1	5	Sidgesbechia orientalis	0.5	50	Viola hederacea lbl	0.1	5
						Pseudoraphis vaginata	0.2	50	Dianella caerulea var. producta	0.1	5
			clerodendrum tomentosum		←	Hairy creeper	0.1	2	Grass 7	0.1	20
						Entolasia marginata	5	500	Verbena bon	0.1	1
Total Cover DO FIRST	80						75				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 5

Date: 12.5.2015	Job number:	Site: Eden	Plot ID: P05	Bearing:	Observers: J.B. E.L.V.

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Arrival time: 1400 **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A	1 - 382 wp - GPS 7 - 2 hollow spout x2 2 - 383 WP GPS 7 - TBC		Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A		1	98	
10 – 19 cm	P / A	Total	2	95	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	95	
30 – 49cm	P / A	4, 3, 5, 3 = 15 + 32	4	100	
50 -79cm	# IIII		5	98	
>80cm	#	Total metres 47	Average	97	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Past fire on uphill side, weed cover moderate, rubbish, dirt bike tracks

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 6

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 13.5.20	Job number: 1971.01	Site: Eden	Plot ID: P06	Bearing: 170°	Observers: YB

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
A. costata	5	2	Melaleuca nodosa	15	20	Ghania sp. clarkei	15	500	Restionaceae sp. 2	1	20
E. piperita	25	5	Glochidion ferr	5	5	Pteridium esc.	0.1	50	Hydrocotyle laxi	0.5	100
E. umbra	10	1	Lepto polyga	8	50	Opuscerus inbecilis	5	500	Dichondra repens	1	500
E. resinifera	5	1	Banksia spinulosa	0.2	10	Lobelia purpurea	2	100	Veronica plebeia	0.1	5
C. gunnii	2	1	Allocasuarina tomulosa	2	5	Lomandra longi	2	20	Eustrephus lati.	0.2	20
1- Brunonella pumilio			Parsonsia linearis	0.2	5	Microlaena stip	10	500	Glycine clandestina	0.1	20
2 Empodisma minus (30%)			Polyscias sambucifolia	0.5	20	Entolasia marginata	5	100	Pseudoanthenum var.	0.2	50
Melaleuca linariifolia	2	1	Elaeocarpus reticulatus	0.1	1	Adiantum aethio.	5	500	Lepidosperma lata	0.5	10
3 Rytidosperma pallidum			Pittosporum undul	0.1	1	Entolasia stricta	0.5	50	Lantana	0.1	2
			Acacia longi var longi	0.1	2	Lomandra obliqua	0.5	20	Xanthorrea latifolia	1	10
			Gamphocarpus lati	0.1	3	Lomandra filiformis	0.1	5	Lindsaea linearis	0.1	50
			Omalanthus populifolius	0.1	1	Calochlaena dubia ~~Hypolepis muelleri~~	1	20	Billardiera scandens	0.1	20
Lagenophora gracilis ←			Native asteraceae	0.1	10	Dianella caerulea var prod	0.2	20	Fuchsia seedling	0.1	1
			Goodenia ovat	0.1	5	Poa affinis ~~sieb~~ ? 3	0.2	10	Pansonsia straminea	0.5	10
			Gentianopsis	0.1	5	Imperata	0.1	20	Acanthus sp.	0.1	100
			Thuenda triandra	0.1	10	Ligustrum sinense	0.1	20	Grass 1 Panicum effusum	0.1	20
			Dianella revo	0.1	5	Oxalis perennans	0.1	5	Dipsacularia (no stink)	0.1	20
			Lomandra sp micrantha	0.1	1	Ageratina adenophora	0.2	20	Flatweed Gamochaeta pensylvanica	0.1	5
Total Cover DO FIRST	45		Verbena bonariensis	0.1	1		70%		Conyza bonariensis	0.1	2

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 6

Date: 13-5-20	Job number: 1971.01	Site: Eden	Plot ID: P06	Bearing: 170°	Observers: YB, JC

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Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.		
< 5 cm	(P) / A	1		Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A		1	100	
10 – 19 cm	(P) / A	Total	2	80	
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length	3	90	
30 – 49cm	(P) / A	29, 8, 4, 1, 3, 1	4	90	
50 -79cm	# ~~IIII~~ II		5	100	
>80cm	#	Total metres 46	Average	92	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other) past fire. more so. on higher elevation, and less in gully.

Large, branched fallen tree in 20x20 plot. (Transect is along a drainage line, gully. Small depression filled with water.

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 7

Date: 13.5.22	Job number: 1971.01	Site: Eden	Plot ID: P07	Bearing: 281	Observers: YB

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
A. cedra	15	10	Allocas. tor.	0.8	3	Imperata	2	1000	Lepidosperma lat	0.1	2
E. globoidea	20	10	Banksia spin	0.5	4	Themeda triandra	40	1000	Lobelia purpurea	0.1	10
C. gummifera	5	1	Polyscias sambucifolia	0.5	10	Pod sieb (Pyrrhosperma pallidum)	10	100	Hardenbergia vio	0.1	50
C. maculata	5	1	Pultenaea pellacea	0.5	20	Entolasia stricta	0.5	100	Brunonella australis	0.1	20
E. umbra	5	1	~~Pultenaea~~ Phyllanthus ~~tenellus~~ hirtellus	0.1	5	Desmodium rhytid	0.1	10	Glycine clandestina	0.1	5
			Glochidion	0.1	2	Dianella caerulea var prod.	0.2	20	Goodenia ten c	0.1	20
			Persoonia linearis	0.1	1	Lomandra filiformis	0.1	20	Acanthus sp.	0.1	100
			Acacia myrtifolia	0.1	1	Lomandra obliqua	0.5	100	Cyanthidium cunnum	0.1	2
			Omalanthus pop.	0.1	1	Echinopogon caesp.	0.5	20	Desmodium varians	0.1	20
			Acacia longi var longi	0.1	5	Lomandra multiflora	0.1	10	Arthropodium milleflo	0.1	5
			Epacris pulchella	0.1	5	Lomandra longifolia	0.5	10	Polyscias calycina	0.1	2
			Dillwynia retorta	0.1	5	Microlaena stip	0.1	20			
			Gamphobolium latifolium	0.1	3	~~Grass 1~~					
						Paspalidium distans	0.1	10			
						Panicum simile	0.5	20			
Total Cover DO FIRST	50			10			~~60~~ 50				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 7

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 13.5.20	Job number: 1971.01	Site: Eden	Plot ID: P07	Bearing: 281	Observers: YB, dc

Arrival time: **Departure time:** **Weather:** Fine

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A	0
5 - 9 cm	(P) / A	
10 – 19 cm	(P) / A	Total
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	(P) / A	3, 2, 5, 2, 2, 1, 2, 11
50 -79cm	# 0	
>80cm	# 0	Total metres 28

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	95	
2	95	
3	95	
4	95	
5	95	
Average	95	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Past fire, blady grass regrowth, clear midstory.

Habitat features, comments and incidental fauna observations:

Regrowth after fire, → wallaby food available.
Bird calls recorded (Justin) - to be identified.

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 8

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 13.5.20	Job number: 1971.01	Site: Eden	Plot ID: PO 8	Bearing:	Observers: YB

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	35	20	Acacia falcata	0.1	2	Entolasia stricta	1	50	Opercularia diphylla	0.1	20
E. fibrosa	5	2	Allocasuarina	0.2	2	Panicum simile	5	100	Eustrephus latifolius	0.1	100
Eucalyptus seedling	0.1	1	Pultenaea villosa	0.1	10	Paspalidium distans	~~1~~	50	Brunonella australis	0.2	100
to drungy E. globulus			Phyllanthus hirtellus ~~Pultenaea sp.~~	0.1	10	Lomandra longifolia	10	100	Lobelia purpurascens	0.1	50
			Acacia ulicifolia	0.1	1	Lepidosperma pallidum ~~Pod seeds~~	1	20	Desmodium rhytidophyllum	0.2	20
			Polyscias sambucifolius	0.1	5	Microlaena stipoides	0.2	50	Glycine clandestina	0.1	20
			Notelaea ovata ?	0.1	2	Dianella revoluta	0.1	10	Billardiera scandens	0.1	5
			Pittosporum undulatum	0.1	1	Xanthorrhoea macronema var. macronema ~~small~~	1	10	Dianella caerulea var. producta	0.1	5
						Dianella longifolia var. longifolia	0.1	20	Hardenbergia violacea	0.2	10
1 Lagenophora stipitata ~~gracilis~~						Dichelachne micrantha	0.2	50	Lomandra filiformis	0.1	5
						Themeda triandra	15	100	Lepidosperma laterale	0.1	2
						Anthropodium milleflorum	0.1	5	Desmodium varians	0.1	20
						Austrodanthonia racemosa	0.5	20	Native aster 1	0.1	5
						Imperata cylindrica	0.1	20	Echinopogon caespitosus	0.1	10
Total Cover DO FIRST	40						85				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 8

Date: 13.5.20	Job number: 1971.01	Site: Eden	Plot ID: P08	Bearing: 130°	Observers: YB, K

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Arrival time: **Departure time:** **Weather:** Fine

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	95	
10 – 19 cm	P / A	Total	2	95	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	95	
30 – 49cm	P / A	5	4	98	
50 -79cm	# 1		5	95	
>80cm	#	Total metres	Average		

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Dirt bike trails outside of plot, past fire

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 9

Date: 11/5	Job number:	Site: Eden	Plot ID: North 1	Bearing:	Observers:

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Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Euc. acmenoides	3		Acacia ulicifolia	50		~~Acacia ulicifolia~~			Hardenbergia violacea	0.1	20
~~Euc.~~ Corymbia mac.	45		Polyscias sambucifolia	0.1	10	Pandorea pandorana	0.3	50	Acianthus sp.	1	1000
Euc. ~~sideroxylon~~ Eucalyptus fergusonii	3		Pultenaea villosa	0.2	5	Imperata cylindrica	0.3	100	Lobelia purpurescens	1	100
Allocas. torrulosa	0.4		Pultenaea linophylla	0.1	10	Desmodium rhytidophyllum	0.1	5	Eustrephus latifolius	0.3	100
			Acacia falcata	0.1	2	Panicum simile	0.1	10	Pseudoraptherum variable	0.1	50
			~~Daviesia squarrosa~~ Pultenaea spinosa	0.2	2	~~Pultenaea daphnoides~~			Pteridium esculentum	0.1	5
			Daviesia ulicifolia	0.1	5	Lepidosperma laterale	0.2	5	Glycine microphylla	0.1	50
			Pultenaea daphnoides	0.1	5	Dichondra repens	0.1	50	~~Polyscias sambucifolia~~		
			Bursaria spinosa	0.1	5	Lomandra longifolia	0.5	20	Solenogyne?	0.1	50
			Podolobium ilicifolium	0.1	5	Hydrocotyl peduncularis	0.1	1	Entolasia marginata	2	100
			Acacia myrtifolia	0.2	5	Lomandra multiflora	0.8	50	Ganocarpos teucrioides	0.1	50
			Lantana camara	0.1	1	Aristida vagans	0.2	30	Entolasia stricta	1	100
			Leptospermum?	0.3	10	Leucopogon lanceolatus	0.1	1	Billardiera scandens	0.1	20
									Oplismenus imbecilis	0.1	15
									Themeda triandra	10	
									Dianella caerulea	0.1	1
									Pterostylis sp.	0.2	100
									Microlaena stip.	10	
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 9

Date: 11/05/20	Job number: 1971-01	Site: Eden	Plot ID: WARK 1	Bearing: 270	Observers: IB LR TM CW SR

WARK 1 TS

Arrival time: 10am **Departure time:** **Weather:** Fine/Sunny

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	80	
10 – 19 cm	P / A	Total	2	100	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	100	
30 – 49cm	P / A		4	100	
50 -79cm	# 1	21	5	90	
>80cm	# 0	Total metres	Average	94	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

in between 2 dirt bike tracks.

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 10

Date: 11/5	Job number:	Site: Eden	Plot ID: WARK 2	Bearing: 177	Observers:

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Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Euc. umbra	30		Pultenaea spinosa	10		Themeda triandra	55	55	Lomandra filiformis	0.1	2
Corymbia mac	10		Dillwynia retorta subsp. Penduncularis	10		Imperata cylindrica	4	500	Lomandra obliqua	0.3	50
Angophora costata	10		Bursaria spinosa	0.1	1	Gonocarpus teuc.	0.2	50	Pseuderanthemum v.	0.1	20
Euc. fibrosa	10		Pultenaea villosa	5		Lobelia purpurescens	0.5	100	Entolasia marginata	0.1	5
			Acacia ulicifolia	10		Dichondra repens	0.1	5	Microlaena stipoides	0.1	5
			Epacris pulchella	0.2	20	Echinopogon caespitosus	0.1	5	Glycine microphylla	0.1	5
			Notelaea longifolia	0.1	3	Dianella caerulea	0.1	10	Centella asiatica	0.1	5
			Ochna serrulata	0.1	1	Eustrephus latifolia	0.2	50	Goodenia heterophylla	0.1	1
			Acacia longifolia	0.3	3	Entolasia stricta	0.1	10	Caesia parviflora	0.1	5
			Acacia falcata	0.1	3	Billardiera scandens	0.2	10	Paspalum dilatum	0.1	1
			Acacia terminalis	0.2	1	Oxalis perrenans	0.1	2			
			Leptospermum polygal	0.2	3	Aristida vagans	0.3	50			
			Lantana camara	0.1	1	Schengyne bellioides	0.1	5			
			Pultenaea ~~rosmarinifolia~~ euchilon	0.2	3	Panicum simile	0.1	5			
			Pultenaea flexilis	5		Poa sp.? Austrostipa?	1	50			
			Acacia myrtifolia	0.1	1	Glycine ~~clem~~ tabacina	0.1	5			
						Opercularia diphylla	0.1	1			
						Hardenbergia violacea	0.1	5			
Total Cover DO FIRST											

3.5

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, …, 1, 2, 3, …, 10, 15, 20, 25, … (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 10

Date: 11/5/2020	Job number: 1971.01	Site: Eden	Plot ID: WARW2	Bearing: 177	Observers: WM, SK

Arrival time: **Departure time:** **Weather:** Sunny 16°

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots		
				Leaf litter	Live vegetation, bare ground, rocks, etc. lv. bg
< 5 cm	P / A				
5 - 9 cm	P / A		1	95	5 nbg
10 – 19 cm	P / A	Total 1	2	20	80
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length	3	95	5 nbg
30 – 49cm	P / A	3.5m, 1.5m, 2.5m >10cm; 4m, 3m, 15.5m, 1m, 1m; 5m, 1m	4	60	40 lv
50 -79cm	#	3m >10cm	5	85	15 (10% moss).
>80cm	#	Total metre: 35	Average	71	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Rubbish (Tyres), Motorbike track,

Habitat features, comments and incidental fauna observations:

Log hollows on ground, HBT (Stag in XS, S hollows)

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 11

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:
15/2020	1971	Eden	1	24	Team Black

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E. sideroxylon (ironbark)	15%		Bursaria spinosa	0.1%	1	Hemerodia frankii	2	100+			
Corymbia maculata	5%	7	Hakea (long) Persoonia linearis	0.1%	2	Lobelia purpurascens	0.1%	100+	Pterostylis acuminata Orchidaceae sp.	0.1	20
~~Angophora costata~~	0		Pultenaea (leaf) linophylla	0.1%	5	Dianella revoluta	0.1%	5	Gonocarpus tetragynus	0.1	50
Eucalyptus umbra	0.1%	1	~~Pultenaea~~ Dillwynia sp. 3	0.1%	30	Opercularia diphylla	0.1	20	Entolasia stricta	0.1	100+
Corymbia gummifera	1%	2	Pultenaea parvifolia	0.1%	3	Entolasia marginata	0.1	30	Lepidosperma gunnii	0.1	1
~~Eucalyptus [illegible]~~			Goodenia heterophylla (holly leaf)	0.1%	1	Cymbopogon refractus	0.1	15	~~Pandorea pandorana~~		
E. acmenoides			Lantana camara	0.1%	1	Glycine clandestina (long)	0.1	10	Imperata cylindrica	2	100+
			Dianella sp. (~~Pultenaea~~)	0.5%	20	Dianella caerulea var. producta	0.1	10	Acianthus Orchidaceae sp. 2	0.1	50
			Pittosporum undulatum	0.1%	1	Billardiera scandens	0.1	5	Desmodium varians	0.1	10
			~~Polyscias sambucifolia~~			Pandorea pandorana	0.2	20	Oxalis sp.	0.1	1
			Notelaea ~~ovata~~ longifolia	0.1%	1	~~Hakea~~ Dichondra repens (long)	0.1	5	Kennedia rubicunda	0.1	1
			Gonocarpus micranthus (simple)	0.1	5	Polymeria calycina	0.1	5	Dipodium variegatum	0.1	1
						Lomandra longifolia	0.1	10	Hardenbergia violacea	0.1	20
						Pseudoanthemum var.	0.1	5	Grass sp. Dichelachne micrantha	0.1	5
						Microlaena stipoides	0.2	100+	Poa sieberiana	1	30
						~~Rupicaster~~ Lagenifera stipitata	0.1	1	Cassytha glabella	0.1	20
						Austrodanthonia (2-awn) racemosa	1	100+	Echinopogon caespitosus	0.1	15
						Dillwynia retorta	1%	10	Goodenia bellidifolia	0.2	~~5~~ 20
Total Cover DO FIRST	~~20~~ 21%			5						35	140

~~yellow flower~~ shrub Tricoryne simplex 0.1 1

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 11

Date: 11/5/2020	Job number: 1971	Site: Eden	Plot ID: 1	Bearing: 24	Observers: Team Black

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / A	0
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length
30 – 49cm	P / A	
50 -79cm	# 1	72.5m
>80cm	# 0	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	75%	Bare 0% live 25%
2	85%	Bare 0% live 15%
3	90%	Bare 0% live 10%
4	80%	Bare 0% Rocks 10% live 10%
5	75%	Bare 0% live 25%
Average		

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Fire disturbance. Not weedy, Rock outcrop present

Habitat features, comments and incidental fauna observations:

Shinks (unknown) Great wren, Mask lorikeet, ~~Great wren~~
magpie, spider Grey fantail, minor, rainbow lorikeet
? Grey Shrike-thrush spp?

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 12

Date: 12/05/20	Job number: 1971.01	Site: Eden Estate.	Plot ID: 1590	Bearing: 44°	Observers: Brook + Warrick

ACEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum 80	C	Ab	Lower stratum	C	Ab
Corymbia maculata.	35	1	Leptospermum trinervium	0.5	1	Lomandra longifolia	2	1	Acianthus sp. fornicatus	0.1	30
Euc. punctata.	5	2	Acacia bp. irrorata.	0.5	150	Microleana stipiodes.	80	1	Macrozamia flexuosa	0.1	1
Euc. fergusonii subsp. fergusonii	10	5	Acacia longifolia.	0.7	200	Imperata cylindrica.	0.5	1	Clematis aristida.	0.2	20
			Hardenbergia violacea	1	100	Pratia purpurescens	1		Senecio diastachos	0.1	30
Syncarpia glomifera.	0.5	2	Melaleuca styphelioides	1	740	Ophiopogon imbecillis	1.0	1	Zieria smithii	0.1	3
Stringybark globoidia	1	2	Pult. hary. villosa. (Pultenaea)	0.3	50	Adiantum aethiopicum.	0.5	1	Desmodium varians.	0.2	30
Melaleuca styphelioides	6	1	Pultenaea linaphylla obcordata.	0.2	30	Entolasia stricta.	5	1	Glycine clandestina ~~microphylla~~	0.2	50
Allocasuarina torulosa.	0.8	3	Notelaea ~~ovata~~ longifolia	0.1	3	Dianella caerulea var producta	0.1	1	~~Restionaceae~~ Xanthorrhoea sp.	0.1	3
mahogany.	1	2	Goodenia ovata	0.1	3	Dioscorea transversa.	0.3	1	Kennedia rubicunda.	0.2	30
E. umbra (probable)			Lantana camara	0.1	2	Panicum simile.	0.2	1	Cassytha glabrata.	0.1	3
both young. very little fruit detected			Smilax australis.	1	20	Brunoniella australis	0.1	30	Galium ~~propinquum~~ binnulorum	0.1	20
			Acacia ulicifolia ~~ericifolia~~.	0.1	2	Breynia oblongfolia.	0.1	3	Conyza sp.	0.1	1
			RF Sp. Dubosia myoporoides	0.2	30	Glochidion ferdinandi	0.1	2	Liliacea Arthropodium milliflorum	0.1	40
			Bursaria spinosa.	0.1	2	Acrotriplesium cymosum.	0.2	15	Orchidacea Pterostylis sp.	0.1	40
			Ochna serrulata	0.1	1	Hydrocotyl peduncularis.	0.2	100	Pandorea pandorana.	0.2	50
			Acacia myrtifolia	0.1	1	Dichondra repens.	0.3	200	~~Ger~~ Rhytidosperma pallidum.	0.1	1
			Backhousia myrtifolia.	0.1	4	Gahnia subsecundus.	0.1	1	Solanum prinophyllum	0.1	3
						Cayratia clematida.	0.1	5	Lomandra multiflora.	0.1	20
Total Cover DO FIRST	60			10		Hibbertia aspera	0.1	5	Goodenia hederacea.	0.1	3

Oxalis perennans. 0.1 2
Lomandra brevis 0.1 1
Gonocarpus teucroides 0.1 20

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants. ~~opp herb~~

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 12

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / A	
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length
30 – 49cm	P / A	
50 -79cm	#	
>80cm	#	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1		
2		
3		
4		
5		
Average		

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

→ Site affected by fire within last 2 years.
→ tracks (dirtbike) just downstream.

Eucalyptus homiamum	0.1	10	✓
Lerdyna einarea.	0.1	2	✓
Pseudoeranthemum variabile	0.2	60	✓
Cymnostachys anceps.	0.1	5	✓
Echinopogon caespitosis	0.2	20	✓

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 12

Date: 12/5/20	Job number: 1971.01	Site: EDEN	Plot ID: 1590.1	Bearing: 044°	Observers: WM BC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:** Sunny

1000m² plot **Mapped Vegetation community:** 1590

Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	95	5% live
10 – 19 cm	P / A	Total	2	70	5% live 20 bare 5 stony trunk
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	95	5% live
30 – 49cm	P / A	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ III	4	65	35 ~~leaf~~ litter bare
50 -79cm	# 1		5	90	5 bare 5 live
>80cm	#	Total metres 18	Average	83	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Fire damage regrowth

Habitat features, comments and incidental fauna observations:

Some loose rocks

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Glycine microphylla
Desmodium varians

PLOT 13 * 'Plot 13

Date: 18/5	Job number:	Site: Eden	Plot ID: PN1	Bearing:	Observers: TM JC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E. acmenoides	25		Acacia ulicifolia	2		Themeda triandra	20		Aristida vagans	0.2	50
E. punctata	4	6	Lantana	1		Microlaena stipoides	15		Lomandra filliformis	0.1	20
C. maculata	25		Daviesia ulicifolia	0.1	3	Lepidosperma laterale	0.2	5	Imperata cylindrica	0.3	50
Ironbark	1	6	Notelaea longifolia	0.1	1	Lobelia purpurescens	1	100	Dichelachne micrantha	0.1	5
~~E. paniculata~~			Breynia oblongifolia	0.1	1	Opercularia ~~varia~~ diphylla	0.1	5	Lomandra multiflora	0.3	5
E. Siderophloia			Pittosporum undulatum	0.1	2	Dianella caerulea var producta	1	40	Fireweed	0.1	1
			SL Privet	0.1	1	Echinopogon caespitosus	0.1	10	Dichondra repens	0.1	10
			Persoonia linearis	0.1	2	Dianella longifolia	0.2	15	Geitnoplesium cymosum	0.1	5
						Cymbopogon refractus	0.1	2	Cayratia clematidea	0.3	20
						Entolasia marginata	10		Desmodium varians	0.1	10
						Oplismenus aemulus	0.1	2	~~Veronica~~ Cyanthillium cinereum	0.1	5
						Desmodium rhytidophyllum	0.3	40	Digitaria parviflora	0.1	10
						Billardaria scandens	0.1	5	Caesia parviflora var. vittata	0.1	10
						Pseuderanthemum variable	0.1	15	Solenogyne bellioides	0.1	10
						Glycine tabacina	0.1	20	Chorizema parvifolium	0.1	1
						Hibbertia aspera	0.3	20	Panicum simile	0.1	2
						Gonocarpos tetragynus	0.1	10	Pandorea pandorana	0.1	1
						Hardenbergia violacea	0.1	10	Cheilanthes seiberi	0.1	5
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

canopy ≈ 55% 25 25 5

shrub ≈ 3

GC ≈ 45-50%

(5.2)

PLOT 13 * 'Plot 13'

Date: 18.5.21	Job number: 19716	Site: Eden Estate Wallsend	Plot ID: PN1	Bearing: 236°	Observers: TM, JC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	95	
10 – 19 cm	P / A	Total	2	100	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	95	
30 – 49cm	P / A	1, 7, 1, 3, 8	4	95	
50 -79cm	# 1, 1		5	95	
>80cm	#	Total metres	Average		

Plot Disturbance: **(weediness, clearing, erosion, edge effects, grazing, fire, other)**

Trail through plot near the end NPNLF

Habitat features, comments and incidental fauna observations:

2 fallen trees

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 14

*'~~PO~~ Plot 14'

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 18/5/20	Job number:	Site: Eden	Plot ID: PN2	Bearing:	Observers: TM JC

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	38		Acacia ulicifolia	23		Themeda triandra	30		Glycine tabacina	0.2	50
E. acmenoides	10		Acacia falcata	0.2	5	Imperata cylindrica	10		Eustrephus latifolia	0.2	50
E. punctata	0.5	2	Daviesia ulicifolia	1.2	8	~~Poa affinis~~ ?			Oplismenus aemulus	0.1	20
E. paniculata	~~0.25~~ 1.5	2	Lantana	0.1	3	Microlaena stip.	2		Desmodium varians	0.1	20
			Breynia oblongifolia	0.1	1	Dianella caerulea var. producta	1		Hardenbergia violacea	0.2	20
			Camphor laurel	0.1	1	Aristida vagans.	0.1	20	Pandorea pandorana	0.3	50
			Smelly Shrub (sample)	0.2	10	Lobelia purpurescens	5		~~Marsdenia~~ (clear sap) ~~0.1~~		
			Persoonia linearis	0.1	1	Desmodium rhytidophyllum	0.1	15	Acianthus (photo)	0.2	50
			Pultenaea retusa	0.1	1	Dichondra repens	~~0.5~~ 1	90	Pseuderanthemum variable	0.2	50
						Lepidosperma laterale	0.1	5	Oxalis perennans	0.1	20
			Platysace lanceolata			Caesia parviflora	0.1	10	Cheilanthes seiberi	0.1	20
						Echinopogon caespitosus	0.1	10	Panicum simile	0.3	50
						Glycine tabacina ~~Microlaena~~	0.1	20	Billardaria scandens	0.1	15
						Solenogyne bellioides	0.1	5	Cayratia clematidea	0.2	30
						Lomandra (sample)	0.1	5	Pterostylis sp.	0.1	20
						Entolasia marginata	0.2	20	Hydrocotyle sibthorpioides	0.1	20
						Galium binifolium	0.1	1	Digitaria parviflora	0.1	10
						Phyllanthus hirtellus	0.1	1	Dichelachne micrantha	0.1	10
Total Cover DO FIRST						Persoonia straminea	0.1	1	Bidens pilosa	0.1	1

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Canopy ≈ 50 - 55%
Shrub ≈ 25%
GC ≈ 50 - 60%

(4%)

PLOT 14 *'Plot 14'

Date: 18.5.20	Job number: 1971.01	Site: Eden Estate Wallsend	Plot ID: PN2	Bearing: 107°	Observers: TM, JC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 12:50 **Departure time:** **Weather:** Rain prior, cloudy.

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	95	
10 – 19 cm	P / A	Total	2	95	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	~~95~~ 90	
30 – 49cm	P / A	4, 2, 6, 3, 3, 5, 1, 4, 3	4	95	
50 -79cm	# 1		5	95	
>80cm	#	Total metres 31	Average	94	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Post fire: 1-2 yrs.

Habitat features, comments and incidental fauna observations:

Many fallen logs, Musk lorikeets, Bell minors

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 15

Date: 19/5/20	Job number: 1971.01	Site: Eden	Plot ID: P15	Bearing: 155°	Observers: TM SK

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	35		Pultenaea spinosa	0.1	5	~~Poa?~~ Phytidosperma pallidum	25		Xanthorrhoea sp.	1	
E. acmenoides	15		Pultenaea retusa	0.1	3	Entolasia marginata	5		(Media or resinosa?)		
E. fibrosa.	2	5	Daviesia ulicifolia	3	5	Thomeda triandra	10		Acianthus fornicatus	0.1	50
			Acacia ulicifolia	0.1	1	Lomandra obliqua	3	100	Imperata cylindrica	0.1	20
			Persoonia linearis	0.1	1	Dianella caerulea var producta	0.2	10	Mirbelia rubifolia	0.1	1
						Entolasia stricta	5				
						Microlaena stipoides	0.1	10			
						Aristida vagans	0.2	50			
						Lobelia purpurescens	0.1	5			
						Lepidosperma gunnii	0.1	1			
						Pseuderanthemum variable	0.2	20			
						~~Gonocarpos~~					
						~~Xanthorrhoea~~					
						Hardenbergia violacea	0.1	2			
						Billardiera scandens	0.1	5			
						Lomandra filiformis	0.1	5			
						Gonocarpos tetragynus	0.1	10			
						Gonocarpos teucroides	0.1	10			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Canopy ≈ 50 - 55 %
Shrub ≈ 3 - 5 %
GC ≈ 45 - 50 %

PLOT 15

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 19/5/2020	Job number: 1971.01	Site: EDEN	Plot ID: P15	Bearing: 155°	Observers: SK TM

Arrival time: 1020 **Departure time:** 1230 **Weather:** SUNNY, PARTLY CLOUDY

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / A	4 STAGS WITH XS HOLLOWS/CRACKS/FISSURES.
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	P / A	1 1 0.5
50 -79cm	#	2 1.5 1
		2 2
>80cm	#	Total metres 11m

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	95	
2	95	
3	80	
4	75	
5	95	
Average	88	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

NONE

Habitat features, comments and incidental fauna observations:

LORIKEET SP, UNIDENTIFIED BIRDS x 2

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 16

Date: 19/5/20	Job number: 1971.01	Site: Eden	Plot ID: P16	Bearing:	Observers: TM SK

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	30		Melaleuca nodosa	1		Themeda triandra	20		Hypochaeris radicata	0.1	1
E. acmenoides	15		Dodonaea triquetra	8		Lobelia purpurescens	15		Pseuderanthemum variable	0.3	50
E. punctata	10		Acacia ~~suaveolens~~ stricta	5		Microlaena stip.	0.3	20	Solanogyne bellioides	0.3	50
E. siderophloia Ironbark	3	3	Acacia ulicifolia	2		Hydrocotyl penduncularis	0.1	10	Lomandra multiflora	0.3	25
(E. globoidea)			Pultenaea villosa	~~[illegible]~~	40	Oplismenus aemulus	0.1	10	Hardenbergia violacea	0.3	
Outside Plot			Hovittea variablis	0.1	1	Dianella caerulea var Producta	0.6	40	Desmodium varians	0.1	5
			Pittosporum undulatum	0.1	1	Panicum simile	0.8	30	Glycine tabacina	0.2	50
			Leucopogon juniperinus	0.1	1	Entolasia stricta	1	50	Glycine microphylla	0.1	50
			~~Zieria~~			Pandorea pandorana	0.2	20	Glycine clandestina	0.2	50
			~~Ch.~~ Pittosporum multiflorum	0.1	5	Aciamthus (Photo) formicatus	5		Operularia diphylla ~~aspera~~	0.1	10
			Pultenaea retusa	0.1	5	Pterostylis sp.	5		Lomandra filliformis	0.1	10
			Pomaderris ferrugynea	0.8		Caesia parviflora	0.3	20	Zieria smithii	0.1	10
						Dichondra repens	0.2	10	Goodenia heterophylla heterophylla s-bsp	0.1	1
						Billardaria scandens	0.1	10	Dioscera transversa	0.2	5
						Echinopogon caespitosus	0.2	20	Veronica plebia	0.1	5
						Eustrephus latifolia	0.2	30	Aristida vagans	0.2	20
						Cayratia clematidea	0.1	10	Imperata cylindrica	0.7	100
						Gonocarpos teucroides	0.1	20	Digitaria parviflora	0.1	1
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Canopy - 60
Shrub - 15 - ~~10~~ 20
GC - 50 - 55

(~~5.8~~) 6.3

PLOT 16

Date: 19/5/2020	Job number: 1971.1	Site: EDEN	Plot ID: P16	Bearing: 35°	Observers: SK TM

ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 1325 **Departure time:** **Weather:** Partly Cloudy

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A	HBT 074		Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A		1	~~80~~ 70	
10 – 19 cm	P / A	Total 1	2	60	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	98	
30 – 49cm	P / A	2 2 1	4	90	
50 -79cm	# ~~||||~~ 4	1 1 79	5	95	
>80cm	# | 1	Total metres 23m	Average	83	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Bike track, Regen after fire, burnt logs/blackened bark.

