Preliminary Biodiversity Development Assessment Report

Proposed zoning of deferred lands, Patyegarang Project.

Prepared by Ms Rebecca Hogan, BAAS17090

Preliminary Report – February 2024

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. * Change in development description from 450 'Lots' to 450 'Dwellings'. * Correction to typographical errors. * Update of BAM-Calculator VI scores, credit calculations, and printed BAM-Calculator reports.
3	26/07/2023	R. Hogan	Preliminary report for Planning Proposal. * Change in project name from 'Morgan Road, Belrose' and 'Lizard Rock' to 'Patyegarang Project'. * 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. * 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.
4	18/02/2024	R. Hogan	Preliminary report for Planning Proposal. * Addition of field results for Spring 2023 threatened plant surveys. * Addition of details relating to avoidance and minimisation of impacts, and calculation of extent of impacts, including addition of Appendix F to

Version	Date	Author	Details
			provide a sequence of alternative development footprints over time. * Addition of Figure 11 illustrating indirect impact areas. * Amendment to Figure 9 (Species polygons) with corresponding update to BAM-Calculator assessment and credit requirements. * Improvements to clarity of information provided in various sections.

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:

* At the regional scale, a comprehensive strategic assessment across the extensive MLALC landholdings in the Northern Beaches LGA (covering 621 hectares of land) to assess constraints and opportunities for development.

  This peer-reviewed assessment investigated the development potential of each of the land parcels, looking at matters such as biodiversity values, heritage values, bushfire risk, and infrastructure needs.

  Six of the land parcels were subsequently included in the Aboriginal Lands SEPP and assessed further within the *Northern Beaches Aboriginal Land Development Delivery Plan* (DDP). It is the intention of the MLALC that remaining land parcels be conserved and used to provide local biodiversity offsets.

  The strategic process resulted in only one of the land parcels, the 71 hectare subject property, being endorsed by the MLALC members and NSW ALC for land dealing. This property was deemed the best option to avoid and minimise biodiversity impacts at the regional scale, whilst meeting project objectives.

* At the site scale, *ie* within the subject property, further biodiversity assessment with resulting amendment to a previous concept masterplan. The development footprint was substantially pulled back from the more remote southeastern areas of the property that are not currently bordered by existing development. This reduction in scale and re-positioning of the development also reduced fragmentation of the large local patch of bushland which extends onto adjacent lands to the south and east.

* At the project scale, comprehensive biodiversity survey and assessment to further inform and refine the project design, resulting in the following avoid and minimise outcomes:

- 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.
- Widening of the Snake Creek riparian corridor in the south to exceed statutory minimum corridor requirements.
- Design measures to provide best practice protection for the conservation zone to avoid all direct and indirect impacts upon this area. These include use of perimeter roads around residential precincts to manage stormwater, access and other indirect impacts, and provision of a substantial bushfire APZ between residential areas and the conservation zone (which does not encroach into the conservation zone) to enable installation of impact minimisation features as well as provide a buffer to the conservation zone.
- 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. These areas include specific areas set aside for threatened species protection.

* At the precinct scale, discussions between the ecologist and stormwater consultant to provide conceptual design around water quality controls and treatment, and the location and method of discharges. The project team is committed to not only meeting statutory requirements in relation to water quality, but to set a benchmark for improvement of the quality of water being discharged from the site.

  Identification of a range of management plans that need be prepared at the development application stage to further manage, minimise and mitigate potential impacts on biodiversity values at the precinct scale (refer to Ch 8.4 of this Preliminary BDAR).

* 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.

In summary, the Structure Plan is the result of a lengthy investigative and assessment process to avoid and minimise impacts on biodiversity values at the regional scale, site scale, and project scale. Additional planning has already commenced to further avoid and minimise impacts at the precinct scale, with these details to be lodged with the development application.

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. No other threatened plant species are known to occur on the land (Bionet records) or have been recorded during the comprehensive field surveys 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*.

The biodiversity assessment has conservatively assumed for the purpose of assessment and calculation of impacts that all land within the development footprint, including APZ inner protection areas, public open space, road verges, and private spaces would be completely cleared of all native vegetation. It should be noted that this is an overestimation of the extent of impacts across 44.7 hectares of land. The Structure Plan specifically addresses lot sizing, road placement and asset protection zone boundaries to facilitate retention of trees and natural rock features within the development.

At this design level there is necessarily some uncertainty over the extent of indirect impacts, and extent of off-site impacts. Reasonable and justified assumptions have been made on the basis of known information and in consultation with relevent experts on the project team. Of importance for assessment, the potential for underestimation of impacts is substantially less than the overestimation of impacts that has been incorporated into the assessment.

This BDAR is a preliminary document prepared for the purpose of a Planning Proposal so the assessment has not been finalised or submitted within BOAMs.

The extent of impact to be offset would be re-calculated on the basis of final detailed plans at the development application stage. Risk associated with changing legislation, species listings and presence, credit calculations and credit pricing is common to all strategic planning decisions which necessarily rely on unfinalised BDARs.

Sufficient information has been provided to confidently assess project merits and feasibility for rezoning.

The credit summaries in Tables E1 and E2 below were calculated on 18th January 2024.

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*	8.4 ha	279
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: 18th February 2024

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 Lead Ecologist Principal, Hayes Environmental	Project management; BDAR preparation & certification; BAM-C data entry and analysis; GIS work & figure preparation; BAM plot surveys (function & habitat attributes); Identification of Plant Community Type/s; Fauna habitat evaluation: Targeted threatened bird surveys.	BSc (environmental biology), UTS Sydney, 1996 MEngMngt, UTS Sydney, 2000 Practicing member of the Ecological Consultants Association of NSW. 26 years of ecological consulting experience in the Sydney and greater Sydney region.
Mr Daniel Clark	n/a	Project Botanist	BAM plot surveys; Review and assistance with identification of plant community type/s; Targeted threatened plant surveys.	BSc (Hons) (Botany), University of Sydney, 2010 Cert. IV in General Horticulture, 2005 Cert. II in Bushland Regeneration, 2000 Cert. IV in Workplace Training and Assessment, 2011 Grad. Plant Science Internship, National Herbarium of NSW, Royal Botanic Gardens, 2009 Practicing member of the Ecological Consultants Association of NSW. 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 Honorary Associate Professor with University of Sydney. Office-bearing member of the Sydney Fungal Studies Group Inc. since 1985. 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 Principal, Lesryk Environmental	Targeted surveys for threatened fauna.	BEnvSc (Hons), University of Wollongong, 1990. Practicing member of the Ecological Consultants Association of NSW. 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. Associate of the Australian Museum (herpetology department) since 2015. Over 15 years of tadpole and frog consulting experience. 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
Paul Burcher	n/a	Botanist	Threatened plant traverses (2023)	BappSc MRZS Practicing member of the Ecological Consultants Association of NSW. Biobanking Assessor (No. 226) Over 32 years of botanical field survey experience across a wide variety of landscapes throughout NSW.
Jessica Davis	n/a	Botanist	Threatened plant traverses (2023)	Lesryk Environmental
Mike Fawcett	n/a	Botanist	Threatened plant traverses (2023)	Lesryk Environmental

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: 18th February 2024

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.

The number of plots sampled to date is sufficient for the purpose of establishing the scale of impact and feasibility of off-sets for a Planning Proposal due to:

- the reasonably uniform character and condition of each vegetation zone across the subject land; and
- that plots surveyed were located in the best quality areas of vegetation (avoiding tracked areas and areas affected by weeds), thus conservatively over-estimating vegetation condition.

Sampling additional plots closer to the development application time will allow for temporal variation to be incorporated into the calculation.

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 by Mr Daniel Clarke (during the July and August surveys), extending to a radius of approximately 10m around the point.

Targeted threatened plant surveys were conducted across the subject land over several years 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. Some small areas with difficult or dangerous access and which were deemed unsuitable habitat for the target species due to presence of dense monotypic shrub thickets or weeds were excluded from the traverse survey.

Surveys were conducted across various time periods:

October 2020 (22nd, 29th & 30th) - Sets of parallel traverses varying from 30m-250m long and positioned approximately 10m apart were surveyed across a range of preliminary target areas by Mr Daniel Clarke (selected on the basis of known threatened species locations and habitat, presence of diverse and intact habitat and to obtain representative sampling across each PCT). A total of 8.4km of traverse was surveyed at a walking speed averaging approximately 3.3km/hr.

September 2023 (12th & 14th) - Parallel traverses at 5m spacing by Mr Daniel Clarke to target the threatened orchid *Caladenia tessellata*. A reference population of this species on the South Coast was confirmed to be flowering prior to commencement of surveys on the subject land. A total of 202 km of traverse was surveyed at a walking speed averaging approximately 1 km/hr.

October 2023 (4th, 5th, 6th, 10th, 11th, 13th, 17th, 18th, 25th), with a final survey on November 11th to fill in gaps – Parallel traverses at 5m spacing were conducted across the entire subject land by two survey teams (i) Daniel Clarke and Katherine Lykos), and (ii) Paul Burcher, Jess Davis and Mike Fawcett. Traverses were surveyed at a walking speed averaging approximately 1 km/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 fauna 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	-
	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 Last 7 Days: 1mm Last 30 days: 21mm
	03/11/2020		25°C	2	0mm	Last 24 hrs: 10.6mm Last 7 Days: 29.6mm October total: 109mm
	09/11/2020		20°C	2	0mm	Last 24 hrs: 0.8mm Last 7 Days: 21.2mm Last 30 days: 160mm
	10/11/2020		(14-23°C)	not avail.	0mm	Last 24 hrs: 0.2mm Last 7 Days: 42.4mm Last 30 days: 160mm
	11/11/2020		(16-30°C)	not avail.	0mm	Last 24 hrs: 0mm Last 7 Days: 42.4mm Last 30 days: 160mm
	17/11/2020		(15-22°C)	not avail.	0.8mm	Last 24 hrs: 0mm Last 7 Days: 2mm Last 30 days: 162mm
	18/11/2020		(15-24°C)	not avail.	0mm	Last 24 hrs: 1.6mm Last 7 Days: 3.6mm Last 30 days: 158mm
	24/11/2020		(16-23°C)	not avail.	0mm	Last 24 hrs: 3.2mm Last 7 Days: 4.8mm Last 30 days: 146mm
	25/11/2020		(16-30°C)	not avail.	0mm	Last 24 hrs: 2mm Last 7 Days: 4.8mm Last 30 days: 127mm

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**
	22/12/2020		(13-24°C)	not avail.	0mm	Last 24 hrs: 32.4mm Last 7 Days: 87.2mm Last month: 122.4mm
Koala SAT survey	18/09/2020		not avail.	not avail.	3.6mm	0mm in preceding three days
	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 - dusk watch - call playback - 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 and mostly shrubby bushland, spread across difficult terrain. Small patches were innaccessible due to dense shrub thickets or dangerous terrain, as indicated on Figure 5b *Threatened Plant Traverses (2023)*.

A recent review of biodiversity information for the deferred lands prepared for the Northern Beaches Council (Arcadis Australia Pacific *Pty Ltd*, 2021) similarly reports that the steep topography of the deferred lands presents a challenge for threatened flora survey, particularly for small cryptic threatened forbs.

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 targeted survey for *Caladenia tessellata* in September 2023 had to be cut short due to a heatwave which caused all plants at the reference population to die and disappear. Similar conditions were experienced at the subject property such that ongoing survey would not have produced reliable results.

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)

Mr Paul Burcher
Scientific Licence, s132c of the NP&W Act 1974

Jessica Davis
Scientific Licence, s132c of the NP&W Act 1974 (operating under Lesryk Environmental licence)

Mike Fawcett
Scientific Licence, s132c of the NP&W Act 1974 (operating under Lesryk Environmental licence)

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. 09 October 2024)

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. Geological features such as rock outcrops, platforms, and low escarpments are common across the landscape and cannot readily be mapped.

There are no relevant threatened species within the subject site specifically associated with these geological features and, therefore, mapping of these features is not required.

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 and soils

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

The dominant landscape across the subject land (and assessment area) is Belrose Coastal Slopes. This is, therefore, the landscape used for BAM assessment purposes. A relatively small diatreme occurs as a localised patch on the southeastern boundary of the subject land.

Belrose Coastal Slopes is characterised as:

> *Benched hill slopes and deep valleys of the coastal fall on horizontal Triassic quartz sandstone, lithic sandstone and shales. High proportion of rock outcrop with discontinuous cliffs to 5m high. General elevation 0 to 180m, local relief 80m. Shallow uniform or gradational sands and earthy sands on ridges, deeper sands, loamy sands and organic sands on wet benches and in hanging swamps, grey or yellow texture-contrast soils on shale benches. Accumulations of deeper sand and occasional podsols in depositional sites and along streams.*

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 – see photos below). 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 are quite small, contain trees, 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.

Spot survey No. 11

Spot survey No. 12

Spot survey No. 53

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*".

There is one very small patch of swampy land within the subject land that does not support a continuous cover of eucalypts, located within the area previously mapped as PCT 1803. This small open area was observed to be dominated by thickets of weeds including Small and Large-leaved Privet *Ligustrum* spp, Crofton Weed *Ageratina adenophora*, Pampas Grass *Cortaderia selloana*, Kahili Ginger *Hedychium gardnerianum*, *Lantana camara*, and *Senna pendula* var *glabrata*, with Coral Tree *Erythina x sykesii* around the upstream fringes. The open area does not contain native vegetation.

All other hanging swamp habitats found within the subject land are 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. These damp and hanging swamp areas within the subject land are regarded as variants of the mapped PCTs, and do not form part of the listed TEC.

On the basis of the above, there are no areas of this TEC within the subject land.

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, as illustrated on Figure 2 (Location Map).

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

Refer to Table 8 (Vegetation zones and patch sizes). Refer to Figure 2 (Location Map) and 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 ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	3	2	2	BAM-VIS Plot 1 BAM-VIS Plot 4
1783	1783: *Sydney North exposed sandstone woodland*	Intact Woodland	17.5	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	3	2	2	BAM-VIS Plot 2 BAM-VIS Plot 3
1824	1824: *Coastal Sandstone Heath-Mallee*	Intact Heath or Mallee	11.0	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	3	2	2	BAM-VIS Plot 5 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. A further three plot surveys (one per zone) would be required to finalise an off-set calculation for development of the land. The number of plots sampled to date is sufficient for the purpose of establishing the scale of impact and feasibility of off-sets for a Planning Proposal due to:

- the reasonably uniform character and condition of each vegetation zone across the subject land; and
- that plots surveyed were located in the best quality areas of vegetation (avoiding tracked areas and areas affected by weeds), thus conservatively over-estimating vegetation condition.

Sampling additional plots closer to the development application time will allow for temporal variation to be incorporated into the calculation.

