# Preliminary Biodiversity Development Assessment Report

## Proposed zoning of deferred lands, Patyegarang Project.

Prepared by Ms Rebecca Hogan, BAAS17090

**Preliminary Report – July 2023**

Hayes Environmental reference: 20005

# Document control

| Version | Date | Author | Details |
|---|---|---|---|
| 1 | 02/10/2022 | R. Hogan | Preliminary report for Planning Proposal. |
| 2 | 16/02/2023 | R. Hogan | Preliminary report for Planning Proposal.<br>* Change in development description from 450 'Lots' to 450 'Dwellings'.<br>* Correction to typographical errors.<br>* Update of BAM-Calculator VI scores, credit calculations, and printed BAM-Calculator reports. |
| 3 | 26/07/2023 | R. Hogan | Preliminary report for Planning Proposal.<br>* Change in project name from 'Morgan Road, Belrose' and 'Lizard Rock' to 'Patyegarang Project'.<br>* Update of references to proposed land zoning to reflect the current proposed zone map. The change is essentially a division of the previously proposed 'development zone' into two zones (R2 and RE2). The change formalises some of the intent of the structure plan. There is no change to the structure plan or to the biodiversity assessment results.<br>* Retention of the February 2023 BAM-Calculator VI scores, credit calculations, and printed BAM-Calculator reports. This is a preliminary BDAR. The previous assessment results are sufficient for current purposes. |
| | | | |

# Summary

The subject property is approximately 71 hectares in size, comprising Lots 86, 89, 90, 91, 92, 93, 176, 177, 178, 189, 190, 191, 196, 944, 945, 946, 947, 948, 953, 2600 and 2630 all in DP752038, Lot 2 DP 1242330 and Lot 197 DP1153773. It is located along Morgan Road at Belrose, within the Northern Beaches Local Government Area.

This Preliminary BDAR has been prepared to assess a Planning Proposal for implementation of the Development Delivery Plan for the subject property that was created under *State Environmental Planning Policy (Planning Systems) 2021.*

An indicative draft structure plan has been developed by COX Architecture that is reflective of the site's opportunities and constraints in the areas of biodiversity, bushfire management, transport planning, Aboriginal heritage and stormwater management.

The project would exceed the NSW Biodiversity Offset Scheme on both the map and area thresholds.

Measures to avoid and minimise impacts on native vegetation have involved:

* A comprehensive strategic assessment across the extensive MLALC landholdings in the Northern Beaches LGA to assess constraints and opportunities for development. The assessment concluded that the subject property was the highest priority for action.

* Within the subject property, land across the north and west of the property was identified through preliminary biodiversity investigation and the planning process as being best suited for development, enabling better connectivity and protection of biodiversity values across the south and east.

* Designation of a conservation zone approximately 19.8 hectares in size (~28% of the property) across the south and east of the property. The proposal would zone this land C2 Environmental Conservation.

* Retention of an additional 6.9 hectares of native vegetation (~10% of the property) in a natural condition (although at risk of indirect and uncertain impacts) in reserves and corridors within the development zone of the property, to protect known habitat for threatened species. The proposal would apply two landuse zones to the 'development zone'. The majority would be zoned R2 Low Density Residential, with larger riparian corridors and reserves zoned RE2 Public recreation.

* Broad-level design features to further avoid and minimise impacts, such as use of perimeter roads around residential precincts and additional use of wide bushfire asset protection zones to buffer the proposed conservation zone from residential areas.

* Stormwater design to ensure that Snake Creek experiences no notable change in the hydrological regime, and to meet downstream water quality improvement objectives for the precinct.

* Identification of a range of further avoidance, minimisation and mitigation options to be considered at the detailed development application stage.

* Review of recent strategic biodiversity assessment reports prepared for Northern Beaches Council (Arcadis Australia Pacific *Pty Ltd*, 2021 & 2022; SMEC, 2022) to confirm consistency of the avoidance, minimisation and mitigation strategy embodied in the draft Structure Plan with regional planning principles and objectives.

The entirety of the subject land supports relatively intact native vegetation, comprising three plant community types:

- PCT 1250 – Coastal Sandstone Gully Forest
- PCT 1783 – Sydney North exposed sandstone woodland
- PCT 1824 – Coastal Sandstone Heath-Mallee

The subject land does not contain any threatened ecological communities listed under either the NSW BC Act or Commonwealth EPBC Act.

One threatened plant species, *Tetratheca glandulosa*, has been recorded at several locations within the subject land. There remains some uncertainty with regard to the presence of several other threatened plants species, one of which, *Cryptostylis hunteriana*, has been assumed present until additional field surveys can be conducted.

A large number of threatened fauna species are predicted to occur or have been recorded within the subject land. Two species credit species are known to be present - the Red-crowned Toadlet *Pseudophryne australis*, and the Eastern Pygmy-possum *Cercartetus nanus*.

It has been assumed for this assessment that the draft Structure Plan would directly impact all native vegetation present within the subject land (the development footprint) shown on Figure 1.

This BDAR is a preliminary document prepared for the purpose of a Planning Proposal. The assessment has not been finalised or submitted within BOAMs. The credit summaries in Tables E1 and E2 below were calculated on 16th February 2023.

**Table E1 Impacts that require an offset – ecosystem credits**

| Vegetation zone | PCT | TEC/EC | Impact area (ha) | Number of ecosystem credits required |
|---|---|---|---|---|
| 1250 | 1250 | n/a | 16.18 | 336 |
| 1783 | 1783 | n/a | 17.50 | 315 |
| 1824 | 1824 | n/a | 11.03 | 258 |

**Table E2 Impacts that require an offset – species credits**

| Common name | Scientific name | Loss of habitat (ha) or individuals | Number of species credits required |
|---|---|---|---|
| Eastern Pygmy-possum | *Cercartetus nanus* | 44.68 ha | 1211 |
| Red-crowned Toadlet | *Pseudophryne australis* | 16.72 ha | 341 |
| *Tetratheca glandulosa* | *Tetratheca glandulosa* | 0.24 ha | 6 |
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | ~1.0 ha | 18 |

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# Shortened forms

| | |
|---|---|
| APZ | asset protection zone |
| BAM | Biodiversity Assessment Method |
| BAM-C | Biodiversity Assessment Method Calculator |
| BC Act | *Biodiversity Conservation Act 2016* (NSW) |
| BC Regulation | Biodiversity Conservation Regulation 2017 (NSW) |
| BDAR | Biodiversity Development Assessment Report |
| BOAMS | Biodiversity Offsets and Agreement Management System |
| BOS | Biodiversity Offsets Scheme |
| CEEC | critically endangered ecological community |
| DBH | diameter at breast height over bark |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) |
| EP&A Act | *Environmental Planning and Assessment Act 1979* (NSW) |
| EEC | endangered ecological community |
| HTW | high threat weed |
| IBRA | Interim Biogeographic Regionalisation for Australia |
| LLS Act | *Local Land Services Act 2013* (NSW) |

| | |
|---|---|
| MNES | matters of national environmental significance |
| NSW | New South Wales |
| PCT | plant community type |
| SAII | serious and irreversible impact |
| TBDC | Threatened Biodiversity Data Collection |
| TEC | threatened ecological community |

# Terms

| | | |
|---|---|---|
| Assessment Area | 1,219 ha | The *Subject Land* and land within a 1500m buffer measured from the outside edge of the *Subject Land.* |
| Conservation Zone | 19.8 ha | Land within the *Subject Property* that is set aside for conservation. The proposal would zone this land C2 Environmental Conservation. |
| Development Zone | 51.0 ha | Land within the *Subject Property* that would be directly or indirectly affected by the draft Structure Plan (Cox, 2022). This includes the *Subject Land*, and additional areas of retained vegetation likely to be affected by indirect impacts, or where impacts are uncertain. The proposal would apply two landuse zones to the Development Zone. The majority would be zoned R2 Low Density Residential, with larger riparian corridors and reserves zoned RE2 Public recreation. |
| Subject Land | 44.7 ha | Areas of the *Subject Property* that would be directly affected by the draft Structure Plan (Cox, 2022), including all roads, residential precincts, temporary impact areas, managed open space and bushfire asset protection zones. |
| Subject Property | ~71 ha | Patyegarang Project, consisting of Lots 86, 89, 90, 91, 92, 93, 176, 177, 178, 189, 190, 191, 196, 944, 945, 946, 947, 948, 953, 2600 and 2630 all in DP752038, Lot 2 DP 1242330 and Lot 197 DP1153773, Morgan Road, Belrose. |
| Study Area (for biodiversity survey & assessment) | ~71 ha | The *Subject Property* and some bordering verges. |

# Declarations

## i. Certification under clause 6.15 *Biodiversity Conservation Act 2016*

This BDAR is a preliminary document prepared for the purpose of a Planning Proposal. The credit assessment is not current (dated 16 February 2023) and has not been finalised or submitted within BOAMs.

I certify that this report has otherwise been prepared based on the requirements of, and information provided under, the Biodiversity Assessment Method and clause 6.15 of the *Biodiversity Conservation Act 2016* (BC Act).

Signature:

Rebecca Hogan

Date: 26th July 2023

BAM Assessor Accreditation no: BAAS17090

This BDAR has been prepared to meet the requirements of BAM 2020. Appendix A provides an assessment of compliance with the minimum information requirements outlined in BAM Appendix K.

# ii. Details and experience of author/s and contributors

## Authors and contributors

| Name | BAM Assessor Accreditation no. (if relevant) | Position/Role | Tasks performed | Relevant qualifications & experience |
|---|---|---|---|---|
| Ms Rebecca Hogan | BAAS17090 | Accredited Assessor<br>Lead Ecologist<br>Principal, Hayes Environmental | Project management;<br>BDAR preparation & certification;<br>BAM-C data entry and analysis;<br>GIS work & figure preparation;<br>BAM plot surveys (function & habitat attributes);<br>Identification of Plant Community Type/s;<br>Fauna habitat evaluation:<br>Targeted threatened bird surveys. | BSc (environmental biology), UTS Sydney, 1996<br>MEngMngt, UTS Sydney, 2000<br>Practicing member of the Ecological Consultants Association of NSW.<br>26 years of ecological consulting experience in the Sydney and greater Sydney region. |
| Mr Daniel Clark | n/a | Project Botanist | BAM plot surveys;<br>Review and assistance with identification of plant community type/s;<br>Targeted threatened plant surveys. | BSc (Hons) (Botany), University of Sydney, 2010<br>Cert. IV in General Horticulture, 2005<br>Cert. II in Bushland Regeneration, 2000<br>Cert. IV in Workplace Training and Assessment, 2011<br>Grad. Plant Science Internship, National Herbarium of NSW, Royal Botanic Gardens, 2009<br>Practicing member of the Ecological Consultants Association of NSW.<br>22 years of field botanist experience in the Sydney and greater Sydney region, including 10 years as a botanical consultant undertaking surveys for |

| Name | BAM Assessor Accreditation no. (if relevant) | Position/Role | Tasks performed | Relevant qualifications & experience |
|---|---|---|---|---|
| | | | | development impact assessment. |
| Dr Ray Kearney | n/a | *Hygrocybe* specialist | Targeted surveys for *Hygrocybe* spp | BSc (Hons), PhD<br>Honorary Associate Professor with University of Sydney.<br>Office-bearing member of the Sydney Fungal Studies Group Inc. since 1985.<br>Involved with the discovery and description of threatened wax-cap fungi species relevant to this BDAR, and with preparation of submissions to the NSW Scientific Committee upon which basis the species were listed as threatened under the BC Act. |
| Mr Deryk Engel | n/a | Project Fauna Surveyor<br>Principal, Lesryk Environmental | Targeted surveys for threatened fauna. | BEnvSc (Hons), University of Wollongong, 1990.<br>Practicing member of the Ecological Consultants Association of NSW.<br>Over 30 years of fauna field survey experience across a wide variety of landscapes throughout NSW. |
| Dr Marion Anstis | n/a | Amphibian specialist | Targeted surveys for threatened amphibians | PhD, Newcastle University, 2013.<br>Associate of the Australian Museum (herpetology department) since 2015.<br>Over 15 years of tadpole and frog consulting experience.<br>Author of '*Tadpoles and Frogs of Australia*' (awarded the Whitley Silver Medal for *best publication on Australian Natural History*, 2014). |
| Joseph Morton | n/a | Fauna Surveyor | Targeted surveys for threatened fauna. | BEnvBio |

| Name | BAM Assessor Accreditation no. (if relevant) | Position/Role | Tasks performed | Relevant qualifications & experience |
|---|---|---|---|---|
| Sarah Marshall | n/a | Fauna Surveyor | Targeted surveys for threatened fauna. | BBioCon |
| Harry Engel | n/a | Fauna surveyor | Targeted surveys for threatened fauna. | BMarineSc |
| Chris Sheil | n/a | Fauna surveyor assistant | Targeted surveys for threatened fauna. | Cert III Hort |

## iii. Conflict of interest

I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest

This declaration has been made in the interests of full disclosure to the decision-maker. Full disclosure has also been provided to the client.

Signature:

Rebecca Hogan

Date: 26th July 2023

BAM Assessor Accreditation no: BAAS17090

# Stage 1: Biodiversity assessment

# 1. Introduction

## 1.1 Proposed development

### 1.1.1 Development overview

The purpose of the Planning Proposal is to implement the Development Delivery Plan for the subject property that was created under *State Environmental Planning Policy (Planning Systems) 2021*.

The objective of the Planning Proposal is to create a residential community embodying strong conservation principles to support the enhancement of the unique environmental and Aboriginal cultural heritage characteristics of the site.

The intended outcome of the Planning Proposal is to amend the applicable local planning controls to accommodate up to 450 new residential dwellings with a variety of scale and character reflective of the dominant dwelling type in the Belrose locality, as well as a new cultural community centre and protection of aboriginal heritage sites.

An indicative draft Structure Plan has been developed by COX Architecture that is reflective of the site's opportunities and constraints in the areas of biodiversity, bushfire management, transport planning, Aboriginal heritage and stormwater management. The Planning Proposal intends to ensure development outcomes align with traditional indigenous 'Caring for Country' practices and relevant 'Connecting with Country' and 'Designing with Country' principles and strategies.

The project is a development that requires consent under Part 4 of the EP&A Act.

### 1.1.2 Location

The subject property is approximately 71 hectares in size. It is located along Morgan Road at Belrose, within the Northern Beaches Local Government Area.

The property comprises Lots 86, 89, 90, 91, 92, 93, 176, 177, 178, 189, 190, 191, 196, 944, 945, 946, 947, 948, 953, 2600 and 2630 all in DP752038, Lot 2 DP 1242330 and Lot 197 DP1153773.

Refer to Figure 1 (Site Map) and Figure 2 (Location Map).

### 1.1.3 Proposed development and the subject land

The subject property is naturally vegetated, supporting a mosaic of relatively intact plant community types. Areas of weed invasion occur around some boundaries and along drainage lines.

The property incorporates virtually all of the upper catchment of Snake Creek, a first order[1] stream in the Narrabeen Lagoon catchment. Numerous small ephemeral drainage lines feed into Snake Creek, many of which support slow draining soaks, small pools, and hanging swamps.

The gully slopes are characterised by a series of sandstone benches with small escarpments, areas of rock shelving and large sandstone boulders.

The land is currently undeveloped. A network of informal tracks are used for recreation by walkers, mountain bikers and amateur naturalists.

This biodiversity assessment has been based on the assignation of two broad impact zones across the subject property, based on the draft Structure Plan:

i. the development zone (51.0ha), being land that would be affected either directly (the subject land, 44.1ha) or indirectly (retained vegetation, 6.9ha) by the draft Structure Plan; and

ii. a conservation zone (19.8ha), being land outside of the development zone that is set aside and managed for conservation.

The planning proposal would apply three landuse zones to the subject property. Two of these zones would be applied to the development impact zone described above – the majority of land would be zoned R2 Low Density Residential, while larger riparian corridors and reserves within the development zone would be zoned RE2 Public recreation. The third zone, C2 Environmental Conservation, would be applied to the entirety of the conservation zone described above.

The draft Structure Plan broadly involves:

* Creation of a series of residential precincts allowing for up to 450 dwellings. Three minimum lot size classes would be applied across the R2 zone: 200m$^2$ in the north, 450m$^2$ through the central part, and 600m$^2$ in the south.

* Construction of a new road network with eight connection points to the existing Morgan Road. The road network has been designed such that roads form the perimeter of residential zones as much as possible.

* Identification of bushfire Asset Protection Zones (APZs) around the perimeter of the residential precincts, including creation of some fire trails within these. APZs form a broad buffer (typically >60m) between residential precincts and the conservation zone. APZs do not encroach into the conservation zone.

* Stormwater management designed so that Snake Creek experiences no notable change in the hydrological regime, and to meet water quality improvement objectives for the precinct.

* Protection of the Patyegarang archaeological sites (Indigenous significance) with creation of an Aboriginal Cultural Centre.

* Retention of 6.9 hectares of native vegetation in various reserves and corridors. These areas are likely to be affected by indirect impacts of the development. There is also some uncertainty with regard to future impacts on these areas.

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1 *Strahler stream classification system*

Refer to Figure 3 (Development Layout – Draft Structure Plan).

### 1.1.4 Other documentation

Documents referred to and relied upon in this assessment include:

* Cox Architecture. *Draft Structure Plan*. September 9, 2022.
* Travers Bushfire & Ecology. *Bushfire Protection Assessment, Planning Proposal, Morgan Road, Belrose.* 12/09/2022.
* Smith, P. & Smith, J. (2000) *Survey of the Duffys Forest Vegetation Community*. Unpublished Report to NSW National Parks and Wildlife Service and Warringah Council.
* Dr Ray Kearney. *Letter regarding Belrose Bushland Hygrophoraceae (Waxcap) Survey – 6th July 2021*. 21st July 2021.

## 1.2 Biodiversity Offsets Scheme entry

The riparian corridor along Snake Creek is mapped on the Biodiversity Values Map. Refer to Figure 4 (Biodiversity Values Map). The draft Structure Plan includes one road crossing of Snake Creek and a potential footbridge. The project would exceed the map criteria.

There is no minimum lot size assigned to the land. However, the extent of clearing required for the draft Structure Plan would exceed the maximum area set out in the BAM area threshold table. The project would exceed the area criteria.

The streamlined assessment modules set out in Appendices B, C and D of BAM 2020 do not apply.

## 1.3 Excluded impacts

There are no biodiversity values not assessed under BAM 2020 (listed in s1.5 of BAM 2020) of relevance to the subject land. There are no areas of LLS Act Category 1 – exempt land within the subject land.

## 1.4 Matters of national environmental significance

A number of species listed as threatened under the Commonwealth EPBC Act are predicted or assumed to occur within the development zone and would be impacted by the draft Structure Plan.

The scale of the project warrants referral to the Commonwealth under the EPBC Act.

Refer to Appendix B (Matters of national environmental significance - MNES) for a summary of details provided throughout the BDAR.

## 1.5 Information sources

Relevant legislation and policies for this report include:

* *Commonwealth Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act)
* *Amending Agreement No. 1 – Amending the Original Agreement relating to environmental assessment. Commonwealth of Australia and the State of New South Wales. 2020.*
* *NSW Biodiversity Conservation Act 2016* (BC Act)
* *NSW Biodiversity Conservation Regulation 2017* (BC Reg)
* *NSW Biodiversity Assessment Method Order 2020* (BAM)

Relevant guidelines for this report include:

* *Biodiversity Assessment Method Operational Manual – Stage 1*. State of NSW and Department of Planning, Industry & Environment (2020).
* *Biodiversity Assessment Method Operational Manual – Stage 2*. State of NSW and Department of Planning, Industry & Environment (2019).
* *Surveying threatened plants and their habitats. NSW survey guide for the Biodiversity Assessment Method (2020).* Department of Planning, Industry & Environment (2020).
* *Flora species with specific survey requirements.* NSW Office of Environment & Heritage.
* *NSW Survey Guide for Threatened Frogs.* Department of Planning, Industry & Environment (2020).
* *Guide for mapping threatened species for inclusion in the NSW regulatory framework.* Department of Planning, Industry & Environment (2020).
* *NSW survey guide – 'Species credit' threatened bats and their habitats (2018).*
* *Threatened biodiversity survey and assessment: Guidelines for developments and activities.* NSW Department of Environment and Conservation (2004, in draft).

Data sources researched include:

* NSW Bionet (www.bionet.nsw.gov.au): Vegetation Classification; Threatened Biodiversity Data Collection (TBDC); and Atlas records.
* Threatened biodiversity profiles. NSW Office of Environment & Heritage.
* *A Directory of Important Wetlands in Australia*, Third Edition, Environment Australia (2001). http://www.environment.gov.au/water/wetlands/publications/directory-important-wetlands-australia-third-edition.
* SEED | Sharing and Enabling Environmental Data (www.seed.nsw.gov.au): NSW Interim Biogeographic Regions of Australia (IBRA) regions and subregions (version 7); NSW Mitchell Landscapes (version 3.1); Vegetation Map – Sydney Metro Area v3.1 2016; State Vegetation Type Map – SVTM_NSW_Extant_PCT.
* Aerial photography of the site: Department of Lands SIX Viewer; Google Maps 2022; and Nearmap (various dates up to 12th September 2022).

# 2. Methods

## 2.1 Site context methods

### 2.1.1 Landscape features

A general walked inspection of the subject property was undertaken by Ms Rebecca Hogan on the 2nd July 2020. Site features were compared in the field to high resolution aerial images of the subject property (Nearmap, various dates). The inspection included observation of features not visible on aerial images due to canopy shading, such as the Snake Creek watercourse.

Field observation of landscape features was undertaken during all subsequent site visits and field surveys to compile as comprehensive an understanding of the property and surrounding area as possible within the project timeframe.

### 2.1.2 Native vegetation cover

An estimate of native woodland and forest cover across the subject property and the assessment area was obtained through interpretation of aerial images (Nearmap, various dates up to 12/09/2022) and Ms Rebecca Hogan's knowledge of the local area.

The assessment area is characterised by suburbs of low to moderate density residential development surrounded by natural woodlands and forests. It has been assumed for this report that:

* treed areas within private lots and gardens are essentially exotic in nature and do not form a functioning native vegetation community;
* all wooded areas not within residential suburbs contain native woodland or forest;
* parks and ovals associated with the residential areas contain managed grassland dominated by exotic species and do not comprise native vegetation. It is noted these areas would historically have supported native woodland or forest. There are no natural grassland communities endemic to the assessment area.

## 2.2 Native vegetation, threatened ecological communities and vegetation integrity methods

### 2.2.1 Existing information

*Existing regional vegetation maps*

Previous mapping of the subject property (Sydney Metro Area v3.1 2016E – VIS 4489) identified the following PCTs:

* PCT 1250 (*Coastal Sandstone Gully Forest*) – occupying the main gully areas and east-facing slopes.

* PCT 1783 (*Sydney North exposed sandstone woodland*) – occupying west-facing slopes and more exposed upper slopes.
* PCT 1824 (*Coastal Sandstone Heath-Mallee*) – occupying plateau areas.
* PCT 1803 (*Coastal upland damp heath swamp*) – one small patch on an upper slope in the west of the subject property.
* PCT 1841 (*Smooth-barked Apple - Turpentine - Blackbutt tall open forest on enriched sandstone slopes and gullies of the Sydney region*) – a narrow corridor along the Snake Creek watercourse in the south of the subject property.

The recently released eastern NSW mapping (SVTM_NSW_Extant_PCT) identifies a similar pattern of vegetation (polygon shapes and locations), with new PCT codes replacing the previous codes essentially as follows:

* PCT 1250 = PCT 3592 (*Sydney Coastal Enriched Sandstone Forest); &*
  PCT 3593 *(Sydney Coastal Sandstone Bloodwood Shrub Forest*); &
  PCT 3595 (*Sydney Coastal Sandstone Gully Forest*)
* PCT 1783 = PCT 3038 (*Sydney Coastal Coachwood Gallery Rainforest*)
* PCT 1824 = PCT 3810 (*Southern Sydney Rockplate Heath*), &
  PCT 3807 (*Northern Sydney Heath-Mallee*); &
  PCT 3814 (*Woronora Plateau Heath-Mallee*)
* PCT 1803 = PCT 3924 (*Sydney Coastal Upland Swamp Heath*)
* PCT 1841 = PCT 3136 (*Blue Gum High Forest*); &
  3176 (*Sydney Enriched Sandstone Moist Forest*)

*Threatened Ecological Communities potentially relevant to the subject land*

i. PCT 1803 is associated with the threatened ecological community '*Coastal Upland Swamp in the Sydney Basin Bioregion*', listed as *endangered* under both the NSW BC Act and Commonwealth EPBC Act.

ii. PCT 3136 is associated with the threatened ecological community '*Blue Gum High Forest in the Sydney Basin Bioregion*', listed as *critically endangered* under both the NSW BC Act and Commonwealth EPBC Act.

iii. Previous botanical survey of the subject land (Travers Bushfire & Ecology, *pers comm*) identified two patches of vegetation within the subject land that could be '*Duffys Forest Ecological Community in the Sydney Basin*'. This community is listed as *endangered* under the BC Act.

Botanical surveys were conducted to investigate the potential presence of TECs within the subject land, as described in Chapter 2.2.3 of this report.

### 2.2.2 Mapping native vegetation extent

Native vegetation extent within the subject land and subject property has been mapped using a combination of:

* high resolution Nearmap aerial images spanning several years and seasons;
* site inspections by Ms Rebecca Hogan and Mr Daniel Clarke.

All areas of the subject land and subject property are classed as native vegetation.

### 2.2.3 Plot-based vegetation survey

*Preliminary and site stratification*

A general walkover and botanical survey was conducted across the subject property on the 30th July 2020 and 6th August 2020 by Mr Daniel Clarke. A total of 12 hours was spent on the property over these two days.

The survey included recording of vegetation details at each of 64 spot observation points. Refer to Appendix C (Vegetation survey data) and Figure 5 (Flora field survey locations).

Data recorded at each spot observation point (within an approximate 10m radius) includes:

* GPS location;
* photograph;
* dominant native canopy, shrub and groundlayer species;
* dominant weeds;
* soil type, including presence of sandstone outcropping, rocks or boulders and specific note of ironstone fragments;
* general comments.

This work was used to ground-truth broadscale vegetation maps and locate vegetation boundaries to produce a Plant Community Type map for the subject property.

Due to time limitations associated with the size of the study area and complexity of draft Structure Plan, it was conservatively assumed for this assessment that all areas of vegetation are in good or intact condition. There are, however, fringing areas bordering existing residential development in the north and west that are degraded by edge-effects and weed-invasion. These areas could be identified, mapped and sampled for a refined assessment and off-set calculation at a later development application stage.

Using the results of desktop investigation, aerial imagery and preliminary site inspections, the subject land was stratified into three vegetation zones:

* PCT 1250: good condition
* PCT 1783: good condition

* PCT 1824: good condition

*BAM-VIS plot surveys*

Six BAM-VIS plot surveys were conducted within the subject property, two within each vegetation zone. Refer to Figure 5 (Flora field survey locations). A further three plot surveys would be required to meet requirements set out in BAM 2020 for the purpose of finalising an off-set calculation for development. However, due to the reasonably uniform character and condition of each vegetation zone across the subject land, the number of plots sampled to date is considered sufficient for the purpose of establishing the scale of impact and feasibility of off-sets for a Planning Proposal.

The method uses a 20m x 20m plot to assess composition and structure, within a 20m x 50m plot to assess function attributes, with five $1m^2$ sub-plots to assess litter cover, as set out in BAM 2020. Plot data was collected in accordance with BAM 2020 and is provided in Appendix C (Vegetation survey data).

BAM plots 1 and 2 were specifically located within areas of vegetation previously identified as potential Duffys Forest EEC (Travers Bushfire & Ecology, *pers comm*) and BAM plot 3 was specifically located in a third location where soils appeared deeper than typical for the site. These locations were chosen to enable a thorough comparison of data against published descriptions of PCTs and TECs (particularly Duffys Forest EEC). All three were surveyed on 27th August 2020.

BAM plot 4 was located to test a typical example of land proposed as bushfire asset protection zone - 'outer protection area' in regard to making a reasonable determination as to the future condition scores of these areas. Surveyed on 4th March 2020.

BAM plots 5 and 6 were located randomly within PCT 1824 which had not yet been sampled. Randomisation was based on random selection of grid points. The rugged nature of the site required that both plots were then relocated short distances for accessibility. Both surveyed on 4th March 2020.

Plots were not located across ecotones or in areas substantially degraded by residential edge-effects.

### 2.2.4 Vegetation integrity survey

Vegetation integrity scores were calculated using data obtained from the plot-based survey described in Ch 2.2.3 above and formulae embedded in the BAM-Calculator. The calculation used standard condition benchmarks within the BAM-Calculator.

## 2.3 Threatened flora survey methods

### 2.3.1 Review of existing information

The BAM-Calculator (Part 4 Developments) was used to generate a list of relevant threatened species on the basis of IBRA subregion (Pittwater SYB07), native vegetation cover class in the assessment area (31-70%) and patch size classes (all zones >100ha).

A review was undertaken of habitat and constraints information held in the TBDC in relation to each of the returned species, and geographic and habitat constraints set out in the BAM-Calculator.

A search was also undertaken within the Bionet Atlas (sightings) database for records of all threatened species on and in the vicinity of the subject property, and a discussion held with Mr Brendan Smith (Senior Environment Officer, Northern Beaches Council) to identify additional or specific threatened species that should be considered in the assessment.

### 2.3.2 Field surveys

The general site walkovers conducted on 30th July and 6th August 2020 by Mr Daniel Clarke included observations and opportunistic searches for threatened plant species known to occur in the vicinity of the subject property. The walked route was approximately 5.3km in length, with observation extending to 5m either side. Walking speed was approximately 3-4km/hr.

Targeted threatened plant surveys were conducted at each of 64 spot observation points (during the July and August surveys), extending to a radius of approximately 10m around the point.

Targeted threatened plant surveys were conducted on the 22nd, 29th & 30th October 2020 using the parallel traverse method (*NSW Guide to Surveying Threatened Plants*, OEH 2016). This method was adapted to suit the rugged terrain of the subject land, with rock outcrops, escarpments, shrub thickets and swampy areas impeding access and straight line transects in many areas.

Time limitations prevented application of the parallel traverse method across all parts of the subject land over all relevant seasons.

Target areas for the parallel traverse surveys were identified using information obtained from desktop study, previous site inspections and the initial random meanders. Target areas were selected having regard to the following:

* areas likely to be most heavily impacted by the draft Structure Plan (with less opportunity for later avoidance through design modification);
* known threatened plant species locations and habitat;
* presence of diverse and intact habitat;
* representative sampling within each PCT.

Sets of parallel traverses varying from 30m-250m long and positioned approximately 10m apart were surveyed in each target area. A total of 8.4km of traverse was surveyed at a walking speed averaging approximately 3.3km/hr. Refer to Figure 5 (Flora field survey locations).

## 2.4 Threatened fauna survey methods

### 2.4.1 Review of existing information

The BAM-Calculator (Part 4 Developments) was used to generate a list of relevant threatened species on the basis of IBRA subregion (Pittwater SYB07), native vegetation cover class in the assessment area (31-70%) and patch size classes (all zones >100ha).

A review was undertaken of habitat and constraints information held in the TBDC in relation to each of the returned species, and geographic and habitat constraints set out in the BAM-Calculator.

A search was also undertaken within the Bionet Atlas (sightings) database for records of all threatened species on and in the vicinity of the subject property, and a discussion held with Mr Brendan Smith (Senior Environment Officer, Northern Beaches Council) to identify additional or specific threatened species that should be considered in the assessment.

### 2.4.2 Habitat constraints assessment

A walked inspection was conducted by Ms Rebecca Hogan throughout the subject land on the 2nd July 2020.

Ongoing habitat assessment was conducted throughout the fauna survey program to adapt, refine and inform survey design.

The habitat assessment included consideration of vegetation structure and diversity, identification of hollow-bearing trees (particularly noting presence of medium and large hollows), and identification of other specific elements such as caves and rock habitat, watercourses and dams, presence of *Allocasuarina* species, mistletoes, termite mounds, quantity and size of fallen timber and logs, burrows *etc*.

### 2.4.3 Field surveys

Targeted fauna surveys were conducted across the subject property specifically for this assessment over a seven-month period (July 2020 to February 2021). Broadly, four survey sessions were undertaken:

* July session (8 July to 13 August 2020)
* September session (17 September to 14 October 2020)
* November (3 to 26 November 2020)
* December (22 December 2020 to 1 February 2021).

A variety of methods and techniques were employed across the subject property. A summary of survey methods and effort employed to target relevant species is set out in Table 1. Refer to Figure 6 (Fauna field survey locations).

Refer to Appendix D (Fauna survey methods and data) for detailed descriptions of survey methods, specific timings and effort.

In addition to the targeted surveys, a record was maintained of all opportunistic sightings and of indirect evidence found, such as tracks, scats, scratchings and diggings.

**Table 1 Summary of threatened fauna survey methods and effort**

| Survey Method | Cumulative survey effort |
|---|---|
| Dedicated bird surveys. | 220 person-minutes |
| Dedicated amphibian surveys | 2,120 person-minutes |
| Dedicated Eastern Pygmy-possum nest-tube survey | 6,720 tube-nights |
| Employment of the Scat Assessment Technique to determine the presence of Koalas. | 510 person-minutes |
| Elliot trapping – arboreal | 160 trap-nights |
| Elliot trapping – ground | 276 trap-nights |
| Cage traps | 24 trap-nights |
| Hairtube trapping – arboreal | 300 hairtube-nights |
| Hairtube trapping – ground | 2,390 hairtube-nights |
| Infrared cameras - arboreal | 279 camera nights |
| Infrared cameras - ground | 199 camera/nights |
| Use of passive acoustic recorders (SongMeters) | 1,791 recording-hours |
| Echolocation detection targeting insectivorous bats (Anabat) | 218 recording-nights |
| Dedicated microchiropteran bat cave searches | 40 person-minutes |
| Dusk surveys | 300 person-minutes |
| Call playbacks | 540 minutes |
| Spotlighting | 1,680 person-minutes |
| Herpetofauna searches | 180 person-minutes |

## 2.5 Weather conditions

**Table 2 Environmental conditions during threatened species surveys**

| **Survey undertaken** (e.g. method / targeted species) | **Date** | **Time** | **Temperature** recorded at time of survey, or (daily min-max.*) | **Wind** (light, mod…) | **Rainfall** (mm**) | **Other conditions relevant to the species** |
|---|---|---|---|---|---|---|
| Bird surveys | 22/07/2020 | 11:40 | 18°C | nil | 0mm | - |
| | 23/09/2020 | 16:00 | 22°C | 3 | 0mm | - |

| **Survey undertaken** (e.g. method / targeted species) | **Date** | **Time** | **Temperature** recorded at time of survey, or (daily min-max.*) | **Wind** (light, mod…) | **Rainfall** (mm**) | **Other conditions relevant to the species** |
|---|---|---|---|---|---|---|
| | 14/10/2020 | noon | 21°C | 2 | 0mm | - |
| | 03/11/2020 | 16:00 | 25°C | 2 | 0mm | - |
| | 09/11/2020 | 19:00 | 20°C | 2 | 0mm | - |
| Amphibian surveys | 14/10/2020 | | 21°C | 2 | 0mm | Last 24 hrs: 0mm<br>Last 7 Days: 1mm<br>Last 30 days: 21mm |
| | 03/11/2020 | | 25°C | 2 | 0mm | Last 24 hrs: 10.6mm<br>Last 7 Days: 29.6mm<br>October total: 109mm |
| | 09/11/2020 | | 20°C | 2 | 0mm | Last 24 hrs: 0.8mm<br>Last 7 Days: 21.2mm<br>Last 30 days: 160mm |
| | 10/11/2020 | | (14-23°C) | not avail. | 0mm | Last 24 hrs: 0.2mm<br>Last 7 Days: 42.4mm<br>Last 30 days: 160mm |
| | 11/11/2020 | | (16-30°C) | not avail. | 0mm | Last 24 hrs: 0mm<br>Last 7 Days: 42.4mm<br>Last 30 days: 160mm |
| | 17/11/2020 | | (15-22°C) | not avail. | 0.8mm | Last 24 hrs: 0mm<br>Last 7 Days: 2mm<br>Last 30 days: 162mm |
| | 18/11/2020 | | (15-24°C) | not avail. | 0mm | Last 24 hrs: 1.6mm<br>Last 7 Days: 3.6mm<br>Last 30 days: 158mm |
| | 24/11/2020 | | (16-23°C) | not avail. | 0mm | Last 24 hrs: 3.2mm<br>Last 7 Days: 4.8mm<br>Last 30 days: 146mm |
| | 25/11/2020 | | (16-30°C) | not avail. | 0mm | Last 24 hrs: 2mm<br>Last 7 Days: 4.8mm<br>Last 30 days: 127mm |
| | 22/12/2020 | | (13-24°C) | not avail. | 0mm | Last 24 hrs: 32.4mm<br>Last 7 Days: 87.2mm<br>Last month: 122.4mm |
| Koala SAT survey | 18/09/2020 | | not avail. | not avail. | 3.6mm | 0mm in preceding three days |

| **Survey undertaken** (e.g. method / targeted species) | **Date** | **Time** | **Temperature** recorded at time of survey, or (daily min-max.*) | **Wind** (light, mod…) | **Rainfall** (mm**) | **Other conditions relevant to the species** |
|---|---|---|---|---|---|---|
| | 23/09/2020 | | (11-22°C) | 3 | 0mm | 10mm rain fell on 21/09/2021 |
| | 06/10/2020 | | (15-20°C) | not avail. | 0.6mm | 0mm in preceding three days |
| Nocturnal surveys<br>- dusk watch<br>- call playback<br>- spotlighting | 08/07/2020 | duration 2 hours, start 30mins prior to dusk | (8-17°C) | not avail. | 0mm | - |
| | 09/07/2020 | | (10-16°C) | not avail. | 0mm | - |
| | 16/07/2020 | | (10-14°C) | not avail. | 0mm | - |
| | 22/07/2020 | | (7-18°C) | not avail. | 0mm | - |
| | 17/09/2020 | | not avail. | not avail. | 0mm | - |
| | 23/09/2020 | | (11-20°C) | not avail. | 0mm | - |
| | 14/10/2020 | | (13-25°C) | not avail. | 0mm | - |
| | 03/11/2020 | | (13-24°C) | not avail. | 0mm | - |
| Herpetofauna | 16/07/2020 | 15:00 | (10-18°C) | 1 | 0mm | - |

** data obtained from BOM records – Terrey Hills AWS*

*** data obtained from BOM records – Belrose (Evelyn Place)*

## 2.6 Limitations

The subject property supports a large area of intact, mostly shrubby, bushland spread across difficult terrain. Field surveys were conducted during 2020, a particularly wet year which created additional challenges for scheduling and conducting field surveys due to impeded drainage across parts of the property.

A recent review of biodiversity information for the deferred lands prepared for the Northern Beaches Council (Arcadis Australia Pacific *Pty Ltd*, 2021) notes that the steep topography of the deferred lands presents a challenge for threatened flora survey, particularly for small cryptic threatened forbs. Further targeted surveys will be required for some species to meet legislative requirements for development assessment in accordance with the BAM.

However, the author notes this BDAR assesses a draft Structure Plan for the subject property rather than a final development application. There is scope for flexibility within the Structure Plan to allow for further avoidance and minimisation of impacts should this be required at a future development application stage.

In addressing limitations to survey effort to inform the planning process, field data has been augmented through research and use of historical records for the land. It is relevant to note that:

* Parts of the subject property have been surveyed and visited on previous occasions by other professional ecological consulting firms, with sightings data added under scientific license to the Bionet Atlas.
* The land has always been (and still is) open to the general public. It is used for amateur bird watching and is regularly traversed by local residents and other members of the public with an interest in native flora and fauna. Some threatened species sightings have been added to the Bionet Atlas from casual observers. The review of biodiversity information for the deferred lands prepared for the Northern Beaches Council (Arcadis Australia Pacific *Pty Ltd*, 2021) refers to threatened species records being located along tracks used for recreation, noting a bias towards fauna sightings.
* These factors have resulted in a more comprehensive record of sightings in the Bionet Atlas for the subject property than is usual for proposed development sites, particularly in relation to interesting, iconic or rare observations.

Current knowledge of the land is believed sufficient for the purpose of assessing the merits of the draft Structure Plan for the Planning Proposal.

*Flora*

Limitations to the application of the parallel traverse survey method were addressed in part through:

* Use of random meanders and site inspection to prioritise areas of the property for survey;
* Focus on surveying parts of the subject land proposed for more intensive use (with less opportunity for later avoidance through design modification);
* Focus on surveying land surrounding known locations of threatened plants;
* Ensuring targeted surveys sampled the range of plant community types and microhabitats present within the subject land;
* Ensuring targeted surveys sampled areas of relatively intact habitat within each plant community type.

It is noted that the years 2020 and 2021 were both wetter than usual following a long period of drought, with many species taking advantage of conditions to shoot new growth, prolong their flowering periods and produce seed.

The BAM-VIS plot data collected is believed representative of the vegetation types present across the subject land.

Surveyor Licences:

Mr Daniel Clark
Scientific Licence, s132c of the NP&W Act 1974 (SL101495)

*Fauna*

There are inherent limitations to fauna surveying due to the mobility of species and natural population fluctuations and movements. However, fauna surveys conducted across the subject property were comprehensive and spanned a range of seasons. The fauna data is also well augmented by historical records within the Bionet Atlas. There is a high level of confidence in the accuracy and completeness of data used for the assessment.

Surveyor Licences:

Ms Rebecca Hogan
Scientific Licence, s132c of the NP&W Act 1974 (SL100778)
DPI Animal Care & Ethics Committee Approval (exp. September 2023)

Mr Deryk Engel
Scientific Licence, s132c of the NP&W Act 1974
DPI Animal Care & Ethics Committee Approval

# 3. Site context

## 3.1 Assessment area

The assessment area is the subject land and land within a 1500m buffer measured from the outside edge of the subject land. Refer to Figure 2 (Location Map).

## 3.2 Landscape features

Landscape features identified within the subject land and assessment area are shown on Figure 1 (Site Map) and/or Figure 2 (Location Map). A discussion of relevant landscape features is provided below.

### 3.2.1 IBRA bioregions and IBRA subregions

Subject Land:

- IBRA bioregion: Sydney Basin (SYB)
  - IBRA subregion: Pittwater (SYB07)

Assessment Area:

- IBRA bioregion: Sydney Basin (SYB)
  - IBRA subregion: Pittwater (SYB07)

### 3.2.2 Rivers, streams, estuaries and wetlands

Subject Land:

- Snake Creek drains to the south through the subject land. This is a 1st order stream under the Strahler classification system – the designated riparian corridor to be 10m wide either side from top of bank. It is fed by a series of minor ephemeral flow paths and hanging swamps within the subject property.
- A separate aquatic ecology assessment of the subject property and draft Structure Plan has been carried out by Marine Pollution Research P/L.

Assessment Area:

- Land east of the Forest Way watershed (including the subject land) drains east to Middle Creek and then to Narrabeen Lagoon.
- Land west of the Forest Way watershed drains west to Middle Harbour Creek, and then to Middle Harbour.
- No listed important wetlands (DIWA) occur within or downstream of the assessment area.
- No large waterbodies or wetlands occur within the assessment area.

### 3.2.3 Habitat connectivity

Vegetation within the subject land and assessment area is well connected to extensive areas of natural vegetation and habitat. There is some minor fragmentation due to roads and pockets of development.

The subject land is not part of a unique or obvious 'corridor', but would provide connectivity for wildlife movement through the locality.

Habitat connectivity is an important biodiversity value of the subject property.

### 3.2.4 Karst, caves, crevices, cliffs, rocks or other geological features of significance

The subject land and assessment area are located across a relatively rugged landscape typical of the Hawkesbury sandstone formation, with rock outcrops, escarpments, overhangs and shallow sandstone caves scattered throughout.

There is no limestone karst within the subject land or assessment area.

### 3.2.5 Areas of outstanding biodiversity value

Not applicable.

### 3.2.6 NSW (Mitchell) landscape

Subject Land:

- *Belrose Coastal Slopes* (Bsl). Landscape 59% cleared
- *Sydney Basin Diatremes* (Dia): Landscape 32% cleared

Assessment Area:

- *Belrose Coastal Slopes* (Bsl). Landscape 59% cleared
- *Sydney Basin Diatremes* (Dia): Landscape 32% cleared

### 3.2.7 Additional landscape features identified in SEARs

Not applicable.

### 3.2.8 Soil hazard features

Not applicable.

## 3.3 Native vegetation cover

Approximately 807 hectares of native woodland and forest in variable condition occurs within the assessment area (based on woody vegetation cover evident on aerial images - Google Satellite 2022 and Nearmap, various dates).

Table 3 summarises the extent of native vegetation cover within the assessment area. Figure 2 (Location Map) shows native vegetation cover within the assessment area.

**Table 3 Native vegetation cover in the assessment area**

| | |
|---|---|
| **Assessment area (ha)** | 1,219 ha |
| **Total area of native vegetation cover (ha)** | 807 ha |
| **Percentage of native vegetation cover (%)** | 66 % |
| **Class (0-10, >10-30, >30-70 or >70%)** | >30-70% |

# 4. Native vegetation, threatened ecological communities and vegetation integrity

## 4.1 Native vegetation extent

The subject land contains 44.7 hectares of native woodland and forest. Refer to Figure 7 (Native vegetation).

### 4.1.1 Changes to the mapped native vegetation extent

Not relevant. Site inspection and field survey found that aerial images represent the current extent of native vegetation across the subject land.

### 4.1.2 Areas that are not native vegetation

Not relevant. All parts of the subject land contain native vegetation.

## 4.2 Plant community types

### 4.2.1 Overview

Vegetation within the subject land has been assessed as aligning with the BioNet Vegetation Classification PCTs identified within Table 4 below. Their extent is shown on Figure 7 (Native vegetation). Detailed descriptions of each PCT are provided in the following subsections.