Habitat features, comments and incidental fauna observations:

Scattered sandstone rocks, potential burrows & holes/cracks amongst rocks

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 17

Done

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 19/05/28	Job number: 1971.01	Site: Eden	Plot ID: P17	Bearing: 280	Observers: YB

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E. piperita	25	6	Persoonia linearis	1	5	Imperata cylindrica	2	100	Senna pendula var glabrata	0.1	2
Syncarpia glomulifera	20	10	Allocasuarina torulosa	1	5	Pteridium esculentum	10	100	Lomatia camara	0.1	3
E. acmenoides	1	2	Pittosporum undulatum	0.5	5	Pratia (Lobelia) purpurascens	0.5	100	Glycine clandestina	0.1	20
A. costata	1	2	Polyscias sambucifolius	0.2	20	Microlaena stipoides	0.2	50	Desmodium varians	0.1	20
C. gummifera	15	5	Glochidion ferdinandii	0.1	2	Oplismenus imbecillis	0.5	100	Viola hederacea	0.1	10
C. maculata	2	1	Breynia oblongifolia	0.1	5	Dianella caerulea var prod.	0.1	20	Gentanopsium cymosum	0.1	5
E. punctata	2	2	Omalanthus (Homalanthus) populifolius	0.1	5	Adiantum aethiopicum	0.5	50	Cayratia clematidea	0.1	1
E. umbra	0.1	2	Elaeocarpus reticulatus	0.1	5	Blechnum cartilagenum	2	50	Lomandra sp. Pillifaniis	0.1	10
E. sideroxylon?	5	1	Callistemon salignus	0.5	1	Themeda triandra	5	100	Arthropodium mellflorum	0.1	50
Leptospermum polygalifolium	0.1	2	Notelaea longifolia	0.1	1	Clematis aristata	1	20	Nephrolepis cordifolia	0.1	10
			Smilax glycophylla	0.5	10	Pseudoraphanus variabile	0.1	50	Asparagus aethiopicus	0.1	5
			Lepidosperma laterale	0.2	10	Billardiera scandens	0.1	10	Ligustrum sinense	0.1	10
			Hibbertia scandens	0.2	10	Hardenbergia violacea	0.1	5	Cinnamomum camphora	0.1	2
			Oxalis perennans	0.1	5	Pandorea pandorana	0.5	10	Ochna serrulata	0.1	2
			Acacia ulicifolia	0.1	1	Entolasia stricta	0.5	50	Phoenix canariensis	0.1	1
			Gymnostachys anceps	0.1	1	Entolasia marginata	0.1	20	~~Running weed~~	~~0.1~~	~~1~~
			Echinopogon caespitosus	0.1	10	Desmodium rhytidophyllum	0.1	10	Calochlaena dubia	2	50
			Sigesbeckia orientalis	0.1	5	Acanthus sp.	0.8	500	Dichondra repens	0.1	50
Total Cover DO FIRST	55%		Xanthorrhoea latifolia	0.5	10	Galium sp. binifolia	0.1	10	Bidens pilosa	0.1	5
									Digitaria parviflora	0.1	5
									~~Lomandra longifolia~~	0.1	5

(35 %)

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 17

Date: 19.05.20	Job number: 1971.01	Site: Eden	Plot ID: P17	Bearing: 280	Observers: YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:** Sunny

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A	1 – OE punctata
5 - 9 cm	(P) / A	
10 – 19 cm	(P) / A	Total
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	(P) / A	𝍸 𝍸 𝍸 ||
50 -79cm	# 𝍸 |	
>80cm	# |	Total metres ~~12m~~ 17m

Leaf Litter Cover within 5 x 1m² sub-plots

Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect

Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.

Also include dead material attached to living plants that is touching the ground. .

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	95	
2	90	10cm dbh tree in subplot
3	60	30cm dbh tree in subplot
4	90	
5	90	
Average	85	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

light weed cover / mostly lantana but also herbaceous / some rubbish

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

✓100

PLOT 18

Done

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 20.5.20	Job number: 1971.01	Site: Eden	Plot ID: P18	Bearing: 82	Observers: YB

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	25	15	Daviesia ulicifolia	0.2	3	Austrida vagans	2	100	Cassytha glabella	0.5	20
E. fibrosa	20	10	Clerodendrum tomentosum	0.1	1	Entolasia stricta	15	500	oxalis perennans	0.1	2
E. umbra	2	3	Phyllanthus hirtellus	0.1	10	Imperata cylindrica	1	100	lagenophora stipitata	0.1	10
E. punctata	5	1	Gonocarpus teucrioides	0.5	20	Microlaena stipoides	1	50	Brunonella australis	0.2	100
			~~Pultenaea scabra~~ Hibbertia aspera	0.1	2	~~Babelia~~ Lobelia purpurascens	0.5	100	Eustrephus latifolius	0.1	2
			Pultenaea villosa	0.1	5	Lomandra ~~Plantaginda~~ multiflora	1	50	Opercularia diphylla	0.1	20
			Bossiaea (Bursaria) spinosa	0.1	2	Dianella caerulea var. producta	0.2	10	Cyanthillium cinereum	0.1	5
			Acacia ulicifolia	0.1	2	Lomandra filiformis	0.5	20	Lantana camara	0.1	1
			Bossiaea oblong	0.1	1	Hardenbergia violacea	0.1	5	Glycine ~~tabacinadostma~~	0.1	10
			Persoonia linearis	0.1	1	Paspalidium distans	0.1	10	Desmodium varians	0.1	2
						Grass 1 poaceae	0.1	2	Brunonella (purple under)	0.1	20
						Lepidosperma laterale	0.2	5	~~Lo~~ pseudoanthemum variabile		
						Dichelachne micrantha	0.1	10			
						Ryticdosperma pallidum	0.5	10			
						Goodenia heterophylla sub glandulosa	0.1	5			
Total Cover DO FIRST	50			1.5			20				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

5 trees 8 shrubs

1 vid

PLOT 18

Date: 20/5/2020	Job number: 1971.01	Site: EDEN	Plot ID: P18	Bearing: 82	Observers: SK YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 900 **Departure time:** 1100 **Weather:** SUNNY, PARTLY CLOUDY

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / A	
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total 1
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	P / A	122
50 -79cm	# IIII 4	44
>80cm	# – 0	Total metres 13m

Leaf Litter Cover within 5 x 1m² sub-plots

Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect

Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.

Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	98	
2	75	
3	98	
4	95	
5	98	
Average	93	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Bike tracks

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

JVS

PLOT 19

Date: 20/5/20	Job number:	Site: Eden	Plot ID: P19	Bearing:	Observers: TM JC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	20		Hibbertia aspera	0.4	20	Rytidosperma pallida	15		Glycine tabacina	0.1	10
E. acmenoides	3		Pultenaea villosa	0.1	2	Lomandra long.	2	20	~~Vernonia~~ Cyanthillium cinereum	0.1	10
E. fibrosa	25		Pittosporum undulatum	0.1	1	Entolasia stricta	0.3	20	Microlaena stip.	0.1	5
			Lantana	0.1	1	Lomandra filiformis	0.2	50	Cinnamomum camphora laurel	0.1	1
						Pseudoraphis variabilis	0.4	100	Dianella caerulea var producta	0.2	
						Eustrephus latifolia	0.2	40	Paspalidium distans	0.1	1
						Caesia parviflora	0.1	10	Pterostylis sp.	0.2	40
						Dichelachne micrantha	0.1	5	Desmodium rhytidophyllum	0.1	1
						Galium binifolium	0.1	5	Themeda triandra	0.1	2
						Lobelia purpurascens	0.1	10	Glycine microphylla ~~micrantha~~	0.1	2
						Imperata cylindrica	0.2	50	Cassytha glabra	0.1	5
						Lomandra multiflora	0.3	20			
						Adiantum ~~(photo)~~ formicatum	0.1	20			
						Opercularia ~~aspera~~ diphylla	0.1	50			
						Ganocarpos teucroides	0.1	20			
						Solenogyne bellioides	0.3	50			
						Hardenbergia violacea	0.1	5			
						Pomderrea pomderrana	0.1	10			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

Canopy - 45-50

GC = 15 - [illegible]

(411)

PLOT 19

Date: 20.5.20	Job number: 1971.01	Site: Wallsen Eden Estate	Plot ID: P19	Bearing: 203°	Observers: TM + JC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 0915 **Departure time:** **Weather:** Fine

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	95	
10 – 19 cm	P / A	Total	2	98	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	100	
30 – 49cm	P / A	2, 1, 1, 1 = 2	4	95	
50 -79cm	# 1, 1		5	100	
>80cm	#	Total metres 7	Average	98	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

MTB Track along ridgline, ≈30m from plot

Habitat features, comments and incidental fauna observations:

Regrowth forest. Dominated by thin, young eucalypts and spotted gums

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 20

Date: 20.5.20	Job number: 1971.01	Site: Eden	Plot ID: P20	Bearing: 318°	Observers: YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	10	15	Melaleuca rhodosa	2	10	Rytidosperma pallidum	25	100	Opercularia diphylla	0.1	20
E. fibrosa	20	5	Leptospermum polygalifolium	2	20	Entolasia stricta	5	500	Brunonella australis	0.2	50
E. globoidea	5	10	Daviesia ulicifolia	0.5	3	Imperata cylindrica	0.1	20	Arthropodium milleflorum	0.1	5
E. propinqua	10	5	Bursaria spinosa	0.2	5	Lomandra longifolia	0.5	20	Lagenophora stipitata	0.1	20
A. costata	1	3	Phyllanthus hirtellus	0.1	20	Lomandra obliqua	1	50	Cassytha glabella var glab	0.1	2
			Pultenaea villosa	0.1	5	Dianella caerulea var. producta	0.2	20	Desmodium varians	0.1	5
1 Pseudonanthemum variabile	0.1					Microlaena stipoides	0.5	100	Goodenia heterophylla sub glandulosa	0.1	10
						Themeda triandra	0.1	20	Brunonella lhl (purple underneath)	0.1	50
						Lepidosperma laterale	0.5	20	Glycine clandestina	0.1	5
						Gonocarpus teucrioides	0.1	20	Cyanthidium cunninghamii	0.1	2
						Lomandra filiformis	1	50	Lobelia purpurascens	0.1	5
						Lomandra multiflora	1	20	Clematis aristata	0.1	1
						Dianella revoluta	0.1	10			
						Aristida vagans	0.1	20			
						Paspalidium distans	0.1	20			
Total Cover DO FIRST	40			5			40				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 20

Date: 20/5/2020	Job number: 1971.01	Site: EDEN	Plot ID: P20	Bearing: 318°	Observers: SK YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 1130 **Departure time:** **Weather:** Sunny Partly Cloudy

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots		
			Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A	4		Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A		1	90	
10 – 19 cm	P / A	Total 0	2	95	
20 – 29 cm	P / A	**Length of logs (m)** **Note:** >10cm diameter, >50cm length	3	97	
30 – 49cm	P / A	1.5 3 2 8 4 2	4	95	
50 -79cm	# 11 2	2 2 2.5	5	99	
>80cm	# 0	Total metres 25m	Average	95	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Bike track

Habitat features, comments and incidental fauna observations:

Some logs hollow

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

JMP

PLOT 21

Date: 20.5.20	Job number: 1971.01	Site: Wallsend Eden Estates	Plot ID: P21	Bearing:	Observers: TM, JC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Corymbia maculata	30		Acacia ulicifolia	0.3	1	Lobelia purpurascens	0.1		Vernonia cinerea	0.1	10
Angophora costata	0.5	1	Daveisea ulicifolia	0.4	5	Hardenbergia violacea	0.1	20	Solenogyne bellioides	0.1	20
~~Euc. umbra~~			Acacia stricta	0.8	8	Imperata cylindrica	0.2	50	Glycine tabacina	0.1	10
~~Euc. propinqua~~			Pultenaea villosa	0.4	20	Eustrephus latifolius	0.2	40	Caesia parviflora	0.1	5
Euc. fibrosa	4	2	Hibbertia aspera	0.4	20	Lomandra multiflora	10		Oxalis perennans	0.1	10
Euc. acmenoides	1	4	Leucopogon lanceolatus	0.3	4	Acianthus fornicatus	0.2	50	Aristida vagans	0.1	10
(~~punctata adjacent to plot~~)			Lantana	0.1	2	Gonocarpus teucreides	0.1	20	Lomandra filiformis	0.3	30
E. punctata	2.5	1	~~Bossiaea~~			Hypolepsis muelleri	0.1	1	Panicum simile	0.1	10
(E. propinqua ~~adj to plot~~)	1	1	Pittosporum multiflorum	0.2	2	Entolasia marginata	0.1	10	Adiantum aethiopicum	0.1	10
			Notelaea longifolia	0.1	2	Microlaena stipoides	1		Goodenia heterophylla	0.1	5
E. sideroxylon	1	1				Oparularia diphylla	0.3		Rytidiosperma pallidum	0.1	2
						Dianella caerulea var. producta	0.5		Entolasia stricta	5	
						~~Bossiaea spinescens~~					
						Poa affinis	5				
						Lepidosperma laterale	0.4				
						Galium binifolium	0.1	5			
						Veronica plebia	0.1	5			
						Pseuderanthemum variabile	0.5				
Total Cover DO FIRST	40%			4%							

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

(4.2)

GC - 25

PLOT 21

Date: 20.5.20	Job number: 19710	Site: Wallsend Eden Estate	Plot ID: P21	Bearing: 235	Observers: *M, JC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:** Fine

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	(P) / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A	0	1	95	
10 – 19 cm	(P) / A	Total	2	98	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	95	
30 – 49cm	(P) / A	5, 2, 3, 12	4	100	✓
50 -79cm	# 11 2		5	100	
>80cm	#	Total metres 22	Average	98	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

MTB tracks crosses out of plot, within transect

Habitat features, comments and incidental fauna observations:

Large, hollow dead log fallen on ground. ≃ 12m

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 22

Date: 20.5.20	Job number: 1971.01	Site: Eden	Plot ID: P22	Bearing: 281	Observers: YB

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E. umbra	10	1	Acacia longissima	0.5	5	Lomandra longifolia	15	50	Pseudoanthemum variabile	0.5	100
E. sideroxylon	25	5	Eustrephus latifolius	0.1	3	Opleismenus imbecilis	0.2	20	Lantana camara	2	20
E. propinqua	5	2	Pandorea stromnea	0.1	5	Paspalidium distans	0.1	20	Cymbidium canaliculatum	0.1	10
C. maculata	8	3	Chlenodendrum tomentosum	0.1	20	Lobelia purpurascens	0.2	50	Desmodium varians	0.1	5
~~E. umbra~~			Geitonoplesium cymosum	0.2	10	Imperata cylindrica	0.1	20	Cymbopogon refractus	0.1	1
E. acmenoides	2	10	Hardenbergia violacea	0.1	2	Brunonella australis	0.1	20	Desmodium rhytidophyllum	0.2	10
			Dianella celastroides	0.1	10	Entolasia stricta	1	100	Opposite leaved vine 1	0.1	10
			Cayratia clematidea	0.1	1	Lomandra filiformis	0.1	10	Lagenophora stipitata	0.1	5
			Hibbertia scandens	0.2	5	Lomandra multiflora	0.1	10	Desmodium gunnii	0.1	20
			Bursaria spinosa	0.1	2	Cymbopogon refractus	0.5	50	Oxalis perennans	0.1	5
			Indigofera australis	0.1	2	Lepidosperma laterale	0.5	20	Dichelachne micrantha	0.1	5
			Dioscorea transversa	0.1	1	Digitaria parviflora	0.1	5	Dianella revoluta	0.1	2
Hibbertia aspera			~~Pultenaea euchila~~	0.2	5	Microlaena stipoides	1	100	Rytidosperma pallidum	0.5	20
			Clematis aristata	0.1	10	Dianella caerulea var producta	0.5	20	Oxalis perennans	0.1	2
						Aristida vagans	0.5	20	Gymnostachys anceps	0.1	1
						Sigesbeckia orientalis	0.1	5	Tylophora barbata 2		
						Arthropodium milleflorum	0.1	2			
						Pandorea pandorana	0.1	1			
Total Cover DO FIRST	50						25				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 22

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 20/5/2020	Job number: 1971.1	Site: Gocu	Plot ID: P22	Bearing: 281	Observers: SK YB

Arrival time: 1330 **Departure time:** 1500 **Weather:** Sunny Partly Cloudy

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / A	
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total 0
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	P / A	15 2 2 2 2 3 1 1.5 0.5 1
50 -79cm	# 11 2	
>80cm	# 1 1	Total metres 30m

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	98	
2	98	
3	99	
4	85	
5	90	
Average	94	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Lantana (light)

Habitat features, comments and incidental fauna observations:

Scattered rocks & fallen trees

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

✓ KB

PLOT 23

Date: 20/5/20	Job number: 1971.01	Site: Eden	Plot ID: P23	Bearing:	Observers: TM JC

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Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Syncarpia glom.	12		Acacia longisima	0.8		Oplismenus aemulus	5		Clematis aristata	0.1	5
Allocas. torulosa	3	2	Lantana	0.5		Dianella caerulea	0.5	20	Pampas Grass	0.1	1
E. propinqua	6		Glochidion ferdinandi	0.1		Adiantum fornicatus	5		Pandorea pandorana	0.1	5
E. punctata	30		Notelaea longifolia	0.1	1	Poa affinis	5		Eustrephus latifolia	0.2	20
E. acmenoides	10		Acacia longifolia	0.8		Pterostylis sp.	0.5	100	~~Dianella caerulea~~		
C. maculata	0.5	2	Synanum glandulosum	0.5		Lobelia purpurescens	5		Hydrocotyl sibthorpioides	0.3	50
			SL privet	0.1	1	Sdengyne bellioides	0.2	20	Entolasia stricta	0.1	5
			~~Clero~~ Clerodendrum tomentosum	0.1	1	Imperata cylindrica	0.5	100	Lepidosperma laterale	0.5	5
						Glycine tabacina	0.2	30	Veronica plebia	0.3	35
						Pseuderanthemum variabile	1		Entolasia marginata	0.1	20
						Microlaena stipoides	2		Cayratia clematidea	0.1	1
						Smilax australis	1		Geranium solerandii	0.3	50
						Dioscorea transversa	1		Tylodon paniculata (sample) ~~Cynanchum~~	0.1	2
						Adiantum aethiopicum	3		Lomandra long	0.3	1
						Hypolepsis meuleri	10		Hardenbergia violacea	0.1	1
						Desmodium varians	0.5	100	~~Entolasia stricta~~		
						Marsdenia rostrata	2		Hibbertia dentata	0.1	1
						Ganocarpos teucrioides	0.3	50	~~Veronica~~ Cyanthillium cinereum	0.1	5
Total Cover DO FIRST				3.4%		~~Clero~~ Centella asiatica	0.2	30	Gymnostachys anceps	0.5	15
									Sarcopetalum harveyanum	0.1	1
									Viola hederacea sub. perrinii	0.2	20
									Rough Fern (sample) Doodia aspera	20	100

(4.5) 52

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

GC. - 60%

PLOT 23

Date: 20.5.20	Job number: 1971.01	Site: Wallsend Eden Estate	Plot ID: P23	Bearing: 064°	Observers: TM, JC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 1400 **Departure time:** **Weather:** Fine

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	(P) / A	1, 1		Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A		1	98	
10 – 19 cm	(P) / A	Total 2	2	95	
20 – 29 cm	(P) / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	98	
30 – 49cm	(P) / A	4, 11, 2, 1, 2	4	98	
50 -79cm	# ~~IIII~~ I 6		5	90	
>80cm	#	Total metres 20	Average	96	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Large, fallen hollow log in plot. Medium - large sized rocks.

HBT. New WPs
'HBT01', 1 med hollow, Mahogany
'HBT02' 1 sml hollow, Grey gum

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 24

Date: 28.5.26	Job number: 1971.01	Site: Eden	Plot ID: P24	Bearing: 275°	Observers: YB+JC

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Corymbia citriodora	2	1	Acacia salicina	5	20	Chloris gayana	35	200	Daucus carota	0.1	50
			Acacia falcata	10	20	Setaria sphacelata	40	500	Lysimachia arvensis	0.1	10
			Acacia linifolia	40	50	Andropogon virginicus	2	50	Cirsium vulgare	0.2	20
			Lantana	5	10	Melinis repens	0.5	20	Gamochaeta sp.	0.1	20
						Ageratina adenophora	0.1	2	Verbena bonariensis	0.5	200
						Briza subaristata	0.1	10	Plantago lanceolata	0.1	5
						Vot~~pex~~ dichelachne micrantha	0.1	10	Lobelia purpurascens	0.1	20
						Hypericum perforatum	0.5	20	~~Microlaena stipoides~~		
						Hardenbergia violacea	0.1	1	Bidens pilosa	0.1	20
									Medicago sp.	0.1	5
									Conyza sp.	0.2	20
									Glycine clandestina	0.1	1
									Desmodium varians	0.1	2
									Solanum pinnatum	0.1	2
									Senecio madagascariensis	0.1	5
						Senecio pterophorus			exotic aster	0.1	2
						Facelis retusa			Parentbena	0.1	5
									tall grass species	0.1	10
Total Cover DO FIRST				60			80				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 24

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 28-5-20	Job number: 19716	Site: Wallsend-Eden	Plot ID: 24	Bearing: 275	Observers: YB, JC

Arrival time: 08 45 **Departure time:** **Weather:** Fine, rain preceding throughout the week.

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / A	
5 - 9 cm	(P) / A	
10 – 19 cm	P / A	Total 0
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	P / A	3 5
50 -79cm	#	1 4
>80cm	#	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	60	
2	90	
3	80	
4	80	
5	60	
Average	74	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

High weed cover

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 25

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 28.5.20	Job number: 1971.01	Site: Eden	Plot ID: P 25	Bearing: 54°	Observers: YB+JC

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	35	50	Daviesia ulicifolia	1	20	Dianella caerulea var producta	0.1	2	Chloris gayana	2	50
E. acmenioides	2	1	Acacia saligna	5	20	Cynodon dactylon	0.1	1	Verbena bonariensis	0.1	10
Dendrophthoe vitellina	0.5	5	Glochidion ferdii	0.1	5	Veronica plebeiva	0.1	1	Hypochaeris rad	0.1	20
Angophora costata	0.1	2	Hardenbergia viola	0.1	5	Solanum pseudocapsicum	0.1	5	Andropogon virginicus	0.1	50
E. ~~sideroxylon~~ pannularis?	0.5	1	Pittosporum undulatum	0.1	1	Desmodium rotundifolium	0.1	2	Melinis repens	0.1	50
E. propinqua?	5	2	Acacia parvipinnula	0.1	1	Dichelachne micrantha	0.1	5	Exotic aster (species P24)	0.1	5
						Senecio pterophorus			Daucus carota	0.1	10
									Bidens pilosa	0.1	20
									Lantana	0.1	10
									Chrysanthemoides monilifera rotundata	0.1	1
									Setaria sphacelata	0.5	20
									Cenchrus clandestinus	0.1	5
									Conyza bonariensis	0.1	5
									Gamochaeta pensylvanica sp.	0.1	2
									Lysimachia arvensis	0.1	1
									Senecio madagascar	0.1	2
									Tapnoot weed	0.1	1
Total Cover DO FIRST	40			5			5				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, S% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 25

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 28.5.20	Job number: 1971.01	Site: Wallsend-Eden	Plot ID: P25	Bearing: 54°	Observers: YB, VC

Arrival time: **Departure time:** **Weather:** Fine, rain preceding

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A	
5 - 9 cm	(P) / A	
10 – 19 cm	(P) / A	Total
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	P / A	5 6 4
50 -79cm	#	1 9 4
>80cm	#	Total metres 29

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	60	
2	50	
3	50	
4	50	
5	70	
Average	56	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Regrowth euc stand - soil = mine spoil, rocky. Mine rehabilitation.

Habitat features, comments and incidental fauna observations:

7 x fallen dead trees, Bell Minors
recruitment of native (Acacia, Peas, eucs)

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 26

Date: 28.5.20	Job number: 1971.01	Site: Eden	Plot ID: P26	Bearing:	Observers: YB+JC

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E. fibrosa	0.5	1	Acacia ulicifolia	1	20	Cymbopogon refractus	5	100	Lobelia purpurascens	0.1	50
			Acacia falcata	5	20	Sebaea sphacelata	25	500	Veronica plebeia	0.1	2
			Daviesia ulicifolia	1	10	Gonocarpus tenuicaulis	0.2	20	Cassytha glabrata	2	20
			Pultenaea villosa	0.5	10	Chloris gayana	2	50	Cheilanthes sieberi	0.2	50
Hibbertia aspera			~~Pultenaea euchila~~	1	20	Paspalum dilatatum	1	20	Tarlbaea cavana	10	20
			Bursaria spinosa	5	20	Entolasia stricta	0.5	50	Axonopus fissifolius	0.1	2
			Ozothamnus diosmifolius	0.2	20	Imperata cylindrica	0.5	100	Centella asiatica	0.1	20
			Acacia parvipinnula	0.1	1	Paspalidium distans	0.2	50	~~Poa sp.~~ Ptilothelachne micrantha	0.1	2
			Leucopogon lanceolatus	0.1	2	Echinopogon caespitosus	0.2	50	Desmodium varians	0.1	20
			Bossiaea oblongifolia	0.1	10	Dianella caerulea var. producta	0.1	10	Glycine clandestina	0.1	5
			Hardenbergia violacea	0.1	2	Lomandra filiformis	0.2	20	Clematis aristata	0.1	2
						Microlaena stipoides	0.2	50	~~Pseudanthus virgatus~~ Bossiaea australis	0.1	10
						Lomandra longifolia	2	20	Parsons grass	0.2	2
						Lomandra multiflora	0.1	2	Ageratina adenophora	0.5	10
						Caesia cyanea	0.1	5	Oxalis perennans	0.1	5
						Austrostipa rudis	0.1	10	Ventenata dubia	0.1	5
						Billardiera scandens	0.1	1			
Total Cover DO FIRST											

20mx20m plot = 400m^2 **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 26

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 28.5.20	Job number: 19f1.01	Site: Wallsend - Eden	Plot ID: P26	Bearing: 339	Observers: Y.B. JC

Arrival time: **Departure time:** **Weather:** Sunny, clear.

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / A	
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total 0
20 – 29 cm	P / A	**Length of logs (m)** **Note:** >10cm diameter, >50cm length
30 – 49cm	P / A	
50 -79cm	# 1	
>80cm	#	Total metres 0

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	40	
2	40	
3	70	
4	30	
5	5	
Average	37	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

High weed cover

Habitat features, comments and incidental fauna observations:

Many rabbit scats

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 27

Date: 28.5.20	Job number: 1971.01	Site: Eden	Plot ID: P27	Bearing:	Observers: YB+SC

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Cissus antarctica	10	5	Acacia ulicifolia	0.5	5	Tomandra longifolia	5	20	Verbena bonariensis	0.1	10
Syncarpia glomulifera	5	3	Daviesia ulicifolia	1	10	Pteridium esculentum	0.2	20	Melinis repens	0.1	20
E. propinqua	2	1	Pultenaea villosa	0.1	10	Imperata cylindrica	15	1000	Lantana	0.5	2
E. pilularis	0.5	1	Bursaria spinosa	0.1	2	Glycine clandestina	0.1	2	Andropogon virginicus	0.1	10
E. resinifera	15	4	Acacia longifolia var longi	0.5	10	Entolasia stricta	0.5	20	Hypochoeris rad.	0.1	10
Pteridium esculentum	0.1	1	Acacia falcata	0.1	5	Lomandra filiformis	0.1	10	Cirsium vulgare	0.1	10
Echinopogon caespitosus	0.1	5	Breynia oblongifolia	0.1	5	Eustrephus latifolius	0.1	5	Dianella revoluta	0.1	5
Themeda triandra	0.1	3	Hibbertia aspera	0.1		Dianella caerulea var producta	0.1	5	Setaria sphacelata	5	100
Dichelachne micrantha	0.1	5	Xanthorrhoea arborea	0.1	2	Cheilanthes sieberi	0.1	20	Chloris gayana	5	500
Leptospermum laevigatum	0.1	1	Glycine clandestina	1	5	Cassytha glabella	0.5	5	Bidens pilosa	0.1	5
1 Xantho. macronema			Pultaea paradoxa	0.1	5	Lobelia purpurascens	0.1	10	Ageratina adenophora	0.1	10
			Clematis aristata	0.1	2	Lomandra multiflora	0.2	10	Centella asiatica	0.1	10
			Dianella revoluta	0.1	5	Brunonia australis	0.1	20	Daucus carota	0.1	20
			Pasporalidium distans	0.1	10	Hardenbergia violacea	0.2	5	Conyza bonariensis	0.1	10
			Cynodon dactylon	0.1	10	Panicum simile	0.2	20	Veronica plebeia	0.1	1
			2 Swainsonia galegifolia			Desmodium varians	0.1	10	exotic climbing pea	0.1	2
			Plantago lanceolata	0.1	2	Cymbopogon refractus	0.1	20	Sida rhombifolia	0.1	1
			Goodenia hederacea	0.1	2	Aristida vagans	0.1	10	Oxalis perennans	0.1	5
Total Cover DO FIRST	10		17			Lysimachia arvensis	0.1	2	Sporobolus africanus	0.2	20

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

19 19

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 27

Date: 28.5.20	Job number: 1971.01	Site: Wallsend-Eden	Plot ID: P27	Bearing: 86	Observers: JC.

Arrival time: **Departure time:** **Weather:** Fine, Sunny.

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	30	
10 – 19 cm	P / A	Total	2	95	
20 – 29 cm	P / A	**Length of logs (m)** **Note:** >10cm diameter, >50cm length	3	60	
30 – 49cm	P / A	2	4	95	
50 -79cm	# —		5	80	
>80cm	# —	Total metres 2	Average	72	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other) mine spoil-mound adjacent to transect

Roadside ≈ 8m from plot, high weed cover on northern side of transect.