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 ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	High
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	Moderate
Gang Gang Cockatoo (foraging)	*Callocephalon fimbriatum*	V	E	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	Moderate
Glossy Black Cockatoo (foraging)	*Calyptorhynchus lathami*	V	-	Yes	☒ BAM-C ☐ TBDC ☒ Previous survey ☒ 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 ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	Moderate
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	High
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☐ 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						
White-bellied Sea-Eagle (foraging)	*Hieraaetus morphnoides*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	2 – habitat constraints	1250, 1783, 1824	High
Little Eagle (foraging)	*Hieraaetus morphnoides*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	Moderate
White-throated Needletail	*Hirundapus caudacutus*	-	V	No	☒ BAM-C ☐ TBDC ☒ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	High
Broad-headed Snake (foraging)	*Hoplocephalus bungaroides*	E	V	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	High
Black Bittern	*Ixobrychus flavicollis*	V	-	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☒ Current survey	Yes	n/a	1250, 1783, 1824	Moderate
Black-chinned Honeyeater	*Melithreptus gularis gularis*	V	-	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☒ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	High
Little Bent-wing Bat (foraging)	*Miniopterus australis*	V	-	Yes	☒ BAM-C ☐ TBDC ☒ Previous survey ☒ Current survey	Yes	n/a	1250, 1783, 1824	High
Large Bent-wing Bat (foraging)	*Miniopterus orianae oceanensis*	V	-	Yes	☒ BAM-C ☐ TBDC ☒ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	High
Turquoise Parrot	*Neophema pulchella*	V	-	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☒ Previous survey ☒ 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 ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☐ 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 ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	High
Grey-headed Flying-fox (foraging)	*Pteropus poliocephalus*	V	V	Yes	☒ BAM-C ☐ TBDC ☒ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824	High
Sooty Owl (foraging)	*Tyto tenebricosa*	V	-	Yes	☒ BAM-C ☐ TBDC ☒ Previous survey ☐ 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 ☐ TBDC ☒ Previous survey ☐ 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 ☐ TBDC ☐ Previous survey ☐ 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				
Acacia prominens - endangered population	*Acacia prominens*	E2	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	1 - Geographic limitations (not within an LGA listed in the Determination)	n/a
Sunshine Wattle	*Acacia terminalis*	E	E	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1824
Nielsen Park She-oak	*Allocasuarina portuensis*	E	E	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	1 - Geographic limitations (not within 5km of Sydney Harbour foreshore)	n/a
Asterolasia elegans	*Asterolasia elegans*	E	E	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Thick-leaf Star-hair	*Astrotricha crassifolia*	V	V	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783
Thick Lip Spider Orchid	*Caladenia tessellata*	E	V	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 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				
Netted Bottlebrush	*Callistemon linearifolius*	V	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Camarophyllopsis kearneyi	*Camarophyllopsis kearneyi*	E	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Leafless Tongue Orchid	*Cryptostylis hunteriana*	V	V	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1783
Darwinia biflora	*Darwinia biflora*	V	V	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1824
Darwinia glaucophylla	*Darwinia glaucophylla*	V	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1783, 1824
Darwinia peduncularis	*Darwinia peduncularis*	V	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ 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				
Deyeuxia appressa	*Deyeuxia appressa*	E	E	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	Extinct – see below	n/a
Diuris bracteata	*Diuris bracteata*	E	X	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	Extinct – see below	n/a
Camfield's Stringybark	*Eucalyptus camfieldii*	V	V	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Bauer's Midge Orchid	*Genoplesium baueri*	E	E	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1824
Tallong Midge Orchid	*Genoplesium plumosum*	CE	E	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1824.
Narrow-leaf Finger Fern	*Grammitis stenophylla*	E	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ 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				
Grevillea shiressii	*Grevillea shiressii*	V	V	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	1 - Geographic limitations (not within Central Coast LGA)	n/a
Haloragodendron lucasii	*Haloragodendron lucasii*	E	E	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Spreading Guinea Flower	*Hibbertia procumbens*	E	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	1 - Geographic limitations (not within Central Coast LGA)	n/a
Hibbertia puberula	*Hibbertia puberula*	E	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783
Hibbertia spanantha	*Hibbertia spanantha*	CE	CE	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Hygrocybe anomala var *ianthinomarginata*	*Hygrocybe anomala* var *ianthinomarginata*	V	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ 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 aurantipes	*Hygrocybe aurantipes*	V	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Hygrocybe austropratensis	*Hygrocybe austropratensis*	E	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Hygrocybe collucera	*Hygrocybe collucera*	E	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Hygrocybe griseoramosa	*Hygrocybe griseoramosa*	E	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Hygrocybe lanecovensis	*Hygrocybe lanecovensis*	E	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Hygrocybe reesiae	*Hygrocybe reesiae*	V	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ 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 rubronivea	*Hygrocybe rubronivea*	V	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Kunzea rupestris	*Kunzea rupestris*	V	V	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1824
Lasiopetalum joyceae	*Lasiopetalum joyceae*	V	V	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1783, 1824
Leptospermum deanei	*Leptospermum deanei*	V	V	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Melaleuca deanei	*Melaleuca deanei*	V	V	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Melaleuca groveana	*Melaleuca groveana*	V	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	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				
Micromyrtus blakelyi	*Micromyrtus blakelyi*	V	V	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1824
Hairy Geebung	*Persoonia hirsuta*	E	E	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1824
Persoonia mollis ssp maxima	*Persoonia mollis ssp maxima*	E	E	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Somersby Mintbush	*Prostanthera junonis*	E	E	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1824
Tetratheca glandulosa	*Tetratheca glandulosa*	V	-	☒ BAM-C ☐ TBDC ☒ Previous survey ☒ Current survey	Yes	n/a	1250, 1783, 1824
Wahlenbergia multicaulis – endangered population	*Wahlenbergia multicaulis*	E2	-	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	1 - Geographic limitations (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
		BC Act	EPBC Act					
Regent Honeyeater (Breeding)	*Anthochaera phrygia*	CE	CE	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	2 - Habitat constraints (subject land is not part of the mapped area)	n/a
Gang Gang Cockatoo (Breeding)	*Callocephalon fimbriatum*	V	E	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Gang Gang Cockatoo (endangered population)	*Callocephalon fimbriatum*	E2	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	1 - Geographic limitations (not within an LGA listed in the Determination)	n/a
Glossy Black Cockatoo (Breeding)	*Calyptorhynchus lathami*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	No	☒ BAM-C ☐ TBDC ☒ Previous survey ☒ Current survey	Yes	n/a	1250, 1783, 1824
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ 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
		BC Act	EPBC Act					
White-bellied Sea-Eagle (Breeding)	*Haliaeetus leucogaster*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	2 - Habitat constraints (further detail provided below this table)	n/a
Giant Burrowing Frog	*Heleioporus australiacus*	V	V	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Little Eagle (Breeding)	*Hieraaetus morphnoides*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Broad-headed Snake (Breeding)	*Hoplocephalus bungaroides*	E	V	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Southern Brown Bandicoot	*Isoodon obesulus obesulus*	E	E	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Swift Parrot (Breeding)	*Lathamus discolor*	E	CE	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	2 - Habitat constraints (subject land is not part of the mapped area)	n/a

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
		BC Act	EPBC Act					
Green & Golden Bell Frog	*Litoria aurea*	E	V	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1824
Square-tailed Kite (Breeding)	*Lophoictinia isura*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Maroubra Woodland Snail	*Meridolum maryae*	E	-	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1824
Little Bent-winged Bat (Breeding)	*Miniopterus australis*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☒ Current survey	Yes	n/a	1250, 1783, 1824
Large Bent-winged Bat (breeding)	*Miniopterus orianae oceanensis*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Southern Myotis	*Myotis macropus*	V	-	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783

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
		BC Act	EPBC Act					
Barking Owl (Breeding)	*Ninox connivens*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783
Powerful Owl (Breeding)	*Ninox strenua*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783
Eastern Osprey (Breeding)	*Pandion cristatus*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	2 - Habitat constraints (further detail provided below this table)	n/a
Long-nosed Bandicoot – endangered population	*Perameles nasuta*	E2	-	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	1 – Geographic limitations (subject land is not south of Addison Road, Manly)	n/a
Greater Glider	*Petauroides volans*	-	V	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Squirrel Glider	*Petaurus norfolcensis*	V	-	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ 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
		BC Act	EPBC Act					
Squirrel Glider – endangered population	*Petaurus norfolcensis*	E2	-	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	1 – Geographic limitations (subject land is not on the Barrenjoey Peninsula)	n/a
Koala	*Phascolarctos cinereus*	E	E	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Dural Land Snail	*Pommerhelix duralensis*	E	E	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	3 - species is vagrant (not known) to the locality	n/a
Long-nosed Potoroo	*Potorous tridactylus*	V	V	No	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250
Red-crowned Toadlet	*Pseudophryne australis*	V	-	No	☒ BAM-C ☐ TBDC ☒ Previous survey ☒ Current survey	Yes	n/a	1250, 1783, 1824
Grey-headed Flying-fox (Breeding)	*Pteropus poliocephalus*	V	V	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	No	2 - Habitat constraints (further detail provided below this table)	n/a

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
		BC Act	EPBC Act					
Masked Owl (Breeding)	*Tyto novaehollandiae*	V	-	Yes	☒ BAM-C ☐ TBDC ☐ Previous survey ☐ Current survey	Yes	n/a	1250, 1783, 1824
Sooty Owl (Breeding)	*Tyto tenebricosa*	V	-	Yes	☐ BAM-C ☐ TBDC ☒ Previous survey ☐ 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

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 glaucophylla	*Darwinia glaucophylla*	V	-	Targeted threatened species survey	No	No
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

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 austropratensis	*Hygrocybe austropratensis*	E	-	Targeted threatened species survey	No	No
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

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			
Micromyrtus blakelyi	*Micromyrtus blakelyi*	V	V	Targeted threatened species survey	No	No
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

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 due to lack of suitable caves*	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

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			
Red-crowned Toadlet	*Pseudophryne australis*	V	-	Targeted threatened species survey	Yes	Yes
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. However, the subject land does not contain suitable breeding caves for this species. The species 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. The Little Bent-wing Bat is therefore classed as an ecosystem credit species for this site.*

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. Relevant PCTs: 1250 Use reference population to identify vegetative state, which will assist in positive identification during survey. 2 BAM plots surveyed within PCT 1250 in March 2021. 5.3km of random meander in July/August 2020, of which approximately one quarter was within relevant PCT 1250. 8.4km of parallel traverses in late October 2020, of which one third were within PCT 1250. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours (2020-2021) + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land. Only two records within 5km of the subject land – both from Frenches Forest in 1911. Not recorded.	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	☒ Yes BAM: May to Jul	☐ No Also surveyed: Aug, Oct	~ 50 person-hours	No	Bionet - not known from subject land. 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**	
		most records from the Port Jackson area and the eastern suburbs of Sydney. Relevant PCTs: 1250 & 1824 Use flowers to identify. 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. *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*. 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				5km are all from the Allambie Heights to Brookvale area. 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	☒ Yes BAM: Sep to Oct Survey: Oct	☐ No Also surveyed: Mar	~ 50 person-hours + parallel traverses at 5m spacing	No	Bionet - not known from subject land and no records within 5km of the 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**	
		Relevant PCTs: 1250 Use flowers to locate. Species is quite sparse and scraggly and more detectable when in flower. 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. 8.4km of parallel traverses in October 2020, of which one third were within PCT 1250. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.			walked at 1kph (2023)		Subject land is not within listed LGAs. Not recorded.	
Thick-leaf Star-hair	*Astrotricha crassifolia*	Shrub to 2.4m high. Occurs in dry sclerophyll woodland on sandstone. Relevant PCTs: 1250 & 1783 Use buds, flowers and fruit to locate and identify. 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). 5.3km of random meander in August 2020, of which the majority was within relevant PCTs. 8.4km of parallel traverses in October 2020, of which two thirds were within relevant PCTs.	☒ Yes BAM: Jul to Dec Survey: Jul, Aug, Oct	☐ No Also surveyed: Mar	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land and no records within 5km of the subject land. Not recorded.	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**	
		Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.						
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. Relevant PCTs: 1250 & 1824 Coastal populations are best surveyed in September and populations on the ranges surveyed in October. 8.4km of parallel traverses were conducted over three days in late October 2020, of which approx. half were in relevant PCTs. 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. 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. 202km of parallel traverses at 5m spacing through suitable habitat, walked at 1kph in September 2023.	☒ Yes BAM: Sept to Oct Survey: Sept, Oct	☐ No Also surveyed: late Aug	~ 29 person-hours + 202km parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land and no records within 5km of the subject land. Not recorded, although targeted traverse surveys in 2023 were cut short due to a heatwave. 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	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**	
							found in the Sydney area. Subject land is shrubby/heathy rather than grassy so does not provide typical habitat. Not believed to be present.	
Netted Bottlebrush	*Callistemon linearifolius*	Shrub to 3-4m high. Dry sclerophyll forest on coast and adjacent ranges. Relevant PCTs: 1250, 1783 & 1824 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. 6 BAM plots surveyed in relevant PCTs, but outside survey period. However, surveys are thorough and no *Callistemon* spp were recorded that could be this species. 8.4km of parallel traverses in October 2020 in relevant PCTs.	☒ Yes BAM: Oct to Jan Survey: Oct	☐ No Also surveyed: Aug, Mar	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land. Nine records within 5km. Not recorded.	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**	
		Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023. No reference site able to be checked, but surveys have been conducted across a range of seasons and years.						
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. Relevant PCTs: 1250 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. 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 BAM: May to Jun	☒ No Survey: 6th Jul on advice from species expert.	~ 4 person-hours	No	Bionet - not known from subject land and no records within 5km (although this is not a species likely to be recorded casually). Dr Ray Kearney advises that habitats within the subject land are unsuitable for this species based on soil substrate and vegetation structure. Not a single waxcap fungi of any	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**	
							species was recorded. Other non-waxcap species were present. Not likely to occur.	
Leafless Tongue Orchid	*Cryptostylis hunteriana*	Terrestrial orchid. Known from a range of habitats. Relevant PCTs: 1783 Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023. Follow-up parallel traverses carried out in small scattered areas on 11th November 2023. Not thoroughly surveyed in accordance with guidelines.	☒ Yes BAM: Nov to Jan Survey: Nov	☐ No Also surveyed: Oct	Parallel traverses at 5m spacing, walked at 1kph	No	Bionet - not known from subject land and no records within 5km of the subject land. Not recorded. Could potentially occur in unsampled parts of the subject land, but does not appear to be present. Assumed that a 1ha patch of habitat occurs	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**	
							within the subject land.	
Darwinia biflora	*Darwinia biflora*	Shrub to 80cm high. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone Relevant PCTs: 1824 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. 2 BAM plots surveyed within PCT 1824 in Mar 2021. 5.3km of random meander in August 2020, of which ~one quarter was within PCT 1824. 8.4km of parallel traverses in October 2020, of which one third was within PCT 1824. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land. One record within 5km from East Killara. Subject land is outside of the stated range and not typified by shale-capped ridgetops. Not recorded.	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**	
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. Relevant PCTs: 1783 & 1824 4 BAM plots surveyed within relevant PCTs in Aug 2020 and Mar 2021. 5.3km of random meander in August 2020, of which ~half was within relevant PCTs. 8.4km of parallel traverses in October 2020, of which ~ half were within relevant PCTs. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Subject land is not within Gosford LGA. Bionet - not known from subject land and no records within 5km of the subject land. Not recorded.	No
Darwinia peduncularis	*Darwinia peduncularis*	Spreading shrub to 1.5m high. Use flowers to locate and identify. Recommend checking a nearby reference site at a similar altitude, to determine flowering times. Relevant PCTs: 1250 & 1783	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing	No	Bionet - not known from subject land and no records within 5km of the 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**	
		4 BAM plots surveyed within relevant PCTs in Aug 2020 and Mar 2021. 5.3km of random meander in August 2020, of which the majority was within relevant PCTs. 8.4km of parallel traverses in October 2020, of which two thirds were within relevant PCTs. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	reference site not able to be used.		walked at 1kph (2023)		Not recorded.	
Camfield's Stringybark	*Eucalyptus camfieldii*	Mallee tree to 4m tall. Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Identifiable throughout year by epicormic growth or juvenile foliage. Juvenile foliage isn't representative of E. camfieldii in the northern populations. Relevant PCTs: 1250 2 BAM plots surveyed within PCT 1250 in March 2021. 5.3km of random meander in August 2020, of which approximately one quarter was within PCT 1250. 8.4km of parallel traverses in late October 2020, of which one quarter were within PCT 1250. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land. 38 records within 5km of the subject land. Relatively common in the vicinity, but also readily detected. Not recorded.	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**	
Bauer's Midge Orchid	*Genoplesium baueri*	Terrestrial orchid. Dry sclerophyll forest and moss gardens over sandstone. Relevant PCTs: 1824 Survey 6 weeks after significant rain. New work indicates species flowers from Jan to Apr. The Australian Plants Society have found recent records in Kur-ring-gai Chase NP, and elsewhere within 1-5km of the subject land. 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.	☒ Yes BAM: Feb to Mar Survey: Mar	☐ No	~ 12 person-hours	No	Bionet - not known from subject land. There are 8 records within 5km of the subject land. Not recorded. Further targeted work required to meet BAM survey guidelines.	No
Tallong Midge Orchid	*Genoplesium plumosum*	Terrestrial orchid. Occurs exclusively in heathland, generally dominated by *Kunzea parvifolia*, *Calytrix tetragona* and *Dillwynia* spp. Relevant PCTs: 1824 Survey late Feb to March. A random meander and 2 BAM plot surveys conducted within PCT 1824 on 4th Mar 2021.	☒ Yes BAM: Feb to Mar Survey: Mar	☐ No	~ 12 person-hours	No	Bionet – not known from subject land and no records within 5km of the subject land. Now known from only two areas – Tallong & Wingello in the	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**	
							Southern Highlands. Not recorded and not likely to occur. Further targeted work required to meet BAM survey guidelines.	
Narrow-leaf Finger Fern	*Grammitis stenophylla*	Small fern. Moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest. Relevant PCTs: 1250 Survey after significant rainfall event. Species is difficult to detect after long dry periods. 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. 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	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land and no records within 5km. Not recorded. Most of the subject land would 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**	
		parallel traverses were surveyed, of which one third were within PCT 1250. 2 BAM plots were surveyed within PCT 1250 in March 2021, following regular ongoing rainfall events throughout the summer. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.						
Haloragodendron lucasii	*Haloragodendron lucasii*	Erect shrub to 1.5m high. Associated with high soil moisture and relatively high soil-phosphorous in dry sclerophyll forest. Relevant PCTs: 1250 2 BAM plots surveyed within PCT 1250 in March 2021. 5.3km of random meander in August 2020, of which ~ one quarter was conducted within PCT 1250. 8.4km of parallel traverses in late October 2020, of which one third were within PCT 1250. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land. Three records within 5km of the subject land – at East Killara and Duffys Forest. Not recorded.	No
Hibbertia puberula	*Hibbertia puberula*	Shrublet with wiry branches to 30cm long. Typically dry sclerophyll woodland and heath on sandy soil. Relevant PCTs: 1250 & 1783	☒ Yes BAM: Oct to Dec Survey: Oct	☐ No Also surveyed: Mar, Aug	~ 50 person-hours +	No	Bionet - not known from subject land. Only one record within 5km of the	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 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. No known local reference site. 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). 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). Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.			parallel traverses at 5m spacing walked at 1kph (2023)		subject land – a herbarium record from Frenches Forest in 1946. Not recorded.	
Hibbertia spanantha	*Hibbertia spanantha*	Shrublet to 30cm high. Grows in forest. Soils are light clay, occurring on shale sandstone transition. Relevant PCTs: 1250 Use flowers to locate. Peak flowering period Oct - Nov, but will flower sporadically throughout the year. 8.4km of parallel traverses over three days in late October 2020, of which one third were within PCT 1250.	☒ Yes BAM: Oct to Nov Survey: Oct	☐ No Also surveyed: Mar	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land and no records within 5km of the subject land. Not recorded.	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 1250 but in March, outside the survey period – however, these surveys are thorough and no *Hibbertia* spp likely to be this species were recorded). Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.						
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*). Relevant PCTs: 1250 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. 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 BAM: May to Jun	☒ No Survey: 6th Jul on advice from species expert.	~ 4 person-hours	No	Bionet - not known from subject land and no records within 5km (although these are not species likely to be recorded casually). Dr Ray Kearney advises that habitats within the subject land are unsuitable for these species based on soil substrate and vegetation	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 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*). Relevant PCTs: 1250 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. 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 BAM: May to Jun	☒ No Survey: 6th Jul on advice from species expert.	~ 4 person-hours	No	structure. Not a single waxcap fungi of any species was recorded. Other non-waxcap species were present. Not likely to occur.	No
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*).	☐ Yes BAM: May to Jun	☒ No Survey: 6th Jul on advice from	~ 4 person-hours	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**	
		Relevant PCTs: 1250 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. 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 expert.				
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*). Relevant PCTs: 1250 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.	☐ Yes BAM: Jun	☒ No Survey: 6th Jul on advice from species expert.	~ 4 person-hours	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**	
		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 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*). Relevant PCTs: 1250 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. 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	☐ Yes BAM: May to Jun	☒ No Survey: 6th Jul on advice from species expert.	~ 4 person-hours	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**	
		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*). Relevant PCTs: 1250 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. 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 BAM: May to Jun	☒ No Survey: 6th Jul on advice from species expert.	~ 4 person-hours	No	see above.	No
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*).	☐ Yes BAM: May to Jun	☒ No Survey: 6th Jul on advice from	~ 4 person-hours	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**	
		Relevant PCTs: 1250 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. 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 expert.				
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*). Relevant PCTs: 1250 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.	☐ Yes BAM: May to Jun	☒ No Survey: 6th Jul on advice from species expert.	~ 4 person-hours	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**	
		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.						
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. Relevant PCTs: 1824 2 BAM plots surveyed within PCT 1824 in Mar 2021, including one which encompassed an area of flat sandstone rock outcrop. 5.3km of random meander in August 2020, of which ~one quarter was within PCT 1824. 8.4km of parallel traverses in October 2020, of which one third was within PCT 1824. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land. 1 record within 5km of the subject land from Ingleside in 2007. Not recorded.	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**	
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. Relevant PCTs: 1783 & 1824 Use flowers to locate and identify, as easily confused with *L. parviflorum* and *L. rufum*. 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). 8.4km of parallel traverses in October 2020, of which ~ half were within relevant PCTs. Surveyor Daniel Clarke has extensive experience with this species. Subject land is not typified by suitable lateritic to shaley ridgetops. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: Sep to Nov Survey: Oct	☐ No Also surveyed: Aug	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land. One record within 5km from Ingleside. Not recorded.	No
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. Relevant PCTs: 1250 This species is detectable all year, but requires fertile material to identify.	☒ Yes BAM: Oct to Nov Survey: Oct	☐ No Also surveyed: Mar, Jul, Aug	~ 50 person-hours + parallel traverses at	No	Bionet - not known from subject land. There is a cluster of records from a population near	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 1250 in March 2021. 5.3km of random meander in August 2020, of which approximately one quarter was within PCT 1250. 8.4km of parallel traverses in October 2020, of which one quarter were within PCT 1250. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.			5m spacing walked at 1kph (2023)		Middle Harbour Creek in Garigal NP ~3km to the west of the subject land. Not recorded.	
Melaleuca deanei	*Melaleuca deanei*	Optimum time for flowering is Oct - Nov, but flowers infrequently and unpredictably. Detectable vegetatively all year round. Relevant PCTs: 1250, 1783 & 1824 6 BAM plots surveyed in Aug 2020 and Mar 2021. 5.3km of random meander in August 2020. 8.4km of parallel traverses in October 2020. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Deane's Paperbark occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. Bionet - not known from subject land. There are records approx. 5km to the east, northeast and	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**	
							southeast of the subject land. Not recorded.	
Melaleuca groveana	*Melaleuca groveana*	Shrub or small tree, to 2-5m high. Grows in heath, shrubland and shrubby open forest and woodlands. Relevant PCTs: 1783 2 BAM plots surveyed within PCT 1783 in Aug 2020. 5.3km of random meander in August 2020, of which approx one third was within PCTs 1783. 8.4km of parallel traverses in October 2020, of which approx. half was within PCT 1783. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land and no records within 5km of the subject land. Not recorded.	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. Relevant PCTs: 1824	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Subject land is not within known distribution. Bionet - not known from subject land and no records within 5km of the subject land. Not recorded.	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 sandstone rock platform. 5.3km of random meander in August 2020, of which ~one quarter was within PCT 1824. 8.4km of parallel traverses in October 2020, of which one third was within PCT 1824. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.						
Hairy Geebung	*Persoonia hirsuta*	Spreading shrub. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. Relevant PCTs: 1250 & 1824 4 BAM plots surveyed within relevant PCTs in Aug 2020 and Mar 2021. 5.3km of random meander in August 2020, of which ~two thirds was within relevant PCTs. 8.4km of parallel traverses in October 2020, of which ~ half were within relevant PCTs. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: all year Survey: Mar, Jul, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Bionet - not known from subject land. There are 27 records within 5km of the subject land. Not recorded.	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	☒ Yes	☐ No	~ 50 person-hours	No	Subject land is more than 10km	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**	
		of narrow gullies on Hawkesbury Sandstone. These habitats support relatively moist, tall forest vegetation communities, often with warm temperate rainforest influences. Relevant PCTs: 1250 Known distribution is highly restricted, known from the Hornsby Heights-Mt Colah area north of Sydney in the Sydney Basin Bioregion. 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. 2 BAM plots surveyed within PCT 1250 in March 2021. 5.3km of random meander in August 2020, of which approximately one quarter was within PCT 1250. 8.4km of parallel traverses in late October 2020, of which one third were within PCT 1250. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	BAM: all year Survey: Mar, Jul, Aug, Oct	+ parallel traverses at 5m spacing walked at 1kph (2023)		east of the known distribution. Bionet - not known from subject land and no records within 5km of the subject land. Not recorded.	