The PCT identification and mapping broadly corresponds with regional vegetation mapping for the subject land (SEED - Sydney Metro Area v3.1 2016E – VIS 4489), with the following variations:

* PCT boundaries have been adjusted to better reflect floristic details recorded at botanical spot observation points.
* The small patch of PCT 1803 (*Coastal upland damp heath swamp*) identified on the SEED map (Sydney Metro Area v3.1 2016E) was found to not be present on the land. The Bionet vegetation classification profile describes this community as a treeless sedgeland. Three botanical spot surveys were conducted within the mapped area (numbers 11, 12 & 53). All three spots recorded a canopy of *Eucalyptus* and related species, with a mid-storey containing *Acacia*, *Pittosporum*, *Callicoma* and/or *Allocasuarina* and a groundlayer containing grasses. Areas on the creekline itself are swampy, but these are dominated by exotic shrubs such as Coral Tree, Pampas Grass, Lantana, Privet, Crofton Weed, Senna, *etc*. There is no native sedge layer.

  This finding is not inconsistent with the recent review of biodiversity information for the deferred lands prepared for the Northern Beaches Council (Arcadis Australia Pacific *Pty Ltd*, 2021). The authors note in relation to the regional vegetation map that, "*there may be some errors in the mapping of Coastal Upland Swamps, which have been identified based on consistent photo patterns rather than ground-truthed information. Coastal Upland Swamp can be difficult to map*

*at larger scale, as some areas of sandstone heath regrowth, particularly in damper areas, can have similar patterns to Coastal Upland Swamp on aerial photographs*".

The previously mapped patch and several other locations across the subject land do contain 'hanging swamps'. However, each of the areas is quite small, none are treeless, and the vegetation understorey lacks a notable sedge layer. None of the damp or swampy areas within the subject land are classed as PCT 1803.

**Table 4 PCTs identified within the subject land**

| PCT ID | PCT name | Subject land area (ha) |
|---|---|---|
| 1250 | *Coastal Sandstone Gully Forest* | 16.2 ha |
| 1783 | *Sydney North exposed sandstone woodland* | 17.5 ha |
| 1824 | *Coastal Sandstone Heath-Mallee* | 11.0 ha |
| | **Total area** | 44.7 ha |

### 4.2.2 PCT 1250: *Coastal Sandstone Gully Forest*

#### *4.2.2.1 PCT overview*

**Table 5 PCT 1250**

| | |
|---|---|
| **PCT ID** | 1250 |
| **PCT name** | *Coastal Sandstone Gully Forest* |
| **Vegetation formation** | Dry Sclerophyll Forests (Shrubby sub-formation) |
| **Vegetation class** | Sydney Coastal Dry Sclerophyll Forests |
| **Per cent cleared value (%)** | 30 % |
| **Extent within subject land (ha)** | 16.2 ha |

PCT 1250 within the subject land is characterised as a mature, occasionally tall, dry sclerophyll forest with a dense shrubby understorey containing mesic elements in wetter areas and in gullies.

The canopy is typically dominated by Sydney Peppermint *Eucalyptus piperita*, Smooth-barked Apple *Angophora costata*, Silvertop Ash *Eucalyptus sieberi*, and Red Bloodwood *Corymbia gummifera*. There is a tall mid-canopy of Old Man Banksia *Bankisa serrata*, and Black She-oak *Allocasuarina littoralis* in more elevated areas, with Christmas Bush *Ceratopetalum gummiferum*, Black Wattle *Callicoma serratifolia*, and Flaky-barked Tea-tree *Leptospermum trinervium* in lower lying areas and along gullies.

The shrub layer is typically dominated by Sweet Wattle *Acacia suaveolens*, *Platysace linearifolia*, Heath Banksia *Banksia ericifolia*, Tick Bush *Kunzea ambigua*, Sydney Boronia *Boronia ledifolia*, Mountain Devil *Lambertia formosa*, and Narrow-leaved Mint Bush *Prostanthera linearis*.

The ground layer typically contains Bracken *Pteridium esculentum*, Wiry Panic *Entolasia stricta*, Mat-rush *Lomandra longifolia*, *Caustis flexuosa*, Saw-sedge *Gahnia sieberiana*, Thatch Saw-sedge *Gahnia radula*, Pouched Coral Fern *Gleichenia dicarpa*, Common Rapier-sedge *Lepidosperma filiforme*, Spear-grass *Austrostipa pubescens* and *Sticherus flabellatus.*

#### *4.2.2.2 Condition states*

All areas of PCT 1250 are classed as a single condition state – Intact Forest.

**Photo 1 PCT 1250, Intact Forest – BAM-VIS Plot 4**

#### *4.2.2.3 Justification of PCT selection*

PCT options were initially selected using the *Bionet Vegetation Classification* tool, on the basis of IBRA subregion, dominant tree species and vegetation class.

The Bionet profiles of PCTs with a high match rate were compared against site data, with final PCT determination influenced by:

* floristic match in understorey and groundcover strata;
* the existing regional PCT map (Sydney Metro Area v3.1);

* accuracy and preciseness of landscape position;
* vegetation structure.

Key decision points used to distinguish PCT 1250 from adjacent PCTs within the subject property relate to presence of *Eucalyptus piperita, Angophora costata* and *Eucalyptus sieberi* in the canopy, and presence of mesic understorey species and ferns.

#### *4.2.2.4 Alignment with TECs*

PCT 1250 is not aligned with any TEC (Bionet Vegetation Classification).

#### *4.2.2.5 Alignment with EPBC Act listed ECs*

PCT 1250 is not aligned with any EPBC Act listed EC (Bionet Vegetation Classification).

### 4.2.3 PCT 1783: *Sydney North exposed sandstone woodland*

#### *4.2.3.1 PCT overview*

**Table 6 PCT 1783**

| | |
|---|---|
| **PCT ID** | 1783 |
| **PCT name** | *Sydney North exposed sandstone woodland* |
| **Vegetation formation** | Dry Sclerophyll Forests (Shrubby sub-formation) |
| **Vegetation class** | Sydney Coastal Dry Sclerophyll Forests |
| **Per cent cleared value (%)** | 30 % |
| **Extent within subject land (ha)** | 17.5 ha |

PCT 1783 within the subject land is characterised as a dry sclerophyll woodland associated with sandstone outcrops, with reduced canopy height and diverse shrub and ground layers.

The canopy is typically dominated by Scribbly Gum *Eucalyptus haemastoma*, Red Bloodwood *Corymbia gummifera*, *Angophora crassifolia*, and Old Man Banksia *Banksia serrata*.

The shrub layer typically contains Sydney Boronia *Boronia ledifolia*, Pale Pink Boronia *Boronia floribunda*, Hairpin Banksia *Banksia spinulosa,* Heath Banksia *Banksia ericifolia*, Sweet Wattle *Acacia suaveolens*, Mountain Devil *Lambertia formosa*, Flaky-barked Tea-tree *Leptospermum trinervium*, Scrub She-oak *Allocasuarina distyla*, Large Wedge-Pea *Gompholobium grandiflorum*, Finger Hakea *Hakea dactyloides*, Carrot Tops *Platysace linearifolia*, and Saw-sedge *Gahnia sieberiana*.

The ground layer typically contains Wiry Panic *Entolasia stricta, Cyathochaeta diandra,* Spear-grass *Austrostipa pubescens, Lepyrodia scariosa,* Forest Raspwort *Gonocarpus teucrioides, Anisopogon avenaceu*s, and Grass Tree *Xanthorrhoea media*.

#### *4.2.3.2 Condition states*

All areas of PCT 1783 are classed as a single condition state – Intact Woodland.

**Photo 2 PCT 1783, Intact Woodland – BAM-VIS Plot 3**

#### *4.2.3.3 Justification of PCT selection*

PCT options were initially selected using the *Bionet Vegetation Classification* tool, on the basis of IBRA subregion, dominant tree species and vegetation class.

The Bionet profiles of PCTs with a high match rate were compared against site data, with final PCT determination influenced by:

* floristic match in understorey and groundcover strata;
* the existing regional PCT map (Sydney Metro Area v3.1);
* accuracy and preciseness of landscape position;
* vegetation structure.

Key decision points used to distinguish PCT 1783 from adjacent PCTs within the subject property relate to the presence and usual co-dominance of *Eucalyptus haemastoma, Corymbia gummifera* and *Banksia serrata* in the canopy, and presence of a diverse sclerophyllous shrub layer.

#### *4.2.3.4 Alignment with TECs*

PCT 1783 is not aligned with any TEC (Bionet Vegetation Classification).

#### *4.2.3.5 Alignment with EPBC Act listed ECs*

PCT 1783 is not aligned with any EPBC Act listed EC (Bionet Vegetation Classification).

### 4.2.4 PCT 1824: *Coastal Sandstone Heath-Mallee*

#### *4.2.4.1 PCT overview*

**Table 7 PCT 1824**

| | |
|---|---|
| **PCT ID** | 1824 |
| **PCT name** | *Coastal Sandstone Heath-Mallee* |
| **Vegetation formation** | Heathlands |
| **Vegetation class** | Sydney Coastal Heaths |
| **Per cent cleared value (%)** | 10 % |
| **Extent within subject land (ha)** | 11.0 ha |

PCT 1824 within the subject land varies from heath to low woodland. To the west of Morgan Road, the is typically a heath with scattered eucalypts (often in mallee form) and patches of native shrubs in pockets amongst rock platforms. To the east of Morgan Road, the vegetation is typically an open low woodland (with eucalypts often in mallee form) with a dense heathy understorey.

The canopy is typically sparse and dominated by Dwarf Apple *Angophora hispida*, *Angophora crassifolia*, Old Man Banksia *Banksia serrata*, and Scribbly Gum *Eucalyptus haemastoma*.

The shrub layer is diverse and typically contains Heath Banksia *Banksia ericifolia*, Scrub She-oak *Allocasuarina distyla*, Spidery Tea-tree *Leptospermum arachnoides*, Flaky-barked Tea-tree *Leptospermum trinervium*, Red Spider Flower *Grevillea speciosa*, Needle Bush *Hakea propinqua*, *Phyllota philicoides*, Grey Spider Flower *Grevillea buxifolia* ssp *buxifolia*, and Handsome Bush-pea *Pultenaea stipularis*.

The ground layer is variable depending on presence of rock platforms and density of shrub layer. Typical species include *Anisopogon avenaceus*, *Schoenus ericetorum*, Grass Tree *Xanthorrhoea media*, *Cyathochaeta diandra* and *Lepyrodia scariosa*.

#### 4.2.4.2 Condition states

All areas of PCT 1824 are classed as a single condition state – Intact Heath.

**Photo 3 PCT 1824, Intact Heath – BAM-VIS Plot 5**

#### 4.2.4.3 Justification of PCT selection

PCT options were initially selected using the *Bionet Vegetation Classification* tool, on the basis of IBRA subregion, dominant tree species and vegetation class.

The Bionet profiles of PCTs with a high match rate were compared against site data, with final PCT determination influenced by:

* floristic match in understorey and groundcover strata;
* the existing regional PCT map (Sydney Metro Area v3.1);
* accuracy and preciseness of landscape position;
* vegetation structure.

Key decision points used to distinguish PCT 1824 from adjacent PCTs within the subject property relate to sparsity of tree canopy, presence of *Angophora hispida* and other mallee-forming species such as *Angophora crassifolia*, presence of *Allocasuarina distyla* and *Leptospermum squarrosum*, dominance of *Banksia ericifolia*, and presence of a diverse range of Proteaceae.

#### 4.2.4.4 Alignment with TECs

PCT 1824 is not aligned with any TEC (Bionet Vegetation Classification).

#### 4.2.4.5 Alignment with EPBC Act listed ECs

PCT 1824 is not aligned with any EPBC Act listed EC (Bionet Vegetation Classification).

## 4.3 Threatened ecological communities

No threatened ecological communities are present on the subject land.

Consideration was given to two TECs with potential to occur on the subject land, based on previous survey or mapping:

1) *Duffys Forest in the Sydney Basin Bioregion* EEC

   Previous botanical survey of the subject property (Travers Bushfire & Ecology, *pers comm*) identified two areas of vegetation that could be *Duffys Forest Ecological Community in the Sydney Basin*. This community is listed as 'endangered' under the BC Act.

   A detailed and comprehensive review of information relevant to the identification and mapping of Duffys Forest EEC was carried out. Primary sources relied upon for this assessment were the Final Determinations to list the community prepared by the NSW Scientific Committee (2002 & 2011), and a report documenting *Survey of the Duffys Forest Vegetation Community* prepared for NSW NP&WS and Warringah Council by Smith & Smith (2000).

   The Smith & Smith (2000) report is referenced in the Final Determination and contains a diagnostic species test for the community. This test was applied to three test plots within the subject land. Refer to Appendix C (Vegetation survey data).

   The subject property is within the study area boundaries for the Smith & Smith (2000) report. No part of the subject property was mapped as Duffys Forest ecological community. Researchers would have driven past or through the subject property to reach one of the areas mapped as Duffys Forest EEC within the report.

   Current regional vegetation maps (Sydney Metro Area, 2016; & SVTM_NSW_Extent_PCT, 2022) do not map any part of the subject property as a PCT associated with Duffys Forest EEC.

   On the basis of BAM-VIS plots conducted within these two areas (BAM-VIS plots 1 and 2), a third plot (BAM-VIS plot 3) located in an additional area that appeared suitable for Duffys Forest EEC, and a comprehensive desktop review of relevant information and mapping, it was concluded that no part of the subject property contains Duffys Forest EEC. The full discussion and reasoning is provided in Appendix C.

2) *Coastal Upland Swamp in the Sydney Basin Bioregion* CEEC

   While PCT 1803 does not occur within the subject land, it is associated with a threatened ecological community '*Coastal Upland Swamp in the Sydney Basin Bioregion*' that encompasses

a broader range of vegetation types, although still typically treeless. Consideration was given to the Final Determination of the NSW Scientific Committee to list this community. Of relevance, the determination states that: "*Smaller swamps are more typically characterised by open graminoid heaths and/or sedgelands, but may include tall scrubs*"; and "*Trees are typically absent from the community, but may be present as scattered individuals or clumps of mallee or arborescent eucalypts*".

On the basis that all hanging swamp habitats found within the subject land are very small (too small to be discernible on aerial photography or shown on the PCT map scale), all support a continuous canopy of Eucalypt and related species consistent with surrounding PCTs, the understorey contains a complex of wet sclerophyll/rainforest shrubs consistent with surrounding PCTs, rather than sedges, and not consistent with the list of characteristic species for Coastal Upland Swamp contained in the Final Determination, it was concluded that damp and hanging swamp habitats within the subject land support variants of the mapped PCTs, and do not form part of the listed endangered ecological community.

## 4.4 Vegetation zones

All vegetation across the subject land has been broadly classed as being in good or intact condition, such that vegetation zones correspond to the three plant community types without further division:

* PCT 1250: good condition
* PCT 1783: good condition
* PCT 1824: good condition

All vegetation zones are part of the same vegetation patch.

Patch size was identified using aerial images (Google 2022, and Nearmap, various dates up to 18th May 2022).

Refer to Table 5 (Vegetation zones and patch sizes). Refer to Figure 7 (Development Footprint and Vegetation Zones).

**Table 8 Vegetation zones and patch sizes**

| Vegetation zone ID | PCT ID number and name | Condition / other defining feature | Area (ha) | Patch size class (select multiple if areas of native vegetation are discontinuous) | No. vegetation integrity plots required | No. vegetation integrity plots completed | No. vegetation integrity plots used in assessment | Plot IDs of vegetation integrity plots used in assessment |
|---|---|---|---|---|---|---|---|---|
| 1250 | 1250: *Coastal Sandstone Gully Forest* | Intact Forest | 16.2 | ☐ <5 ha<br>☐ 5–24 ha<br>☐ 25–100 ha<br>☒ >100 ha | 3 | 2 | 2 | BAM-VIS Plot 1<br>BAM-VIS Plot 4 |
| 1783 | 1783: *Sydney North exposed sandstone woodland* | Intact Woodland | 17.5 | ☐ <5 ha<br>☐ 5–24 ha<br>☐ 25–100 ha<br>☒ >100 ha | 3 | 2 | 2 | BAM-VIS Plot 2<br>BAM-VIS Plot 3 |
| 1824 | 1824: *Coastal Sandstone Heath-Mallee* | Intact Heath or Mallee | 11.0 | ☐ <5 ha<br>☐ 5–24 ha<br>☐ 25–100 ha<br>☒ >100 ha | 3 | 2 | 2 | BAM-VIS Plot 5<br>BAM-VIS Plot 6 |

## 4.5 Vegetation integrity (vegetation condition)

### 4.5.1 Vegetation integrity survey plots

Two plots per zone have been sampled, which does not yet meet the requirements of BAM Table 3. An additional three plot surveys (one per zone) will be required for the purpose of finalising an off-set calculation for development of the land.

However, due to the reasonably uniform character and condition of each vegetation zone across the subject land, the plot data obtained is believed sufficient for the purpose of assessing the merits of the draft Structure Plan for the Planning Proposal.

### 4.5.2 Scores

**Table 9 Vegetation integrity scores**

| Vegetation zone ID | Composition condition score | Structure condition score | Function condition score (where relevant) | Vegetation integrity score | Hollow bearing trees present? |
|---|---|---|---|---|---|
| 1250 | 98.3 | 24.9 | 70.5 | 55.7 | Yes |
| 1783 | 88.6 | 21.8 | 62.4 | 49.4 | Yes |
| 1824 | 99.1 | 33.0 | 78.0 | 63.4 | Yes |

### 4.5.3 Use of benchmark data

Standard condition benchmarks within the BAM-Calculator were used to assess the vegetation integrity attributes of each vegetation zone.

# 5. Habitat suitability for threatened species

## 5.1 Identification of threatened species for assessment

### 5.1.1 Ecosystem credit species

**Table 10 Predicted ecosystem credit species**

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Regent Honeyeater | *Anthochaera phrygia* | CE | CE | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |
| Dusky Woodswallow | *Artamus cyanopterus cyanopterus* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | Moderate |
| Gang Gang Cockatoo (foraging) | *Callocephalon fimbriatum* | V | E | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | Moderate |
| Glossy Black Cockatoo (foraging) | *Calyptorhynchus lathami* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☒ Current survey | Yes | n/a | 1250, 1783, 1824 | High |

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Spotted Harrier | *Circus assimilis* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1824 | Moderate |
| Varied Sittella | *Daphoenositta chrysoptera* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | Moderate |
| Spotted-tailed Quoll | *Dasyurus maculatus* | V | E | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |
| Eastern False Pipistrelle | *Falsistrellus tasmaniensis* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1250 | High |
| Little Lorikeet | *Glossopsitta pusilla* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |

Proposed zoning of deferred lands, Patyegarang Project.

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| White-bellied Sea-Eagle (foraging) | *Hieraaetus morphnoides* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | 2 – habitat constraints | 1250, 1783, 1824 | High |
| Little Eagle (foraging) | *Hieraaetus morphnoides* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | Moderate |
| White-throated Needletail | *Hirundapus caudacutus* | - | V | No | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |
| Broad-headed Snake (foraging) | *Hoplocephalus bungaroides* | E | V | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |
| Black Bittern | *Ixobrychus flavicollis* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1250 | Moderate |
| Swift Parrot (foraging) | *Lathamus discolor* | E | CE | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | Moderate |

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Square-tailed Kite (foraging) | *Lophoictinia isura* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☒ Current survey | Yes | n/a | 1250, 1783, 1824 | Moderate |
| Black-chinned Honeyeater | *Melithreptus gularis gularis* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1783 | Moderate |
| Eastern Coastal Free-tailed Bat | *Micronomus norfolkensis* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |
| Little Bent-wing Bat (foraging) | *Miniopterus australis* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☒ Current survey | Yes | n/a | 1250, 1783, 1824 | High |
| Large Bent-wing Bat (foraging) | *Miniopterus orianae oceanensis* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |
| Turquoise Parrot | *Neophema pulchella* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Barking Owl (foraging) | *Ninox connivens* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1250, 1783 | High |
| Powerful Owl (foraging) | *Ninox strenua* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☒ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1250, 1783 | High |
| Eastern Osprey (foraging) | *Pandion cristatus* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1250, 1783 | Moderate |
| Yellow-bellied Glider | *Petaurus australis* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1250 | High |
| Scarlet Robin | *Petroica boodang* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey | Yes | n/a | 1250, 1783, 1824 | Moderate |

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| | | | | | ☐ Current survey | | | | |
| Flame Robin | *Petroica phoenicea* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1250, 1824 | Moderate |
| Golden-tipped Bat | *Phoniscus papuensis* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1250 | High |
| New Holland Mouse | *Pseudomys novaehollandiae* | - | V | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |
| Grey-headed Flying-fox (foraging) | *Pteropus poliocephalus* | V | V | Yes | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | | |
| Yellow-bellied Sheath-tail Bat | *Saccolaimus flaviventris* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1250 | High |
| Greater Broad-nosed Bat | *Scoteanax rueppellii* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1250, 1824 | High |
| Masked Owl (foraging) | *Tyto novaehollandiae* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |
| Sooty Owl (foraging) | *Tyto tenebricosa* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☐ Current survey | Partial (when a species is retained within one vegetation zone but not another) | n/a | 1250 | High |
| Rosenberg's Goanna | *Varanus rosenbergi* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 | High |

The White-bellied Sea-Eagle has been removed from the list on the basis of habitat constraint – the subject land is not within 1km of a river, lake, large dam or creek, wetland or coastline.

The Sooty Owl has been added to the list on the basis of known records nearby (associated with rainforests of Middle Creek and the lower sections of Snake Creek), and discussion with Mr Brendan Smith (Senior Environment Officer, Northern Beaches Council).

The following species have been retained within some but not all vegetation zones within the subject land (as specified in Table 7 above), on the basis of PCT associations set within Bionet - Vegetation Classification:

- Spotted Harrier
- Eastern False Pipistrelle
- Black Bittern
- Black-chinned Honeyeater
- Barking Owl
- Powerful Owl
- Eastern Osprey
- Yellow-bellied Glider
- Flame Robin
- Golden-tipped Bat
- Yellow-bellied Sheath-tail Bat
- Greater Broad-nosed Bat

### 5.1.2 Species credit species

**Table 11 Predicted flora species credit species**

| Common name | Scientific name | Listing status | | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| Bynoe's Wattle | *Acacia bynoeana* | E | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey | Yes | n/a | 1250 |

| Common name | Scientific name | Listing status | | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| | | | | ☐ Current survey | | | |
| *Acacia prominens* - endangered population | *Acacia prominens* | E2 | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 1 - Geographic limitations<br>(not within an LGA listed in the Determination) | n/a |
| Sunshine Wattle | *Acacia terminalis* | E | E | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1824 |
| Nielsen Park She-oak | *Allocasuarina portuensis* | E | E | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 1 - Geographic limitations<br>(not within 5km of Sydney Harbour foreshore) | n/a |
| *Asterolasia elegans* | *Asterolasia elegans* | E | E | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| Thick-leaf Star-hair | *Astrotricha crassifolia* | V | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783 |

| Common name | Scientific name | Listing status | | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| Thick Lip Spider Orchid | *Caladenia tessellata* | E | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1824 |
| Netted Bottlebrush | *Callistemon linearifolius* | V | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |
| *Camarophyllopsis kearneyi* | *Camarophyllopsis kearneyi* | E | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | V | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1783 |
| *Darwinia biflora* | *Darwinia biflora* | V | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1824 |
| *Darwinia glaucophylla* | *Darwinia glaucophylla* | V | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1783, 1824 |

| Common name | Scientific name | Listing status | | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| *Darwinia peduncularis* | *Darwinia peduncularis* | V | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783 |
| *Deyeuxia appressa* | *Deyeuxia appressa* | E | E | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | Extinct – see below | n/a |
| *Diuris bracteata* | *Diuris bracteata* | E | X | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | Extinct – see below | n/a |
| Camfield's Stringybark | *Eucalyptus camfieldii* | V | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| Bauer's Midge Orchid | *Genoplesium baueri* | E | E | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1824 |
| Tallong Midge Orchid | *Genoplesium plumosum* | CE | E | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1824. |

| Common name | Scientific name | Listing status | | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| Narrow-leaf Finger Fern | *Grammitis stenophylla* | E | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| *Grevillea shiressii* | *Grevillea shiressii* | V | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 1 - Geographic limitations<br>(not within Central Coast LGA) | n/a |
| *Haloragodendron lucasii* | *Haloragodendron lucasii* | E | E | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| Spreading Guinea Flower | *Hibbertia procumbens* | E | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 1 - Geographic limitations<br>(not within Central Coast LGA) | n/a |
| *Hibbertia puberula* | *Hibbertia puberula* | E | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783 |
| *Hibbertia spanantha* | *Hibbertia spanantha* | CE | CE | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |

| Common name | Scientific name | Listing status | | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| *Hygrocybe anomala* var *ianthinomarginata* | *Hygrocybe anomala* var *ianthinomarginata* | V | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| *Hygrocybe aurantipes* | *Hygrocybe aurantipes* | V | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| *Hygrocybe austropratensis* | *Hygrocybe austropratensis* | E | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| *Hygrocybe collucera* | *Hygrocybe collucera* | E | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| *Hygrocybe griseoramosa* | *Hygrocybe griseoramosa* | E | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| *Hygrocybe lanecovensis* | *Hygrocybe lanecovensis* | E | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |

| Common name | Scientific name | Listing status | | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| *Hygrocybe reesiae* | *Hygrocybe reesiae* | V | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| *Hygrocybe rubronivea* | *Hygrocybe rubronivea* | V | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| *Kunzea rupestris* | *Kunzea rupestris* | V | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1824 |
| *Lasiopetalum joyceae* | *Lasiopetalum joyceae* | V | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1783, 1824 |
| *Leptospermum deanei* | *Leptospermum deanei* | V | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| *Melaleuca deanei* | *Melaleuca deanei* | V | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |

| Common name | Scientific name | Listing status | | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| *Melaleuca groveana* | *Melaleuca groveana* | V | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1783 |
| *Micromyrtus blakelyi* | *Micromyrtus blakelyi* | V | V | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1824 |
| Hairy Geebung | *Persoonia hirsuta* | E | E | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1824 |
| *Persoonia mollis ssp maxima* | *Persoonia mollis ssp maxima* | E | E | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| Somersby Mintbush | *Prostanthera junonis* | E | E | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1824 |
| *Tetratheca glandulosa* | *Tetratheca glandulosa* | V | - | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☒ Current survey | Yes | n/a | 1250, 1783, 1824 |

| Common name | Scientific name | Listing status | | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | |
| *Wahlenbergia multicaulis* – endangered population | *Wahlenbergia multicaulis* | E2 | - | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 1 - Geographic limitations<br>(not within an LGA listed in the Determination) | n/a |

*Predicted flora species added to assessment:*

None.

*Predicted flora species excluded from assessment:*

Applicable vegetation zones for each species have been assigned on the basis of associations listed in the Bionet vegetation classification, as at 2nd October 2022.

The terrestrial orchid *Diuris bracteata* has been removed from the list on the basis of the following:

i. For over 100 years *Diuris bracteata* was known only from the original collection made near Gladesville in northern Sydney.

ii. This species is known only from the illustration of it in Fitzgerald R (1891) Austral. Orch. 2(4): 26. Specimens identified as D. bracteata were all misidentified. Those from Duffys Forest, Mt White and Kulnura are misidentified plants of Diuris platichila. Rupp's specimen from Buladelah is D. aurea. The specimens from the Northern Tablelands are D. abbreviata. Following the latest taxonomy, this species is thought to be extinct or at least there are no known extant plants or populations). Information obtained from the TBDC.

iii. The species is considered to be extinct, though the listing under the *BC Act* does not yet reflect this status.

iv. This species is not known from site and there are no records within 5km of the site (Bionet sightings).

v. Of lesser consideration, this species is described as occurring in dry sclerophyll woodland and forest with a predominantly grassy understorey, yet the subject land is shrubby/heathy rather than grassy. Other species preferring a grassy understorey have not been found during targeted surveys.

The perennial grass *Deyeuxia appressa* has been removed from the list on the basis of the following:

i. It is known only from two pre-1942 records in the Sydney area - 1930 at Herne Bay, Saltpan Creek, off the Georges River, south of Bankstown, and 1941 from Killara, near Hornsby. It has not been collected since and may now be extinct.

ii. It is not predicted to occur within the IBRA Pittwater subregion.

iii. This species is not known from the site and there are no records within 5km of the site (Bionet sightings).

The following species have been excluded from further assessment on the basis of geographic limitations (with specific details provided in Table 8 above):

- *Acacia prominens* – endangered population
- *Allocasuarina portuensis*
- *Grevillea shiressii*
- *Hibbertia procumbens*
- *Wahlenbergia multicaulis* – endangered population

**Table 12 Predicted fauna species credit species**

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | |
| Regent Honeyeater (Breeding) | *Anthochaera phrygia* | CE | CE | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 2 - Habitat constraints<br>(subject land is not part of the mapped area) | n/a |
| Gang Gang Cockatoo (Breeding) | *Callocephalon fimbriatum* | V | E | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |
| Gang Gang Cockatoo (endangered population) | *Callocephalon fimbriatum* | E2 | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 1 - Geographic limitations<br>(not within an LGA listed in the Determination) | n/a |
| Glossy Black Cockatoo (Breeding) | *Calyptorhynchus lathami* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |
| Eastern Pygmy-possum | *Cercartetus nanus* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☒ Current survey | Yes | n/a | 1250, 1783, 1824 |
| Large-eared Pied Bat | *Chalinolobus dwyeri* | V | V | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey | Yes | n/a | 1250, 1783, 1824 |

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | |
| | | | | | ☐ Current survey | | | |
| White-bellied Sea-Eagle (Breeding) | *Haliaeetus leucogaster* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 2 - Habitat constraints<br>(further detail provided below this table) | n/a |
| Giant Burrowing Frog | *Heleioporus australiacus* | V | V | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |
| Little Eagle (Breeding) | *Hieraaetus morphnoides* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |
| Broad-headed Snake (Breeding) | *Hoplocephalus bungaroides* | E | V | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |
| Southern Brown Bandicoot | *Isoodon obesulus obesulus* | E | E | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | |
| Swift Parrot (Breeding) | *Lathamus discolor* | E | CE | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 2 - Habitat constraints<br>(subject land is not part of the mapped area) | n/a |
| Green & Golden Bell Frog | *Litoria aurea* | E | V | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1824 |
| Square-tailed Kite (Breeding) | *Lophoictinia isura* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |
| Maroubra Woodland Snail | *Meridolum maryae* | E | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1824 |
| Little Bent-winged Bat (Breeding) | *Miniopterus australis* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☒ Current survey | Yes | n/a | 1250, 1783, 1824 |
| Large Bent-winged Bat (breeding) | *Miniopterus orianae oceanensis* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | |
| Southern Myotis | *Myotis macropus* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783 |
| Barking Owl (Breeding) | *Ninox connivens* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783 |
| Powerful Owl (Breeding) | *Ninox strenua* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783 |
| Eastern Osprey (Breeding) | *Pandion cristatus* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 2 - Habitat constraints<br>(further detail provided below this table) | n/a |
| Long-nosed Bandicoot – endangered population | *Perameles nasuta* | E2 | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 1 – Geographic limitations<br>(subject land is not south of Addison Road, Manly) | n/a |
| Greater Glider | *Petauroides volans* | - | V | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | |
| Squirrel Glider | *Petaurus norfolcensis* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |
| Squirrel Glider – endangered population | *Petaurus norfolcensis* | E2 | - | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 1 – Geographic limitations (subject land is not on the Barrenjoey Peninsula) | n/a |
| Koala | *Phascolarctos cinereus* | E | E | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |
| Dural Land Snail | *Pommerhelix duralensis* | E | E | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 3 - species is vagrant (not known) to the locality | n/a |
| Long-nosed Potoroo | *Potorous tridactylus* | V | V | No | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |
| Red-crowned Toadlet | *Pseudophryne australis* | V | - | No | ☒ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☒ Current survey | Yes | n/a | 1250, 1783, 1824 |

| Common name | Scientific name | Listing status | | Dual credit species | Sources | Species retained for further assessment? | Reason for exclusion from further assessment | Vegetation zone ID species retained within, including PCT ID |
|---|---|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | | | |
| Grey-headed Flying-fox (Breeding) | *Pteropus poliocephalus* | V | V | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | No | 2 - Habitat constraints<br>(further detail provided below this table) | n/a |
| Masked Owl (Breeding) | *Tyto novaehollandiae* | V | - | Yes | ☒ BAM-C<br>☐ TBDC<br>☐ Previous survey<br>☐ Current survey | Yes | n/a | 1250, 1783, 1824 |
| Sooty Owl (Breeding) | *Tyto tenebricosa* | V | - | Yes | ☐ BAM-C<br>☐ TBDC<br>☒ Previous survey<br>☐ Current survey | Yes | n/a | 1250 |

*Predicted fauna species added to assessment:*

The Sooty Owl has been added to the list on the basis of known records nearby (associated with rainforests of Middle Creek and the lower sections of Snake Creek), and discussion with Mr Brendan Smith (Senior Environment Officer, Northern Beaches Council).

*Predicted fauna species excluded from assessment:*

Applicable vegetation zones for each species have been assigned on the basis of associations listed in the Bionet vegetation classification, as at 2nd October 2022.

The following endangered populations have been excluded from further assessment on the basis of geographic limitations (with details specified in Table 8 above):

- Gang Gang Cockatoo – endangered population

- Long-nosed Bandicoot – endangered population
- Squirrel Glider – endangered population

The following threatened species have been excluded from further assessment on the basis of habitat constraints:

- Regent Honeyeater (Breeding): subject land is not part of the mapped area for this species.
- White-bellied Sea-Eagle (Breeding): subject land is not within 1km of a river, lake, large dam or creek, wetland or coastline.
- Swift Parrot (Breeding): subject land is not part of the mapped area for this species.
- Eastern Osprey (Breeding): subject land is not within 100m of a floodplain.
- Grey-headed Flying-fox (Breeding): no camps are known to occur within the subject land.

The following species have been excluded from further assessment on the basis of vagrancy (as set out below):

- Dural Land Snail: species is not known or likely to occur in the Northern Beaches LGA – see below discussion from the TBDC:

  *"The species is a shale-influenced-habitat specialist, which occurs in low densities along the western and northwest fringes of the Cumberland IBRA subregion on shale-sandstone transitional landscapes.*

  *There is currently a degree of uncertainty about the distribution and identity of the snails in this and related species. Pommerhelix duralensis in the strict sense is found in an area of north-western Sydney between Rouse Hill - Cattai and Wiseman's Ferry, west from Berowra Creek. In the northern side of Sydney, between Parramatta and Port Jackson and east of Berowra Creek is identified as Meridolum middenense.*

  *The species is definitely found within the Local Government Areas of The Hills Shire, Hawkesbury Shire and Hornsby Shire. Records from the Blue Mountains City, Penrith City and Parramatta City may represent this species. Occurrence in Wollondilly Shire is considered unlikely in light of current knowledge."*

## 5.2 Presence of candidate species credit species

Candidate flora species requiring further assessment are listed in Table 10.

**Table 13 Determining the presence of candidate flora species credit species on the subject land**

| Common name | Scientific name | Listing status | | Method used to determine presence * | Present? | Further assessment required? (BAM Subsections 5.2.5 and 5.2.6) |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Bynoe's Wattle | *Acacia bynoeana* | E | V | Targeted threatened species survey | No | No |
| Sunshine Wattle | *Acacia terminalis* | E | E | Targeted threatened species survey | No | No |
| *Asterolasia elegans* | *Asterolasia elegans* | E | E | Targeted threatened species survey | No | No |
| Thick-leaf Star-hair | *Astrotricha crassifolia* | V | V | Targeted threatened species survey | No | No |
| Thick Lip Spider Orchid | *Caladenia tessellata* | E | V | Targeted threatened species survey | No | No |
| Netted Bottlebrush | *Callistemon linearifolius* | V | - | Targeted threatened species survey | No | No |
| *Camarophyllopsis kearneyi* | *Camarophyllopsis kearneyi* | E | - | Targeted threatened species survey | No | No |
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | V | V | Assumed present | Assumed present | Yes |
| *Darwinia biflora* | *Darwinia biflora* | V | V | Targeted threatened species survey | No | No |
| *Darwinia glaucophylla* | *Darwinia glaucophylla* | V | - | Targeted threatened species survey | No | No |

| Common name | Scientific name | Listing status | | Method used to determine presence * | Present? | Further assessment required? (BAM Subsections 5.2.5 and 5.2.6) |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| *Darwinia peduncularis* | *Darwinia peduncularis* | V | - | Targeted threatened species survey | No | No |
| Camfield's Stringybark | *Eucalyptus camfieldii* | V | V | Targeted threatened species survey | No | No |
| Bauer's Midge Orchid | *Genoplesium baueri* | E | E | Targeted threatened species survey | No | No |
| Tallong Midge Orchid | *Genoplesium plumosum* | CE | E | Targeted threatened species survey | No | No |
| Narrow-leaf Finger Fern | *Grammitis stenophylla* | E | - | Targeted threatened species survey | No | No |
| *Haloragodendron lucasii* | *Haloragodendron lucasii* | E | E | Targeted threatened species survey | No | No |
| *Hibbertia puberula* | *Hibbertia puberula* | E | - | Targeted threatened species survey | No | No |
| *Hibbertia spanantha* | *Hibbertia spanantha* | CE | CE | Targeted threatened species survey | No | No |
| *Hygrocybe anomala* var *ianthinomarginata* | *Hygrocybe anomala* var *ianthinomarginata* | V | - | Targeted threatened species survey | No | No |
| *Hygrocybe aurantipes* | *Hygrocybe aurantipes* | V | - | Targeted threatened species survey | No | No |
| *Hygrocybe austropratensis* | *Hygrocybe austropratensis* | E | - | Targeted threatened species survey | No | No |

| Common name | Scientific name | Listing status | | Method used to determine presence * | Present? | Further assessment required? (BAM Subsections 5.2.5 and 5.2.6) |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| *Hygrocybe collucera* | *Hygrocybe collucera* | E | - | Targeted threatened species survey | No | No |
| *Hygrocybe griseoramosa* | *Hygrocybe griseoramosa* | E | - | Targeted threatened species survey | No | No |
| *Hygrocybe lanecovensis* | *Hygrocybe lanecovensis* | E | - | Targeted threatened species survey | No | No |
| *Hygrocybe reesiae* | *Hygrocybe reesiae* | V | - | Targeted threatened species survey | No | No |
| *Hygrocybe rubronivea* | *Hygrocybe rubronivea* | V | - | Targeted threatened species survey | No | No |
| *Kunzea rupestris* | *Kunzea rupestris* | V | V | Targeted threatened species survey | No | No |
| *Lasiopetalum joyceae* | *Lasiopetalum joyceae* | V | V | Targeted threatened species survey | No | No |
| *Leptospermum deanei* | *Leptospermum deanei* | V | V | Targeted threatened species survey | No | No |
| *Melaleuca deanei* | *Melaleuca deanei* | V | V | Targeted threatened species survey | No | No |
| *Melaleuca groveana* | *Melaleuca groveana* | V | - | Targeted threatened species survey | No | No |
| *Micromyrtus blakelyi* | *Micromyrtus blakelyi* | V | V | Targeted threatened species survey | No | No |

| Common name | Scientific name | Listing status | | Method used to determine presence * | Present? | Further assessment required? (BAM Subsections 5.2.5 and 5.2.6) |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Hairy Geebung | *Persoonia hirsuta* | E | E | Targeted threatened species survey | No | No |
| *Persoonia mollis ssp maxima* | *Persoonia mollis ssp maxima* | E | E | Targeted threatened species survey | No | No |
| Somersby Mintbush | *Prostanthera junonis* | E | E | Targeted threatened species survey | No | No |
| *Tetratheca glandulosa* | *Tetratheca glandulosa* | V | - | Targeted threatened species survey | Yes | Yes |

* *The author notes that targeted threatened species survey effort and timing does not meet BAM requirements for all candidate flora species. Table 10 reflects the intent for sufficient surveys to be conducted prior to lodgement of a development application and final calculation of offset liability, together with the expected outcome of the surveys based on current knowledge. Where there is substantial uncertainty, species have been assumed present.*

**Table 14 Determining the presence of candidate fauna species credit species on the subject land**

| Common name | Scientific name | Listing status | | Method used to determine presence | Present ? | Further assessment required? (BAM Subsections 5.2.5 and 5.2.6) |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Gang Gang Cockatoo (Breeding) | *Callocephalon fimbriatum* | V, E2 | E | Targeted threatened species survey | No | No |
| Glossy Black Cockatoo (Breeding) | *Calyptorhynchus lathami* | V | - | Targeted threatened species survey | No | No |
| Eastern Pygmy-possum | *Cercartetus nanus* | V | - | Targeted threatened species survey | Yes | Yes |
| Large-eared Pied Bat | *Chalinolobus dwyeri* | V | V | Targeted threatened species survey | No | No |
| Giant Burrowing Frog | *Heleioporus australiacus* | V | V | Targeted threatened species survey | No | No |
| Little Eagle (Breeding) | *Hieraaetus morphnoides* | V | - | Targeted threatened species survey | No | No |
| Broad-headed Snake (Breeding) | *Hoplocephalus bungaroides* | E | V | Targeted threatened species survey | No | No |
| Southern Brown Bandicoot | *Isoodon obesulus obesulus* | E | E | Targeted threatened species survey | No | No |
| Green & Golden Bell Frog | *Litoria aurea* | E | V | Targeted threatened species survey | No | No |
| Square-tailed Kite (Breeding) | *Lophoictinia isura* | V | - | Targeted threatened species survey | No | No |

| Common name | Scientific name | Listing status | | Method used to determine presence | Present ? | Further assessment required? (BAM Subsections 5.2.5 and 5.2.6) |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Maroubra Woodland Snail | *Meridolum maryae* | E | - | Targeted threatened species survey | No | No |
| Little Bent-wing Bat (Breeding) | *Miniopterus australis* | V | - | Targeted threatened species survey | Not breeding* | No |
| Large Bent-wing Bat (Breeding) | *Miniopterus orianae oceanensis* | V | - | Targeted threatened species survey | No | No |
| Southern Myotis | *Myotis macropus* | V | - | Targeted threatened species survey | No | No |
| Barking Owl (Breeding) | *Ninox connivens* | V | - | Targeted threatened species survey | No | No |
| Powerful Owl (Breeding) | *Ninox strenua* | V | - | Targeted threatened species survey | No | No |
| Greater Glider | *Petauroides volans* | - | V | Targeted threatened species survey | No | No |
| Squirrel Glider | *Petaurus norfolcensis* | V, E2 | - | Targeted threatened species survey | No | No |
| Long-nosed Potoroo | *Potorous tridactylus* | V | V | Targeted threatened species survey | No | No |
| Koala | *Phascolarctos cinereus* | E | E | Targeted threatened species survey | No | No |
| Red-crowned Toadlet | *Pseudophryne australis* | V | - | Targeted threatened species survey | Yes | Yes |

| Common name | Scientific name | Listing status | | Method used to determine presence | Present ? | Further assessment required? (BAM Subsections 5.2.5 and 5.2.6) |
|---|---|---|---|---|---|---|
| | | BC Act | EPBC Act | | | |
| Masked Owl (Breeding) | *Tyto novaehollandiae* | V | - | Targeted threatened species survey | No | No |
| Sooty Owl (Breeding) | *Tyto tenebricosa* | V | - | Targeted threatened species survey | No | No |

* *The Little Bent-wing Bat was recorded during the field surveys. It was recorded on one night (10th November 2020) with the first pass at 00:54 hours. It is considered that this recording was during the foraging period for the animal, rather than leaving a roost site at dusk. Whilst the subject land offers roosting opportunities for bats, it is believed that this species is not using the subject land for roosting or breeding.*