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 28

Date: 31/8	Job number:	Site: Eden	Plot ID: BAM A	Bearing: 182°	Observers: JM

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
~~Corymbia maculata~~			Epacris microphylla	5	50	Entolasia stricta	15	60	Aristida ramosa	1.5	5
Angophora costata	15	8	Acacia brownii	1	1	Lobelia purpurescens	1	55	Glycine clandestina	0.1	3
Eucalyptus capitellata	22	7	Banksia collina	2	3	Goodenia bellidifolia	0.1	1	Hydrocotyle laxiflora	0.2	19
Corymbia gummifera	7	2	~~Leucopogon~~			Eragrostis brownii	4	16	Caladenia	0.1	17
			Polyscias sambucifolia	2	9	Lepidosperma laterale	2	5	Entolasia marginata	0.8	6
			Hoteldea venosa	1	4	Xanthorrhoea	2	4	Bidens pilosa	0.1	~~10~~ 2
			Exocarpus sp	3	4	Hypochaeris radicata	1	24	Microlaena stipoides	3	12
			Leptospermum polygalifolia	2	4	Poa	5	25	Desmodium varians	0.1	11
			Leptospermum trinervium	1	1	Dianella caerulea	0.4	7	Pteridium	0.6	5
			Acacia falcata	4	19	Hovea linearis	0.6	32	Billardiera scandens	0.1	12
			Acacia myrtifolia	1	7	Ironcarpus teucrioides	0.3	28	Hibbertia riparia	0.2	3
						Lomandra multiflora	2	16	Hibbertia obtusifolia	0.3	2
						Echinopogon caespitosus	2	12	~~Caladenia~~		
						Lomandra obliqua	1	40	Hardenbergia violacea	0.1	2
						Themeda triandra	2	11			
						Imperata cylindrica	5	44			
						Pimelea linifolia	0.4	5			
						Cymbopogon refractus	0.4	2			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 28

Date: 31/8/20	Job number: 1971	Site: Eden South	Plot ID: BAM A START	Bearing: 214°	Observers: BY JM

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	(P) / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A		1	25%	75 veg
10 – 19 cm	(P) / A	Total 0	2	~~20%~~ 30%	20 logs 50 veg?
20 – 29 cm	(P) / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	85%	15 veg
30 – 49cm	(P) / A		4	90%	10 veg
50 -79cm	# 11		5	90%	5 bare, 5 veg
>80cm	#	Total metres 46	Average	64%	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 29

Date: 31/8	Job number:	Site: Eden	Plot ID: BAM B	Bearing: 214°	Observers: JM

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Acacia smithii	20	11	Lantana camara	8	10	Blechnum cartilagineum	2	16			
Melaleuca nodosa	10	3	Cryptocarya microneura	1	2	Adiantum aethiopicum	5	45			
Eucalyptus piperita	10	1	Ficus coronata	1	1	Pteridium esculentum	16	40			
			Breynia oblongifolia	0.1	1	Lomandra longifolia	5	16			
			Cloezylon australe	1	2	Oplismenus aemulus	3	28			
			Leptospermum	0.2	2	Austrostipa cymosum	2	14			
						Smilax australis	2	12			
						Livistona linearis	0.1	4			
						Adiantum hispidum	0.2	4			
						Clematis aristata	1	7			
						Brodia ajacis	0.2	4			
						Glycine clandestina	0.5	30			
						Morinda jasminoides	0.2	4			
						Entolasia stricta	4	35			
						Imperata cylindrica	0.6	9			
						Dichondra repens	0.1	17			
						Lobelia purpurascens	0.1	4			
						Austrodatalaena dubia	0.1	3			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

31/8/20

PLOT 29

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 29.4	Job number: 1971	Site: Eden Scrub	Plot ID: BAM B	Bearing:	Observers: BY JM

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	(P) / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
S - 9 cm	(P) / A		1	75	
10 – 19 cm	(P) / A	Total 1	2	90	
20 – 29 cm	(P) / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	5	
30 – 49cm	(P) / A		4	95	
S0 -79cm	# ~~3~~ 1		5	50	
>80cm	# 1	Total metres 38 + 55 = 93	Average	63	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Bits of lantana

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 30

Date: 4/9/20	Job number:	Site: Eden	Plot ID: BAM 1a	Bearing: 187°	Observers: JM

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Corymbia maculata	65	36	Lantana camara	44	27	Dianella caerulea var pad	2	7	Oxalis perennans	0.1	35
Eucalyptus punctata	10	3	Bursaria spinosa	1	2	Hardenbergia violacea	0.5	5	∅ white mid vein	2	14
Syncarpia glomulifera	6	2	Pittosporum undulatum	3	3	Imperata cylindrica	3	17	Acianthus fornicatus	0.1	10
stringy	4	1				Lomandra longifolia	1.5	4	Caladenia	0.1	4
						Oplismenus imbecillis	3	32	Goodenia bellidifolia	0.1	3
						Dakonia	1.5	3	Poa affinis	0.3	4
						Microlaena stipoides	4	14	Entolasia stricta	1	7
						Pertenopleurum cymosum	5	42	Lomandra multiflora	1	4
						Desmodium varians	0.3	15	Ligustrum sinense	0.1	2
						Geranium solanderi	0.1	20			
						Lobelia purpurascens	3	65			
						Pandorea pandorana	3	34			
						Oxalis perennans	0.8	20			
						Glycine clandestina	0.1	2			
						Lomandra filiformis	1	5			
						Lepidosperma laterale	1	4			
						Trifolium sp	0.1	22			
						Pteostylis acuminata	0.1	12			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 30

Date: 4.9.20	Job number:	Site: Eden	Plot ID: BAM1a	Bearing:	Observers: JM

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.		
< 5 cm	(P) / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A		1	90	
10 – 19 cm	(P) / A	Total 0	2	95	
20 – 29 cm	(P) / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	96	
30 – 49cm	(P) / A		4	88	
50 -79cm	#		5	85	
>80cm	#	Total metres 6	Average		

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 31

Date: 4.9.20	Job number:	Site: Eden	Plot ID: BAM2a	Bearing: 192°	Observers: JM

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Corymbia maculata	80	40	Daviesia ulicifolia	0.5	3	Hardenbergia violacea	0.4	7	Acacia sp.	0.3	2
Euc. punctata	3	2	Acacia longifolia	2	4	Andropogon virginicus	~~7~~ 0.1	~~30~~ 3	Amyema sp.	0.1	1
			Acacia brownii	1	2	Chloris gayana	3	20			
						Lomandra longifolia	1	4			
						Lantana camara	7	24			
						Paspalum	4	17			
						Senecio madagascariensis	1	15			
						Cymbopogon refractus	~~1~~ 7	30			
						Plantago lanceolata	0.5	11			
						Hypochaeris radicata	0.1	7			
						Bidens pilosa	0.1	5			
						Prunella vulgaris	0.2	6			
						Cirsium vulgare	0.1	3			
						Microlaena stipoides	0.5	6			
						Veronica plebeia	0.1	9			
						Lobelia purpurascens	0.3	20			
						Eragrostis brownii	0.1	4			
						Verbena bonariensis	0.2	7			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 31

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 4/9/20	Job number:	Site: Eden	Plot ID: BAM 2a	Bearing: 220	Observers: JM

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A	
5 - 9 cm	(P) / A	
10 – 19 cm	(P) / A	Total 6
20 – 29 cm	(P) / A	Length of logs (m) **Note:** >10cm diameter, >50cm length
30 – 49cm	P / (A)	
50 -79cm	# 0	
>80cm	# 0	Total metres 9.

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	45	
2	55	
3	60	
4	55	
5	70	
Average		

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 32

Date: 4.9.20	Job number:	Site: Eden	Plot ID: BAM3a.	Bearing: 119°	Observers: JM

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Conyzbia maculata	70	36	Lantana camara	40	33	Pandorea pandorana	0.1	6			
						Poa affinis	0.2	3			
						Lobelia purpurascens	0.2	14			
						Kikuyu	1	10			
						Chloris gayana	2	20			
						Einadia nutans	0.4	4			
						Microlaena stipoides	0.2	4			
						Desmodium varians	0.1	12			
						Senecio madagascariensis	0.1	3			
						Imperata cylindrica	2.5	28			
						☑ white mid-vein	0.1	6			
						Entolasia stricta	0.1	2			
						Cheilanthes austrotenuifolia	0.1	2			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 32

Date: 4.9.20	Job number:	Site: Eden	Plot ID: BAM3a	Bearing:	Observers: JM

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	(P) / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A		1	98	
10 – 19 cm	(P) / A	Total 0	2	96	
20 – 29 cm	(P) / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	99	
30 – 49cm	(P) / A		4	98	
50 -79cm	# 0		5	96	
>80cm	# 0	Total metres 3	Average		

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 33

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:
7/10/	1971.01	Eden	364(33)	286	FoB, SK

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
~~E. acmenoides~~ E. umbra	7	11	Leptospermum polygalifolium	0.6	10	Lomandra multiflora	0.2	50	Boronia polygalifolia	0.1	20
Banksia sieberiana	10	8	Bursaria spinosa	0.1	2	Lomandra obliqua	0.1	50	Oxalis corniculata * small, pale green	0.1	20
C. maculata	4	8	~~Leptospermum~~			Phyllanthus hirtellus	0.2	20	~~Grass 1~~ Aristida warburgii	0.1	5
E. punctata	0.7	9	Acacia ulicifolia	0.1	2	Glycine tabacina	0.1	30	Lomandra filiformis	0.2	50
C. gummifera	0.1	1	~~Dillwynia~~ ~~Goodenia~~ Pultenaea microphylla	0.1	1	Billardiera scandens	0.1	5	Opercularia diphylla	0.2	30
						Poa sieberiana	15		Calochilus sp.	0.1	1
						Themeda triandra	0.3	50+	Entolasia stricta	0.1	10
						Lobelia purpurascens	0.5	100+	Dianella ~~revoluta~~ caerulea var. producta	0.3	25
						Gossiaea ebracteata	0.1	1	Panicum simile	0.1	15
						Goodenia heterophylla	0.1	20	Parsonsia straminea	0.1	5
						Microlaena stipoides	0.1	100+	Pseudoraphis spinescens	0.2	50
						Goodenia heterophylla	0.1	5	Grass 2 Rytidosperma pallidum	0.1	20
						Kennedia rubicunda	0.1	1	Lomandra longifolia	0.1	10
						too small, U not dotted Dianella longifolia	0.1	3	Vernonia cinerea	0.1	2
						Glycine clandestina	0.1	5	Juncus continuus	0.1	50
						Lepidosperma gunnii	0.1	10	Bunnonella peculiaris	0.1	10
						Eustrephus latifolius	0.2	50+	Cassytha pubescens	0.1	10
						Juncus bufonius	0.1	10	Desmodium varians	0.1	2
Total Cover DO FIRST						~~Hibbertia~~ Goodenia heterophylla	0.1	20	Grass 3 Dichelachne ~~sciurdi~~ crinita	0.1	30

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 33

Date: 7/10/2020	Job number: 1971.01	Site: EDEN	Plot ID: P33	Bearing: 286	Observers: SK FOB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:** OVERCAST

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	(P) / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A		1	90	
10 – 19 cm	(P) / A	Total 1	2	90	
20 – 29 cm	(P) / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	80	
30 – 49cm	(P) / A	5, 3, 1, 8, 0.5, 0.5, 1, 5, 1	4	80	
50 -79cm	# 11 (2)	6, 2	5	95	
>80cm	# (0)	Total metres (33)	Average	87	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

EVIDENCE OF FIRE, BARELY DISTURBED

Habitat features, comments and incidental fauna observations:

SCATTERED BUSH ROCK, BURROW, STAG BRANCH ON C. MACULATA W/ PIPE HOLLOW ~ 5cm (XS), STAGS x 3, LARGE DRAGONFLY SP.
FAN-TAILED CUCKOO, KOOKABURRA

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 34

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:
7/10/20	1971.01	Eden	365 (P34)	354	FOB, SK

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Ficus coronata	30		Diploglottis australis (terminal, photo)	15		Oplismenus aemulus	0.5	100+	Dichondra repens	0.2	100+
Acacia smithii (smooth bark, sample)	15		Cassinia aculeata (glaucous leaf flecks) *	0.2	30	Calochlaena dubia	25		Pseudoraphis v.	0.1	10
			Homalanthus populifolius	0.1	10	Dioscorea transversa	0.1	20	Tetrastigma nitens	0.1	1
Cryptocarya glaucescens	15		Lantana camara *	0.2	5	Tylophora barbata (photo)	0.1	20	Clematis aristata	0.1	10
E. acmenoides (photo, samples)	15		Diospyros australis	5		Lomatia (score) microstachya	8		Blechnum cartilagineum (photo)	0.1	1
E. sieberi? Jenkinsonii	5		Acacia smithii (sample)			Selaginella sp.	0.2	100+	Cissus hypoglauca	0.1	1
Syncarpia glomulifera	20		Ligustrum sinense *	0.1	2	Ageratina adenophora (cotton) *	0.1	10	Stephania japonica	0.1	5
			Hedycarya (photo) arborea? (soft)	0.1	1	Adiantum aethiopicum	1	100+	Doodia caudata (Fern 2)	0.1	4
			Melicope micrococca	12		Lonicera japonica *	0.1	10	Sarcopetalum harveyanum	0.1	5
			Notelaea? (photo) longifolia f. glabra	0.1	1	Christella dentata (fern)	0.3	50			
			Rhodamnia rubescens	1	11	Hibbertia scandens	0.1	1			
			Cinnamomum camphora	7		Pteristylis sp.	0.1	1			
			Cleodendron tomentosum (photo)	0.2	2	Entolepis latifolius	0.1	50			
			Villea? (photo) huegeliana	0.1	1	Doodia aspera	10				
						Cayratia clematidea	0.1	10			
						Desmodium varians	0.1	5			
						Smilax australis	0.1	5			
						Lom longifolia	0.5	12			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 34

P34

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 7/10/2020	Job number: 1971.01	Site: EDEN	Plot ID: ~~365~~	Bearing: 354	Observers: SK, FaB

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:**

Transect photos and GPS points taken ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A	
5 - 9 cm	(P) / A	
10 – 19 cm	(P) / A	Total
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	(P) / A	7, 17, 4.5, 2, 1.5, 1, 4.5, 1, 3, 11, 4
50 -79cm	# ~~IIII~~ I (6)	
>80cm	# I (1)	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots

Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect

Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.

Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	30	CREEK BED/BANK
2	90	
3	80	
4	30	CREEK BED/BANK
5	90	
Average	64	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

SOME RUBBISH & TYRE

Habitat features, comments and incidental fauna observations:

CREEK RUNS THROUGH PLOT, SOME BUSH ROCK, GROUND HOLLOW

YELLOW-TAILED BLACK COCKATOO, FAN-TAILED CUCKOO, PIED CURRAWONG, EASTERN WHIPBIRD?, UNIDENTIFIED SP.

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 35

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:
7/10/20	a1977.01	Eden	B35	104	FOB, SK

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
casuarina glauca	0.2	~~3~~4	Acacia longifolia var sophorae	8	30	Briza subaristata	70		Hydrocotyle (Geranium?) pedunculosa	0.2	50
C mac.	0.1	1	Lantana	10		Verbena bon.	0.1	30	Veronica plebeia	0.1	2
			~~Cotoneaster~~ Gomphocarpus fruticosus	0.1	2	Centella asiatica	0.2	100+	Daucus carota	0.1	50
			Pittosporum undulatum	1	7	Bidens pilosa	0.3	100+	Vicia sativa	0.1	5
			Leptospermum polygalifolium	0.3	3	Medicago orbicularis	0.2	100+	~~Centella asiatica~~		
			Glochidion ferdinandi	0.2	1	Geranium homeanum	0.1	50	Cerastium clandestinum	0.2	100+
			~~Spyridium parvifolium~~ Tillandsia sp.	0.1	100+	Fern? Daucus glochidiatus	0.1	10	Lysimachia arvensis	0.1	3
			Leptolaena	0.1	1	Cyperus gracilis	0.1	50	large photo/xanthorrhea? Gahnia clarkei	1	1
						Selaginella	0.2	100+	Dichondra repens	0.1	50
						Lom longifolia	3	10	Paspalum dilatatum	0.1	10
						Microlaena stipoides	0.1	50	Themeda triandra	0.2	50
						Plantago varrable	0.1	20	Juncus pl. to subsecundus	0.1	3
						Glycine clandestina yellow	0.1	5	Grass 2 v fine Lachnagrostis filiformis	0.1	5
						Cassytha pubescens apetlon	25		Senecio madagascariensis	0.1	20
						Ajuga adenophora	0.1	20	Wahlenbergia gracilis	0.1	5
						Lysimachia arvensis var coc.	0.1	1	Hypochaeris albiflora	0.1	1
						Fireweed	0.1	10	Artemisia vulgaris	0.2	5
						~~Grass 1~~ Dichelachne micrantha	0.1	20			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 35

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 7/10/2020	Job number: 1971.01	Site: EDEN	Plot ID: P35	Bearing: 104	Observers: SK, FOB

Arrival time: **Departure time:** **Weather:** OVERCAST/CLEARING/HUMID

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / (A)			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A		1	70	
10 – 19 cm	(P) / A	Total 0	2	25	
20 – 29 cm	(P) / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	80	
30 – 49cm	(P) / A	0.5	4	70	
50 -79cm	# 0		5	60	
>80cm	# 0	Total metres 0.5	Average	61	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

HIGHLY DISTURBED HEAVILY WEEDED, RUBBISH

Habitat features, comments and incidental fauna observations:

SEVERAL BIRD SP OBSERVED IN LANTANA THICKETS

SILVEREYE, THORNBILL SP, WILLY WAGTAIL, GOLDEN WHISTLER?

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 36

Date: 7/10/22	Job number: 1971.01	Site: Eden	Plot ID: P36	Bearing: 243	Observers: ROB, SKe

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E. fibrosa	10		Acacia falcata	15		Briza subaristata *	6		Polymeria calycina	0.1	15
Angophora costata	0.5	1	Pultenaea ~~Bossiaea~~ obcordata	0.1	5	Lobelia purpurascens	0.3	100+	yellow Sisyrinchium rosulatum * var. flavum	0.1	15
			Dillwynia tenuifolia	0.1	5	Cynodon dactylon	10		blue Sisyrinchium rosulatum var. coeruleum *	0.1	30
			Acacia longifolia var. long.	7		Digitaria sp. *	0.4	40	Eragrostis brownii	0.1	5
			Lantana *	0.5	3	Themeda triandra	0.1	20	Fruity legumes Medicago polymorpha *	0.1	2
			Acacia long leaves	0.1	2	Dianella caerulea	0.1	5	Red natal grass *	0.3	100+
						Glycine tabacina	0.1	15	Imperata cylindrica	0.1	100+
						Hypochaeris albiflora	0.1	10	? sample Verbena sp. *	0.1	10
						Senecio madagascariensis *	0.1	25	Microlaena stipoides	0.1	20
						Lysimachia arvensis var. c. *	0.1	12	Wahlenbergia gracilis	0.1	15
						~~Area~~ ~~Flowers need photo~~ Centaury ~~erythraea~~ *	0.1	20	rounded leaves Medicago orbicularis *	0.1	10
						Juncus subsecundus	0.2	50	Cheilanthes sieberi	0.1	30
						Centella asiatica	0.5	100+	~~grass sample~~ Lachnagrostis avenacea	0.1	20
						andreed *	0.1	5	Wahlenbergia - pale, 3/4 petals Veronica sp. * *	0.1	3
						Ageratina adenophora cofton	0.1	3	Bidens pilosa *	0.1	10
						Conyza sp. *	0.1	3	Cotton bush Gomphocarpus fruticosus *	0.1	1
						Verbena bonariensis *	0.1	5	Oxalis corniculata *	0.1	10
						Grass ~~Lachnagrostis~~ Digitaria sanguinalis	0.1	20			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 36

Date: 7/10/2020	Job number: 1971.01	Site: EDEN	Plot ID: P36	Bearing: 243	Observers: SK, FOB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:** OVERCAST/CLEARING/HUMID

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< S cm	(P) / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A		1	80	
10 – 19 cm	(P) / A	Total 0	2	40	
20 – 29 cm	(P) / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	50	
30 – 49cm	(P) / A	0.5	4	40	
50 -79cm	# 1 (1)		5	90	
>80cm	# 1 (1)	Total metres 0.5	Average	60	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

TRACK, TYRES, RUBBISH, LANTANA THICKETS

Habitat features, comments and incidental fauna observations:

VARIEGATED FAIRYWREN, MAGPIE, RAINBOW LORIKEETS + P3S BIRDS

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 37

Date: 7/10/20	Job number:	Site: Eden North	Plot ID: P37	Bearing: 1150	Observers: EC, BY

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Exotic Lower stratum	C	Ab
E punctata	20	1	Ozothamnus dios			dianella caerulea	0.3	10	ehrharta erecta	0.2	20
			acacia falcata	2	5	Oxalis perrenans	0.1	5	lantana camara	10	50
			Acacia longifolia	0.2	3	themeda triandra australis	3	200	anagalis arvensis	0.2	20
			Acacia (irrorata compound)	0.2	3	Centella asciata	2	200	briza subaristata	10	2000
			glochidion ferdinandi	0.2	5	microlaena stipoides	0.1	100	3* bindi weed	0.1	5
			pittosporum undulatum	2	10	veronica plebeia	0.3	20	hypochaeris radicata	0.2	10
			acacia ulicifolia	0.3	1	kennedia rubicunda	0.2	5	gamochaeta sp.	0.1	10
7. Vaccaria hispanica						Cymbopogon tenuioides	0.2	10	paspalum dilatatum	0.5	20
8. Verbena sp.						echinopogon ovatus	0.1	1	4* hypericum	1	50
						Dichelachne micrantha	0.1	1	Senecio madagascar	0.2	10
						pratia lobelia purpurascens	0.3	50	5 Crofton weed	2	100
						Cheilanthes sieberi	0.2	10	Solanum mauritianum	0.2	50
1. hydrocotyle sibthorpioides									melinus repens	0.3	20
2. juncus usitatus					1*	hydrocotyle sp.	0.2	20	6* grass sp. (v?)	1	100
3. soliva sessilis						wahlenbergia gracilis	0.1	1	7* Shining weed	0.1	5
4. hypericum hirta						desmodium gunni	0.1	2	Chondrilla juncea (weed)	0.1	2
5. Ageratina adenophora						enadia nutans	0.1	1	radial weed Facelis retusa	0.1	20
6. Vulpia bromoides					2*	juncus sp	0.1	1	gamochaeta americana	0.2	10
						Cynodon dactylon	2	100	Serrated weed *8	0.2	5
Total Cover DO FIRST						poa affinis	1	20	briza minor	0.1	10
									Setaria (giant)	3	50
									Cirsium vulgare sphaerodata	0.1	1
									asparagus aethiopicus	0.1	5

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4cm, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 37

Date: 7/10/20	Job number: 1971	Site: Eden North	Plot ID: P37	Bearing: 115°	Observers: BY, EC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:** Overcast, humid

1000m² plot **Mapped Vegetation community:** 1584 DIRTS

Transect photos and GPS points taken ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / (A)			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / (A)		1	50%	5% v, 40% gr
10 – 19 cm	P / (A)	Total 0	2	70%	30% v
20 – 29 cm	P / (A)	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	70%	
30 – 49cm	(P) / A	HH 1	4	100%	~~60%~~
50 -79cm	# 1		5	10%	60% v, 25 rocks, 5 bare
>80cm	# 0	Total metres 6	Average	60%	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Lantana, exotics

Habitat features, comments and incidental fauna observations:

Some rocks, rabbit scats, Grey kangaroo scats

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 38

Done

Date: 7/10/20	Job number: 1970.01	Site: Eden North	Plot ID: P38	Bearing: 290	Observers: BY, EC

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Corymbia maculata	4%	7	Acacia ~~sp.~~ floribunda (11)	35%	50	*Senecio madagascariensis	0.5	100	Verbena ~~quadritaria~~ rigida	0.3	20
			Acacia longifolia	0.5	1	Imperata cylindrica	1	100	Centaurium tenuiflorum (8)	0.1	50
						*Hypertenia hirta	10	500	Gamochaeta americana	0.5	100
1 Vetch - Vicia sativa						*Vetch (1) Vicia sativa	0.2	20	Bindi - Solvia sessilis (9)	0.1	5
2 Crofton weed - Ageratina adenophora						Briza ~~integrifolia~~ subaristata	3	1000	*~~Aster subulata~~		
3 Trifolium campestre						Wahlenburgia gracilis	0.1	10	Cotton bush (10) Gomphocarpus fruticosus	0.2	10
4 Linum trigynum (French flax)						Lachnagrostis filiformis	0.2	50	Radiole weed (12) Facelis retusa	0.3	50
5 Melilotus indicus (not medicago)						~~Dichelachne~~ ?			Microtis sp.	0.1	1
6 Slender celery - Cyclospermum leptophyllum						Crofton weed ~~Biddens~~ (2) Ageratina adenophora	0.3	10	Plantago lanceolata	0.5	150
7 *Vulpia myuros						Lantana (sapling) Camara	0.1	1	Hypocherus glabra	0.2	50
8 Centaurium tenuiflorum						Asparagus aethiopicus	0.1	1	Hypocherus radicata	0.1	20
9 Bindi - Solivia sessilis						Anagalis arvensis Lysimachia arvensis	0.5	200	~~Setaria sp.~~ Vulpia myuros (7)	0.1	20
10 Cotton bush - Gomphocarpus fruticosis						Setaria sphacelata	3	1000	Conyza bonariensis	0.1	1
11 Acacia floribunda						Trifolium dubium	0.1	20	Eucalyptus sp. (juv stringy)	1	3
12 Radiole weed - Facelis retusa						Trifolium campestre sp (3)	1	200	Biddens pilosa	0.2	20
						Chloris gayana	30%	2000	Solanum mauritianum	0.1	1
						*Linum trigynum (4)	0.5	1000	Cirsium vulgare	0.1	1
						Slender celery Cyclospermum leptophyllum (6)	0.2	20	Euchiton sphaerichus	0.1	10
Total Cover DO FIRST						~~Medicago~~ Melilotus indicus (5)	1	200	Melinis ~~Melinus~~ repens ripens	0.1	1

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

✓ VS

Now P38 (2) sheet?

PLOT 38

Date: 7/10/20	Job number:	Site: North Eden	Plot ID: 38	Bearing: 290°	Observers: EC, By

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	85%	Live 10% bare 5/10
10 – 19 cm	P / A	Total	2	90%	Live 79%. 30% rocks
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	75%	Live 10%. 10% rocks
30 – 49cm	P / A		4	45%	Live 50%. 5% rocks
50 -79cm	# A	0	5	20%	Live 30% is bare 25 rocks
>80cm	# A	Total metres	Average	63%	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Previously cleared. Regenerating area + young Corymbia maculata, Gravel from nursery trade

Habitat features, comments and incidental fauna observations: - Dominated by hyperhenia hirta - ground layer

Areas of dense grass & shrubs only.

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 39

Date: 20.10.20	Job number: 1971.01	Site: Eden	Plot ID: P39	Bearing: 77°	Observers: YB+BY

2 sps still need to be id'd

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Syncarpia glomulifera	20	10	~~Pittosporum multiflorum~~			Lomandra longifolia	5	20	Lantana camara	15	20
C. maculata	6	5	Myrsine variabilis	0.2	5	Grass 1 3	15	100	Glycine clandestina	0.1	5
E. propinqua	10	5	Acmena smithii	0.1	1	Lobelia purpurascens	0.5	100	Gonocarpus teucrioides	0.1	10
E. paniculata	5	2	Cremate RF shrub 2	2	2	Pseudoraanthemum variabile	0.5	100	Plantago debilis	0.1	10
Eustrephus latifolius	0.5	10	Cassytha glabella var glabella	4	10	Clematis aristata	0.2	10	Adiantum aethiopicum	1	50
Hardenbergia violacea	0.2	1	Chlenodendron tomentosum	1	10	Dichondra repens	0.5	50	Hydrocotyle sibthorpioides	0.5	50
Bursaria spinosa	1	10	Pittosporum undulatum	0.5	5	Dioscorea transversa	0.1	5	Lomandra filiformis	0.5	20
1 RF vine (pink flower)	0.1	1	Hibbertia dentata	0.1	1	Imperata cylindrica	0.2	20	Veronica plebeia	0.1	2
* Pandorea pandorana	0.2	2	Notelaea longifolia	0.5	10	Desmodium gunnii	0.1	20	Coelhum glauc. 4	0.1	10
* E. piperita	15	6	Pittosporum revolutum	0.1	1	Microlaena stipoides	15		Ageratina adenophora	0.5	10
* Dendrophthoe vitellina	0.1	1	Ozothamnus diosmifolius	0.1	1	~~Dockrillia~~ / Dawsonia	2	100	Asparagus asparagoides	0.1	2
A. cocrata	5	2	Dentaria ~~calycinum~~ sylvestris	0.2	5	Oplismenus imbecillis	1	50	Microtis parviflora	0.1	2
1 Tylophora barbata			Geranoplesium cymosum	0.1	2	Goodenia heterophylla sub heterophylla	0.5	20	Pterostylis sp.	0.1	1
2 Myrsine variabilis			Cayratia clematidea	1	10	Cheilanthes sieberi	0.1	5	Slender celery Cyclospermum leptophyllum	0.1	5
3 Poa labillardieri sieberiana			Polyscias sambucifolia	0.1	1	Dianella caerulea var producta	0.1	5	Arthropodium milleflorum	0.1	1
			Acacia longi var longi	0.1	1	Entolasia stricta	0.5	20	Ligustrum sinense	0.1	1
* = not included prior			Breynia oblongifolia	0.1	2	Lagenophora stipitata	0.2	50	4 Galium leiocarpum		
						Oxalis perennans	0.1	20			
Total Cover DO FIRST	55						40				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 39

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:
20/10/20	1971.01	~~1971.01~~ Eden (North)	P39	077	BY YB

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:** Overcast

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken [X]

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A		1	85	15 veg
10 – 19 cm	P / A	Total 0	2	95	5
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	90	10
30 – 49cm	P / A	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ III	4	90	10
50 -79cm	# IIII		5	40	60
>80cm	# I	Total metres 33	Average	80	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

weedy - Lantana - mine rehab

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

J WB

PLOT 40

Date: 26.10.20	Job number: 1971.01	Site: Eden	Plot ID: P40	Bearing: 223	Observers: YB+BY

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Done

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
			Acacia saligna	0.5	2	Verbena rigida	1	50	Plantago lanceolata	1	100
			Lantana camara	0.1	1	Verbena bonariensis	0.5	50	~~Opposite leaf weed~~ Spirea flower	~~0.1~~	~~20~~
			Acacia longifolia	0.1	1	Briza minor	5	100	Slender celery 4	0.1	5
			Cassytha glabella var glabella	0.1	1	Axonopus fissifolius	15	1000	Amagalis arvensis	0.5	20
			Ageratina adenophora	0.1	5	Paspalum dilatatum	1	50	Plantago sp. myosuros	0.2	20
						Hypochaeris radicata	0.1	20	Amagalis arvensis var caerulea	0.5	20
			?			Cynodon dactylon	0.5	20	Lachnagrostis filiformis	0.1	50
			2 Trifolium compestre			Briza subaristata	15	1000	Medicago (long flower)	1	100
			3 Centaurium erythraea			Setaria sphacelata	5	100	Medicago (short flower)	0.5	20
			~~[illegible]~~			Hypericum hirta	0.5	20	Senecio madagascariensis	0.1	10
			4 Cyclospermum leptophyllum			Briza maxima	1	50	Pink flower/opposite leaf	0.1	20
			5 Linum trigynum			~~Vulpos sp.~~ Vulpia muralis	0.1	20	Yellow flower tiny weed	0.1	5
						* Medicago pink flower	0.1	20	~~Medicago yellow flower~~	~~0.5~~	~~50~~
						Conyza bonariensis	0.1	20	Bidens pilosa	0.5	50
						Climbing pea Vicia sativa	0.1	5	Sonchus oleraceus	0.1	10
						Cirsium vulgare	0.1	10	Gonocarpus sp. americana	0.1	5
					1	Melilotus indicus	~~0.1~~	~~20~~	Sonchus asper	0.1	2
						~~Sp. [illegible]~~			Sisyrinchium iridifolium	0.1	20
Total Cover DO FIRST							85		* Trifolium sp. arvense	0.1	20

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 40

Date: 20.10.2	Job number: 1971-01	Site: Eden	Plot ID: P 40	Bearing: 223	Observers: YBTBY

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A		1	10	
10 – 19 cm	P / A	Total 0	2	85	
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length	3	60	
30 – 49cm	P / A	11	4	70	
50 -79cm	# 0		5	60	
>80cm	# 0	Total metres ~~6~~ 2m	Average	57	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Highly weedy, not original soil profile (coal) totally cleared

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 41

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 20.10.20	Job number: 1971.01	Site: Eden	Plot ID: PL41	Bearing: 80°	Observers: YE + BY

Done

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
			Acacia saligna	1	5	Arctotopus fissifolius	25	1000	Cirsium vulgare	0.5	20
			Acacia longifolia var longifolia	0.1	1	Imperata cylindrica	20	500	Sonchus asper	0.2	10
			Lantana camara	0.1	1	Echinopogon caespitosus	0.5	20	Solanum nigrum	0.1	2
			Ageratina adenophora	0.2	10	Plantago lanceolata	1	50	Juncus usitatus	0.2	50
			Sida rombifolia	0.1	1	Briza maxima	0.5	20	Weedy climbing poa 3	0.1	10
			Richardia sp. humistrata	0.1	2	Briza subaristata	10	500	Slender celery 2	0.1	10
Ranunculus sardous (hairy buttercup)		←	Buttercup.	0.2	50	Briza minor ~~Briza maxima~~	0.2	50	Geranium homeanum	0.1	20
Daucus carota		←	Giant slender celery	0.2	20	Setaria parviflora	0.2	20	Oxalis perennans	0.1	5
(4) Wahlenbergia gracilis			Conyza bonariensis (conyza sonariensis)	0.1	20	Dichelachne micrantha	0.1	50	Centella asiatica	0.1	20
Senecio pterophorus		←	Conyza sp (serrated)	0.1	2	Andropogon virginicus	15	500	Hydrocotyle laxiflora sp.	0.2	50
~~*Rostraria cristata~~			Modiola caroliniana	0.1	5	Verbena bonariensis	0.5	50	Hypochaeris radicata	5	100
~~Dichelachne mi~~			Murdannia sp.	0.1	10	(4) Wahlenbergia communis sp.	0.1	10	Medicago short yellow flower (5)	1	100
(5) Trifolium campestre			Medicago pink long flower	0.1	20	Facelis retusa	0.1	20	~~Cirsium vulgare~~		
(6) Linum trigynum			Hypericum hirta	0.1	10	Desmodium varians	0.1	5	Billardiera scandens	0.1	1
* not included			Glycine spc clandestina	0.1	5	Lysimachia arvensis	0.2	50	Lachnagrostis filiformis	0.1	50
~~Medicago sativa (lucerne)~~			Melinis repens	0.5	20	Petrorhagia dubia	0.1	20	Pink flower opposite leaves	0.1	20
			Pellaea paradoxa	0.1	1	~~Spc pink flower weed~~	0.1	10	tiny yellow flower weed (linum trigynum)	0.1	20
M. medic			Silene gallica var gallica			Hairy pink sticky flower	0.1	5	(6) Vulpia ~~Vulpos sp~~ ~~myuros~~	0.1	20
Total Cover DO FIRST	trifolium arvense.			0.1		(1)	85		1 Centaurium erythraea 2 Cyclosporum leptophyllum 3 Vicia sativa		

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, …, 1, 2, 3, …, 10, 15, 20, 25, … (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 41

Date: 20.10.20	Job number: 1971.01	Site: Eden	Plot ID: P41	Bearing: 80	Observers: YB+BY

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	30	
10 – 19 cm	P / A	Total	2	15	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	25	
30 – 49cm	P / A		4	10	
50 -79cm	# 0	0	5	10	
>80cm	# 0	Total metres	Average	18	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Highly weedy, coal ground, rubbish

Habitat features, comments and incidental fauna observations:

bush rocks

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

J WD

PLOT 42 M

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 6.11.20	Job number: 197101	Site: Eden	Plot ID: P42	Bearing: 57	Observers: YB+SP

Done

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E. ~~viridis~~ acmenoides	10	4	Lantana camara	30	20	Themeda triandra	20	500	Dipodium punctatum sp.	0.1	3
E. ~~propinqua~~ punctata	12	11	Acacia ulicifolia	5	10	Panicum simile	2		Lobelia purpurascens	0.1	20
			Acacia falcata	3	10	Paspalum dilatatum	10		Chiloglottis sp.	0.1	5
Dendrophtoe vitellina	0.1	1	Acacia myrtifolia	0.1	2	Microlaena stipoides	0.2	20	Cheilanthes sieberi	0.1	20
			Ozothamnus diosmifolius	0.5	5	Cynodon dactylon	10		Hardenbergia violacea	0.1	5
			Pultenaea ~~Daviesia~~ spinosa	0.1	10	Bisiza subaristata	0.2	20	Senecio madagascariensis	0.1	20
Sample 1											
Acianopus fissiflorus	0.1	5	Daviesia ulicifolia	1	10	Bunbwine grass (Cymbopogon refractus)	0.1	2	Viola hederacea	5	100
Sample 2			Pultenaea (~~ericifolia~~ microphylla)	0.1	5	Dichelachne micrantha	3		Poranthera microphylla	0.1	20
Glycine clandestina	0.1	1	Glochidion ferdinandi	0.1	5	Ageratina adenophora	0.1	1	Oxalis perennans	0.1	5
Plantago lanceolata	0.1	5	Entolasia stricta	5 (var 0.1)		Acaena novae-zelandiae (2)	0.1	5	Desmodium varians	0.1	20
			Hakea sericea	0.1	1	Wahlenbergia communis	0.1	10	Sonchus oleraceus	0.1	10
			Podolepis hieracioides	0.5	5	Euchiton japonicus? (1)	0.1	1	Veronica plebeia	0.1	2
			Cassytha glabella	0.1	5	Sida rhombifolia	0.2	20	Lomandra filiformis	0.1	5
			Billardiera scandens	0.1	1	Verbena bonariensis	0.1	10	Hypochaeris radicata	0.1	20
(1) Euchiton japonicus (collected)			Polyscias sambucifolia	0.1	1	Gamochaeta americana	0.1	2	Sherardia arvensis (Cyclospermum leptophyllum)	0.1	1
(2) Senecio pteropherus			Pittosporum undulatum	0.1	1	Conyza bonariensis	0.1	20	Dichondra repens	0.2	50
			~~Hakea~~ Persoonia linearis	0.1	2	Bidens pilosa	0.1	10	Lomandra multiflora	0.1	1
			Austrodanthonia ~~Austrostipa~~ racemosa	0.1	10	Dianella caerulea var producta	0.1	2	Microtis sp.	0.1	5
Total Cover DO FIRST	20			40			60				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 42 ✓ done

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 6.11.20	Job number: 1971.01	Site: Eden	Plot ID: P42	Bearing: 57	Observers: YB+SP

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A	0		Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A		1	85	
10 – 19 cm	P / A	Total	2	80	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	90	
30 – 49cm	P / A	1	4	60	
50 -79cm	# 0		5	80	
>80cm	# 0	Total metres 1	Average	79	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

~~Leg~~ moderate weed cover.