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**	
Somersby Mintbush	*Prostanthera junonis*	Low shrub up to 1m diameter. Relevant PCTs: 1824 Use flowers to locate. Survey when most likely to flower Oct - Dec. Species also sporadically flowers at other times throughout the year. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: Oct to Dec Survey: Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	No	Has a north-south range of approximately 19 km on the Somersby Plateau in the Gosford and Wyong local government areas. Restricted to the Somersby Plateau. Bionet - not known from subject land and no records within 5km. Not recorded.	No
Tetratheca glandulosa	*Tetratheca glandulosa*	Small shrub to 20-50cm in height. Associated with shale-sandstone transition habitat where shale cappings occur over sandstone. Relevant PCTs: 1250, 1783 & 1824 Use flowers to locate. Occasionally flowers in Jul. Parallel traverses at 5m spacing through all suitable habitat, walked at 1kph in October 2023.	☒ Yes BAM: Aug to Nov Survey, Aug, Oct	☐ No	~ 50 person-hours + parallel traverses at 5m spacing walked at 1kph (2023)	Yes	Previous records on subject land (Travers, 2018 & Bionet). Recorded during surveys in August and October.	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**	
						Refer to Figure 8 (Threatened Species Locations).	

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. 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. 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. 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 BAM: Oct to Jan 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. 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. Three diurnal bird surveys (point count method) were conducted at three locations across the range of	☒ Yes BAM: Jan to Sep 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. 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. 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). 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. 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 BAM: Oct to Mar	☒ No 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: 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. Elliot trapping (arboreal) 11-15th January 2021: 40 traps set across all PCTs, total of 160 trap-nights. Hairtube trapping (arboreal) – 15 hairtubes placed in flowering banksias 11th Jan to 1st Feb 2021, total of 300 tube-nights. 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. 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 Hairtube arboreal – 300 tube-nights cameras (arboreal) – 181 + 98 camera-nights 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. Potential breeding habitat is suitable PCTs within 100m of rocky areas containing caves, or overhangs	☒ Yes BAM: Nov to Jan Survey Nov, Jan	☐ No	acoustic – 218 recording-nights 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. Surveys included: Anabat detection: 3rd Nov to 26th Nov 2020 – 4 units, and 11th Jan to 1st Feb – 6 units. Total effort = 218 recording nights. 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. Relevant surveys included: 1,280mins of aural-visual searches along 750m of transect, with transects surveyed on 8 separate days in Nov 2020. 480 mins (10mins per pool) dip-netting for tadpoles in pools along Snake & Lizard Creeks in Dec 2020. Not known from subject land. 42 records within 5km of the subject land (Bionet Atlas).	☒ Yes BAM: Sep to May Survey: Nov, Dec	☐ No	1,280 mins of searches 480 mins dip-netting	No	Bionet - not known from subject land. 42 records within 5km of the subject land. 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. 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. Opportunistic records were maintained at all times when surveyors were on site. The Little Eagle is a large and conspicuous bird.	☒ Yes BAM: Aug to Oct Survey: Aug, Sep, Oct	☐ No	160 person-minutes diurnal	No	Bionet not known from subject land. 2 records within 5km of the subject land. 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. 180mins of herpetofauna searches conducted in July, Aug & Sept 2020, including rock platforms in PCT 1824.	☒ Yes BAM: Aug to Sep & Dec to Feb 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. 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. Surveys included: Elliot trapping (ground) 11-15th January 2021: 69 traps set across all PCTs, total of 276 trap-nights. Cage traps (ground) 11-15th January 2021: 6 traps, total of 24 trap-nights. 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. Infrared nocturnal camera (ground) July 2020: 6 cameras, Nov 2020: 4 cameras. Total of 199 camera-nights. Dusk surveys and spotlighting – 33 person-hours 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 BAM: all year Survey: Jul, Sep, Oct, Nov, Jan	☐ No	Elliott ground – 276 trap-nights Cage ground – 24 trap-nights Hairtube – 2,390 tube-nights camera – 199 nights 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. 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 BAM: Nov to Mar	☐ No	1,280 mins searches 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. Relevant surveys included: 1,280mins of aural-visual searches along 750m of transect, with transects surveyed on 8 separate days in Nov 2020. 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). 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. 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. 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. Opportunistic records were maintained at all times when surveyors were on subject land. The Square-tailed Kite is a large and conspicuous bird.	☒ Yes BAM: Sep to Jan Survey Sep, Nov	☐ No	180 person-mins diurnal	No	Bionet - not previously recorded from subject land. 10 records within 5km. 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. 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. BAM survey period: all year 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 BAM: all year 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. Not likely to occur. 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. Surveys included: Anabat detection: 3rd Nov to 26th Nov 2020 – 4 units, and 11th Jan to 1st Feb – 6 units. Total effort = 218 recording nights.	☒ Yes BAM: Dec to Feb Survey: Nov, Jan	☐ No	Acoustic - 218 recording nights 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. 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. 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. Surveys included: Anabat detection: 3rd Nov to 26th Nov 2020 – 4 units, and 11th Jan to 1st Feb – 6 units. Total effort = 218 recording nights. Cave searches – active searches of suitable sheltering sites using hand-held torches, including looking for indirect evidence such as guano. Effort = 40 person-minutes. Subject land does not contain deep or substantial cave systems.	☒ Yes BAM: Dec to Feb Survey: Nov, Jan	☐ No	Acoustic - 218 recording nights 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. 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. Surveys included: Anabat detection: 3rd Nov to 26th Nov 2020 – 4 units, and 11th Jan to 1st Feb – 6 units. Total effort = 218 recording nights.	☒ Yes BAM: Oct to Mar Survey: Nov, Jan	☐ No	Acoustic - 218 recording nights 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. 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 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. Dusk surveys to observe birds leaving roosts – twelve surveys (~30mins each) at twelve locations over eight nights in July and Sept/Oct. Spotlighting on eight separate nights from July to November. A total of 42 person-hours of combined active dusk/nocturnal surveys). 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 BAM: May to Dec Survey: Jul, Sep, Oct, Nov	☐ No	dusk – 360 mins nocturnal – 720 mins 42 person hours of combined surveys Acoustic – 1,164 recording hours	No	Bionet - not known from subject land. Five records within 5km of the subject land. Not likely to breed within 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**	
Powerful Owl (Breeding)	*Ninox strenua*	Powerful Owls nest in large tree hollows in large eucalypts. While the female and young are in the 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. 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. Note that this species does not respond as well to call-play-back and could require stagwatching and other evidence of nesting. Dusk surveys to observe birds leaving roosts (~30mins each) on four separate nights at eight separate locations in July. Call playback on four separate nights at eight separate locations in July. Spotlighting on four separate nights in July. A total of 20 person-hours of combined active dusk/nocturnal surveys). Nocturnal acoustic recorders set during July (4 units - 14 nights). Total of 4 locations and 420 recording-hours.	☒ Yes BAM: May to Aug Survey: Jul	☐ No	dusk – 240 mins call playback - eight locations nocturnal – 360mins 20 person hours of combined surveys Acoustic – 420 recording hours	Yes	Bionet - one previous record from subject land – call heard in 2018. 281 records within 5km of the subject land. 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. No likely nest tree or evidence of breeding observed.	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**	
							Is expected to breed in the vicinity, but does not appear to breed within the subject land.	
Greater Glider	*Petauroides volans*	Can be reliably detected from survey. Surveys included: Elliot trapping (arboreal) 11-15th January 2021: 40 traps set across all PCTs, total of 160 trap-nights. Hairtube trapping (arboreal) – 15 hairtubes placed in flowering banksias 11th Jan to 1st Feb 2021, total of 300 tube-nights. 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. 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. Dusk surveys at twelve locations over eight nights in July and Sept/Oct, and spotlighting on eight separate	☒ Yes BAM: all year Survey: Jul, Aug, Sep, Oct, Nov, Jan	☐ No	Elliott arboreal – 160 trap-nights Hairtube arboreal – 300 tube-nights camera arboreal – 279 camera-nights acoustic – 1,164 recording-hours nocturnal – 42 person hours	No	Bionet - not known from the subject land and no records within 5km of the subject land. Not likely to occur on 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**	
		nights from July to November. Total 42 person-hours of combined active dusk/nocturnal surveys.						
Squirrel Glider	*Petaurus norfolcensis*	Inhabits mature old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Requires abundant tree hollows for refuge and nest sites. Surveys included: Elliot trapping (arboreal) 11-15th January 2021: 40 traps set across all PCTs, total of 160 trap-nights. Hairtube trapping (arboreal) – 15 hairtubes placed in flowering banksias 11th Jan to 1st Feb 2021, total of 300 tube-nights. 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. 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. Dusk surveys at twelve locations over eight nights in July and Sept/Oct, and spotlighting on eight separate	☒ Yes BAM: all year Survey: Jul, Aug, Sep, Oct, Nov, Jan	☐ No	Elliott arboreal – 160 trap-nights Hairtube arboreal – 300 tube-nights camera arboreal – 279 camera-nights acoustic – 1,164 recording-hours nocturnal – 42 person hours	No	Bionet - not known from the 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. Not likely to occur on 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**	
		nights from July to November. Total 42 person-hours of combined active dusk/nocturnal surveys.						
Long-nosed Potoroo	*Potorous tridactylus*	Uses a variety of vegetation types (from heath to rainforest) across its range. It is detectable by survey (e.g. camera trapping) and has relatively small home ranges. 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. Surveys included: Elliot trapping (ground) 11-15th January 2021: 69 traps set across all PCTs, total of 276 trap-nights. Cage traps (ground) 11-15th January 2021: 6 traps, total of 24 trap-nights. 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. Infrared nocturnal camera (ground) July 2020: 6 cameras, Nov 2020: 4 cameras. Total of 199 camera-nights. Dusk surveys and spotlighting – 33 person-hours	☒ Yes BAM: all year Survey: Jul, Aug, Sep, Oct, Nov, Jan	☐ No	Elliott ground – 276 trap-nights Cage ground – 24 trap-nights Hairtube ground – 2,390 tube-nights camera ground – nocturnal – 33 person-hours ground searches – 690 person-minutes	No	Bionet - not known from the subject land and no records within 5km of the subject land. Not likely to occur.	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**	
		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.						
Koala	*Phascolarctos cinereus*	Surveys included: Infrared nocturnal camera (ground) July 2020: 6 cameras, Nov 2020: 4 cameras. 199 camera-nights. 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. 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. Dusk surveys and spotlighting in Jul, Sep, Oct, Nov 2020 – 33 person-hours. Koala Scat Assessment Technique - approx 510 person-minutes of ground searches were conducted at 8 locations in Sept/Oct 2020.	☒ Yes BAM: all year Survey: Jul, Aug, Sep, Oct, Nov, Jan, Feb	☐ No	Nocturnal cameras – 478 camera nights Nocturnal acoustic recording – 1,164 recording-hours Nocturnal surveys – 33 person hours SAT – 8 locations – 510 person-minutes	No	Bionet - not known from the subject land. Does not appear to reside within the subject land. 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. Relevant surveys included:	☒ Yes BAM: all year	☐ No	1,280 mins searches 480 mins dip-netting	Yes	Has previously been recorded within the subject land and was	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**	
		1,280mins of aural-visual searches along 750m of transect, with transects surveyed on 8 separate days in Nov 2020. 480 mins (10mins per pool) dip-netting for tadpoles in pools along Snake & Lizard Creeks in Dec 2020.	Survey: Nov, Dec				recorded during Hayes Env general and opportunistic surveys in 2020.	
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. Dusk surveys to observe birds leaving roosts (~30mins each) on four separate nights at eight separate locations in July. Call playback on four separate nights at eight separate locations in July. Spotlighting on four separate nights in July. A total of 20 person-hours of combined active dusk/nocturnal surveys). Nocturnal acoustic recorders set during July (4 units - 14 nights). Total of 4 locations and 420 recording-hours.	☒ Yes BAM: May to Aug Survey: Jul	☐ No	dusk – 240 mins call playback – 8 locations combined nocturnal – 20 person-hours. 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. 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.	☒ Yes BAM: Apr to Aug Survey: Jul	☐ No	dusk – 240 mins call playback – 8 locations	No	Bionet - not known from subject land. Two records within 5km of 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**	
		Dusk surveys to observe birds leaving roosts (~30mins each) on four separate nights at eight separate locations in July. Call playback on four separate nights at eight separate locations in July. Spotlighting on four separate nights in July. A total of 20 person-hours of combined active dusk/nocturnal surveys). Nocturnal acoustic recorders set during July (4 units - 14 nights). Total of 4 locations and 420 recording-hours.		combined nocturnal – 20 person-hours. Acoustic – 420 recording-hours		subject land, downstream along Oxford Creek. 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*). 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 (17.5ha of PCT 1783, 16.2ha of PCT 1250 & 11.0ha of PCT 1824)	n/a	1250: 55.7 1783: 49.4 1824: 63.4
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. Assumed that toadlets using Lizard Creek	n/a	16.72 ha (6.0ha of PCT 1783, 6.9ha of PCT 1250 & 3.9ha of PCT 1824)	n/a	1250: 55.7 1783: 49.4 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)
				would not cross Morgan Road				
Tetratheca glandulosa	*Tetratheca glandulosa*	High (2)	No	Recorded within PCTs 1783 and 1824 within the study area with all records above the 120m contour. TBDC: Typically occupies ridgetops and upper slopes. Habitat is mapped as areas of PCTs 1783 and 1824 above 120m, where connectivity from records is not interupted by roads or creekline gullies (noting the species is believed to be clonal).	n/a	8.4 ha (2.4ha of PCT 1783 & 7.1ha of PCT 1824)	n/a	1783: 49.4 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)
Leafless Tongue Orchid	*Cryptostylis hunteriana*	Moderate (1.5)	No	Assumed that a 1 ha patch occurs at an undetermined location within vegetation zone PCT 1783.	n/a	1ha (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, although the site does not contain caves suitable for breeding by these species. Rock features may be used for shelter by the threatened Rosenberg's Goanna. 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. 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. 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.