## 5.3 Threatened species surveys

**Table 15 Threatened species surveys for candidate flora species credit species on the subject land**

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| Bynoe's Wattle | *Acacia bynoeana* | Semi-prostrate shrub to 1m high. Occurs in heath or dry sclerophyll forest. Prefers open, disturbed and recently burnt areas.<br>Relevant PCTs: 1250<br>Use reference population to identify vegetative state, which will assist in positive identification during survey.<br>2 BAM plots surveyed within PCT 1250 in March 2021.<br>5.3km of random meander in July/August 2020, of which approximately one quarter was within relevant PCT 1250.<br>8.4km of parallel traverses in late October 2020, of which one third were within PCT 1250. | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours<br>x 1 person | No | Bionet - not known from subject land. Only two records within 5km of the subject land – both from Frenches Forest in 1911.<br>Not likely to occur. | No |
| Sunshine Wattle | *Acacia terminalis* | Erect shrub 1-5m tall. Very limited distribution, mainly in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay, with most records from the Port Jackson area and the eastern suburbs of Sydney. | ☒ Yes<br>BAM: May to Jul | ☒ No<br>Survey: Aug, Oct | ~ 50 hours<br>x 1 person | No | Bionet - not known from subject land. Records within 5km are all from | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Relevant PCTs: 1250 & 1824<br>Use flowers to identify.<br>A few plants of *Acacia terminalis* were found by Daniel Clarke during the 30 July and 6 August 2020 random meander. The plants were post flowering stage, but a preliminary scrutiny indicated that the plants were not the listed threatened subspecies.<br>*Acacia terminalis* was also found during the Oct 2020 traverses. Whilst flowers were not present for a sound identification, the leaves were analysed and did not have the stated features for *A terminalis* ssp *terminalis*.<br>A further survey was conducted on 5th July 2021 to collect material to determine species. Analysis of fruit determined the species to be *A terminalis* ssp *angustifolia*, (aka *A terminalis* ssp Glabrous Form). | Survey: Jul | | | | the Allambie Heights to Brookvale area.<br>Not likely to occur based on current knowledge of the species distribution (D Clarke, *pers comm*). | |
| *Asterolasia elegans* | *Asterolasia elegans* | Tall thin shrub to 3m high. Found in sheltered forests on mid to lower slopes and valleys on Hawkesbury sandstone. Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area<br>Relevant PCTs: 1250 | ☒ Yes<br>BAM: Sep to Oct<br>Survey: Oct | ☒ No<br>Survey: Mar | ~ 50 hours x 1 person | No | Bionet - not known from subject land and no records within 5km of the subject land.<br>Subject land is not within listed LGAs. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Use flowers to locate. Species is quite sparse and scraggly and more detectable when in flower.<br>2 BAM plots surveyed within PCT 1250 in March 2021. Whilst outside of the flowering period, these surveys are thorough and would have detected the plant.<br>8.4km of parallel traverses in October 2020, of which one third were within PCT 1250. | | | | | Not likely to occur. | |
| Thick-leaf Star-hair | *Astrotricha crassifolia* | Shrub to 2.4m high. Occurs in dry sclerophyll woodland on sandstone.<br>Relevant PCTs: 1250 & 1783<br>Use buds, flowers and fruit to locate and identify.<br>3 BAM plots surveyed in August 2020 within relevant PCTs. One additional plot surveyed in relevant PCT in March 2021 (outside survey period – but no *Astrotricha* spp present).<br>5.3km of random meander in August 2020, of which the majority was within relevant PCTs.<br>8.4km of parallel traverses in October 2020, of which two thirds were within relevant PCTs. | ☒ Yes<br>BAM: Jul to Dec<br>Survey: Jul, Aug, Oct | ☒ No<br>Survey: Mar | ~ 50 hours<br>x 1 person | No | Bionet - not known from subject land and no records within 5km of the subject land.<br>Not likely to occur. | No |
| Thick Lip Spider Orchid | *Caladenia tessellata* | Terrestrial orchid. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. | ☒ Yes<br>BAM: Sept to Oct | ☒ No<br>Survey: late Aug | ~ 29 hours<br>x 1 person | No | Bionet - not known from subject land and no records within | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Relevant PCTs: 1250 & 1824<br>Coastal populations are best surveyed in September and populations on the ranges surveyed in October.<br>8.4km of parallel traverses were conducted over three days in late October 2020, of which approx. half were in relevant PCTs.<br>1 BAM plot was surveyed on 27th August 2020 within a relevant PCT, just prior to the survey period when the species would be emerging and likely detected in a detailed plot survey.<br>This is a very small plant and could easily be missed amongst the heathy understorey across most of the subject land. A reference population for flowering was not used. Surveys conducted are not sufficient to demonstrate absence. | Survey: Oct | | | | 5km of the subject land.<br>There are no recent records of this species occurring in Sydney, at least since about 1960. Hence, it is currently very difficult to determine if this species can still be found in the Sydney area.<br>Subject land is shrubby/heathy rather than grassy so does not provide typical habitat.<br>Not likely to occur. | |
| Netted Bottlebrush | *Callistemon linearifolius* | Shrub to 3-4m high. Dry sclerophyll forest on coast and adjacent ranges. | ☒ Yes | ☒ No | ~ 50 hours x 1 person | No | Bionet - not known from | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Relevant PCTs: 1250, 1783 & 1824<br>Use flowers to identify. If not observed in flower, return to site for re-survey later in the survey period. Check nearest possible reference site (within 20km) at similar altitude.<br>6 BAM plots surveyed in relevant PCTs, but outside survey period. However, surveys are thorough and no *Callistemon* spp recorded that could be this species.<br>8.4km of parallel traverses in October 2020 in relevant PCTs.<br>Reference site not checked and subject land not re-surveyed during flowering period. | BAM: Oct to Jan<br>Survey: Oct | Survey: Aug, Mar | | | subject land. Nine records within 5km.<br>Could potentially occur in unsampled parts of the subject land, but does not appear to be present. | |
| *Camarophyllopsis kearneyi* | *Camarophyllopsis kearneyi* | Small fungus. Occurrence appears to be limited to the Lane Cove Bushland Park. Surveys in potentially suitable habitats elsewhere in the Sydney Basin Bioregion have failed to find this species.<br>Relevant PCTs: 1250<br>Survey 7 - 10 days after at least 40 mm rain over 2 weeks when soil moisture levels are high during May - Jun. May also be present at other times of the year after suitable rain.<br>Targeted survey conducted for this species throughout relevant parts of the subject land on 6th | ☐ Yes<br>BAM: May to Jun | ☒ No<br>Survey: 6th Jul on advice from species expert. | ~ 2 hours x 2 persons | No | Bionet - not known from subject land and no records within 5km (although this is not a species likely to be recorded casually).<br>Dr Ray Kearney advises that | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | July 2021 by Dan Clarke and species expert Dr Ray Kearney. BOM data: ~30mm of rain received at Belrose (Evelyn Place) during a period 4-9 days prior to the 6th July 2021. This followed a similar rain event a week earlier. Total rainfall for June 2021 was 78.6mm. | | | | | habitats within the subject land are unsuitable for this species based on soil substrate and vegetation structure. Not a single waxcap fungi of any species was recorded. Other non-waxcap species were present.<br>Not likely to occur. | |
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | Terrestrial orchid. Known from a range of habitats.<br>Relevant PCTs: 1783<br>Not surveyed. | ☐ Yes<br>BAM: Nov to Jan | ☐ No | n/a | No | Bionet - not known from subject land and no records within 5km of the subject land.<br>There is much uncertainty regarding | Yes |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | | | | | | presence/absence of this species due to its ephemeral and cryptic habit and insufficient knowledge of the species.<br>Assumed present within a 1ha patch of PCT 1783. | |
| *Darwinia biflora* | *Darwinia biflora* | Shrub to 80cm high. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone<br>Relevant PCTs: 1824<br>Flowers sporadically at any time of the year, likely driven by rainfall or disturbance. Return to site for re-survey if not found during first or second surveys. If the site has not been disturbed by fire or mechanical intervention for > 20 years and all indicators suggest the species should be there, it should be presumed present. Expert report required to discount presence or absence if site conditions do not meet requirements.<br>2 BAM plots surveyed within PCT 1824 in Mar 2021. | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours x 1 person | No | Bionet - not known from subject land. One record within 5km from East Killara.<br>Subject land is outside of the stated range and not typified by shale-capped ridgetops.<br>Not likely to occur. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | 5.3km of random meander in August 2020, of which ~one quarter was within PCT 1824.<br>8.4km of parallel traverses in October 2020, of which one third was within PCT 1824. | | | | | | |
| *Darwinia glaucophylla* | *Darwinia glaucophylla* | Spreading shrub with branchlets to 15cm high. Occurs in sandy heath, scrub and woodlands associated with sandstone rock platforms. Occurs between Gosford and the Hawkesbury River around Calga, Kariong and Mt Karing. Known from approximately 15 sites, several within or near to Brisbane Waters NP and one within Popran NP. Occurs entirely within the Gosford Local Government Area of the Sydney Basin Bioregion.<br>Relevant PCTs: 1783 & 1824<br>4 BAM plots surveyed within relevant PCTs in Aug 2020 and Mar 2021.<br>5.3km of random meander in August 2020, of which ~half was within relevant PCTs.<br>8.4km of parallel traverses in October 2020, of which ~ half were within relevant PCTs. | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours x 1 person | No | Subject land is not within Gosford LGA.<br>Bionet - not known from subject land and no records within 5km of the subject land.<br>Not likely to occur. | No |
| *Darwinia peduncularis* | *Darwinia peduncularis* | Spreading shrub to 1.5m high.<br>Use flowers to locate and identify. Recommend checking a nearby reference site at a similar altitude, to determine flowering times. | ☒ Yes<br>BAM: all year | ☐ No | ~ 50 hours x 1 person | No | Bionet - not known from subject land and no records within | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Relevant PCTs: 1250 & 1783<br>4 BAM plots surveyed within relevant PCTs in Aug 2020 and Mar 2021.<br>5.3km of random meander in August 2020, of which the majority was within relevant PCTs.<br>8.4km of parallel traverses in October 2020, of which two thirds were within relevant PCTs. | Survey: Mar, Jul, Aug, Oct<br>reference site not used. | | | | 5km of the subject land.<br>Not likely to occur. | |
| Camfield's Stringybark | *Eucalyptus camfieldii* | Mallee tree to 4m tall. Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone.<br>Identifiable throughout year by epicormic growth or juvenile foliage. Juvenile foliage isn't representative of E. camfieldii in the northern populations.<br>Relevant PCTs: 1250<br>2 BAM plots surveyed within PCT 1250 in March 2021.<br>5.3km of random meander in August 2020, of which approximately one quarter was within PCT 1250.<br>8.4km of parallel traverses in late October 2020, of which one quarter were within PCT 1250. | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours<br>x 1 person | No | Bionet - not known from subject land. 38 records within 5km of the subject land.<br>Relatively common in the vicinity, but also readily detected.<br>Does not appear to be present on the subject land. | No |
| Bauer's Midge Orchid | *Genoplesium baueri* | Terrestrial orchid. Dry sclerophyll forest and moss gardens over sandstone.<br>Relevant PCTs: 1824 | ☒ Yes<br>BAM: Feb to Mar | ☐ No | ~ 6 hours<br>x 2 persons | No | Bionet - not known from subject land. There are 8 | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Survey 6 weeks after significant rain. New work indicates species flowers from Jan to Apr.<br>The Australian Plants Society have found recent records in Kur-ring-gai Chase NP, and elsewhere within 1-5km of the subject land.<br>BOM data: 63mm of rain fell in the period from 5th to 8th Jan, and 93mm of rain fell in the period from 28th Jan to 3rd Feb, approx. eight and five weeks respectively prior to a random meander and 2 BAM plot surveys conducted within PCT 1824 on 4th Mar 2021. | Survey: Mar | | | | records within 5km of the subject land.<br>Does not appear to be present in surveyed areas.<br>Further targeted work required. | |
| Tallong Midge Orchid | *Genoplesium plumosum* | Terrestrial orchid. Occurs exclusively in heathland, generally dominated by *Kunzea parvifolia*, *Calytrix tetragona* and *Dillwynia* spp.<br>Relevant PCTs: 1824<br>Survey late Feb to March.<br>A random meander and 2 BAM plot surveys conducted within PCT 1824 on 4th Mar 2021. | ☒ Yes<br>BAM: Feb to Mar<br>Survey: Mar | ☐ No | ~ 6 hours<br>x 2 persons | No | Bionet – not known from subject land and no records within 5km of the subject land.<br>Now known from only two areas – Tallong & Wingello in the Southern Highlands. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | | | | | | Not likely to occur. | |
| Narrow-leaf Finger Fern | *Grammitis stenophylla* | Small fern. Moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest.<br>Relevant PCTs: 1250<br>Survey after significant rainfall event. Species is difficult to detect after long dry periods.<br>Surveys were conducted during a particularly wet year, with over 110mm recorded from 26th to 29th July, prior to the random meander surveys conducted on 30th July and 6th August. 5.3km of random meander was conducted, of which ~ one quarter was within PCT 1250.<br>BOM data: ~20mm rain fell immediately prior to the 22nd Oct 2020 traverses, and 79mm in the week leading up to the 29th & 20th Oct traverses. 8.4km of parallel traverses were surveyed, of which one third were within PCT 1250.<br>2 BAM plots were surveyed within PCT 1250 in March 2021, following regular ongoing rainfall events throughout the summer. | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours<br>x 1 person | No | Bionet - not known from subject land and no records within 5km.<br>Does not appear to be present.<br>most of the subject land would probably be too dry for this species. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| *Haloragodendron lucasii* | *Haloragodendron lucasii* | Erect shrub to 1.5m high. Associated with high soil moisture and relatively high soil-phosphorous in dry sclerophyll forest.<br>Relevant PCTs: 1250<br>2 BAM plots surveyed within PCT 1250 in March 2021.<br>5.3km of random meander in August 2020, of which ~ one quarter was conducted within PCT 1250.<br>8.4km of parallel traverses in late October 2020, of which one third were within PCT 1250. | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours<br>x 1 person | No | Bionet - not known from subject land. Three records within 5km of the subject land – at East Killara and Duffys Forest.<br>Does not appear to be present. | No |
| *Hibbertia puberula* | *Hibbertia puberula* | Shrublet with wiry branches to 30cm long. Typically dry sclerophyll woodland and heath on sandy soil.<br>Relevant PCTs: 1250 & 1783<br>Use flowers to locate and identify as species is cryptic. Survey when temperature is below 25 degrees (drops petals at higher temperatures). Use local reference site within 10 km and at similar elevation, to determine flowering period.<br>No known local reference site.<br>8.4km of parallel traverses over three days in late October 2020, of which two thirds were within relevant PCTs. Max daily temps were 23.1°C, 19.8°C & 20.6°C respectively – BOM Terry Hills AWS). | ☒ Yes<br>BAM: Oct to Dec<br>Survey: Oct | ☒ No<br>Survey: Mar, Aug | ~ 50 hours<br>x 1 person | No | Bionet - not known from subject land. Only one record within 5km of the subject land – a herbarium record from Frenches Forest in 1946.<br>Not likely to occur. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | 4 BAM plots surveyed within relevant PCTs but outside survey period – however, these surveys are thorough and no *Hibbertia* spp likely to be this species were recorded). | | | | | | |
| *Hibbertia spanantha* | *Hibbertia spanantha* | Shrublet to 30cm high. Grows in forest. Soils are light clay, occurring on shale sandstone transition.<br>Relevant PCTs: 1250<br>Use flowers to locate. Peak flowering period Oct - Nov, but will flower sporadically throughout the year.<br>8.4km of parallel traverses over three days in late October 2020, of which one third were within PCT 1250.<br>2 BAM plots surveyed within PCT 1250 but in March, outside the survey period – however, these surveys are thorough and no *Hibbertia* spp likely to be this species were recorded). | ☒ Yes<br>BAM: Oct to Nov<br>Survey: Oct | ☒ No<br>Survey: Mar | ~ 50 hours<br>x 1 person | No | Bionet - not known from subject land and no records within 5km of the subject land.<br>Not likely to occur. | No |
| *Hygrocybe anomala* var *ianthinomargin ata* | *Hygrocybe anomala* var *ianthinomargin ata* | Small fungus. Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*).<br>Relevant PCTs: 1250 | ☐ Yes<br>BAM: May to Jun | ☒ No<br>Survey: 6th Jul on advice from species expert. | ~ 2 hours<br>x 2 persons | No | Bionet - not known from subject land and no records within 5km (although these are not | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Survey 7 - 10 days after at least 40 mm rain over 2 weeks when soil moisture levels are high during May - Jun. May also be present at other times of the year after suitable rain.<br>Targeted survey conducted for this species throughout relevant parts of the subject land on 6th July 2021 by Dan Clarke and species expert Dr Ray Kearney. BOM data: ~30mm of rain received at Belrose (Evelyn Place) during a period 4-9 days prior to the 6th July 2021. This followed a similar rain event a week earlier. Total rainfall for June 2021 was 78.6mm. | | | | | species likely to be recorded casually).<br>Dr Ray Kearney advises that habitats within the subject land are unsuitable for these species based on soil substrate and vegetation structure. Not a single waxcap fungi of any species was recorded. Other non-waxcap species were present.<br>Not likely to occur. | |
| *Hygrocybe aurantipes* | *Hygrocybe aurantipes* | Small fungus. Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*).<br>Relevant PCTs: 1250<br>Survey 7 - 10 days after at least 40 mm rain over 2 weeks when soil moisture levels are high during May - Jun. May also be present at other times of the year after suitable rain.<br>Targeted survey conducted for this species throughout relevant parts of the subject land on 6th | ☐ Yes<br>BAM: May to Jun | ☒ No<br>Survey: 6th Jul on advice from species expert. | ~ 2 hours<br>x 2 persons | No | | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | July 2021 by Dan Clarke and species expert Dr Ray Kearney. BOM data: ~30mm of rain received at Belrose (Evelyn Place) during a period 4-9 days prior to the 6th July 2021. This followed a similar rain event a week earlier. Total rainfall for June 2021 was 78.6mm. | | | | | | |
| *Hygrocybe austropratensis* | *Hygrocybe austropratensis* | Small fungus. Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*).<br>Relevant PCTs: 1250<br>Survey 7 - 10 days after at least 40 mm rain over 2 weeks when soil moisture levels are high during May - Jun. May also be present at other times of the year after suitable rain.<br>Targeted survey conducted for this species throughout relevant parts of the subject land on 6th July 2021 by Dan Clarke and species expert Dr Ray Kearney. BOM data: ~30mm of rain received at Belrose (Evelyn Place) during a period 4-9 days prior to the 6th July 2021. This followed a similar rain event a week earlier. Total rainfall for June 2021 was 78.6mm. | ☐ Yes<br>BAM: May to Jun | ☒ No<br>Survey: 6th Jul on advice from species expert. | ~ 2 hours<br>x 2 persons | No | see above. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| *Hygrocybe collucera* | *Hygrocybe collucera* | Small fungus. Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*).<br>Relevant PCTs: 1250<br>Survey 7 - 10 days after at least 40 mm rain over 2 weeks when soil moisture levels are high during May - Jun. May also be present at other times of the year after suitable rain.<br>Targeted survey conducted for this species throughout relevant parts of the subject land on 6th July 2021 by Dan Clarke and species expert Dr Ray Kearney. BOM data: ~30mm of rain received at Belrose (Evelyn Place) during a period 4-9 days prior to the 6th July 2021. This followed a similar rain event a week earlier. Total rainfall for June 2021 was 78.6mm. | ☐ Yes<br>BAM: Jun | ☒ No<br>Survey: 6th Jul on advice from species expert. | ~ 2 hours<br>x 2 persons | No | see above. | No |
| *Hygrocybe griseoramosa* | *Hygrocybe griseoramosa* | Small fungus. Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*).<br>Relevant PCTs: 1250 | ☐ Yes<br>BAM: May to Jun | ☒ No<br>Survey: 6th Jul on advice from species expert. | ~ 2 hours<br>x 2 persons | No | see above. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Survey 7 - 10 days after at least 40 mm rain over 2 weeks when soil moisture levels are high during May - Jun. May also be present at other times of the year after suitable rain.<br>Targeted survey conducted for this species throughout relevant parts of the subject land on 6th July 2021 by Dan Clarke and species expert Dr Ray Kearney. BOM data: ~30mm of rain received at Belrose (Evelyn Place) during a period 4-9 days prior to the 6th July 2021. This followed a similar rain event a week earlier. Total rainfall for June 2021 was 78.6mm. | | | | | | |
| *Hygrocybe lanecovensis* | *Hygrocybe lanecovensis* | Small fungus. Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*).<br>Relevant PCTs: 1250<br>Survey 7 - 10 days after at least 40 mm rain over 2 weeks when soil moisture levels are high during May - Jun. May also be present at other times of the year after suitable rain.<br>Targeted survey conducted for this species throughout relevant parts of the subject land on 6th | ☐ Yes<br>BAM: May to Jun | ☒ No<br>Survey: 6th Jul on advice from species expert. | ~ 2 hours<br>x 2 persons | No | see above. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | July 2021 by Dan Clarke and species expert Dr Ray Kearney. BOM data: ~30mm of rain received at Belrose (Evelyn Place) during a period 4-9 days prior to the 6th July 2021. This followed a similar rain event a week earlier. Total rainfall for June 2021 was 78.6mm. | | | | | | |
| *Hygrocybe reesiae* | *Hygrocybe reesiae* | Small fungus. Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*).<br>Relevant PCTs: 1250<br>Survey 7 - 10 days after at least 40 mm rain over 2 weeks when soil moisture levels are high during May - Jun. May also be present at other times of the year after suitable rain.<br>Targeted survey conducted for this species throughout relevant parts of the subject land on 6th July 2021 by Dan Clarke and species expert Dr Ray Kearney. BOM data: ~30mm of rain received at Belrose (Evelyn Place) during a period 4-9 days prior to the 6th July 2021. This followed a similar rain event a week earlier. Total rainfall for June 2021 was 78.6mm. | ☐ Yes<br>BAM: May to Jun | ☒ No<br>Survey: 6th Jul on advice from species expert. | ~ 2 hours<br>x 2 persons | No | see above. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| *Hygrocybe rubronivea* | *Hygrocybe rubronivea* | Small fungus. Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*).<br>Relevant PCTs: 1250<br>Survey 7 - 10 days after at least 40 mm rain over 2 weeks when soil moisture levels are high during May - Jun. May also be present at other times of the year after suitable rain.<br>Targeted survey conducted for this species throughout relevant parts of the subject land on 6th July 2021 by Dan Clarke and species expert Dr Ray Kearney. BOM data: ~30mm of rain received at Belrose (Evelyn Place) during a period 4-9 days prior to the 6th July 2021. This followed a similar rain event a week earlier. Total for June 2021 was 78.6mm. | ☐ Yes<br>BAM: May to Jun | ☒ No<br>Survey: 6th Jul on advice from species expert. | ~ 2 hours<br>x 2 persons | No | see above. | No |
| *Kunzea rupestris* | *Kunzea rupestris* | Shrub to 1.5m high. Grows in shallow depressions on large flat sandstone rock outcrops. Restricted, with most locations in the Maroota - Sackville - Glenorie area and one outlier in Ku-ring-gai Chase National Park.<br>Relevant PCTs: 1824 | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours<br>x 1 person | No | Bionet - not known from subject land. 1 record within 5km of the subject land from Ingleside in 2007. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | 2 BAM plots surveyed within PCT 1824 in Mar 2021, including one which encompassed an area of flat sandstone rock outcrop.<br>5.3km of random meander in August 2020, of which ~one quarter was within PCT 1824.<br>8.4km of parallel traverses in October 2020, of which one third was within PCT 1824. | | | | | Not likely to occur. | |
| *Lasiopetalum joyceae* | *Lasiopetalum joyceae* | Erect shrub to 2m tall. Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River.<br>Relevant PCTs: 1783 & 1824<br>Use flowers to locate and identify, as easily confused with *L. parviflorum* and *L. rufum*.<br>2 BAM plots surveyed within relevant PCTs in Oct 2020. Two additional plots surveyed in relevant PCTs in August 2021 (just outside survey period – but thorough plot searches would detect this shrub, no similar species recorded).<br>8.4km of parallel traverses in October 2020, of which ~ half were within relevant PCTs.<br>Surveyor Daniel Clarke has extensive experience with this species. Subject land is not typified by suitable lateritic to shaley ridgetops. | ☒ Yes<br>BAM: Sep to Nov<br>Survey: Oct | ☒ No<br>Survey: Aug | ~ 50 hours x 1 person | No | Bionet - not known from subject land. One record within 5km from Ingleside.<br>Not likely to occur. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| *Leptospermum deanei* | *Leptospermum deanei* | Shrub to 5m high. Occurs in woodland and riparian scrub on lower hill slopes in Hornsby, Warringah, Ku-ring-gai and Ryde LGAs.<br>Relevant PCTs: 1250<br>This species is detectable all year, but requires fertile material to identify.<br>2 BAM plots surveyed within PCT 1250 in March 2021.<br>5.3km of random meander in August 2020, of which approximately one quarter was within PCT 1250.<br>8.4km of parallel traverses in October 2020, of which one quarter were within PCT 1250. | ☒ Yes<br>BAM: Oct to Nov<br>Survey: Oct | ☒ No<br>Survey: Mar, Jul, Aug | ~ 50 hours<br>x 1 person | No | Bionet - not known from subject land. There is a cluster of records from a population near Middle Harbour Creek in Garigal NP ~3km to the west of the subject land.<br>Not likely to occur. | No |
| *Melaleuca deanei* | *Melaleuca deanei* | Optimum time for flowering is Oct - Nov, but flowers infrequently and unpredictably. Detectable vegetatively all year round.<br>Relevant PCTs: 1250, 1783 & 1824<br>6 BAM plots surveyed in Aug 2020 and Mar 2021.<br>5.3km of random meander in August 2020.<br>8.4km of parallel traverses in October 2020. | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours<br>x 1 person | No | Deane's Paperbark occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively.<br>Bionet - not known from subject land. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | | | | | | There are records approx. 5km to the east, northeast and southeast of the subject land.<br>Does not appear to be present. | |
| *Melaleuca groveana* | *Melaleuca groveana* | Shrub or small tree, to 2-5m high. Grows in heath, shrubland and shrubby open forest and woodlands.<br>Relevant PCTs: 1783<br>2 BAM plots surveyed within PCT 1783 in Aug 2020.<br>5.3km of random meander in August 2020, of which approx one third was within PCTs 1783.<br>8.4km of parallel traverses in October 2020, of which approx. half was within PCT 1783. | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours x 1 person | No | Bionet - not known from subject land and no records within 5km of the subject land.<br>Not likely to occur. | No |
| *Micromyrtus blakelyi* | *Micromyrtus blakelyi* | Low shrub 30-60cm high. Typically occurs within heathlands in shallow sandy soil in cracks and depressions of sandstone rock platforms. Restricted to areas near the Hawkesbury River, north of Sydney. Distribution extends from north of Maroota in the north, to Cowan in the south. All known populations occur within the Baulkham Hills and Hornsby local government areas. | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours x 1 person | No | Subject land is not within known distribution.<br>Bionet - not known from subject land and no records within | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Relevant PCTs: 1824<br>2 BAM plots surveyed within PCT 1824 in Mar 2021, including one which encompassed an area of sandstone rock platform.<br>5.3km of random meander in August 2020, of which ~one quarter was within PCT 1824.<br>8.4km of parallel traverses in October 2020, of which one third was within PCT 1824. | | | | | 5km of the subject land.<br>Not likely to occur. | |
| Hairy Geebung | *Persoonia hirsuta* | Spreading shrub. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.<br>Relevant PCTs: 1250 & 1824<br>4 BAM plots surveyed within relevant PCTs in Aug 2020 and Mar 2021.<br>5.3km of random meander in August 2020, of which ~two thirds was within relevant PCTs.<br>8.4km of parallel traverses in October 2020, of which ~ half were within relevant PCTs. | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours x 1 person | No | Bionet - not known from subject land. There are 27 records within 5km of the subject land.<br>Does not appear to be present. | No |
| *Persoonia mollis ssp maxima* | *Persoonia mollis ssp maxima* | Tall branching shrub 2-6m high. Occurs in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. These habitats support relatively moist, tall forest vegetation communities, often with warm temperate rainforest influences. | ☒ Yes<br>BAM: all year<br>Survey: Mar, Jul, Aug, Oct | ☐ No | ~ 50 hours x 1 person | No | Subject land is more than 10km east of the known distribution. | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Relevant PCTs: 1250<br>Known distribution is highly restricted, known from the Hornsby Heights-Mt Colah area north of Sydney in the Sydney Basin Bioregion.<br>Species may not maintain an above-ground presence without fire or other disturbance. When the site contains suitable habitat to support this species, and records or observations indicate that this species is/was previously on or near the site, it is advisable that either an expert report or seedbank analysis be undertaken to discount its presence at the site.<br>2 BAM plots surveyed within PCT 1250 in March 2021.<br>5.3km of random meander in August 2020, of which approximately one quarter was within PCT 1250.<br>8.4km of parallel traverses in late October 2020, of which one third were within PCT 1250. | | | | | Bionet - not known from subject land and no records within 5km of the subject land.<br>Not likely to occur. | |
| Somersby Mintbush | *Prostanthera junonis* | Low shrub up to 1m diameter.<br>Relevant PCTs: 1824<br>Use flowers to locate. Survey when most likely to flower Oct - Dec. Species also sporadically flowers at other times throughout the year. | ☒ Yes<br>BAM: Oct to Dec<br>Survey: Oct | ☐ No | ~ 50 hours x 1 person | No | Has a north-south range of approximately 19 km on the Somersby Plateau in the Gosford and Wyong local | No |

| Common name | Scientific name | Threatened flora species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (transects or grids) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | | | | | | government areas. Restricted to the Somersby Plateau.<br>Bionet - not known from subject land and no records within 5km.<br>Not likely to occur. | |
| *Tetratheca glandulosa* | *Tetratheca glandulosa* | Small shrub to 20-50cm in height. Associated with shale-sandstone transition habitat where shale cappings occur over sandstone.<br>Relevant PCTs: 1250, 1783 & 1824<br>Use flowers to locate. Occasionally flowers in Jul. | ☒ Yes<br>BAM: Aug to Nov<br>Survey, Aug, Oct | ☐ No | ~ 50 hours x 1 person | Yes | Previous records on subject land (Travers, 2018 & Bionet).<br>Recorded during surveys in August and October.<br>Refer to Figure 8 (Threatened Species Locations). | Yes |

**Table 16 Threatened species surveys for candidate fauna species credit species on the subject land**

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| Gang Gang Cockatoo (Breeding) | *Callocephalon fimbriatum* | Assessors should look for SIGNS OF BREEDING on site as follows; (a) lone adult males during the breeding season; or (b) an occupied nest.<br>Nine diurnal bird surveys (point count method) were conducted at seven locations across the range of relevant PCTs during the Sept/Oct and November survey sessions. A total of 180 person-minutes of survey.<br>Dusk surveys were conducted primarily to target nocturnal fauna, but also noting any diurnal birds returning to hollows. Dusk surveys were conducted at one location in October, and two locations in November 2020.<br>Opportunistic records were maintained at all times when surveyors were on site. The Gang Gang is usually conspicuous if present and has a distinctive call. | ☒ Yes<br>BAM: Oct to Jan<br>Survey: Sep/Oct, Nov | ☐ No | 180 person-minutes diurnal + 90 minutes dusk watching | No | Bionet - not known from subject land. 2 records within 5km of the subject land, from Forestville and near Elanora Heights.<br>Does not appear to use or breed within subject land. | No |
| Glossy Black Cockatoo (Breeding) | *Calyptorhynchus lathami* | Assessors should look for SIGNS OF BREEDING on site as follows; (a) begging birds of any age or sex; or (b) lone adult males during the breeding season; or (c) an occupied nest.<br>Three diurnal bird surveys (point count method) were conducted at three locations across the range of | ☒ Yes<br>BAM: Jan to Sep<br>Survey: Jul/Aug, Sep | ☐ No | 60 person-minutes diurnal + 240 minutes dusk watching. | No | Previous anecdotal records of chewed cones from subject land (Travers, 2018). 85 records within | No |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | relevant PCTs during the July/Aug survey session. A total of 60 person-minutes of survey.<br>Dusk surveys were conducted primarily to target nocturnal fauna, but also noting any diurnal birds returning to hollows. Eight dusk surveys were conducted over 4 nights in July 2020.<br>Opportunistic records were maintained at all times when surveyors were on site. The Glossy Black Cockatoo is not generally conspicuous, but is distinctive. | | | | | 5km of the subject land (Bionet Atlas).<br>Chewed cones were recorded at several locations within the subject land in July/Aug 2020 and Sept/Oct 2020. One individual bird was recorded flying over the western part of the subject land on 11th January 2021.<br>This species uses the subject land, but no evidence for breeding. | |
| Eastern Pygmy-possum | *Cercartetus nanus* | 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. | ☒ Yes<br>BAM: Oct to Mar | ☒ No<br>Survey: Jul, Aug, Sep | Nest tubes - 6,720 nest tube-nights | Yes | Previous records from the subject land (Travers, 2018; Bionet - 261 | Yes |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Surveys included:<br>Nest-tube survey – 35 purpose-built nest-tubes were installed on or near patches of banksias across the relevant PCTs on 8th July 2020 and collected on 16th January 2021. A total of 6,720 tube-nights.<br>Elliot trapping (arboreal) 11-15th January 2021: 40 traps set across all PCTs, total of 160 trap-nights.<br>Hairtube trapping (arboreal) – 15 hairtubes placed in flowering banksias 11th Jan to 1st Feb 2021, total of 300 tube-nights.<br>Infrared nocturnal camera (arboreal) 17th Sept to 6th Oct: 4 cameras, 11th Jan to 1st Feb 2021: 5 cameras. Total of 181 camera-nights. Cameras also set in July and August 2020 for an additional 98 camera-nights.<br>Dusk surveys and spotlighting on 14th October and 3rd November. Total 12 person-hours of combined active dusk/nocturnal surveys. | Survey: Oct, Nov, Dec, Jan | | Elliott arboreal – 160 trap nights<br>Hairtube arboreal – 300 tube-nights<br>cameras (arboreal) – 181 + 98 camera-nights<br>Dusk: 12 person-hours | | records within 5km of the subject land, scattered throughout the surrounding area. Species was recorded within the subject land in July 2020 (spotlighting, camera) and January 2021 (an individual, and established dreys found in nest-tubes). | |
| Large-eared Pied Bat | *Chalinolobus dwyeri* | Found in well-timbered areas containing gullies. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in disused nests of the Fairy Martin. Maternity roosts have been found in the roof domes of sandstone caves and overhangs.<br>Potential breeding habitat is suitable PCTs within 100m of rocky areas containing caves, or overhangs | ☒ Yes<br>BAM: Nov to Jan<br>Survey Nov, Jan | ☐ No | acoustic – 218 recording-nights<br>cave searches – 40 person-minutes | No | Bionet - not known from the subject land. Twelve records within 5km of the subject land. | No |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | or crevices, cliffs or escarpments, or old mines, tunnels, culverts, derelict concrete buildings.<br>Surveys included:<br>Anabat detection: 3rd Nov to 26th Nov 2020 – 4 units, and 11th Jan to 1st Feb – 6 units. Total effort = 218 recording nights.<br>Cave searches – active searches of suitable sheltering sites using hand-held torches, including looking for indirect evidence such as guano. Effort = 40 person-minutes. | | | | | Does not appear to use the subject land. | |
| Giant Burrowing Frog | *Heleioporus australiacus* | Found in heath, woodland and dry sclerophyll forest on a variety of soil types except clay based. Breeding habitat is soaks or pools within 1st or 2nd order streams, commonly 'hanging swamps'. Non-breeding habitat extends up to 300m from breeding sites.<br>Relevant surveys included:<br>1,280mins of aural-visual searches along 750m of transect, with transects surveyed on 8 separate days in Nov 2020.<br>480 mins (10mins per pool) dip-netting for tadpoles in pools along Snake & Lizard Creeks in Dec 2020.<br>Not known from subject land. 42 records within 5km of the subject land (Bionet Atlas). | ☒ Yes<br>BAM: Sep to May<br>Survey: Nov, Dec | ☐ No | 1,280 mins of searches<br>480 mins dip-netting | No | Bionet - not known from subject land. 42 records within 5km of the subject land.<br>Does not appear to be present. | No |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| Little Eagle (Breeding) | *Hieraaetus morphnoides* | Breeding habitat is live (occasionally dead) large old trees within suitable vegetation AND the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy.<br>Eight diurnal bird surveys (point count method) were conducted at seven locations across the range of relevant PCTs during the July/Aug and Sept/Oct survey sessions. A total of 160 person-minutes of survey.<br>Opportunistic records were maintained at all times when surveyors were on site. The Little Eagle is a large and conspicuous bird. | ☒ Yes<br>BAM: Aug to Oct<br>Survey: Aug, Sep, Oct | ☐ No | 160 person-minutes diurnal | No | Bionet not known from subject land. 2 records within 5km of the subject land.<br>Not likely to occur. | No |
| Broad-headed Snake (Breeding) | *Hoplocephalus bungaroides* | This species shelters under rocks and crevices during the late summer to early spring, as conditions warm up it shifts to using hollows in trees - often in sandstone gully forest just downslope from the outcrops. Survey in dry weather only, to minimise damage to sandstone, must not be too warm with survey restricted to August and September only, late Aug and early Sep optimal.<br>180mins of herpetofauna searches conducted in July, Aug & Sept 2020, including rock platforms in PCT 1824. | ☒ Yes<br>BAM: Aug to Sep & Dec to Feb<br>Survey: Jul, Aug, Sep | ☐ No | 180 mins herp searches | No | Bionet - not known from subject land and no records within 5km of the subject land.<br>Does not appear to be present. | No |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| Southern Brown Bandicoot | *Isoodon obesulus obesulus* | Generally only found in heath or open forest with a heathy understorey on sandy or friable soils. Their searches for food often create distinctive conical holes in the soil.<br>Surveys included:<br>Elliot trapping (ground) 11-15th January 2021: 69 traps set across all PCTs, total of 276 trap-nights.<br>Cage traps (ground) 11-15th January 2021: 6 traps, total of 24 trap-nights.<br>Hairtube trapping (ground) Jul 2020, Sep/Oct 2020, Nov 2020, Jan 2021: no. of tubes set each period varied from 15 to 52, total of 2,390 tube-nights.<br>Infrared nocturnal camera (ground) July 2020: 6 cameras, Nov 2020: 4 cameras. Total of 199 camera-nights.<br>Dusk surveys and spotlighting – 33 person-hours<br>Ground searches for herpetofauna and Koala SAT included looking for conical diggings. Approx 690 person-minutes of ground searches were conducted at 11 locations in July/Aug and Sept/Oct. | ☒ Yes<br>BAM: all year<br>Survey: Jul, Sep, Oct, Nov, Jan | ☐ No | Elliott ground – 276 trap-nights<br>Cage ground – 24 trap-nights<br>Hairtube – 2,390 tube-nights<br>camera – 199 nights<br>nocturnal – 33 person-hours | No | Bionet - not known from the subject land. 120 records within 5km of the subject land, virtually all from ridges within and adjacent to Garigal NP and Ku-ring-gai Chase NP to the northeast of the subject land and west of Forest Way.<br>Does not appear to be present. | No |
| Green & Golden Bell Frog | *Litoria aurea* | Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes waterbodies that are unshaded, have a | ☒ Yes<br>BAM: Nov to Mar | ☐ No | 1,280 mins searches<br>Acoustic – 693 mins | No | Bionet - not known from subject land. Two records within | No |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | grassy area nearby and diurnal sheltering sites available.<br>Relevant surveys included:<br>1,280mins of aural-visual searches along 750m of transect, with transects surveyed on 8 separate days in Nov 2020.<br>acoustic recording at four locations within or proximate to PCT 1250 near Snake & Lizard Creeks in Nov 2020 (1 unit, 11 nights, total 220mins) & Jan 2020 (3 units, 12 nights, total 693mins).<br>480 mins (10mins per pool) dip-netting for tadpoles in pools along Snake & Lizard Creeks in Dec 2020. | Survey: Nov, Dec, Jan | | 480mins dip-netting | | 5km of the subject land - from Terry Hills in 1975 and Warriewood in 1997.<br>Does not appear to be present. | |
| Square-tailed Kite (Breeding) | *Lophoictinia isura* | Breeding habitat is live large old trees within suitable vegetation AND the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy.<br>Nine diurnal bird surveys (point count method) were conducted at seven locations across the range of relevant PCTs during the September and November survey sessions. A total of 180 person-minutes of survey.<br>Opportunistic records were maintained at all times when surveyors were on subject land. The Square-tailed Kite is a large and conspicuous bird. | ☒ Yes<br>BAM: Sep to Jan<br>Survey Sep, Nov | ☐ No | 180 person-mins diurnal | No | Bionet - not previously recorded from subject land. 10 records within 5km.<br>One individual was sighted flying across the northwest of the subject land on 9th November 2020. | No |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| Maroubra Woodland Snail | *Meridolum maryae* | Species occurs within leaf litter and debris but will be buried under the humic/organic layer of the soil profile when conditions aren't suitable.<br>Presence of snail shells and can be detected all year round. Note for the purpose of survey, the presence of MWS shells equals the presence of this species.<br>BAM survey period: all year<br>Two herpetofauna searches were conducted within PCT 1824 in July 2020. Each search lasted for a minimum of 20 person-minutes. Searches were targeting reptiles and frogs, but the habitat searched and methods used are the same as for this snail. | ☒ Yes<br>BAM: all year<br>Survey: Jul | ☐ No | 40 person-minutes | No | Bionet - not known from the subject land and no records within 5km of the subject land (Bionet Atlas). It is not predicted to occur in the Pittwater IBRA subregion.<br>Not likely to occur.<br>Further survey effort is recommended for certainty. | No |
| Little Bent-wing Bat | *Miniopterus australis* | Breeding habitat is within caves, tunnels, mines, culverts or other structures.<br>Surveys included:<br>Anabat detection: 3rd Nov to 26th Nov 2020 – 4 units, and 11th Jan to 1st Feb – 6 units. Total effort = 218 recording nights. | ☒ Yes<br>BAM: Dec to Feb<br>Survey: Nov, Jan | ☐ No | Acoustic - 218 recording nights<br>cave searches – 40 person-mins | Yes, non-breeding record from 10 Nov during forage | Bionet – records in the vicinity are not during the breeding period.<br>Does not appear to use the subject land for roosting or breeding. | No |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Cave searches – active searches of suitable sheltering sites using hand-held torches, including looking for indirect evidence such as guano. Effort = 40 person-minutes.<br>Subject land does not contain deep or substantial cave systems that are typical for breeding. | | | | time (00:54 hrs) | | |
| Large Bent-wing Bat | *Miniopterus orianae oceanensis* | Breeding habitat is within caves, tunnels, mines, culverts or other structures.<br>Surveys included:<br>Anabat detection: 3rd Nov to 26th Nov 2020 – 4 units, and 11th Jan to 1st Feb – 6 units. Total effort = 218 recording nights.<br>Cave searches – active searches of suitable sheltering sites using hand-held torches, including looking for indirect evidence such as guano. Effort = 40 person-minutes.<br>Subject land does not contain deep or substantial cave systems. | ☒ Yes<br>BAM: Dec to Feb<br>Survey: Nov, Jan | ☐ No | Acoustic - 218 recording nights<br>cave searches – 40 person-mins | No | Bionet – records on the land and in the vicinity are nearly all from outside of the breeding period, or in late Feb.<br>Does not appear to use the subject land for roosting or breeding. | No |
| Southern Myotis | *Myotis macropus* | Dependent on waterways with pools of 3m wide or greater for foraging.<br>Surveys included:<br>Anabat detection: 3rd Nov to 26th Nov 2020 – 4 units, and 11th Jan to 1st Feb – 6 units. Total effort = 218 recording nights. | ☒ Yes<br>BAM: Oct to Mar<br>Survey: Nov, Jan | ☐ No | Acoustic - 218 recording nights<br>cave searches – | No | Bionet - not known from the subject land. 35 records within 5km of the subject land. | No |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Cave searches – active searches of suitable sheltering sites using hand-held torches, including looking for indirect evidence such as guano. Effort = 40 person-minutes.<br>Subject land contains very few pools suitable for foraging. | | | 40 person-mins | | Does not appear to use the subject land. | |
| Barking Owl (Breeding) | *Ninox connivens* | BAM breeding survey period: May to Dec<br>Assessors should look for SIGNS OF BREEDING on site as follows; suitable habitat AND (a) presence of male and female OR (b) calling to each other (duetting) OR (c) find nest.<br>Dusk surveys to observe birds leaving roosts – twelve surveys (~30mins each) at twelve locations over eight nights in July and Sept/Oct.<br>Spotlighting on eight separate nights from July to November.<br>A total of 42 person-hours of combined active dusk/nocturnal surveys).<br>Nocturnal acoustic recorders set during July (4 units - 14 nights), Sept/Oct (2 units – 19 nights) and November (2 units – 20 nights). Total of 11 locations and 1,164 recording-hours. | ☒ Yes<br>BAM: May to Dec<br>Survey: Jul, Sep, Oct, Nov | ☐ No | dusk – 360 mins<br>nocturnal – 720 mins<br>42 person hours of combined surveys<br>Acoustic – 1,164 recording hours | No | Bionet - not known from subject land. Five records within 5km of the subject land.<br>Not likely to breed within the subject land. | No |
| Powerful Owl (Breeding) | *Ninox strenua* | Powerful Owls nest in large tree hollows in large eucalypts. While the female and young are in the | ☒ Yes | ☐ No | dusk – 240 mins | Yes | Bionet - one previous record | No |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him.<br>Assessors should look for SIGNS OF BREEDING on site as follows; suitable habitat AND (a) presence of male and female OR (b) calling to each other (duetting) OR (c) find nest.<br>Note that this species does not respond as well to call-play-back and could require stagwatching and other evidence of nesting.<br>Dusk surveys to observe birds leaving roosts (~30mins each) on four separate nights at eight separate locations in July.<br>Call playback on four separate nights at eight separate locations in July.<br>Spotlighting on four separate nights in July.<br>A total of 20 person-hours of combined active dusk/nocturnal surveys).<br>Nocturnal acoustic recorders set during July (4 units - 14 nights). Total of 4 locations and 420 recording-hours. | BAM: May to Aug<br>Survey: Jul | | call playback - eight locations<br>nocturnal – 360mins<br>20 person hours of combined surveys<br>Acoustic – 420 recording hours | | from subject land – call heard in 2018. 281 records within 5km of the subject land.<br>Powerful Owls detected by active surveys on 8th, 9th & 19th July 2020 mainly in far east of subject land, and by SongMeter on multiple occasions during November 2020 and in January 2021.<br>No likely nest tree or evidence of breeding observed.<br>Is expected to breed in the vicinity, but does | |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | | | | | | not appear to breed within the subject land. | |
| Greater Glider | *Petauroides volans* | Can be reliably detected from survey.<br>Surveys included:<br>Elliot trapping (arboreal) 11-15th January 2021: 40 traps set across all PCTs, total of 160 trap-nights.<br>Hairtube trapping (arboreal) – 15 hairtubes placed in flowering banksias 11th Jan to 1st Feb 2021, total of 300 tube-nights.<br>Infrared nocturnal camera (arboreal) 8th to 22nd July 2020: 3 cameras, 29th July to 13th August 2020: 4 cameras, 17th Sept to 6th Oct: 4 cameras, 11th Jan to 1st Feb 2021: 5 cameras. Total of 279 camera-nights.<br>Nocturnal acoustic recorders set during July (4 units - 14 nights), Sept/Oct (2 units – 19 nights) and November (2 units – 20 nights). Total of 11 locations and 1,164 recording-hours.<br>Dusk surveys at twelve locations over eight nights in July and Sept/Oct, and spotlighting on eight separate nights from July to November. Total 42 person-hours of combined active dusk/nocturnal surveys. | ☒ Yes<br>BAM: all year<br>Survey: Jul, Aug, Sep, Oct, Nov, Jan | ☐ No | Elliott arboreal – 160 trap-nights<br>Hairtube arboreal – 300 tube-nights<br>camera arboreal – 279 camera-nights<br>acoustic – 1,164 recording-hours<br>nocturnal – 42 person hours | No | Bionet - not known from the subject land and no records within 5km of the subject land.<br>Not likely to occur on the subject land. | No |
| Squirrel Glider | *Petaurus norfolcensis* | Inhabits mature old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the | ☒ Yes | ☐ No | Elliott arboreal – | No | Bionet - not known from the | No |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Requires abundant tree hollows for refuge and nest sites.<br>Surveys included:<br>Elliot trapping (arboreal) 11-15th January 2021: 40 traps set across all PCTs, total of 160 trap-nights.<br>Hairtube trapping (arboreal) – 15 hairtubes placed in flowering banksias 11th Jan to 1st Feb 2021, total of 300 tube-nights.<br>Infrared nocturnal camera (arboreal) 8th to 22nd July 2020: 3 cameras, 29th July to 13th August 2020: 4 cameras, 17th Sept to 6th Oct: 4 cameras, 11th Jan to 1st Feb 2021: 5 cameras. Total of 279 camera-nights.<br>Nocturnal acoustic recorders set during July (4 units - 14 nights), Sept/Oct (2 units – 19 nights) and November (2 units – 20 nights). Total of 11 locations and 1,164 recording-hours.<br>Dusk surveys at twelve locations over eight nights in July and Sept/Oct, and spotlighting on eight separate nights from July to November. Total 42 person-hours of combined active dusk/nocturnal surveys. | BAM: all year<br>Survey: Jul, Aug, Sep, Oct, Nov, Jan | | 160 trap-nights<br>Hairtube arboreal – 300 tube-nights<br>camera arboreal – 279 camera-nights<br>acoustic – 1,164 recording-hours<br>nocturnal – 42 person hours | | subject land. One record within 5km of the subject land from Terrey Hills in 2008 – this record is of tracks/scratchings rather than a sighting.<br>Not likely to occur on the subject land. | |
| Long-nosed Potoroo | *Potorous tridactylus* | Uses a variety of vegetation types (from heath to rainforest) across its range. It is detectable by survey | ☒ Yes | ☐ No | Elliott ground – | No | Bionet - not known from the | No |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | (e.g. camera trapping) and has relatively small home ranges.<br>It is possibly slightly easier to locate in spring but with suitable survey effort and using appropriate techniques (such as camera trapping) it should be detectable all year round. All cameras should be deployed for a minimum of 14 nights.<br>Surveys included:<br>Elliot trapping (ground) 11-15th January 2021: 69 traps set across all PCTs, total of 276 trap-nights.<br>Cage traps (ground) 11-15th January 2021: 6 traps, total of 24 trap-nights.<br>Hairtube trapping (ground) Jul 2020, Sep/Oct 2020, Nov 2020, Jan 2021: no. of tubes set each period varied from 15 to 52, total of 2,390 tube-nights.<br>Infrared nocturnal camera (ground) July 2020: 6 cameras, Nov 2020: 4 cameras. Total of 199 camera-nights.<br>Dusk surveys and spotlighting – 33 person-hours<br>Ground searches for herpetofauna and Koala SAT included looking for diggings. Approx 690 person-minutes of ground searches were conducted at 11 locations in July/Aug and Sept/Oct. | BAM: all year<br>Survey: Jul, Aug, Sep, Oct, Nov, Jan | | 276 trap-nights<br>Cage ground – 24 trap-nights<br>Hairtube ground – 2,390 tube-nights<br>camera ground –<br>nocturnal – 33 person-hours<br>ground searches – 690 person-minutes | | subject land and no records within 5km of the subject land.<br>Not likely to occur. | |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| Koala | *Phascolarctos cinereus* | Surveys included:<br>Infrared nocturnal camera (ground) July 2020: 6 cameras, Nov 2020: 4 cameras. 199 camera-nights.<br>Infrared nocturnal camera (arboreal) 8th to 22nd July 2020: 3 cameras, 29th July to 13th August 2020: 4 cameras, 17th Sept to 6th Oct: 4 cameras, 11th Jan to 1st Feb 2021: 5 cameras. Total of 279 camera-nights.<br>Nocturnal acoustic recorders set during July (4 units - 14 nights), Sept/Oct (2 units – 19 nights) and November (2 units – 20 nights). Total of 11 locations and 1,164 recording-hours.<br>Dusk surveys and spotlighting in Jul, Sep, Oct, Nov 2020 – 33 person-hours.<br>Koala Scat Assessment Technique - approx 510 person-minutes of ground searches were conducted at 8 locations in Sept/Oct 2020. | ☒ Yes<br>BAM: all year<br>Survey: Jul, Aug, Sep, Oct, Nov, Jan, Feb | ☐ No | Nocturnal cameras – 478 camera nights<br>Nocturnal acoustic recording – 1,164 recording-hours<br>Nocturnal surveys – 33 person hours<br>SAT – 8 locations – 510 person-minutes | No | Bionet - not known from the subject land.<br>Does not appear to reside within the subject land.<br>Noted as likely to be a vagrant within the deferred lands in the Arcadis Australia Pacific *Pty Ltd*, (2021) report to Northern Beaches Council. | No |
| Red-crowned Toadlet | *Pseudophryne australis* | Inhabits periodically wet drainage lines below sandstone ridges in open forests on sandstone.<br>Relevant surveys included:<br>1,280mins of aural-visual searches along 750m of transect, with transects surveyed on 8 separate days in Nov 2020.<br>480 mins (10mins per pool) dip-netting for tadpoles in pools along Snake & Lizard Creeks in Dec 2020. | ☒ Yes<br>BAM: all year<br>Survey: Nov, Dec | ☐ No | 1,280 mins searches<br>480 mins dip-netting | Yes | Has previously been recorded within the subject land and was recorded during Hayes Env general and opportunistic surveys in 2020. | Yes |