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

✓ YB

PLOT 43

DONE

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 6.11.20	Job number: 1971.01	Site: Eden	Plot ID: P43	Bearing: 31°	Observers: WB + SP

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	1	3	Allocasuarina tonulosa	30	20	Thereda triandra	2	100	Microtis sp.	0.1	5
Corymbia (bubble gum small) sp.	0.1	1	Lomatia ceramica	20	10	Microlaena stipoides	10		Cheilanthes sieberi	0.1	20
			Ozothamnus diosmifolius	0.1	3	Aristida vagans	25		Trachymene ebracteata	0.1	10
			Glochidion ferdinandi	0.1	1	Dichelachne micrantha	2		Lobelia purpurascens	0.5	20
			Polyscias sambucifolia	0.1	1	Entolasia stricta	2		Calochilus sp.	0.1	5
			Pittosporum undulatum	0.1	1	Paspalum dilatatum	0.2	10	Lomandra filiformis	0.1	10
			Stephania japonica	0.1	1	Entolasia marginata	0.1	1	Lomandra multiflora	0.1	5
			Persoonia linearis	0.1	1	Bidens pilosa	0.1	5	Dianella caerulea var producta	0.1	2
						Ageratina adenophora	0.1	1	Glycine clandestina	0.1	5
						Dichondra repens	0.2	50	Austrostipa eudula ?	0.1	2
						Veronica plebeia	0.1	5	Dianella revoluta	0.1	2
						Oplismenus imbecillis	0.1	10	Hypochaeris radicata	0.1	10
						Sonchus oleraceus	0.1	2	Senecio madagascariensis	0.1	5
						Lomandra longifolia	0.1	2	Austrostipa pemenaus	0.1	5
						~~Hubbertia obtusifolia~~	~~0.1~~	~~5~~	Echinopogon caespitosus	1	50
									Axonopus fissifolius	0.1	2
									Patrorhangia debia	0.1	1
									Poranthera microphylla	0.1	2
Total Cover DO FIRST							45				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

J 10

PLOT 43

Date: 6.11.20	Job number: 1970.01	Site: Eden	Plot ID: P43	Bearing: 31°	Observers: YB+SP

Dane

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.		
< 5 cm	(P) / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A	0	1	85	
10 – 19 cm	(P) / A	Total	2	85	
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length	3	100	
30 – 49cm	(P) / A	~~IIII~~ ~~IIII~~ II	4	100	
50 -79cm	# 0		5	95	
>80cm	# 0	Total metres 18	Average	95	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

moderate weed cover / rubbish

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 44

DONE

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 6.11.20	Job number: 1971.01	Site: Eden	Plot ID: P44	Bearing: 224	Observers: YB+SP

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. nacularia	5	2	Acacia sp (constables bipinnate sample)	30	20	Paspalum dilatatum	0.5	20	Tricoryne elatior	0.1	10
Melia azaderach	0.1	1	Acacia falcata	5	20	Themeda triandra	25	500	Chrolaskos siebeni	1	100
			~~Hakea teretifolia~~			Lomandra longifolia (tenuior?)	5	20	Hypochaeris radicata	0.1	20
			Pittosporum undulatum	5		Aristida vagans	25	500	Dianella revoluta	1	50
			Lantana camara	10	10	Dichelachne micrantha	0.5	20	Plantago lanceolata	0.1	10
			Hubbertia sp. (Obtusifolia)	0.5	10	Briza subaristata	0.5	20	Andropogon virginicus	0.1	5
			Glochidion ferdinandi	0.1	5	Melinis repens	2	100	Richardia brasiliensis	0.1	2
			Hakea salicifolia	0.5	1	Briza maxima	0.1	10	Ageratum adenophorum	0.1	2
			Hakea teretifolia	1	5	Aconopus fissifolius	0.1	10	Conyza bonariensis	0.1	5
			Allocasuarina littoralis	0.1	1	Cynodon dactylon	0.5	5	~~Ath[illegible]~~		
			Banksia ulicifolia	0.1	1	Paspalidium distans	0.5	20	Wahlenbergia communis	0.1	10
						Echinopogon caespitosus	0.5	50	Senecio madagascariensis	0.1	5
						Oxalis perennans	0.1	5	Verbena bonariensis	0.1	10
						Lobelia purpurascens	0.1	10	Petrorhagia dubia	0.1	1
						Imperata cylindrica	0.5	50	Dianella caerulea prod.	0.2	5
						Microlaena stipoides	1	50	Lomandra filiformis	2	50
									Glycine clandestina	0.1	2
Total Cover DO FIRST							60				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

✓ ND

PLOT 44

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 6.11.20	Job number: 1971.01	Site: Eden	Plot ID: PL44	Bearing: 224	Observers: BP.

Arrival time: **Departure time:** **Weather:** DONE

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	(P) / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A		1	95	
10 – 19 cm	(P) / A	Total 0	2	95	
20 – 29 cm	P / (A)	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	85	
30 – 49cm	(P) / A	~~IIII~~ IIII	4	80	
50 -79cm	#		5	90	
>80cm	#	Total metres 9	Average	89	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Small sections of erosion, moderate weed cover, old disturbed track running through a section of the block

Habitat features, comments and incidental fauna observations:

Whipbird heard in the block.

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 45

DONE

Date: 10/11	Job number: 1971	Site: Eden	Plot ID: P45	Bearing:	Observers: BY 4B

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Corymbia maculata	25	~~30~~ 25	Acacia falcata	15	6	Lomandra multiflora	50	5	Hardenbergia violacea	5	0.1
E. punctata	3	~~10~~ 15	Lantana camara	10	1	Entolasia stricta	50	0.5	Brunonella australis	5	0.1
			Daviesia ulicifolia	15	0.2				Opercularia diphylla (difyla)	5	0.1
			Dendrophto vitiensis	4	0.3				Gyanthilium cinereum	2	0.1
Glochidion ferdinandi	5	0.1	Bursaria spinosa	10	0.2				Asparagus aethiopicus	3	0.1
E. glob	3	~~5~~	Notolaea longifolia	5	0.2	Pittosporum multiflorum	3	0.1	Aristacta vagrans	3 ~~10~~	0.1 ~~0.5~~
			P. undulatum (Pittosporum)	1	0.1	Dipodium punctatum	3	0.1			
			Camphor laurel (Cinnamomum camphora)	1	0.1	Lomandra longifolia	50	10			
			Parsonsia straminea	1	0.1	Lomandra filiformis	100	7			
						Lobelia purpurescens	10	0.1			
						Dichelachne micrantha	5	0.1			
						Themeda triandra	15	0.2			
						Microlaena stipoides	15	0.2			
						Dianella caerulea var prod	5	0.2			
						Glycine clandestina	5	0.1			
						Dianella revoluta	5	0.1			
						Pellidosperma pallidum	10	0.5			
						Hibbertia sp. obtusifolia	3	0.2			
Total Cover DO FIRST	~~50~~						25				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

KO

PLOT 45

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 10/11	Job number: 1971.01	Site: Eden	Plot ID: P45	Bearing: 240	Observers: BY, YB

DONE.

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	(P) / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	(P) / A		1	95	
10 – 19 cm	(P) / A	Total ~~#~~ 2	2	100	
20 – 29 cm	(P) / A	**Length of logs (m)** **Note:** >10cm diameter, >50cm length	3	90	
30 – 49cm	(P) / A	~~37~~	4	85	
50 -79cm	# 11		5	95	
>80cm	# 11	Total metres 37	Average	93	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regeneroting stems and does not require a height of 1.3m.

J KD

PLOT 46

DONE

Date: 10/11	Job number: 1971	Site: Eden	Plot ID: P46	Bearing: 181	Observers: BY YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. mac	25					Imperata cylindrica	3	100	Dipodium punctatum	0.1	3
E. fibrosa	5		Bursaria spinosa	0.1	5	Dendrophthoe vitellina	0.2	2	Lobelia purpurascens	0.2	50
E. punctata	10		Pittosporum multiflorum	0.1	5	Dianella caerula var pro	0.1	3	Dacus carrota?	0.2	50
E. acmenoides	5		Lantana	0.1	3	Lomandra multiflora	3	50	Crofton weed (Ageratina adenophora)	0.2	10
			Notolaea longifolia	0.1	5	Cynodon dactylon	0.1	10	Farmers friends (Bidens pilosa)	0.1	10
			Mel nodosa	7	10	Melinis repens	0.2	20	Oxalis perrenans (perrenans)	0.1	20
			A. ulicifolia	0.2	3	Desmodium varians	0.1	30	Paramatta grass (sporobolus africanus)	0.1	1
			Camphor laurel (Gina)	0.1	1	Clematis aristata	0.1	20	Brunonella australis	0.1	50
						Denhamia silvestris	0.2	5	hardenbergia	0.5	20
						Eustrepus latifolius	0.1	10	Microlaena stip	0.1	20
						Aristata ex. vagrans	0.1	10	Rhytidosperma	0.2	10
						Glycine clandestina	0.1	20	Cirsium vulgare (Selium)	0.1	5
			Urospermum dalechampii			Aster sp1 (Senecio pteophorus)	0.1	5	Entolasia stricta	0.5	30
						Desmodium rotidophyl	0.1	10	Lomandra longifolia	3	50
			Phyllanthus tenulus	0.1	1	Aster sp2 (fireweed look)	0.1	5	Hibbertia scandens	0.5	5
			Barbwire (cymbopogon) grass	0.1	5	Pseudoranthemum variable	0.1	5	Pandorea pandorana	0.2	5
			Acacia saligna	0.1	2	Goodenia heterophylla var hetero	0.1	20	Cyanthellum cinerium	0.1	20
						Lomandra filiformis	0.1	10	Gastenoplesium (Geitonoplesium) cymosum	0.1	5
Total Cover DO FIRST	45					Arthropodium minifloruim	0.1	5	Sonchus oleraceus	0.1	5
						Poa sp1 (Poa siberiana)	0.1	5	Oplesmenus imbeselus	0.2	20
									Plantago lanceolata	0.1	5
									Echinopogon caespitosus	0.1	5

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 46

DONE

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 10/11	Job number: 1971	Site: Eden	Plot ID: P46	Bearing: 181	Observers: BY YB

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A		1	100	
10 – 19 cm	P / A	Total 0	2	90	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	95	
30 – 49cm	P / A		4	100	
50 -79cm	# 2		5	50	
>80cm	# 0	Total metres 28	Average	~~92~~ 87	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regeneroting stems and does not require a height of 1.3m.

J WD

PLOT 47

Done

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 10/11	Job number: 1971	Site: Eden	Plot ID: P47	Bearing: 254	Observers: BY YB

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
			Acacia saligna	1	5	Chloris gayana	10		Trifolium dubium Yellow trifolium	0.1	30
			Acacia sp. (floribunda)	5	50	Setaria fascilata, Pidgeon grass Sphaerolobium	70	300	Petrorhagia dubia	0.1	30
			Acacia falcata	0.1	1	Verbena bonariensis	2	50	Hypochaeris albiflora Small white flower	0.1	20
						Senecio madagascariensis	0.2		Plantago lanceolata	0.1	10
						Cotton bush Gonphocarpus fruticosis	0.3		Microlaena stipoides	0.1	
						Trifolium repens	0.1	5	Hypochaeris radicarta	0.5	
						Briza subaristata	0.5	200	Hypochaeris ~~sp~~ dir hirta	1	
						Linum trigynum	0.1		Juncus ~~sp~~ cognatus	0.1	10
						~~Sp~~ Setaria parviflora			Conyza bonariensis	0.1	10
						Burchardia umbellata	0.1	50	Plantago myosuros subsp. myosuros Purple stem- basal rosette	0.1	30
						Axinopus fissifolius	5		Cirsium Celsium vulgare	0.1	1
						Lisimachia arvensis	0.1		Paspalum dilitatum	0.1	
						Grass 1 (sml) Lachnagrostis Aira cupaniana	0.2		Senecio pterophorus Aster - serated (in P45)	0.1	5
						Vulpia Vulpis ~~sp~~. myuros	0.1		Dichelachne micrantha	0.2	20
						Gamochaeta purpurea	0.1	20	Wahlenbergia gracilis sp.	0.1	1
						Slender celery Daucus carota	0.1	20	Vetch - Vicia sativa	0.1	1
			~~Senecio~~			Desmodium varians	0.1	5	Chelanthes sieberi	0.1	20
			Lactuca saligna	0.1	10	Pink trifolium Trifolium arvense	0.2	100	Imperata cylindrica	0.1	10
Total Cover DO FIRST							~~90~~ 85				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

J VB

PLOT 47

Dane

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date:	Job number: 1971.01	Site: Eden	Plot ID: P47	Bearing: 2	Observers: BY YB

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
				Leaf litter	Live vegetation, bare ground, rocks, etc.
< 5 cm	P / A				
5 - 9 cm	P / A		1	50	
10 – 19 cm	P / A	Total 0	2	30	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	30	
30 – 49cm	P / A		4	90	
50 -79cm	# 0		5	40	
>80cm	# 0	Total metres 0	Average	48	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regeneroting stems ond does not require a height of 1.3m.

PLOT 48

Dave

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 19.11	Job number: 1971.01	Site: Eden	Plot ID: P48.	Bearing: 2°	Observers: YBTSK

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
C. maculata	5	3	Allo tomentosa	1	2	Panicum effusum	30	1000	Glycine clandestina	0.1	50
E. punctata	10	7	Acacia falcata	5	50	Entolasia stricta	10	500	Lobelia purpurascens	0.1	10
E. umbra	15	5	Acacia ulicifolia	15	100	Themeda triandra	15	1000	Desmodium rhytidophyllum	0.5	20
E. pilularis	5	3	Dodonaea triquetra	12	100	Entolasia marginata	0.5	50	Brunonella australis	0.5	100
Dendrophthoe vitellina	0.1	2	Indigofera australis	0.1	5	Lomandra longifolia	5	50	Veronica plebeia	0.1	20
			Dianella sylvestris	0.1	1	Imperata cylindrica	5	100	Lantana camara	0.1	1
			Acacia irrorata	0.2	5	Lepidosperma laterale	1	20	Conyza bonariensis	0.1	5
			Pultenaea villosa	3	50	Handsonbangia violacea	5	60	Lagenophora stipitata	0.1	20
			Phyllanthus hirtellus	1	20	Eustrephus latifolius	0.5	10	Hypochoeris radicata	0.1	5
			Melaleuca styphelioides	0.1	1	Microlaena stipoides	1	50	Dianella caerulea var parv	0.5	10
			Pultenaea euchilla	1	20	Digitaria sparsiflora	0.5	20	Cyathochaeta avenacea	0.1	5
			Motelaea longifolia	0.1	5	Echinopogon caespitosus	0.1	10	Oxalis perennans	0.1	5
			Bursaria spinosa	0.1	2	Pandorea pandorana	0.1	5	Dichondra repens	0.1	20
						Rytidosperma pallidum	0.1	2	Solanum nigrum	0.1	1
						Lomandra multiflora	0.1	5	Tenaxia tillaeformis	0.5	20
						Dichelachne micrantha	0.1	10	Brunonella pumilio Brunonella pumilio	0.1	10
Total Cover DO FIRST	35			40			80				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

10

PLOT 48

Done

Date: 19.11.20	Job number: 1971.01	Site: Edm	Plot ID: P 48	Bearing: 2°	Observers: YB SK

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** Transect photos and GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	90	
10 – 19 cm	P / A	Total	2	90	
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length	3	60	
30 – 49cm	P / A	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ IIII	4	90	
50 -79cm	# 11 2		5	90	
>80cm	# 0	Total metres 24	Average	84	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems ond does not require a height of 1.3m.

J KB

PLOT 49

Date: 28.11.20	Job number: 1971.01	Site: Eden	Plot ID: P 49	Bearing: 275°	Observers: DB+BY

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
absent			C. nodosa	0.1	5	Imperata cylindrica	35	100	Oxalis perennans	0.1	20
			Ozothamnus diosmifolius	0.3	1	Schoenus apogon	2	500	Goodenia ericoides	1	100
			Pultenaea villosa	12	30	Echinopogon caespitosus	5	100	Paspalum dilatatum	0.5	20
			Acacia suaveolens? strigosa	0.1	1	Microlaena stipoides	10	500	Dianella revoluta	0.1	2
			Acacia ulicifolia	1	20	Austrodanthonia racemosa	5	100	Dianella caerulea var. producta	0.2	10
			~~[illegible]~~			Pyrrhosperma pallidum	2	100	Briza maxima	0.1	5
			Hibbertia aspera	0.5	20	Themeda triandra	10	500	Pelargonium cacorum	0.1	30
			Clematis aristata	0.1	1	Entolasia stricta	10	500	Senecio spp. tenuiflorus	0.1	3
			Andropogon virginicus	0.1	10	Panicum simile	2	100	Hypochaeris radicata	0.1	10
			Brunonia australis	0.1	5	Caesalpinia glabrata	0.1	5	Lomandra multiflora	0.1	1
			Sebaea ovata	0.1	2	Opercularia diphylla	0.1	5	Lagenophora stipitata?	0.1	5
			Hydrocotyle sp. laxiflora	0.1	5	Glycine clandestina	0.1	20	Bidens pilosa	0.1	2
			Persoonia linearis	0.1	1	Cheilanthes sieberi	0.1	10	Lobelia purpurascens	0.2	50
						Veronica plebeia	0.1	10	Lomandra longifolia	0.1	5
						Verbena bonariensis	0.1	1	Centella asiatica	0.1	50
						Pteridium esculentum	0.1	10	Burbidgea Budbandra vulgaris	0.1	10
			Centaurium erythraea			Centaurium (pink flower opposite leaf)	0.1	5	Eustrephus latifolius	0.1	10
						Panicum effusum	0.1	5	Goodenia heterochrona var. heterochrona	0.1	10
Total Cover DO FIRST							85				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

✓ pD

PLOT 49

Dane

Date: 20/11	Job number: 1971.01	Site: Eden	Plot ID: P49	Bearing: 278	Observers: BY YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** [X]

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A		1	80	
10 – 19 cm	P / A	Total 0	2	80	
20 – 29 cm	P / A	**Length of logs (m)** **Note:** >10cm diameter, >50cm length	3	90	
30 – 49cm	P / A		4	85	
50 -79cm	# 0		5	25	
>80cm	# 0	Total metres 0	Average	72	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Light weed cover, No canopy, powerline easement

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

J WB

PLOT 50

Done

Date: 20/11	Job number: 1971.01	Site: Eden	Plot ID: P50	Bearing: 237	Observers: BY YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Dyscarpia glomulifera	4	2	~~Lomandra long~~			Lomandra long	30	30	Paspilidium distans	0.5	30
E. acmenoides	15	10	Dendrophtoe vitellina	0.1	1	Lomandra multi	1	20	Parsonsia stramina	0.1	1
C. mac	15	10	Acacia ulicifolia ~~Lomandra multi~~	0.1	5	Chelanthes siberii	0.1	20	Poa sp. affinis	0.5	20
E. propinqua	15	10	Bursaria spinosa ~~Pittosporum multiflorum~~	0.1	5	Dianella caerulea var. pro	0.5	20	Brunonelia pumilio pumila	0.1	30
			Pultanea villosa	0.1	5	Glycine clandestina	0.1	10	Laganophora sipitata	0.1	20
			Notolaea long.	0.1	1	Galochilus sp.	0.1	1	Themeda triandra	0.2	25
			Pittosporum multiflorum	0.1	5	Echinopogon caespitosus capspisotuse	0.2	50	Eustrepus latifolius	0.1	5
						Cassytha glabella var glabella	0.2	50	Entolasia stricta	25	200
						Opercularia diphylla	0.1	10			
						Pseudorathium variabile ~~Brunonella~~	0.1	20			
						Lomandra filliformis	0.1	10			
						Goodenia hederacea var hederacea	0.1	5			
						Aristata vagans	0.1	20			
						Lobelia purpurescens	0.1	10			
						Desmodium rhytidophyllum retidophylum	0.1	5			
						Oxalis perrananS	0.1	10			
						~~Entolasia~~ Imperata cylindrica	0.1	10			
						Gonocarpus teucrioides	0.1	10			
Total Cover DO FIRST	50			0.5			40				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

✓ 100

PLOT 50

Done

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 28.11.20	Job number: 1971.01	Site: Eden	Plot ID: P50	Bearing: 237	Observers: YB+PB

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< S cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
S - 9 cm	P / A	0	1	100	
10 – 19 cm	P / A	Total	2	95	
20 – 29 cm	P / A	Length of logs (m) **Note:** >10cm diameter, >50cm length	3	85	tree trunk 30cm dbh
30 – 49cm	P / A	0	4	100	
50 -79cm	# 0		5	100	
>80cm	# 0	Total metres	Average	96	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

No weed, cleared, most ecus young regrowth

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

J 1488

PLOT 51

Done

Date: 20/11	Job number: 1971.01	Site: Eden	Plot ID: P51	Bearing: 92	Observers: BY YB

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
A. costata	0.1	5	Acacia falcata	0.1	5	Themeda triandra	40		Microlaena stip	2	
E. globoidia ~~stringy~~	0.1	5	Epacris pulchella	0.2	10	Stylidium graminifolium			Bucharadia umbellata Bicardia sp.	0.1	10
			Hibbertia aspera	0.1		Trigger plant	0.1	10	Gamochaeta americana	0.1	5
			Daviesia squarrosa spinosa	0.1		Microtis sp.	0.1	20	Opercularia diphylla	0.1	
			Pultanea villosa	0.1		Dianella revoluta?	0.1	10	Cynodon dactylon	0.2	
			Acacia myrtifolia	0.1	1	Axonopus fissifolius	0.2		Andropogon virginicus	0.2	
			Acacia ulicifolia	0.1	2	Conocarpus teucrioides	0.1		Dianella caerulea var prod	0.1	
			Pultanea ~~linophylla~~ ~~sp.~~ retusa	0.1		Lobelia purpurescens	0.1	20	Lomandra multi	0.2	
			Dillwynia retorta ~~Hibbertia sp.~~	0.1		Centaurium erythrea	0.1	5	Paspalidium distans	0.5	
			Daviesia ulicifolia	0.1	1	Leucopogon? junip	0.1	10	Calochilus sp.	0.1	1
						Dichelachne micrantha	0.1		Polymeria calcina calycina	0.1	5
						Echinopogon caespitosus	0.2		Imperata cylindrica	0.5	50
						Hypocaeris radicata	0.1	10	Cheilanthes sieberi	0.1	5
						Lomandra filiformis	0.1	10	Entolasia stricta	0.5	200
						Lomandra longifolia	0.1	10	Acacia longifolia var longifolia	0.1	1
						Paspalum dilatatum	0.1		Lomandra obliqua	0.1	5
						Rytidosperma spp.	0.2				
						Billardiera scandens	0.1	5			
Total Cover DO FIRST	0.2			0.5			~~80~~ 40				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

VKO

PLOT 51

Done

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Date: 20.11.20	Job number: 1971.01	Site: Eden	Plot ID: P51	Bearing: 92	Observers: VB + BM

Arrival time: **Departure time:** **Weather:**

1000m² plot **Mapped Vegetation community:** **Transect photos and GPS points taken** ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.		
< 5 cm	P / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A	0	1	40	
10 – 19 cm	P / A	Total	2	10	
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length	3	25	
30 – 49cm	P / A		4	75	
50 -79cm	# 0	0	5	5	
>80cm	# 0	Total metres	Average	31	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

PW easement trenches / light erosion low weed cover

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

J 1/8

PLOT 52

52

Date: 3/2/21	Job number: 1971	Site: Eden	Plot ID: 1588DIRLU	Bearing: 231	Observers: FOB AM
Starting point Easting / Northing: 373559 6258032			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Corymbia maculata	0.1	1	Acacia falcata	0.2	1	Verbena officinalis	40		~~Aster~~ ~~Aster~~ Senecio pterophorus	0.1	5
			Acacia ~~sieberi~~ floribunda	0.1	1	Verbena bonariensis	5		Veronica plebeia	0.1	10
						Verbena rigida	5		Cheilanthes sieberi	0.2	50
						Paspalum urvillei	15		Oxalis exilis (antose, small)	0.1	10
						Centella asiatica	5		Juncus usitatus	0.1	20
						Microlaena stipoides	1	1000+	Cynodon dactylon	15	
						Plantago lanceolata	5		Echinopogon ovatus	1	1000+
						Paspalum dilatatum	0.1	5	Desmodium varians	0.1	10
						Cyperus sphaerodens (Cyperus)	20		Oxalis corniculata	0.1	1
						Sida rhombifolia	4	50	Tricoryne simplex	0.1	2
						Senecio madagascariensis	0.1	15	Cyperus breviflorus	0.1	15
						Desmodium rhytidophyllum	0.1	5	Dichondra repens	0.1	20
						Bidens pilosa	0.2	20	Galenia microphylla	0.1	20
						Galium propinquum (Galium small whorled)	0.1	5	Thenedia triandra	1	
						Hydrocotyle peduncularis	0.2	10	Lobelia purpurascens	0.1	20
						Juncus cognatus	0.5	1000+	Setaria gracilis	5	
						Axonopus fissifolius	20		Anagallis arvensis (Lysimachia)	0.1	1
Total Cover DO FIRST						Briza subaristata	0.2	50	Plantago varia	2	50
						Pelargonium australe (Pelargonium)	0.1	5	Trifolium repens	0.1	10

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

✓ KD

PLOT 52 (52) ✓✓

Date: 3.2.21	Job number:	Site: Eden	Plot ID:	Bearing:	Observers: FOB AGM
Starting point Easting / Northing:			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

TWO Transect photos (one landscape one Portrait) taken ✓

1000m² plot **Mapped Vegetation community:**

Transect GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	~~P~~ / A	
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	P / A	IIII
50 -79cm	# A	
>80cm	# A	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	7	
2	8	
3	5	
4	2	
5	15	
Average	6.8	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

edge effects: within 10m of access way (dirt track) - within 100m of major access way (asphalt road).
Weediness: high

Habitat features, comments and incidental fauna observations:

magpie

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 53

53

Date: 3/2/21	Job number: 1970	Site: Eden	Plot ID: 1588G	Bearing:	Observers: FOB AM
Starting point Easting / Northing: 373547 6358112			End point Easting / Northing: 373585 6358113		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
E. punctata	15		Acacia ulicifolia	0.2	5	Themeda triandra	80		Dianella caerulea	0.1	8
E. umbra	05	1	Daviesia ulicifolia	0.3	2	Cynodon dactylon	0.5	100+	Lily white Arthropodium millefolium	0.1	2
E. siderophloia	1	13	Polyscias sambucifolia ~~elegans~~	0.1	1	Eulalopsis cespitosus	0.5	100+	Senecio madagascariensis	0.1	1
C. maculata	7	3	Acacia falcata	0.1	1	~~Grass 1~~ Ehrharta erecta	0.2	50+	Aster Senecio pterophorus	0.1	3
E. acmenoides	1	2				Glycine no stipule clandestina	0.1	3	Hypochaeris radicata	0.1	1
						Lobelia purpurascens	0.1	10	Dichondra repens	0.1	50+
						Polyneria calycina	0.1	5	Desmodium rhytidophyllum	0.1	1
						Goodenia tenuiordes	0.1	5	Ophiopogon aemulus	0.2	100+
						Oxalis exilis	0.1	20	Cheilanthes sieberi	0.1	20
						Lomandra longifolia	0.2	10	Aristida vagans (Aristida ramosa)	0.1	1
						Glycine stipules microphylla	0.1	4	Lomandra multiflora	0.1	2
						Paspalidium distans	0.2	50+	Lomandra filiformis	0.1	2
						Entolasia stricta	0.5	50+	Passiflora suberosa	0.1	1
						Hardenbergia violacea	0.1	1	Billardiera scandens	0.1	1
						~~Grass 2~~ Microlaena	0.2	50+			
						Hypoxis hygrometrica ~~Ficinia nodosa~~	0.1	3			
						Bidens pilosa	0.1	2			
						~~Grass~~ Panicum simile	0.1	10			
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

1 NO

PLOT 53

P53

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:
Starting point Easting / Northing:			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

TWO Transect photos (one landscape one Portrait) taken ✓

1000m² plot **Mapped Vegetation community:**

Transect GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A	0
5 - 9 cm	(P) / A	
10 – 19 cm	(P) / A	Total
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	(P) / A	
50 -79cm	# |||| 4	4.5
>80cm	# —	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	75%	
2	75	
3	90	
4	80	
5	80	
Average	80	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Some evidence of fire around trunks of ~6 trees Crimson rosella

Habitat features, comments and incidental fauna observations:

Snake egg (hatched), possum scratchings on ~~E. maculata~~ E. punctata, Crimson rosella, noisy miners

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 54

54

Date: 3/2/21	Job number: 1971	Site: Eden	Plot ID: 1539-1. 54.	Bearing:	Observers: JB.
Starting point Easting / Northing:			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Eucalyptus ~~propinqua~~ propinqua. -gum	5	1	Goodenia ovata. -shrub.	20	100+	Adiantum aethiopicum	5	100+	Echinopogon ovatus.	2	100+
Eucalyptus acmenoides. -stringy -mahogany	20	5	Melaleuca styphelioides	10	15	Doodia aspera.	5	100+	Oplismenus aemulus	40	1000+
Eucalyptus fergusonii? -ironbark	5	1	Pultenaea villosa. -hairy pea -fabaceae.	0.2	1	Plectranthus parviflorus	5	100+	Eragrostis sp.	0.2	20+
Bodhaousia myrtifolia.	10	13	35% ? -toothed edge leaf/needle underlamina	0.2	2	Glycine tabacina. -stem margins.	0.2		Digitaria? -large.	0.1	10
Acacia ~~bidecurrens~~ -bipin -sandpaper.	5	14	Dillwynia sp. -linear leaf toothed margin white vein	0.1	1	Clematis glycinoides.	3	1	Imperata cylindrica.	0.4	20
Ficus coronata	0.1	1	Notelaea longifolia f. longifolia.	1	5	Dianella caerulea var producta.	0.2	5	Microlaena stipoides.	1	100+
			Pittosporum Spiral leaf. - revolutum.	0.1	1	Sigesbeckia orientalis.	4	100+	Arthropodium minus.	0.1?	
			~~[illegible]~~ Breynia oblongifolia	0.2	2	Lobelia purpurescens	3	100+			
50%			Spiral branch shrub Zieria ~~smithii~~ smithii	0.1 0.1	1 2	Lepidosperma. elatius	2	10			
			Pseudoanthemum variable.	0.1	50+	Gahnia aspera.	2	10	Senecio madagascariensis.	0.1	1
			Plantago debilis.	0.1	1	Lomandra longifolia.	1	5	Kennedia rubicunda. ~~Desmodium rhytidophyllum~~.	0.1	1
			~~[illegible]~~.			Polyscia calycina	0.1	20	Brunonella? australis. ~~[illegible]~~ Austrobuxus?	5	100+
	?		~~Pellitre, Parietaria~~ Stephania japonica.	0.1	1	Gymnostachys anceps anceps	2	7	Pollalia gunnii	0.2	10
			Geranium gardneri	0.1	10	~~Cayratia clematidea~~ ~~[illegible]~~	0.2	1	Viola hederacea.	3	100+
-bushgreen vine - opp leaves. ?.	0.2	1	Centella asiatica.	0.5	100+	Hydrocotyle hydrocotyloides.	0.5	50	Hydrocotyle sp.	3	100+
Geitnoplesium cymosum	0.1	1	Cayratia clematidea.	0.2	2	~~Viola hederacea~~ ~~Centella asiatica~~.			Eustrephus latifolius.	0.1	2
~~Arrapatilum~~ Smilax glycyphylla -heart shape leaf. Large firm leaf twiner.	0.1	1	Pandorea pandorana.	0.2	6	Cissus antarctica -toothed edge. -red underside -arrows.	0.5	1	Smilax australis.	0.5	10
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

- roadline through plot.
- dog faeces in BAM plot.