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
Wind turbine strikes (wind farm development only)	☐Yes / ☒No	n/a	n/a
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. 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. 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

The MLALC seek an income stream to fund the goals identified in their Community Land Business Plan.

Consideration of funding options by MLALC identified that a land development project could achieve this goal, noting that the MLALC own 912 hectares of land in Metropolitan Sydney, including 621 hectares in the Northern Beaches LGA.

All of the MLALC lands contain native vegetation in good condition so there was no upfront option to completely avoid impacts on biodiversity.

The proposed Structure Plan is the result of a lengthy investigative and assessment process to avoid and minimise impacts on biodiversity values at the regional scale, site scale, and project scale.

Additional planning has commenced to further avoid and minimise impacts at the precinct scale, with these details to be lodged with the development application.

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. Refer to Appendix F Figure 12.

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 assessment investigated the development potential of each of the land parcels, looking at matters such as biodiversity values, heritage values, bushfire risk, and infrastructure needs.

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.

The assessment resulted in only six of the sites being nominated for inclusion in the Aboriginal Lands SEPP. It was identified that avoidance of the significant remaining landholdings across the Northern

Beaches LGA provides opportunity for biodiversity offsets to be achieved locally, including through creation of biodiversity stewardship sites.

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 the six identified 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*".

Whilst fully vegetated, this site contains lower biodiversity values than the other sites, and also contains an important cultural rock engraving that could be better protected and managed with development of the land. This site was deemed the best option to avoid and minimise impacts at the regional scale, whilst meeting project objectives.

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.

Biodiversity values within the site were assessed to identify opportunities for further avoidance and minimisation of impacts at the site scale. This resulted in substantial amendment to a previous 2004 concept masterplan (Appendix F Figure 13) for the land.

The amended Structure plan (2019 – Appendix F Figure 14) was further tested 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 result was a Structure Plan (2021) which substantially pulled the development back from the more remote southeastern areas not currently bordered by existing development, retaining lands in the southeast as a future conservation zone, and retaining a riparian corridor along Snake Creek. This reduction in scale and re-positioning of the development also reduced fragmentation of the large local patch of bushland which extends onto adjacent lands to the south and east. Refer to Appendix F Figure 15.

The Patyegarang site within the property was identified as an important cultural zone and a focal point for creation of an Aboriginal cultural centre.

Review of external strategic regional planning documents

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

Hayes Environmental carried out a more comprehensive biodiversity assessment (following the *Biodiversity Assessment Method 2020*) to inform and refine the project design, and to assess the likely impacts and offset liability for the purpose of strategic decision-making.

The 2021 Structure Plan underwent a series of further refinements to avoid and minimise impacts on biodiversity values in response to additional biodiversity information. Refinements included:

Conservation Zone

* The 19.8 hectares of avoided land across the southeast was formally designated to become a C2 conservation zone, with discussion and agreement between specialist consultants and the project team to ensure the Structure Plan could be achieved without impacting directly or indirectly upon the conservation zone.

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 (1st 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.

Indirect Impacts

* Design of residential precincts include use of perimeter roads, to enable collection and management of stormwater, and to provide opportunities for control of access to community land (particularly the conservation zone).

* A substantial bushfire APZ (up to 60m in width) would extend beyond the perimeter road, thus providing open space for recreational use, and a buffer to indirect impacts on the conservation zone, including opportunity for installation of stormwater management features and other impact management measures.

* These design measures combine to provide best practice protection for the conservation zone, avoiding all direct and indirect impacts upon this area.

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 biodiversity 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.

Precinct-scale avoidance and minimisation

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

Discussions between the ecologist and stormwater consultant have resulted in conceptual design around water quality controls and treatment, and the location and method of discharges. The project team is committed to not only meeting statutory requirements in relation to water quality, but to set a benchmark for improvement of the quality of water being discharged from the site.

A range of management plans would be prepared at the development application stage to further manage, minimise and mitigate potential impacts on biodiversity values at the precinct scale (refer to Ch 8.4 of the Preliminary BDAR). These would include, but not be limited to:

* Conservation Zone Management Plan, to protect and monitor biodiversity values within the conservation zone. This would be a separate and distinct plan to the Biodiversity Management Plan that is proposed for the development zone, to ensure a clear distinction between these two landuses. The Conservation Zone is not to be regarded by the strata community as a community open space or recreational area.

* Biodiversity Management Plan (BMP) 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). Points of consideration relate to 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, and limiting of pedestrian access to areas of habitat for the Red-crowned Toadlet and for threatened plants (such as the known locations of *Tetratheca glandulosa*), to avoid trampling or picking.

* Bushfire APZ plan to be incorporated into the BMP to facilitate replacement of canopy trees and maintenance of natural diversity in the groundlayer, thus maintaining vegetation integrity in the long term and preserving the buffer value of the outer APZ to the conservation zone.

* 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. Species 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.

* Site-specific Development Control Plan, to address matters such as street and external house lighting, road and verge design to avoid wildlife collisions, designation of building envelopes on some larger lots to protect existing rock features and minimise site disturbance, signage, design of footpaths, bollards and fencing to limit and control pedestrian access, biosecurity, *etc.*

* Tree Removal Protocol, as set out below (indicative).

i. A licensed ecologist or wildlife rescuer shall be engaged to be present during vegetation clearing works to spot and rescue wildlife injured or trapped in vegetation.

ii. Significant habitat trees should be identified and left until last. These should be removed at least one day following removal of surrounding vegetation.

iii. Trees shall initially be 'bumped' using machinery to encourage any roosting fauna to evacuate on their own accord. For trees with a diameter at breast height (DBH) of greater than 30cm, 'bumping' shall be repeated at 1 minute intervals for approximately 5 minutes per tree. Care shall be taken to place the machinery such that it is not likely to be hit by falling branches.

iv. Any hollow sections of trees or limbs that are found to be hollow shall be left on the ground until the next working day to provide further opportunity for fauna to evacuate, and then shall be relocated to an area of retained vegetation within the subject property, either placed on the ground or strapped into trees.

v. Any injured native fauna shall be rescued and transferred to the care of WIRES or an equivalent wildlife rescue agency. In the event that native fauna requires medical treatment by a vet, or long-term care by a wildlife rescue agency, all costs shall be covered by the proponent for the development. Note that microchiropteran bats carry lethal diseases and should not be handled by untrained and unvaccinated persons.

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 formal C2 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 design	Proponent
Retain habitat for *Tetratheca glandulosa*	Protection of approximately 1 ha of known habitat for *Tetratheca glandulosa* at two locations	Structure Plan & DA design	Proponent
Stormwater design and installation of water quality control features	Protection of water quality within and downstream of the subject land.	DA design	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 design	Proponent
Preparation and implementation of a Conservation Zone Management Plan	Protect and monitor biodiversity values within the conservation zone. This would be a separate and distinct plan to management plans proposed for the development zone, to ensure a clear distinction between these two landuses. The Conservation Zone is not to be regarded by the strata community as a community open space or recreational area.	Prior to assessment of development application.	Proponent
Preparation and implementation of management plans to control and manage future detailed design, and indirect impacts. Refer to Ch 8.4 for more detail on mitigation and management measures.	Direct and control future designs, decision-making and maintenance of the development to ensure consistency with strategic planning goals.	Prior to assessment of development application.	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	8.4 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.

Indirect impacts would be minimised through a range of design features and through implementation of a range of detailed management plans (identified in Ch 7.1.2). These features and plans have been designed to avoid impacts to the extent that no further off-setting is required.

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. Refer to Ch 7.1.2 for details.

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. 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	3.2 (Patyegarang reserve)	unlikely	ongoing	construction, 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**
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. Reduced quality of habitat retained within the development zone for some species
	PCT 1783	1.5	unlikely	ongoing	occupation	
	PCT 1824	2.2	unlikely	ongoing	occupation	
	Eastern Pygmy-possum	6.9	unlikely	ongoing	occupation	
	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. 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*	3.2 (Patyegarang reserve area)	unlikely	ongoing	construction, occupation	Can be managed and avoided during construction. 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. 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), although the Structure Plan specifically addresses lot sizing, road placement and asset protection zone boundaries to facilitate retention of natural rock features within the development.

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 would 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 intent to manage future development to minimise wildlife collisions.

8.5 Mitigating residual impacts – management measures and implementation

Various site management plans and mitigation measures would be prepared for the development application stage. Plans proposed include (without being limited to):

* Conservation Zone Management Plan;
* Biodiversity Management Plan (BMP), including Bushfire APZ plan;
* Construction Management Plan, including a Tree Removal Protocol;
* Stormwater Management Plan;
* Site-specific Development Control Plan (DCP).

A summary of the content of plans and measures is set out in Table 24. Further details for all plans/ methods shall be developed as part of the detailed design for the development application stage and assessed in the Final BDAR lodged with the development application.

Table 24 Summary of proposed mitigation and management measures for residual impacts.

Method/technique	Timing, Responsibility, & Frequency	Efficacy, Performance Criteria, & Adaptive Management
Biodiversity Management Plan (BMP): To cover 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). Points of consideration relate to 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, and limiting of pedestrian access to areas of habitat for the Red-crowned Toadlet and for threatened plants (such as the known locations of *Tetratheca glandulosa*), to avoid trampling or picking	Further details for all plans/ methods shall be developed as part of the detailed design for the development application stage and assessed in the Final BDAR lodged with the development application.	BMP to be tied into the strata in perpetuity via a S88 instrument. Plans to include measurable performance criteria, and triggers for adaptive management. Efficacy and outcomes of these to be assessed in the Final BDAR.
Bushfire APZ plan: To be incorporated into the BMP to facilitate replacement of canopy trees and maintenance of natural diversity in the groundlayer, thus maintaining vegetation integrity in the long term and preserving the buffer value of the outer APZ to the conservation zone.		
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, and control of site wastes.		Plans to include measurable performance criteria, and triggers for adaptive management. Efficacy and outcomes of these to be assessed in the Final BDAR.
Tree Removal Protocol: To be incorporated into the Construction Management Plan. 1. A licensed ecologist or wildlife rescuer shall be engaged to be present during vegetation clearing works to spot and rescue wildlife injured or trapped in vegetation. 2. Significant habitat trees should be identified and left until last. These should be removed at least one day following removal of surrounding vegetation.		

Method/technique	Timing, Responsibility, & Frequency	Efficacy, Performance Criteria, & Adaptive Management
3. Trees shall initially be 'bumped' using machinery to encourage any roosting fauna to evacuate on their own accord. For trees with a diameter at breast height (DBH) of greater than 30cm, 'bumping' shall be repeated at 1 minute intervals for approximately 5 minutes per tree. Care shall be taken to place the machinery such that it is not likely to be hit by falling branches. 4. Any hollow sections of trees or limbs that are found to be hollow shall be left on the ground until the next working day to provide further opportunity for fauna to evacuate, and then shall be relocated to an area of retained vegetation within the subject property, either placed on the ground or strapped into trees. 5. Any injured native fauna shall be rescued and transferred to the care of WIRES or an equivalent wildlife rescue agency. In the event that native fauna requires medical treatment by a vet, or long-term care by a wildlife rescue agency, all costs shall be covered by the proponent for the development. Note that microchiropteran bats carry lethal diseases and should not be handled by untrained and unvaccinated persons.		
Stormwater Management Plan: To include a specific section addressing avoidance/minimisation/ mitigation of impacts on areas of known Red-crowned Toadlet habitat. Species 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.		

Method/technique	Timing, Responsibility, & Frequency	Efficacy, Performance Criteria, & Adaptive Management
Site-specific Development Control Plan (DCP): To address matters such as street and external house lighting, road and verge design to avoid wildlife collisions, designation of building envelopes on some larger lots to protect existing rock features and minimise site disturbance, signage, design of footpaths, bollards and fencing to limit and control pedestrian access, biosecurity, *etc.*	Draft DCP has been prepared by the Proponent as part of the Planning Proposal documents. DCP to be assessed and adopted by the consent authority prior to assessment of the development application.	To be discussed and agreed with the consent authority prior to being adopted.

8.6 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 minor areas of 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)

It has conservatively been assumed that all areas of the development footprint contain native vegetation of sufficient integrity to require an offset. This is an over-estimation of the extent of impact across most of the subject land.

There are no impacts on native vegetation that have been assessed as not requiring an offset.

Table 25 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 26 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	-	8.4	2	279
Leafless Tongue Orchid	*Cryptostylis hunteriana*	V	V	1.0	1.5	18
					Total credits	1,849

10.1.3 Indirect and prescribed impacts

There remains some uncertainty at this draft Structure Plan stage regarding details and extent of indirect impacts.