| Common name | Scientific name | Threatened fauna species surveys | | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| Masked Owl (Breeding) | *Tyto novaehollandiae* | Lives in dry eucalypt forests and woodlands. Often hunts along the edges of forests. Roosts and breeds in moist eucalypt forested gullies.<br>Dusk surveys to observe birds leaving roosts (~30mins each) on four separate nights at eight separate locations in July.<br>Call playback on four separate nights at eight separate locations in July.<br>Spotlighting on four separate nights in July.<br>A total of 20 person-hours of combined active dusk/nocturnal surveys).<br>Nocturnal acoustic recorders set during July (4 units - 14 nights). Total of 4 locations and 420 recording-hours. | ☒ Yes<br>BAM: May to Aug<br>Survey: Jul | ☐ No | dusk – 240 mins<br>call playback – 8 locations<br>combined nocturnal – 20 person-hours.<br>Acoustic – 420 recording-hours | No | Bionet - not known from subject land. Three records within 5km of the subject land, all from the Terrey Hills area in 2019.<br>Does not appear to breed within the subject land. | No |
| Sooty Owl (Breeding) | *Tyto tenebricosa* | Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts in the hollow of a tall forest tree or in heavy vegetation. Nests in very large tree-hollows.<br>Dusk surveys to observe birds leaving roosts (~30mins each) on four separate nights at eight separate locations in July.<br>Call playback on four separate nights at eight separate locations in July. | ☒ Yes<br>BAM: Apr to Aug<br>Survey: Jul | ☐ No | dusk – 240 mins<br>call playback – 8 locations<br>combined nocturnal – 20 person-hours.<br>Acoustic – 420 | No | Bionet - not known from subject land. Two records within 5km of the subject land, downstream along Oxford Creek. | No |

| Common name | Scientific name | Threatened fauna species surveys | | | Present | | Further assess requ'd (BAM 5.2.5 & 5.2.6) |
|---|---|---|---|---|---|---|---|
| | | **Survey method** (e.g. harp trap, Elliott trap, bioacoustics, etc.) | **Timing of survey – within recommended period?** (BAM-C / TBDC) | **Effort** (hours & no. people) | **Survey result** | **Comments & Context** | |
| | | Spotlighting on four separate nights in July.<br>A total of 20 person-hours of combined active dusk/nocturnal surveys).<br>Nocturnal acoustic recorders set during July (4 units - 14 nights). Total of 4 locations and 420 recording-hours. | | recording-hours | | Subject land does not contain typical habitat but is likely to be part of a foraging range for a known breeding pair along Oxford Creek (Mr Brendan Smith, *pers comm*).<br>Does not appear to breed within the subject land. | |

## 5.4 Expert reports

No Expert Reports have been used or relied upon for this assessment.

Specialists were consulted and assisted with surveys during appropriate seasons for threatened amphibians (Dr Marion Anstis) and threatened waxcap fungi (Dr Ray Kearney).

## 5.5 More appropriate local data (where relevant)

No local data has been used in this assessment in place of data contained within the TBDC and BAM-C.

## 5.6 Area or count, and location of suitable habitat for a species credit species (a species polygon)

Species polygons for species assumed or determined to be present are shown on Figure 9 (Species Credit Species Polygons).

**Table 17 Results for species assumed or determined to be present within the subject land.**

| **Common name** | **Scientific name** | **Biodiversity risk weighting** (BAM-C & TBDC*) | **SAII entity**** (BAM-C & TBDC) | **Habitat constraints / microhabitats present on the subject land / vegetation zone** | **Abundance – No. individual plants present on subject land** (flora with unit of measure of count) | **Extent (ha) of suitable habitat present on site** (flora or fauna with unit of measure of area) | **TBDC species specific recommendations e.g. buffers, general comments** (where relevant) | **Habitat condition** (vegetation integrity score for each vegetation zone in the polygon – area species only) |
|---|---|---|---|---|---|---|---|---|
| Eastern Pygmy-possum | *Cercartetus nanus* | High (2) | No | Appears to use all habitats within the subject land. | n/a | 44.68 ha<br>(17.5ha of PCT 1783, 16.2ha of PCT 1250 & 11.0ha of PCT 1824) | n/a | 1250: 55.7<br>1783: 49.4<br>1824: 63.4 |

| **Common name** | **Scientific name** | **Biodiversity risk weighting** (BAM-C & TBDC*) | **SAII entity**** (BAM-C & TBDC) | **Habitat constraints / microhabitats present on the subject land / vegetation zone** | **Abundance – No. individual plants present on subject land** (flora with unit of measure of count) | **Extent (ha) of suitable habitat present on site** (flora or fauna with unit of measure of area) | **TBDC species specific recommendations e.g. buffers, general comments** (where relevant) | **Habitat condition** (vegetation integrity score for each vegetation zone in the polygon – area species only) |
|---|---|---|---|---|---|---|---|---|
| Red-crowned Toadlet | *Pseudophryne australis* | Moderate (1.5) | No | Based on 100m buffer from suitable drainage lines (DPIE Survey Guide), being those drainage lines associated with Hayes Env and Bionet records of the species.<br>It is assumed that toadlets using Lizard Creek would not cross Morgan Road | n/a | 16.72 ha<br>(6.0ha of PCT 1783, 6.9ha of PCT 1250 & 3.9ha of PCT 1824) | n/a | 1250: 55.7<br>1783: 49.4<br>1824: 63.4 |
| *Tetratheca glandulosa* | *Tetratheca glandulosa* | High (2) | No | Species polygons based on a 30m buffer around the groups of individuals. | n/a | 0.24 ha (0.13ha of PCT 1783 & 0.11ha of PCT 1824) | n/a | 1783: 49.4<br>1824: 63.4 |
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | Moderate (1.5) | No | Assumed to be a 1 ha patch of PCT 1783 | n/a | 1ha<br>(PCT 1783) | n/a | 1783: 49.4 |

**Table 18 Results for EPBC Act listed species assumed or determined to be present within the subject land.**

| **Common name** | **Scientific name** | **Abundance – No. individual plants present on subject land** (flora with unit of measure as count) | **Extent (ha) of suitable habitat present on site** (flora or fauna with unit of measure as area) |
|---|---|---|---|
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | n/a | assumed extent – 1 hectare (PCT 1783). |

# 6. Identifying prescribed impacts

**Table 19 Prescribed impacts identified**

| Feature | Present | Description of feature characteristics and location | Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC or EC, that are at risk of vehicle strike |
|---|---|---|---|
| Karst, caves, crevices, cliffs, rocks or other geological features of significance | ☒Yes / ☐No | The subject land contains substantial areas of sandstone rock outcropping with associated escarpments, crevices, caves, overhangs *etc*. These features are scattered across the land, with larger areas visible on aerial imagery | Deeper caves and crevices may be used for roosting by microchiropteran bats such as the Little Bent-wing Bat and Eastern Bent-wing Bat.<br>Rock features may be used for shelter by the threatened Rosenberg's Goanna.<br>Caves may also be used as den sites by the Spotted-tailed Quoll. |
| Human-made structures | ☐Yes / ☒No | n/a | n/a |
| Non-native vegetation | ☐Yes / ☒No | Exotic vegetation present is not likely to be of value for any threatened species. | n/a |
| Habitat connectivity | ☒Yes / ☐No | Development of the site would increase fragmentation of habitats in the assessment area. | Most threatened species, but particularly, Eastern Pygmy-possum, Yellow-bellied Glider, Red-crowned Toadlet, Spotted-tailed Quoll, New Holland Mouse and Koala. |
| Waterbodies, water quality and hydrological processes | ☒Yes / ☐No | There are ephemeral flow paths within subject land draining to the permanent Snake Creek.<br>There is a lesser likelihood of impact on water bodies downstream of the site. These, however, have been identified as of importance for a range of additional threatened entities and are also considered in this assessment. | The Red-crowned Toadlet is known to inhabit ephemeral drainage paths within the subject land.<br>Other threatened species predicted or known to use the subject land are likely to use water features within the subject land, though would not be reliant on particular features. |
| Wind turbine strikes (wind farm development only) | ☐Yes / ☒No | n/a | n/a |

| Feature | Present | Description of feature characteristics and location | Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC or EC, that are at risk of vehicle strike |
|---|---|---|---|
| Vehicle strikes | ☒Yes / ☐No | The proposed development would create new roads surrounding and within retained areas of habitat, and would increase vehicle numbers on the local road system.<br>There would be an increased risk of vehicle strikes on threatened fauna that reside on the site and within adjacent lands, particularly terrestrial species. | Terrestrial species are most at risk, such as the Red-crowned Toadlet, Rosenberg's Goanna, New Holland Mouse, and Spotted-tailed Quoll.<br>The Eastern Pygmy-possum may also be at risk in fragmented landscapes. |

# Stage 2: Impact assessment (biodiversity values and prescribed impacts)

## 7. Avoid and minimise impacts

### 7.1 Avoid and minimise direct and indirect impacts

#### 7.1.1 Project location

The Metropolitan Local Aboriginal Land Council (MLALC) owns a significant amount of land totalling approximately 912 hectares across 25 LGAs, including 621 hectares in the Northern Beaches LGA.

An independent strategic assessment of (MLALC) landholdings in the Northern Beaches LGA was prepared in 2020 by Gyde Consulting, in association with Craig & Rhodes, Travers Bushfire and Ecology, JMT Consulting and in consultation with the MLALC. The strategic assessment was peer reviewed by Barr Property and Planning (October 2021).

The strategic assessment involved three phases:

1. Contextual analysis within the MLALC portfolio;
2. Site specific review of constraints and opportunities, including high level strategic assessment of flora and fauna;
3. Priority site assessment.

A key conclusion of the strategic assessment was that the Patyegarang Project site (the subject property) is the highest priority for action in the short term.

The *Northern Beaches Aboriginal Land Development Delivery Plan* (DDP) was subsequently prepared by the NSW Department of Planning & Environment (DPE) in accordance with *State Environmental Planning Policy (Planning Systems) 2021*. The DDP considers the high-level opportunities and constraints associated with future development of six sites within the Northern Beaches LGA.

The DDP states, "*Only the 71ha Lizard Rock* [now referred to as the Patyegarang Project] *site is currently endorsed by MLALC members and the NSW ALC to be actively investigated for land dealing. The intention is that future development potential at Lizard Rock will provide an income stream to fund the goals identified in the Community Land Business Plan*".

Documents relevant to the site selection process include:

* *Strategic Assessment, Metropolitan Local Aboriginal Land Council Landholdings* (Gyde Consulting, October 2021).
* *Review of Strategic Assessment, Metropolitan LALC landholdings in Northern Beaches LGA* (Bar Planning, October 2021).

* *Northern Beaches Aboriginal Land, Development Delivery Plan* (NSW DPE, June 2022). Figure 10 of the DDP shows the MLALC landholdings in the Northern Beaches LGA, indicating which sites were considered in the strategic assessment but not included in the Planning Systems SEPP, and which sites are now included in the Planning Systems SEPP.

The Planning Proposal assessed in this BDAR has been prepared to implement the DDP for the subject property.

A preliminary Structure plan was prepared in response to biodiversity values and constraints identified during the strategic assessment process, and through preliminary field surveys conducted by Hayes Environmental (2020-2021). Biodiversity values prioritised for avoidance were:

i. Land mapped on the NSW Biodiversity Values Map, being limited within the subject property to that associated with the Snake Creek riparian corridor.

ii. Connectivity values of the subject property, particularly the Snake Creek riparian corridor. It was noted that eastern parts of the subject property are more substantially embedded in the large remnant patch of native vegetation which extends to the east, than western areas which adjoin existing residential development.

iii. Known habitat for threatened plant species - currently two locations of *Tetratheca glandulosa*.

iv. Known habitat for threatened fauna species, particularly the Red-crowned Toadlet and Eastern Pygmy-possum which are known to be resident within the site and are less mobile than other species known to be present (Bionet Atlas records and current survey results).

v. Water quality within and downstream of the subject property, noting that Snake Creek and Oxford Creek downstream of the property contain high aquatic biodiversity values.

vi. Ridgetop rock platforms supporting low woodland and heath which have historically been more heavily impacted in the assessment area than other landscape and vegetation formations.

The broad level result was a preliminary Structure Plan which clustered residential precincts in the north and west of the subject property, retaining lands in the southeast as a future conservation zone, and retaining a riparian corridor along Snake Creek. The Patyegarang site within the property was identified as an important cultural zone and a focal point for creation of an Aboriginal cultural centre.

The more recent *Biodiversity Assessment of Deferred Lands, Stage 1* report prepared for Northern Beaches Council (Arcadis Australia Pacific *Pty Ltd*, 2021) includes a discussion of biodiversity values of the deferred lands and prioritises those values for conservation. The report ranks the values in order of importance, as follows:

*i. Threatened species habitat (extent and quality).*

*ii. Threatened ecological communities (extent and quality).*

*iii. Proximity to protected bushland.*

*iv. Wildlife corridors.*

*v. Riparian land/water sustainability.*

Of these five priority values, two are not of relevance to the subject property (threatened ecological communities and proximity to protected bushland), and the remaining three were already prioritised for avoidance within the draft Structure Plan.

The draft Structure Plan thus applies an avoidance strategy consistent with the Arcadis Australia Pacific *Pty Ltd* (2021) report.

The subsequent *Biodiversity Assessment of Deferred Lands, Stage 2* report prepared for Northern Beaches Council (Arcadis Australia Pacific *Pty Ltd*, 2022) applies the ranking of biodiversity values developed in Stage 1 to the deferred lands. The report assigns the deferred lands to four conservation value levels using information gained from Stage 1, supplemented with field surveys and investigation conducted during Stage 2:

- Purple (very high) – large number of threatened species records, presence of TECs, adjacent to national park, stream orders 3-5.
- Red (high) – multiple threatened species records, PCTs that are not TECs, wildlife corridors, stream orders 1-2.
- Orange (moderate) – threatened flora or threatened fauna records, green spaces not classed as a PCT, disturbed native vegetation buffers.
- Green (low) – no threatened species records, urban areas.

The majority of the deferred lands (52%) contain native vegetation with threatened species records, and were accordingly classed as 'red'.

The Arcadis Australia Pacific *Pty Ltd* (2022) report states:

> "*Many of the areas of highest ecological value will likely be inaccessible for development, due to the steep and rugged nature of the area as well as bushfire risk. However, other areas also contain high or very high ecological values, especially along creeks and in areas with vegetation mapped as TECs. Areas mapped as low ecological value are generally already cleared, and mostly developed. Moderate ecological values consist primarily of buffers around urbanised locations that generally show moderate levels of disturbance and few threatened species records*."

Most of the subject property is classed red, with the western and northern edges classed orange, bordering green, and land through the centre of the property either side of Morgan Road classed orange. The southern section of the Snake Creek riparian corridor is mapped purple to a distance of 50m from the creekline. The patch of PCT 1803 mapped within the subject property (Sydney Metro Area v3.1 2016) is also classed purple, on the basis of being a TEC (Coastal Upland Swamp). This mapping, however, was found during Hayes Environmental field survey to be incorrect. The vegetation is not a TEC, so application of the Arcadis Australia Pacific *Pty Ltd* (2022) conservation value criteria would class the land as red, consistent with surrounding areas.

The avoidance of impact strategy embodied in the draft Structure Plan is consistent with the recent Arcadis Australia Pacific *Pty Ltd* (2022) report, in that:

- Residential precincts are arranged across the northern and western parts of the subject property, using areas classed orange and adjacent areas classed red. The development zone is set well back from the corridor classed purple along Snake Creek in the south.
- A broad corridor of vegetation would be retained along Snake Creek, with a buffer of intact vegetation extending to approximately 100m from the creek along the section classed 'purple' (twice the buffer applied in the classification).
- The southern section of the subject property, including and adjacent to the land classed 'purple', would be assigned to a conservation zone. The conservation zone would be further buffered from residential precincts by approximately 60m of bushfire asset protection zone.
- The draft Structure Plan incorporates a strong stormwater management design to ensure that Snake Creek experiences no notable change in the hydrological regime, and to meet downstream water quality improvement objectives for the precinct.

### 7.1.2 Project design

*Draft Structure Plan*

The preliminary Structure Plan was amended and refined in response to ongoing biodiversity surveys and research to further avoid and minimise impacts on priority biodiversity values, to produce the current draft Structure Plan (Cox, 2022) submitted with the Planning Proposal:

*Connectivity*

- The retained riparian corridor along Snake Creek was broadened, particularly in the south where it connects to the conservation zone, to better maintain connectivity and protect water quality. Most of the corridor is substantially broader than the minimum setbacks required based on Strahler stream classification (1$^{st}$ order - 10m either side from top of bank) – the corridor is generally 40m wide in the north, 100m wide in the south, and >200m wide in the southeast where Snake Creek forms the boundary of the subject property (approximately 100m of the width of the corridor is within the subject property).
- The draft Structure Plan was compared against the findings and recommendations of the recent Northern Beaches Council Biodiversity Planning Review (SMEC, December 2021). There is a general consensus of information presented in the document in relation to corridors:
  - It is generally agreed that a minimum of 30-40m width achieves a threshold level for corridor value and use, with another threshold for use reached at a width of 80-100m. The draft Structure Plan is consistent with this approach.
  - Shorter corridors are better. The SMEC (2021) report does not discuss specifications relevant to this principle. The narrower section of the corridor within the draft Structure Plan (~40m wide) is approximately 400m in length.
  - Corridors should connect and incorporate a diverse range of vegetation communities. The Snake Creek corridor is essentially a riparian corridor containing PCT 1250. Other PCTs are retained as smaller reserves within the development zone of the draft Structure Plan, with provision for some connectivity to the main Snake Creek corridor. Larger extents of intact

PCT 1783 and PCT 1824 are present in the conservation zone across the east of the subject property and would retain connectivity to the lower section of the Snake Creek corridor where it converges with Oxford Creek.

- Corridors that are part of a network are more valuable than single or dead-end corridors. The Snake Creek corridor links to fragmented vegetation within residential areas to the northwest, and with some minor gaps, loops back to the extensive areas of remnant vegetation to the northeast of the subject property. The corridor also provides opportunity for connection of smaller reserves within the subject land. The draft Structure Plan retains good connectivity to the north, south and east, and provides for some limited connectivity to the west (towards the existing residential area).

* The SMEC (2021) report also identifies that structurally and floristically simple open space areas may provide important connectivity roles, being hostile to predators and offering refuge habitat. The draft Structure Plan contains wide open space buffers (incorporating bushfire asset protection zones) that are additional to retained native vegetation along the Snake Creek corridor. The total width of the corridor (including open space) in the south of the subject property varies from 130m to 280m. The total width of the corridor in the southeast where Snake Creek forms the boundary of the subject property is around 350m to 400m, with approximately 160m of the width within the subject property.

*Threatened species habitat*

* Two areas of known habitat for *Tetratheca glandulosa* were designated as 'retained native vegetation' within the draft Structure Plan. One population is on the western fringe of the subject property and the other is just north of the Patyegarang rock feature. Retention of the Patyegarang population required relocation of the proposed Aboriginal Cultural Centre and modification to bushfire APZs.

* Several corridors of native vegetation along natural ephemeral flow paths on the western side of Snake Creek were designated as 'retained native vegetation' to provide opportunity for protection of Red-crowned Toadlet habitat. The size and width (~20m) of these corridors was limited to reduce bushfire risk and avoid requirement for management of the corridors as bushfire asset protection zone. A vegetation management plan will be required at the detailed development application stage to ensure appropriate ongoing protection of these areas.

* The draft Structure Plan was compared against the findings and recommendations of the recent Northern Beaches Council Biodiversity Planning Review (SMEC, December 2021) in relation to the value of retaining smaller patches of native vegetation. The document discusses the relationship of patch size with biodiversity value, finding:

  - A general consensus that 3.5 to 5 hectares is a threshold value below which species diversity declines rapidly. The Patyegarang patch of retained native vegetation within the draft Structure Plan is approximately 4 hectares in size. This is consistent with scientific opinion for the minimum patch size for an area to be classed as 'core habitat'. The smaller reserves along western drainage paths do not meet this size threshold. The size and shape of these patches is a compromise between protecting specific values associated with the drainage paths, and not creating a bushfire hazard within the residential precinct.

- Perimeter to area ratio has a negative impact on species richness. The Patyegarang patch is broadly an oval shape, with a reasonable perimeter to area ratio. Three sides of the patch would be bordered by perimeter roads to minimise edge-effects associated with residential development. The patch is also upslope of residential precincts and would not be affected by stormwater run-off from residential areas or roads. The smaller reserves along western drainage paths would require ongoing management to minimise edge-effects on biodiversity values.
- Connectivity of a patch has a positive impact on species richness, albeit of lesser importance than the above principles. All areas of retained vegetation within the development zone have some connection to the Snake Creek corridor. Further consideration of this principle will be required at the detailed development application stage.

*Riparian protection and water quality*

* Increased size of the riparian corridor and buffers along Snake Creek, particularly in the south where it connects to the conservation zone, to better protect water quality.
* Bushfire asset protection zones provide a 'green' buffer typically >60m in distance between residential precincts and the conservation zone, increasing opportunity for management of water flows and water quality from the development zone. APZs do not encroach into the conservation zone (or into areas designated as 'retained vegetation' within the development zone).
* Stormwater design to ensure that Snake Creek experiences no notable change in the hydrological regime, and to meet downstream water quality improvement objectives for the precinct.

*Future detailed development design stage*

Further design features for inclusion at the more detailed development application stage have been considered and discussed.

Specific threatened species habitat measures considered include:

* Preparation of a Vegetation Management Plan for areas of 'retained vegetation' within the development zone.
* Specific location and design of stormwater discharge points to avoid impacts on known habitat for the Red-crowned Toadlet and minimise impact on natural hanging swamp features within ephemeral flow paths.
* Limiting of pedestrian access to areas of habitat for the Red-crowned Toadlet and for threatened plants (such as the two known locations of *Tetratheca glandulosa*), to avoid trampling or picking.

Additional specific stormwater management features considered include:

* Protecting and retaining active natural flow paths, where possible.
* Mimicking natural stormwater flows by minimising impervious areas and reusing rainwater.

- Harvesting and filtration of stormwater, including reuse where possible, with passive irrigation & bioretention features.
- Providing water treatment measures that replicate the natural water cycle, such as green spaces.
- Controlled discharge of stormwater to match existing water movements into snake creek.
- Controlled overland flows to reduce erosion and impacts on flora & fauna as well as eliminate the risk of flooding.

General design features considered include:

- Preparation of a precinct bushfire APZ management plan that facilitates replacement of canopy trees and maintains natural diversity in the groundlayer, to maintain vegetation integrity in the long term and preserve the buffer value of the outer APZ to the conservation zone.
- Design of footpaths, bollards and fencing to limit and control pedestrian access to areas of retained vegetation.
- Installation of traffic control devices and street lighting to reduce risk of vehicle collision with native animals at identified higher risk locations.
- Designation of building envelopes on some larger lots to protect existing rock features and minimise site disturbance.
- Controls on external lighting from dwellings overlooking native vegetation to avoid indirect impacts on fauna habitat.

## 7.2 Avoid and minimise prescribed impacts

Prescribed impacts associated with the subject land include:

- impacts on sandstone rock features containing shallow caves and crevices;
- impacts on connectivity;
- impacts on water quality and hydrological features;
- increased likelihood of vehicle strikes on threatened native fauna;

Project location and design to avoid and minimise prescribed impacts is discussed in Chapter 7.1 above.

More specific design details would be incorporated at the development application stage and discussed in a final BDAR at this time.

## 7.3 Other measures considered

No other broad measures at the Structure Plan scale were considered and not selected for implementation.

A range of fine-scale location and design measures have been considered for implementation at the development application stage, as discussed in Chapter 7.1 above.

## 7.4 Summary of measures to avoid and minimise impacts

**Table 20 Avoidance and minimisation measures for direct, indirect and prescribed impacts**

| Action | Outcome (Describe the outcome of implementing the measure, with reference to specific entities identified in Sections 4 and 5) | Timing | Responsibility |
|---|---|---|---|
| Establish a conservation zone across the southeast of the subject property | Protect 19.8 hectares of intact bushland and threatened species habitat for conservation | Planning Proposal | Proponent |
| Retain native vegetation along Snake Creek and associated western flow paths | Maintain connectivity, retain habitat for the Red-crowned Toadlet and protect water quality | Structure Plan | Proponent |
| Use of perimeter roads around residential areas | To minimise edge-effects and avoid long-term encroachment of the development | Structure Plan & DA stage | Proponent |
| Retain habitat for *Tetratheca glandulosa* | Protection of approximately 1 ha of known habitat for *Tetratheca glandulosa* at two locations | Structure Plan & DA stage | Proponent |
| Stormwater design and installation of water quality control features | Protection of water quality within and downstream of the subject land. | DA stage | Proponent |
| Sensitive design and maintenance of bushfire APZs. | Minimise extent of impact on native vegetation and habitats, and to provide an effective buffer to the conservation zone. | DA stage | Proponent |

# 8. Impact assessment

## 8.1 Direct impacts

### 8.1.1 Residual direct impacts

The extent of residual direct impacts on native vegetation is shown on Figure 3 (Draft Structure Plan).

**Table 21 Summary of residual direct impacts**

| **Direct impact** (Describe the impact on PCT/TEC/EC or threatened species and their habitat) | **BC Act status** | **EPBC Act status** | **SAII entity** | **Project phase/timing of impact** (e.g. construction, operation, rehabilitation) | **Extent** (ha, number of individuals) |
|---|---|---|---|---|---|
| PCT 1250 - loss of native vegetation | not listed | not listed | No | construction | 16.2 ha |
| PCT 1783 - loss of native vegetation | not listed | not listed | No | construction | 17.5 ha |
| PCT 1824 - loss of native vegetation | not listed | not listed | No | construction | 11.0 ha |
| Eastern Pygmy-possum – loss of habitat | V | not listed | No | construction | 44.68 ha |
| Red-crowned Toadlet – loss of habitat | V | not listed | No | construction | 16.72 ha |
| *Tetratheca glandulosa* – loss of habitat and potential loss of individuals | V | not listed | No | construction | 0.24 ha |
| *Cryptostylis hunteriana* - assumed loss of individuals and habitat | V | V | No | construction | 1.0 ha |

### 8.1.2 Change in vegetation integrity score

**Table 22 Impacts to vegetation integrity**

| Vegetation zone | PCT ID | Management zone | Area (ha) | Before development | | | | After development | | | | Change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Composition | Structure | Function | VI score | Composition | Structure | Function | VI score | Change in VI score |
| 1250 | 1250 | Cleared | 15.74 | 98.3 | 24.9 | 70.5 | 55.7 | 0 | 0 | 0 | 0 | -55.7 |
| 1250 | 1250 | outer APZ | 0.44 | 98.3 | 24.9 | 70.5 | 55.7 | 38.3 | 3.1 | 27.4 | 14.8 | -40.9 |
| 1783 | 1783 | Cleared | 15.91 | 88.6 | 21.8 | 62.4 | 49.4 | 0 | 0 | 0 | 0 | -49.4 |
| 1783 | 1783 | outer APZ | 1.59 | 88.6 | 21.8 | 62.4 | 49.4 | 31.8 | 4.5 | 22.8 | 14.8 | -34.6 |
| 1824 | 1824 | Cleared | 10.39 | 99.1 | 33.0 | 78.0 | 63.4 | 0 | 0 | 0 | 0 | -63.4 |
| 1824 | 1824 | outer APZ | 0.64 | 99.1 | 33.0 | 78.0 | 63.4 | 40.8 | 4.5 | 36.1 | 18.8 | -44.6 |

Outer APZs would be created and maintained at a broad development scale (not individual lot scale) in accordance with an APZ Management Plan (to be prepared and approved at the development application stage). The management plan would be designed to permit replacement of canopy trees and to maintain natural diversity in the groundlayer, to maintain vegetation integrity in the long term and preserve the buffer value of the outer APZ to the conservation zone.

Specific details and integrity values of the outer APZ would be refined at the DA stage.

## 8.2 Indirect impacts

The draft Structure Plan would retain 6.9 hectares of native vegetation and habitat in various reserves and corridors within the development zone. These areas are likely to be affected by indirect impacts of the development.

The proposed conservation zone would be buffered from residential areas by perimeter roads and substantial APZs (typically >60m in distance between residential precincts and the conservation zone) to avoid indirect impacts from future development. Outer protection areas would be managed to preserve their value as conservation buffers.

**Table 23 Summary of residual indirect impacts**

| **Indirect impact** (Describe impact, e.g. transport of weeds and pathogens form the site to adjacent vegetation) | **Impacted entities** (PCT/threatened entity and their habitats and where relevant, EPBC Act listing) | **Extent** (ha or zone reference) | **Frequency** | **Duration** (long-term/ short-term/ medium-term) | **Project phase/ timing of impact** (e.g. construction, operation, rehabilitation) | **Likelihood and consequences** |
|---|---|---|---|---|---|---|
| Inadvertent physical damage to vegetation retained in various reserves and corridors within the development zone. | PCT 1250 | 2.87 | unlikely | ongoing | construction, occupation | Higher risk during construction, lower ongoing risk during occupation.<br>Damage or loss of additional vegetation and habitat |
| | PCT 1783 | 1.52 | unlikely | ongoing | construction, occupation | |
| | PCT 1824 | 2.21 | unlikely | ongoing | construction, occupation | |
| | Eastern Pygmy-possum | 6.9 | unlikely | ongoing | construction, occupation | |
| | Red-crowned Toadlet | 2.0 | unlikely | ongoing | construction, occupation | |
| | *Tetratheca glandulosa* | 1.0 | unlikely | ongoing | construction, occupation | |
| Reduced viability of habitat due to edge effects, noise, dust or light spill | PCT 1250 | 2.9 | unlikely | ongoing | occupation | Variable risk across different reserves. |
| | PCT 1783 | 1.5 | unlikely | ongoing | occupation | |
| | PCT 1824 | 2.2 | unlikely | ongoing | occupation | |

| **Indirect impact** (Describe impact, e.g. transport of weeds and pathogens form the site to adjacent vegetation) | **Impacted entities** (PCT/threatened entity and their habitats and where relevant, EPBC Act listing) | **Extent** (ha or zone reference) | **Frequency** | **Duration** (long-term/ short-term/ medium-term) | **Project phase/ timing of impact** (e.g. construction, operation, rehabilitation) | **Likelihood and consequences** |
|---|---|---|---|---|---|---|
| | Eastern Pygmy-possum | 6.9 | unlikely | ongoing | occupation | Reduced quality of habitat retained within the development zone for some species |
| | Red-crowned Toadlet | 2.0 | unlikely | ongoing | occupation | |
| Spread of diseases and weeds | PCT 1250 | 2.9 | unlikely | ongoing | construction, occupation | Can be managed and avoided during construction.<br>Increase to existing risk during occupation. |
| | PCT 1783 | 1.5 | unlikely | ongoing | construction, occupation | |
| | PCT 1824 | 2.2 | unlikely | ongoing | construction, occupation | |
| Trampling/picking of threatened flora species | *Tetratheca glandulosa* | 1.0 | unlikely | ongoing | construction, occupation | Can be managed and avoided during construction.<br>Slight increase to existing risk during occupation. |
| Removal of rocks for use in landscaping | Red-crowned Toadlet | 2.0 | unlikely | ongoing | occupation | Can be managed and avoided during construction.<br>Slight increase to existing risk during occupation. |
| Increase in predators | Eastern Pygmy-possum | 6.9 | unlikely | ongoing | occupation | Increase to existing risk during occupation. |
| | Red-crowned Toadlet | 2.0 | unlikely | ongoing | occupation | |

## 8.3 Prescribed impacts

### 8.3.1 Karst, caves, crevices, cliffs, rocks or other geological features of significance

Rock features are characteristic of the Hawkesbury sandstone landscape and are prominent throughout most of the nearby vegetated lands (66% of the assessment area), including within Garigal and Kur-ring-gai Chase National Parks.

Rock features occur throughout both the development zone (51ha) and the conservation zone (20ha) of the subject property.

*During construction:*

Rock outcropping within APZs and reserve areas within the development zone would largely be retained (approx. 20ha of land). Rock outcropping within residential precincts and road reserves would substantially be removed or disturbed (approx. 31ha of land – 44% of the subject property).

The impacts on threatened species identified as likely to use these features would be:

* Rosenberg's Goanna – this species is known to occur within the study area and is predicted to use rock crevices within the subject land for shelter. It also shelters in hollow logs and burrows. It breeds in termite nests. Likely impact: loss of non-breeding shelter sites across ~31ha (44% of the subject property).
* Little & Eastern Bent-wing Bats – these species are known to occur within the study area and may use features present within the subject land for shelter during the non-breeding season. However, bat survey work within the study area does not indicate the species are resident within the subject land, or that large numbers are present (based on number and timing of calls). No important roost caves were found during surveys and targeted searches. Potential impact: loss of non-breeding shelter sites across ~31ha (44% of the subject property).
* Spotted-tailed Quoll – this is an ecosystem credit species predicted to occur (BAM-C), but has not been recorded within the study area. There are 17 records within 5km of the subject land so it is probable it would occur on the land on occasions. This species uses caves as den sites. It also uses hollow trees and logs and burrows. No den sites, latrines or indirect evidence were found during targeted searches. Potential impact: loss of den sites across ~31ha (44% of the subject property).

*During occupation:*

Rock outcropping within APZs and some open space areas would be subject to ongoing disturbance through APZ maintenance works and trampling by site occupants. These impacts could be minimised and mitigated through management plans prepared for the detailed development application stage.

### 8.3.2 Habitat connectivity

*During construction:*

The extent of clearing proposed would have an impact on general connectivity of habitats across the landscape.

Residential precincts have been positioned at the edge of the large remnant area of native vegetation, such that connectivity would be retained around the development zone.

Some connectivity would also be retained within and through the development zone along drainage corridors and within reserves. These would continue to be used by more disturbance-tolerant species.

The majority of threatened species predicted or known to occur within the subject land are highly mobile or wide-ranging species not likely to be significantly affected by the impacts on connectivity.

Threatened species more likely to be affected are:

* Eastern Pygmy-possum – this species currently uses most of the subject property. It would not be expected to continue to use the smaller reserves within the subject land. Retained vegetation within the conservation zone and along Snake Creek would have sufficient connectivity to maintain habitat values for this species. Impacts on connectivity would not be significant for this species.
* Yellow-bellied Glider – this is an ecosystem credit species predicted to occur (BAM-C), but which has not been recorded in the study area or within 5km of the subject land (Bionet). No indirect evidence such as distinctive chew marks were observed within the study area. This species is not believed to be present within the study area. It is associated with PCT 1250, which is the primary PCT of the Snake Creek riparian corridor and the conservation zone. Retained vegetation in these areas would have sufficient connectivity to maintain habitat values for this species. Impacts on connectivity would not be significant for this species.
* Red-crowned Toadlet – movement of individuals associated with local populations retained within the western flow path corridors would be restricted to the vegetated corridors. The extent and significance of this impact is not known. Populations retained within the conservation zone would not be affected by impacts on connectivity.
* Spotted-tailed Quoll – this is an ecosystem credit species predicted to occur (BAM-C), but has not been recorded within the study area. There are 17 records within 5km of the subject land so it is probable it would occur on the land on occasions. This species has been shown to use highly fragmented landscapes and is known to traverse their home ranges along densely vegetated creeklines. Impacts on connectivity would not be significant for this species.
* New Holland Mouse – this is an ecosystem credit species predicted to occur (BAM-C), but which has not been recorded in the study area. There are 7 records within 5km of the subject land (Bionet). If present, it would not be expected to continue to use the smaller reserves within the subject land. Retained vegetation within the conservation zone and along Snake Creek would have sufficient connectivity to maintain habitat values for this species. Impacts on connectivity would not be significant for this species.

* Koala – this is a species credit species predicted to occur (BAM-C), but which has not been recorded within the study area (current survey or Bionet Atlas records). This species is generally sedentary so evidence suggests it is not resident within the subject land. However, individuals may disperse moderate distances during the breeding season and when searching new territories, and can be found in sub-optimal habitat at these times. There are 15 records of Koalas within 5km of the subject land, so it is possible it could occur on the land on occasions. The draft Structure Plan would retain sufficient native vegetation and connectivity to enable movement through the property and assessment area.

*During occupation:*

Occupation of the site would not result in additional connectivity impacts.

### 8.3.3 Waterbodies, water quality and hydrological processes

*During construction:*

There is potential for increased sedimentation and pollution of water courses during earthworks and construction activities. The initial subdivision works would include construction of perimeter roads and installation of stormwater treatment features. These features would then provide an additional buffer to impacts from the subsequent development of lots and construction of dwellings, for which site management can be more difficult to regulate and control.

Best practice sediment and pollution control measures would be implemented during all construction work within the development zone. A comprehensive site management plan would be required at the detailed development application stage to detail the mitigation features and actions required.

Threatened species that would be affected by impacts on water quality and hydrological processes:

* Red-crowned Toadlet – this species is sensitive to pollution and occupies fragile microhabitats in ephemeral drainage paths. It is vulnerable to impacts on water flows and water quality. A protection strategy for areas of known habitat for the Red-crowned Toadlet would be devised in consultation with a species specialist at the detailed development application stage. There is scope within the draft Structure Plan and real intent to manage future development to avoid and minimise impacts on the Red-crowned Toadlet habitat.

There are a range of additional threatened species and significant water bodies located downstream of the subject land. The short term impacts of construction are not likely to extend beyond the subject land and would not be significant for these species.

*During occupation:*

Residential areas typically discharge pollutants, rubbish, fertiliser and sediment into stormwater. These impacts are addressed separately in the stormwater strategy prepared by Craig & Rhodes. A detailed stormwater management plan would be prepared at the development application stage, with specific sections to address protection of Red-crowned Toadlet habitat.

### 8.3.4 Vehicle strikes

*During construction:*

Construction works would be limited to daylight hours. The additional vehicle movements on local and new roads during this time would not be likely to significantly affect threatened species.

During occupation:

There would be an increased risk of vehicle collision with native fauna along Morgan Road and a new risk along perimeter roads around new residential precincts. These risks can be minimised through road design, road verge management, lighting and signage. These features would be considered further and appropriate measures incorporated into detailed designs at the development application stage.

Threatened fauna most at risk of impact from vehicle strikes would be:

* Red-crowned Toadlet – this species could occasionally attempt to disperse or travel across roads and would be at high risk of vehicle strike on these occasions.
* Rosenberg's Goanna – this is a largely terrestrial species that will cross open areas such as roads. It is known to occur on the subject property and would be at increased risk of vehicle collision.
* New Holland Mouse – this is a small nocturnal and terrestrial species that may cross open areas such as roads. It is predicted to occur by the BAM-C, but is not known to be present within the subject property.
* Spotted-tailed Quoll - this is a nocturnal and largely terrestrial species that will cross open areas such as roads. It is known to occur on the subject property and would be at increased risk of vehicle collision at night.

A range of impact avoidance and minimisation measures would be incorporated into the development design at the detailed development application stage. Measures to be considered include traffic slowing devices in key areas, signage, lighting, wildlife exclusion fencing/barriers, fauna overpasses and underpasses, and cleared space along road verges for better visibility.

There is scope within the draft Structure Plan and real intent to manage future development to minimise wildlife collisions.

## 8.4 Mitigating residual impacts – management measures and implementation

Various site management plans and mitigation measures would be prepared for the detailed development application stage. These may include (but not be limited to):

* Conservation Zone Management Plan, to protect and monitor biodiversity values within the conservation zone.

* Vegetation Management Plan for areas of 'retained vegetation' within the development zone, including specific management and protection actions for areas of known habitat for threatened species (such as *Tetratheca glandulosa* and the Red-crowned Toadlet).
* Construction Management Plan, to include a Chapter on biodiversity management and protection, including a tree and vegetation removal protocol, management of displaced and injured wildlife protocol, protection measures such as temporary fencing, biosecurity actions, control of site wastes.
* Stormwater Management Plan, including specific sections addressing avoidance of impacts on areas of known Red-crowned Toadlet habitat.
* Site-specific Development Control Plan, to address matters such as street and external house lighting, road and verge design to avoid wildlife collisions, signage, pedestrian management, biosecurity, *etc*.