JB

PLOT 54

1539-1/~~55~~ (54)

Date: 3/2	Job number: 1971.01	Site: Eden South	Plot ID: ~~17371~~	Bearing: 140	Observers: IS BY
Starting point Easting / Northing: 0372472, 6357998			End point Easting / Northing: 0372500, 6357957		

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

TWO Transect photos (one landscape one Portrait) taken ☑

1000m² plot **Mapped Vegetation community:**

Transect GPS points taken ☑

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots **Note:** - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.		
< 5 cm	P / A	II		Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A		1	10	
10 – 19 cm	(P) / A	Total	2	15	
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length	3	25	
30 – 49cm	(P) / A	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ IIII	4	20	
50 -79cm	# IIII (4)		5	50	
>80cm	#	Total metres 69	Average	24	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Creekline, charred trunks, minimal disturbance

Australian raven

Habitat features, comments and incidental fauna observations:

?Mahony's toadlet, dog poo, red backed toadlet
U. fusca?

HBT1-2-3 E. punctata, 64DBH, 3 small stag hollows. HBT2-2/3 E. acmenoides, 1sml, 2 xsml stag hollows, 55 DBH.

Eastern grey scat

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

E. acmenoides? leaves discolourous?

KD ✓

PLOT 55

(55)

Date: 3/1/21	Job number: 1971	Site: Eden.	Plot ID: 1621 D1 / ~~56~~	Bearing:	Observers: JS/BY
Starting point Easting / Northing:			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Eucalyptus sp. -stringy	2	3	Lantana camara.	50	100+	Ageratina adenophora. Crofton Weed.	10	100+	Chloris gayana.	3	100+
Corymbia gummifera	1	2	Leptospermum polygalifolium subsp. polygalifolium sp. polygalifolium	0.1	1	Dichondra ~~sp.~~ repens	2	100+	Setaria parviflora.	0.5	50+
Angophora costata.	6	3	Polyscias sambuccifolia	0.1	1	Glycine microphylla.	0.1	10	Eragrostis curvula.	5	100
Acacia decurrens var. dealbata	5	6.	Notelaea ovata. sp.	0.1	1	Solanum chenopodioides.	0.1	2	Megathyrsus maximus	3	100
Allocasuarina littoralis	1	1				Euchilon inuducratus.	0.2	30	Oplismenus aemulus	5	200+
						Verbena incompta.	0.3	50	Imperata cylindrica.	5	200+
						Conyza bonariensis.	0.2	10	Briza subaristata.	1	20+
						Adiantum aethiopicum.	0.1	15	Paspalum dilatatum.	1	20+
						Conyza sp. (gouv.) bonariensis	0.2	20	Briza maxima.	1	20+
						Hardenbergia gracilis	0.1	2	Eragrostis sp. brownii	1	20+
						Hardenbergia violacea.	0.1	1			
						Cirsium vulgare.	0.1	3	Conyza bilbaoana.	0.1	15
						Senecio madagascariensis.	0.1	10			
						Lobelia purpurescens	0.1	10	Pellenia pulkenica gonii	3	100+
						Polyneria calycina.	0.2	10	Gamochaeta americana. (Hatchlings).	0.1	20.
						Hypochaeris radicata.	0.1	10	Cynthillium cinereum	1	20
						Cheilanthes sieberi	0.1	15	Oxalis perennans	0.1	
Total Cover DO FIRST	15			50			50.				

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

JKB

PLOT 55

(55)

Date: 03/02	Job number: 1971.01	Site: Eden South	Plot ID: 1621D1	Bearing: 240	Observers: IS, BY
Starting point Easting / Northing: 0372534, 6357459			End point Easting / Northing: 0372486, 6357454		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: **Departure time:** **Weather:**

TWO Transect photos (one landscape one Portrait) taken [X]

1000m² plot **Mapped Vegetation community:** 1621 degraded

Transect GPS points taken [X]

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect Litter includes leaves, seeds, twigs and branches less than 10cm in diameter. Also include dead material attached to living plants that is touching the ground.		
< 5 cm	(P) / A			Leaf litter	Live vegetation, bare ground, rocks, etc.
S - 9 cm	(P) / A		1	95	
10 – 19 cm	(P) / A	Total	2	95	
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length	3	95	
30 – 49cm	(P) / A	~~IIII~~ ~~IIII~~ ~~IIII~~	4	95	
S0 -79cm	#		5	70	
>80cm	#	Total metres 15	Average	90	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Highly disturbed, creekline adjacent, natives persisting

Habitat features, comments and incidental fauna observations:

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

KB

PLOT 56

Date: 8/2/21	Job number: 1971	Site: Eelen	Plot ID: 1621 (57) Plot 56	Bearing: 225	Observers: FOB, SC, BC
Starting point Easting / Northing: 372461 6356417			End point Easting / Northing: 372431 6356383		

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Angophora costata	40		Pittosporum undulatum	1	4	Imperata cylindrica	30		Poranthera ericaea	0.1	5
Eucalyptus ~~globulus~~ eugenioides	5		Lantana camara	5		Lobelia purpurascens	5		Lomandra obliqua	0.1	20
~~Eucalyptus eugenioides~~			Ligustrum sinense	0.1	10	Juncus bufonius	0.5	50+	~~Strattonia~~ Gonocarpus tetragynus	0.1	11
Eucalyptus piperita	20		Acacia longifolia	1	11	Pteridium esculentum	0.2	7	Themeda triandra	25	
			Melaleuca linariifolia	1	4	Eustrephus latifolius	0.1	20	Brunonella australis	0.1	3
			~~Rainforest sp.~~ Cheiloglossum varieg. Gordo 3		10	Entolasia stricta	15	100+	Hardenbergia violacea	0.1	1
			Polyscias sambucifolia	0.1	1	Panicum simile	0.2	100+	Veronica plebeia	0.1	1
			Banksia spinulosa	0.1	1	~~Entolasia~~ Dillwynia floribunda	0.1	3	Glycine clandestina	0.1	1
			Notelaea longifolia	0.1	1	Homalanthus populifolius	0.1	1	Lomandra longifolia	1	4
			Breynia oblongifolia	0.1	1	Lepidosperma sp.	0.1	5	Cockspur-Acacia adenophylla	0.1	1
			Melaleuca sieberi	0.5	2	Calochlaena dubia	0.1	12	Hydrocotyle sibthorpioides	0.1	50+
			Hibbertia dentata	0.1	1	Dianella caerulea var prod	0.2	30	Cryptostylis erecta purple	0.1	8
			Leptospermum polygalifolium	0.1	2	~~Sphagnum~~ Stenanthera japonica	0.1	6	Gahnia melanocarpa erythrocarpa	0.1	1
						Echinopogon caespitosus	0.1	10	Echinopogon ovatus	0.1	5
						~~Cinnamomum~~ Cinnamomum camphora	0.1	2	Hypoxis hygrometrica	0.1	3
						~~Pachinsia?~~			Setaria palmifolia	0.1	1
						Persoonia linearis	0.1	2	Oplismenus aemulus	0.1	50+
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

(%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

bundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 56

56

Date: 8/2/21	Job number: 1971	Site: Wallsend – Eden	Plot ID: 1621	Bearing:	Observers:
Starting point Easting / Northing:			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 11:15 **Departure time:** **Weather:** cloudy but hot

1000m² plot **Mapped Vegetation community:** 1621

TWO Transect photos (one landscape one Portrait) taken ✓

Transect GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees (less than 50cm diameter)
< 5 cm regeneration	P / A	HHT II
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total 7.
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	P / A	6, 2, 7, 1, 4, 3, 2.5, 8, 7.5, 10, 3
50 -79cm	# IIII	
>80cm	#	Total metres 54.

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	45%	
2	40%	
3	65%	
4	50%	
5	30%	
Average	46%.	

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Some disturbance - Lantana present.

Habitat features, comments and incidental fauna observations:

Foraging pit present under fallen log. Eastern grey scat, skinks (L. delicata) observed., large grass burrow

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 57

PCT 1588?

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:
6/4/21	1971.01	Eden	P57		IS/CR/TM.

Starting point Easting / Northing:

End point Easting / Northing:

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Corymbia maculata.	5	1	Acacia longifolia	0.1	1	Fimbrystylus (tall).	0.2	50+	Paspalum (unwell?).	8	100+
Corymbia gummifera.	5	2	Nandina (small leaf bamboo)	0.1	1	Bidens pilosa. var. pilosa.	3	100+	Setaria parviflora.	10	200+
			Senna pendula var glabra.	0.1	5	Verbena incompta.	0.1	5	Eragrostis (long).	0.2	20+
			Lavandula sp	0.1	1	Euchiton involucratus	0.2	30+	Paspalidium	1	20+
			<1%			Conyza bonariensis	0.2	20+	Cymbopogon refractus.	2	100+
Trifolium sp. (wht?)	0.1	1	Lomandra (fine).	0.1	3.						
			Cyperus eragrostis.	0.1	5	Centella asiatica	1	50+	Andropogon? (same as plot 58) nr dichloadine ✓	0.5	20+
Geranium.	0.1	1	Aster subulatus	0.1	5	Gamochaeta americana.	1	100+	Digitaria (Ane P58)	0.5	30+
Bidens pilosa var minor	0.1	1	Nasturtium.	0.1	10	Oxalis	0.2	50+	Oplismenus aemulus.	5	200+
Alternanthera basiliana.	0.1	2	Marigolds (Tagetes)	0.2	20+	Sisyrinchium (blue)	0.1	20+	Paspalum dilatatum.	1	50+
Lonicera (multi?).	0.1	1	Sonchus (soft)	0.1	2	Sida rhombifolia.	0.3	20+	Microlaena stipoides	5	100+
Amaranth.	0.1	10	Garlic.	0.1	20+	Commelina cyanea.	1	50+	Aristida vagans	0.2	20+
Phyllanthus (tenuella?)	0.1	10	Mint Mentha.	0.1	1	Lobelia purpurascens	3	100+	Imperata cylindrica.	20	200+
Lettuce	0.1	10	Cucumis sativus.	0.2	3	Rersicaria (pink) capitata.	0.1	2	Themeda triandra.	5	100+
Tall divided leaf Aster.	0.1	3	Basil Ocimum basilicum.	0.1	5	Juncus	0.1	1	Axonopus fissifolius	5	100+
Sedum	0.1	1	Flat leaf Parsley. Petroselinum crispum.	0.1	1	Plantago lanceolata.	3	100+	Digitaria (Ane P58)	0.5	20
Brassica sp.	0.1	5	Amaranthus (red) cruentus.	0.2	20+	Hypochaeris radicata.	0.5	30+	Echinopogon ovatus.	0.2	20+
Fimbristylus dichotoma.	0.1	10.	Senecio madagascariensis	2	50+	Solanum lycopersicum	2	20+	Briza subaristata.	0.1	5
Total Cover DO FIRST	60%		Modiola cardiniana.	0.1	0.1	Euphorbia. gunnica	0.2	3	Rhytidosperma.	0.1	10
									Sporobolus	0.1	5
									Eastern Rosella. ~~talking~~ Bell Miner	Paspalum (red hairy) 0.1	5
										85%	Tot.

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 57

PCT 1588?

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:
6/4/21	1971.01	Eden	P57		IS/CR/TM

Starting point Easting / Northing: 0373838 E 6357115 N

End point Easting / Northing: 0373798 E 6357080 N

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 12:00 pm **Departure time:** **Weather:** Sunny / Overcast

TWO Transect photos (one landscape one Portrait) taken ✓

1000m² plot **Mapped Vegetation community:**

Transect GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees	Leaf Litter Cover within 5 x 1m² sub-plots		
			Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect **Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.** **Also include dead material attached to living plants that is touching the ground.**		
< 5 cm	(P) / A	1		Leaf litter	Live vegetation, bare ground, rocks, etc.
5 - 9 cm	P / A		1	5m 65	
10 – 19 cm	P / A	Total	2	15 - 60	
20 – 29 cm	P / A	**Length of logs (m)** **Note:** >10cm diameter, >50cm length	3	90	
30 – 49cm	(P) / A		4	85	
50 -79cm	# 1		5	65	
>80cm	#	Total metres 0	Average		

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Under Scrubbed, Garden dumping;

Habitat features, comments and incidental fauna observations:

Hasinell's Frog

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 58

PCT 1619

Date: 6.4.21	Job number: 1971.01	Site: Eden	Plot ID: P58	Bearing:	Observers: IS/CR/TM.
Starting point Easting / Northing:			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
Eucalyptus punctata.	20	1	Acacia falcata	1	12	Hardenbergia violacea.	1	5	Paspalum (dilatatum?)	0.1	20
Eucalyptus (stringy) -long fibrous	10	3	Bursaria spinosa.	0.5	1	Glycine. (hairy brown)	0.2	20+	Themeda ~~australis~~ triandra.	50	1000+
Corymbia gummifera.	5	1	Pittosporum multiflorum.	0.1	6	Dichondra repens	3	100+	Aristida vagans.	1	20+
Eucalyptus (urnigera?) -short fibrous.	20	2	Dodonaea triquetra?.	0.5	5	Hypochaeris radicata.	0.3	30+	Entolasia.	0.2	50+
			Ligustrum sinense.	1	3	Bidens pilosa var pilosa.	0.2	30+	Panicum	5	100+
Angophora costata (seedlings)	0.1	5	Acacia ulicifolia	0.1	5	Desmodium. (leafhairy)	0.1	3	Microlaena stipoides	3	100+
			Pittosporum ~~[illegible]~~.	0.1	3	Phyllanthus hemilus.	0.1	20+	Paspalidium	2	100
			Acacia longifolia var long.	1	1	Conyza bonariensis.	0.2	20+	Echinopogon caespitosus.	2	100+
			Acacia (blue/green)	0.2	1	Lobelia purpurescens.	2	100+	Paspalum (urvelli?).	2 ~~[illegible]~~	50+
			Verbena sp.	0.1	1	Plantago lanceolata.	1	100+	Setaria parviflora.	0.2	50+
			Conyza sumatrensis	0.1	10	Gamochaeta americana	0.3	50+	Digitaria (lge)	0.5	80+
Lomandra longifolia.	0.1	1	Leontodon	0.1	10	Veronica.	1	100+	Echinopogon ovatus.	0.1	20+
Dianella longifolia	0.1	2	Sida rhombifolia.	0.1	5	Euchiton involucratus.	0.2	20+	Imperata cylindrica.	0.5	20+
Glycine clandestina	0.1	5	Polymeria? or convolvulus calycina.	1	20+	Arthropodium	0.1	2	Cymbopogon refractus	1 ~~[illegible]~~	50+
Hypoxis hygrometrica.	0.1	5	Glycine (davisii/venulosa?).	0.5	20+	Cirsium vulgare.	0.1	2	Arrangus.	0.3	20+
Cyanthillium cinereum	0.1	3	Pomax umbellata.	0.2	20+	Wahlenbergia (gracilis?)	0.1	1	Austrodiplo?.	0.1	5+
			Oxalis.	0.2	50+	Viola hederacea	0.1	5	Digitaria (sat).	0.1	10+
Total Cover DO FIRST	60%.			5 ~~[illegible]~~%.			70%.				

0mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

(%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

bundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

- wallaby scat.

PLOT 58

PCT 1619

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:
6.4.21	1971.01	Eden.	P58	270°	IS/CR/TM

Starting point Easting / Northing: 0373631 6356903

End point Easting / Northing:

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 9:30 **Departure time:** **Weather:** O'cast

TWO Transect photos (one landscape one Portrait) taken ✓

1000m² plot **Mapped Vegetation community:**

Transect GPS points taken ✓

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	(P) / A	IIII
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total
20 – 29 cm	(P) / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	(P) / A	
50 -79cm	# II	0
>80cm	#	Total metres

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	70%	
2	70%	
3	85%	
4	70%	
5	65%	
Average		

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

20x20 low weed levels, remainder of plot setaria & paspalum dominant, 1 x nest box

Habitat features, comments and incidental fauna observations:

Hare, gala x 2, Maswell's Frog

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

PLOT 59

PCT 1737

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:
6.4.21	1971.01	Eden	P59		IS/CR/TM.
Starting point Easting / Northing:			End point Easting / Northing:		

AEP
ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Upper stratum	C	Ab	Mid stratum	C	Ab	Lower stratum	C	Ab	Lower stratum	C	Ab
	0.1	1	Lantana camara	50%	1000	Typha orientalis					
				1%	100	Persicaria decipiens					
				0.5%	50	Capilipedium spiceridginm					
				0.8	20	Tall fern					
				0.1	5	Cyperus sp - sample - polystacius? ~~or fengetus~~					
				0.5	40	Eragrostis sp - elongata?					
				0.1	1	Gratiola pedunculata					
			BAM Plot approx	0.4	20	Cybopogon objectus? - ambiguous					
			30m long	0.5	50	Cynodon dactilon					
			by 2m wide	0.1	20	Centella asiatica					
			non standard	0.1	1	Setaria parvifolia					
			on dam in	1	100	Juncus sp					
			water	0.8	15	Paspalum urvellia					
						←					
Total Cover DO FIRST											

20mx20m plot = 400m² **Note:** 0.1% = 63x63cm, 0.5% = 1.4x1.4m, 1% = 2x2m, 5% = 4x5m, 25% = 10x10m

C (%): 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ... (to nearest 5%). Include overhanging plants.

Abundance: 1-20, 50, 100, 500, 1000 etc. (numbers >20 are estimates only. For overhanging plants, record abundance as 1.

PLOT 59

PCT 1737

Date:	Job number:	Site:	Plot ID:	Bearing:	Observers:
6/4/21	1971.01	Eden	P59	147	IS/CR/TM.

Starting point Easting / Northing: 0373466 E 6359084 N

End point Easting / Northing: 0373476 E 6359056 N

AEP ECOLOGY | BIOBANKING | OFFSETS | BUSHFIRE

Arrival time: 3:05 **Departure time:** **Weather:** Overcast, 24 °C ESE wind 18km/h **TWO Transect photos (one landscape one Portrait) taken** ✓

1000m² plot **Mapped Vegetation community:** **Transect GPS points taken** ☐

Tree Stem Size Class DBH (1.3m high)	Presence/Absence Count above 50 cm	Count of Hollow Bearing Trees
< 5 cm	P / A	
5 - 9 cm	P / A	
10 – 19 cm	P / A	Total 0
20 – 29 cm	P / A	Length of logs (m) Note: >10cm diameter, >50cm length
30 – 49cm	P / A	
50 -79cm	# 0	
>80cm	# 0	Total metres 0

Leaf Litter Cover within 5 x 1m² sub-plots
Note: - located at 5m, 15m, 25m, 35m and 45m along the transect - first plot located 5m on the left of the transect
Litter includes leaves, seeds, twigs and branches less than 10cm in diameter.
Also include dead material attached to living plants that is touching the ground.

	Leaf litter	Live vegetation, bare ground, rocks, etc.
1	0 N/A	Water
2	0 N/A	Water
3	0	
4		
5		
Average	0	Water - Dam

Plot Disturbance: (weediness, clearing, erosion, edge effects, grazing, fire, other)

Lantana edge, Pampass grass edge; man made dam

Habitat features, comments and incidental fauna observations:

Striped Marsh Frog; Littoria Dallat

Note: Tree Stem Size Class <5cm refers to any regenerating stems and does not require a height of 1.3m.

Appendix F – AEP BAM Plot Data

| Family | Scientific Name | Common Name | BAM Growth Form | BAM Growth Form Code | BAM Growth Form Group | HTE | Present on Site | Plot 1 | Plot 2 | Plot 3 | Plot 4 | Plot 5 | Plot 6 | Plot 7 | Plot 8 | Plot 9 | Plot 10 | Plot 11 | Plot 12 | Plot 13 | Plot 14 | Plot 15 | Plot 16 | Plot 17 | Plot 18 | Plot 19 | Plot 20 | Plot 21 | Plot 22 | Plot 23 | Plot 24 | Plot 25 | Plot 26 | Plot 27 | Plot 28 | Plot 29 | Plot 30 | Plot 31 | Plot 32 | Plot 33 | Plot 34 | Plot 35 | Plot 36 | Plot 37 | Plot 38 | Plot 39 | Plot 40 | Plot 41 | Plot 42 | Plot 43 | Plot 44 | Plot 45 | Plot 46 | Plot 47 | Plot 48 | Plot 49 | Plot 50 | Plot 51 | Plot 52 | Plot 53 | Plot 54 | Plot 55 | Plot 56 | Plot 57 | Plot 58 | Plot 59 |
|---|---|---

Family	Scientific Name	Common Name	BAM Growth Form	BAM Growth Form Group	HTE	Present on Site	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17	Plot 18	Plot 19	Plot 20	Plot 21	Plot 22	Plot 23	Plot 24	Plot 25	Plot 26	Plot 27	Plot 28	Plot 29	Plot 30	Plot 31	Plot 32	Plot 33	Plot 34	Plot 35	Plot 36	Plot 37	Plot 38	Plot 39	Plot 40	Plot 41	Plot 42	Plot 43	Plot 44	Plot 45	Plot 46	Plot 47	Plot 48	Plot 49	Plot 50	Plot 51	Plot 52	Plot 53	Plot 54	Plot 55	Plot 56	Plot 57	Plot 58	Plot 59
Orchidaceae	*Calochilus* sp.		Forb	F	Forb (FG)		1																																0.1																0.1	0.1									
Orchidaceae	*Cryptostylis erecta*	Bonnet Orchid	Forb	F	Forb (FG)		1																																																							0.1			
Orchidaceae	*Dipodium punctatum*	Hyacinth Orchid	Forb	F	Forb (FG)		1																																								0.1			0.1	0.1													
Orchidaceae	*Dipodium variegatum*	Blotched Hyacinth Orchid	Forb	F	Forb (FG)		1										0.1																																															
Orchidaceae	*Microtis parviflora*	Slender Onion Orchid	Forb	F	Forb (FG)		1																																		0.1	0.1		0.1																						
Orchidaceae	*Microtis* sp.		Forb	F	Forb (FG)		1																																				0.1				0.1	0.1								0.1									
Orchidaceae	*Pterostylis acuminata*	Pointed Greenhood	Forb	F	Forb (FG)		1										0.1																			0.1																														
Orchidaceae	*Pterostylis* sp.	Greenhood	Forb	F	Forb (FG)		1		0.1						0.2			0.2		0.1		5			0.2				0.5											0.1				0.1																								
Oxalidaceae	*Oxalis compressa*		nil - exotic				1																																																								0.1	
Oxalidaceae	*Oxalis corniculata**	Yellow Wood Sorrel, Creeping Oxalis	nil - exotic				1																																0.1																							0.2	
Oxalidaceae	*Oxalis exilis*		Forb	F	Forb (FG)		1																																																	0.1	0.1						
Oxalidaceae	*Oxalis perrenans*	Yellow-flowered Wood Sorrel	Forb	F	Forb (FG)		1	0.1			0.1	0.1				0.1		0.1		0.1			0.1	0.1			0.1	0.1				0.1	0.1			0.9							0.1		0.1		0.1	0.1	0.1		0.1		0.1	0.1	0.1					0.1			
Oxalidaceae	*Oxalis* sp.				Forb (FG)		1										0.1																																																
Passifloraceae	*Passiflora suberosa**	Cork Passionflower	nil - exotic			Y	1																																																		0.1							
Phormiaceae	*Dianella caerulea*	Blue Flax-lily	Forb	F	Forb (FG)		1								0.1	0.1													0.5							0.2						0.1															0.1									
Phormiaceae	*Dianella caerulea var. caerulea*	Flax Lily	Forb	F	Forb (FG)		1																								0.4												0.3																						
Phormiaceae	*Dianella caerulea var. producta*	Flax Lily	Forb	F	Forb (FG)		1	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1		0.1	0.1	1	1	0.2	0.6	0.1	0.2	0.2	0.2	0.5	0.5		0.1	0.1	0.1			2				0.3					0.1			0.1	0.1	0.2	0.2	0.1		0.5	0.2	0.5	0.1			0.2		0.2			
Phormiaceae	*Dianella longifolia*	Blue Flax Lily	Forb	F	Forb (FG)		1												0.2																																															
Phormiaceae	*Dianella longifolia var. longifolia*	A Blue Flax Lily	Forb	F	Forb (FG)		1																																0.1																												
Phormiaceae	*Dianella revoluta var. revoluta*	Spreading Flax Lily	Forb	F	Forb (FG)		1				0.1		0.1				0.1									0.1		0.1					0.1														0.1	1	0.1					0.1		0.1								
Phyllanthaceae	*Glochidion ferdinandi var. ferdinandi*	Cheese Tree	Tree	T	Tree (TG)		1		0.1	20		5	0.1					0.1					0.1						0.1		0.1		1								0.2		0.2				0.1	0.1	0.1	0.1											3			
Pittosporaceae	*Billardiera scandens*	Hairy Apple berry	Vine	L	Other (OG)		1	0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.2	0.1		0.1	0.1	0.1	0.1	0.1									0.1		0.1					0.1						0.1	0.1								0.1		0.1								
Pittosporaceae	*Bursaria spinosa subsp. spinosa*	Native Blackthorn	Shrub	S	Shrub (SG)		1		0.1						0.1	0.1	0.1	0.1						0.1		0.2		0.1				5	0.1			1				0.1					1			0.2	0.1			0.1		0.1								0.5	
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn	Shrub	S	Shrub (SG)		1															0.1					0.2																						0.1	0.1					0.1								0.1	
Pittosporaceae	*Pittosporum revolutum*	Yellow Pittosporum	Shrub	S	Shrub (SG)		1																																					0.1															0.1					0.1	
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	Shrub	S	Shrub (SG)		1					0.1				0.1		0.1				0.1	0.5		0.1											3					1		2		0.5			0.1	0.1	1	0.1									1			0.5	
Plantaginaceae	*Plantago debilis*	Slender Plantain	Forb	F	Forb (FG)		1																																					0.1															0.1						
Plantaginaceae	*Plantago lanceolata**	Ribwort	nil - exotic				1																							0.1			0.1				0.5						0.5		1	1	0.1		0.1		0.1	0.1					5					3	1	
Plantaginaceae	*Plantago myosuros subsp. myosuros**		nil - exotic				1																																							0.2							0.1												
Plantaginaceae	*Plantago varia*		Forb	F	Forb (FG)		1																																																		2							
Poaceae	*Aira cupaniana**	Silvery Hairgrass	nil - exotic				1																																														0.2											
Poaceae	*Andropogon virginicus**	Whisky Grass	nil - exotic			Y	1																							2	0.1		0.1			0.1										15			0.1					0.1		0.2								1	
Poaceae	*Aristida vagans*	Three-awn Speargrass	Tussock Grass	G	Grass & grasslike (GG)		1	2	2					0.5	0.2	0.3	1		0.2	0.1	0.2	0.2		2		0.1	0.1	0.5				0.1	0.1	2												0.1	25	25	0.1	0.1			5	0.1			0.1					0.2	1	
Poaceae	*Aristida warburgii*		Tussock Grass	G	Grass & grasslike (GG)		1																																0.1																										
Poaceae	*Austrostipa* sp.	A Speargrass	Tussock Grass	G	Grass & grasslike (GG)		1										1																																																
Poaceae	*Axonopus fissifolius**	Narrow-leaved Carpet Grass	nil - exotic			Y	1																									0.1														45	25	0.1	0.1	0.1			5			0.2	20					5	0.3	
Poaceae	*Briza maxima**	Quaking Grass	nil - exotic				1																																							1	0.5							0.1						1				
Poaceae	*Briza minor**	Shivery Grass	nil - exotic				1																																				0.1			5	0.2																		
Poaceae	*Briza subaristata**		nil - exotic			Y	1																							0.1																15	10	0.2		0.5			0.5				0.2			1		0.1		
Poaceae	*Cenchrus pennisetiformis**	Scented-top Grass	Tussock Grass	G	Grass & grasslike (GG)		1																																																											0.5
Poaceae	*Chloris gayana**	Rhodes Grass	nil - exotic			Y	1																							35	2	2	5				3	2						30									10							8					
Poaceae	*Cortaderia selloana**	Pampas Grass	nil - exotic			Y	1																						0.1			0.2																																	
Poaceae	*Cymbopogon ambiguus*	Lemon Grass			Grass & grasslike (GG)		1																																																											0.4
Poaceae	*Cymbopogon refractus*	Barbwire Grass	Tussock Grass	G	Grass & grasslike (GG)		1										0.1		0.1									0.5				5	0.1	0.4			7										0.1				0.1											2		1	
Poaceae	*Cynodon dactylon*	Common Couch	Other Grass	D	Grass & grasslike (GG)		1																								0.1		0.1										10	2			0.5		10		0.5		0.1					0.2	15	0.5					0.5
Poaceae	*Dichelachne crinita*	Long-hair Plume Grass	Tussock Grass	G	Grass & grasslike (GG)		1																																0.1																											
Poaceae	*Dichelachne inaequiglumis*		Tussock Grass	G	Grass & grasslike (GG)		1																																																						0.5	0.3	
Poaceae	*Dichelachne micrantha*	Short-hair Plume Grass	Tussock Grass	G	Grass & grasslike (GG)		1							0.2			0.1		0.1	0.1				0.1	0.1			0.1		0.1	0.1	0.1	0.1								0.1	0.1	0.1			0.1	3	2	0.5	0.1		0.2	0.1	0.1		0.1						0.1	
Poaceae	*Digitaria ciliaris**	Summer Grass	nil - exotic				1																																																								0.5	0.5	
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass	Tussock Grass	G	Grass & grasslike (GG)		1							0.1					0.1		0.1	0.1						0.1																									0.5											
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass	Tussock Grass	G	Grass & grasslike (GG)		1																											2												0.5		1	0.5		0.1						0.5			0.1		2	
Poaceae	*Echinopogon caespitosus var. caespitosus*	Tuffed Hedgehog Grass	Tussock Grass	G	Grass & grasslike (GG)		1	0.2					0.5	0.1		0.1	0.1	0.2	0.1	0.1		0.2	0.1									0.2	0.1																				0.1	5	0.2	0.2								
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass	Tussock Grass	G	Grass & grasslike (GG)		1																																				0.1															1		2		0.1	0.2	0.1	
Poaceae	*Entolasia marginata*	Bordered Panic	Tussock Grass	G	Grass & grasslike (GG)		1			10		5	5		2	0.1	0.1		10	0.2	5		0.1				0.1		0.1					0.8														0.1							0.5				0.2							
Poaceae	*Entolasia* sp.				Grass & grasslike (GG)		1																																																								0.2	
Poaceae	*Entolasia stricta*	Wiry Panic	Tussock Grass	G	Grass & grasslike (GG)		1	12	10	0.1	2		0.5	0.5	1	1	0.1	0.1	5		5	1	0.5	15	0.3	5	5	1	0.1			0.5	0.5	15	4	1		0.1	0.1					0.5			5	2		0.5	0.5		10	10	25	5		0.5				15			
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	Tussock Grass	G	Grass & grasslike (GG)		1	0.2																										4			0.1					0.1																			1					
Poaceae	*Eragrostis curvula**	African Lovegrass	nil - exotic			Y	1																																																							5			
Poaceae	*Eragrostis elongata*	Clustered Lovegrass	Tussock Grass	G	Grass & grasslike (GG)		1																																																											0.5
Poaceae	*Hyparrhenia hirta**	Coolatai Grass	nil - exotic			Y	1																							0.5													1	10		0.5	0.1					1												
Poaceae	*Imperata cylindrica*	Blady Grass	Tussock Grass	G	Grass & grasslike (GG)		1	35	1	2	0.2	0.2	0.1	2	0.1	0.3	4	2	0.5	0.3	10	0.1	0.7	2	1	0.2	0.1	0.2	0.1	0.5		0.5	15	5	0.6	3		3				1		1	0.2		25			0.5		3	0.1	5	35	0.1	0.5			0.4	5	30	20	0.5	
Poaceae	*Lachnagrostis filiformis*	Blown Grass	Tussock Grass	G	Grass & grasslike (GG)		1																																		0.1	0.1		0.2		0.1	0.1																				
Poaceae	*Melinis repens**	Red Natal Grass	nil - exotic				1																							0.5	0.1		0.1										0.3	0.3	0.1			0.5			2		0.2														
Poaceae	*Microlaena stipoides*	Weeping Grass	Other Grass	D	Grass & grasslike (GG)		1																																0.1				0.1		15			0.2	10		0.2	0.1	0.1						1	0.2	1				
Poaceae	*Microlaena stipoides var. stipoides*	Weeping Rice Grass	Tussock Grass	G	Grass & grasslike (GG)		1	0.1	0.5	3	0.5	10	10	0.1	0.2	10	0.1	0.2	60	15	2	0.1	0.3	0.2	1	0.1	0.5	1	1	2		0.2		3		4	0.5	0.2									0.1			1					1	10		2					5	3	
Poaceae	*Oplismenus aemulus*	Basket Grass	Other Grass	D	Grass & grasslike (GG)		1													0.1	0.1		0.1							5					3						0.5																				0.2	40	5	0.1	5		
Poaceae	*Oplismenus imbecillis*		Other Grass	D	Grass & grasslike (GG)		1			20		10	5			0.1			10				0.5					0.2							3											1			0.1			0.2														
Poaceae	*Panicum effusum*	Hairy Panic	Tussock Grass	G	Grass & grasslike (GG)		1						0.1																																										0.1									
Poaceae	*Panicum gilvum**		nil - exotic				1																																																								5	
Poaceae	*Panicum simile*	Two Colour Panic	Tussock Grass	G	Grass & grasslike (GG)		1	0.5		5	6			0.5	5	0.1	0.1		0.2	0.1	0.3		0.3					0.1																			2								30	2			0.1			0.2			
Poaceae	*Paspalidium distans*		Tussock Grass	G	Grass & grasslike (GG)		1	0.5	0.2		0.5			0.1	1									0.1	0.1	0.1		0.1				0.2	0.1																	0.5								0.5	0.5		0.2				1	2	
Poaceae	*Paspalum dilatatum**	Paspalum	nil - exotic			Y	1									0.1																1										0.1		0.5			1		10	0.2	0.5			0.1		0.5		0.2	0.1			1		1	0.1	
Poaceae	*Paspalum orbiculare*	Ditch Millet	Tussock Grass	G	Grass & grasslike (GG)		1																																																								0.1		
Poaceae	*Paspalum* sp.*		nil - exotic				1																														4																													
Poaceae	*Paspalum urvillei**	Vasey Grass	nil - exotic				1																																																		15					8	2	0.8
Poaceae	*Pennisetum clandestinum**	Kikuyu	nil - exotic			Y	1																								0.1							1		0.2																										
Poaceae	*Poa affinis*		Tussock Grass	G	Grass & grasslike (GG)		1																				5		5							0.3		0.2					1												0.5										
Poaceae	*Poa annua**	Winter Grass	nil - exotic				1																							0.1																																			
Poaceae	*Poa sieberiana*	Tussock Grass	Tussock Grass		Grass & grasslike (GG)		1											1																						15					15							0.1											
Poaceae	*Poa* sp.*		nil - exotic				1																											5																																
Poaceae	*Rytidosperma tenuius*	Wallaby Grass	Tussock Grass	G	Grass & grasslike (GG)		1																																																						0.1			
Poaceae	*Setaria gracilis**	Slender Pigeon Grass	nil - exotic				1																																																	5									
Poaceae	*Setaria pumila**	Palm Grass	nil - exotic				1																																																						0.1			
Poaceae	*Setaria parviflora**	Slender Pigeon Grass	nil - exotic				1	0.1																																						0.1							0.1						0.5		10	0.2	0.1
Poaceae	*Setaria sphacelata**	South African Pigeon Grass	nil - exotic				1																							40	0.5	25	5											3	35		5						70													
Poaceae	*Sporobolus africanus**	Parramatta Grass	nil - exotic				1																										0.2																		0.1												
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass	Tussock Grass		Grass & grasslike (GG)		1																																																						0.1			
Poaceae	*Themeda triandra*	Kangaroo Grass	Tussock Grass	G	Grass & grasslike (GG)		1	10	3	2	5		0.1	40	15	10	55	2		20	30	10	20	5		0.1	0.1						0.1	2					0.3		0.2	0.1	3				20	2	25	0.2			15	10	0.2	40	1	80				25	5	50	
Poaceae	*Vulpia bromoides**	Squirrel Tail Fescue	nil - exotic				1																																				1																					
Poaceae	*Vulpia myuros**	Rat's Tail Fescue	nil - exotic				1																																					0.1		0.1	0.1						0.1												
Poaceae	*Poaceae* sp.		Other Grass	D	Grass & grasslike (GG)		1		0.1			0.1												0.1																																									
Poaceae	*Rytidosperma pallidum*	Silvertop Wallaby Grass	Tussock Grass	G	Grass & grasslike (GG)		1	5	35	0.1	0.5		0.2	10	1			0.1			25			0.5	15	25	0.1	0.5											0.1										0.5	0.2		0.1	2		0.2											
Polygonaceae	*Persicaria capitata**	Knotweed	nil - exotic				1																																																							0.1			
Polygonaceae	*Persicaria decipiens*	Slender Knotweed	Forb	F	Forb (FG)		1																																																											1
Primulaceae	*Lysimachia arvensis var. caerulea**	Blue Pimpernel	nil - exotic				1																																							0.5																				
Primulaceae	*Lysimachia arvensis**	Scarlet Pimpernel	nil - exotic				1																							0.1	0.1		0.1														0.5																				
Proteaceae	*Banksia spinulosa*	Hairpin Banksia	Shrub	S	Shrub (SG)		1			0.5	0.1		0.2	0.5																																														0.1						
Proteaceae	*Banksia spinulosa var. collina*	Hairpin Banksia	Shrub	S	Shrub (SG)		1																											2																																	
Proteaceae	*Hakea salicifolia*	Willow Hakea	Shrub	S	Shrub (SG)		1																																												0.5														
Proteaceae	*Hakea sericea*	Needlebush	Shrub	S	Shrub (SG)		1																																									0.1																	
Proteaceae	*Hakea teretifolia*	Dagger Hakea	Shrub	S	Shrub (SG)		1																																											1														
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung	Shrub	S	Shrub (SG)		1					0.2	0.1	0.1			0.1		0.1	0.1	0.1		1	0.1																								0.1	0.1						0.1								0.1			
Pteridaceae	*Cheilanthes sustrotenuifolia*	Rock Fern	Fern and fern allies	E	Fern (EG)		1																															0.1																											
Pteridaceae	*Cheilanthes sieberi*	Rock Fern	Fern and fern allies	E	Fern (EG)		1												0.1	0.1									0.2	0.1												0.1	0.2		0.1			0.1	0.1	1			0.1		0.1	0.1	0.1	0.2	0.1		0.1					
Ranunculaceae	*Clematis aristata*	Old Man's Beard	Vine	L	Other (OG)		1											0.2					1			0.1		0.1	0.1			0.1	0.1		1					0.1														0.1			0.1					0.5				
Ranunculaceae	*Clematis glycinoides var. glycinoides*	Headache Vine	Vine	L	Other (OG)		1																																																								3			
Ranunculaceae	*Ranunculus* sp.		nil - exotic				1																																							0.2																				
Restionaceae	*Empodisma minus*	Spreading Rope-rush	Rush	R	Grass & grasslike (GG)		1			2			1																																																				
Rhamnaceae	*Pomaderris ferruginea*	Rusty Pomaderris	Shrub	S	Shrub (SG)		1			0.1												0.8																																												
Rubiaceae	*Galium propinquum*	Bedstraw			Forb (FG)		1																																																		0.1									
R