Indirect impacts would be minimised through a range of design features and through implementation of a range of detailed management plans (identified in Ch 7.1.2). These features and plans have been designed to avoid impacts to the extent that no further off-setting is required.

This is a matter to be considered and assessed further at the development application stage.

10.2 Impacts that do not need further assessment

Not applicable. All impacts are assessed. There are no impacts that do not need further assessment.

11. Biodiversity credit report

Refer to Appendix E (Credit reports).

11.1 Ecosystem credits

Table 27 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 28 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).

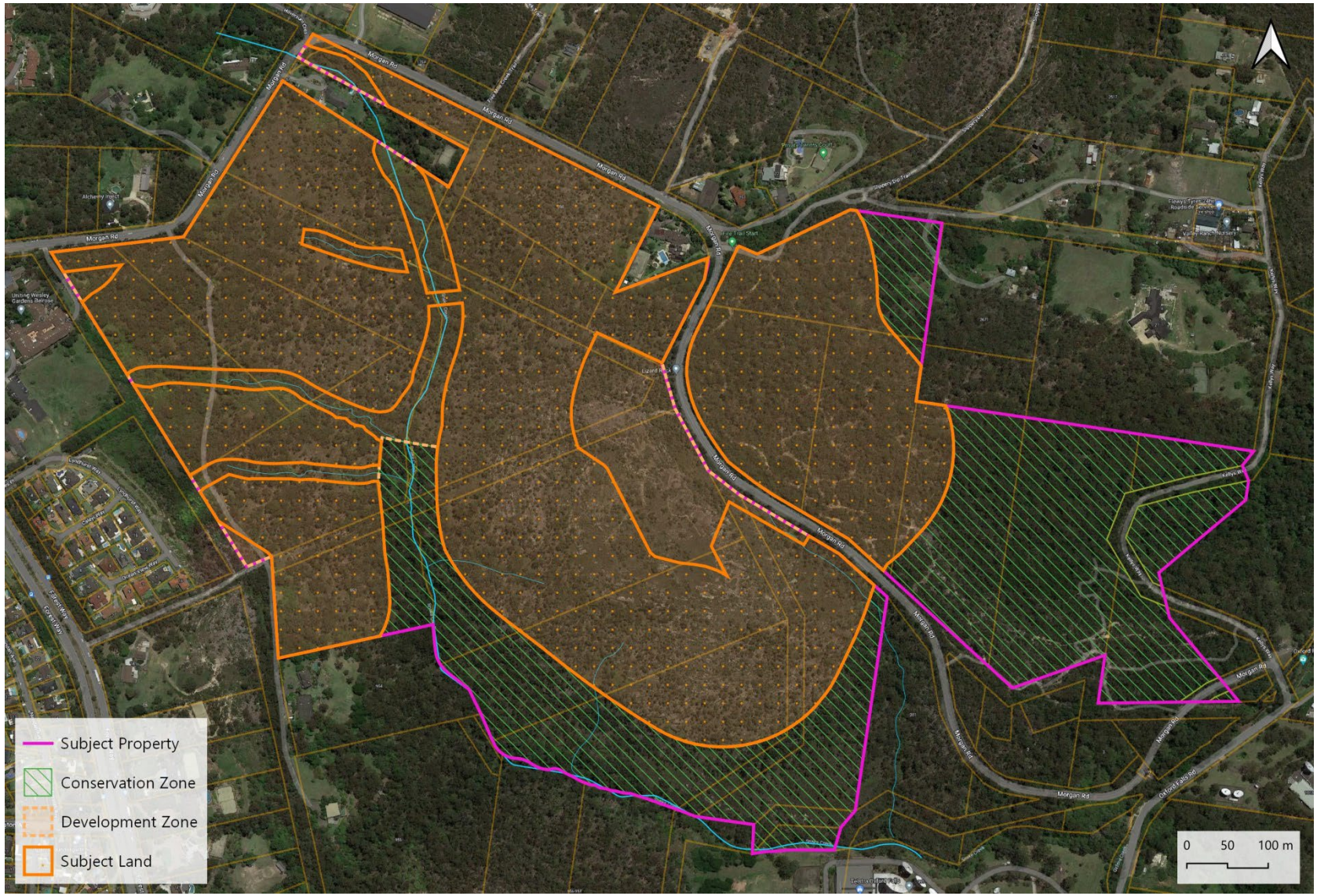
Smith, P. & Smith, J. (2000) *Survey of the Duffys Forest Vegetation Community*. Unpublished Report to NSW National Parks and Wildlife Service and Warringah Council.

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

13. Figures

Proposed zoning of deferred lands, Patyegarang Project.

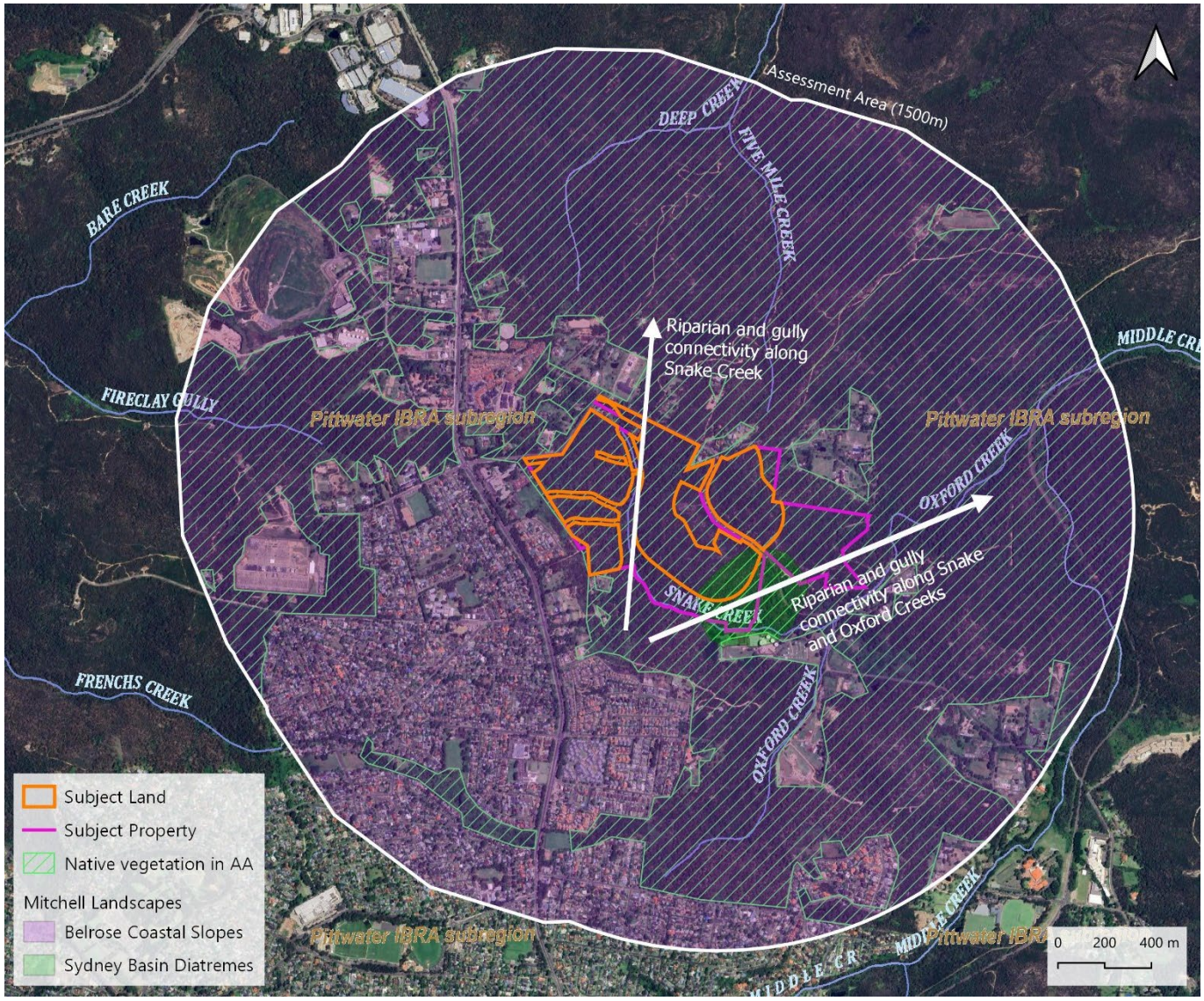
Figure 1 Site Map



The entire map area is within the Northern Beaches LGA, and is within the Pittwater IBRA subregion (SYB07).

Proposed zoning of deferred lands, Patyegarang Project.

Figure 2 Location Map



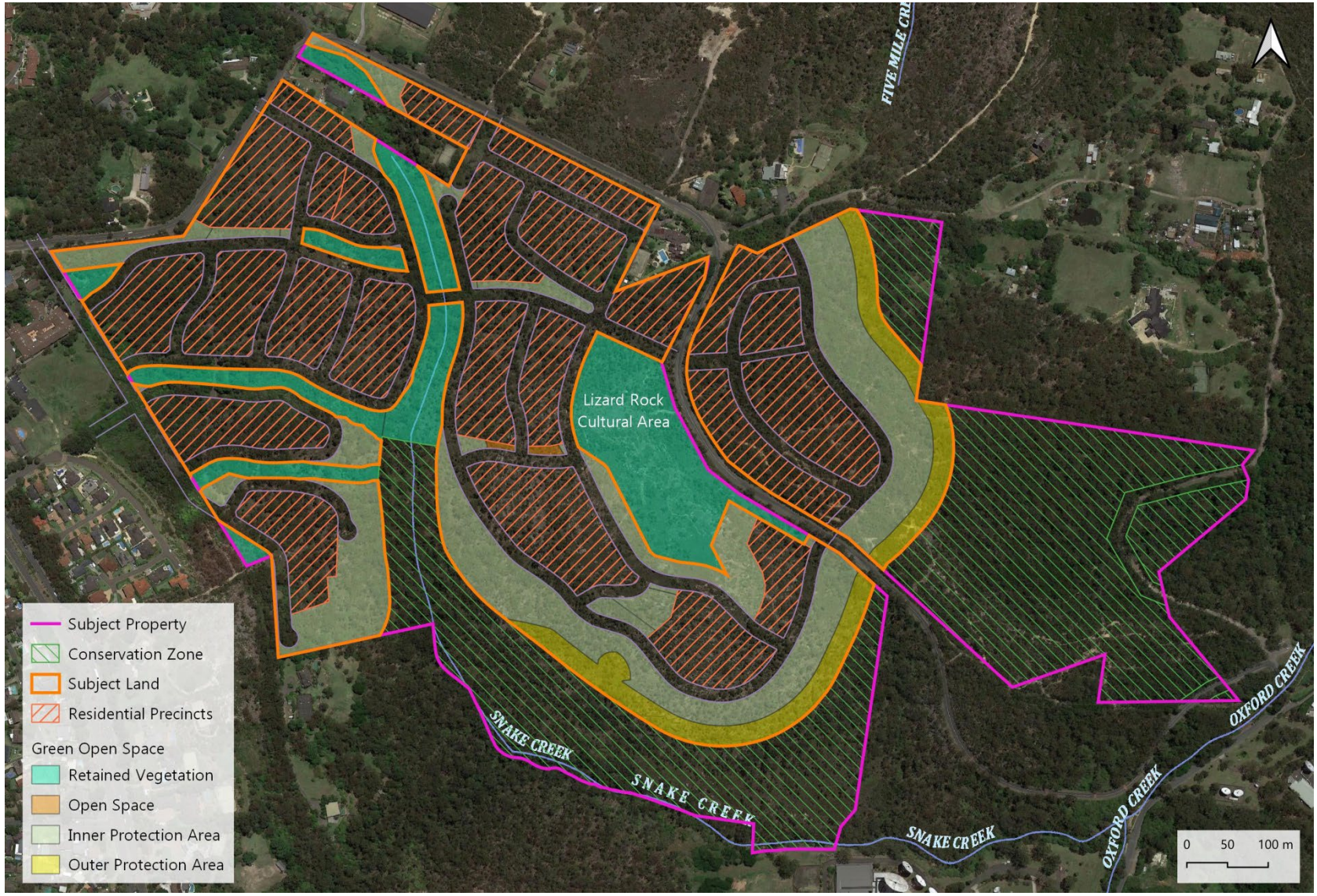
The entire map area is within the Northern Beaches LGA, and is within the Pittwater IBRA subregion (SYB07).

All areas of vegetation within the subject land are part of the same large patch that is greater than 100 hectares in extent, as indicated by green hashed lines on the map.

Arrows indicate existing habitat connectivity that would be retained through project location within the property and through project design.

Proposed zoning of deferred lands, Patyegarang Project.

Figure 3 Draft Structure Plan



Proposed zoning of deferred lands, Patyegarang Project.