## 8.5 Adaptive management strategy for uncertain impacts (where relevant)

There is some uncertainty at this high level planning stage with regard to impacts upon native vegetation retained within reserves and corridors within the development zone.

These areas will require further consideration at the detailed development application stage. An adaptive management strategy may be required to be prepared at that time.

The Conservation Zone Management Plan will include a monitoring program for early detection of unexpected indirect impacts on biodiversity values of this area. An adaptive management strategy would form part of this plan.

# 9. Serious and irreversible impacts

## 9.1 Assessment for serious and irreversible impacts on biodiversity values

Predicted and candidate species that are identified in the Threatened Biodiversity Data Collection as being at risk of a Serious And Irreversible Impact (SAII) are:

* Broad-headed Snake;
* Swift Parrot;
* Sooty Owl;
* Regent Honeyeater;
* Little Bent-wing Bat;
* Eastern Bent-wing Bat.

For all of these species, the SAII risk is associated with breeding habitat or important mapped areas. None of these features occur within the subject land.

The draft Structure Plan would not be likely to have an SAII on any threatened entity.

There remains some uncertainty over the presence or absence of several threatened plant species that are listed as SAII entities. These species have been assumed absent on the basis of existing knowledge and data for the site, extent of survey work conducted, and specialist advice. Further survey work and discussion with experts is ongoing in relation to these species and would be finalised at the development application stage.

If present, these species would not be widespread across the subject land. There is scope within the draft Structure Plan for minor adjustments to avoid localised high value areas if these are identified at a future time. Sufficient work has been conducted to demonstrate that the draft Structure Plan is broadly permissible and is feasible.

# 10. Impact summary

## 10.1 Determine an offset requirement for impacts

### 10.1.1 Impacts on native vegetation and TECs or ECs (ecosystem credits)

All areas of the development footprint contain native vegetation of sufficient integrity to require an offset. There are no impacts on native vegetation that do not require an offset.

**Table 24 Impacts that require an offset – ecosystem credits**

| Vegetation zone | PCT name | TEC | Impact area (ha) | Current VI score | Future VI score | Change in VI score | Biodiversity risk weighting | Number of ecosystem credits required |
|---|---|---|---|---|---|---|---|---|
| 1250 | Coastal sandstone gully forest | n/a | 16.2 | 55.7 | 0.4 | -55.3 | 1.5 | 336 |
| 1783 | Sydney North exposed sandstone woodland | n/a | 17.5 | 49.4 | 1.4 | -48.0 | 1.5 | 315 |
| 1824 | Coastal sandstone heath-mallee | n/a | 11.0 | 63.4 | 1.1 | -62.3 | 1.5 | 258 |
| | | | | | | | Total credits | 909 |

### 10.1.2 Impacts on threatened species and their habitat (species credits)

**Table 25 Impacts that require an offset – species credits**

| Common name | Scientific name | BC Act status | EPBC Act status | Loss of habitat (ha) or individuals | Biodiversity risk weighting | Number of species credits required |
|---|---|---|---|---|---|---|
| Eastern Pygmy-possum | *Cercartetus nanus* | V | - | 44.68 | 2 | 1211 |
| Red-crowned Toadlet | *Pseudophryne australis* | V | - | 16.72 | 1.5 | 341 |
| *Tetratheca glandulosa* | *Tetratheca glandulosa* | V | - | 0.24 | 2 | 6 |
| Leafless Tongue Orchid | *Cryptostylis hunteriana* | V | V | 1.0 | 1.5 | 18 |
| | | | | | **Total credits** | 1,576 |

### 10.1.3 Indirect and prescribed impacts

There is uncertainty over the details and extent of indirect impacts of future development of the subject land at this draft Structure Plan stage.

No offsets relating to indirect impacts or prescribed impacts are currently proposed. This is a matter to be considered further at the development application stage.

## 10.2 Impacts that do not need further assessment

There are no impacts that do not require further assessment.

# 11. Biodiversity credit report

Refer to Appendix E (Credit reports).

## 11.1 Ecosystem credits

**Table 26 Ecosystem credit class and matching credit profile**

| Ecosystem credit | Attributes shared with matching credits | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PCT name** | **PCT vegetation class** | **PCT vegetation formation** | **Associated TEC or EC** | **Offset trading group** (BAM Section 10.2, Tables 4 & 5) | **Hollow bearing trees present?** | **IBRA subregion** (in which proposal is located) |
| 1250 | *Coastal sandstone gully forest* | Sydney Coastal Dry Sclerophyll Forests | Dry Sclerophyll Forests (Shrubby sub-formation) | n/a | Sydney Coastal Dry Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status) | Yes | Pittwater |
| 1783 | *Sydney North exposed sandstone woodland* | Sydney Coastal Dry Sclerophyll Forests | Dry Sclerophyll Forests (Shrubby sub-formation) | n/a | Sydney Coastal Dry Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status) | Yes | Pittwater |
| 1824 | *Coastal sandstone Heath-Mallee* | Sydney Coastal Heaths | Heathlands | n/a | Sydney Coastal Heaths - < 50% cleared group (including Tier 4 or higher threat status) | Yes | Pittwater |

## 11.2 Species credits

**Table 27 Species credit class and matching credit profile**

| Species credit | Attributes shared with matching credits | | | | |
|---|---|---|---|---|---|
| | Name of threatened species | Kingdom | BC Act status | EPBC Act status | IBRA region |
| Eastern Pygmy-possum | Eastern Pygmy-possum | Animal | V | - | Pittwater |
| Red-crowned Toadlet | Red-crowned Toadlet | Animal | V | - | Pittwater |
| *Tetratheca glandulosa* | *Tetratheca glandulosa* | Plant | V | - | Pittwater |
| *Cryptostylis hunteriana* | *Cryptostylis hunteriana* | Plant | V | V | Pittwater |

# 12. References

Arcadis Australia Pacific Pty Ltd. 2021. *Biodiversity Assessment Of Deferred Lands, Stage 1: Review of Existing Information – Draft*. Report prepared for Northern Beaches Council, 22 June 2021.

Arcadis Australia Pacific Pty Ltd. 2021. *Biodiversity Assessment Of Deferred Lands, Stage 2: Biodiversity Survey and Reporting – Draft 3*. Report prepared for Northern Beaches Council, 25 May 2022.

SMEC. 2021. *Northern Beaches Council Biodiversity Planning Review*. Report prepared for the Northern Beaches Council, 9 December 2021 (Ref: 30012906).

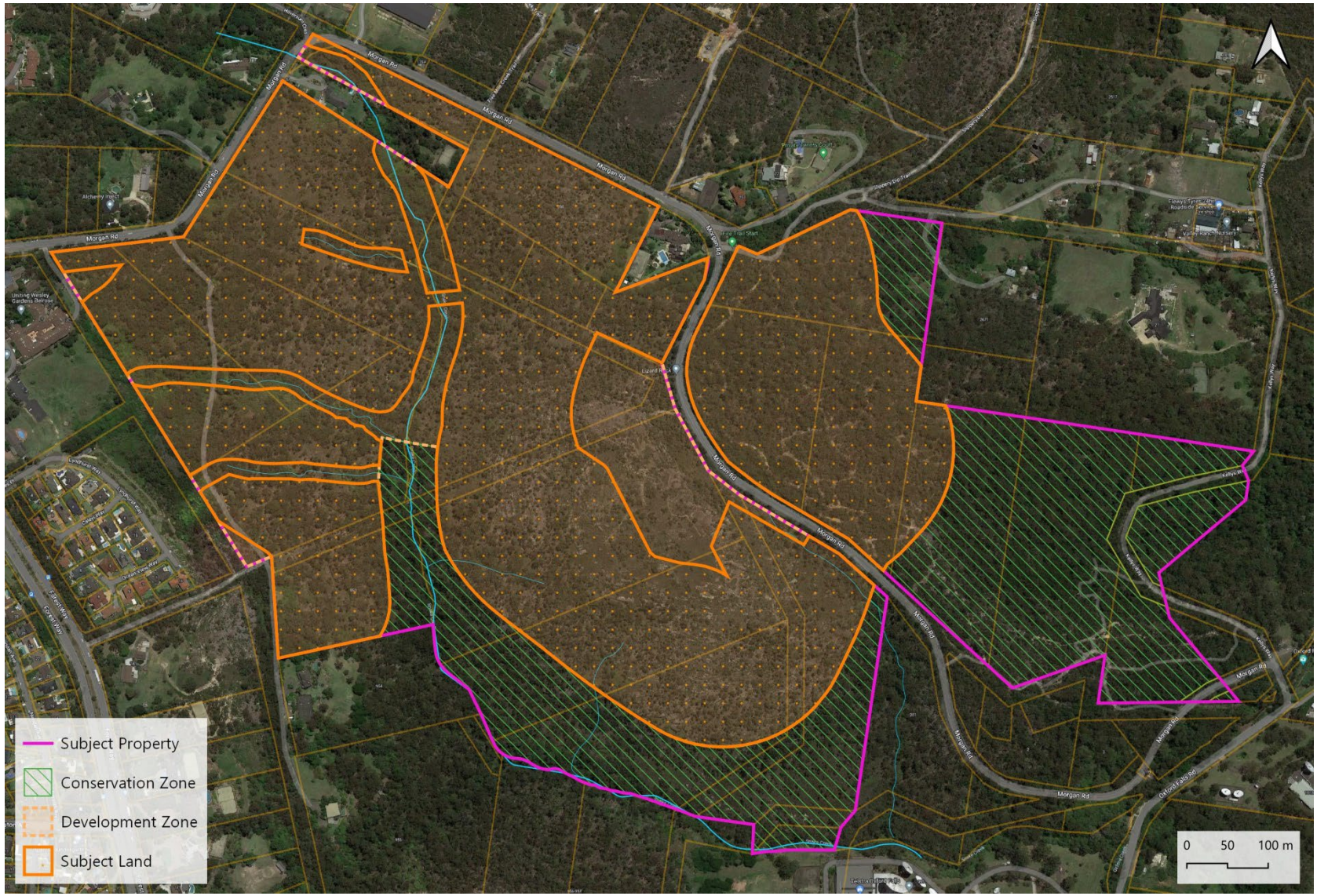
Smith, P. & Smith, J. (2000) *Survey of the Duffys Forest Vegetation Community*. Unpublished Report to NSW National Parks and Wildlife Service and Warringah Council.

Travers Bushfire & Ecology. *Bushfire Protection Assessment, Planning Proposal, Morgan Road, Belrose*. 12/09/2022.

# 13. Figures

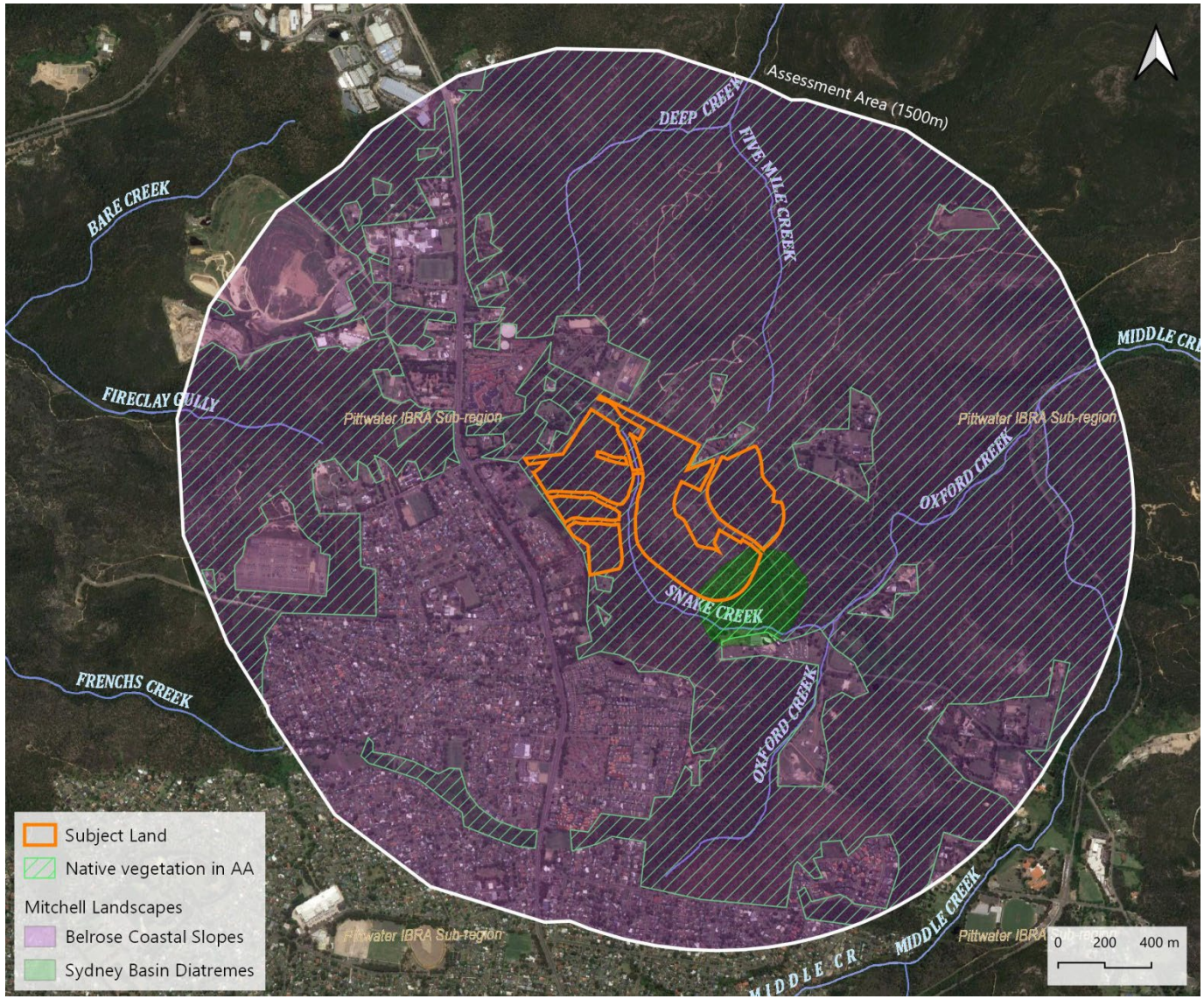
Proposed zoning of deferred lands, Patyegarang Project.

**Figure 1 Site Map**



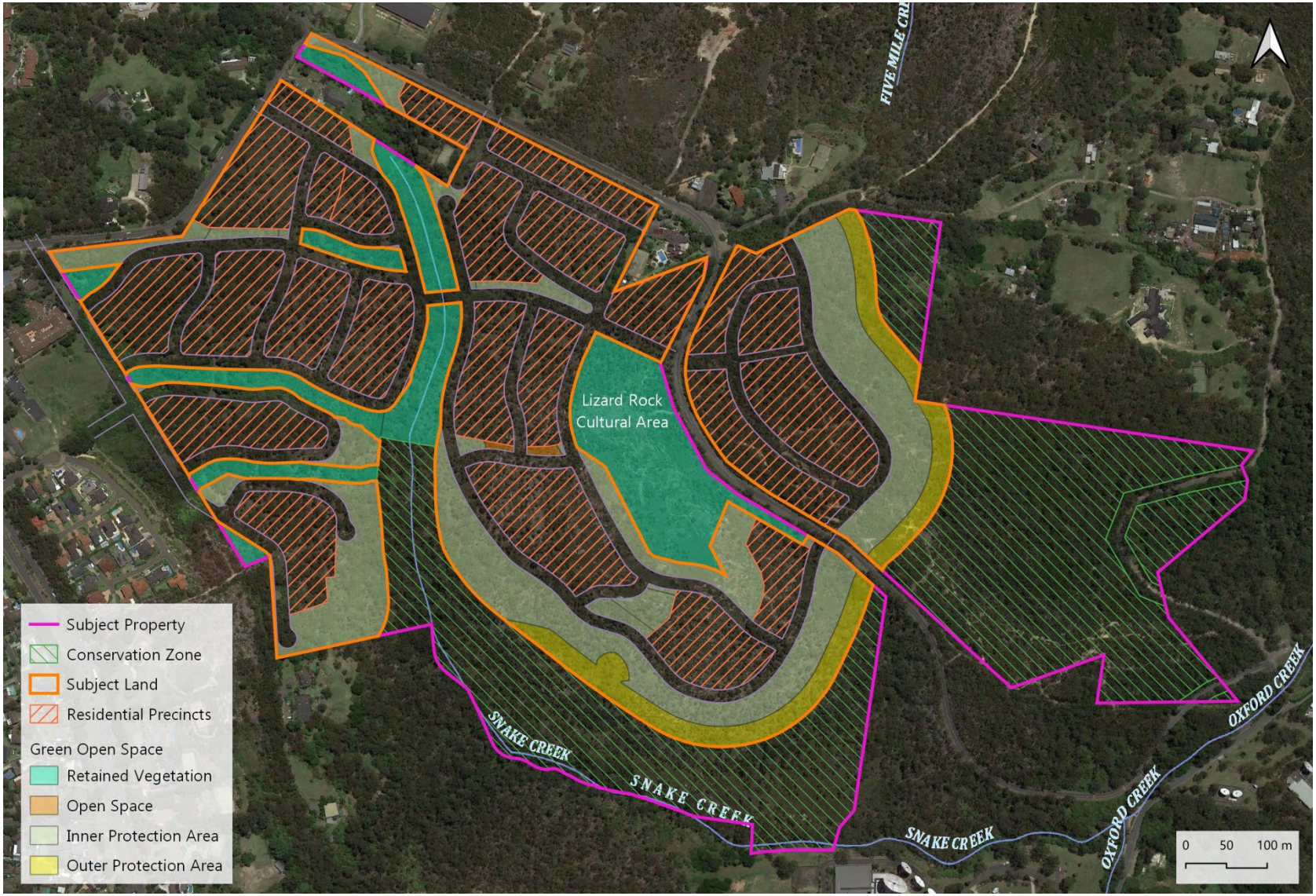
Proposed zoning of deferred lands, Patyegarang Project.

**Figure 2 Location Map**



Proposed zoning of deferred lands, Patyegarang Project.

**Figure 3 Draft Structure Plan**



Proposed zoning of deferred lands, Patyegarang Project.

**Figure 4 Biodiversity Values Map**

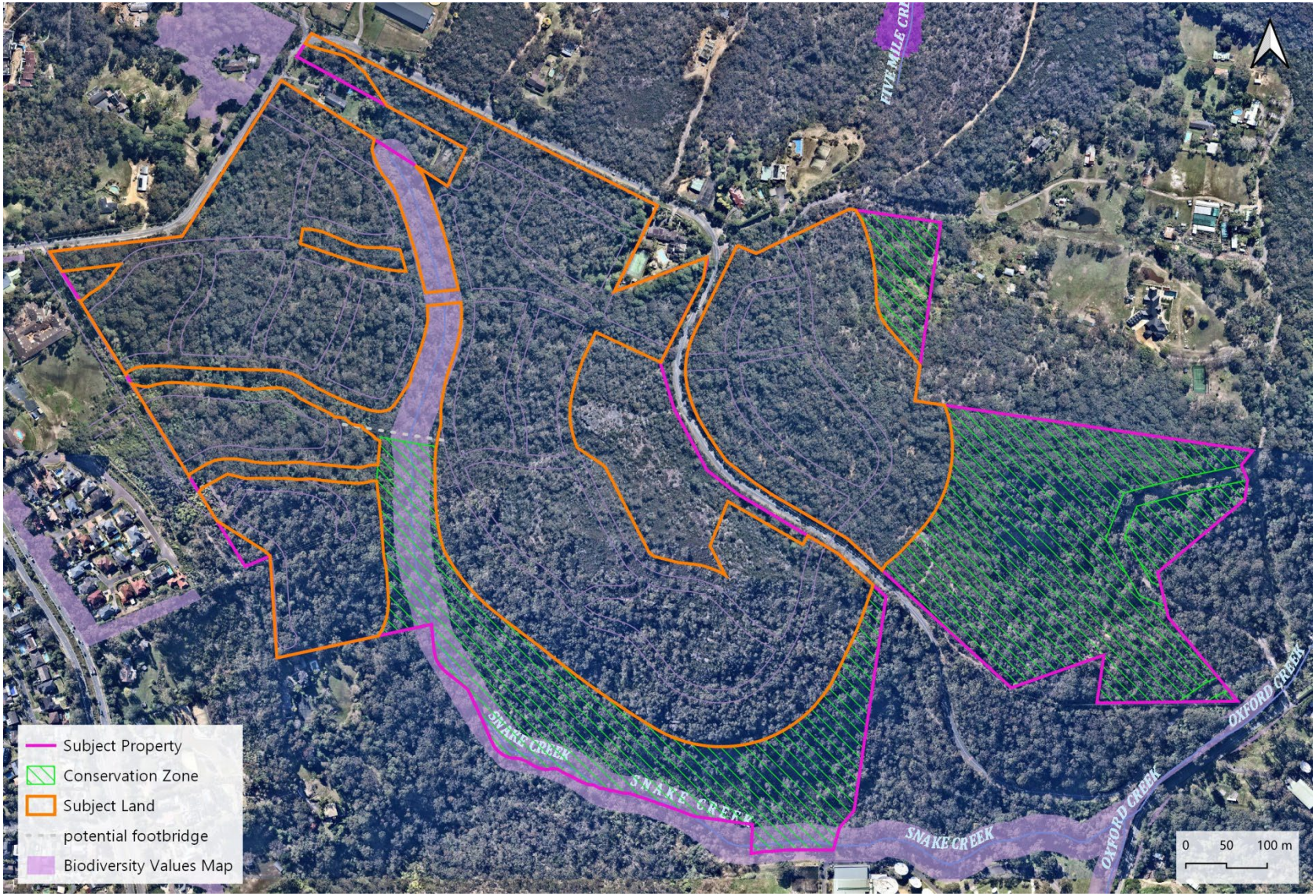
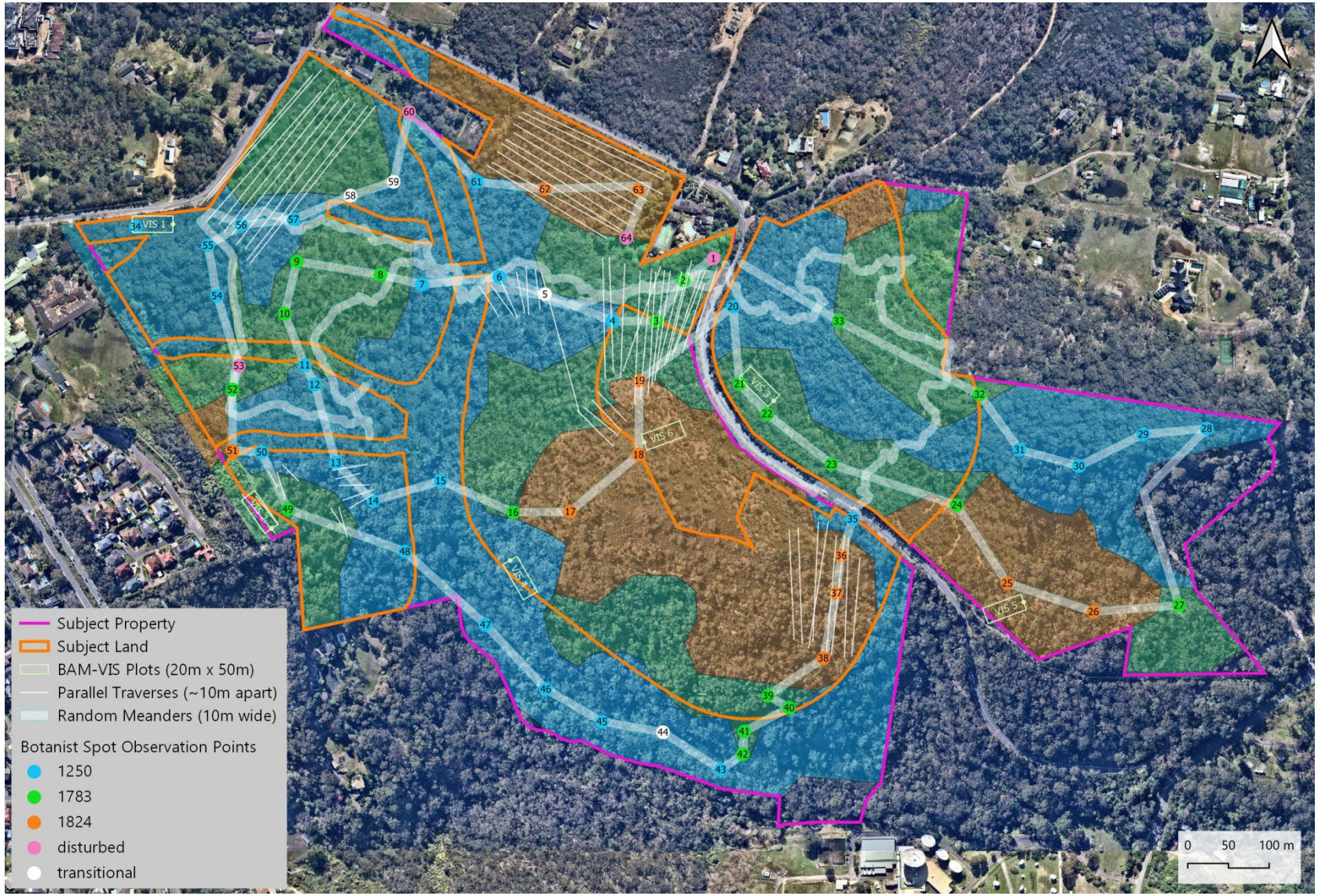


**Figure 5 Flora Field Survey Locations**



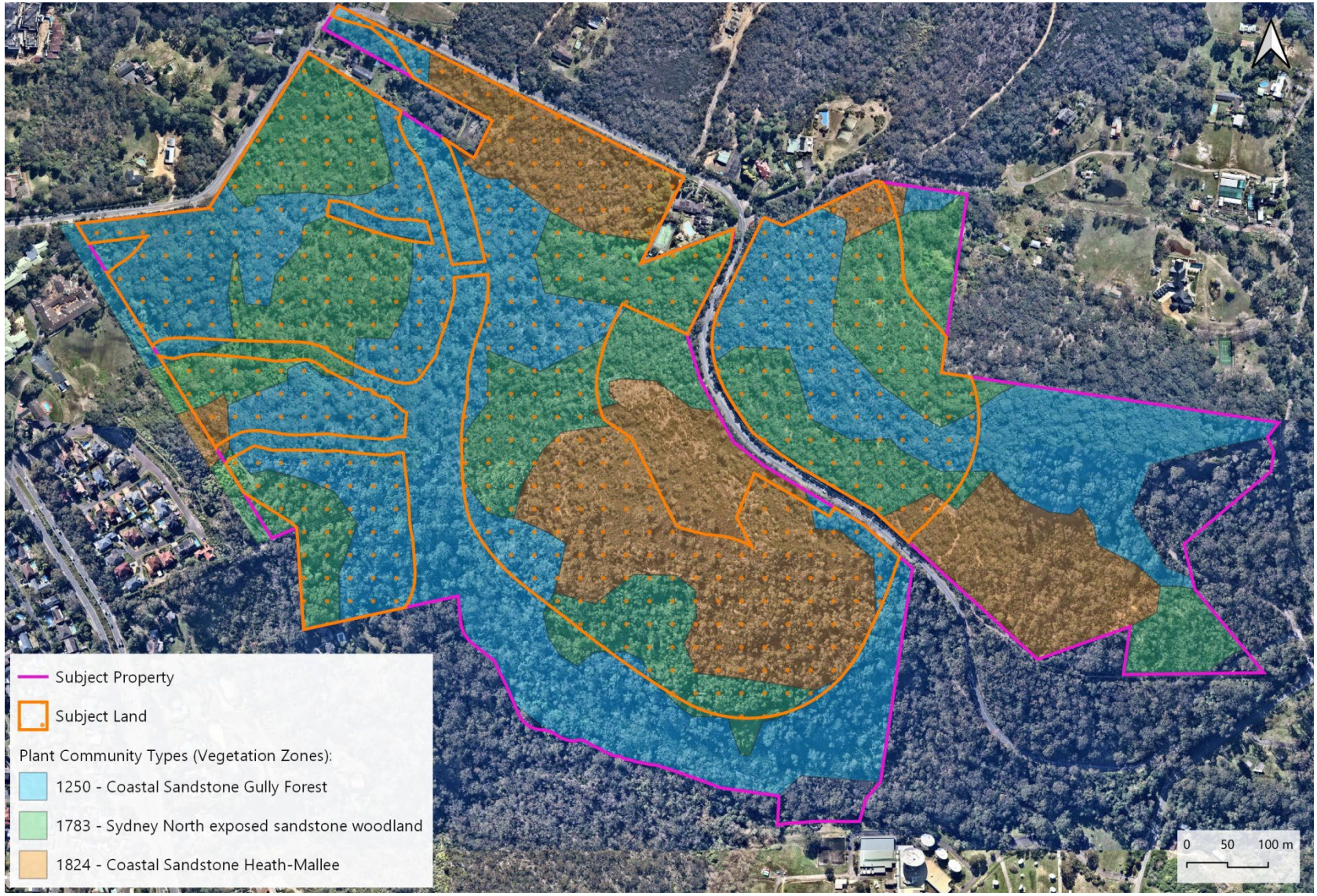

BAM-VI plots are based on the standard nested plot method set out in the BAM 2020, with the starting point of the 50m transect indicated by the start dot on the plan.

Proposed zoning of deferred lands, Patyegarang Project.

**Figure 6 Fauna Field Survey Locations**

Proposed zoning of deferred lands, Patyegarang Project.

**Figure 7 Native Vegetation**



Proposed zoning of deferred lands, Patyegarang Project.

**Figure 8 Threatened Species Locations**

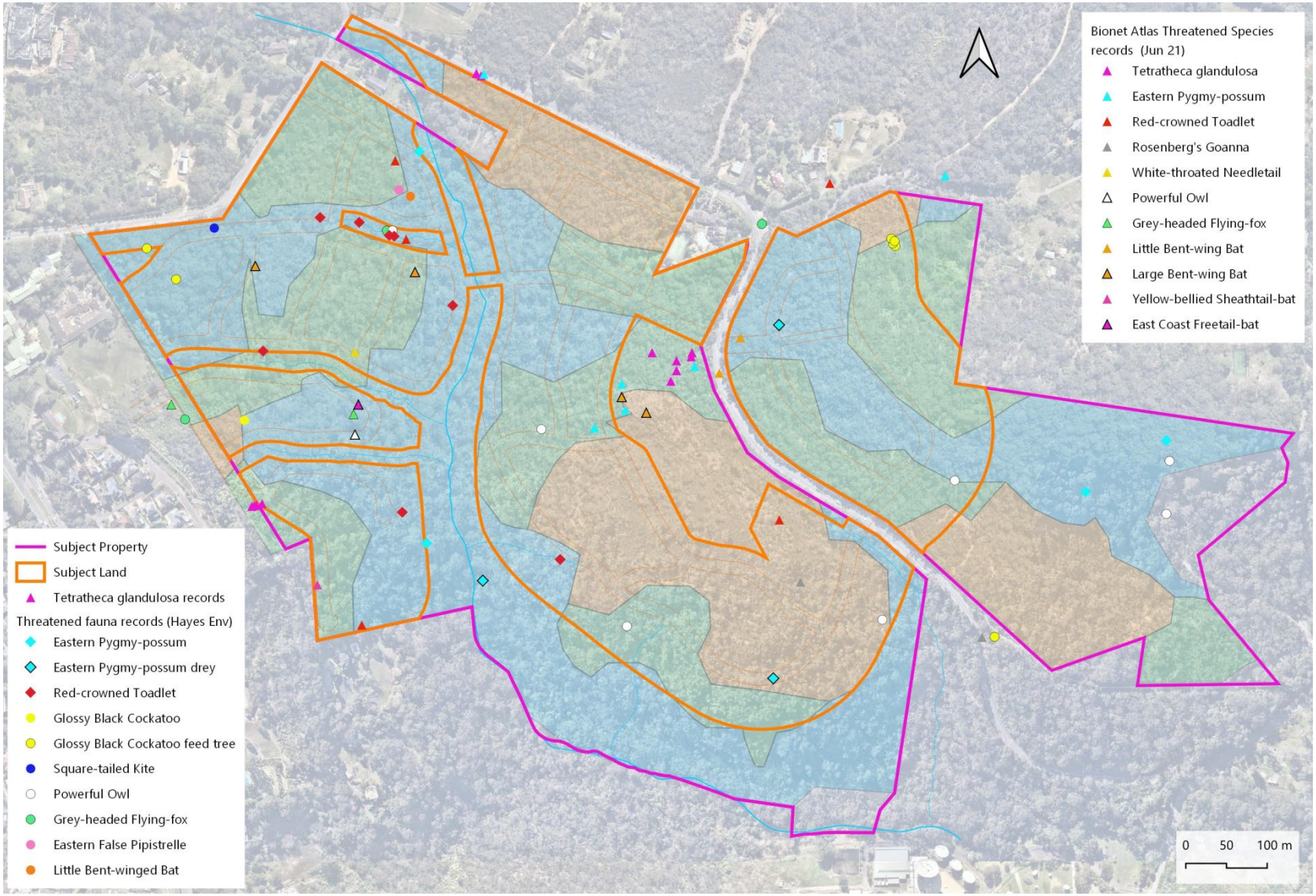
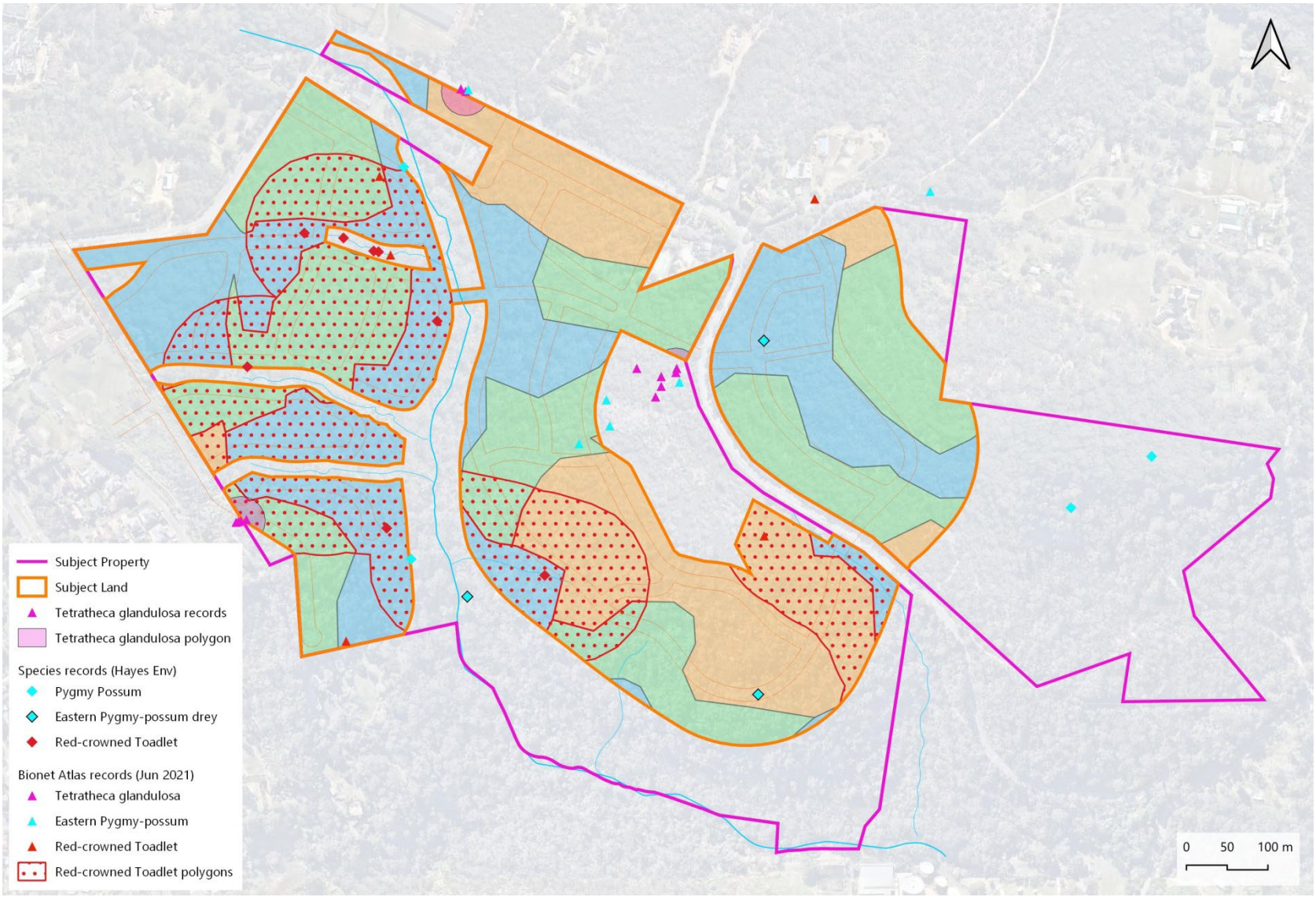


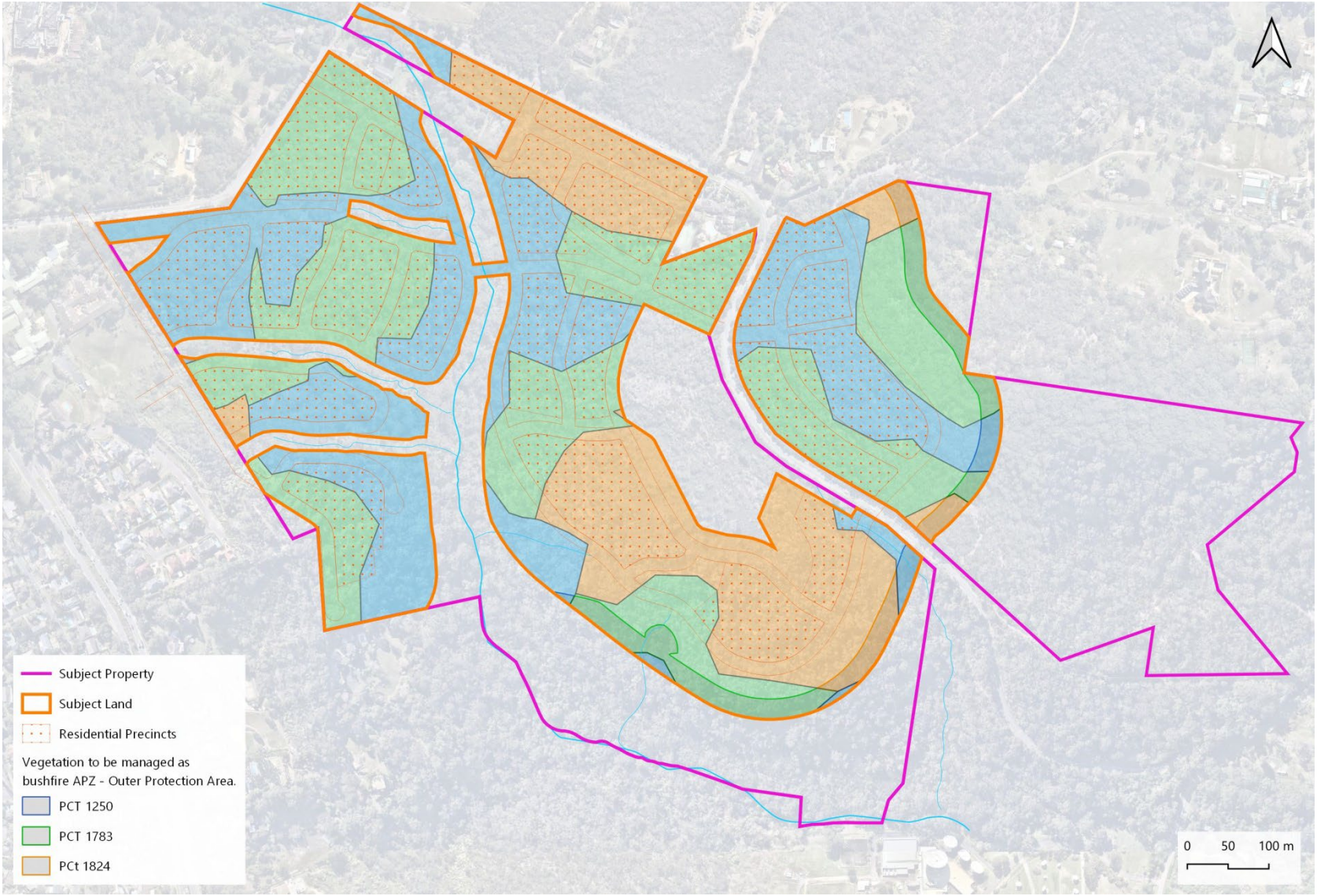
**Figure 9 Species Credit Species Polygons**




The Eastern Pygmy-possum polygon is equivalent to the entirety of the Subject Land.

Proposed zoning of deferred lands, Patyegarang Project.