Appendix G – Biodiversity Credit Reports

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00019967/BAAS17002/21/00024249	Proposal Name Eden Estates BCAR	BAM data last updated * 28/10/2024
Assessor Name	Assessor Number	BAM Data version * Legacy Classification (pre-ENSW) (80)
Proponent Names	Report Created 09/12/2024	BAM Case Status Finalised
Assessment Revision 8		Assessment Type Biocertification
Date Finalised 09/12/2024		

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Rhodamnia rubescens / Scrub Turpentine

Additional Information for Approval

PCT Outside Ibra Added

PCT
1543-Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1543-Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley	Not a TEC	0.0	0	1	1
1573-Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment	Not a TEC	0.7	19	0	19
1584-White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	Not a TEC	87.0	922	303	1225
1588-Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	Not a TEC	15.2	414	78	492
1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	24.6	835	24	859
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Not a TEC	80.7	2067	0	2067
1621-Smooth-barked Apple open forest on coastal lowlands of the Central Coast	Not a TEC	13.8	362	3	365

1543-Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

	Dry Rainforests This includes PCT's: 669, 1123, 1300, 1525, 1541, 1543, 2068, 3010, 3059, 3062, 3065, 3066, 3068, 3075, 3076, 3080, 3082, 3083, 3089, 3091, 3104, 3114, 3116, 4144	Dry Rainforests >=50% and <70%	1543_Good	No	1	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1573-Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	North Coast Wet Sclerophyll Forests This includes PCT's: 487, 613, 661, 684, 686, 692, 693, 694, 695, 699, 747, 748, 752, 812, 826, 827, 1073, 1208, 1217, 1222, 1237, 1244, 1245, 1257, 1259, 1260, 1261, 1265, 1266, 1282, 1284, 1285, 1504, 1561, 1562, 1563, 1566, 1567, 1568, 1569, 1572, 1573, 1575, 1579, 1841, 1843, 1915, 3058, 3060, 3067, 3073, 3078, 3084, 3087, 3088, 3102, 3125, 3136, 3137, 3138, 3139, 3140, 3141, 3142, 3145, 3147, 3148, 3149, 3150, 3153, 3154, 3156, 3157, 3158, 3160, 3161, 3162, 3163, 3164, 3165, 3166, 3168, 3169, 3171, 3172, 3173, 3174, 3176, 3177, 3178, 3180, 4043, 4115	North Coast Wet Sclerophyll Forests <50%	1573_Good	Yes	19	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1584-White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	**Like-for-like credit retirement options**

Class	Trading group	Zone	HBT	Credits	IBRA region
Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914, 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109	Northern Hinterland Wet Sclerophyll Forests <50%	1584_DiRLU	No	0	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914, 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109	Northern Hinterland Wet Sclerophyll Forests <50%	1584_DiRTS	No	303	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914, 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109	Northern Hinterland Wet Sclerophyll Forests <50%	1584_Good	Yes	752	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914, 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109	Northern Hinterland Wet Sclerophyll Forests <50%	1584_Rehab	Yes	170	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1588-Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 922, 1178, 1588, 1589, 1600, 1601, 1602, 1608, 3431, 3433, 3436, 3437, 3439, 3442, 3444, 3446	Hunter-Macleay Dry Sclerophyll Forests >=50% and <70%	1588_DiRLU	No	37	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 922, 1178, 1588, 1589, 1600, 1601, 1602, 1608, 3431, 3433, 3436, 3437, 3439, 3442, 3444, 3446	Hunter-Macleay Dry Sclerophyll Forests >=50% and <70%	1588_DiRTS	No	41	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 922, 1178, 1588, 1589, 1600, 1601, 1602, 1608, 3431, 3433, 3436, 3437, 3439, 3442, 3444, 3446	Hunter-Macleay Dry Sclerophyll Forests >=50% and <70%	1588_Good	Yes	414	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1588-Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast						
1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602, 3433, 3442, 3443, 3444, 4158	-	1592_DiRLU	No	16	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602, 3433, 3442, 3443, 3444, 4158	-	1592_DiRTS	No	8	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602, 3433, 3442, 3443, 3444, 4158	-	1592_Good	Yes	835	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1619_DiUS	Yes	1	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1619_Good	Yes	2066	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1621-Smooth-barked Apple open forest on coastal lowlands of the Central Coast	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1621_DiRTS	No	1	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1621_Good	Yes	362	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1621_RPPF	No	2	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Callistemon linearifolius / Netted Bottle Brush	**1619_Good, 1621_Good**	936.0	1404.00

Chalinolobus dwyeri / Large-eared Pied Bat	**1573_Good, 1584_Good, 1588_Good, 1592_Good, 1619_Good, 1621_Good, 1621_RPPF, 1543_Good, 1584_DiRLU, 1584_DiRTS, 1584_Rehab, 1588_DiRLU, 1588_DiRTS, 1592_DiRLU, 1592_DiRTS, 1619_DiUS, 1621_DiRTS**	222.0	9825.00
Grevillea parviflora subsp. parviflora / Small-flower Grevillea	**1619_Good**	1.6	54.00
Myotis macropus / Southern Myotis	**1573_Good, 1584_Good, 1588_Good, 1592_Good, 1619_Good, 1621_Good, 1584_DiRLU, 1588_DiRLU, 1588_DiRTS, 1592_DiRLU, 1592_DiRTS, 1621_DiRTS**	19.5	564.00
Ninox strenua / Powerful Owl	**1588_Good, 1619_Good**	0.1	3.00
Petaurus norfolcensis / Squirrel Glider	**1573_Good, 1584_Good, 1588_Good, 1592_Good, 1619_Good, 1621_Good, 1621_RPPF, 1543_Good, 1584_DiRLU, 1584_DiRTS, 1584_Rehab, 1588_DiRLU, 1588_DiRTS, 1592_DiRLU, 1592_DiRTS, 1619_DiUS, 1621_DiRTS**	222.0	6551.00

Rhodamnia rubescens / Scrub Turpentine	**1584_Good**	1.0	3.00
Tetratheca juncea / Black-eyed Susan	**1592_Good, 1619_Good, 1621_Good, 1621_RPPF**	49.6	1702.00

Credit Retirement Options

Like-for-like credit retirement options

Callistemon linearifolius / Netted Bottle Brush	Spp	IBRA subregion
	Callistemon linearifolius / Netted Bottle Brush	Any in NSW
Chalinolobus dwyeri / Large-eared Pied Bat	Spp	IBRA subregion
	Chalinolobus dwyeri / Large-eared Pied Bat	Any in NSW
Grevillea parviflora subsp. parviflora / Small-flower Grevillea	Spp	IBRA subregion
	Grevillea parviflora subsp. parviflora / Small-flower Grevillea	Any in NSW
Myotis macropus / Southern Myotis	Spp	IBRA subregion
	Myotis macropus / Southern Myotis	Any in NSW
Ninox strenua / Powerful Owl	Spp	IBRA subregion
	Ninox strenua / Powerful Owl	Any in NSW

Petaurus norfolcensis / Squirrel Glider	Spp	IBRA subregion
	Petaurus norfolcensis / Squirrel Glider	Any in NSW
Rhodamnia rubescens / Scrub Turpentine	Spp	IBRA subregion
	Rhodamnia rubescens / Scrub Turpentine	Any in NSW
Tetratheca juncea / Black-eyed Susan	Spp	IBRA subregion
	Tetratheca juncea / Black-eyed Susan	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00019967/BAAS17002/21/00024249

Proposal Name
Eden Estates BCAR

BAM data last updated *
28/10/2024

Assessor Name

Assessor Number

BAM Data version *
Legacy Classification (pre-ENSW) (80)

Proponent Name(s)

Report Created
09/12/2024

BAM Case Status
Finalised

Assessment Revision
8

Assessment Type
Biocertification

Date Finalised
09/12/2024

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Rhodamnia rubescens / Scrub Turpentine

Additional Information for Approval

PCT Outside Ibra Added

PCT
1543-Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1543-Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley	Not a TEC	0.0	0	1	1.00
1573-Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment	Not a TEC	0.7	19	0	19.00
1584-White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	Not a TEC	87.0	922	303	1225.00
1588-Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	Not a TEC	15.2	414	78	492.00
1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	24.6	835	24	859.00

1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Not a TEC	80.7	2067	0	2067.00
1621-Smooth-barked Apple open forest on coastal lowlands of the Central Coast	Not a TEC	13.8	362	3	365.00

1543-Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Dry Rainforests This includes PCT's: 669, 1123, 1300, 1525, 1541, 1543, 2068, 3010, 3059, 3062, 3065, 3066, 3068, 3075, 3076, 3080, 3082, 3083, 3089, 3091, 3104, 3114, 3116, 4144	Dry Rainforests >=50% and <70%	1543_Good	No	1	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region
Rainforests	Tier 3 or higher threat status	1543_Good	No	1	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1573-Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

North Coast Wet Sclerophyll Forests This includes PCT's: 487, 613, 661, 684, 686, 692, 693, 694, 695, 699, 747, 748, 752, 812, 826, 827, 1073, 1208, 1217, 1222, 1237, 1244, 1245, 1257, 1259, 1260, 1261, 1265, 1266, 1282, 1284, 1285, 1504, 1561, 1562, 1563, 1566, 1567, 1568, 1569, 1572, 1573, 1575, 1579, 1841, 1843, 1915, 3058, 3060, 3067, 3073, 3078, 3084, 3087, 3088, 3102, 3125, 3136, 3137, 3138, 3139, 3140, 3141, 3142, 3145, 3147, 3148, 3149, 3150, 3153, 3154, 3156, 3157, 3158, 3160, 3161, 3162, 3163, 3164, 3165, 3166, 3168, 3169, 3171, 3172, 3173, 3174, 3176, 3177, 3178, 3180, 4043, 4115	North Coast Wet Sclerophyll Forests <50%	1573_Good	Yes	19	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region

	Wet Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1573_Good	Yes (including artificial)	19	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1584-White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914, 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109	Northern Hinterland Wet Sclerophyll Forests <50%	1584_DiRLU	No	0	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914, 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109	Northern Hinterland Wet Sclerophyll Forests <50%	1584_DiRTS	No	303	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914, 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109	Northern Hinterland Wet Sclerophyll Forests <50%	1584_Good	Yes	752	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914, 3063, 3069, 3094, 3115, 3144, 3152, 3155, 3167, 3170, 3179, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3285, 4109	Northern Hinterland Wet Sclerophyll Forests <50%	1584_Rehab	Yes	170	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region
Wet Sclerophyll Forests (Grassy sub-formation)	Tier 4 or higher threat status	1584_DiRLU	No	0	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Wet Sclerophyll Forests (Grassy sub-formation)	Tier 4 or higher threat status	1584_DiRTS	No	303	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Wet Sclerophyll Forests (Grassy sub-formation)	Tier 4 or higher threat status	1584_Good	Yes (including artificial)	752	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Wet Sclerophyll Forests (Grassy sub-formation)	Tier 4 or higher threat status	1584_Rehab	Yes (including artificial)	170	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1588-Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 922, 1178, 1588, 1589, 1600, 1601, 1602, 1608, 3431, 3433, 3436, 3437, 3439, 3442, 3444, 3446	Hunter-Macleay Dry Sclerophyll Forests >=50% and <70%	1588_DiRLU	No	37	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 922, 1178, 1588, 1589, 1600, 1601, 1602, 1608, 3431, 3433, 3436, 3437, 3439, 3442, 3444, 3446	Hunter-Macleay Dry Sclerophyll Forests >=50% and <70%	1588_DiRTS	No	41	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 922, 1178, 1588, 1589, 1600, 1601, 1602, 1608, 3431, 3433, 3436, 3437, 3439, 3442, 3444, 3446	Hunter-Macleay Dry Sclerophyll Forests >=50% and <70%	1588_Good	Yes	414	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Variation options					
Formation	Trading group	Zone	HBT	Credits	IBRA region
Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher threat status	1588_DiRLU	No	37	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher threat status	1588_DiRTS	No	41	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher threat status	1588_Good	Yes (including artificial)	414	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1592-Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602, 3433, 3442, 3443, 3444, 4158	-	1592_DiRLU	No	16	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602, 3433, 3442, 3443, 3444, 4158	-	1592_DiRTS	No	8	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions This includes PCT's: 1590, 1592, 1593, 1600, 1602, 3433, 3442, 3443, 3444, 4158	-	1592_Good	Yes	835	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Variation options					
Formation	Trading group	Zone	HBT	Credits	IBRA region
Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher threat status	1592_DiRLU	No	16	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher threat status	1592_DiRTS	No	8	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 3 or higher threat status	1592_Good	Yes (including artificial)	835	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Like-for-like credit retirement options					
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Class	Trading group	Zone	HBT	Credits	IBRA region
	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1619_DiUS	Yes	1	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1619_Good	Yes	2066	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1619_DiUS	Yes (including artificial)	1	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1619_Good	Yes (including artificial)	2066	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1621-Smooth-barked Apple open forest on coastal lowlands of the Central Coast	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1621_DiRTS	No	1	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1621_Good	Yes	362	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1621_RPPF	No	2	Wyong,Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Variation options					
Formation	Trading group	Zone	HBT	Credits	IBRA region
Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1621_DiRTS	No	1	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1621_Good	Yes (including artificial)	362	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1621_RPPF	No	2	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Callistemon linearifolius / Netted Bottle Brush	**1619_Good, 1621_Good**	936.0	1404.00
Chalinolobus dwyeri / Large-eared Pied Bat	**1573_Good, 1584_Good, 1588_Good, 1592_Good, 1619_Good, 1621_Good, 1621_RPPF, 1543_Good, 1584_DiRLU, 1584_DiRTS, 1584_Rehab, 1588_DiRLU, 1588_DiRTS, 1592_DiRLU, 1592_DiRTS, 1619_DiUS, 1621_DiRTS**	222.0	9825.00
Grevillea parviflora subsp. parviflora / Small-flower Grevillea	**1619_Good**	1.6	54.00
Myotis macropus / Southern Myotis	**1573_Good, 1584_Good, 1588_Good, 1592_Good, 1619_Good, 1621_Good, 1584_DiRLU, 1588_DiRLU, 1588_DiRTS, 1592_DiRLU, 1592_DiRTS, 1621_DiRTS**	19.5	564.00
Ninox strenua / Powerful Owl	**1588_Good, 1619_Good**	0.1	3.00

Petaurus norfolcensis / Squirrel Glider	**1573_Good, 1584_Good, 1588_Good, 1592_Good, 1619_Good, 1621_Good, 1621_RPPF, 1543_Good, 1584_DiRLU, 1584_DiRTS, 1584_Rehab, 1588_DiRLU, 1588_DiRTS, 1592_DiRLU, 1592_DiRTS, 1619_DiUS, 1621_DiRTS**	222.0	6551.00
Rhodamnia rubescens / Scrub Turpentine	**1584_Good**	1.0	3.00
Tetratheca juncea / Black-eyed Susan	**1592_Good, 1619_Good, 1621_Good, 1621_RPPF**	49.6	1702.00

Credit Retirement Options

Like-for-like options

Callistemon linearifolius/ Netted Bottle Brush	Spp		IBRA region
	Callistemon linearifolius/Netted Bottle Brush		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Vulnerable	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Chalinolobus dwyeri/ Large-eared Pied Bat	Spp		IBRA region
	Chalinolobus dwyeri/Large-eared Pied Bat		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Endangered	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Grevillea parviflora subsp. parviflora/ Small-flower Grevillea	Spp		IBRA region
	Grevillea parviflora subsp. parviflora/Small-flower Grevillea		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Vulnerable	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Myotis macropus/ Southern Myotis	Spp		IBRA region
	Myotis macropus/Southern Myotis		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Ninox strenua/ Powerful Owl	Spp		IBRA region
	Ninox strenua/Powerful Owl		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Petaurus norfolcensis/ Squirrel Glider	Spp		IBRA region
	Petaurus norfolcensis/Squirrel Glider		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Rhodamnia rubescens/ Scrub Turpentine	Spp		IBRA region
	Rhodamnia rubescens/Scrub Turpentine *Note: Variation rules do not apply for Critically Endangered species and impacts on Commonwealth listed entities that are a controlled action.*		Any in NSW
Tetratheca juncea/ Black-eyed Susan	Spp		IBRA region
	Tetratheca juncea/Black-eyed Susan		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

	Flora	Vulnerable	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Appendix H – Habitat Photographs

Above: Powerful Owl nest hollow in the central-north of the Subject Site;
Below: Boulders in escarpment.

Above and below: Standing water habitat

Appendix I – Fauna Photographs

Above: Powerful Owl pair with prey; Below: Masked Owl

Above: Tawny Frogmouth; Below: Broad-palmed Frog

Above: Red-backed Toadlet; Below: Wedge-tailed Eagle

Above: Glossy Black-cockatoo; Below: Southern Boobook

Above: Common Brushtail Possum; Below: Feathertail Glider

Above: Echidna; Below: Glider sp.

Above Glider sp.; Below: Sugar Glider

Above: Sugar Glider

Above: Regurgitated pellet including Grey-headed Flying-fox remains;
Below: Regurgitated pellet including Common Ringtail Possum remains

Appendix J – Threatened Flora Photographs

Above: *Rhodamnia rubescens*; Below: *Tetratheca juncea*

Above: ***Grevillea parviflora subsp. parviflora***

(identified as *G. humilis* by Royal Botanic Gardens)

Appendix K – Comparison of Impacts by LGA

				Lake Macquarie City Council					City of Newcastle				
Entity	Unit of measure	Extent of occurrence within Study Area	Extent of occurrence within BCAR lands	Extent of occurrence within LGA portion of Study Area	Extent of occurrence within LGA as a proportion of extent of occurrence within the Study Area %	Extent of occurrence within BCAR lands within LGA	Development impact within LGA as a proportion of extent of occurrence within LGA %	Retention within LGA as a proportion of extent of occurrence within LGA %	Extent of occurrence within LGA portion of Study Area	Extent of occurrence within LGA as a proportion of extent of occurrence within the Study Area %	Extent of occurrence within BCAR lands within LGA	Development impact within LGA as a proportion of extent of occurrence within LGA %	Retention within LGA as a proportion of extent of occurrence within LGA %
PCT 1539	Hectare	1.12	0	1.10	98.21%	0	0.00%	100.00%	0	0.00%	0	-	-
PCT 1543	Hectare	1.38	0.01	0.10	7.25%	0	0.00%	100.00%	1.30	94.20%	0	0.00%	100.00%
PCT 1573	Hectare	6.61	0.66	2.50	37.82%	0.05	2.19%	97.81%	4.10	62.03%	0.60	14.66%	85%
PCT 1584	Hectare	203.00	86.98	16.20	7.98%	0.05	0.32%	99.68%	186.80	92.02%	86.93	46.53%	53.47%
PCT 1588	Hectare	76.04	15.19	19.60	25.78%	2.85	14.53%	85.47%	56.40	74.17%	12.34	21.88%	78.12%
PCT 1592 (EEC)	Hectare	99.77	24.62	27.40	27.46%	1.70	6.21%	93.79%	72.40	72.57%	22.92	31.66%	68.34%
PCT 1619	Hectare	136.56	80.70	62.40	45.69%	48.96	78.46%	21.54%	74.10	54.26%	31.74	42.84%	57.16%
PCT 1621	Hectare	32.79	13.83	31.50	96.07%	13.44	42.67%	57.33%	1.30	3.96%	0.39	30.36%	69.64%
PCT 1737	Hectare	0.73	0	0.02	2.74%	0	0.00%	100%	0.68	93.15%	0	0.44%	99.56%
Total native vegetation	**Hectare**	**558.0**	**222.0**	**160.8**	**28.8%**	**67.1**	**41.7%**	**58.3%**	**397.1**	**71.2%**	**154.9**	**39.0%**	**61.0%**
Callistemon linearifolius	Count	5151	936	5149	99.96%	935	18.16%	81.84%	2	0.04%	1	50.00%	50.00%
Grevillea parviflora subsp. parviflora	Hectare	1.61	1.58	1.61	100%	1.58	98.14%	2%	0	0%	0	-	-
Rhodamnia rubescens	Count	2772	1	747	26.95%	0	0.00%	100%	2025	73.05%	1	0.05%	99.95%
Tetratheca juncea	Hectare	83.80	49.60	27.80	33.17%	23.96	86.19%	13.81%	56	66.83%	25.64	39.69%	60.31%
Chalinolobus dwyeri	Hectare	557.90	222.00	160.82	28.83%	67.10	41.72%	58.28%	397.08	71.17%	154.90	39.00%	61.00%
Myotis macropus	Hectare	93.10	19.50	30.70	32.98%	4.19	13.65%	86.35%	62.40	67.02%	15.31	24.54%	75.46%
Ninox strenua	Hectare	9.30	0.04	5.30	56.99%	0	0%	100%	4.00	43.01%	0.04	1%	99%
Petaurus norfolcensis	Hectare	557.90	222.00	160.82	28.8%	67.10	41.7%	58.3%	397.08	71.2%	154.90	39.0%	61.0%

Appendix L – Other Legislation

State Environmental Planning Policy (Biodiversity and Conservation) 2021 – Chapter 4 Koala Habitat Protection

The State Environmental Planning Policy (Biodiversity and Conservation) 2021 (BC SEPP) commenced on 1 March 2022. The State Environment Planning Policy (Koala Habitat Protection) 2021 was one SEPP that was consolidated within the BC SEPP 2021 under Chapter 4 Koala Habitat Protection. No policy changes were made as part of the consolidation nor did the legal effect of the existing SEPPs, with section 30A of the *Interpretation Act 1987* applying to the transferred provisions. The consolidation was undertaken in accordance with section 3.22 of the *Environmental Planning and Assessment Act 1979*.

The land which comprises the Study Area has no approved Koala plan of management. According to the BC SEPP 2021, the policy applies if:

4.9 Development assessment process—no approved Koala plan of management for land

(1) This clause applies to land to which this Policy applies if the land—

(a) has an area of at least 1 hectare (including adjoining land within the same ownership), and

(b) does not have an approved Koala plan of management applying to the land.

Review of the information identified that the Study Area comprises approx. 558ha and does not have an approved Koala plan of management. Therefore, Chapter 4 of the BC SEPP applies. As a result, additional assessments were required to satisfy the Development Assessment Process.

However, despite subclauses (3) and (4), the council may grant development consent if the applicant provides to the council –

a. information, prepared by a suitably qualified and experienced person, the council is satisfied demonstrates that the land subject of the development application –

i. does not include any trees belonging to the Koala use tree species listed in Schedule 3 for the relevant Koala management area, or

ii. is not core Koala habitat,

Site inspections identified that trees belonging to the Koala use tree species listed in Schedule 3 for the relevant Koala management area were located on site.

In regards to identifying the site as core Koala habitat, core Koala habitat is defined as;

a. an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable Koala habitat and where Koalas are recorded as being present at the time of assessment of the land as highly suitable Koala habitat, or

b. *an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable Koala habitat and where Koalas have been recorded as being present in the previous 18 years.*

Highly Suitable Koala Habitat is defined as – Where trees within any PCT are the regionally relevant species of those listed in Schedule 3 for the relevant Koala management area.

Koala Investigation Results

As Koala feed trees were identified on site additional assessments were undertaken to determine if Koalas were present on site and to determine if the site was core Koala habitat as per the definitions above.

Survey effort for Koalas included:

- Targeted searches including nocturnal searches (April-Sept 2020, Nov 2020, Jan-Feb 2021);
- Spot Assessment Technique surveys using a grid-based systematic approach (250m spacing) (Phillips & Callaghan 2011; DPIE 2020f; DPE 2022b) (May-June 2020);
- Spotlighting and call playback (Apr-Sep 2020, Nov 2020, Jan-Feb 2021);
- Passive Song Meter recording (Mar-Sep 2020).