Figure 4 Biodiversity Values Map

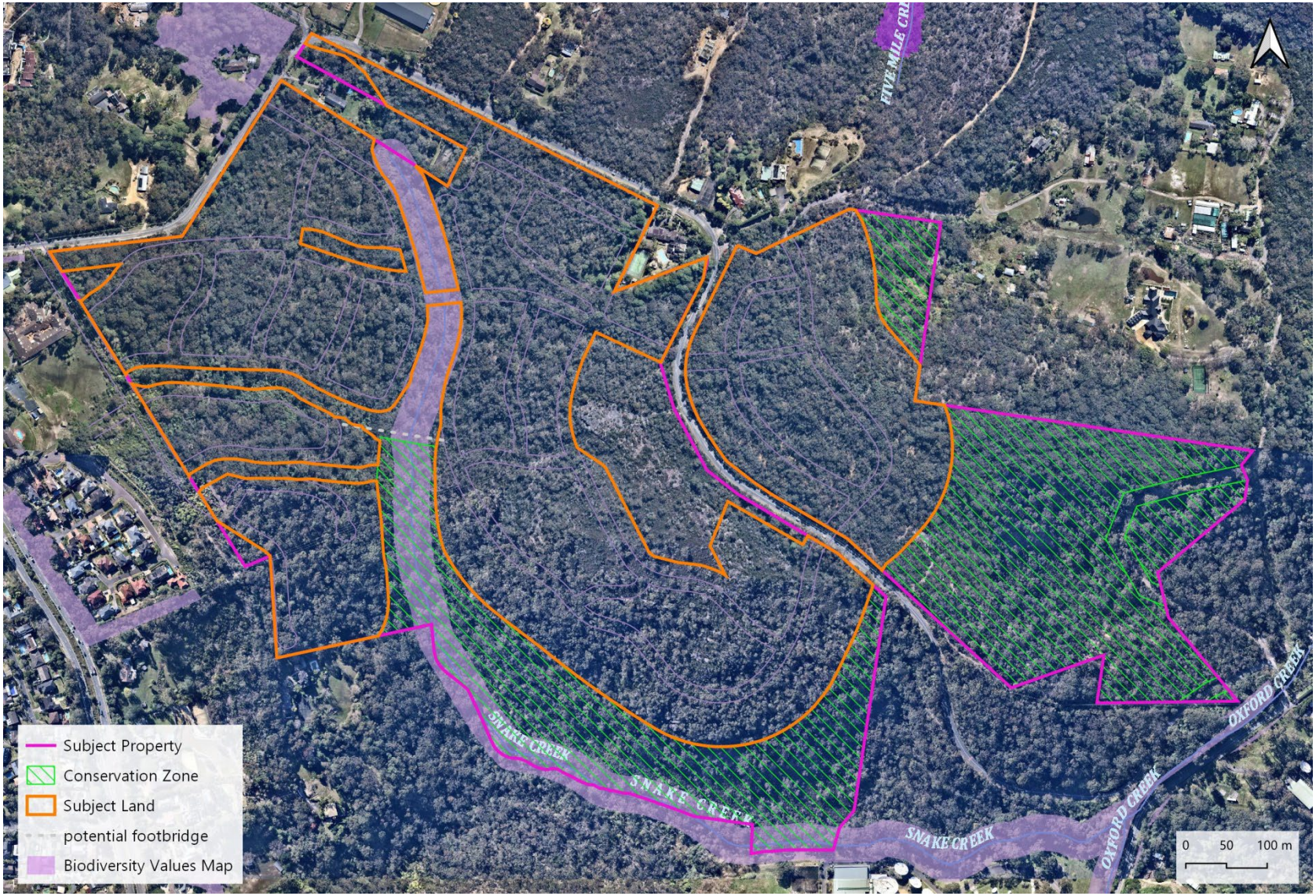
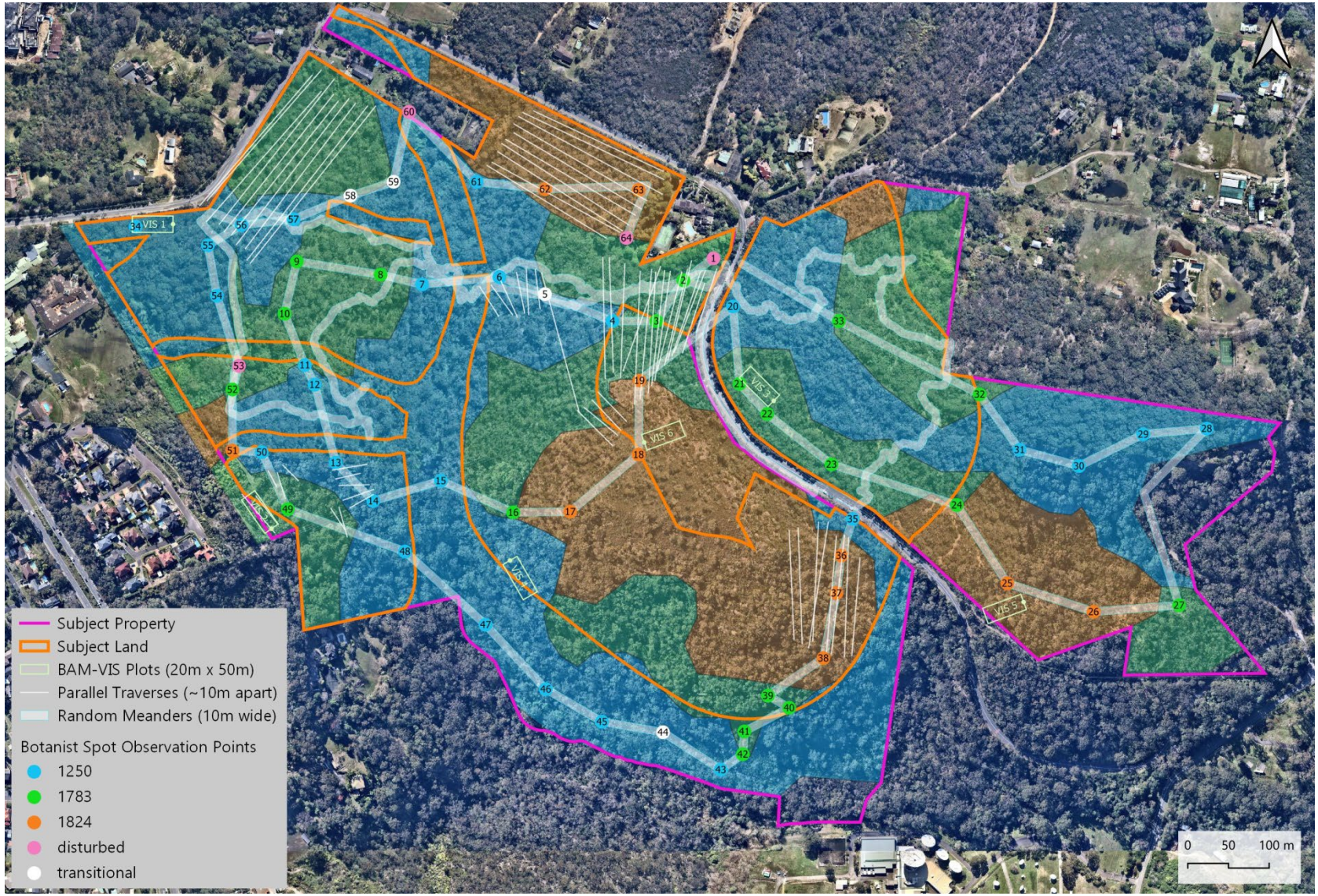
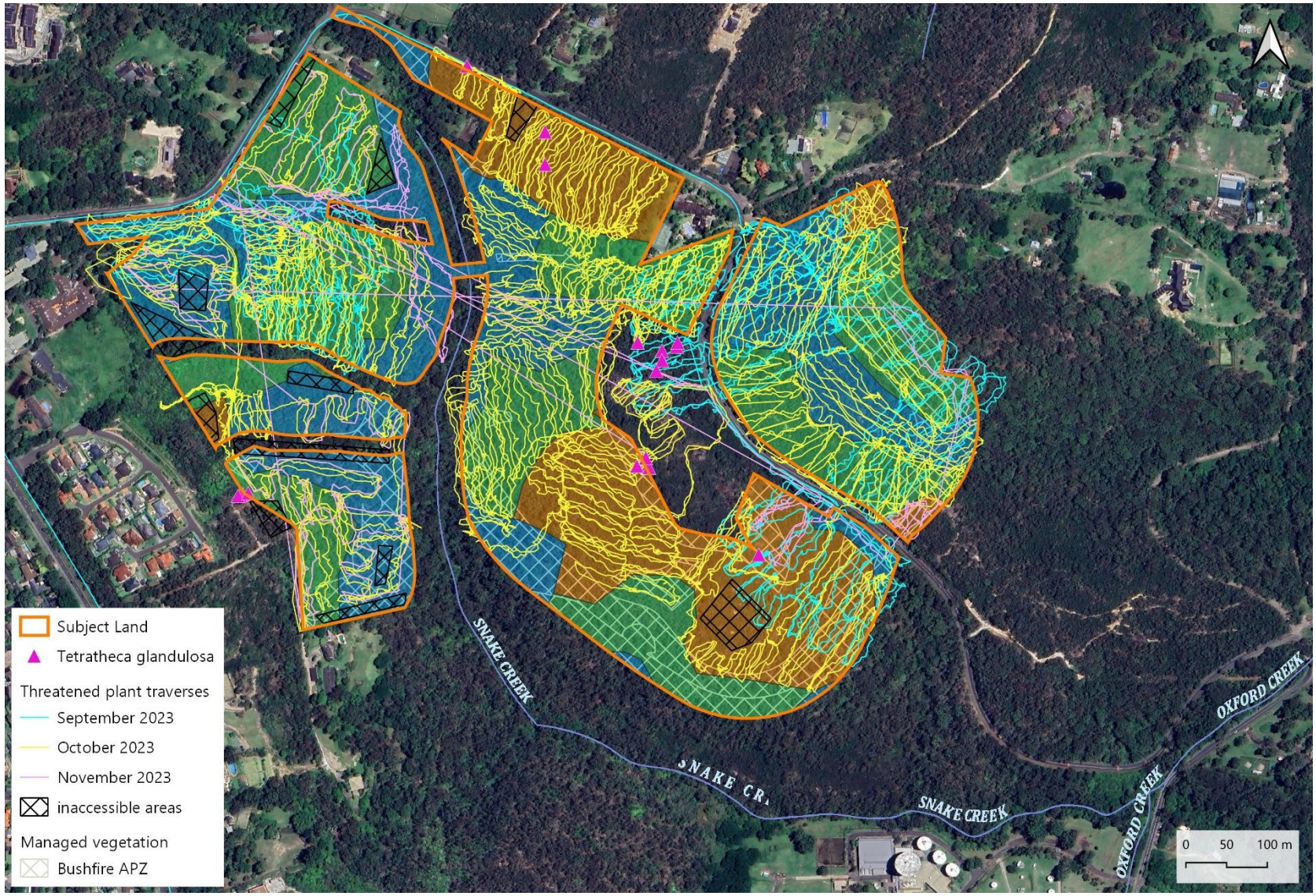


Figure 5a Flora Field Survey Locations (2020 to 2021)



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.

Figure 5b Threatened Plant Traverses (2023)



Spring 2023 threatened plant traverses at 5m spacing.

Some areas were not surveyed due to accessibility constraints, as indicated.

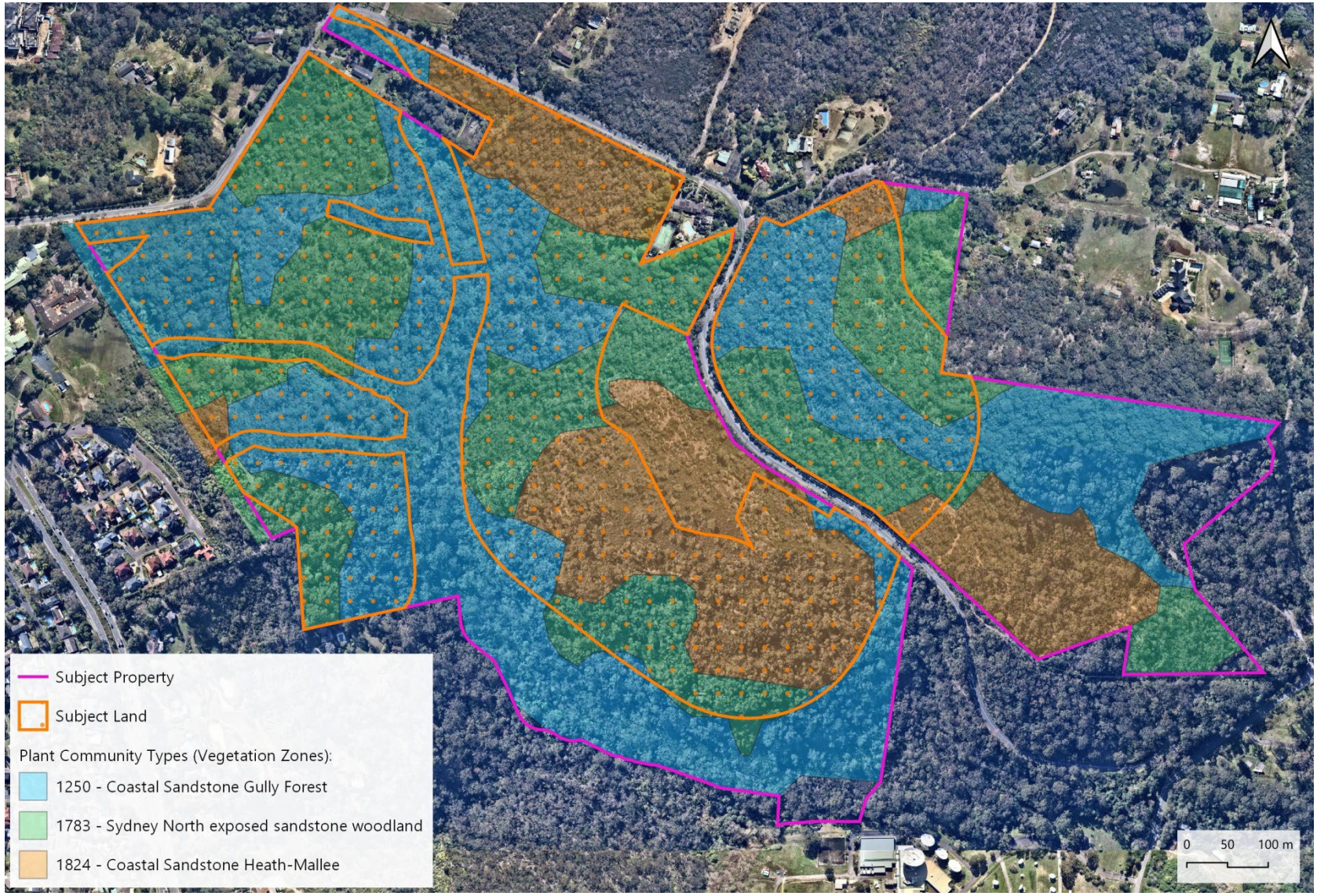
Some areas were not surveyed due to time constraints. Most of these areas would be within managed bushfire APZs, such that there is substantial flexibility to allow for furture protection of threatened plants if they are found during the development application stage. Given the extent of work and lack of records across the rest of the land, it is not likely that new threatened species would be found.

Proposed zoning of deferred lands, Patyegarang Project.

Figure 6 Fauna Field Survey Locations

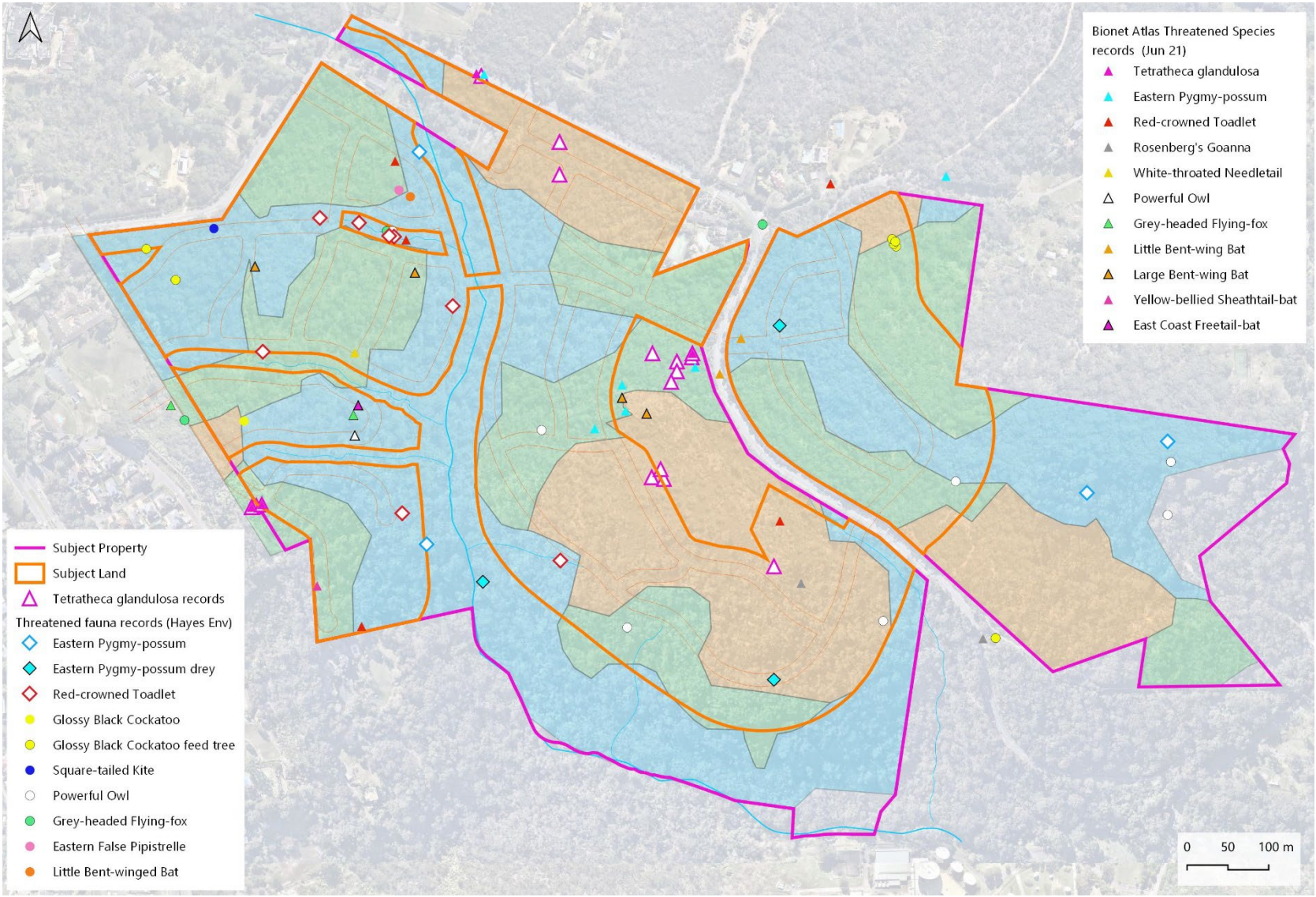
Proposed zoning of deferred lands, Patyegarang Project.