**Figure 10 Impact on Native Vegetation**



# Appendix A: BDAR requirements compliance

**Table 28 Assessment of compliance with BDAR minimum information requirements**

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| Introduction | Chapters 2 and 3 | **Information** | |
| | | Introduction to the biodiversity assessment including: | – |
| | | ☒ brief description of the proposal | Ch 1.1.1, pg 1 |
| | | ☒ identification of subject land boundary, including:<br>☒ operational footprint<br>☐ construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure – *not applicable – to be restricted to subject land* | Terms, pg x<br>Ch 1.1.3. pg 1 |
| | | ☒ general description of the subject land | Ch 1.1.3, pg 1 |
| | | ☒ sources of information used in the assessment, including reports and spatial data | Ch 1.1.4, pg 2; &<br>Ch 1.5, pg 3 |
| | | ☒ identification and justification for entering the BOS | Ch 1.2, pg 3 |
| | | **Maps and tables** | |
| | | ☒ 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 | Figure 1; &<br>Figure 3 |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| Landscape | Sections 3.1 and 3.2, Appendix E | **Information** | |
| | | Identification of site context components and landscape features, including: | – |
| | | ☒ general description of subject land topographic and hydrological setting, geology and soils | Ch 1.1.3, pg 1 |
| | | ☒ per cent native vegetation cover in the assessment area (as described in BAM Section 3.2) | Ch 3.3, pg 17 |
| | | ☒ IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.)) | Ch 3.2.1, pg 16 |
| | | ☒ rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3.) and Appendix E) | Ch 3.2.2, pg 16 |
| | | ☒ wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(3.)) | Ch 3.2.2, pg 16 |
| | | ☒ connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.)) | Ch 3.2.3, pg 16 |
| | | ☒ 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.)) | Ch 3.2.4, pg 16 |
| | | ☐ areas of outstanding biodiversity value occurring on the subject land and assessment area (as described in BAM Subsection 3.1.3(8–9.)) – *not applicable* | Ch 3.2.5, pg 16 |
| | | ☐ any additional landscape features identified in any SEARs for the proposal – *not applicable* | Ch 3.2.7, pg 16 |
| | | ☒ NSW (Mitchell) landscape on which the subject land occurs | Ch 3.2.6, pg 16 |
| | | ☒ details of field reconnaissance undertaken to confirm the extent and condition of landscape features and native vegetation cover (as described in Operational Manual Stage 1 Section 2.4) | Ch 2.1, pg 5 |
| | | **Maps and tables** | |
| | | ☒ Site Map<br>☒ Property boundary<br>☒ Boundary of subject land<br>☒ Cadastre of subject land (including labelling of Lot and DP or section plan if relevant) – *Lots not labelled on plan due to complexity, but are listed in Ch 1.1.2, pg 1.*<br>☒ Landscape features identified in BAM Subsection 3.1.3 | Figure 1 |
| | | ☒ Location Map<br>☒ Digital aerial photography at 1:1,000 scale or finer | Figure 2 |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ Boundary of subject land<br>☒ Assessment area (i.e. the subject land and either 1500 m buffer area or 500 m buffer for linear development)<br>☒ Landscape features identified in BAM Subsection 3.1.3<br>☐ Additional detail (e.g. local government area boundaries) relevant at this scale – *entire area is within a single LGA (Northern Beaches), no other relevant details* | |
| | | Landscape features identified in BAM Subsection 3.1.3 and to be shown on the Site Map and/or Location Map include: | – |
| | | ☒ IBRA bioregions and subregions<br>☒ rivers, streams and estuaries<br>☐ wetlands and important wetlands – *none relevant*<br>☒ connectivity of different areas of habitat<br>☐ karst, caves, crevices, cliffs, rocks and other geological features of significance and if required, soil hazard features – *rock features are prevalent throughout, not mapped. No karst*.<br>☐ areas of outstanding biodiversity value occurring on the subject land and assessment area – *none relevant*<br>☐ any additional landscape features identified in any SEARs for the proposal – none relevant<br>☒ NSW (Mitchell) landscape on which the subject land occurs | Figure 1; & Figure 2 |
| | | **Data** | |
| | | ☒ 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 | – |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| Native vegetation | Chapter 4, Appendix A and Appendix H | **Information** | |
| | | ☒ 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) | Ch 4.1, pg19; & Figure 7 |
| | | ☒ Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM Subsection 4.1.2) – *not relevant* | - |
| | | ☒ 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) | Ch 2.2.1, pg 5 |
| | | ☒ Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2 | Ch 2.2.3, pg 6 |
| | | ☐ 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) – *not relevant* | - |
| | | For each PCT within the subject land, describe: | – |
| | | ☒ PCT name and ID | Ch 4.2, pg 19; & Figure 7 |
| | | ☒ vegetation class | Ch 4.2 – Tables 5, 6 & 7 |
| | | ☒ extent (ha) within subject land | Ch 4.2 – Tables 5, 6 & 7 |
| | | ☒ evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM Section 4.2(1–3.)) | Ch 4.2 |
| | | ☒ plant species relied upon for identification of the PCT and relative abundance of each species | Ch 4.2 |
| | | ☒ if relevant, TEC status including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2(1–2.)) | Ch 4.2<br>Ch 4.3, pg 26 |
| | | ☒ estimate of per cent cleared value of PCT (BAM Subsection 4.2.1(5.)) | Ch 4.2 – Tables 5, 6 & 7 |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | Describe the vegetation integrity assessment of the subject land, including: | – |
| | | ☒ identification and mapping of vegetation zones (as described in BAM Subsection 4.3.1) | Ch 4.4; & Figure 3 |
| | | ☒ description of vegetation zones within the subject land (as described in Operational Manual Stage 1 Table 2 and Subsection 3.3.2) | Ch 4.4, pg 27; & Figure 7 |
| | | ☒ area (ha) of each vegetation zone | Table 8, pg 28 |
| | | ☒ assessment of patch size (as described in BAM Subsection 4.3.2) | Table 8, pg 28 |
| | | ☒ survey effort (i.e. number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4(1–2.) | Ch 4.5.1, pg 29 |
| | | ☒ use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3(5.)) – *not relevant* | Ch 4.5.3, pg 29 |
| | | 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): - *not relevant* | – |
| | | ☐ 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 | |
| | | **Maps and tables** | |
| | | ☒ Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of all areas of native vegetation including areas that are ground cover only, 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 7 |
| | | ☒ Map of PCTs within the subject land (as described in BAM Section 4.2(1.)) | Figure 7 |
| | | ☒ Map of vegetation zones within the subject land (as described in BAM Subsection 4.3.1) | Figure 7 |
| | | ☒ Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCT boundaries | Figure 5 |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | ☐ Map of TEC distribution on the subject land and table of TEC listing, status and area (ha) – *not relevant* | |
| | | ☐ Map of patch size locations for each native vegetation zone and table of patch size areas (as described in BAM Subsection 4.3.2) – *not mapped – all zones are part of the same patch with patch size >100ha* | - |
| | | Table of current vegetation integrity scores for each vegetation zone within the site and including: | – |
| | | ☒ composition condition score<br>☒ structure condition score<br>☒ function condition score<br>☒ presence of hollow bearing trees | Table 9, pg 29 |
| | | **Data** | |
| | | ☒ All report maps as separate jpeg files | – |
| | | ☒ Plot field data (MS Excel format) | separate file |
| | | ☒ Plot field datasheets – *transcribed into Table 29* | Appendix C, Table 29 |
| | | Digital shape files of: | – |
| | | ☒ PCT boundaries within subject land | – |
| | | ☐ TEC boundaries within subject land - *not relevant* | – |
| | | ☒ vegetation zone boundaries within subject land | – |
| | | ☒ floristic vegetation survey and vegetation integrity plot locations | – |
| Threatened species | Chapter 5 | **Information** | |
| | | 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.)) | Ch 5.1.1, pg 30; Table 10 |
| | | ☒ 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) | Ch 5.1.1, pg 37 |
| | | ☒ justification for addition of any ecosystem credit species to the list | Ch 5.1.1, pg 37 |
| | | Identify species credit species likely to occur on the subject land, including: | – |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ list of species credit species derived from the BAM-C (as described in BAM Subsection 5.1.1) | Ch 5.1.2, pg 37; Tables 11 & 12 |
| | | ☒ 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) | Ch 5.1.2. pg 45-46 & 52-53 |
| | | ☒ 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) | Ch 5.1.2. pgs 45-46 & 52-53 |
| | | ☒ justification for addition of any species credit species to the list | Ch 5.1.2. pg 52 |
| | | 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.)) -<br>☒ 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.)) –<br>☒ species for which targeted surveys are to be completed to determine species presence (BAM Subsection 5.2.4(2.b.))<br>☐ species for which an expert report is to be used to determine species presence (BAM Subsection 5.2.4(2.c.)) - *none* | Ch 5.2;<br>Table 13, pg 54 |
| | | Present the outcomes of species credit species assessments from: | – |
| | | ☒ threatened species survey (as described in BAM Section 5.2.4) | Table 13, pg 54 |
| | | ☐ expert reports (if relevant) including justification for presence of the species and information used to make this determination (as described in BAM Subsection 5.2.4, Section 5.3, Box 3) – *not relevant* | |
| | | Where survey has been undertaken include detailed information on: | – |
| | | ☒ survey method and effort (as described in BAM Section 5.3) | Ch 2.3 & 2.4. Appendix D |
| | | ☒ 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 | Ch 2.3 & 2.4 Appendix D |
| | | ☒ 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 | Ch 5.3 – Table 15 Appendix D |
| | | ☒ survey personnel and relevant experience | Declarations – xii |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ describe any limitations to surveys and how these were addressed/overcome | Ch 2.6, pg 13 |
| | | Where an expert report has been used in place of survey (as described in BAM Section 5.3, Box 3), include: - *not relevant* | Ch 5.4, pg 102 |
| | | ☐ justification of the use of an expert report<br>☐ identify the expert, provide evidence of their expert credentials and departmental approval of expert status<br>☐ all requirements of Box 3 have been addressed in the expert report | |
| | | Where use of local data is proposed (BAM Subsection 1.4.2): - *not relevant* | Ch 5.5, pg 103 |
| | | ☐ identify relevant species<br>☐ identify data to be amended<br>☐ identify source of information for local data, e.g. published literature, additional survey data, etc.<br>☐ 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 | |
| | | 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: - | Figure 9 |
| | | ☒ the unit of measure for each species is documented | Ch 5.6, pg 103<br>Table 17 |
| | | 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) | Figure 9<br>Table 17 |
| | | ☒ 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 | Table 17 |
| | | for species assessed by counts of individuals: - *not relevant* | – |
| | | ☐ 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 | |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ Identify the biodiversity risk weighting for each species credit species identified as present within the subject land (as described in BAM Section 5.4) | Table 17 |
| | | **Maps and tables** | |
| | | ☒ Table showing ecosystem credit species in accordance with BAM Subsection 5.1.1, and identifying: | |
| | | ☒ the ecosystem credit species removed from the list | Table 10 |
| | | ☒ the sensitivity to gain class of each species | Table 10 |
| | | ☒ Table detailing species credit species in accordance with BAM Section 5.2 and identifying: | Tables 11 & 12 |
| | | ☒ the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or microhabitat features are not present | Tables 11 & 12 |
| | | ☒ the candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map | Tables 13 & 14<br>Tables 15 & 16 |
| | | ☒ 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) - | Tables 17 |
| | | ☒ Map indicating the GPS coordinates of all individuals of each species recorded within the subject land and the species polygon for each species (as described in BAM Subsection 5.2.5) | Figure 9 |
| | | **Data** | |
| | | ☒ Digital shape files of suitable habitat identified for survey for each candidate species credit species | - |
| | | ☒ Survey locations including GPS coordinates of any plots, transects, grids | - |
| | | ☒ Digital shape files of each species polygon including GPS coordinates of located individuals - | - |
| | | ☒ Species polygon map in jpeg format | Figure 9 |
| | | ☐ Expert reports and any supporting data used to support conclusions of the expert report – *not relevant* | - |
| | | ☒ Field datasheets detailing survey information including prevailing conditions, date, time, equipment used, etc. – *data transcribed into Appendices* | Appendix C and D |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| Prescribed impacts | Chapter 6 | **Information** | |
| | | 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) | Table 19, pg 106 |
| | | ☒ occurrences of human-made structures and non-native vegetation (as described in BAM Subsection 6.1.2) | |
| | | ☒ corridors or other areas of connectivity linking habitat for threatened entities (as described in BAM Subsection 6.1.3) | |
| | | ☒ waterbodies 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) – *not relevant* | - |
| | | ☒ 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) | Table 19, pg 106 |
| | | ☒ Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts | Table 19, pg 106 |
| | | ☒ 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) – | Table 19, pg 106 |
| | | Where the proposed development is for a wind farm: – *not relevant* | – |
| | | ☐ 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.)) | |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | Where the proposal may result in vehicle strike: – | – |
| | | ☒ identify a list of threatened fauna or protected fauna species that are part of a TEC and at risk of vehicle strike due to the proposal | Table 19, pg 106 |
| | | **Maps and tables** | |
| | | ☒ Map showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human-made structures, etc.) – | Streams and connectivity are shown on various Figures. Rock areas are widespread and not mapped |
| | | ☒ Map showing location of potential vehicle strike locations - | roads, as shown on various Figures |
| | | ☐ 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) – *not relevant* | |
| | | **Data** | |
| | | ☒ Digital shape files of prescribed impact feature locations – | - |
| | | ☐ Prescribed impact features map in jpeg format – *not a specific map* | - |
| Avoid and minimise impacts | Chapter 7 | **Information** | |
| | | 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 | Ch 7.1.2, pg 108 |
| | | ☐ routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route – *not relevant* | - |
| | | ☒ alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location | Ch 7.1.1, pg 108 |
| | | ☒ 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 | Ch 7.1.1, pg 108 |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design (as described in BAM Sections 7.1 and 7.2) | Ch 7.1 |
| | | ☒ 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.)) | Ch 7.1 |
| | | ☐ Detail measures or options considered but not implemented because they are not feasible and/or practical (e.g. due to site constraints) – *not relevant* | Ch 7.3, pg 114 |
| | | **Maps and tables** | |
| | | ☒ Table of measures to be implemented to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility | Table 20 |
| | | ☐ Map of alternative footprints considered to avoid or minimise impacts on biodiversity values; and of the final proposal footprint, including construction and operation – *not applicable* | |
| | | ☒ Maps demonstrating indirect impact zones where applicable | Figure 3 |
| | | **Data** | |
| | | Digital shape files of: | – |
| | | ☐ alternative and final proposal footprint - *not applicable* | – |
| | | ☒ direct and indirect impact zones | – |
| | | ☒ Maps in jpeg format | – |
| Assessment of impacts | Chapter 8, Sections 8.1 and 8.2 | **Information** | |
| | | ☒ 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) | Ch 8.1, pg 116<br>Tables 21 & 22 |
| | | Assessment of indirect impacts on vegetation and threatened species and their habitat including (as described in BAM Section 8.2): | Ch 8.2, pg 118 |
| | | ☒ description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal | Table 23 |
| | | ☒ documenting the consequences to vegetation and threatened species and their habitat including evidence-based justifications | Table 23 |
| | | ☒ reporting any limitations or assumptions, etc. made during the assessment | Ch 8.2 |
| | | ☒ identification of the threatened entities and their habitat likely to be affected | |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | Assessment of prescribed biodiversity impacts (as described in BAM Section 8.3) including: | Ch 8.3, pg 120 |
| | | assessment of the nature, extent frequency, duration and timing of impacts on the habitat of threatened species or ecological communities associated with: | |
| | | ☒ karst, caves, crevices, cliffs, rocks and other features of geological significance | Ch 8.3.2, pg 120 |
| | | ☐ human-made structures – *not relevant* | - |
| | | ☐ non-native vegetation – *not relevant* | - |
| | | ☒ connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range | Ch 8.3.2, pg 120 |
| | | ☒ movement of threatened species that maintains their life cycle | Ch 8.3.2, pg 120 |
| | | ☒ water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities | Ch 8.3.3, pg 120 |
| | | ☐ assessment of the impacts of wind turbine strikes on protected animals – not relevant | - |
| | | ☒ assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC | Ch 8.3.4, pg 120 |
| | | ☒ evaluate the consequences of prescribed impacts | in relevant chapters listed above |
| | | ☒ describe impacts that are uncertain | Ch 8.5, pg 124 |
| | | ☒ document limitations to data, assumptions and predictions | Ch 8.5, pg 124 |
| | | **Maps and tables** | |
| | | ☒ Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts | Table 24 |
| | | **Data** | |
| | | N/A | – |
| Mitigation and management of impacts | Chapter 8, Sections 8.4 and 8.5 | **Information** | |
| | | Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Sections 8.4 and 8.5 including: | Ch 8.4, pg 123 |
| | | | CH 8.4, pg 123 |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ techniques, timing, frequency and responsibility - *requires discussion at more detailed development application stage*<br>☐ identify measures for which there is risk of failure – *requires discussion at more detailed development application stage*<br>☐ evaluate the risk and consequence of any residual impacts – *requires discussion at more detailed development application stage* | |
| | | ☐ document any adaptive management strategy proposed – *requires discussion at more detailed development application stage* | |
| | | Identification of measures for mitigating impacts related to: | – |
| | | ☒ displacement of resident fauna (as described in BAM Subsection 8.4.1(2.)) –<br>☒ indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.))<br>☒ mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2) | Ch 8.4, pg 123 |
| | | ☒ Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5) - | Ch 8.5, pg 124 |
| | | **Maps and tables** | |
| | | ☒ Table of measures to be implemented before, during and after construction to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility | Table 17 |
| | | **Data** | |
| | | N/A | – |
| Impact summary | Chapter 9 | **Information** | |
| | | 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: - *not relevant with current knowledge* | Ch 9, pg 125 |
| | | ☐ addressing all criteria in Subsection 9.1.1 for each TEC listed as at risk of an SAII present on the subject land | |
| | | ☐ for each TEC, report the extent of the TEC in NSW | |
| | | ☐ addressing all criteria in Subsection 9.1.2 for each threatened species at risk of an SAII present on the subject land | |
| | | ☐ for each threatened species, report the population size in NSW | |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | ☐ documenting assumptions made and/or limitations to information<br>☐ documenting all sources of data, information, references used or consulted<br>☐ clearly justifying why any criteria could not be addressed | |
| | | ☒ Identification of impacts requiring offset in accordance with BAM Section 9.2 | Ch 10.1, pg 126 |
| | | ☐ Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.) - *not relevant* | |
| | | ☐ Identification of areas not requiring assessment in accordance with BAM Section 9.3 – *not relevant* | |
| | | **Maps and tables** | |
| | | ☐ Map showing the extent of TECs at risk of an SAII within the subject land - *not relevant* | - |
| | | ☐ Map showing location of threatened species at risk of an SAII within the subject land - *not relevant* | - |
| | | Map showing location of: | – |
| | | ☒ impacts requiring offset | Figure 10 |
| | | ☐ impacts not requiring offset - *not relevant* | - |
| | | ☐ areas not requiring assessment - *not relevant* | - |
| | | **Data** | |
| | | Digital shape files of: | – |
| | | ☐ extent of TECs at risk of an SAII within the subject land - *not relevant* | – |
| | | ☐ location of threatened species at risk of an SAII within the subject land - *not relevant* | – |
| | | ☒ boundary of impacts requiring offset | Figure 10 |
| | | ☐ boundary of impacts not requiring offset - *not relevant* | – |
| | | ☐ boundary of areas not requiring assessment – *not relevant* | – |
| | | ☒ Maps in jpeg format | – |
| Impact summary | Chapter 10 | **Information** | |
| | | Ecosystem credits and species credits that measure the impact of the development on biodiversity values, including: | – |
| | | ☒ future vegetation integrity score for each vegetation zone within the subject land (Equation 25 and Equation 26 in BAM Appendix H)<br>☒ change in vegetation integrity score (BAM Subsection 8.1.1) | Tables 24 & 25 |

| BDAR section | BAM ref. | BAM requirement | Page reference(s) in the BDAR |
|---|---|---|---|
| | | ☒ number of required ecosystem credits for the direct impacts of the proposal on each vegetation zone within the subject land (BAM Subsection 10.1.2) | |
| | | ☒ biodiversity risk weighting for each | Tables 24 & 25 |
| | | ☒ number of required species credits for each candidate threatened species that is directly impacted on by the proposal (BAM Subsection 10.1.3) - | Table 25 |
| | | **Maps and tables** | |
| | | ☒ Table of PCTs requiring offset and the number of ecosystem credits required | Table 24 |
| | | ☒ Table of threatened species requiring offset and the number of species credits required - | Table 25 |
| | | **Data** | |
| | | ☐ Submitted proposal in the BAM Calculator – *not for this preliminary BDAR* | – |
| Biodiversity credit report | Chapter 10 | **Information** | |
| | | ☒ 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) | Table 26 |
| | | ☒ BAM credit report in pdf format | Appendix E |
| | | **Maps and tables** | |
| | | ☒ Table of credit class and matching credit profile | Table 26 |
| | | **Data** | |
| | | ☒ BAM credit report in pdf format | Appendix E |

# Appendix B: Matters of national environmental significance

MNES relevant to the project (refer to Chapter 1.4 of the BDAR):

* Leafless Tongue Orchid *Cryptostylis hunteriana* - assumed presence of 1 hectare extent within PCT 1783 (exact location of the extent not determined).

Measures to avoid and minimise impacts on MNES (refer to Chapter 7 of the BDAR):

* Further surveys to confirm presence or absence;
* Draft Structure Plan contains sufficient flexibility such that avoidance is likely should this species be found during future surveys.

Impacts to MNES (refer to Chapter 8 of the BDAR):

* Potential loss of 1 hectare of habitat.

Mitigation measures relevant to MNES (refer to Chapter 8.4 of the BDAR):

* Avoidance, if possible;
* If found, measures such as those proposed for known locations of *Tetratheca glandulosa*.

Final offset requirements for MNES (refer to Chapter 10.1 of the BDAR):

* 18 species credits required to offset loss of 1 hectare patch.

# Appendix C: Vegetation survey data

**Table 29 Vegetation survey data and locations**

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | 5 | 4 | 3 | 2 | 1 | **plot** |
| 1824 | 1824 | 1250 | 1783 | 1783 | 1250 | **pct** |
| 11.0 | 11.0 | 16.2 | 17.5 | 17.5 | 16.2 | **area** |
| 101 | 101 | 101 | 101 | 101 | 101 | **patchsize** |
| good | good | good | good | good | good | **condition class** |
| 56 | 56 | 56 | 56 | 56 | 56 | **zone** |
| 335765 | 336237 | 335606 | 335930 | 335313 | 335192 | **easting** |
| 6267317 | 6266781 | 6266832 | 6267028 | 6266871 | 6267245 | **northing** |
| 70 | 250 | 150 | 315 | 325 | 270 | **bearing** |
| 2 | 6 | 6 | 7 | 7 | 5 | **compTree** |
| 35 | 35 | 32 | 28 | 27 | 28 | **compShrub** |
| 11 | 9 | 9 | 3 | 3 | 5 | **compGrass** |
| 7 | 11 | 8 | 7 | 15 | 9 | **compForbs** |
| 0 | 1 | 5 | 2 | 4 | 3 | **compFerns** |
| 2 | 3 | 2 | 11 | 14 | 16 | **compOther** |
| 8 | 11.5 | 20.3 | 22.35 | 20.45 | 26.25 | **strucTree** |
| 26.85 | 32.1 | 16.6 | 14.45 | 5.35 | 10.35 | **strucShrub** |
| 10.8 | 16.55 | 5.3 | 5.25 | 4.1 | 7.2 | **strucGrass** |
| 2.15 | 1.15 | 2.75 | 2 | 6.8 | 1.05 | **strucForbs** |
| 0 | 0.1 | 3.45 | 0.2 | 0.7 | 0.45 | **strucFerns** |
| 1.1 | 3.1 | 0.2 | 12.25 | 6.9 | 13.9 | **strucOther** |
| 1 | 2 | 1 | 1 | 1 | 2 | **funLargeTrees** |
| 1 | 1 | 0 | 0 | 1 | 1 | **funHollowtrees** |
| 60 | 94 | 84 | 57 | 54 | 79 | **funLitterCover** |
| 0 | 3 | 22 | 21 | 30 | 21 | **funLenFallenLogs** |
| ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | **funTreeStem5to9** |
| ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | **funTreeStem10to19** |
| ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | **funTreeStem20to29** |
| n/a | n/a | ✓ | ✓ | ✓ | ✓ | **funTreeStem30to49** |
| n/a | n/a | n/a | n/a | n/a | n/a | **funTreeStem50to79** |
| ✓ | ✓ | ✓ | ✓ | 0 | 0 | **funTreeRegen** |
| 0 | 0.1 | 0.1 | 0 | 0.1 | 0.1 | **funHighThreatExotic** |
| ☐ No ☒ Yes | ☐ No ☒ Yes | ☐ No ☒ Yes | ☐ No ☒ Yes | ☐ No ☒ Yes | ☐ No ☒ Yes | **Plot-based vegetation survey?** |
| ☐ No ☒ Yes | ☐ No ☒ Yes | ☐ No ☒ Yes | ☐ No ☒ Yes | ☐ No ☒ Yes | ☐ No ☒ Yes | **Vegetation integrity survey?** |

# BAM Plot – Field Survey Form

Site Sheet no: **1 of 3**

| Survey Name | Plot Identifier | Recorders |
|---|---|---|
| Belrose | Hayes 001 | Dan Clarke |

| Date | Datum | IBRA region | | Photo # | Zone ID |
|---|---|---|---|---|---|
| 27/08/2020 | MGA | | | 001-008 | |

| Zone | Easting | Northing | Dimensions | Orientation of midline from the 0 m point. |
|---|---|---|---|---|
| 56 | 335192 | 6267245 | 50 x 20 m | West 270° |

| | | |
|---|---|---|
| **Vegetation Class** | | Confidence: **H** M L |
| **Plant Community Type** | **EEC:** | Confidence: H **M** L |

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

| BAM Attribute (400 m² plot) | | Sum values |
|---|---|---|
| Count of **Native Richness** | **Trees** | 5 |
| | **Shrubs** | 28 |
| | **Grasses etc.** | 5 |
| | **Forbs** | 9 |
| | **Ferns** | 3 |
| | **Other** | 16 |
| Sum of **Cover** of native vascular plants by growth form group | **Trees** | 26.25 |
| | **Shrubs** | 10.35 |
| | **Grasses etc.** | 7.2 |
| | **Forbs** | 1.05 |
| | **Ferns** | 0.45 |
| | **Other** | 13.9 |
| **High Threat Weed cover** | | 0.1 |

| BAM Attribute (20 x 50 m plot) dbh | Euc* | Non Euc | Stem Classes and Hollows: HBTs † | 20cm+ |
|---|---|---|---|---|
| large trees for Euc* & Non Euc: **80 + cm** | | | 1 | |
| large trees for Euc* & Non Euc: **50 – 79 cm** | 2 | | | |
| **30 – 49 cm** | X | | | |
| **20 – 29 cm** | X | | | |
| **10 – 19 cm** | X | | | n/a |
| **5 – 9 cm** | X | tick | n/a | |
| **< 5 cm** | tick | tick | This size class records tree regeneration | |
| **Length of logs (m)** (≥10 cm diameter, >50 cm in length) | 2,1,5,5,4,3 | | | Total 21 m |

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only, unless a 'large tree' for that class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† Hollow must be at least 1m above ground, entrance at least 5cm

Each size class is noted as present by the **living tree stems** only. Measured at 1.3m above the ground. Depending on the Vegetation Class, DBH values and counts may be needed for a class.

For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

| BAM Attribute (1 x 1 m plots) | Litter cover (%) | | | | | Bare ground cover (%) | | | | | Cryptogam cover (%) | | | | | Rock cover (%) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Subplot score (% in each)** | 70 | 95 | 80 | 80 | 70 | 0 | 0 | 0 | 0 | 0 | | | | | | 0 | 0 | 0 | 0 | 0 |
| **Average of the 5 subplots** | 79 | | | | | 0 | | | | | | | | | | 0 | | | | |

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

## Physiography + site features that may help in determining PCT and Management Zone (optional)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Morphological Type | | Landform Element | | Landform Pattern | | Microrelief | |
| Lithology | | Soil Surface Texture | | Soil Colour | | Soil Depth | |
| Slope | | Aspect | | Site Drainage | | Distance to nearest water and type | |

## Plot Disturbance

| | Severity code | Age code |
|---|---|---|
| Clearing (inc. logging) | | |
| Cultivation (inc. pasture) | | |
| Soil erosion | | |
| Firewood / CWD removal | | |
| Grazing (identify native/stock) | | |
| Fire damage | | |
| Storm damage | | |
| Weediness | | |
| Other | | |

**Free Text Section for brief site description**

**Intact native bushland with trees to 16 m, in north-west corner of mapped Duffys Forest EEC. Dense shrub layer in places. Almost weed free.**
***Corymbia gummifera* recorded in 20 x 50 but not in 20 x 20.**
**Some ironstone rocks present with sandstone outcrop.**
**Photos 001 to 003 – general plot**
**Photos 004 to 008 – soil and rocks in plot**
**5 species of *Lomandra* recorded.**

| 400 m² plot: Sheet 2_ of 2_ | | Survey Name | Plot Identifier | Recorders |
|---|---|---|---|---|
| Date | 27/08/2020 | Belrose | Hayes-001 | Dan Clarke |

| GF Code | *Species name* | N, E or HTE | Cover | Abund | Stratum | vou cher |
|---|---|---|---|---|---|---|
| E | *Pteridium esculentum* | N | 0.25 | 20 | Ground | |
| E | *Lindsaea microphylla* | N | 0.1 | 10 | Ground | |
| E | *Lindsaea linearis* | N | 0.1 | 50 | Ground | |
| F | *Patersonia sericea* | N | 0.25 | 50 | Ground | |
| F | *Actinotus minor* | N | 0.1 | 100 | Ground | |
| F | *Dampiera stricta* | N | 0.1 | 10 | Ground | |
| F | *Xanthosia tridentata* | N | 0.1 | 200 | Ground | |
| G | *Entolasia stricta* | N | 3 | 500 | Ground | |
| G | **Andropogon virginicus* | HTE | 0.1 | 50 | Ground | |
| G | *Austrostipa pubescens* | N | 2 | 250 | Ground | |
| R | *Lomandra longifolia* | N | 2 | 20 | Ground | |
| R | *Lomandra cylindrica* | N | 0.1 | 100 | Ground | |
| R | *Leptospermum squarrosum* | N | 0.5 | 20 | Mid | |
| R | *Leptospermum trinervium* | N | 10 | 100 | Mid | |
| R | *Lepyrodia scariosa* | N | 0.1 | 50 | Ground | |
| R | *Lomandra gracilis* | N | 0.1 | 50 | Ground | |
| R | *Lomandra obliqua* | N | 0.25 | 200 | Ground | |
| S | *Banksia ericifolia* | N | 2 | 20 | Mid | |
| S | *Kunzea ambigua* | N | 2 | 20 | Mid | |
| S | *Grevillea linearifolia* | N | 2 | 50 | Mid | |
| S | *Bauera rubioides* | N | 0.25 | 50 | Ground | |
| S | *Micrantheum ericoides* | N | 0.5 | 200 | Ground | |
| S | *Platysace linearifolia* | N | 0.1 | 50 | Mid | |
| S | *Aotus ericoides* | N | 0.1 | 20 | Mid | |
| S | *Phyllanthus hirtellus* | N | 0.25 | 200 | Ground | |
| S | *Bossiaea heterophylla* | N | 0.1 | 2 | Mid | |
| S | *Hakea teretifolia* | N | 0.1 | 1 | Mid | |
| S | *Monotoca scoparia* | N | 0.1 | 2 | Mid | |
| S | *Hibbertia linearis* | N | 0.25 | 20 | Mid | |
| S | *Tetratheca ericifolia* | N | 0.5 | 100 | Ground | |
| S | *Epacris pulchella* | N | 0.1 | 10 | Mid | |
| S | *Lambertia formosa* | N | 0.25 | 2 | Mid | |
| S | *Banksia oblongifolia* | N | 0.25 | 3 | Mid | |
| S | *Lasiopetalum ferrugineum* | N | 0.1 | 10 | Mid | |
| T | *Angophora costata* | N | 15 | 10 | Upper | |
| T | *Eucalyptus haemastoma* | N | 5 | 3 | Upper | |
| T | *Allocasuarina littoralis* | N | 0.25 | 3 | Mid | |
| V | *Cyathochaeta diandra* | N | 2 | 250 | Ground | |
| V | *Gahnia radula* | N | 5 | 250 | Ground | |

**GF Code:** see Growth Form definitions in Appendix 4 (can be worked out later) **N:** native, **E:** exotic, **HTE:** high threat exotic
**Cover:** 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
**Abundance:** For species with cover less than or equal to 5% count or estimate the number of individuals or shoots of each species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, 1500, 2000 etc. Numbers above 20 are estimates.
**Stratum:** not for entry to calculator, to assist with PCT identification.
Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

| 400 m² plot: Sheet 3_ of 3_ | | Survey Name | Plot Identifier | Recorders |
|---|---|---|---|---|
| Date | 27/08/2020 | Belrose | Hayes-001 | Dan Clarke |

| GF Code | *Species name* | N, E or HTE | Cover | Abund | Stratum | vou cher |
|---|---|---|---|---|---|---|
| F | *Patersonia glabrata* | N | 0.1 | 20 | Ground | |
| F | *Dianella caerulea* | N | 0.1 | 10 | Ground | |
| F | *Cryptostylis erecta* | N | 0.1 | 20 | Ground | |
| F | *Xanthosia pilosa* | N | 0.1 | 10 | Ground | |
| F | *Hibbertia salicifolia* | N | 0.1 | 2 | Ground | |
| G | *Microlaena stipoides* | N | 0.1 | 200 | Ground | |
| G | *Imperata cylindrica* | N | 0.1 | 50 | Ground | |
| G | *Anisopogon avenaceus* | N | 2 | 100 | Ground | |
| L | *Cassytha pubescens* | N | 0.1 | 100 | Ground | |
| L | *Billardiera scandens* | N | 0.1 | 20 | Ground | |
| L | *Smilax glyciphylla* | N | 0.1 | 20 | Ground | |
| R | *Schoenus ericetorum* | N | 0.1 | 50 | Ground | |
| R | *Lomandra multiflora* | N | 0.1 | 20 | Ground | |
| R | *Lomandra glauca* | N | 0.1 | 50 | Ground | |
| S | *Pimelea linifolia* | N | 0.1 | 2 | Ground | |
| S | *Grevillea buxifolia* | N | 0.1 | 2 | Mid | |
| S | *Acacia linifolia* | N | 0.1 | 1 | Mid | |
| S | *Acacia longissima* | N | 0.25 | 2 | Mid | |
| S | *Boronia ledifolia* | N | 0.1 | 3 | Mid | |
| S | *Allocasuarina distyla* | N | 0.25 | 1 | Mid | |
| S | *Lomatia silaifolia* | N | 0.1 | 1 | Ground | |
| S | *Acacia ulicifolia* | N | 0.1 | 2 | Mid | |
| S | *Dillwynia retorta* | N | 0.1 | 2 | Mid | |
| S | *Isopogon anemonifolius* | N | 0.1 | 1 | Mid | |
| S | *Persoonia pinifolia* | N | 0.1 | 2 | Mid | |
| T | *Eucalyptus oblonga* | N | 1 | 1 | Upper | |
| T | *Eucalyptus sieberi* | N | 5 | 3 | Upper | |
| X | *Xanthorrhoea media* | N | 0.25 | 1 | Ground | |

**GF Code:** see Growth Form definitions in Appendix 4 (can be worked out later) **N:** native, **E:** exotic, **HTE:** high threat exotic

**Cover:** 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

**Abundance:** For species with cover less than or equal to 5% count or estimate the number of individuals or shoots of each species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, 1500, 2000 etc. Numbers above 20 are estimates.

**Stratum:** not for entry to calculator, to assist with PCT identification.

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

# BAM Plot – Field Survey Form

Site Sheet no: **1 of 3**

| Survey Name | Plot Identifier | Recorders |
|---|---|---|
| Belrose | Hayes 002 | Dan Clarke |

| Date | Datum | IBRA region | | Photo # | Zone ID |
|---|---|---|---|---|---|
| 27/08/2020 | MGA | | | 009-015 | |

| Zone | Easting | Northing | Dimensions | Orientation of midline from the 0 m point. |
|---|---|---|---|---|
| 56 | 335313 | 6266871 | 50 x 20 m | NNW 325° |

| Vegetation Class | | Confidence: H M L |
|---|---|---|
| Plant Community Type | EEC: | Confidence: H **M** L |

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

| BAM Attribute (400 m² plot) | | Sum values |
|---|---|---|
| Count of **Native Richness** | Trees | 7 |
| | Shrubs | 27 |
| | Grasses etc. | 3 |
| | Forbs | 15 |
| | Ferns | 4 |
| | Other | 14 |
| Sum of **Cover** of native vascular plants by growth form group | Trees | 20.45 |
| | Shrubs | 5.35 |
| | Grasses etc. | 4.1 |
| | Forbs | 6.8 |
| | Ferns | 0.7 |
| | Other | 6.9 |
| **High Threat Weed cover** | | 0.1 |

| BAM Attribute (20 x 50 m plot) dbh | Euc* | Non Euc | HBTs † | 20cm+ |
|---|---|---|---|---|
| large trees for Euc* & Non Euc: 80 + cm | | | 1 | |
| large trees for Euc* & Non Euc: 50 – 79 cm | 1 | | | |
| 30 – 49 cm | X | X | | |
| 20 – 29 cm | X | X | | |
| 10 – 19 cm | X | X | | n/a |
| 5 – 9 cm | X | Xtick | n/a | |
| < 5 cm | tick | tick | This size class records tree regeneration | |
| **Length of logs (m)** (≥10 cm diameter, >50 cm in length) | 3,4,2,2,5,2,7,3,2 | | | Total **30 m** |

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only, unless a 'large tree' for that class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† Hollow must be at least 1m above ground, entrance at least 5cm

Each size class is noted as present by the **living tree stems** only. Measured at 1.3m above the ground. Depending on the Vegetation Class, DBH values and counts may be needed for a class.

For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

| BAM Attribute (1 x 1 m plots) | Litter cover (%) | | | | | Bare ground cover (%) | | | | | Cryptogam cover (%) | | | | | Rock cover (%) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subplot score (% in each) | 80 | 80 | 80 | 30 | 80 | 1 | 2 | 0 | 1 | 0 | | | | | | 1 | 1 | 1 | 50 | 0 |
| Average of the 5 subplots | 54 | | | | | 0.8 | | | | | | | | | | 10.6 | | | | |

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

## Physiography + site features that may help in determining PCT and Management Zone (optional)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Morphological Type | | Landform Element | | Landform Pattern | | Microrelief | |
| Lithology | | Soil Surface Texture | | Soil Colour | | Soil Depth | |
| Slope | | Aspect | | Site Drainage | | Distance to nearest water and type | |

## Plot Disturbance

| | Severity code | Age code |
|---|---|---|
| Clearing (inc. logging) | | |
| Cultivation (inc. pasture) | | |
| Soil erosion | | |
| Firewood / CWD removal | | |
| Grazing (identify native/stock) | | |
| Fire damage | | |
| Storm damage | | |
| Weediness | | |
| Other | | |

**Free Text Section for brief site description**

**Open woodland on extensive sandstone outcrop recovering from bushfire.**
**On moderate slope.**
**On western boundary of site in mapped Duffys Forest polygon.**
**Some weed invasion.**

| 400 m² plot: Sheet 2_ of 3_ | | Survey Name | Plot Identifier | Recorders |
|---|---|---|---|---|
| Date | 27/8/2020 | Belrose | Hayes 002 | Dan Clarke |

| GF Code | *Species name* | N, E or HTE | Cover | Abund | Stratum | vou cher |
|---|---|---|---|---|---|---|
| E | *Lindsaea linearis* | N | 0.25 | 250 | Ground | |
| F | *Gonocarpus teucrioides* | N | 5 | 500 | Ground | |
| F | *Amperea xiphoclada* | N | 0.1 | 10 | Ground | |
| F | *Dampiera stricta* | N | 0.1 | 100 | Ground | |
| F | *Xanthosia tridentata* | N | 0.25 | 500 | Ground | |
| F | *Actinotus minor* | N | 0.25 | 200 | Ground | |
| F | *Hibbertia salicifolia* | N | 0.1 | 20 | Ground | |
| F | *Opercularia aspera* | N | 0.1 | 50 | Ground | |
| F | *Xanthosia pilosa* | N | 0.1 | 100 | Ground | |
| G | *Entolasia stricta* | N | 2 | 250 | Ground | |
| G | *Microlaena stipoides* | N | 0.1 | 200 | Ground | |
| G | *Anisopogon avenaceus* | N | 2 | 200 | Ground | |
| L | *Cassytha pubescens* | N | 0.1 | 100 | Ground | |
| L | *Smilax glyciphylla* | N | 0.1 | 10 | Ground | |
| R | *Lepyrodia scariosa* | N | 0.1 | 100 | Ground | |
| R | *Lomandra cylindrica* | N | 0.1 | 100 | Ground | |
| R | *Lomandra multiflora* | N | 0.1 | 100 | Ground | |
| R | *Lomandra filiformis* subsp. *filiformis* | N | 0.1 | 100 | Ground | |
| S | *Grevillea speciosa* | N | 0.25 | 100 | Mid | |
| S | *Micrantheum ericoides* | N | 0.1 | 20 | Mid | |
| S | *Platysace linearifolia* | N | 0.25 | 100 | Mid | |
| S | *Pultenaea stipularis* | N | 0.1 | 200 | Mid | |
| S | *Leptospermum trinervium* | N | 2 | 500 | Mid | |
| S | *Acacia ulicifolia* | N | 0.1 | 50 | Mid | |
| S | *Boronia ledifolia* | N | 0.25 | 100 | Mid | |
| S | *Zieria pilosa* | N | 0.1 | 10 | Ground | |
| S | *Acacia myrtifolia* | N | 0.1 | 10 | Ground | |
| S | *Bossiaea heterophylla* | N | 0.1 | 10 | Ground | |
| S | *Acacia linifolia* | N | 0.1 | 10 | Ground | |
| S | *Lambertia formosa* | N | 0.1 | 10 | Ground | |
| S | *Leptospermum squarrosum* | N | 0.25 | 10 | Ground | |
| T | *Banksia serrata* | N | 1 | 20 | Mid | |
| T | *Corymbia gummifera* | N | 5 | 10 | Upper | |
| T | *Eucalyptus haemastoma* | N | 10 | 7 | Upper | |
| T | *Angophora crassifolia* | N | 2 | 20 | Mid | |
| T | *Allocasuarina littoralis* | N | 0.1 | 5 | Mid | |
| V | *Gahnia sieberiana* | N | 2 | 20 | Ground | |
| V | *Lepidosperma laterale* | N | 0.5 | 100 | Ground | |
| X | *Xanthorrhoea media* | N | 1 | 4 | Ground | |

**GF Code:** see Growth Form definitions in Appendix 4 (can be worked out later) **N:** native, **E:** exotic, **HTE:** high threat exotic
**Cover:** 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
**Abundance:** For species with cover less than or equal to 5% count or estimate the number of individuals or shoots of each species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, 1500, 2000 etc. Numbers above 20 are estimates.
**Stratum:** not for entry to calculator, to assist with PCT identification.
Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

| 400 m² plot: Sheet 3_ of 3_ | Survey Name | Plot Identifier | Recorders |
|---|---|---|---|
| Date | | | |

| GF Code | *Species name* | N, E or HTE | Cover | Abund | Stratum | vou cher |
|---|---|---|---|---|---|---|
| E | *Calochlaena dubia* | N | 0.1 | 20 | **Ground** | |
| E | *Gleichenia dicarpa* | N | 0.25 | 50 | **Ground** | |
| E | *Pteridium esculentum* | N | 0.1 | 10 | **Ground** | |
| F | *Tetratheca ericifolia* | N | 0.25 | 100 | **Ground** | |
| F | **Senecio madagascariensis* | E | 0.1 | 1 | **Ground** | |
| F | *Hibbertia fasciculata* | N | 0.1 | 1 | **Ground** | |
| F | *Dianella caerulea* | N | 0.1 | 10 | **Ground** | |
| F | *Calochilus* sp. | N | 0.1 | 2 | **Ground** | |
| F | *Cryptostylis erecta* | N | 0.1 | 20 | **Ground** | |
| F | **Hypochaeris radicata* | E | 0.1 | 1 | **Ground** | |
| F | *Patersonia sericea* | N | 0.1 | 10 | **Ground** | |
| F | *Mitrasacme polymorpha* | N | 0.1 | 10 | **Mid** | |
| G | **Andropogon virginicus* | HTE | 0.1 | 20 | **Ground** | |
| R | *Schoenus ericetorum* | N | 0.1 | 50 | **Ground** | |
| R | *Lomandra obliqua* | N | 0.25 | 100 | **Ground** | |
| R | *Lomandra glauca* | N | 0.25 | 100 | **Ground** | |
| S | *Pultenaea tuberculata* | N | 0.1 | 20 | **Mid** | |
| S | *Allocasuarina distyla* | N | 0.1 | 20 | **Mid** | |
| S | *Acacia suaveolens* | N | 0.1 | 1 | **Mid** | |
| S | *Banksia oblongifolia* | N | 0.25 | 3 | **Mid** | |
| S | *Grevillea buxifolia* subsp. *buxifolia* | N | 0.1 | 1 | **Mid** | |
| S | *Boronia floribunda* | N | 0.1 | 10 | **Mid** | |
| S | *Epacris pulchella* | N | 0.1 | 3 | **Mid** | |
| S | *Woollsia pungens* | N | 0.1 | 1 | **Mid** | |
| S | *Dodonaea triquetra* | N | 0.1 | 50 | **Mid** | |
| S | *Hovea linearis* | N | 0.1 | 1 | **Mid** | |
| S | *Tetratheca glandulosa?* | N | 0.1 | 3 | **Ground** | |
| S | *Hakea teretifolia* | N | 0.1 | 1 | **Mid** | |
| S | *Aotus ericoides* | N | 0.1 | 20 | **Mid** | |
| T | *Angophora costata* | N | 2 | 2 | **Upper** | |
| S | *Banksia ericifolia* | N | 0.25 | 50 | **Mid** | |
| T | *Elaeocarpus reticulatus* | N | 0.1 | 1 | **Mid** | |
| V | *Cyathochaeta diandra* | N | 3 | 250 | **Ground** | |

**GF Code:** see Growth Form definitions in Appendix 4 (can be worked out later) **N:** native, **E:** exotic, **HTE:** high threat exotic
**Cover:** 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
**Abundance:** For species with cover less than or equal to 5% count or estimate the number of individuals or shoots of each species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, 1500, 2000 etc. Numbers above 20 are estimates.
**Stratum:** not for entry to calculator, to assist with PCT identification.
Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

# BAM Plot – Field Survey Form

Site Sheet no: **1 of 3**

| Survey Name | Plot Identifier | Recorders |
|---|---|---|
| Belrose | Hayes 003 | Dan Clarke |

| Date | Datum | IBRA region | | Photo # | Zone ID |
|---|---|---|---|---|---|
| 27/08/2020 | MGA | | | 016-022 | NW - 315° |

| Zone | Easting | Northing | Dimensions | Orientation of midline from the 0 m point. |
|---|---|---|---|---|
| 56 | 335930 | 6267028 | 50 x 20 | |

| | | |
|---|---|---|
| **Vegetation Class** | | Confidence: **H** M L |
| **Plant Community Type** | **EEC:** | Confidence: H **M** L |

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

| BAM Attribute (400 m² plot) | | Sum values |
|---|---|---|
| Count of **Native Richness** | **Trees** | 7 |
| | **Shrubs** | 28 |
| | **Grasses etc.** | 3 |
| | **Forbs** | 7 |
| | **Ferns** | 2 |
| | **Other** | 11 |
| Sum of **Cover** of native vascular plants by growth form group | **Trees** | 22.35 |
| | **Shrubs** | 14.45 |
| | **Grasses etc.** | 5.25 |
| | **Forbs** | 2 |
| | **Ferns** | 0.2 |
| | **Other** | 12.25 |
| **High Threat Weed cover** | | 0 |

| BAM Attribute (20 x 50 m plot) dbh | Stem Classes and Hollows: Euc* | Non Euc | HBTs † | 20cm+ |
|---|---|---|---|---|
| large trees for Euc* & Non Euc: **80 + cm** | | | | |
| large trees for Euc* & Non Euc: **50 – 79 cm** | 1 | | | |
| **30 – 49 cm** | X | | | |
| **20 – 29 cm** | X | | | |
| **10 – 19 cm** | X | | | n/a |
| **5 – 9 cm** | X | tick | n/a | |
| **< 5 cm** | X | tick | This size class records tree regeneration | |
| **Length of logs (m)** (≥10 cm diameter, >50 cm in length) | **2, 5, 3, 5, 2, 2, 2** | | | Total **21 metres** |

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only, unless a 'large tree' for that class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† Hollow must be at least 1m above ground, entrance at least 5cm

Each size class is noted as present by the **living tree stems** only. Measured at 1.3m above the ground. Depending on the Vegetation Class, DBH values and counts may be needed for a class.