As such, the survey effort for Koala within the Subject Site is compliant both with SEPP 2019 and BC SEPP, since SEPP 2019 survey guidelines were more comprehensive than those referred to in BC SEPP.

Targeted surveys failed to identify any sign of Koala utilisation of the site. Desktop assessment of local records in BioNet Atlas showed three (3) Koala records, two (2) within 5km west of the Subject Site in 2015 and 2016 and one (1) within 5km north of the Subject Site. These are the only BioNet records within the last 18 years. As such the site is deemed an area of historical occupation as defined by the SEPP guidelines.

Therefore, a Tier 2 Assessment has been undertaken.

Tier 2 Assessment
Part A: Presence of highly suitable Koala Habitat

Determine the PCT (using suitable methods) and if PCT have Schedule 3 listed trees an assessment must be undertaken to determine Koala presence.

PCTs identified within the Study Area are listed in **Table 4** of the BCAR. Trees listed under Schedule 3 of the SEPP occur throughout the site. Therefore, the site is deemed to have highly Suitable Koala Habitat and a Tier Two assessment is required. Targeted Koala surveys were undertaken on site to achieve a diligent survey effort.

Assess BioNet for records - All records within set distance (2.5km OR 5km) in the last 18 years apply. = Core Habitat. Requiring a Part B Assessment to determine Koala presence.

An assessment of BioNet showed three (3) records within 5kms from the Study Area.

Part B Assessment

i) Koala Presence – Spot Assessment Technique, Nocturnal Survey, Call Playback and Songmeter

Table A: Survey Effort

Survey Effort			
Survey type	**Actual Survey Period**	**Survey UOM**	**Survey Effort**
Songmeter	Sept-Nov 2020	Night	278
Spotlighting	Apr-Sept 2020 Nov 2020 Jan-Feb 2021	Person-hour	199.25
Call Playback	Apr-Sept 2020 Sept 2020	Person-hour	86.5
SAT Survey	May-June 2020	250m grid survey	94

Further detail on survey effort is available in **Appendix D**. These surveys did not result in finding any Koalas, scats or markings within the Subject Site, nor were any calls recorded by Songmeters deployed within the site.

ii) Koala Records

As stated above, two (2) BioNet records occur within 5km to the west, and one (1) within 5kms to the north from the Study Area within the last 18 years.

Records within these maximum distances must only be considered after a careful examination of the broader landscape. That is, within areas of contiguous habitat or between areas of habitat with connectivity. For example, a record from 2.5km from the subject site must not be used if natural or artificial landscape features would prevent Koalas from the area with the record ever moving to the site (e.g. due to large rivers, roads, fences or built up areas).

Table B: Koala Assessment

Principles	Criteria	Assessment
Introduction	Describe the nature of the proposed development.	It is proposed to rezone and subsequently develop the Subject Site for residential, public recreation, commercial and general mixed-use purposes. The majority of retained lands will be managed under a BSA. Details of native vegetation occurring within the Study Area and proposed to be impacted within the Subject Site are provided in **Table 4** of the BCAR.
	Define how the SEPP applies to the proposed development.	Refer above to Tier 1 and Tier 2 Assessment.
Koala habitat values – addressing criteria 1 and 2	Describe the site area, including the general environment and condition, location and extent of the development area and any other areas that may be directly or indirectly impacted by the proposed development.	The site occurs as a former mining site which has been rehabilitated, and vacant bushland. The land is subject to various types of disturbance (human incursions, rubbish dumping and environmental weed infestation). The location of the proposed development is shown on **Figure 1** of the BCAR. Consideration was given to potential indirect impacts via the identification of a 30-meter buffer around the Subject Site. A comprehensive assessment of direct and indirect impacts is provided in **Section 2.0** of the BCAR.
	Provide details of Koala survey as undertaken in accordance with Appendix C. This should include details of the results of the Koala surveys, including how the site area meets the definition of core Koala habitat and mapping that shows habitat areas and Koala records within the site area and adjoining areas.	Details of Koala surveys are provided in **Appendix D** of the BCAR. Surveys included SAT surveys (using a 250m grid), spotlighting, call playback and passive acoustic recording. Survey effort did not detect evidence of Koala within the Study Area.
	Describe the site context (including mapping showing habitat that might be associated with vegetation in the adjoining landscape and records within the vicinity of the site area) and provide an analysis of the Koala habitat values (including how Koalas might use the site area and the relative importance of the site area to a local Koala population).	Nine (9) PCTs were identified within the study area; PCT 1539 – Grey Myrtle sheltered gully dry rainforest in gullies of the Sydney Basin; PCT 1543 - Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley; PCT 1573 – Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment; PCT 1584 – White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley; PCT 1588 – Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum

Principles	Criteria	Assessment
		shrubby open forest on Coastal Lowlands of the Central Coast; PCT 1592 – Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter; PCT 1619 – Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands; PCT 1621 – Smooth-barked Apple open forest on coastal lowlands of the Central Coast; and PCT 1737 – Typha Rushland. As mentioned above three (3) Koala records exist within 5km radius of the study area, from >7 years ago. Given that surveys failed to find any sign of Koala it is considered that there is no current local population present that would utilise the site.
Measures taken to avoid impacts to Koalas – addressing criteria 3, 4, 5, 6, 7 and 8	Describe the site selection process, including how Koala habitat was taken into account and any avoidance outcomes achieved through this process.	Targeted surveys failed to identify any sign of Koala utilisation of the site. Therefore, it was determined that it is unlikely that Koalas are present within the Study Area.
	Describe how the proposed development avoids or minimises direct impacts to Koala habitat and habitat function within the site area.	The avoid and minimise process has been undertaken throughout an iterative design process, and the proposal includes habitat corridors managed under a BSA throughout the Study Area. Comprehensive survey has been undertaken and given that it is highly likely that there is no Koala population present, no further action was considered necessary.
Analysis of potential impacts – addressing criteria 9	Identify the residual direct impacts to Koalas and Koala habitat within the site area, including the nature and extent of impacts and the likely implications for the viability of a local Koala population.	Targeted surveys failed to identify any sign of Koala utilisation of the site. Therefore, it was determined that it is unlikely that Koalas are present within the Study Area.
	Identify the relevant potential indirect impacts to Koalas and Koala habitat within the site area and adjacent habitat areas, including the nature and extent of potential indirect impacts and the likely implications for the viability of a local Koala population.	Likely impacts associated with the proposed development include the clearing of approx. 222ha of native vegetation and related habitat, increased noise and light spill from urban development, vehicle strikes and potential human incursions into stewardship lands. However, given no evidence of site use by Koala has been identified, it is considered unlikely that a local population would be impacted by the proposal.

Principles	Criteria	Assessment
Plan to manage and protect Koalas and their habitat – addressing criteria 10, 11, 12 and 13	Describe the management measures that will be implemented as part of proposed construction and operations to manage the direct and indirect impacts identified. These measures should be outcomes focussed and include performance targets.	Not applicable – no evidence of site use by Koala.
	Describe any compensatory measures that will be delivered, including an analysis of the suitability of these measures against criteria 9 and 10.	No Koala biodiversity offsets credits are incurred required because of the lack of a Koala population that could utilise the site. However, retained vegetation will be placed under stewardship improving habitat conditions should Koalas move into the locality in the future.
	Outline a plan for monitoring, adaptive management and reporting against the key outcomes and performance targets.	Not Applicable as no local Koala population is likely to be present.

Conclusion

Field surveys identified that the site contained highly suitable Koala habitat, which meant further assessment was required. Detailed Koala surveys were undertaken on site and did not detect evidence of Koalas within the Subject Site or Study Area. Additionally, desktop assessment showed that there are only three (3) records of a Koala from 2004, 2015 & 2016 within the 100km^2 BioNet Atlas search area.

Although the species is unlikely to occur in the area, the proposed retention of more than half of the lands, within which the majority will be managed under a BSA, indicates that Koala mobility would be preserved, should the species move into the locality.

Therefore, in its current condition, it was concluded that the Study Area does not constitute Core Koala Habitat and no Koala population is at risk of direct or indirect impacts resulting from the proposed rezoning.

State Environmental Planning Policy (Resilience and Hazards) 2021 – Chapter 2 Coastal Management

The State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP) commenced on 1 March 2022. The State Environment Planning Policy (Coastal Management) 2018 (Coastal SEPP) was one SEPP that was consolidated within the Resilience and Hazards SEPP 2021 under Chapter 2 Coastal Management. No policy changes were made as part of the consolidation nor did the legal effect of the existing SEPPs, with section 30A of the *Interpretation Act 1987* applying to the transferred provisions. The consolidation was undertaken in accordance with section 3.22 of the *Environmental Planning and Assessment Act 1979*.

Consultation of Chapter 2 Coastal Management maps revealed that the Subject Site is partly mapped within Proximity to Coastal Wetlands, Coastal Environment Area and Coastal Use Area. Therefore, in accordance with Division 1 - Clause 8 (*Development on land in proximity to coastal wetlands or littoral rainforest*), Division 3 – Clause 10 (*Development on land within the coastal environment area*) and Division 4 – Clause 11 (*Development on land within the coastal use area*) of Chapter 2 Coastal Management, the following assessment has been undertaken (**Table 1**).

Table A: Coastal Environment Area Assessment

Clause Number	Clause	Assessment
8 (1)	Development consent must not be granted to development on land identified as “proximity area for coastal wetlands” or “proximity area for littoral rainforest” on the *Coastal Wetlands and Littoral Rainforests Area Map* unless the consent authority is satisfied that the proposed development will not significantly impact on— (a) the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or	The proposed development within the Subject Site should have minimal impact on the biophysical, hydrological and ecological integrity of the coastal wetland ensuring best practices are used. With the use of proper sediment and erosion controls, the proposed development should not impact the biophysical integrity of the coastal wetland. The proposed development proposes to meet LMCC and NCC guidelines for both stormwater and water treatment. The proposed regeneration of the FFMP Lands will reduce weeds and increase biodiversity within the riparian area. This will significantly improve the water quality leaving the site. This will be addressed within the Avoid and Minimise considerations of the BCAR.
	(b) the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland or littoral rainforest.	As stated above the proposed development includes the regeneration of the riparian land throughout the Subject Site. The proposed management includes weed and planting regimes to improve the biodiversity, assisting with the water quality and overall coastal processes. It is unlikely that the proposed development would have any impact on coastal environment values due to its distance from any such coastal area.

Clause Number	Clause	Assessment
10 (1)	Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following: (a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,	Refer to assessment against Clause 8 (1) above.
	(b) coastal environmental values and natural coastal processes,	The proposed development will impact a large area of land, whereas larger areas of residue land with higher biodiversity value within the wider locality will not be impacted. As such, impacts to coastal environmental values and natural coastal processes will be limited. It is also unlikely that the proposed development would have any impact on coastal environment values due to its distance from any such coastal area.
	(c) the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,	Refer to assessment against Clause 8 (1) above. The site is not located adjacently to a listed sensitive coastal lake.
	(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,	Any impact to native biodiversity will be addressed, avoided and/or minimised and/or offset as part of the Biodiversity Certification process. No impact on undeveloped headlands or coastal rock platforms is expected.
	(e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,	Existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability.

Clause Number	Clause	Assessment
	(f) Aboriginal cultural heritage, practices and places,	No known sites were identified on DPIE's website.
	(g) the use of the surf zone.	The subject site is not proximate to any surf zone.
10 (2)	Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that: (a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subclause (1), or	The proposed development is located well away from the nominated coastal areas. Also, as states above the proposed development include the regeneration of the riparian land. The proposed management includes weeding and planting regimes to improve the biodiversity within the Subject Site, assisting with the water quality and overall downstream coastal processes.
	(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or	As above.
	(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.	As above.
11 (1)	Development consent must not be granted to development on land that is within the coastal use area unless the consent authority: (a) has considered whether the proposed development is likely to cause an adverse impact on the following: (i) existing, safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability, (ii) overshadowing, wind funnelling and the loss of views from public places to foreshores,	The proposed development is located on private property. No impact to accessibility of public land is expected.

Clause Number	Clause	Assessment
	(iii) the visual amenity and scenic qualities of the coast, including coastal headlands, (iv) Aboriginal cultural heritage, practices and places, (v) cultural and built environment heritage, and	
	(b) is satisfied that: (i) the development is designed, sited and will be managed to avoid an adverse impact referred to in paragraph (a), or (ii) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or (iii) if that impact cannot be minimised—the development will be managed to mitigate that impact, and	As mentioned above, no impacts on matters referred to in Clause 11 (1) (a) are expected as a result of the proposed development.
11 (2)	This clause does not apply to land within the Foreshores and Waterways Area within the meaning of *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005*.	Not applicable to this application.

As demonstrated in the above assessment, it is likely that the proposed development will have minimal impact on the catchment area following the use of appropriate sediment and erosion control.

Environment Protection and Biodiversity Conservation Act 1999 Assessment

A search was conducted in August 2022 for Matters of National Environmental Significance (MNES) as relevant to the *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act). The following MNES are considered in this assessment.

World Heritage Properties:

The site is not a World Heritage area and is not in close proximity to any such area.

National Heritage Places:

The site is not a National Heritage Place and does not contain any matters of national heritage.

Wetlands of International Significance (declared Ramsar wetlands):

The site is not part of declared Ramsar wetlands. However, it comprises a section of Maryland Creek which is located upstream from the Ramsar-listed Hunter Wetlands. **Section 2.0** of the BCAR includes provisions to avoid downstream impacts resulting from the proposal.

Great Barrier Reef Marine Park:

The site is not part of, or within close proximity to, the Great Barrier Reef Marine Park.

Commonwealth Marine Areas:

The site is not part of, or within close proximity to, any Commonwealth Marine Area.

Threatened Ecological Communities (TECs):

There are four (4) listed TECs within a 5km radius of the Subject Site:

- Central Hunter Valley eucalypt forest and woodland;
- Costal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community;
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland; and
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria.

Of the above listed TECs, *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria* has the potential to occur on site due to the presence of PCT 1573 - *Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment*, which is potentially associated with the TEC.

However, at State-level, as indicated in the BAM Calculator, the PCT as it occurs on site is not associated with BC Act listed *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* EEC. Furthermore, consultation of the EPBC Act *Conservation Advice for the River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria* (DAWE, 2020), specifically Section 4.2, provides the following statement:

> *"Much of this ecological community in New South Wales corresponds to the NSW-listed 'River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions'. In the Hunter/Central Coast area some patches may correspond to the NSW-listed 'Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions', or the NSW-listed 'Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion'."*

None of the above TEC associations were identified within the site.

As such it was concluded that there are not EPBC Act listed TECs within the Study Area and no impacts to EPBC Act listed TECs are likely to occur as a result of the proposal.

Threatened Species:

Several threatened species listed under the EPBC Act were identified on site, as per **Table A**.

Table A: EPBC Act Listed Species

Scientific name	Common name	BC Act listing*	EPBC Act listing*
Rhodamnia rubescens	Scrub Turpentine	CE	CE
Tetratheca juncea	Black-eyed Susan	V	V
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V
Chalinolobus dwyeri	Large-eared Pied-bat	V	V

(*): Listing codes are as follows. “V” for vulnerable, “E” for endangered and “CE” for critically endangered.

Based on **Table A**, two (2) types of assessments are required to be undertaken: An assessment of impacts to one (1) critically endangered species, and an assessment of impacts to three (3) vulnerable species.

- Assessment of significance of impact to critically endangered *Rhodamnia rubescens.*

Table B: Assessment of Impact to *Rhodamnia rubescens*

Criterion	Assessment
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	
• Lead to a long-term decrease in the size of a population	No. 99.9% of the individuals occurring within the Study Area will be retained and protected within the Stewardship Site.
• Reduce the area of occupancy of the species	The reduction of the area of occupancy as a result of the proposal will be minimal in the context of the species’ occurrence within the locality and wider NSW.
• Fragment an existing population into two or more populations	No. The near-entirety of the subpopulation will be retained and conserved within the Stewardship site. The subpopulation already occurs as a fragmented population, being separated by the Newcastle Link Road.
• Adversely affect habitat critical to the survival of a species	Suitable habitat for the species within the Study Area was identified as being associated with PCTs 1584, 1543, 1573 and 1539. The majority of the occurrence of each PCT within the Study Area will be retained, as evidenced in **Table 13** of the BCAR. As such it is considered that the proposal will affect habitat critical to the survival of the

Criterion	Assessment
	species to a small extent, mainly through the clearing of PCT 1584.
• Disrupt the breeding cycle of a population	No. Direct impacts will be limited to the clearing of one (1) stem as assessed during targeted surveys in 2020. Furthermore, evidence of Myrtle Rust infection was found on site, which impedes breeding. As such, it is not considered that the proposal will significantly disrupt the breeding cycle of the population on site.
• Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	As described above, suitable habitat for the species within the Study Area was identified as being associated with PCTs 1584, 1543, 1573 and 1539. The majority of the occurrence of each PCT within the Study Area will be retained, as evidenced in **Table 13** of the BCAR. Furthermore, the presence of the Newcastle Link Road which separates the Study Area into two disconnected sections has historically fragmented the local population of *Rhodamnia rubescens.* As such, with only one (1) stem of *Rhodamnia rubescens* proposed to be cleared in an already fragmented landscape, whereby the majority of suitable habitat will be retained, it is not considered that the proposal will lead to a significant decline in the species.
• Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The conversion of the Subject Site into an urban landscape will likely lead to increase pressure on local ecology from development, with weed spread from residential areas and unmanaged lands a possible risk. However, the development of a precinct-specific DCP and the proposed management of residue lands under a BSA will provide a framework for control of invasive species. Furthermore, lands where *Rhodamnia rubescens* is located will largely be retained, with nature buffers implemented where urban interfaces are proximate, such that the risk of contamination and disturbance by invasive species will be limited.

Criterion	Assessment
• Introduce disease that may cause the species to decline, or • Interfere with the recovery of the species.	As discussed previously, *Rhodamnia rubescens* within the Study Area already shows evidence of Myrtle Rust infection. There is also a risk of further exposure to disease due to increase urban pressure within the site. However, the proposed retention and management of the majority of *Rhodamnia rubescens* stems and related habitat under a BSA will provide safeguards in order to prevent further spread of disease that may affect the species. This will also support the recovery of the existing subpopulation.

While impacts to the species and related habitat will result from the proposal, it was considered that the small extent of clearing of the species combined with the proposed management of the majority of related suitable habitat under a BSA would not lead to a significant impact to *Rhodamnia rubescens.*

- Assessment of significance of impact to vulnerable species *Grevillea parviflora* subsp. *parviflora, Tetratheca juncea* and Large-eared Pied-bat.

A preliminary step to the assessment of impacts to vulnerable species under the EPBC Act is the assessment of the population within the Study Area against the criteria defining an important population under the EPBC Act. The assessment is included in **Table C**.

Furthermore, an assessment of impacts to the above-mentioned EPBC Act listed vulnerable species is included in **Table D.**

Table C: Assessment of population importance

Species	*Grevillea parviflora* subsp. *parviflora*	*Tetratheca juncea*	Large-eared Pied Bat
Criterion	**Assessment**		
An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:			
• Key source populations either for breeding or dispersal	Only four (4) individuals were identified within the Study Area. Furthermore, while LMCC deemed the species to be *Grevillea parviflora* subsp. *parviflora*, an analysis of a sample by the National Herbarium of New South Wales confirmed that the species was *Grevillea humilis* subsp. *humilis*. Therefore, in either case, the subpopulation within the Study Area is not considered to be a key source population.	Approximately 310 plant clumps were identified within the Study Area. This subpopulation is potentially significant at a local level.	The species was identified via echolocation call detection on a few instances. Furthermore, harp trapping surveys in areas of potential breeding habitat did not lead to the capture of any Large-eared Pied-bat individuals. As such, it is considered that while the site constitutes foraging habitat, it is not utilised for breeding purposes.
• Populations that are necessary for maintaining genetic diversity, and/or	As stated above, within only four (4) stems within the Study Area, it is considered that the local subpopulation is not critical in maintaining the genetic diversity.	As stated above, the population identified within the Study Area is potentially significant and as such, would qualify as an important population from a genetic diversity.	The paucity of echolocation call records over the survey period may indicate that the subpopulation utilising the site is unlikely to be significant in maintaining genetic diversity. However, consultation of the *Conservation Advice for Chalinolobus dwyeri (Large-eared Pied-bat)* (DAWE, 2021) indicates that "*all populations of this species should be considered*

Species	*Grevillea parviflora* subsp. *parviflora*	*Tetratheca juncea*	Large-eared Pied Bat
Criterion	**Assessment**		
			important due to their likely role in maintaining population connectivity and genetic diversity necessary for the evolutionary potential of the species." As such, there is potential for the local subpopulation to be necessary for maintaining genetic diversity.
• Populations that are near the limit of the species range.	According to the species profile (DPE 2022c), the population is sporadically distributed throughout the Sydney Basin with sizeable populations around Picton, Appin and Bargo (and possibly further south to the Moss Vale area) and in the Hunter at in the Cessnock - Kurri Kurri area (particularly Werakata NP). Separate populations are also known from Putty to Wyong and Lake Macquarie on the Central Coast. Therefore, the subpopulation is located near the northern limits of the species range.	According to the species profile (DPE 2022c), it is confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. Therefore, the subpopulation within the Study Area is in centre of the species range.	According to the species profile (DPE 2022c), the species is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Therefore, the subpopulation within the Study Area is not located near the limit of the species range.

Table D: Assessment of Impact *to Grevillea parviflora subsp. parviflora*, *Tetratheca juncea* and Large-eared Pied-bat

Species	*Grevillea parviflora* subsp. *parviflora*	*Tetratheca juncea*	Large-eared Pied Bat
Criterion	**Assessment**		
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:			
• Lead to a long-term decrease in the size of an Important population	As per **Table C**, not considered an important population.	The proposal will incur the clearing of approx. 41 clumps out of 310 identified on site. From an individual perspective, the impact is not considered to be of such magnitude that it would lead to a long-term decrease in the size of the subpopulation. Furthermore, approx. 53.7% of suitable habitat, as defined using the Extent of Occurrence approach, is proposed to be cleared, which may have a notable impact on the local subpopulation.	The retention of more than half of native vegetation within the Study Area, either as residue lands or under a BSA, will contribute to the provision of foraging habitat for the species, such that a long-term decrease in the size of the population as a result of the proposal is unlikely.
• Reduce the area of occupancy of an important population	As per **Table C**, not considered an important population.	A review of information held by DCCEEW for the species indicates that little is known about the area of occupancy of the species. The estimate of 46km^2 is considered to be of low reliability. (DSEWCP, 2011) As such, it is not possible to determine whether the area of occupancy will be reduced as a result of the proposal.	A review of information held by DCCEEW for the species indicates that the "*area of occupancy is approximately 9120 km². This is calculated from the extent of occurrence and the detection rate of echolocation calls of 1.6% at 3154 sites across the range of the Large-eared Pied Bat.*" (DAWE, 2021).

Species	*Grevillea parviflora* subsp. *parviflora*	*Tetratheca juncea*	Large-eared Pied Bat
Criterion	**Assessment**		
			As such, there is potential for the proposal to reduce the area of occupancy of the species.
• Fragment an existing important population into two or more populations	Only four (4) individuals were identified within the Study Area, thus indicating that the level of fragmentation is already significant. No other subpopulation is known in adjacent lands.	There is potential for the proposal to lead to fragmentation of the species population due to the layout of the development and BSA lands.	There is potential for the proposal to lead to fragmentation of the landscape due to the layout of the development and BSA lands. Given the high mobility of the space and absence of a breeding colony on site, it is considered unlikely that the proposal would lead to further fragmentation of the subpopulation.
• Adversely affect habitat critical to the survival of a species	Approx. 1.6ha of habitat comprising four (4) individuals are proposed to be cleared. The species occurs within PCT 1619 in the Study Area, of which 59.1% is proposed to be cleared. The location of individuals on site is such that there isn't a clear correlation between PCT 1619 and the species. Therefore, the entirety of PCT 1619 on site is not considered to constitute critical habitat for the species. Clearing of 1.6ha of suitable habitat is not considered as likely to lead to adverse	92.4ha of suitable habitat for the species exists on site, 53.7% of which will be cleared. While this level of clearing may be significant at a local level, it is not considered that the proposal would adversely affect habitat critical to the survival of the species at a national level.	Suitable roosting habitat in the form of caves and escarpments occurs on site and will largely be retained under a BSA. Vegetation proposed to be cleared constitutes foraging habitat of which more than half is proposed to be retained, largely under a BSA. As such it is not considered that the proposal will adversely impact habitat critical to the survival of the species.

Species	*Grevillea parviflora* subsp. *parviflora*	*Tetratheca juncea*	Large-eared Pied Bat
Criterion	**Assessment**		
	effects on habitat critical to the survival of the species.		
• Disrupt the breeding cycle of an important population	As per **Table C**, not considered an important population.	There is potential for the clearing of 13.2% of *Tetratheca juncea* clumps within the Study Area to disrupt to small extent the breeding cycle of the population. A translocation plan leveraging learnings from previous plans implemented in NSW is proposed to be undertaken within BSA lands as a compensatory measure.	No evidence of breeding was found on site. As such, it is not considered that the proposal would lead to a disruption in the breeding cycle of the species.
• Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Four (4) stems will be removed by the proposed development and as such a minimal decline for the species will occur.	53.7% of suitable habitat for the species will be removed by the proposed development and as such decline will occur. Compensatory measures including a translocation plan are proposed to support the subpopulation within the BSA lands.	39.8% of suitable foraging habitat for the species will be removed by the proposed development. However, breeding habitat will not be impacted given none was identified on site. As such, while foraging habitat will be reduced, there will be no impact to breeding habitat such that the species would significantly decline as a result of the proposal.
• Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The establishment of Stewardship Site within residue lands and the implementation of biodiversity provisions as part of a precinct-specific DCP will limit the risk of invasive	The establishment of Stewardship Site within residue lands and the implementation of biodiversity provisions as part of a precinct-specific DCP will limit the risk of invasive	The establishment of Stewardship Site within residue lands and the implementation of biodiversity provisions as part of a precinct-specific DCP will limit the risk of invasive

Species	*Grevillea parviflora* subsp. *parviflora*	*Tetratheca juncea*	Large-eared Pied Bat
Criterion	**Assessment**		
	species spread into suitable retained habitat. Furthermore, Construction Environmental Management Plans (CEMPs) will accompany development stages at subdivision time.	species spread into suitable retained habitat. Furthermore, Construction Environmental Management Plans (CEMPs) will accompany development stages at subdivision time.	species spread into suitable retained habitat. Furthermore, Construction Environmental Management Plans (CEMPs) will accompany development stages at subdivision time.
• Introduce disease that may cause the species to decline, or	The establishment of Stewardship Site within residue lands and the implementation of biodiversity provisions as part of a precinct-specific DCP will limit the risk of diseases spread into suitable retained habitat. Furthermore, Construction Environmental Management Plans (CEMPs) will accompany development stages at subdivision time.	The establishment of Stewardship Site within residue lands and the implementation of biodiversity provisions as part of a precinct-specific DCP will limit the risk of diseases spread into suitable retained habitat. Furthermore, Construction Environmental Management Plans (CEMPs) will accompany development stages at subdivision time.	The establishment of Stewardship Site within residue lands and the implementation of biodiversity provisions as part of a precinct-specific DCP will limit the risk of diseases spread into suitable retained habitat. Furthermore, Construction Environmental Management Plans (CEMPs) will accompany development stages at subdivision time.
• Interfere substantially with the recovery of the species.	Given the small extent of the subpopulation identified on site, it is considered unlikely that the proposal would substantially interfere with the recovery of the species.	There is potential for the proposal to interfere with the recovery of the species. As such, the establishment of a Stewardship Site and the implementation of a translocation plan will help mitigate impacts by protecting and enhancing retained suitable habitat and *Tetratheca juncea* occurrences therein.	Given the paucity of records of the species within the Study Area and the retention of suitable roosting and foraging habitat within the proposed Stewardship Site, it is not expected that the proposal would substantially interfere within the recovery of the species.

Conclusion:

A review of impacts to Matters of Environmental Significance under the EPBC Act 1999 has concluded that the clearing of *Tetratheca juncea* and Large-eared Pied-bat foraging habitat is potentially significant, which warrants further assessment as part of a Referral under the Act. However, impacts to *Grevillea parviflora* subsp. *parviflora* were not considered of such magnitude and significance that they would require a Referral.