Figure 7 Native Vegetation



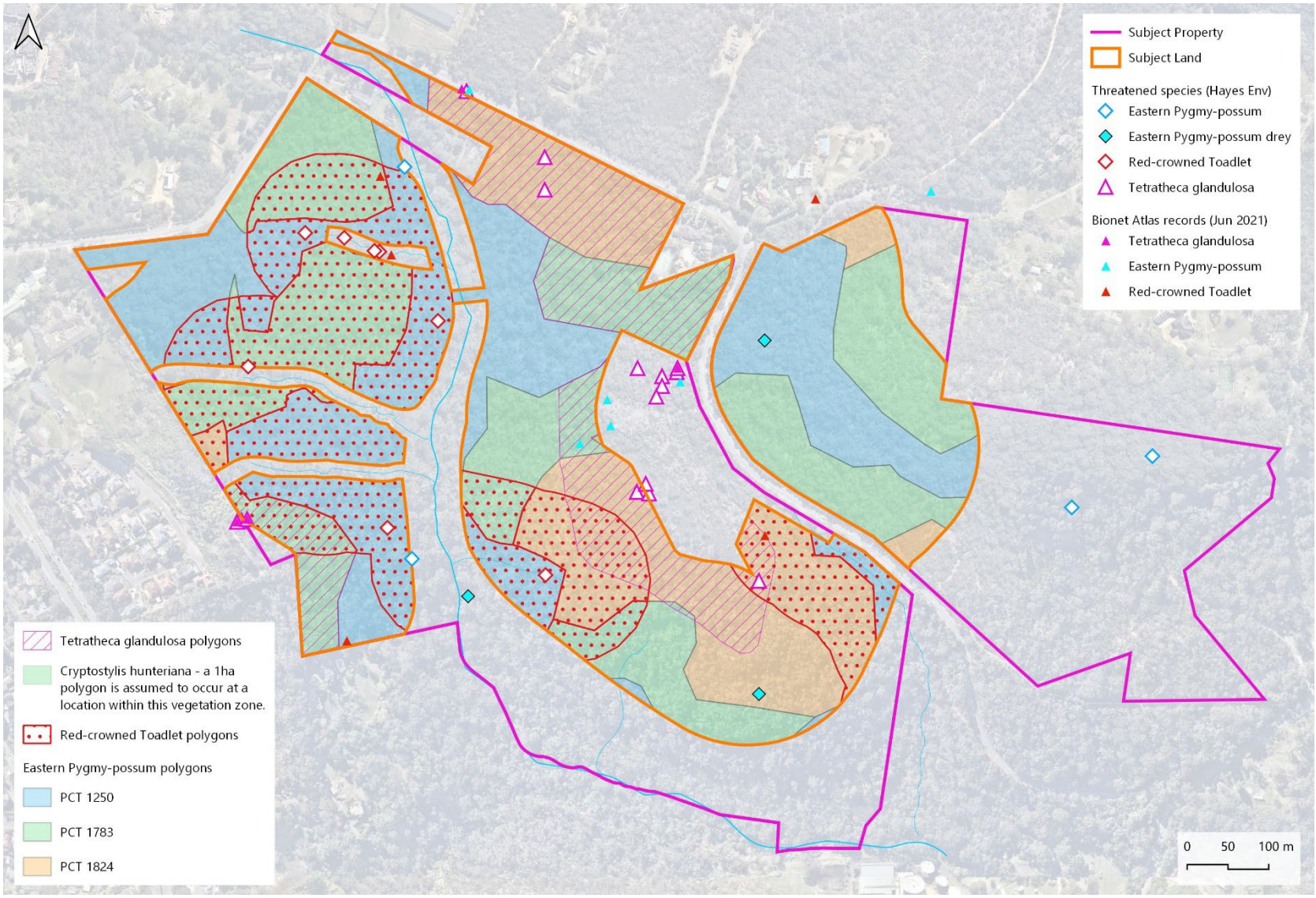
Proposed zoning of deferred lands, Patyegarang Project.

Figure 8 Threatened Species Locations



Proposed zoning of deferred lands, Patyegarang Project.

Figure 9 Species Credit Species Polygons



Proposed zoning of deferred lands, Patyegarang Project.

Figure 10 Direct impacts on Native Vegetation

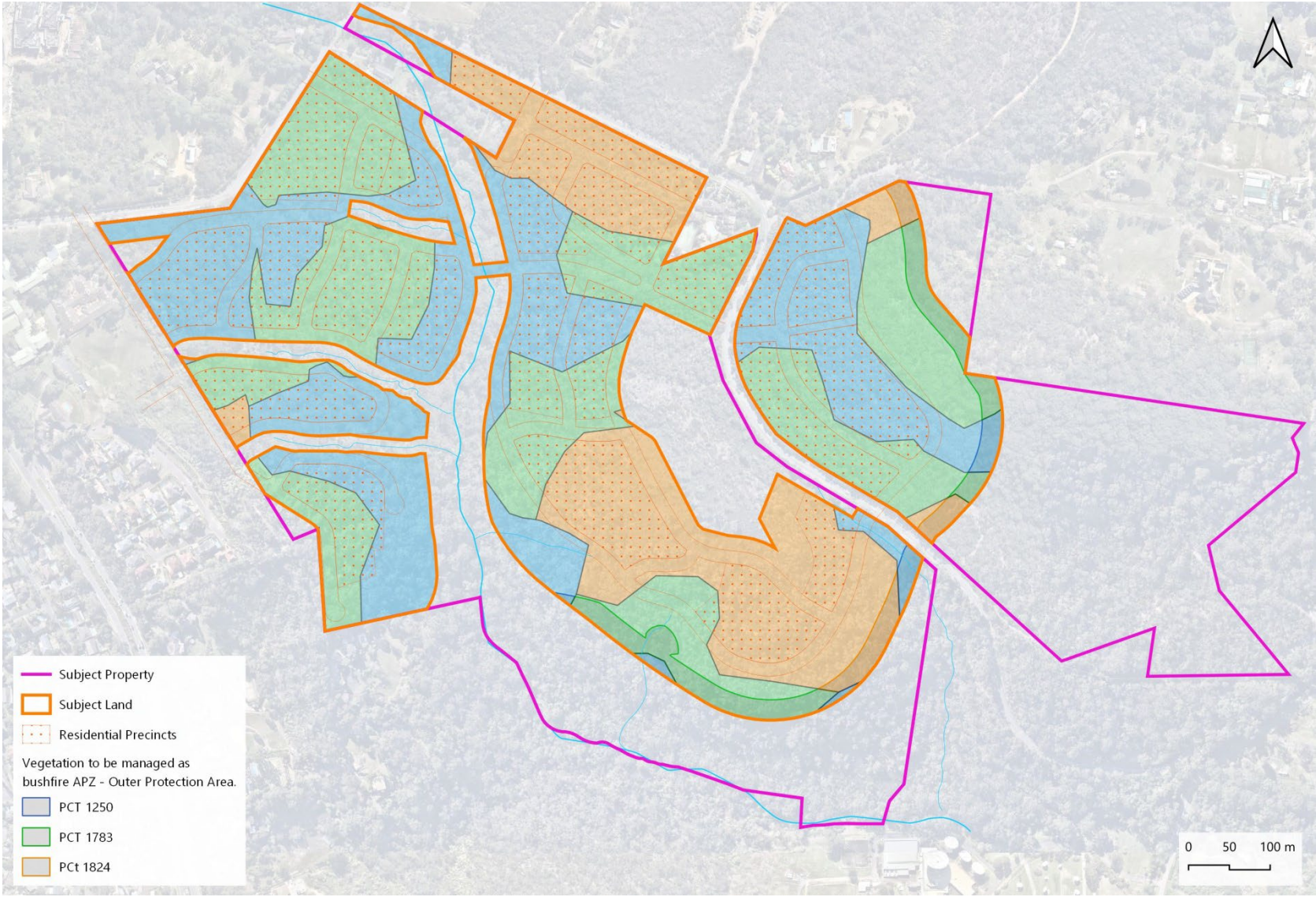
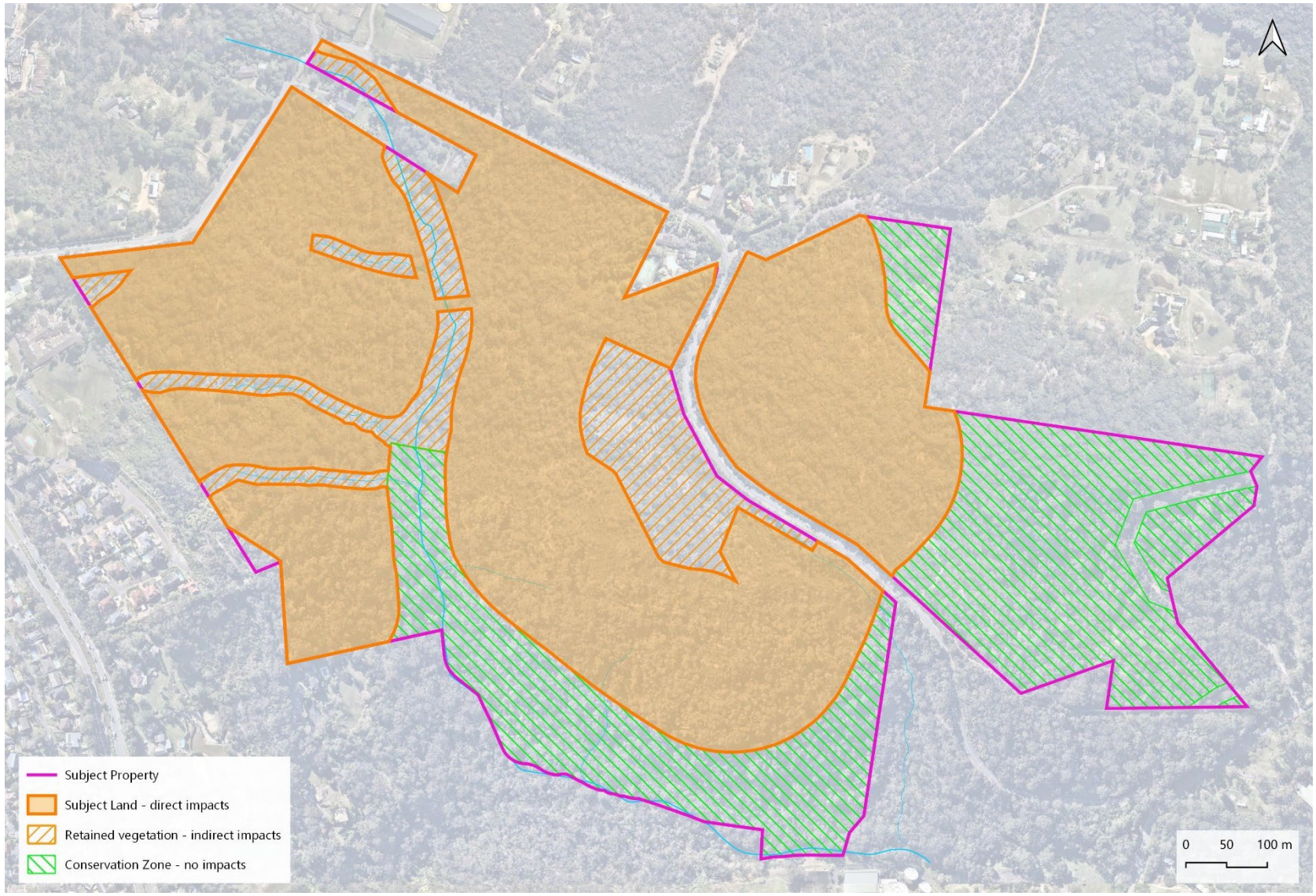


Figure 11 Indirect Impacts on Native Vegetation



The entire subject land would be directly affected by the development (to varying degrees).

Areas of retained vegetation are likely to be subject to indirect impacts. These would be managed to avoid and minimise residual impacts to the extent additional offsets are not warranted.

The development has been designed and would be implemented to avoid all impacts (both direct and indirect) on the conservation zone.

Appendix A: BDAR requirements compliance

Table 29 Assessment of compliance with BDAR minimum information requirements

BDAR section	BAM ref.	BAM requirement	Chapter ref(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,
		☒ identification of subject land boundary, including: ☒ operational footprint ☐ construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure – *not applicable – to be restricted to subject land*	Terms, pg x Ch 1.1.3.
		☒ general description of the subject land	Ch 1.1.3
		☒ sources of information used in the assessment, including reports and spatial data	Ch 1.1.4,; & Ch 1.5,
		☒ identification and justification for entering the BOS	Ch 1.2,
		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; & Figure 3

BDAR section	BAM ref.	BAM requirement	Chapter ref(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
		☒ per cent native vegetation cover in the assessment area (as described in BAM Section 3.2)	Ch 3.3,
		☒ IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.))	Ch 3.2.1,
		☒ rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3.) and Appendix E)	Ch 3.2.2,
		☒ wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(3.))	Ch 3.2.2,
		☒ connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.))	Ch 3.2.3,
		☒ 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,
		☐ 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,
		☐ any additional landscape features identified in any SEARs for the proposal – *not applicable*	Ch 3.2.7,
		☒ NSW (Mitchell) landscape on which the subject land occurs	Ch 3.2.6,
		☒ 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,
		Maps and tables	
		☒ Site Map ☒ Property boundary ☒ Boundary of subject land ☒ 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.* ☒ Landscape features identified in BAM Subsection 3.1.3	Figure 1
		☒ Location Map ☒ Digital aerial photography at 1:1,000 scale or finer	Figure 2

BDAR section	BAM ref.	BAM requirement	Chapter ref(s) in the BDAR
		☒ Boundary of subject land ☒ Assessment area (i.e. the subject land and either 1500 m buffer area or 500 m buffer for linear development) ☒ Landscape features identified in BAM Subsection 3.1.3 ☐ Additional detail (e.g. local government area boundaries) relevant at this scale – *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 ☒ rivers, streams and estuaries ☐ wetlands and important wetlands – *none relevant* ☒ connectivity of different areas of habitat ☐ 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*. ☐ areas of outstanding biodiversity value occurring on the subject land and assessment area – *none relevant* ☐ any additional landscape features identified in any SEARs for the proposal – none relevant ☒ 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	Chapter ref(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 & 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,
		☒ Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2	Ch 2.2.3,
		☐ 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 & 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 Ch 4.3,
		☒ 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	Chapter ref(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 & Figure 7
		☒ area (ha) of each vegetation zone	Table 8,
		☒ assessment of patch size (as described in BAM Subsection 4.3.2)	Table 8,
		☒ survey effort (i.e. number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4(1–2.)	Ch 4.5.1,
		☒ use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3(5.)) – *not relevant*	Ch 4.5.3,
		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	Chapter ref(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) – *all zones are part of the same patch with patch size >100ha*	Figure 2
		Table of current vegetation integrity scores for each vegetation zone within the site and including:	–
		☒ composition condition score ☒ structure condition score ☒ function condition score ☒ presence of hollow bearing trees	Table 9,
		Data	
		☒ All report maps as separate jpeg files	–
		☒ Plot field data (MS Excel format)	separate file
		☒ Plot field datasheets – *transcribed into Table 30*	Appendix C, Table 30
		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, 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,
		☒ justification for addition of any ecosystem credit species to the list	Ch 5.1.1,
		Identify species credit species likely to occur on the subject land, including:	–

BDAR section	BAM ref.	BAM requirement	Chapter ref(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, 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.
		☒ 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.
		☒ justification for addition of any species credit species to the list	Ch 5.1.2.
		From the list of candidate species credit species, identify:	–
		☒ species assumed present within the subject land (if relevant) (as described in BAM Subsection 5.2.4(2.a.)) - ☒ species present within the subject land on the basis of being identified on an important habitat map for a species (as described in BAM Subsection 5.2.4(2.d.)) – ☒ species for which targeted surveys are to be completed to determine species presence (BAM Subsection 5.2.4(2.b.)) ☐ 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; Tables 13 & 14
		Present the outcomes of species credit species assessments from:	–
		☒ threatened species survey (as described in BAM Section 5.2.4)	Tables 13 & 14
		☐ 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 – Tables 15 & 16 Appendix D
		☒ survey personnel and relevant experience	Declarations – xii

BDAR section	BAM ref.	BAM requirement	Chapter ref(s) in the BDAR
		☒ describe any limitations to surveys and how these were addressed/overcome	Ch 2.6,
		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,
		☐ justification of the use of an expert report ☐ identify the expert, provide evidence of their expert credentials and departmental approval of expert status ☐ all requirements of Box 3 have been addressed in the expert report	
		Where use of local data is proposed (BAM Subsection 1.4.2): - *not relevant*	Ch 5.5,
		☐ identify relevant species ☐ identify data to be amended ☐ identify source of information for local data, e.g. published literature, additional survey data, etc. ☐ justify use of local data in preference to VIS Classification or TBDC data	
		☐ provide written confirmation from the decision-maker that they support the use of local data	
		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, 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 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	Chapter ref(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 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) -	Table 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	Chapter ref(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
		☒ 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
		☒ 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
		☒ 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
		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	Chapter ref(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
		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,
		☐ 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,
		☒ 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,

BDAR section	BAM ref.	BAM requirement	Chapter ref(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,
		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*	Ch 7.1, Appendix F
		☒ Maps demonstrating indirect impact zones where applicable	Figure 11
		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, 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,
		☒ 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	Chapter ref(s) in the BDAR
		Assessment of prescribed biodiversity impacts (as described in BAM Section 8.3) including:	Ch 8.3,
		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,
		☐ 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,
		☒ movement of threatened species that maintains their life cycle	Ch 8.3.2,
		☒ water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities	Ch 8.3.3,
		☐ 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,
		☒ evaluate the consequences of prescribed impacts	in relevant chapters listed above
		☒ describe impacts that are uncertain	Ch 8.5,
		☒ document limitations to data, assumptions and predictions	Ch 8.5,
		Maps and tables	
		☒ Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts	Table 22
		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, Table 24

BDAR section	BAM ref.	BAM requirement	Chapter ref(s) in the BDAR
		☒ techniques, timing, frequency and responsibility - *requires discussion at more detailed development application stage*	Ch 8.4,
		☐ identify measures for which there is risk of failure – *requires discussion at more detailed development application stage*	
		☐ 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*	Ch 8.5
		Identification of measures for mitigating impacts related to:	–
		☒ displacement of resident fauna (as described in BAM Subsection 8.4.1(2.)) –	Ch 8.4,
		☒ indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.))	
		☒ mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2)	
		☒ Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5) -	Ch 8.5,
		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 - *Further details for all plans/ methods shall be developed as part of the detailed design for the development application stage and assessed in the Final BDAR lodged with the development application*	Table 24
		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*	Ch 9,
		☐ 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	Chapter ref(s) in the BDAR
		☐ documenting assumptions made and/or limitations to information ☐ documenting all sources of data, information, references used or consulted ☐ clearly justifying why any criteria could not be addressed	
		☒ Identification of impacts requiring offset in accordance with BAM Section 9.2	Ch 10.1,
		☐ 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*	Figure 11
		☐ 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	Figure 11
		☐ 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) ☒ change in vegetation integrity score (BAM Subsection 8.1.1)	Table 25

BDAR section	BAM ref.	BAM requirement	Chapter ref(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 25
		☒ number of required species credits for each candidate threatened species that is directly impacted on by the proposal (BAM Subsection 10.1.3) -	Tables 26
		Maps and tables	
		☒ Table of PCTs requiring offset and the number of ecosystem credits required	Table 25
		☒ Table of threatened species requiring offset and the number of species credits required -	Table 26
		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 27
		☒ BAM credit report in pdf format	Appendix E
		Maps and tables	
		☒ Table of credit class and matching credit profile	Table 27
		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 30 Vegetation survey data and locations

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

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 amphibian expert and field guide author, 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, which are to be retained and protected.