For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate. For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

| BAM Attribute (1 x 1 m plots) | Litter cover (%) | | | | | Bare ground cover (%) | | | | | Cryptogam cover (%) | | | | | Rock cover (%) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Subplot score (% in each)** | 50 | 95 | 10 | 50 | 40 | 1 | 0 | 0 | 0 | 0 | | | | | | 0 | 0 | 90 | 0 | 0 |
| **Average of the 5 subplots** | 57 | | | | | 0.2 | | | | | | | | | | 18 | | | | |

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

## Physiography + site features that may help in determining PCT and Management Zone (optional)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Morphological Type | | Landform Element | | Landform Pattern | | Microrelief | |
| Lithology | | Soil Surface Texture | | Soil Colour | | Soil Depth | |
| Slope | | Aspect | | Site Drainage | | Distance to nearest water and type | |

## Plot Disturbance

| | Severity code | Age code |
|---|---|---|
| Clearing (inc. logging) | | |
| Cultivation (inc. pasture) | | |
| Soil erosion | | |
| Firewood / CWD removal | | |
| Grazing (identify native/stock) | | |
| Fire damage | | |
| Storm damage | | |
| Weediness | | |
| Other | | |

**Free Text Section for brief site description**

**Intact open sandstone woodland – very good quality with a dense groundlayer of shrubs and sedges. Midstorey of shrubs.**
**Heavy leaf litter.**
***Eucalyptus umbra* in 20 x 50 m but not 20 x 20 m.**
**Sandstone outcrop surrounding plot.**
**Large goanna sighted.**

| 400 m² plot: Sheet 2_ of 3_ | | Survey Name | Plot Identifier | Recorders |
|---|---|---|---|---|
| Date | 27/08/2020 | Belrose | Hayes 003 | Dan Clarke |

| GF Code | *Species name* | N, E or HTE | Cover | Abund | Stratum | voucher |
|---|---|---|---|---|---|---|
| E | *Lindsaea microphylla* | N | 0.1 | 20 | Ground | |
| F | *Actinotus minor* | N | 0.1 | 100 | Ground | |
| F | *Tetratheca ericifolia* | N | 0.5 | 250 | Ground | |
| F | *Patersonia glabrata* | N | 1 | 250 | Ground | |
| F | *Dampiera stricta* | N | 0.1 | 250 | Ground | |
| G | *Anisopogon avenaceus* | N | 3 | 200 | Ground | |
| G | *Entolasia stricta* | N | 2 | 500 | Ground | |
| L | *Cassytha pubescens* | N | 0.1 | 500 | Ground | |
| R | *Lomandra obliqua* | N | 0.25 | 250 | Ground | |
| R | *Lepyrodia scariosa* | N | 0.1 | 100 | Ground | |
| R | *Schoenus ericetorum* | N | 0.25 | 250 | Ground | |
| S | *Epacris pulchella* | N | 0.1 | 100 | Mid | |
| S | *Grevillea speciosa* | N | 0.25 | 50 | Mid | |
| S | *Pultenaea stipularis* | N | 0.1 | 50 | Mid | |
| S | *Boronia floribunda* | N | 1 | 100 | Mid | |
| S | *Hakea gibbosa* | N | 0.25 | 50 | Mid | |
| S | *Banksia ericifolia* | N | 2 | 20 | Mid | |
| S | *Leptospermum trinervium* | N | 3 | 50 | Mid | |
| S | *Platysace linearifolia* | N | 2 | 200 | Mid | |
| S | *Lambertia formosa* | N | 1 | 20 | Mid | |
| S | *Pimelea linifolia* | N | 0.1 | 20 | Mid | |
| S | *Hibbertia bracteata* | N | 1 | 50 | Mid | |
| S | *Dillwynia retorta* | N | 0.1 | 10 | Mid | |
| S | *Hakea teretifolia* | N | 0.1 | 10 | Mid | |
| S | *Grevillea buxifolia subsp. buxifolia* | N | 0.1 | 3 | Mid | |
| S | *Pultenaea tuberculata* | N | 0.1 | 10 | Mid | |
| S | *Micrantheum ericoides* | N | 0.25 | 50 | Mid | |
| S | *Acacia ulicifolia* | N | 0.5 | 10 | Mid | |
| T | *Eucalyptus oblonga* | N | 2 | 2 | Upper | |
| T | *Eucalyptus sieberi* | N | 2 | 1 | Upper | |
| T | *Eucalyptus haemastoma* | N | 10 | 5 | Upper | |
| T | *Corymbia gummifera* | N | 7.5 | 20 | Upper | |
| T | *Allocasuarina littoralis* | N | 0.1 | 10 | Upper | |
| T | *Banksia serrata* | N | 0.5 | 10 | Mid | |
| V | *Gahnia radula* | N | 3 | 200 | Ground | |
| V | *Cyathochaeta diandra* | N | 3 | 500 | Ground | |
| V | *Lepidosperma viscidum* | N | 5 | 100 | Ground | |
| X | *Xanthorrhoea media* | N | 0.25 | 3 | Ground | |
| X | *Xanthorrhoea minor* | N | 0.1 | 3 | Ground | |

**GF Code:** see Growth Form definitions in Appendix 4 (can be worked out later) **N:** native, **E:** exotic, **HTE:** high threat exotic
**Cover:** 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
**Abundance:** For species with cover less than or equal to 5% count or estimate the number of individuals or shoots of each species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, 1500, 2000 etc. Numbers above 20 are estimates.
**Stratum:** not for entry to calculator, to assist with PCT identification.

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

| 400 $m^2$ plot: Sheet 3_ of 3_ | Survey Name | Plot Identifier | Recorders |
|---|---|---|---|
| Date | | | |

| GF Code | *Species name* | N, E or HTE | Cover | Abund | Stratum | vou cher |
|---|---|---|---|---|---|---|
| G | *Microlaena stipoides* | N | 0.25 | 200 | **Ground** | |
| E | *Lindsaea linearis* | N | 0.1 | 50 | **Ground** | |
| F | *Dianella caerulea* | N | 0.1 | 20 | **Ground** | |
| F | *Hybanthus monopetalus* | N | 0.1 | 20 | **Ground** | |
| F | *Dianella prunina* | N | 0.1 | 1 | **Ground** | |
| R | *Lomandra glauca* | N | 0.1 | 20 | **Ground** | |
| S | *Lomatia silaifolia* | N | 0.1 | 3 | **Ground** | |
| S | *Bossiaea heterophylla* | N | 0.1 | 2 | **Mid** | |
| S | *Phyllanthus hirtellus* | N | 0.1 | 50 | **Ground** | |
| S | *Persoonia levis* | N | 0.5 | 2 | **Mid** | |
| S | *Hakea dactyloides* | N | 0.1 | 1 | **Mid** | |
| S | *Aotus ericoides* | N | 0.1 | 20 | **Mid** | |
| S | *Monotoca scoparia* | N | 0.1 | 2 | **Mid** | |
| S | *Gompholobium grandiflorum* | N | 0.1 | 1 | **Mid** | |
| S | *Hovea linearis* | N | 0.1 | 2 | **Mid** | |
| S | *Boronia ledifolia* | N | 0.1 | 20 | **Mid** | |
| S | *Persoonia pinifolia* | N | 0.1 | 1 | **Mid** | |
| T | *Angophora crassifolia* | N | 0.25 | 2 | **Mid** | |
| V | *Billardiera scandens* | N | 0.1 | 1 | **Ground** | |

**GF Code:** see Growth Form definitions in Appendix 4 (can be worked out later) **N:** native, **E:** exotic, **HTE:** high threat exotic
**Cover:** 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
**Abundance:** For species with cover less than or equal to 5% count or estimate the number of individuals or shoots of each species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, 1500, 2000 etc. Numbers above 20 are estimates.
**Stratum:** not for entry to calculator, to assist with PCT identification.

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

# BAM Plot – Field Survey Form

Site Sheet no: 1 of

| Survey Name | Plot Identifier | Recorders |
|---|---|---|
| Berowe E | 4 | R Hoge D Clarke |

| Date | Zone | Datum | IBRA region | Photo # | Zone ID |
|---|---|---|---|---|---|
| 4 3 21 | 56 | | Pilliga | ✓ | |

| Easting | Northing | Plot Dimensions (e.g. 20 x 20 in 20 x 50) | Orientation of midline from the 0 m point. |
|---|---|---|---|
| -33.725804 | 151.225651 | 20x20 in 20x50 | 150° SE Magnetic ° |

| Likely Vegetation Class | Confidence: H M L |
|---|---|
| DSF | |

| Plant Community Type | EEC: | Confidence: H M L |
|---|---|---|
| | X | |

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

| BAM Attribute (400 m² plot) | | Sum values |
|---|---|---|
| Count of Native Richness | Trees | 6 |
| | Shrubs | 32 |
| | Grasses etc. | 9 |
| | Forbs | 8 |
| | Ferns | 5 |
| | Other | 2 |
| Sum of Cover of native vascular plants by growth form group | Trees | 20.3 |
| | Shrubs | 16.6 |
| | Grasses etc. | 5.3 |
| | Forbs | 2.75 |
| | Ferns | 3.45 |
| | Other | 0.2 |
| High Threat Weed cover % | | 0.1 |

This table may be completed after entering data into available tools. It is not required while in the field.

| BAM Attribute (20 x 50 m plot) dbh | Euc* | Non Euc | Stem Classes and Hollows: Hollows† |
|---|---|---|---|
| 80 + cm | | | — |
| 50 – 79 cm | 1 | | |
| 30 – 49 cm | III | | Hollows 20cm+ |
| 20 – 29 cm | ✓ | | — |
| 10 – 19 cm | ✓ | | |
| 5 – 9 cm | ✓ | ✓ | |
| < 5 cm | ✓ | ✓ | This size class records tree regeneration |
| Length of logs (m) (≥10 cm diameter, >50 cm in length) | 4+6+2+5+3+2 | | total 22 |

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

| BAM Attribute (1 x 1 m plots) | Litter cover (%) | Bare ground cover (%) | Cryptogam cover (%) | Rock cover (%) |
|---|---|---|---|---|
| Subplot score (% in each) | 80 80 100 70 90 | a b c d e | a b c d e | a b c d e |
| Average of the 5 subplots | 84 | | | |

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

## Physiography + site features that may help in determining PCT and Management Zone (optional)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Morphological Type | | Landform Element | | Landform Pattern | | Microrelief | |
| Lithology | | Soil Surface Texture | | Soil Colour | | Soil Depth | |
| Slope | | Aspect | | Site Drainage | | Distance to nearest water and type | |

| Plot Disturbance | Severity code | Age code |
|---|---|---|
| Clearing (inc. logging) | | |
| Cultivation (inc. pasture) | | |
| Soil erosion | | |
| Firewood / CWD removal | | |
| Grazing (identify native/stock) | | |
| Fire damage | | |
| Storm damage | | |
| Weediness | | |
| Other | | |

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

**Free Text Section for brief site description**

regenerating bushland
good condition
old quarry for old track in plot

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

| 400 m² plot: Sheet 2_ of 2_ | | Survey Name | Plot Identifier | Recorders |
|---|---|---|---|---|
| Date | 04/03/2021 | Belrose | Hayes-004 | Dan Clarke |

| GF Code | *Species name* | N, E or HTE | Cover | Abund | Stratum | voucher |
|---|---|---|---|---|---|---|
| E | *Pteridium esculentum* | N | 0.25 | 20 | Ground | |
| E | *Lindsaea microphylla* | N | 0.1 | 10 | Ground | |
| F | *Actinotus minor* | N | 1 | 1000 | Ground | |
| F | *Dampiera stricta* | N | 0.1 | 200 | Ground | |
| F | *Xanthosia tridentata* | N | 0.25 | 200 | Ground | |
| G | *Entolasia stricta* | N | 0.25 | 200 | Ground | |
| G | **Andropogon virginicus* | HTE | 0.1 | 5 | Ground | |
| G | *Austrostipa pubescens* | N | 0.1 | 10 | Ground | |
| R | *Lomandra longifolia* | N | 0.25 | 20 | Ground | |
| S | *Leptospermum squarrosum* | N | 0.25 | 50 | Mid | |
| R | *Lepyrodia scariosa* | N | 3 | 500 | Ground | |
| S | *Banksia ericifolia* | N | 2 | 100 | Mid | |
| S | *Kunzea ambigua* | N | 5 | 100 | Mid | |
| S | *Grevillea linearifolia* | N | 0.1 | 20 | Mid | |
| S | *Micrantheum ericoides* | N | 0.5 | 250 | Ground | |
| S | *Platysace linearifolia* | N | 2 | 200 | Mid | |
| S | *Aotus ericoides* | N | 1 | 100 | Mid | |
| S | *Bossiaea heterophylla* | N | 0.1 | 50 | Mid | |
| S | *Hakea teretifolia* | N | 0.1 | 10 | Mid | |
| S | *Monotoca scoparia* | N | 0.1 | 10 | Mid | |
| S | *Epacris pulchella* | N | 1 | 200 | Mid | |
| T | *Angophora costata* | N | 5 | 20 | Upper | |
| T | *Allocasuarina littoralis* | N | 0.1 | 10 | Mid | |
| F | *Patersonia glabrata* | N | 0.1 | 50 | Ground | |
| F | *Dianella caerulea* | N | 0.1 | 20 | Ground | |
| F | *Xanthosia pilosa* | N | 1 | 500 | Ground | |
| L | *Billardiera scandens* | N | 0.1 | 10 | Ground | |
| L | *Smilax glyciphylla* | N | 0.1 | 5- | Ground | |
| R | *Schoenus ericetorum* | N | 0.1 | 20 | Ground | |
| R | *Lomandra glauca* | N | 0.25 | 100 | Ground | |
| S | *Grevillea buxifolia* subsp. *buxifolia* | N | 0.1 | 20 | Mid | |
| S | *Acacia linifolia* | N | 0.1 | 20 | Mid | |
| S | *Boronia ledifolia* | N | 0.5 | 100 | Mid | |
| S | *Acacia ulicifolia* | N | 0.1 | 20 | Mid | |
| S | *Dillwynia retorta* | N | 0.1 | 20 | Mid | |
| S | *Persoonia pinifolia* | N | 0.1 | 2 | Mid | |
| T | *Eucalyptus piperita* | N | 5 | 10 | Upper | |
| T | *Eucalyptus sieberi* | N | 10 | 7 | Upper | |
| S | *Eriostemon australasius* | N | 1 | 200 | Mid | |
| T | *Banksia serrata* | N | 0.1 | 20 | Mid | |
| S | *Dodonaea triquetra* | N | 0.1 | 100 | Mid | |
| V | *Gahnia sieberiana* | N | 0.25 | 50 | Ground | |
| S | *Phyllota phylicoides* | N | 0.1 | 50 | Mid | |

| | | | | | | |
|---|---|---|---|---|---|---|
| S | *Acacia terminalis* subsp. 'Glabrous Form' | N | 0.1 | 10 | Mid | |
| V | *Caustis flexuosa* | N | 1 | 100 | Ground | |
| S | *Hakea laevipes* | N | 0.1 | 50 | Mid | |
| S | *Grevillea speciosa* | N | 1 | 50 | Mid | |
| S | *Pultenaea stipularis* | N | 0.1 | 20 | Mid | |
| S | *Epacris longiflora* | N | 0.1 | 20 | Mid | |
| E | *Gleichenia dicarpa* | N | 2 | 50 | Ground | |
| S | *Zieria pilosa* | N | 0.1 | 20 | Ground | |
| S | *Crowea saligna* | N | 0.25 | 50 | Ground | |
| S | *Woollsia pungens* | N | 0.1 | 50 | Mid | |
| S | *Kunzea capitata* | N | 0.1 | 2 | Mid | |
| F | *Mitrasacme polymorpha* | N | 0.1 | 20 | Mid | |
| S | *Phebalium squamulosum* | N | 0.1 | 10 | Mid | |
| F | *Gonocarpus teucrioides* | N | 0.1 | 20 | Ground | |
| T | *Elaeocarpus reticulatus* | N | 0.1 | 2 | Mid | |
| S | *Acacia suaveolens* | N | 0.1 | 2 | Mid | |
| S | *Epacris microphylla* | N | 0.1 | 10 | Mid | |
| G | *Aristida calycina* var. *calycina* | N | 0.1 | 5 | Ground | |
| E | *Schizaea bifida* | N | 0.1 | 10 | Ground | |
| E | *Calochlaena dubia* | N | 1 | 20 | Ground | |

**GF Code:** see Growth Form definitions in Appendix 4 (can be worked out later) **N:** native, **E:** exotic, **HTE:** high threat exotic
**Cover:** 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
**Abundance:** For species with cover less than or equal to 5% count or estimate the number of individuals or shoots of each species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, 1500, 2000 etc. Numbers above 20 are estimates.
**Stratum:** not for entry to calculator, to assist with PCT identification.
Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

# BAM Plot – Field Survey Form

Site Sheet no: 1 of

| | | Survey Name | Plot Identifier | Recorders |
|---|---|---|---|---|
| Date | 4 3 21 | Belrose | 5 | R Hogg D Clark |
| Zone 56 | Datum | IBRA region: Pittwater | Photo # ✓ | Zone ID |
| Easting -33.726358 | Northing 151.232431 | Plot Dimensions (e.g. 20 x 20 in 20 x 50): 20x20 in 20x50 | | Orientation of midline from the 0 m point.: 250° Magnetic |
| Likely Vegetation Class | tall shrubland | | | Confidence: H M L |
| Plant Community Type | | | EEC: X | Confidence: H M L |

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

| BAM Attribute (400 m² plot) | | Sum values |
|---|---|---|
| Count of Native Richness | Trees | 6 |
| | Shrubs | 35 |
| | Grasses etc. | 9 |
| | Forbs | 11 |
| | Ferns | 1 |
| | Other | 3 |
| Sum of Cover of native vascular plants by growth form group | Trees | 11.5 |
| | Shrubs | 32.1 |
| | Grasses etc. | 16.55 |
| | Forbs | 1.15 |
| | Ferns | 0.1 |
| | Other | 3.1 |
| High Threat Weed cover % | | 0.1 |

This table may be completed after entering data into available tools. It is not required while in the field.

| BAM Attribute (20 x 50 m plot) | Stem Classes and Hollows | | |
|---|---|---|---|
| dbh | Euc* | Non Euc | Hollows† |
| 80 + cm | | | 1 |
| 50 – 79 cm | | | |
| 30 – 49 cm | 11 | | Hollows 20cm+ |
| 20 – 29 cm | ✓ | ✓ | — |
| 10 – 19 cm | ✓ | ✓ | |
| 5 – 9 cm | ✓ | ✓ | |
| < 5 cm | ✓ | ✓ | This size class records tree regeneration |
| Length of logs (m) (≥10 cm diameter, >50 cm in length) | 3 | Tally space | total 3 |

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

| BAM Attribute (1 x 1 m plots) | Litter cover (%) | Bare ground cover (%) | Cryptogam cover (%) | Rock cover (%) |
|---|---|---|---|---|
| Subplot score (% in each) | a: 100, b: 100, c: 100, d: 100, e: 70 | a b c d e | a b c d e | a b c d e |
| Average of the 5 subplots | 94 | | | |

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

## Physiography + site features that may help in determining PCT and Management Zone (optional)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Morphological Type | | Landform Element | | Landform Pattern | | Microrelief | |
| Lithology | | Soil Surface Texture | | Soil Colour | | Soil Depth | |
| Slope | | Aspect | | Site Drainage | | Distance to nearest water and type | |

| Plot Disturbance | Severity code | Age code |
|---|---|---|
| Clearing (inc. logging) | | |
| Cultivation (inc. pasture) | | |
| Soil erosion | | |
| Firewood / CWD removal | | |
| Grazing (identify native/stock) | | |
| Fire damage | | |
| Storm damage | | |
| Weediness | | |
| Other | | |

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

| 400 m² plot: Sheet 2_ of 2_ | | Survey Name | Plot Identifier | Recorders |
|---|---|---|---|---|
| Date | 04/03/2021 | Belrose | Hayes-005 | Dan Clarke |

| GF Code | *Species name* | N, E or HTE | Cover | Abund | Stratum | vou cher |
|---|---|---|---|---|---|---|
| S | *Allocasuarina distyla* | N | 3 | 100 | Mid | |
| S | *Petrophile pulchella* | N | 1 | 100 | Mid | |
| F | *Actinotus minor* | N | 0.1 | 200 | Ground | |
| G | *Entolasia stricta* | N | 0.1 | 20 | Ground | |
| G | **Andropogon virginicus* | HTE | 0.1 | 10 | Ground | |
| S | *Acacia obtusifolia* | N | 0.1 | 20 | Mid | |
| R | *Lomandra longifolia* | N | 1 | 20 | Ground | |
| S | *Leptospermum squarrosum* | N | 1 | 50 | Mid | |
| R | *Lepyrodia scariosa* | N | 1 | 100 | Ground | |
| S | *Banksia ericifolia* | N | 15 | 100 | Mid | |
| S | *Kunzea ambigua* | N | 1 | 50 | Mid | |
| S | *Micrantheum ericoides* | N | 0.25 | 50 | Ground | |
| S | *Platysace linearifolia* | N | 1 | 50 | Mid | |
| S | *Bossiaea heterophylla* | N | 0.1 | 10 | Mid | |
| S | *Hakea teretifolia* | N | 1 | 50 | Mid | |
| S | *Epacris pulchella* | N | 0.1 | 10 | Mid | |
| T | *Allocasuarina littoralis* | N | 0.25 | 20 | Mid | |
| F | *Patersonia glabrata* | N | 0.1 | 50 | Ground | |
| F | *Dianella caerulea* | N | 0.25 | 50 | Ground | |
| F | *Xanthosia pilosa* | N | 0.1 | 50 | Ground | |
| L | *Billardiera scandens* | N | 1 | 10 | Ground | |
| R | *Schoenus ericetorum* | N | 2 | 500 | Ground | |
| R | *Lomandra glauca* | N | 0.1 | 50 | Ground | |
| S | *Boronia ledifolia* | N | 0.1 | 1 | Mid | |
| S | *Persoonia pinifolia* | N | 0.1 | 2 | Mid | |
| T | *Banksia serrata* | N | 1 | 10 | Mid | |
| S | *Dodonaea triquetra* | N | 0.1 | 50 | Mid | |
| S | *Acacia terminalis* subsp. 'Glabrous Form' | N | 0.1 | 10 | Mid | |
| S | *Hakea laevipes* | N | 0.1 | 20 | Mid | |
| S | *Grevillea speciosa* | N | 1 | 20 | Mid | |
| S | *Kunzea capitata* | N | 0.1 | 10 | Mid | |
| X | *Xanthorrhoea media* | N | 2 | 20 | Ground | |
| F | *Bossiaea scolopendria* | N | 0.1 | 20 | Ground | |
| E | *Cheilanthes sieberi* | N | 0.1 | 10 | Ground | |
| S | *Leptospermum arachnoides* | N | 2 | 100 | Mid | |
| S | *Leptospermum trinervium* | N | 2 | 100 | Mid | |
| F | **Conyza* sp. | E | 0.1 | 1 | Ground | |
| F | *Dianella prunina* | N | 0.1 | 10 | Ground | |
| T | *Angophora crassifolia* | N | 2 | 10 | Upper | |
| T | *Angophora hispida* | N | 3 | 20 | Mid | |
| G | *Anisopogon avenaceus* | N | 10 | 200 | Ground | |
| F | *Genoplesium fimbriatum* | N | 0.1 | 1 | Ground | |
| V | *Cyathochaeta diandra* | N | 2 | 50 | Ground | |

| | | | | | | |
|---|---|---|---|---|---|---|
| F | *Goodenia bellidifolia* | N | 0.1 | 100 | Ground | |
| S | *Zieria pilosa* | N | 0.1 | 20 | Ground | |
| S | *Calytrix tetragona* | N | 1 | 50 | Mid | |
| S | *Pultenaea tuberculata* | N | 0.1 | 20 | Mid | |
| S | *Banksia marginata* | N | 0.1 | 1 | Mid | |
| S | *Baeckea diosmifolia* | N | 0.5 | 100 | Ground | |
| S | *Acacia parramattensis* | N | 0.1 | 5 | Mid | |
| T | *Eucalyptus haemastoma* | N | 5 | 3 | Upper | |
| V | *Lepidosperma laterale* | N | 0.25 | 20 | Ground | |
| F | *Actinotus helianthi* | N | 0.1 | 10 | Ground | |
| S | *Crowea saligna* | N | 0.1 | 2 | Ground | |
| S | *Pimelea linifolia* | N | 0.1 | 10 | Ground | |
| V | *Caustis pentandra* | N | 0.1 | 2 | Ground | |
| S | *Lambertia formosa* | N | 0.1 | 10 | Mid | |
| S | *Hovea linearis* | N | 0.1 | 1 | Mid | |
| S | *Banksia oblongifolia* | N | 0.1 | 10 | Mid | |
| L | *Cassytha glabella* | N | 0.1 | 100 | Ground | |
| F | *Patersonia sericea* | N | 0.1 | 20 | Ground | |
| S | *Bauera rubioides* | N | 0.1 | 10 | Ground | |
| T | *Corymbia gummifera* | N | 0.25 | 1 | Upper | |
| S | *Acrotriche serrulata* | N | 0.1 | 3 | Mid | |
| S | *Leucopogon lanceolatus* | N | 0.1 | 1 | Mid | |
| S | *Hakea propinqua* | N | 0.25 | 1 | Mid | |
| F | *Tetratheca ericifolia* | N | 0.1 | 5 | Ground | |

**GF Code:** see Growth Form definitions in Appendix 4 (can be worked out later) **N:** native, **E:** exotic, **HTE:** high threat exotic
**Cover:** 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
**Abundance:** For species with cover less than or equal to 5% count or estimate the number of individuals or shoots of each species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, 1500, 2000 etc. Numbers above 20 are estimates.
**Stratum:** not for entry to calculator, to assist with PCT identification.
Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

# BAM Plot – Field Survey Form

Site Sheet no:

| Survey Name | Plot Identifier | Recorders |
|---|---|---|
| Belrose | 6 | R Hogan D Clarke |

| Date | Zone | Datum | IBRA region | Photo # | Zone ID |
|---|---|---|---|---|---|
| 4 3 21 | 56 | | Pittwater | ✓ | |

| Easting | Northing | Plot Dimensions (e.g. 20 x 20 in 20 x 50) | Orientation of midline from the 0 m point. |
|---|---|---|---|
| -33.724518 | 151.227444 | 20x20 in 20x50 | 70° E |

| Likely Vegetation Class | Confidence: H M L |
|---|---|
| plateau heath | |

| Plant Community Type | EEC: | Confidence: H M L |
|---|---|---|
| | ✗ | |

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified. magnetic bearing taken along midline.

| BAM Attribute (400 m² plot) | | Sum values |
|---|---|---|
| Count of Native Richness | Trees | 2 |
| | Shrubs | 35 |
| | Grasses etc. | 11 |
| | Forbs | 7 |
| | Ferns | 0 |
| | Other | 2 |
| Sum of Cover of native vascular plants by growth form group | Trees | 8 |
| | Shrubs | 26.85 |
| | Grasses etc. | 10.8 |
| | Forbs | 2.15 |
| | Ferns | 0 |
| | Other | 1.1 |
| High Threat Weed cover % | | 0 |

This table may be completed after entering data in available tools. It is not required while in the field.

| BAM Attribute (20 x 50 m plot) dbh | Euc* | Non Euc | Stem Classes and Hollows Hollows† |
|---|---|---|---|
| 80 + cm | | | 1 |
| 50 – 79 cm | | | |
| 30 – 49 cm | | | Hollows 20cm+ |
| 20 – 29 cm | 1 | | — |
| 10 – 19 cm | ✓ | ✓ | |
| 5 – 9 cm | ✓ | | |
| < 5 cm | ✓ | | This size class records tree regeneration |
| Length of logs (m) (≥10 cm diameter, >50 cm in length) | — | | total — |

Record **living** eucalypt* (Euc*) and **living native** non-eucalypt (Non Euc) stems separately

Data needed is presence only (tick) unless a 'large tree' for that veg class.

* includes all species of *Eucalyptus*, *Corymbia*, *Angophora*, *Lophostemon* and *Syncarpia*

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

| BAM Attribute (1 x 1 m plots) | Litter cover (%) | Bare ground cover (%) | Cryptogam cover (%) | Rock cover (%) |
|---|---|---|---|---|
| Subplot score (% in each) | 70 20 70 90 50 | | | |
| Average of the 5 subplots | 60 | | | |

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

## Physiography + site features that may help in determining PCT and Management Zone (optional)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Morphological Type | | Landform Element | | Landform Pattern | | Microrelief | |
| Lithology | | Soil Surface Texture | | Soil Colour | | Soil Depth | |
| Slope | | Aspect | | Site Drainage | | Distance to nearest water and type | |

| Plot Disturbance | Severity code | Age code |
|---|---|---|
| Clearing (inc. logging) | | |
| Cultivation (inc. pasture) | | |
| Soil erosion | | |
| Firewood / CWD removal | | |
| Grazing (identify native/stock) | | |
| Fire damage | | |
| Storm damage | | |
| Weediness | | |
| Other | | |

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

**Free Text Section for brief site description**

intact heathland
& exposed sandstone rock platforms, scattered low trees.

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

| 400 m² plot: Sheet 2_ of 2_ | | Survey Name | Plot Identifier | Recorders |
|---|---|---|---|---|
| Date | 04/03/2021 | Belrose | Hayes-006 | Dan Clarke |

| GF Code | *Species name* | N, E or HTE | Cover | Abund | Stratum | voucher |
|---|---|---|---|---|---|---|
| S | *Allocasuarina distyla* | N | 0.25 | 100 | Mid | |
| S | *Petrophile pulchella* | N | 0.1 | 100 | Mid | |
| F | *Actinotus minor* | N | 0.5 | 500 | Ground | |
| G | *Entolasia stricta* | N | 0.1 | 200 | Ground | |
| S | *Leptospermum squarrosum* | N | 0.5 | 20 | Mid | |
| R | *Lepyrodia scariosa* | N | 0.1 | 50 | Ground | |
| S | *Banksia ericifolia* | N | 5 | 200 | Mid | |
| S | *Platysace linearifolia* | N | 0.25 | 50 | Mid | |
| S | *Bossiaea heterophylla* | N | 0.1 | 20 | Mid | |
| S | *Hakea teretifolia* | N | 1 | 100 | Mid | |
| S | *Epacris pulchella* | N | 0.25 | 200 | Mid | |
| F | *Patersonia glabrata* | N | 1 | 250 | Ground | |
| R | *Schoenus ericetorum* | N | 2 | 500 | Ground | |
| R | *Lomandra glauca* | N | 0.25 | 200 | Ground | |
| S | *Boronia ledifolia* | N | 0.1 | 50 | Mid | |
| S | *Persoonia pinifolia* | N | 0.1 | 1 | Mid | |
| S | *Hakea laevipes* | N | 0.1 | 50 | Mid | |
| S | *Grevillea speciosa* | N | 2 | 100 | Mid | |
| S | *Kunzea capitata* | N | 0.1 | 100 | Mid | |
| X | *Xanthorrhoea media* | N | 1 | 20 | Ground | |
| F | *Bossiaea scolopendria* | N | 0.1 | 100 | Ground | |
| S | *Leptospermum trinervium* | N | 1 | 20 | Mid | |
| T | *Angophora crassifolia* | N | 5 | 50 | Upper | |
| G | *Anisopogon avenaceus* | N | 2 | 200 | Ground | |
| V | *Cyathochaeta diandra* | N | 1 | 100 | Ground | |
| F | *Goodenia bellidifolia* | N | 0.1 | 200 | Ground | |
| S | *Pultenaea tuberculata* | N | 1 | 200 | Mid | |
| S | *Baeckea diosmifolia* | N | 0.25 | 500 | Ground | |
| T | *Eucalyptus haemastoma* | N | 3 | 2 | Upper | |
| S | *Crowea saligna* | N | 0.1 | 10 | Ground | |
| S | *Pimelea linifolia* | N | 0.1 | 100 | Ground | |
| V | *Caustis pentandra* | N | 0.25 | 20 | Ground | |
| S | *Lambertia formosa* | N | 0.1 | 10 | Mid | |
| S | *Banksia oblongifolia* | N | 0.25 | 10 | Mid | |
| L | *Cassytha glabella* | N | 0.1 | 200 | Ground | |
| F | *Patersonia sericea* | N | 0.25 | 100 | Ground | |
| S | *Hakea propinqua* | N | 2 | 100 | Mid | |
| S | *Phyllota philicoides* | N | 5 | 50 | Mid | |
| S | *Hemigenia purpurea* | N | 1 | 500 | Mid | |
| V | *Lepidosperma viscidum* | N | 2 | 100 | Mid | |
| S | *Grevillea buxifolia* subsp. *buxifolia* | N | 2 | 100 | Mid | |
| F | *Stylidium lineare* | N | 0.1 | 50 | Ground | |
| V | *Ptilothrix deusta* | N | 1 | 1000 | Ground | |

| | | | | | | |
|---|---|---|---|---|---|---|
| F | *Dampiera stricta* | N | 0.1 | 100 | Ground | |
| S | *Phebalium squamulosum* | N | 1 | 250 | Mid | |
| S | *Styphelia triflora* | N | 0.1 | 20 | Mid | |
| S | *Dillwynia retorta* | N | 0.25 | 200 | Mid | |
| S | *Aotus ericoides* | N | 0.25 | 100 | Mid | |
| V | *Chordifex dimorphus* | N | 2 | 500 | Mid | |
| S | *Leucopogon microphyllus* | N | 0.1 | 50 | Mid | |
| S | *Olax stricta* | N | 0.1 | 50 | Mid | |
| S | *Pultenaea stipularis* | N | 2 | 200 | Mid | |
| S | *Epacris microphylla* | N | 0.1 | 50 | Mid | |
| S | *Woollsia pungens* | N | 0.1 | 10 | Mid | |
| S | *Hibbertia obtusifolia* | N | 0.1 | 2 | Mid | |
| S | *Philotheca reichenbachii* | N | 0.1 | 5 | Ground | |
| G | *Rytidosperma pallidum* | N | 0.1 | 20 | Ground | |

**GF Code:** see Growth Form definitions in Appendix 4 (can be worked out later) **N:** native, **E:** exotic, **HTE:** high threat exotic
**Cover:** 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
**Abundance:** For species with cover less than or equal to 5% count or estimate the number of individuals or shoots of each species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, 1500, 2000 etc. Numbers above 20 are estimates.
**Stratum:** not for entry to calculator, to assist with PCT identification.
Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

# Duffys Forest EEC identification

Legal description of the entity:

1 NSW Scientific Committee Final Determination (1998). Duffys Forest Ecological Community in the Sydney Basin Bioregion – endangered ecological community listing.

2 NSW Scientific Committee Final Determination (2002). Duffys Forest ecological community in the Sydney Basin Bioregion – endangered ecological community listing.

3 NSW Scientific Committee Minor Amendment Determination (2011). Duffys Forest Ecological Community in the Sydney Basin Bioregion – Determination to make a minor amendment to Part 3 of Schedule 1 of the Threatened Species Conservation Act.

The 2002 Determination amended and replaced the original 1998 Determination for this community. The reason for the new Determination is given in Point 1: "*The NSW Scientific Committee considers that an amendment should be made to this listing following the receipt of additional information about the ecological community*." The 2002 Determination made changes to the description and identification of the community. Only two of the references listed in Point 7 (which provides a list of documents noted to contain general information on the community) are dated after 1998. It is therefore assumed that these two references contain the additional information upon which the updated description and identification information is based:

> NPWS (2001) Grevillea caleyi R.Br. (Proteaceae) Draft Recovery Plan for public comment. NSW National Parks and Wildlife Service, Hurstville.
>
> Smith, P. & Smith, J. (2000) Survey of the Duffys Forest Vegetation Community. Unpublished Report to NSW National Parks and Wildlife Service and Warringah Council.

The 2011 Determination amended and replaced the 2002 Determination. The reason for the new Determination is given in a paragraph above the title: "*The Scientific Committee is of the opinion that the amendment is necessary or desirable to correct minor errors or omissions in the Determination in relation to the Thackway and Cresswell (1995) reference and to clarify the description of the ecological community.*" Upon comparison with the previous 2002 Determination, there are only two changes:

i. The numbering of points is changed, due to replacement of the reason for the 2002 Determination with the reason for the 2011 Determination, and relocation of the reason from Point 1 to above the title; and

ii. There is an additional sentence placed at the end of Point 2 (which becomes Point 1 in the 2011 Determination). The new sentence is: "*Bioregions are defined in Thackway and Cresswell (1995).*"

None of the information relating to description and identification of the community varies between the 2002 and 2011 Determinations. It is therefore assumed that the two references listed above have not been superseded, and remain the most relevant information sources for description and identification of the community. Only one of these (Smith & Smith, 2000) specifically relates to the identification and mapping of the community.

Hereafter in this document, 'the Determination' refers to the current 2011 Determination, which provides the legal description and definition of the Duffys Forest ecological community.

Applying the description (2011 Determination):

| Point/s | The Determination | General discussion | Application to Study Area |
|---|---|---|---|
| 1 | The community occurs on ridgetops, plateaus, upper slopes and occasionally mid slopes on Hawkesbury sandstone geology. | This describes a broad landscape form containing many different communities. It cannot be used to distinguish between Duffys Forest and other similar communities. | The Study Area contains this landscape form, so *could* contain Duffys Forest EEC. |
| | It typically occurs in association with laterite soils, and soils derived from shale and laminite lenses. | This provides information pertaining to the broad soil types on which Duffys Forest EEC occurs, but use of the word 'typically' prevents this descriptor from being definitive.<br>The Smith & Smith (2000) report states that "*Shale lenses are probably present at all sites where the community occurs. Rock outcrops are usually absent from Duffys Forest vegetation, except on the fringes, where it adjoins typical sandstone vegetation, generally characterised by extensive sandstone outcrops*." | Very minimal evidence of laterite soils (ironstone nodules) have been recorded within the Study Area, although detailed soil work has not been conducted.<br>Some shale lenses probably occur, but are not mapped. The majority of the site contains exposed sandstone rock outcropping.<br>The geology is *not typical* for Duffys Forest EEC, but does not exclude it either. |
| | It has the structural form predominantly of open-forest to woodland. | This describes many similar communities, and due to use of the word 'predominantly', is not definitive. | Much of the Study Area contains vegetation of open-forest to woodland structure, so *could* contain Duffys Forest EEC. |
| | It has been reported from the Warringah, Pittwater, Ku-ring-gai, Hornsby and Manly Local Government Areas, although it may occur elsewhere in the Sydney Basin Bioregion. | This describes a broad political land region containing many different communities. It cannot be used to distinguish between Duffys Forest and other similar communities. | The Study Area is located within this region, so *could* contain Duffys Forest EEC. |
| 2 & 3 | A list of characteristic plant species is provided, with qualification that the list is not comprehensive, | The Duffys Forest ecological community has achieved some notoriety for being very similar in | The Study Area contains a high proportion of characteristic plant species for Duffys Forest EEC, so |

| | | | |
|---|---|---|---|
| | or definitive. It is noted that species composition will vary in response to size of the site and recent disturbance history, including fire. | floristic composition to surrounding ecological communities.<br><br>It is very difficult to identify and map the community in the field on the basis of qualitative comparison of a patch of vegetation against the list of characteristic plants. | *could* contain this community.<br><br>However, the Study Area also contains a high proportion of characteristic plant species for other locally occurring communities. |
| 4 | The Determination makes reference to the Smith & Smith (2000) description and diagnostic plant species.<br><br>There is a caution that care should be taken in use of diagnostic plant species, because of:<br><br>* Sampling limitations;<br>* Reduction in species diversity of degraded sites;<br>* Presence of dormant species. | It is usual for a Final Determination to provide a discussion of dominant plant species to aid with identification of the community, in addition to the list of characteristic plant species (listed in Point 2).<br><br>This Determination, however, makes reference to the Smith & Smith (2000) report and diagnostic species instead.<br><br>It is reasonable to conclude that the Smith & Smith (2000) report is regarded as a current and legally supported identification tool for Duffys Forest EEC.<br><br>The Smith & Smith (2000) report provides a definitive test for Duffys Forest (DF) based on the diagnostic species, and used this to compare between the two most similar communities:<br><br>▪ Sydney Sandstone Ridgetop Woodland (SSRW)<br>▪ Sydney Sandstone Gully Forest (SSGF)<br><br>This test has been previously used by consultants, and accepted by determining authorities, for the purpose of identifying Duffys Forest EEC. | Three 20mx20m plots were surveyed at locations within the Study Area considered most likely to support Duffys Forest EEC (on the basis of previous consultant assessment (Travers, 2018), regional vegetation mapping (SEED - Southeast NSW Native Vegetation, 2010), and observed soil characteristics (D. Clarke *pers comm*).<br><br>Application of the Smith & Smith (2000) method resulted in the following indices:<br><br>Plot 1 – SSRW 50, DF 47.5, SSGF 42.5<br><br>Plot 2 – SSRW 52.5, SSGF 50, DF 47.5<br><br>Plot 3 – SSRW 52.5, DF 47.5, SSGF 42.5<br><br>Using this method, all three sites comprise Sydney Sandstone Ridgetop Woodland, and none are Duffys Forest EEC.<br><br>Extrapolating the results on the basis that these sites were considered most likely to contain Duffys Forest EEC within the Study Area, it is reasonable to conclude that no part of the Study Area contains Duffys Forest EEC.<br><br>In relation to the caution contained in the Determination for use of diagnostic plants. The |

| | | | |
|---|---|---|---|
| | | | three sites are in good condition and are part of an extensive tract of intact native vegetation. The plots were comprehensively sampled in accordance with the BAM. The survey was conducted in early Spring, following a warm and wet winter, such that most plant species would be present and identifiable. Total number of native plant species within the plots were 66, 69 and 58 respectively. Smith & Smith (2000) compiled species lists for 55 sites (note that these lists are for 'sites', not just a 0.04ha plot within the site). Plant numbers for the sites ranged from 50 to 215 plants, averaging at 93. |
| 5 | The Determination refers to threatened plant species associated with the community – *Grevillea caleyi, Persoonia hirsuta, Tetratheca glandulosa, Pimelea curviflora* var *curviflora, Epacris purpurascens* var *purpurascens*. | None of these species are restricted solely to the community, so are not definitive.<br>The Smith & Smith (2000) report states "*Duffys Forest is the chief habitat of G. caleyi and an important habitat, at least locally, for the other threatened species, with the exception of T. glandulosa, for which it is only a minor habitat.*" | *Tetratheca glandulosa* occurs at the Plot 2 site. None of the other threatened species are known to occur within the Study Area, although targeted survey work is not yet complete.<br>This information does not assist with determination of the presence or absence of Duffys Forest EEC. |
| 6 | A list is provided of six documents noted to contain general information on the community. Two are related primarily to recovery planning for the threatened plant *Grevillea caleyi*:<br>a) NPWS (2001) – *Grevillea caleyi* Draft Recovery Plan<br>b) Scott, Marshall & Auld (1995) – *Grevillea caleyi* conservation research statement and recovery plan<br>The remaining four are vegetation surveys and | It is assumed that the Smith & Smith (2000) report contains the most relevant information for use in identifying the Duffys Forest EEC, on the basis that this report was the prime catalyst for amending the original 1998 description of the community in 2002, and that this report is referred to specifically in Points 4 and 6 of the Determination. | The Study Area is located within the Smith & Smith (2000) map boundary. It contains a large extent of publically accessible intact native vegetation.<br>The Smith & Smith (2000) map shows a patch of Duffys Forest EEC located approximately 1km to the northeast of the Study Area, which could only be accessed by driving past or through the Study Area.<br>No part of the Study Area was mapped as Duffys Forest EEC in the Smith & Smith (2000) report. It is reasonable to conclude that the authors of the |

| | | | |
|---|---|---|---|
| | maps specific to the Duffys Forest community:<br>a) Benson & Howell (1994) – Vegetation map - Sydney 1:100 000<br>b) Thomas & Benson (1985) – Vegetation survey - Kur-ring-gai Chase National Park<br>c) Sheringham & Sanders (1993) – Vegetation survey – Garigal National Park and surrounding Crown Lands.<br>d) Smith & Smith (2000) – Vegetation survey and diagnostic test (as referred to above).<br>The Determination states: "*These surveys and accompanying maps are by no means inclusive in their representation of Duffys Forest Ecological Community*." The Determination lists the deficiencies for each map source.<br>a) Scale too coarse to map smaller remnants.<br>b) Southern edge does not extend into predominantly cleared areas to meet with northern edge of (c).<br>c) Northern edge does not extend into predominantly cleared areas to meet with southern edge of (b).<br>d) Some disturbed or degraded remnants of Duffys Forest Ecological Community may not be mapped as the community in Smith and Smith (2000). | | Smith & Smith (2000) report did not consider vegetation within the Study Area to be Duffys Forest EEC.<br>Having regard to the deficiencies noted in the Determination, there is a caution that disturbed and degraded remnants of Duffys Forest EEC may not be mapped. However, the Study Area contains intact native vegetation, so this caution is not applicable. |
| 7 - 10 | Reasons for listing Duffys Forest as endangered. | Not relevant to identification of the community. | Not relevant. |

Other considerations:

*Regional mapping*

In addition to the Smith & Smith (2000) mapping of the locality, there have been a range of other broadscale vegetation mapping projects undertaken across the Study Area. These broadscale mapping projects rely heavily on aerial photo interpretation, with spot ground-truthing, and have become more sophisticated and accurate over time with improvements in technology.

* 1994 - Benson & Howell mapping of the Sydney 1:100 000 map sheet. This is referred to in the Determination.

* 2010 - Southeast NSW Native Vegetation (Tozer *et al*, 2010 - available on-line through the Government SEED website). Not referenced in the Determination, possibly due to being published at around the same time as the Determination.

  This map shows the majority of the Study Area containing Coastal Sandstone Gully Forest, Coastal Sandstone Ridgetop Woodland and Coastal Sandstone Plateau Heath, with the western fringe containing Sydney Shale-Ironstone Cap Forest (attributable generally to Duffys Forest).

* 2016 - Sydney Metropolitan Area (Sydney Metro Area v3.1 2016E – VIS 4489 – available on-line through the Government SEED website). This is the most recent vegetation map, and assigns vegetation to Plant Community Types (PCTs) that are used with the Biodiversity Assessment Method (BAM).

  This map shows the majority of the Study Area containing Coastal Sandstone Gully Forest, Sydney North exposed sandstone woodland, and Coastal sandstone Heath-Mallee. No parts of the Study Area are mapped as Duffys Forest.

Summary:

The Study Area does not contain Duffys Forest ecological community:

1 Application of the Smith & Smith (2000) diagnostic species test found all three test plots were Sydney Sandstone Ridgetop Woodland, not Duffys Forest ecological community.

2 The Study Area contains abundant sandstone rock outcrops, and minimal evidence of laterite or shale soils.

3 Smith & Smith (2000) did not map any part of the Study Area as Duffys Forest ecological community. The Study Area is within their map boundaries, and easily accessible. They would have driven past or through the Study Area to reach one of the mapped patches of the community.

4 The most recent regional mapping project (Sydney Metro Area, 2016) does not map any part of the Study Area as Duffys Forest ecological community.