Appendix M – BCAR Checklist

Stage 1 Checklist

BAM Reference	Information	BDAR Section	Completed
	Report		
Introduction - Chapters 2 and 3	Introduction to the biodiversity assessment including: ● brief description of the proposal ● identification of subject land boundary, including: - operational footprint (if BDAR) - construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure (if BDAR) - land proposed for biodiversity certification (if BCAR) ● general description of the subject land ● sources of information used in the assessment, including reports and spatial data	1.1- The Proposal 1.2- Consultation and Investigation Process 1.3- Site Particulars 1.3.1 Assessment Scope 1.4- Information Sources 1.5- Site Particulars Figure 1 Site Map Figure 3 Location Map Appendix A Structure Plan Versions Appendix L Other Legislation	Yes
Landscape - Section 3.1, 3.2 and Appendix E	Identification of site context components and landscape features, including; General description of subject land topographic and hydrological setting, geology and soils	1.5- Landscape Features Figure 3 – Location Map	Yes
	Percent native vegetation cover in the assessment area (as described in BAM Subsection 3.2).	1.6.2 Site Context Components – Landscape Native Vegetation Cover	Yes
	IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.))	1.5.1 Regional Landscapes	Yes
	Rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3.) and Appendix E)	Figure 3 – Location Map	Yes
	Wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(3.))	1.5.2 Identified Landscape Features Appendix L Other Legislation	Yes
	Connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.))	1.5.2 Identified Landscape Features	Yes
	Karst, caves, crevices, cliffs, rocks and other geological features of significance and for vegetation clearing proposals, soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(12.)	1.5.2 Identified Landscape Features	Yes
	Areas of geological significance and soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(8-9.))	1.5.2 Identified Landscape Features	Yes
	Any additional landscape features identified in any SEARs for the proposal	1.5.2 Identified Landscape Features	Yes
	NSW (Mitchell) landscape on which the subject land occurs	1.5.1 Regional Landscapes	Yes

BAM Reference	Information	BDAR Section	Completed
Native vegetation, Chapter 4, Appendix A and Appendix H	Identify native vegetation extent within the subject land, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery (as described in BAM Section 4.1(1–3.) and Subsection 4.1.1)	1.7 Native Vegetation Figure 3 Location Map Appendix H-J Site Photographs	Yes
	Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM Subsection 4.1.2)	1.7 Native Vegetation 1.7.3 PCT Selection Justification and Description Appendix H-J Site Photographs	Yes
	Review of existing information on native vegetation including references to previous vegetation maps of the subject land and assessment area (described in BAM Section 4.1(3.) and Subsection 4.1.1)	1.5.1 Regional Landscapes 1.5.2 Identified Landscape Features 1.8.3 Field Survey Methods Appendix C Flora Survey Methodology and Results	Yes
	Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2	1.5.1 Regional Landscapes 1.7.2 Plot Based Floristic Surveys 1.7.3 PCT Selection Justification and Description 1.7.4 Vegetation Integrity Assessment 1.8.3 Field Survey Methods Appendix B-Vegetation Mapping by Eastcoast Flora Survey Appendix E AEP BAM Field Sheets Appendix H-J Site Photographs	Yes
	Where relevant, describe the use of more appropriate local data, provide reasons that support the use of more appropriate local data and include the written confirmation from the decision-maker that they support the use of more appropriate local data (as described in BAM Subsection 1.4.2 and Appendix A)	N/A	Yes
	For each PCT within the subject land, describe: ● vegetation class ● extent (ha) within subject land ● evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM Section 4.2(1–3.)) ● plant species relied upon for identification of the PCT and relative abundance of each species ● if relevant, TEC status including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2(1–2.)) ● estimate of percent cleared value of PCT (BAM Subsection 4.2.1(5.))	1.7 Native Vegetation 1.7.3 PCT Selection Justification and Description Figure 3 Location Map Table 4 – Plant Community Types Table 5 – PCT by Condition Table 6 – Level of Retention by PCT based on Structure Plan Version 055.WS.025.00 Appendix L – Other Legislation	Yes
	Describe the vegetation integrity assessment of the subject land, including:	1.7 Native Vegetation 1.5.1 Regional Landscapes	Yes

BAM Reference	Information	BDAR Section	Completed
	• identification and mapping of vegetation zones (as described in BAM Subsection 4.3.1) • assessment of patch size (as described in BAM Subsection 4.3.2) • survey effort (i.e. number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4(1–2.) • use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3(5.))	1.7.2 Plot Based Floristic Surveys 1.7.4 Vegetation Integrity Assessment Table 7 Vegetation Integrity Score Table 1.8.3 Field Survey Methods Figure 3 Location Map Figure 4 Plant Community Types	
	Where use of more appropriate local benchmark data is proposed (as described in BAM Subsection 1.4.2, BAM Subsection 4.3.3(5.) and BAM Appendix A): • identify the PCT or vegetation class for which local benchmark data will be applied • identify published sources of local benchmark data (if benchmarks obtained from published sources) • describe methods of local benchmark data collection (if reference plots used to determine local benchmark data) • provide justification for use of local data rather than BioNet Vegetation Classification benchmark values • provide written confirmation from the decision-maker that they support the use of local benchmark data	N/A	
Threatened Species, Chapter 5	Identify ecosystem credit species likely to occur on the subject land, including: • list of ecosystem credit species derived from the BAM-C (as described in BAM Subsection 5.1.1 and Section 5.2(1.)) • justification and supporting evidence for exclusion of any ecosystem credit species based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2) • justification for addition of any ecosystem credit species to the list	1.8 Threatened Species 1.8.3 Field Survey Methods 1.8.1 Ecosystem Credit Species 1.8.1 Species Credit Species 1.8.5 Species Credit Species Survey Results 2.3.2 Serious and Irreversible Impacts Table 8 Predicted Ecosystem Credit Species Table 12 Species Credit Species Appendix G Biodiversity Credit Reports	Yes
	Identify species credit species likely to occur on the subject land, including: • list of species credit species derived from the BAM-C (as described in BAM Subsection 5.1.1) • justification and supporting evidence for exclusions based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2)	1.8.3 Field Survey Methods 1.8.1 Ecosystem Credit Species 1.8.1 Species Credit Species Table 8 Predicted Ecosystem Credit Species Table 9 Potential Species Credit and SAII Species 1.8.3 Field Survey Methods Table 12 Species Credit Species	Yes

BAM Reference	Information	BDAR Section	Completed
	• justification and supporting evidence for exclusions based on degraded habitat constraints and/or microhabitats on which the species depends (as described in BAM Subsection 5.2.2) • justification for addition of any species credit species to the list		
	From the list of candidate species credit species, identify: • species assumed present within the subject land (if relevant) (as described in BAM Subsection 5.2.4(2.a.)) • species present within the subject land on the basis of being identified on an important habitat map for a species (as described in BAM Subsection 5.2.4(2.d.)) • species for which targeted surveys are to be completed to determine species presence (Subsection 5.2.4(2.b.)) • species for which an expert report is to be used to determine species presence (Subsection 5.2.4(2.c.))	Table 4, 5 & 6 PCT Determination 1.8.3 Field Survey Methods Table 8 Predicted Ecosystem Credit Species EPBC Act Assessment recorded within the Subject Site – Appendix L Other Legislation Table 12 Species Credit Species Koalas – Appendix L Other Legislation	Yes
	Present the outcomes of species credit species assessments from: • threatened species survey (as described in BAM Section 5.2.4) • expert reports (if relevant) including justification for presence of the species and information used to make this determination (as described in BAM Section 5.2.4 and 5.3, Box 3)	Table 12 Species Credit Species Appendix C Flora Methodology and Results Appendix D Fauna Methodology and Results Appendix G Biodiversity Credit Reports Appendix H-J Site Photographs	Yes
	Where survey has been undertaken include detailed information on: • survey method and effort, (as described in BAM Section 5.3) • justification of survey method and effort (e.g. citation of peer-reviewed literature) if approach differs from the Department's taxa-specific survey guides or where no relevant guideline has been published • timing of survey in relation to requirements in the TBDC or the Department's taxa-specific survey guides. Where survey was undertaken outside these guides include justification for the timing of surveys • survey personnel and relevant experience • describe any limitations to surveys and how these were addressed/overcome	1.8.3 Field Survey Methods Table 12 Species Credit Species Appendix C Flora Survey Methodology and Results Appendix D Fauna Survey Methodology and Results Appendix E AEP BAM Field Sheets	Yes
	Where an expert report has been used in place of survey (as described in BAM Section 5.3, Box 3), include: • justification of the use of an expert report • identify the expert, provide evidence of their expert credentials and Departmental approval of expert status • all requirements of Box 3 have been addressed in the expert report	1.7.1 Description of Vegetation Communities Appendix B-Vegetation Mapping by Eastcoast Flora Survey	

BAM Reference	Information	BDAR Section	Completed
	Where use of local data is proposed (BAM Subsection 1.4.2): ● identify relevant species ● identify data to be amended ● Identify source of information for local data, e.g. published literature, additional survey data, etc. ● justify use of local data in preference to VIS Classification or TBDC data ● provide written confirmation from the decision-maker that they support the use of local data	N/A	
	Species polygon completed for species credit species present within the subject land (assumed present or determined on the basis of survey, expert report or important habitat map) ensuring that: ● the unit of measure for each species is documented for species assessed by area: ● the polygon includes the extent of suitable habitat for the target species within the subject land (as described in BAM Subsection 5.2.5) ● a description of, and evidence-based justification for, the habitat constraints, features or microhabitats used to map the species polygon including reference to information in the TBDC for that species and any buffers applied for species assessed by counts of individuals: ● the number of individual plants present on the subject land (as described in BAM Subsection 5.2.5(3.)) ● the method used to derive this number (i.e. threatened species survey or expert report) and evidence-based justification for the approach taken ● the polygon includes all individuals located on the subject land with a buffer of 30 m around the individuals or groups of individuals on the subject land Identify the biodiversity risk weighting for each species credit species identified as present within the subject land (as described in BAM Section 5.4)	2.4 Biodiversity Credits to Offset Residual Impacts Figures 8-15	Yes
Prescribed impacts - Chapter 6	Identify potential prescribed biodiversity impacts on threatened entities, including: ● karst, caves, crevices, cliffs, rocks and other geological features of significance (as described in BAM Subsection 6.1.1) ● occurrences of human-made structures and non-native vegetation (as described in BAM Subsection 6.1.2)	1.5.2 Identified Landscape Features 2.2 Impact Avoidance and Minimisation Measures	Yes

BAM Reference	Information	BDAR Section	Completed
	• corridors or other areas of connectivity linking habitat for threatened entities (as described in BAM Subsection 6.1.3) • water bodies or any hydrological processes that sustain threatened entities (as described in BAM Subsection 6.1.4) • protected animals that may use the proposed wind farm development site as a flyway or migration route (as described in BAM Subsection 6.1.5) • where the proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community (as described in BAM Subsection 6.1.6)		
	Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts	Table 12 Species Credit Species	Yes
	Describe the importance of habitat features to the species including, where relevant, impacts on life-cycle or movement patterns (e.g. Subsection 6.1.3)	1.5.2 Identified Landscape Features 1.5.2 Identified Landscape Features Table 10 Tree and Hollow Retention Table 11 Removal and Retention Levels by Hollow Size Class Table 12 Species Credit Species	Yes
	Where the proposed development is for a wind farm: • identify a candidate list of protected animals that may use the development site as a flyway or migration route, including: resident threatened aerial species, resident raptor species and nomadic and migratory species that are likely to fly over the proposal area (as described in BAM Subsection 6.1.5) • provide details of targeted survey for candidate species of wind farm developments undertaken in accordance with BAM Subsection 6.1.5(2–3.) • predict the habitual flight paths for nomadic and migratory species likely to fly over the subject land and map the likely habitat for resident threatened aerial and raptor species (BAM Subsection 6.1.5(4.))	N/A	
Maps			
Introduction – Chapters 2 and 3	Map of the subject land boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure (if BDAR)	Figure 1 Site Map Figure 3 Location Map	Yes

BAM Reference	Information	BDAR Section	Completed
Landscape - Section 3.1, 3.2 and Appendix E	Site Map ● Boundary of subject land ● Cadastre of subject land ● Landscape features identified in BAM Subsection 3.1.3	Figure 1 Site Map Figure 3 Location Map	Yes
	Location Map ● Digital aerial photography at 1:1,000 scale or finer ● Boundary of subject land ● Assessment area (i.e. the subject land and either 1500 m buffer area or 500 m buffer for linear development) ● Landscape features identified in BAM Subsection 3.1.3 ● Additional detail (e.g. local government area boundaries) relevant at this scale	Figure 1 Site Map Figure 3 Location Map	Yes
	Landscape features identified in BAM Subsection 3.1.3 and to be shown on the Site Map and/or r Location map include: ● IBRA bioregions and subregions ● rivers, streams and estuaries ● wetlands and important wetlands ● connectivity of different areas of habitat ● karst, caves, crevices, cliffs, rocks and other geological features of significance and if required, soil hazard features ● areas of outstanding biodiversity value occurring on the subject land and assessment area ● any additional landscape features identified in any SEARs for the proposal ● NSW (Mitchell) landscape on which the subject land occurs	Figure 1 Site Map Figure 3 Location Map	Yes
Native vegetation, Chapter 4, Appendix A and Appendix H	Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of cleared areas (as described in BAM Section 4.1(1–3.)) and all parts of the subject land that do not contain native vegetation (BAM Subsection 4.1.2)	Figure 1 Site Map Figure 3 Location Map Figure 4 Plant Community Types	Yes
	Map of PCTs within the subject land (as described in BAM Section 4.2(1.))	Figure 4 Plant Community Types	Yes
	Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCTs boundaries	Figure 4 Plant Community Types	Yes
	Map of TEC distribution on the subject land and table of TEC listing, status and area (ha)	Figure 4 Plant Community Types	Yes
	Map of patch size locations for each native vegetation zone and table of patch size areas (as described in BAM Subsection 4.3.2)	Figure 3 Location Map Figure 4 Plant Community Types Table 4, 5 & 6 PCT Determination Table 7 Vegetation Integrity Score Table	Yes

BAM Reference	Information	BDAR Section	Completed
Prescribed impacts Chapter 6	Map showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human-made structures, etc.)	Figure 6 – Habitat Features	
	Maps of habitual flight paths for nomadic and migratory species likely to fly over the site and maps of likely habitat for threatened aerial species resident on the site (for wind farm developments only)	N/A	
Tables			
Native vegetation, Chapter 4, Appendix A and Appendix H	Table of current vegetation integrity scores for each vegetation zone within the site and including: ● composition condition score ● structure condition score ● function condition score ● presence of hollow bearing trees	Table 7 Vegetation Integrity Score Table Table 10 Tree and Hollow Retention	Yes
Threatened Species, Chapter 5	Table showing ecosystem credit species in accordance with BAM Section 5.1.1, and identifying: ● the ecosystem credit species removed from the list ● the sensitivity to gain class of each species	Table 8 Predicted Ecosystem Credit Species Table 9 Potential Species Credit and SAII Species Table 12 Species Credit Species	Yes
	Table detailing species credit species in accordance with BAM section 5.2 and identifying: ● the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or micro habitat features are not present ● the candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map	Table 9 Potential Species Credit and SAII Species	Yes
	Table detailing species credit species recorded or assumed as present within the subject land, habitat constraints or microhabitats associated with the species, counts of individuals (flora)/extent of suitable habitat (flora and fauna) (as described in BAM Subsection 5.2.6) and biodiversity risk weighting (BAM Section 5.4)	Table 8 Predicted Ecosystem Credit Species Table 25 & 27 Ecosystem and Species Credit Requirements Table 9 Potential Species Credit and SAII Species Table 12 Species Credit Species	Yes
Prescribed impacts Chapter 6			
Data			

BAM Reference	Information	BDAR Section	Completed
Landscape - Section 3.1, 3.2 and Appendix E	All report maps as separate jpeg files / Individual digital shape files of: ● subject land boundary ● assessment area ((i.e. subject land and 1500 m buffer area) boundary ● cadastral boundary of subject land ● areas of native vegetation cover ● landscape features	Attached files	Yes
Native vegetation, Chapter 4, Appendix A and Appendix H	All report maps as separate jpeg files ● Plot field data (MS Excel format) ● Plot field data sheets		Yes
	Digital shape files of: ● PCT boundaries within subject land ● TEC boundaries within subject land ● vegetation zone boundaries within subject land ● floristic vegetation survey and vegetation integrity plot locations		Yes
Threatened Species, Chapter 5	Digital shape files of suitable habitat identified for survey for each candidate species credit species		Yes
	Survey locations including GPS coordinates of any plots, transects, grids		Yes
	Digital shape files of each species polygon including GPS coordinates of located individuals		Yes
	Species polygon map in jpeg format		Yes
	Expert reports and any supporting data used to support conclusions of the expert report		N/A
	Field data sheets detailing survey information including prevailing conditions, date, time, equipment used, etc		Yes
Prescribed impacts Chapter 6	● Digital shape files of prescribed impact feature locations ● Prescribed impact features map in jpeg format		Yes

Stage 2 Checklist

BAM Reference	Information	BDAR Section	Completed
	Report		
Avoid and minimise impacts – Chapter 7	Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative: ● modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology ● routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route ● alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location ● alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site	2.2 Impact Avoidance and Minimisation Measures 1.5.2 Identified Landscape Features Table 9 Potential Species Credit and SAII Species	Yes
	Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design (as described in BAM Subsections 7.1.2 and 7.2)	2.2.1 Project Design 2.2 Impact Avoidance and Minimisation Measures Appendix L Other Legislation	Yes
	Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal (as described in BAM Subsection 7.2.1(3.))	2.2.1 Project Design 2.2 Impact Avoidance and Minimisation Measures	Yes
Assessment of Impacts - Chapter 8, Section 8.1 and 8.2	Determine the impacts on native vegetation and threatened species habitat, including a description of direct impacts of clearing of native vegetation, threatened ecological communities and threatened species habitat (as described in BAM Section 8.1)	1.7.3 PCT Selection Justification and Description 2.2 Impact Avoidance and Minimisation Measures Appendix L Other Legislation	Yes
	Assessment of indirect impacts on vegetation and threatened species and their habitat including (as described in BAM Section 8.2): ● description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal	2.2 Impact Avoidance and Minimisation Measures	Yes

BAM Reference	Information	BDAR Section	Completed
	● documenting the consequences to vegetation and threatened species and their habitat including evidence-based justifications ● reporting any limitations or assumptions, etc. made during the assessment ● identification of the threatened entities and their habitat likely to be affected		
	Assessment of prescribed biodiversity impacts (as described in BAM Section 8.3) including: assessment of the nature, extent and duration of impacts on the habitat of threatened species or ecological communities associated with: ● karst, caves, crevices, cliffs, rocks and other features of geological significance ● human-made structures ● non-native vegetation ● connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range ● movement of threatened species that maintains their life cycle ● water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities assessment of the impacts of wind turbine strikes on protected animals assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC	1.5.2 Identified Landscape Features 2.1 Avoid and Minimise Summary Table 9 Potential Species Credit and SAII Species	Yes
Mitigation and Management of Impacts - Chapter 8, Section 8.4 and 8.5	Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Sections 8.4 and 8.5, including: ● techniques, timing, frequency and responsibility ● identify measures for which there is risk of failure ● evaluate the risk and consequence of any residual impacts ● document any adaptive management strategy proposed	2.2 Impact Avoidance and Minimisation Measures 2.2.3 General Construction & Operation Table 16 Prescribed Impact Avoidance and Minimisation Table 17 Direct Impact Assessment Table 18 Prescribed Impact Assessment Table 19 Indirect Impact Assessment Table 20 Residual Impact Assessment	Yes
	Identification of measures for mitigating impacts related to:	2.2 Impact Avoidance and Minimisation Measures Tables 15-19	Yes

BAM Reference	Information	BDAR Section	Completed
	• displacement of resident fauna (as described in BAM Subsection 8.4.1(2.)) • indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.)) • mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2)		
	Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5)	2.2 Impact Avoidance and Minimisation Measures Tables 15-19	Yes
Impact Summary - Chapter 9	Identification and assessment of impacts on TECs and threatened species that are at risk of a serious and irreversible impacts (SAII, in accordance with BAM Section 9.1) including: • addressing all criteria in Subsection 9.1.1 for each TEC listed as at risk of an SAII present on the subject land • addressing all criteria in Subsection 9.1.2 for each threatened species at risk of an SAII present on the subject land • documenting assumptions made and/or limitations to information • documenting all sources of data, information, references used or consulted • clearly justifying why any criteria could not be addressed	2.2 Impact Avoidance and Minimisation Measures Table 9 Potential Species Credit and SAII Species	Yes
	Identification of impacts requiring offset in accordance with BAM Section 9.2	2.4 Biodiversity Credits to Offset Residual Impacts	Yes
	Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.)	N/A	Yes
	Identification of areas not requiring assessment in accordance with BAM Section 9.3	2.4.3 Areas not requiring Assessment	Yes
Biodiversity credit report – Chapter 10	Description of credit classes for ecosystem credits and species credits at the development or clearing site or land to be biodiversity certified (BAM Section 10.2)	2.4 Biodiversity Credits to Offset Residual Impacts Appendix G Biodiversity Credit Reports	Yes
Biodiversity certification offsets and strategy (biodiversity certification only) - Chapter 12 and Appendix J	Land-based conservation measures including (strategic biodiversity certification only): • identification of parcels subject to land-based conservation measures • identification of land-based conservation measures proposed for each parcel • supporting information to demonstrate suitability of land-based conservation measures (Appendix J)	N/A	

BAM Reference	Information	BDAR Section	Completed
	• credit score of land-based conservation measures (Appendix J)		
	Biodiversity certification strategy including: • land proposed for biodiversity certification • land proposed for biodiversity conservation • proposed conservation measures • legal mechanisms for securing delivery of proposed conservation measures • parties to the biodiversity certification and responsibilities, noting where biodiversity certification agreements are proposed • timing for delivery of conservation measures • funding sources for delivery of conservation measures • framework for monitoring, reporting or auditing implementation of conservation measures	3.0 Biodiversity Certification Strategy	Yes
Maps			
Avoid and minimise impacts – Chapter 7	Map of alternative footprints considered to avoid or minimise impacts on biodiversity values; and of the final proposal footprint, including construction and operation	Appendix A Structure Plan Versions	
	Maps demonstrating indirect impact zones where applicable	Appendix A Structure Plan Versions	Yes
Assessment of Impacts - Chapter 8, Section 8.1 and 8.2	Maps showing areas of direct and indirect impact.	Figure 7 Direct and Indirect Impact Areas	Yes
Mitigation and Management of Impacts - Chapter 8, Section 8.4 and 8.5	No Maps		
Impact Summary – Chapter 9	Map showing the extent of TECs at risk of an SAII within the subject land	N/A	Yes
	Map showing location of threatened species at risk of an SAII within the subject land	Figure 8-15	
	Map showing location of: • impacts requiring offset • impacts not requiring offset • areas not requiring assessment	Figures 1, 3 and 7	Yes

BAM Reference	Information	BDAR Section	Completed
Impact Summary - Chapter 10	No Maps	Figure 7	Yes
Biodiversity credit report – Chapter 10	No Maps		
Biodiversity certification offsets and strategy (biodiversity certification only) - Chapter 12 and Appendix J	Maps showing areas of retention and proposed Stewardship Site.	Figures 7-15	Yes
Tables			
Avoid and minimise impacts – Chapter 7	Table of measures to be implemented to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility	Tables 15-19	Yes
Assessment of Impacts - Chapter 8, Section 8.1 and 8.2	Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts	Table 7 Vegetation Integrity Score Table	Yes
Mitigation and Management of Impacts - Chapter 8, Section 8.4 and 8.5	Table of measures to be implemented to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility	Tables 15-19	Yes
Impact Summary - Chapter 9	No Tables		
Impact Summary - Chapter 10	Table of PCTs requiring offset and the number of ecosystem credits required	Table 26 Ecosystem Credit Requirements	Yes
	Table of threatened species requiring offset and the number of species credits required	Table 28 Species Credit Requirements	Yes
Biodiversity credit report – Chapter 10	Table of credit class and matching credit profile	Appendix G	Yes
Biodiversity certification offsets and strategy	Tables as per Appendix M as required in relation to any land-based conservation measures	N/A	

BAM Reference	Information	BDAR Section	Completed
(biodiversity certification only)	Table of credit scores for land-based conservation measures, including scores produced by BAM and weighting adjusted scores as per Appendix J	N/A	
Data			
Avoid and minimise impacts – Chapter 7	Digital shape files of: ● final proposal footprint ● direct and indirect impact zones Maps in jpeg format	Attached files	Yes
Assessment of Impacts - Chapter 8, Section 8.1 and 8.2	No data.		
Mitigation and Management of Impacts - Chapter 8, Section 8.4 and 8.5	No Data		
Impact Summary - Chapter 9	Digital shape files of: ● extent of TECs at risk of an SAII within the subject land ● location of threatened species at risk of an SAII within the subject land ● boundary of impacts requiring offset ● boundary of impacts not requiring offset ● boundary of areas not requiring assessment		Yes
	Maps in jpeg format		
Impact Summary - Chapter 10	Submitted proposal in the BAM Calculator		Yes
Biodiversity credit report – Chapter 10	BAM credit report in pdf format		Yes

BAM Reference	Information	BDAR Section	Completed
Biodiversity certification offsets and strategy (biodiversity certification only) - Chapter 12 and Appendix J	Digital shape files of parcels of land proposed for land-based conservation measures	N/A	N/A
	Maps in jpeg format	N/A	N/A

Appendix N – History of Consultation with Councils

Date	Type of event	Mailing list or attendees	Council involved	Key topics	Milestone achieved
21/11/2019	Email	LMCC - Strategic Planning Department	Y	Submission on LMCC Draft Local Strategic Planning Statement	
19/02/2020	Email	From Eden Estates (EE) to CON	Y	Scope of works	Scope of works shared, feedback requested
19/02/2020	Email	From EE to LMCC	Y	Scope of works	Scope of works shared, feedback requested
19/02/2020	Email	EE / Steven Cox (DPIE BCD)	N	Scope of works	BCD confirming that BAM must be applied to the assessment
25/02/2020	Email	EE / Steven Cox (DPIE BCD)	N	Scope of works	Confirming that consultation with Greg Sullivan (Regional Director, Hunter and Central Coast) has occurred
27/02/2020	Meeting	EE / AEP / DPIE BCD / LMCC / CON	Y	Scope of works	Presentation of scope of works to BCD and Councils, discussion on Biocertification process and methodology
27/02/2020	Email	LMCC / CON / EE / AEP	Y	Scope of works	Shared with Councils for input
13/03/2020	Email	LMCC / EE / AEP	Y	Council consultation	Detailed advice provided by LMCC regarding assessment process, methodology and areas of focus
18/03/2020	Email	CON / EE / AEP	Y	Council consultation	Detailed advice provided by CON (Daniel Starreveld) regarding assessment process, methodology and areas of focus
18/03/2020	Email	EE / AEP	N	Council consultation	Response to Councils ecology scope comments
24/03/2020	Email	AEP / CON / LMCC	Y	Council consultation	Request for additional info addressed to Councils
26/03/2020	Email	AEP / EE	N	Council consultation	Advice letter with further response to LMCC requirements
28/04/2020	Email	AEP / EE / LMCC	Y	Council consultation	Additional advice and methodology information from LMCC
15/05/2020	Meeting	AEP / EE / LMCC	Y	Scope of works in LMCC LGA	Confirmation of LMCC-specific survey and assessment requirements
21/05/2020	Email	AEP / LMCC / CON	Y	Survey methodology	Site stratification for survey purposes sent to CON and LMCC
10/06/2020	Email	AEP / EE / LMCC	Y	Scope of works	Follow up comments regarding scope of works further to meeting
24/06/2020	Email	AEP / EE / LMCC	Y	Tetratheca juncea	Request by LMCC for further detail from AEP about TJ survey methodology
27/07/2020	Email	AEP / EE / LMCC	Y	Tetratheca juncea	EE sent AEP response re: TJ to LMCC
17/08/2020	Meeting	AEP / EE / LMCC / DPIE	Y		
27/08/2020	Email	AEP / EE	N	Tetratheca juncea	Advice on TJ survey methodology by AEP in response to LMCC request
31/08/2020	Email	AEP / EE / LMCC	Y	Tetratheca juncea, rezoning	Recommendation to follow Council guidelines for TJ survey, advice on other rezoning matters, Obtained guidance from LMCC regarding TJ survey requirements
W/C 7/09/2020	Meeting or Email?	EE / LMCC / CON	Y	Structure plan	Presentation of plan version 055.WS.008 to Councils
27/09/2020	Email	AEP / EE / ADWJ	N	Gateway process	Ecology Report for Gateway proposal sent by AEP to EE
26/11/2020	Email	AEP / EE	N	Brush-tailed Phascogale	Advice letter regarding Brush-tailed Phascogale survey requirements
16/12/2020	Email	AEP / EE	N	Gateway process	Updated Gateway Ecology Report sent to EE
24/12/2020	Email	EE / AEP / ADWJ	N	Gateway process	Confirming lodgement of Planning Proposal documents to LMCC
5/01/2021	Email	AEP / EE	N	Brush-tailed Phascogale	Advice letter on survey method sent to EE
13/01/2021	Email	AEP / EE / LMCC / CON	Y	Brush-tailed Phascogale	Advice letter on survey method sent to Councils
15/02/2021	Email	AEP / LLS	N	Stewardship site	Engagement with LLS to collect information as part of the BSSAR writing process
19/02/2021	Email	AEP / LMCC / EE	Y	Brush-tailed Phascogale	Advice about involvement of DPIE for BTP survey method
23/02/2021	Email	AEP / EE / DPIE	N	Brush-tailed Phascogale	Request sent to BCD to seek concurrence on survey methodology
12/03/2021	Email	AEP / EE / DPIE	N	Brush-tailed Phascogale	Received confirmation from BCD that species expert was engaged to review methodology
12/03/2021	Email	AEP / EE / RBG	N	Grevillea parviflora subsp. parviflora	Received letter from RBG confirming that the species is Grevillea humilis
16/03/2021	Email	AEP / EE / DPIE	N	Brush-tailed Phascogale	Further info sent to BCD
17/03/2021	Email	AEP / EE	N	Constraints report	Constraints Report for Councils shared with EE
23/03/2021	Email	AEP / EE / DPIE BCD	N	Brush-tailed Phascogale	Received confirmation from BCD that BTP survey effort was sufficient
5/05/2021	Meeting	AEP / EE / LMCC / ADWJ / DPIE BCD	Y	EE Workshop with LMCC / monthly working group	
10/05/2021	Email	AEP / EE / LMCC / CON / BCD / ADWJ	Y	Council consultation	Request for attendance to workshop by Councils and BCD
10/05/2021	Email	AEP / EE / BCD	N	Council consultation	Response from DPIE indicating no capacity for meeting
26/05/2021	Meeting	AEP / EE / LMCC / CON	Y	Council consultation	Survey findings and A&M propositions shared with Councils
31/05/2021	Email	AEP / EE / LMCC / CON	Y	Council consultation	Meeting notes sent by EE to working group
11/06/2021	Email	AEP / EE	N	Council consultation	Follow up information shared by AEP with EE
30/06/2021	Email	AEP / EE / CON	Y	Council consultation	Detailed response from CON received in response to rezoning request
7/07/2021	Email	AEP / EE	N	Council consultation	Response by AEP to CON letter sent to EE
18/08/2021	Meeting	AEP / EE / HCEC	N	Community engagement	Meeting with Hunter Community Environment Centre
24/08/2021	Meeting	AEP / EE / LMCC / CON / DPIE BCD	Y	Council consultation / monthly working group	Clarity sought about corridors, community concerns, aboriginal heritage assessment
2/09/2021	Email	AEP / EE	N	Council consultation	Updated response by AEP to CON letter sent to EE
9/09/2021	Email	AEP / EE / DPIE	N	Common Planigale	Advice letter on survey methodology sent to DPIE to request concurrence

Date	Type of event	Mailing list or attendees	Council involved	Key topics	Milestone achieved
21/09/2021	Email	AEP / EE / ADWJ	N	Constraints report	Updated constraints report package sent to EE
22/09/2021	Email	AEP / EE / ADWJ / CON / LMCC / DPIE BCD	Y	Constraints report	Updated constraints report package sent to Councils and DPIE BCD
5/11/2021	Email	AEP / EE / LMCC	Y	Constraints report	Response from LMCC raising concerns about impacts, footprint etc.
10/11/2021	Email	AEP / EE / CON	Y	Constraints report	Response from CON to updated constraints report, raising concerns regarding impacts, hydro mapping etc
17/11/2021	Email	EE / LMCC	Y	Constraints report	Additional ecology comments received from LMCC
19/11/2021	Email	DPIE / LMCC	Y	Gateway process	Advice from DPIE to LMCC recommending LMCC-only PP due to hold put on CON PP submission
19/11/2021	Email	DPIE / LMCC	Y	Gateway process	Request from DPIE for LMCC to resubmit a LMCC-only PP
22/11/2021	Email	AEP / DPIE	N	Common Planigale	Species cannot be discounted - survey is required
30/11/2021	Email	AEP / EE / LMCC	Y	Biocertification	Factsheets shared by LMCC with EE
3/12/2021	Email	AEP / EE / DPIE BCD	N	Asperula asthenes	Seeking advice from BCD regarding survey requirements
5/12/2021	Email	AEP / EE / DPIE BCD	N	Asperula asthenes	Confirmation received that survey is required
14/12/2021	Email	AEP / EE / CON	Y	Hydroline mapping	Info received from Council re: hydro mapping
23/12/2021	Email	AEP / EE	N	Constraints report	Response from AEP to Council's comments sent to EE
30/12/2021	Email	AEP / EE / DPIE BCD	N	Common Planigale	Request from AEP to BCD regarding minimum survey effort
18/01/2022	Email	AEP / EE / DPIE BCD	N	Common Planigale	Advice re: survey method received from BCD
2/02/2022	Email	AEP / EE	N	Constraints report	Updated response by AEP to Councils letter sent to EE
20/02/2022	Meeting	AEP / EE / ADWJ / Realm / UC	N	Strategy	Strategy workshop
21/02/2022	Email	AEP / EE	N	Constraints report	Updated response by AEP to Councils letter sent to EE
14/03/2022	Meeting	AEP / EE / LMCC	Y	Structure plan	Meeting with LMCC
23/03/2022	Email	EE / CON	Y	Constraints report	Response from AEP to Council's email to Trevor dated 10/11/2021 forwarded to Shane Cahill
23/03/2022	Email	EE / LMCC	Y	Constraints report	Response from AEP to CON's email to Trevor dated 17/11/2021 forwarded to Joanne Dunkerley
5/05/2022	Meeting	AEP / EE	N	Ellalong	
19/05/2022	Email	AEP / EE / ADWJ / UC	N	Gateway process - LMCC	Updated Biodiversity Assessment for LMCC PP sent to group
24/05/2022	Meeting	AEP / EE / DPIE Planning Concierge	N	Biocertification	Discuss process with BCD - advice receive re: A&M focus and EPBC Act referral to be started asap
25/05/2022	Email	AEP / EE / DPIE Planning Concierge	N	Biocertification	Meeting minutes received
30/05/2022	Email	AEP / EE / DAWE / ADWJ	N	EPBC Act Referral	Engagement with DAWE
30/05/2022	Email	AEP / EE / DPIE BCT / ADWJ	N	Stewardship site	Engagement with BCT re: Stewardship site
31/05/2022	Meeting	AEP / EE / ADWJ / and others	N	EE PCG	
8/06/2022	Email	AEP / EE / DAWE	N	EPBC Act Referral	Advice received regarding pre-referral meeting and prep required
27/06/2022	Meeting	AEP / EE / DAWE	N	EPBC Act Referral	Pre-referral meeting
28/07/2022	Email	AEP / EE / LMCC	Y	Gateway process - LMCC	Challenges from LMCC regarding SAII, extent of impacts etc
7/09/2022	Meeting	AEP / EE / DPIE PDU / DPIE BCD	N	Biocertification	Clarification of BCAR lodgement process
8/09/2022	Meeting	AEP / EE / DPIE BCT-CST	N	Stewardship site	Pre-submission meeting
15/09/2022	Email	AEP / EE / DPIE BCT-CST	N	Stewardship site	Received Eden Estates and Ellalong Lagoon BSA pre-submission meeting recommendations
30/09/2022	Email	AEP / EE / DPIE BCD	N	Biocertification	BCAR lodged to BCD and LMCC via BOAMS + by email
15/12/2022	Email	AEP / EE / BCD	N	BCD Review of BCAR	Review by BCD - Feedback by EE for consideration
17/05/2023	Email	AEP / EE / BCD	N	Response to BCD review	Provision of details about survey effort adequacy
7/07/2023	Email	AEP / EE / LMCC / CON	Y	Response to Councils' feedback emails and presentation of amended Structure Plan	Amended Structure Plan proposes to reduce impacts to biodiversity
13/09/2023	Email	AEP / EE / CON	Y	Response to Council's commentary, presentation of amended Structure Plan	Amended Structure Plan proposes to reduce impacts to biodiversity in line with CON feedback
22/11/2023	Email	AEP / EE / LMCC / CON	Y	Response to Councils commentary, presentation of amended Structure Plan	Amended Structure Plan proposes to reduce impacts to biodiversity in line with both Councils' feedback - November 2023 version presented
24/05/2024	Email	AEP / EE / LMCC	Y	Response to Council's commentary, presentation of amended Structure Plan	Provision of details about survey effort adequacy