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21st July 2021

To Whom it May Concern,

# Belrose Bushland Hygrophoraceae (Waxcap) Survey – 6th July 2021

In response to the invitation by Ms Rebecca Hogan, I undertook a survey in the subject bushland in Belrose for the presence of any of the nine species of currently listed threatened species in the family Hygrophoraceae (Waxcaps). I agreed to voluntarily inspect the site on the morning of Tuesday, 6th July 2021, in the company of botanist/ecologist, Daniel Clarke of DM Clarke Botanical Consulting Services.

1. My academic qualifications briefly: BSc (Hon) PhD.

I retired from the former Department of Infectious Diseases, Faculty of Medicine, The University of Sydney in 2006, after 45 years, and was Head of the Department from 1993-2000. I retain my affiliation with the Sydney University as an Honorary Associate Professor.

2. Experience and expertise in mycology, separate to my academic responsibilities – in summary

(a) My wife (Elma Kearney) and I are the only persons in NSW with long-standing experience to reliably identify waxcap species as we were the ones who discovered the nine *new* threatened species in 1998 in Lane Cove Bushland Park and were collected/given, by us, to taxonomic mycologist Dr Tony Young to formally describe.

We have been office-bearing members of the SFSGI since 1985 and I have been its chairman for well over 15 years.

(b) My wife and I, on behalf of the Sydney Fungal Studies Group Inc., (SFSGI) were responsible for writing all the submissions to the respective NSW Scientific Committees from 1999 onwards to formally list the waxcaps in the critically-endangered assemblage in Lane Cove Bushland Park (LCBP), now over 30 species. See links:

p.13 http://www.fungal-conservation.org/newsletter/issue_1_2011_high_resolution.pdf
p.27 http://www.fungal-conservation.org/newsletter/issue_3_2013_09_15_high_resolution.pdf

Each year, we monitor the waxcap-species in the assemblage of LCBP. Separately, we also monitor waxcaps in bushlands which are subject to fungi field-studies by SFSGI in the Greater Sydney Region.

(c) We have assisted Lane Cove Council (LCC) in securing grants to remove smothering creeper-vine, *Morinda jasminoides*, on our advice. Damaging the habitat of threatened species can carry heavy penalties. Our aim being to:

- Map and monitor fruiting bodies of species growing in moss (most in families Pottiaceae and Bryaceae) and/or leaf-litter and monitor any differences morphologically as well as identify specimens accordingly.
- Establish if new colonies of fungi appeared in the areas cleared of *Morinda jasminoides* vine.
- Record daily weather-conditions including temperature and rainfall. (Riverview Observatory)
- Compare our findings with the reported observations regarding the ecology of waxcaps in the Northern Hemisphere (UK, Europe and Canada).

We have continued monitoring and mapping the waxcaps to the present time and have documented the impacts of pollution, logjams, building developments, changing weather-pattens and alleged incompetent bush regeneration. Selected outcome examples:

- *Over 20 new colonies of different waxcap species appeared in areas cleared of the morinda vine.*
- *Species appeared at different times during the fruiting season – some early, a few late. Temp. & rain crucial.*
- *Most species were found mainly in leaf litter and not in moss. Six new species of waxcaps were discovered.*
- *Waxcap species which grow in moss also grow in leaf-litter. Spores of waxcaps cannot be cultured.*
- *Species in moss were smaller than the same species in leaf litter. Spores germinate in faeces of scavengers.*

3. Awards

Examples:

- 1996 - *Leadership Award* presented by Lane Cove Council
- 2001 - *Citizen of the Year Award* presented by Lane Cove Council
- 2003 - *Centenary Medal* presented by Prime Minister the Hon. John Howard
- 2005 - Among NSW State Finalists for the *'Australian of the Year Award'* 2005
- 2007 - On Australia Day, 2007, awarded a *Medal of the Order of Australia (OAM)* for voluntary contributions to public health and land-mark contributions in conservation.
- 2011 - *Sydney Catchment Management Authority Award* 2011
- 2013 - Among finalists in *Eureka Photographic Award* 2013 (Rosecomb in *Hygrocybe reesiae*) https://australianmuseum.net.au/image/rosecomb
- 2014 - Winner *Green Globe Award* – SFSGI – Endangered Fungi
- 2014 - Nominated for NSW Environment Category in *'2014 Pride of Australia Award'* Ray and Elma Kearney of Lane Cove earn Pride of Australia nomination for their environmental work | Daily Telegraph
- 2018 – *North Sydney Community Award* – in recognition of outstanding service to the community

Selected, relevant mycology publications since retirement (2006):
Book chapter:
(a) R. Kearney *et. al*., 'Adaptations of fungi and fungi-like organisms for growth under reduced dissolved oxygen concentrations' p275-292; 18 (2017) in *The Fungal Community: Its Organization and Role in the Ecosystem*. Fourth Edition. Eds. J. Dighton & J.F. White. Publisher: 2014 Walter de Gruyter GmbH, Berlin/Boston. ISBN 978-3-11-033345-9.
(b) R. Kearney *et.al*., *'Microsporidia*', p157-171; 7 (2014) in *Freshwater Fungi: and Fungal-like Organisms* (Marine and Freshwater Botany). Eds. E. B. Gareth Jones, Kevin D Hyde and Ka-Lai Pang.

Relevant journal articles:
(a) R. Kearney. 'Citizen Science in Mycology'. *PAN*: Philosophy, Activism, Nature p87-97, no. 10, (2013).
(b) R. Kearney et al., 'Conservation of fungi in Lane Cove Bushland Park'. *Australasian Plant Conservation* p10-12; 24, No. 3 (2015-16).
(c) R. Kearney et al., 'THE LISTING OF AN AUSTRALIAN HYGROCYBEAE COMMUNITY and its holotype species under State and Commonwealth legislations. *Field Mycology*, p13- 21; 8 (2007). 24 Number 3 December 2015


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There are only nine currently listed species of waxcaps, five *'endangered'* and four *'vulnerable'*. See photo composite above of a PowerPoint slide recording the holotypes we discovered in Lane Cove Bushland Park (LCBP) in 1998.

We have also taking steps to have seven of these species delisted as *not threatened*, based on our records of these species now found elsewhere in the Greater Sydney Region.

**Results of the Survey at Belrose Bushland Reserve**

1. The two-hour survey for threatened fungi in the family Hygrophoraceae (waxcaps) yielded **no** positive findings.

2. As mentioned above, the background to our submissions to successfully list, by the respective NSW Scientific Committees, is found at the following links:

See p 13: http://www.fungal-conservation.org/newsletter/issue_1_2011_high_resolution.pdf
and p 27: http://www.fungal-conservation.org/newsletter/issue_3_2013_09_15_high_resolution.pdf

Note the extract:
*"The two major rock types in LCBP are Wianamatta shale and Hawkesbury sandstone that give rise to two distinctly different types of soil. The shale produces deeper and more fertile clay soils, which also hold more water easily. The sandstone produces sandy, stony soils, which dry out readily and tend to be associated with steep slopes and rock outcrops over which drip water into leaf litter below – ideal conditions for certain species of Hygrocybe. The unusual combination of both soil types, coupled with the topography of the site in a north-south aspect, has created a range of unique habitats and ecosystems, which support the different colourful species in the family of Hygrophoraceae."*

The habitat in the subject survey site in Belrose was predominantly sandstone – allegedly too dry and unsuitable for species of waxcaps that grow best in soil with Wianamatta soil. However, several species of fungi in other Genera/Orders were observed including *Cortinarius archeri*, *Cortinarius rotundisporus*, *Hydnum repandum*, *Gymnopilus junonius* and several other non-waxcap species.

The limited surveyed sections of the 'Snake Creek', polluted with sewage and subject to rainwater overflow, had some species of moss in which was found not a single waxcap species, including *Gliophorus graminicolor*, common at this time of the year, as are most waxcaps, in other bushlands in the Sydney region with Wianamatta shale e.g., LCBP, Greenwich, Ferndale Park, Chatswood and Wolli Creek Reserve Earlwood.

Waxcaps do not tolerate smothering by creeper vines, ferns or low-crowded vegetation, as was common in the Belrose site. They grow best under a canopy of trees resembling a warm/cool temperate rainforest around a creek-line. Nor do they tolerate high nitrogen added by fertilizers and sewage, observed in the Snake Creek, Belrose.

Waxcaps have a biotrophic relationship with plants. In moss, in LCBP, they are smaller than the few that grow in leaf litter above the creek-line. Not a single species of waxcaps (over 36 species in the Sydney metropolitan bushlands including LCBP) was observed in moss or leaf-litter in the Belrose survey site

Therefore, it was disappointing not to record a single species of waxcap including not one of the currently listed 'threatened' (endangered or vulnerable) nine species as per the composite photo above.

Yours sincerely,

# Appendix D: Fauna survey methods and data

## Fauna survey methods

### *1. Dedicated Bird Surveys*

Point count method (DEC 2004). Each survey was conducted for 20 minutes, during which time all birds heard calling or observed were recorded. Any evidence suggesting the presence of a threatened bird species (e.g. white wash, crushed eucalypt fruit, nest site) was recorded and the location targeted during the surveys.

Twelve surveys were conducted at ten locations over the July, September and November sessions, as shown on Figure 6. Total effort = 240 person-minutes

### *2. Dedicated amphibian surveys*

There are three threatened amphibians relevant to the site: the Red-crowned Toadlet, Green & Golden Bell Frog and Giant Burrowing Frog.

An initial site inspection was conducted on the 14th October 2020 (13:30 to 15:30) in the company of Dr Marion Anstis to identify threatened amphibian habitats within the Study Area and guide survey design. Dr Anstis inspected the structure of Snake Creek and several of its ephemeral feeder drainage lines.

Dr Anstis determined that most of the ephemeral drainage lines within the site had a structure suitable for occupation by the Red-crowned Toadlet. Potential habitat for the Giant Burrowing Frog, however, was limited to habitats associated with Snake Creek and an unnamed drainage line west of Morgans Road and south of the Patyegarang rock feature (hereafter referred to as Lizard Creek).

The Green & Golden Bell Frog is not expected to occur on the site due to lack of optimal habitat and scarcity of records within 5km (only two - from Terry Hills in 1975 and Warriewood in 1997). The site does not contain unshaded water or waterbodies with emergent vegetation such as bulrushes. The site has a shrubby/heathy understorey throughout rather than grassy. If present, the Green & Golden Bell Frog would only be associated with habitats along Snake and Lizard Creeks.

Red-crowned Toadlets have previously been recorded within the Study Area (Bionet Atlas) and were heard calling from a number of ephemeral drainage lines during preliminary site surveys. An individual was also sighted opportunistically (and photographed) by engineering consultants investigating hydrology and aquatic habitats within the site in 2020. Further searches for this species were conducted opportunistically when crossing creeklines and wet areas encountered while traversing the site.

The Green & Golden Bell Frog is a distinctive and vocal species, it was surveyed in parallel with effort targeted towards the Giant Burrowing Frog.

In consultation with the *NSW Survey Guide for Threatened Frogs* (DPIE 2020), methods employed to target Giant Burrowing Frogs were:

* *Aural-visual surveys*

  Three 250 m long transects were established (as shown on Figure 6), one immediately west of Lizard Creek and two west (upslope of) Snake Creek. The Snake Creek transects were positioned 200 m apart and within 300 m of suitable Giant Burrowing Frog breeding habitat (i.e. Snake Creek itself). The transects were only 250 m long as habitat north and south of these was not considered suitable.

  To enable repeat surveys, transects were identified by placement of reflective tape at head height at intervals of 5 to 10m along the length.

  Each aural-visual survey was carried out over a minimum period of 80 minutes per transect. Each survey consisted of a five-minute listening period at the start and then at each 50 m interval along the transect (total = 6 survey points per transect). After each 5-minute listening period, the next 50 m interval was slowly walked with spotlighting (using 200 lumen hand torches) to target frog eye shine or movement.

  Each transect was surveyed over 8 nights (as set out in Table D-1)

  All frog calls heard during the surveys were recorded (using Apple iPhones™) and emailed to Dr Anstis to confirm identification.

  A total of 1,280 minutes of aural-visual amphibian surveys were conducted.

* *Dip-netting*

  Dip-netting was undertaken by two researchers within both Snake and Lizard Creek - these being the only drainage lines that contained pools of standing water (Dr M. Anstis *pers comm* 14 October 2020). Fine meshed nets (minimum head diameter of 30 cm) were employed during the dip-netting sessions, with each pool being searched for about 10 minutes.

  Approximately 250m of Snake Creek and 150m of Lizard creek were surveyed during the dip netting sessions.

  Given the limited depth and size of pools present, sampling included all parts of the water column, including areas near the vegetated banks.

  It is noted that no emergent aquatic vegetation or any occurrences of the introduced Plague Minnow (*Gambusia holbrooki*) were observed in either Snake or Lizard Creeks.

  Tadpoles collected were identified and released on site. Photographs of tadpoles collected were emailed to Dr Anstis to confirm identification (as required).

  A total of 480 minutes of dip-netting were conducted.

*Table D-1 Giant Burrowing Frog targeted survey details*

| Date 2020 | Researcher | Effort (person-mins) | Rain fall | Activities |
|---|---|---|---|---|
| 14 October | Dr Anstis, DE & HE | 360 | Last 24 Hours = 0mm<br>Last 7 Days = 1mm<br>Last month = 22.6mm | Amphibian survey and habitat identification with specialist Dr M. Anstis. |
| 3 November | DE, HE, JM & CS | 320 | Last 24 Hours = 10.6mm<br>Last 7 Days = 29.6mm | Aural-visual surveys along transects |
| 9 November | DE, JM & CS | 240 | Last 24 Hours = 0.8mm<br>Last 7 Days = 21.2mm | |
| 10 November | JM & CS | 160 | Last 24 Hours = 0.2mm<br>Last 7 Days = 42.4mm | |
| 11 November | DE, JM & CS | 240 | Last 24 Hours = 0mm<br>Last 7 Days = 42.4mm | |
| 17 November | JM | 80 | Last 24 Hours = 0mm<br>Last 7 Days = 2mm | |
| 18 November | JM | 80 | Last 24 Hours = 1.6mm<br>Last 7 Days = 3.6mm | |
| 24 November | JM | 80 | Last 24 Hours = 3.2mm<br>Last 7 Days = 4.8mm | |
| 25 November | JM | 80 | Last 24 Hours = 2mm<br>Last 7 Days = 4.8mm | |
| 22 December | HE & SM | 480 | Last 24 Hours = 32.4mm<br>Last 7 Days = 87.2mm<br>Last month = 122.4mm | Dip-netting |
| Cumulative effort | | 2120 person minutes | | |

## 3. Dedicated Eastern Pygmy-possum nest-tube survey

Thirty-five purpose-built nesting tubes were installed within the Study Area to target the Eastern Pygmy-possum. Nesting tubes were constructed from either hollow timber tree branches, PVC piping or bamboo (thickness of bamboo wood being 7 mm), the design of these being:

* Tube length – 35 cm long.
* Tubed capped at top and bottom. Bottom cap glued, top fitting with either threaded cap or screw to permit easy examination (with bamboo tubes, the presence of a nodal diaphragm negated the need for a bottom cap).

* Entrance hole – 25 mm diameter and located approximately 50 mm below top cap.
* Tube internal – insulating material and plastic mesh.
* Tube external – shade cloth (PVC piping only).

The nesting tubes were positioned either on a banksia or close to a patch of banksias. Cable ties were used to secure the tubes to a suitable plant at a height of about 1.5m above ground. Rough-barked plants were preferred, with tubes placed on the southern side, the entrance hole positioned close to the tree's trunk. Tubes were placed with a vertical orientation.

Tubes were installed on 8 July 2020 and collected on 16 January 2021. Tube locations are shown on Figure 6.

## *4. Dedicated Koala SAT survey*

Eight dedicated Koala scat searches were conducted. Each search lasted for at least 30 minutes and was carried out by two researchers. The method complied with the *Scat Assessment Technique* (SAT) (Phillips and Callaghan 2011).

Searches were conducted on the 18th and 23rd September, and 6th October, 2020. 10mm of rain fell on Monday 21st September (BOM, 2021). No other rainfall was recorded for three days prior to each survey.

The eight SAT locations are shown on Figure 6. Total effort = 510 person-minutes.

## *5. Live trapping*

Live trapping was conducted from 11th to 15th January 2021, to target both arboreal and ground dwelling species. Traps used were:

* 10 x size B Elliott™;
* 99 x size E Elliott™; and
* 6 x wire cage.

*(a) Elliott traps*

Elliott traps were baited with the universal bait mixture (rolled oats, peanut butter and honey).

40 traps were placed arboreally – secured to wooden platforms that were all affixed to banksia plants at a height of 2m above ground. Above each arboreal trap, a diluted honey solution was sprayed daily to a height of above 3m above the platform.

69 traps were placed on the ground.

Traps were checked each morning, with any captured animals being released at their point of capture.

*(b) Cage traps*

Cage traps were baited with meat.

All cage traps were located on the ground, with a tarpaulin placed over each to provide weather protection during the course of the study. The tarpaulins had been exposed to the elements for a number of months prior to their use to remove smells that may prevent an animal entering the trap.

Traps were checked each morning, with any captured animals being released at their point of capture.

Arboreal trap locations are shown on Figure 6. Terrestrial trap locations are shown on Figure 6. Total effort = 460 trap-nights.

## 6. Hairtube trapping

*(a) Arboreal hairtube trapping*

Arboreal hairtube trapping was undertaken to target the Eastern Pygmy-possum.

15 hairtubes were placed in flowering banksias, from 11th January to 1st February 2021.

All hairtubes were baited with the universal bait (rolled oats, peanut butter and honey).

To entice possums to inspect the hairtube, the banksias were sprayed at the start of the survey session with a diluted honey solution (to a height of about 3 m above the hairtube). The hairtubes were generally secured to a horizontal limb by use of a cable tie.

Hair samples were sent to ScatsAbout (Majors Creek, NSW) for analysis and identification.

*(b) Ground hairtube trapping*

Hairtubes were placed on the ground during each of the survey sessions, as follows:

- July 2020 (set 8th July, collected 22nd July): 52 units
- September 2020 (set 17th Sept, collected 6th Oct): 39 units
- November 2020 (set 3rd Nov, collected 26th Nov): 27 units
- January 2021 (set 11th Jan, collected 1st Feb): 15 units

All hairtubes were baited with the universal bait (rolled oats, peanut butter and honey).

Hair samples were sent to ScatsAbout (Majors Creek, NSW) for analysis and identification.

Arboreal trap locations are shown on Figure 6. Terrestrial trap locations are shown on Figure 6. Total effort = 2,690 hairtube-nights.

## 7. Infrared cameras

### (a) Arboreal cameras

Infrared (Reconyx™) cameras were placed arboreally and directed at banksia inflorescences to target the Eastern Pygmy-possum.

Arboreal cameras were installed:

- 11th January to 1st February 2021: five cameras;
- 8th July to 22nd July 2020: three cameras;
- 29th July to 13th August 2020: four cameras;
- 17th September to 6th October 2020: four cameras.

Cameras were placed at a height between 1.5m to 2m, with the distance between each camera and the inflorescence generally 0.5m to 1m. The banksia inflorescences were in flower, so no additional lure or bait was used.

The cameras employ a passive infrared system, this requiring an animal to 'break' an invisible 'beam'. The cameras were set to operate nocturnally, each being set to a sensitivity level of high and a photo interval of 3/ten seconds.

Based on a review of the unit's date stamp, it was possible to determine that each camera was operating at the time of its collection.

### (b) Ground cameras

Infrared (Reconyx™) cameras were also positioned to target ground-dwelling species. Cameras were secured to a tree at a height of about 0.4m above ground and angled downwards.

The cameras employ a passive infrared system, this requiring an animal to 'break' an invisible 'beam'. The cameras were set to operate diurnally and nocturnally, each being set to a sensitivity level of high and a photo interval of 3/ten seconds.

To entice animals into the field of view of the cameras, a lure scented with truffle oil was used. This was placed at a distance of about 1m in front of the camera and secured to the ground by a large steel peg. This distance was selected as it is within the unit's motion detector coverage range. The lure was also placed in such a position (e.g. at the base of a tree or rock face) that detection of a heat signature was possible.

The lure is constructed from 250 mm long PVC piping, into which has been drilled a number of holes. Foam is placed into the piping and into this the truffle oil is poured.

Based on a review of the unit's date stamp, it was possible to determine that each camera was operating at the time of its collection.

Arboreal camera locations are shown on Figure 6. Terrestrial camera locations are shown on Figure 6. Total effort = 279 arboreal camera-nights, plus 199 ground camera-nights.

## 8. Passive acoustic recording

Wildlife Acoustic SM2 SongMeters™ were employed to detect vocal nocturnal animals that occupy, utilise or occur in the vicinity of the Study Area. The SongMeters™ were used to target areas of potential habitat for nocturnal candidate species credit fauna species.

Each device was set to record calls either (i) between dusk and dawn, or (ii) during specific scheduled periods (these corresponding to likely dawn/dusk or species active call periods).

Each device was noted to be still operating upon collection at the end of each survey session.

Calls were analysed by Lesryk Environmental using Wildlife Acoustic's program Kaleidoscope Pro™. Attention was primarily paid to identification of threatened species, as opposed to the diverse range of common to abundant birds recorded.

Survey times are set out in Table D-2 below.

*Table D-2 SongMeter™ recording times*

| Survey session | Number Units | Date set | Date collected | Start (24 hr time) | Finish (24 hr time) |
|---|---|---|---|---|---|
| July 2020 | 1 | 8 July | 22 July | 17.00 | 20.30 |
| | | | | 23.30 | 02.00 |
| | 2 | 8 July | 22 July | 17.00 | 20.30 |
| | | | | 23.30 | 02.00 |
| | | | | 04.00 | 05.00 |
| | 1 | 8 July | 22 July | 17.00 | 19.00 |
| | | | | 00.00 | 02.00 |
| | | | | 04.30 | 06.30 |
| September 2020 | 2 | 17 September | 6 October | 17.30 | 20.00 |
| | | | | 23.30 | 02.00 |
| | | | | 04.00 | 05.00 |
| November 2020 | 2 | 3 November | 23 November | 19.15 | 06.15 |
| January 2021 | 3 | 11 January | 1 February | 19.15 | 06.15 |

All SongMeter™ locations are shown on Figure 6. Total effort = 1,791 recording-hours.

## 9. Microchiropteran bat surveys

### (a) Echolocation detection

Anabat Express™ echolocation detectors were used during the November and December survey sessions to target microchiropteran bats.

Four units were used in the November session, set from 3rd November to 26th November 2020.

Six units were used in the December session, set from 11th January to 1st February 2021.

Each unit was placed on a tree or atop a cliff line/rock outcrop at a height of between 3m and 10m above ground. The units were programmed for nocturnal recording.

Sites selected for the placement of the echolocation detector units were chosen as they corresponded to those habitats likely to be used by microchiropterans as a roosting site (i.e. proximity to hollow-bearing trees) and/or during their foraging and dispersal periods (i.e. possible flyway).

Each unit was noted to still be operating upon collection.

Calls were analysed by Lesryk Environmental using Anabat 6.3 computer software.

### (b) Cave searches

Where caves, overhangs or suitable sheltering sites that could be occupied by cave-dependent microchiropteran bats were observed, active searches using hand-held torches were carried out to look for sheltering bats, or indirect evidence of bats such as characteristic guano or staining.

All Anabat detector locations are shown on Figure 6 Total effort = 218 recording-nights and 40 person-minutes spent searching caves and overhangs.

## 10. Nocturnal surveys

Nocturnal surveys were designed to target candidate species credit fauna species, and included:

### (a) Dusk surveys

Dusk surveys commenced at least half an hour before sunset. The researcher selected a position that silhouetted hollow-bearing trees or was in proximity to a gully that could be utilised by roosting owls, and stayed in position until full dark, recording any species heard calling or observed.

### (b) Call playback

Call playback sessions were conducted at the completion of the dusk survey.

Call playback targeted the Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*).

Playback sessions commenced with a ten-minute listening period, and then involved broadcasting the characteristic calls of each owl (Stewart 1999) through a loud hailer connected to an iPod™. Calls were broadcast for five minutes (with a two-minute period of silence between each species call). A ten-minute listening period was carried out at the completion of the playback session.

Due to the size of the Study Area and in line with standard survey guidelines (DEC 2004), up to two call playback sessions per evening were carried out, these generally alternated between east and west or north and south of the Study Area.

*(c) Spotlighting*

Spotlighting surveys (using 200 lumen hand-held spotlights) were conducted at the completion of each call playback session.

Effort was made to target areas of potential habitat for candidate species credit species.

Existing tracks and clearings were used, where possible, to minimise disturbance and flushing of target species.

Each spotlighting survey lasted for around 60 minutes.

All calls heard during the spotlighting surveys were identified at the time of the survey.

Dates and combined effort of nocturnal surveys are set out below:

| Date | Researcher | Total effort accumulated (person-minutes) |
|---|---|---|
| 8 July | DE and HE | 240 |
| 9 July | DE and HE | 240 |
| 16 July | DE, HE and JM | 360 |
| 22 July | DE, HE and JM | 360 |
| 17 September | HE and JM | 240 |
| 23 September | DE, HE and JM | 360 |
| 14 October | DE and HE | 240 |
| 3 November | DE, HE, JM and CS | 480 |
| Total effort | | 2520 (42 person-hours) |

All nocturnal survey locations are shown on Figure 6. Total effort = 2520 person-minutes.

## *11. Herpetofauna searches*

Dedicated herpetofauna searches were conducted at three locations within the Study Area in July, August and September 2020 to target reptiles and frogs.

Searches involved lifting and looking underneath rocks, logs, natural and artificial ground debris (e.g. urban refuse), under exfoliated bark or within any suitable rock crevices/ledges/caves.

Each dedicated search generally lasted for a minimum of 20 person-minutes.

Carnivore scats containing bone and hair material found during the ground debris and SAT searches (or otherwise opportunistically whilst traversing the site) were collected and sent to ScatsAbout (Majors Creek NSW) for analysis and identification.

In total, eight predator scats and five samples (including animal carcasses, shed hair *etc*) that required identification were collected.

Herpetofauna survey locations are shown on Figure 6. Total effort = 180 person-minutes.

# Appendix E: Credit reports

This BDAR is a preliminary document prepared for the purpose of a Planning Proposal. The assessment has not been finalised or submitted within BOAMs. The attached credit reports were current on the 2nd October 2022.

Attached:

* Credits summary report
* Biodiversity credit report (Like-for-like)
* Candidate threatened species report
* Predicted species report.

# BAM Credit Summary Report

## Proposal Details

| | | |
|---|---|---|
| Assessment Id | Proposal Name | BAM data last updated * |
| 00026048/BAAS17090/21/00026049 | Proposed Rezoning - Morgan Road Belrose | 01/02/2023 |
| Assessor Name | Report Created | BAM Data version * |
| Rebecca Hogan | 16/02/2023 | 57 |
| Assessor Number | BAM Case Status | Date Finalised |
| BAAS17090 | Open | To be finalised |
| Assessment Revision | Assessment Type | BOS entry trigger |
| 0 | Part 4 Developments (General) | BOS Threshold: Biodiversity Values Map and area clearing threshold |

* 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.

## Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

| Zone | Vegetation zone name | TEC name | Current Vegetation integrity score | Change in Vegetation integrity (loss / gain) | Area (ha) | Sensitivity to loss (Justification) | Species sensitivity to gain class | BC Act Listing status | EPBC Act listing status | Biodiversity risk weighting | Potential SAII | Ecosystem credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Coastal sandstone gully forest** | | | | | | | | | | | |
| 1 | 1250_Intact_Forest | Not a TEC | 55.7 | 55.3 | 16.2 | PCT Cleared - 30% | High Sensitivity to Gain | | | 1.50 | | 336 |
| | | | | | | | | | | | **Subtotal** | **336** |
| **Coastal sandstone Heath-Mallee** | | | | | | | | | | | |
| 3 | 1824_Intact-Heath | Not a TEC | 63.4 | 62.3 | 11 | PCT Cleared - 10% | High Sensitivity to Gain | | | 1.50 | | 258 |
| | | | | | | | | | | | **Subtotal** | **258** |
| **Sydney North exposed sandstone woodland** | | | | | | | | | | | |
| 2 | 1783_Intact_Woodland | Not a TEC | 49.4 | 48.0 | 17.5 | PCT Cleared - 30% | High Sensitivity to Gain | | | 1.50 | | 315 |
| | | | | | | | | | | | **Subtotal** | **315** |
| | | | | | | | | | | | **Total** | **909** |

## Species credits for threatened species

| Vegetation zone name | Habitat condition (Vegetation Integrity) | Change in habitat condition | Area (ha)/Count (no. individuals) | Sensitivity to loss (Justification) | Sensitivity to gain (Justification) | BC Act Listing status | EPBC Act listing status | Potential SAII | Species credits |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Cercartetus nanus / Eastern Pygmy-possum ( Fauna )*** | | | | | | | | | |
| 1250_Intact_Forest | 55.3 | 55.3 | 16.2 | | | Vulnerable | Not Listed | False | 447 |
| 1783_Intact_Woodland | 48.0 | 48.0 | 17.5 | | | Vulnerable | Not Listed | False | 420 |
| 1824_Intact-Heath | 62.3 | 62.3 | 11 | | | Vulnerable | Not Listed | False | 344 |
| | | | | | | | | **Subtotal** | **1211** |
| ***Cryptostylis hunteriana / Leafless Tongue Orchid ( Flora )*** | | | | | | | | | |
| 1783_Intact_Woodland | 48.0 | 48.0 | 1 | | | Vulnerable | Vulnerable | False | 18 |
| | | | | | | | | **Subtotal** | **18** |
| ***Pseudophryne australis / Red-crowned Toadlet ( Fauna )*** | | | | | | | | | |
| 1250_Intact_Forest | 55.3 | 55.3 | 6.9 | | | Vulnerable | Not Listed | False | 143 |
| 1783_Intact_Woodland | 48.0 | 48.0 | 6 | | | Vulnerable | Not Listed | False | 108 |
| 1824_Intact-Heath | 62.3 | 62.3 | 3.8 | | | Vulnerable | Not Listed | False | 90 |
| | | | | | | | | **Subtotal** | **341** |
| ***Tetratheca glandulosa / Tetratheca glandulosa ( Flora )*** | | | | | | | | | |
| 1783_Intact_Woodland | 48.0 | 48.0 | 0.13 | | | Vulnerable | Not Listed | False | 3 |
| 1824_Intact-Heath | 62.3 | 62.3 | 0.11 | | | Vulnerable | Not Listed | False | 3 |
| | | | | | | | | **Subtotal** | **6** |

# BAM Biodiversity Credit Report (Like for like)

## Proposal Details

Assessment Id
00026048/BAAS17090/21/00026049

Proposal Name
Proposed Rezoning - Morgan Road Belrose

BAM data last updated *
01/02/2023

Assessor Name
Rebecca Hogan

Assessor Number
BAAS17090

BAM Data version *
57

Proponent Names

Report Created
16/02/2023

BAM Case Status
Open

Assessment Revision
0

Assessment Type
Part 4 Developments (General)

Date Finalised
To be finalised

BOS entry trigger
BOS Threshold: Biodiversity Values Map and area clearing threshold

* 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 |
|---|
| **Nil** |

## Additional Information for Approval

# BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

| PCT |
|---|
| No Changes |

Predicted Threatened Species Not On Site

| Name |
|---|
| **Haliaeetus leucogaster /** White-bellied Sea-Eagle |

## 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 |
|---|---|---|---|---|---|
| 1250-Coastal sandstone gully forest | Not a TEC | 16.2 | 336 | 0 | 336 |
| 1783-Sydney North exposed sandstone woodland | Not a TEC | 17.5 | 315 | 0 | 315 |
| 1824-Coastal sandstone Heath-Mallee | Not a TEC | 11.0 | 258 | 0 | 258 |

| **1250-Coastal sandstone gully forest** | **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 | Sydney Coastal Dry Sclerophyll Forests <50% | 1250_Intact_Forest | Yes | 336 | Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo.<br>or<br>Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| **1783-Sydney North exposed sandstone woodland** | **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 | Sydney Coastal Dry Sclerophyll Forests <50% | 1783_Intact_Woodland | Yes | 315 | Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

| **1824-Coastal sandstone Heath-Mallee** | **Like-for-like credit retirement options** | | | | | |
|---|---|---|---|---|---|---|
| | Class | Trading group | Zone | HBT | Credits | IBRA region |
| | Sydney Coastal Heaths This includes PCT's: 772, 881, 882, 1134, 1143, 1641, 1822, 1823, 1824, 1826 | Sydney Coastal Heaths <50% | 1824_Intact-Heath | Yes | 258 | Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site. |

# BAM Biodiversity Credit Report (Like for like)

## Species Credit Summary

| Species | Vegetation Zone/s | Area / Count | Credits |
|---|---|---|---|
| **Cercartetus nanus** / Eastern Pygmy-possum | **1250_Intact_Forest, 1783_Intact_Woodland, 1824_Intact-Heath** | 44.7 | 1211.00 |
| **Cryptostylis hunteriana** / Leafless Tongue Orchid | **1783_Intact_Woodland** | 1.0 | 18.00 |
| **Pseudophryne australis** / Red-crowned Toadlet | **1250_Intact_Forest, 1783_Intact_Woodland, 1824_Intact-Heath** | 16.7 | 341.00 |
| **Tetratheca glandulosa** / Tetratheca glandulosa | **1783_Intact_Woodland, 1824_Intact-Heath** | 0.2 | 6.00 |

## Credit Retirement Options

Like-for-like credit retirement options

| | | |
|---|---|---|
| **Cercartetus nanus** / Eastern Pygmy-possum | Spp | IBRA subregion |
| | **Cercartetus nanus /** Eastern Pygmy-possum | Any in NSW |
| **Cryptostylis hunteriana** / Leafless Tongue Orchid | Spp | IBRA subregion |
| | **Cryptostylis hunteriana /** Leafless Tongue Orchid | Any in NSW |
| **Pseudophryne australis** / Red-crowned Toadlet | Spp | IBRA subregion |

| | | |
|---|---|---|
| | **Pseudophryne australis /** Red-crowned Toadlet | Any in NSW |
| **Tetratheca glandulosa** / Tetratheca glandulosa | Spp | IBRA subregion |
| | **Tetratheca glandulosa /** Tetratheca glandulosa | Any in NSW |

# BAM Candidate Species Report

## Proposal Details

| | | |
|---|---|---|
| Assessment Id<br>00026048/BAAS17090/21/00026049 | Proposal Name<br>Proposed Rezoning - Morgan Road Belrose | BAM data last updated *<br>01/02/2023 |
| Assessor Name<br>Rebecca Hogan | Report Created<br>16/02/2023 | BAM Data version *<br>57 |
| Assessor Number<br>BAAS17090 | Assessment Type<br>Part 4 Developments (General) | BAM Case Status<br>Open |
| Assessment Revision<br>0 | Date Finalised<br>To be finalised | BOS entry trigger<br>BOS Threshold: Biodiversity Values Map and area clearing threshold |

* 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.

## List of Species Requiring Survey

| Name | Presence | Survey Months |
|---|---|---|
| ***Acacia bynoeana***<br>Bynoe's Wattle | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Acacia terminalis subsp. Eastern Sydney***<br>Sunshine wattle | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Asterolasia elegans***<br>Asterolasia elegans | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Astrotricha crassifolia***<br>Thick-leaf Star-hair | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Caladenia tessellata***<br>Thick Lip Spider Orchid | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Callistemon linearifolius***<br>Netted Bottle Brush | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Callocephalon fimbriatum***<br>Gang-gang Cockatoo | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☑ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Calyptorhynchus lathami***<br>Glossy Black-Cockatoo | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Camarophyllopsis kearneyi***<br>Camarophyllopsis kearneyi | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Cercartetus nanus***<br>Eastern Pygmy-possum | Yes (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☑ Oct ☑ Nov ☑ Dec<br>☐ Survey month outside the specified months? |
| ***Chalinolobus dwyeri***<br>Large-eared Pied Bat | No (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Cryptostylis hunteriana***<br>Leafless Tongue Orchid | Yes (assumed present) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Darwinia biflora***<br>Darwinia biflora | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Darwinia glaucophylla***<br>Darwinia glaucophylla | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Darwinia peduncularis***<br>Darwinia peduncularis | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Eucalyptus camfieldii***<br>Camfield's Stringybark | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Genoplesium baueri***<br>Bauer's Midge Orchid | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Genoplesium plumosum***<br>Tallong Midge Orchid | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Grammitis stenophylla***<br>Narrow-leaf Finger Fern | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Haloragodendron lucasii***<br>Haloragodendron lucasii | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Heleioporus australiacus***<br>Giant Burrowing Frog | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☑ Dec<br>☐ Survey month outside the specified months? |
| ***Hibbertia puberula***<br>Hibbertia puberula | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Hibbertia spanantha***<br>Julian's Hibbertia | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Hieraaetus morphnoides***<br>Little Eagle | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☑ Aug<br>☑ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Hoplocephalus bungaroides***<br>Broad-headed Snake | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☑ Aug<br>☑ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Hygrocybe anomala var. ianthinomarginata***<br>Hygrocybe anomala var. ianthinomarginata | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☑ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Hygrocybe aurantipes***<br>Hygrocybe aurantipes | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Hygrocybe austropratensis***<br>Hygrocybe austropratensis | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Hygrocybe collucera***<br>Hygrocybe collucera | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Hygrocybe griseoramosa***<br>Hygrocybe griseoramosa | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Hygrocybe lanecovensis***<br>Hygrocybe lanecovensis | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Hygrocybe reesiae***<br>Hygrocybe reesiae | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☑ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Hygrocybe rubronivea***<br>Hygrocybe rubronivea | No (surveyed)<br>*Survey months are outside of the months specified in Bionet. | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☑ Survey month outside the specified months? |
| ***Isoodon obesulus obesulus***<br>Southern Brown Bandicoot (eastern) | No (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☑ Sep ☑ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Kunzea rupestris***<br>Kunzea rupestris | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Lasiopetalum joyceae***<br>Lasiopetalum joyceae | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Leptospermum deanei***<br>Leptospermum deanei | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Litoria aurea***<br>Green and Golden Bell Frog | No (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☑ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Lophoictinia isura***<br>Square-tailed Kite | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☑ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Melaleuca deanei***<br>Deane's Paperbark | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Melaleuca groveana***<br>Grove's Paperbark | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Meridolum maryae***<br>Maroubra Woodland Snail | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Micromyrtus blakelyi***<br>Micromyrtus blakelyi | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Miniopterus australis***<br>Little Bent-winged Bat | No (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Miniopterus orianae oceanensis***<br>Large Bent-winged Bat | No (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Myotis macropus***<br>Southern Myotis | No (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Ninox connivens***<br>Barking Owl | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☑ Sep ☑ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Ninox strenua***<br>Powerful Owl | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Persoonia hirsuta***<br>Hairy Geebung | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Persoonia mollis subsp. maxima***<br>Persoonia mollis subsp. maxima | No (surveyed) | ☐ Jan ☐ Feb ☑ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Petauroides volans***<br>Greater Glider | No (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☑ Sep ☑ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Petaurus norfolcensis***<br>Squirrel Glider | No (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☑ Sep ☑ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Phascolarctos cinereus***<br>Koala | No (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☑ Sep ☑ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Potorous tridactylus***<br>Long-nosed Potoroo | No (surveyed) | ☑ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☑ Aug<br>☑ Sep ☑ Oct ☑ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Prostanthera junonis***<br>Somersby Mintbush | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Pseudophryne australis***<br>Red-crowned Toadlet | Yes (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☐ Aug<br>☐ Sep ☐ Oct ☑ Nov ☑ Dec<br>☐ Survey month outside the specified months? |

| | | |
|---|---|---|
| ***Tetratheca glandulosa***<br>Tetratheca glandulosa | Yes (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☐ Jul ☑ Aug<br>☐ Sep ☑ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Tyto novaehollandiae***<br>Masked Owl | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |
| ***Tyto tenebricosa***<br>Sooty Owl | No (surveyed) | ☐ Jan ☐ Feb ☐ Mar ☐ Apr<br>☐ May ☐ Jun ☑ Jul ☐ Aug<br>☐ Sep ☐ Oct ☐ Nov ☐ Dec<br>☐ Survey month outside the specified months? |

## Threatened species Manually Added

| Common Name | Scientific Name |
|---|---|
| Sooty Owl | Tyto tenebricosa |

## Threatened species assessed as not on site

Refer to BAR for detailed justification

| Common name | Scientific name | Justification in the BAM-C |
|---|---|---|
| Deyeuxia appressa | Deyeuxia appressa | Refer to BAR |
| Diuris bracteata | Diuris bracteata | Refer to BAR |
| Dural Land Snail | Pommerhelix duralensis | Species is vagrant |
| Eastern Osprey | Pandion cristatus | Habitat constraints |
| Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas | Callocephalon fimbriatum - endangered population | Refer to BAR |
| Gosford Wattle, Hurstville and Kogarah Local Government Areas | Acacia prominens - endangered population | Refer to BAR |
| Grevillea shiressii | Grevillea shiressii | Refer to BAR |

| | | |
|---|---|---|
| Grey-headed Flying-fox | Pteropus poliocephalus | Habitat constraints |
| Long-nosed Bandicoot, North Head | Perameles nasuta - endangered population | Refer to BAR |
| Nielsen Park She-oak | Allocasuarina portuensis | Refer to BAR |
| Regent Honeyeater | Anthochaera phrygia | Habitat constraints |
| Spreading Guinea Flower | Hibbertia procumbens | Refer to BAR |
| Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill | Petaurus norfolcensis - endangered population | Refer to BAR |
| Swift Parrot | Lathamus discolor | Habitat constraints |
| Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield | Wahlenbergia multicaulis - endangered population | Refer to BAR |
| White-bellied Sea-Eagle | Haliaeetus leucogaster | Habitat constraints |

# BAM Predicted Species Report

## Proposal Details

| | | |
|---|---|---|
| Assessment Id | Proposal Name | BAM data last updated * |
| 00026048/BAAS17090/21/00026049 | Proposed Rezoning - Morgan Road Belrose | 01/02/2023 |
| Assessor Name | Report Created | BAM Data version * |
| Rebecca Hogan | 16/02/2023 | 57 |
| Assessor Number | Assessment Type | BAM Case Status |
| BAAS17090 | Part 4 Developments (General) | Open |
| Assessment Revision | BOS entry trigger | Date Finalised |
| 0 | BOS Threshold: Biodiversity Values Map and area clearing threshold | To be finalised |

* 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.

## Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

| Common Name | Scientific Name | Vegetation Types(s) |
|---|---|---|
| Barking Owl | Ninox connivens | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| Black Bittern | Ixobrychus flavicollis | 1250-Coastal sandstone gully forest |
| Black-chinned Honeyeater (eastern subspecies) | Melithreptus gularis gularis | 1783-Sydney North exposed sandstone woodland |
| Broad-headed Snake | Hoplocephalus bungaroides | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Dusky Woodswallow | Artamus cyanopterus cyanopterus | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Eastern Coastal Free-tailed Bat | Micronomus norfolkensis | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Eastern False Pipistrelle | Falsistrellus tasmaniensis | 1250-Coastal sandstone gully forest |

| | | |
|---|---|---|
| Eastern Osprey | Pandion cristatus | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| Flame Robin | Petroica phoenicea | 1250-Coastal sandstone gully forest |
| | | 1824-Coastal sandstone Heath-Mallee |
| Gang-gang Cockatoo | Callocephalon fimbriatum | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Glossy Black-Cockatoo | Calyptorhynchus lathami | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Golden-tipped Bat | Phoniscus papuensis | 1250-Coastal sandstone gully forest |
| Greater Broad-nosed Bat | Scoteanax rueppellii | 1250-Coastal sandstone gully forest |
| | | 1824-Coastal sandstone Heath-Mallee |
| Grey-headed Flying-fox | Pteropus poliocephalus | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Large Bent-winged Bat | Miniopterus orianae oceanensis | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Little Bent-winged Bat | Miniopterus australis | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Little Eagle | Hieraaetus morphnoides | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Little Lorikeet | Glossopsitta pusilla | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Masked Owl | Tyto novaehollandiae | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| New Holland Mouse | Pseudomys novaehollandiae | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Powerful Owl | Ninox strenua | 1250-Coastal sandstone gully forest |

| | | |
|---|---|---|
| Powerful Owl | Ninox strenua | 1783-Sydney North exposed sandstone woodland |
| Regent Honeyeater | Anthochaera phrygia | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Rosenberg's Goanna | Varanus rosenbergi | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Scarlet Robin | Petroica boodang | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Sooty Owl | Tyto tenebricosa | 1250-Coastal sandstone gully forest |
| Spotted Harrier | Circus assimilis | 1824-Coastal sandstone Heath-Mallee |
| Spotted-tailed Quoll | Dasyurus maculatus | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Square-tailed Kite | Lophoictinia isura | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Swift Parrot | Lathamus discolor | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Turquoise Parrot | Neophema pulchella | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Varied Sittella | Daphoenositta chrysoptera | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| White-throated Needletail | Hirundapus caudacutus | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| Yellow-bellied Glider | Petaurus australis | 1250-Coastal sandstone gully forest |
| Yellow-bellied Sheathtail-bat | Saccolaimus flaviventris | 1250-Coastal sandstone gully forest |

## Threatened species Manually Added

# BAM Predicted Species Report

| Common Name | Scientific Name |
|---|---|
| Sooty Owl | Tyto tenebricosa |

## Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

| Common Name | Scientific Name | Plant Community Type(s) |
|---|---|---|
| Sooty Owl | Tyto tenebricosa | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |
| White-bellied Sea-Eagle | Haliaeetus leucogaster | 1250-Coastal sandstone gully forest |
| | | 1783-Sydney North exposed sandstone woodland |
| | | 1824-Coastal sandstone Heath-Mallee |

## Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

| Common Name | Scientific Name | Justification in the BAM-C |
|---|---|---|
| White-bellied Sea-Eagle | Haliaeetus leucogaster | Habitat constraints |