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 Last 7 Days = 1mm 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 Last 7 Days = 29.6mm	Aural-visual surveys along transects
9 November	DE, JM & CS	240	Last 24 Hours = 0.8mm Last 7 Days = 21.2mm	
10 November	JM & CS	160	Last 24 Hours = 0.2mm Last 7 Days = 42.4mm	
11 November	DE, JM & CS	240	Last 24 Hours = 0mm Last 7 Days = 42.4mm	
17 November	JM	80	Last 24 Hours = 0mm Last 7 Days = 2mm	
18 November	JM	80	Last 24 Hours = 1.6mm Last 7 Days = 3.6mm	
24 November	JM	80	Last 24 Hours = 3.2mm Last 7 Days = 4.8mm	
25 November	JM	80	Last 24 Hours = 2mm Last 7 Days = 4.8mm	
22 December	HE & SM	480	Last 24 Hours = 32.4mm Last 7 Days = 87.2mm 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

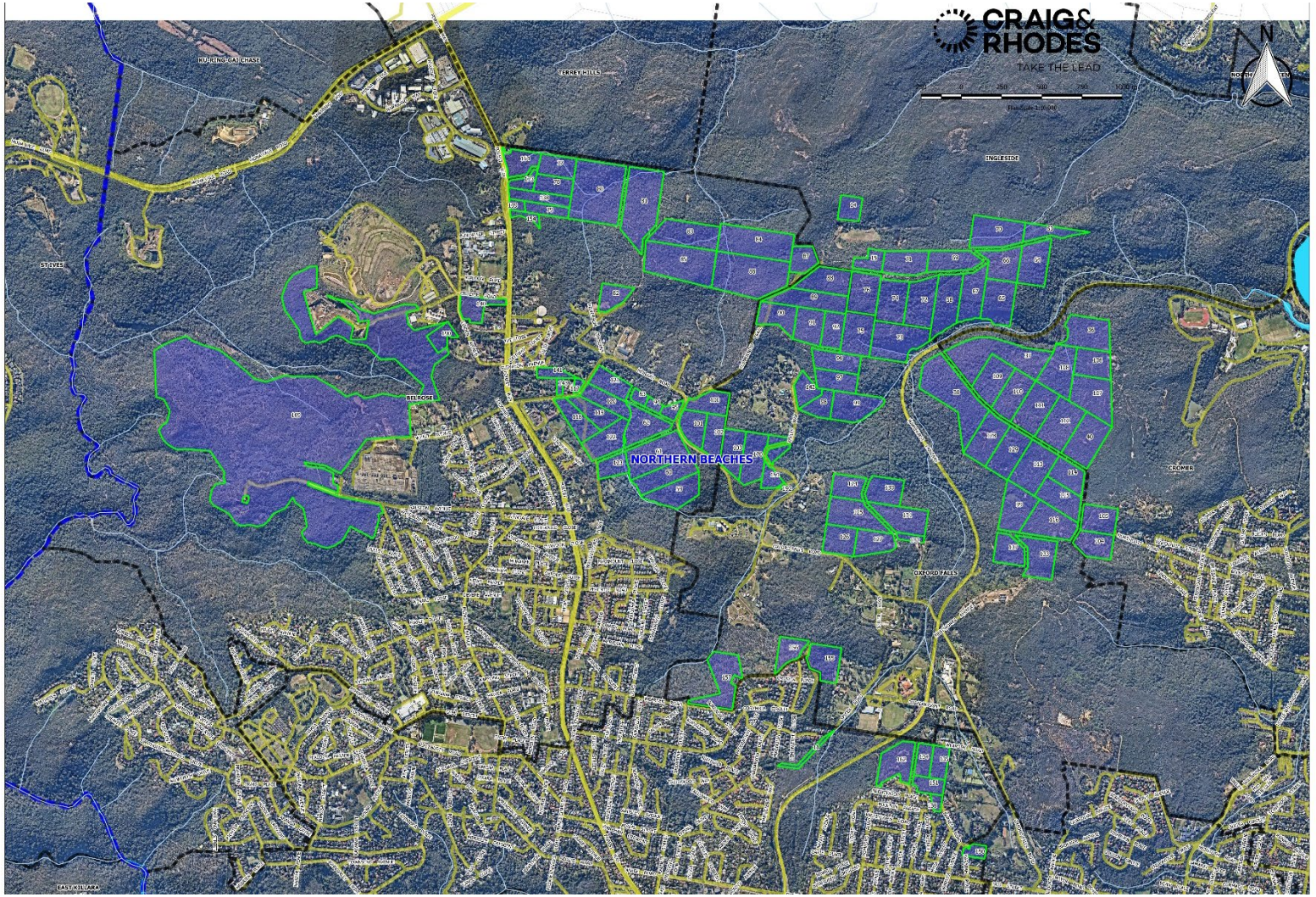
This BDAR is a preliminary document prepared for the purpose of a Planning Proposal. The assessment has not been finalised or submitted within BOAMs. The attached credit reports were current on the 18th January 2024.

Attached:

* Credits summary report
* Biodiversity credit report (Like-for-like)
* Candidate threatened species report
* Predicted species report.

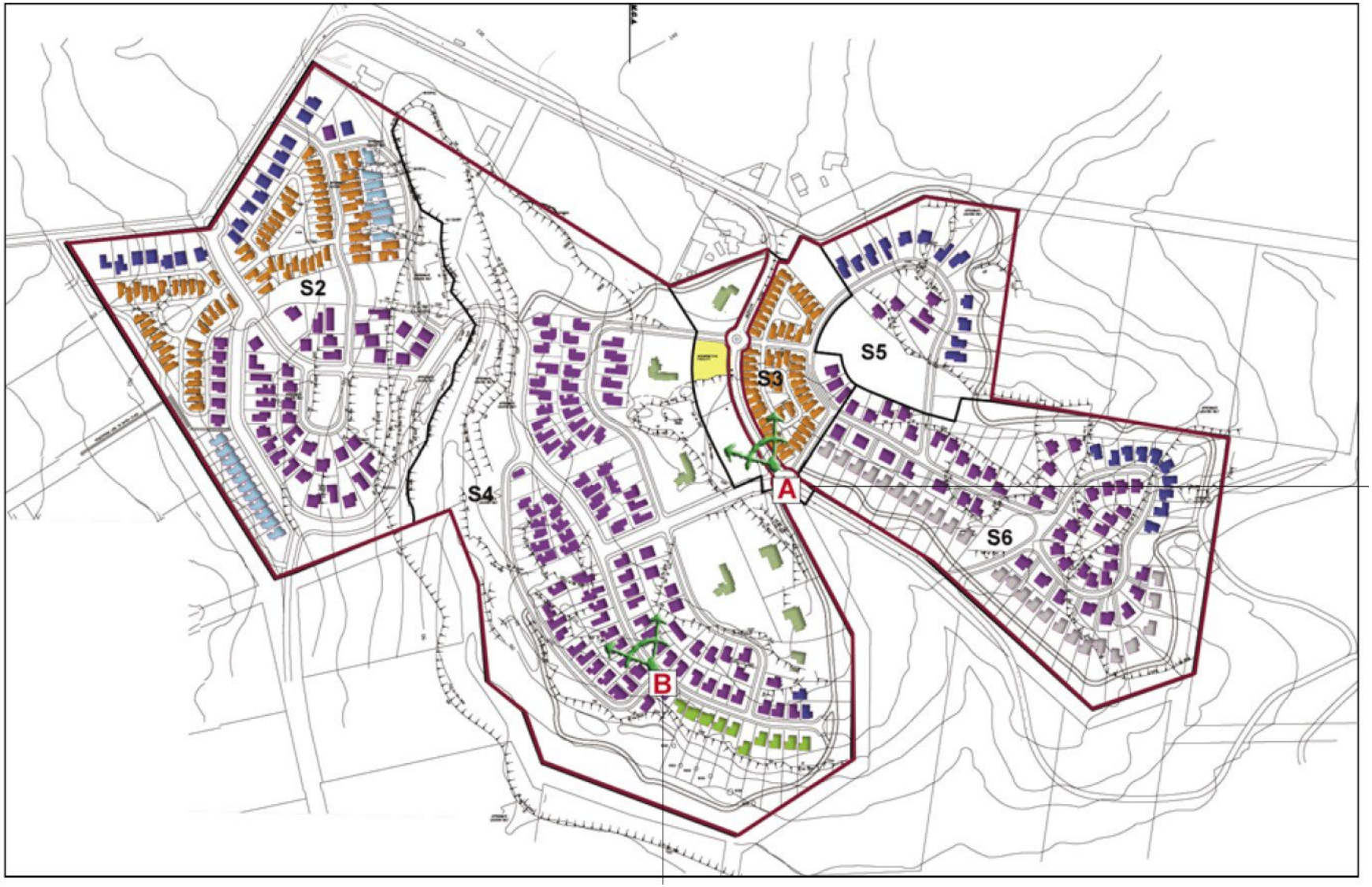
Appendix F: Alternative development footprints

Figure 12 Location of MLALC lands across the Northern Beaches LGA.



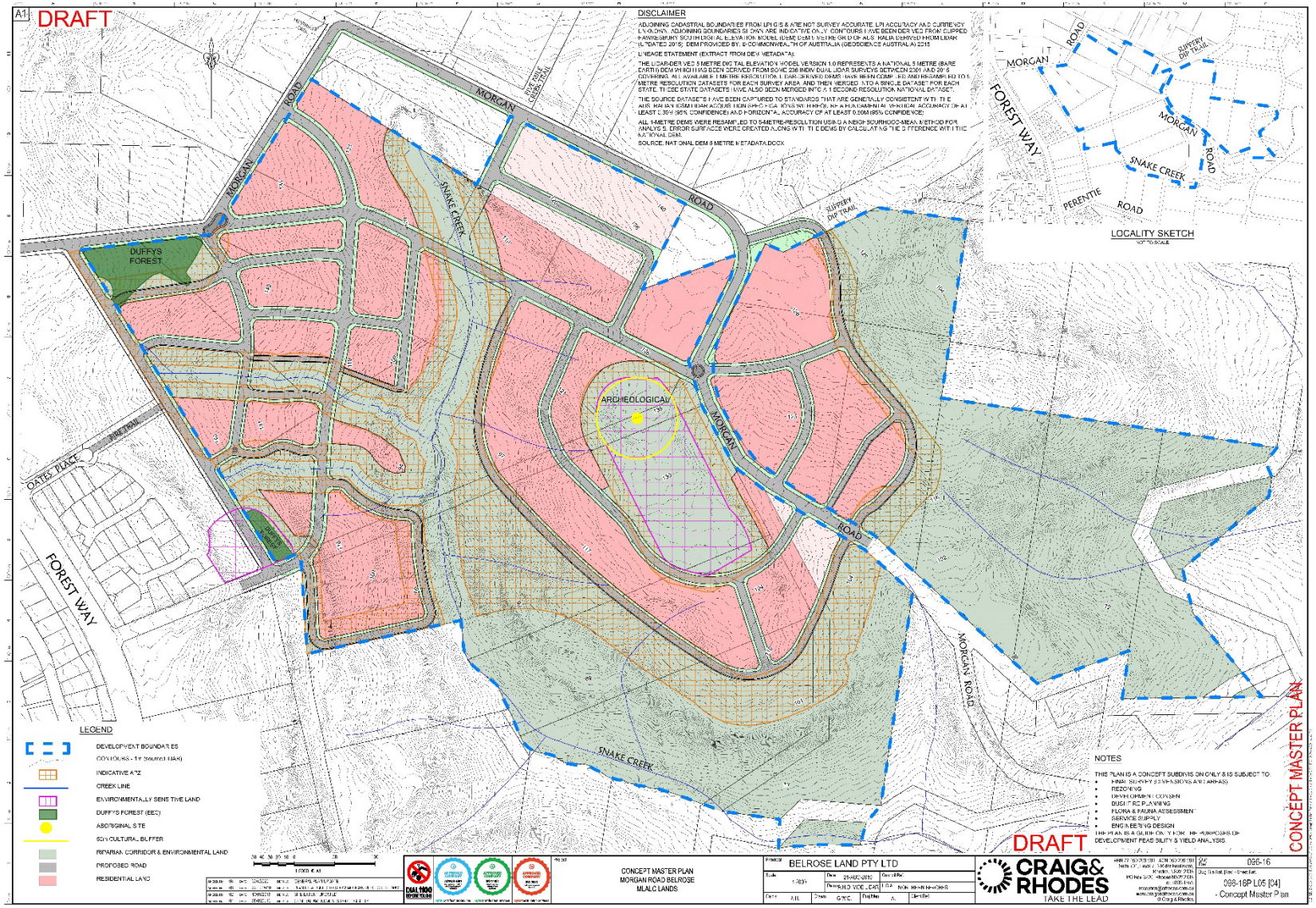
Proposed zoning of deferred lands, Patyegarang Project.

Figure 13 2004 Concept Masterplan.



Proposed zoning of deferred lands, Patyegarang Project.

Figure 14 2019 Concept Masterplan.



Proposed zoning of deferred lands, Patyegarang Project.

Figure 15 2021 Concept Masterplan.

HAYES ENVIRONMENTAL

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22nd December 2022

GYDE Consulting
Level 6, 120 Sussex Street
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Att: Juliet Grant
julietg@gyde.com.au

Dear Juliet,

RE: Planning Proposal Patyegarang (PP-2022-3802) - response to DPE (EHG) submission dated 21 November 2023

I have considered the submission provided by EHG relating to the Preliminary BDAR (Hayes Environmental, July 2023) prepared for the Patyegarang Planning Proposal.

The submission has been read alongside a detailed review of the Preliminary BDAR, with a table of technical responses appended to this letter.

In summary of the responses:

* Several of the specific issues have been addressed by an update to the Preliminary BDAR, with additional data, information or explanation provided;
* Many of the issues relate to misunderstandings or incorrect interpretations by EHG, as set out in the appended table;
* Some issues relate to the planning process itself, and the level of design detail required for a Planning Proposal as opposed to a Development Application, as set out in the appended table.

The issues are grouped below into four broad discussion topics:

A. Adequacy of demonstration of the avoid and minimise, then offset hierarchy.
B. Underestimation of the extent of impacts.
C. Identification of threatened ecological communities (TECs), specifically Duffy's Forest EEC and Coastal Upland Swamp.
D. Adequacy of targeted surveys for relevant threatened species.

A Adequate demonstration of the avoid and minimise, then offset hierarchy

The Patyegarang project is the culmination of a lengthy and comprehensive avoid and minimise process, as follows:

1 The MLALC seek an income stream to fund the goals identified in their Community Land Business Plan.

2 Consideration of funding options by MLALC identified that a land development project could achieve this goal, noting that the MLALC own 912 hectares of land in Metropolitan Sydney, including 621 hectares in the Northern Beaches LGA.

3 All of the MLALC lands contain native vegetation in good condition so there was no upfront option to completely avoid impacts on biodiversity.

Regional-scale avoidance and minimisation.

4 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 assessment investigated the development potential of each of the land parcels, looking at matters such as biodiversity values, heritage values, bushfire risk, and infrastructure needs.

5 The assessment resulted in only six of the sites being nominated for inclusion in the Aboriginal Lands SEPP. It was identified that avoidance of the significant remaining landholdings across the Northern Beaches LGA provides opportunity for biodiversity offsets to be achieved locally, including through creation of biodiversity stewardship sites.

6 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 the six identified sites within the Northern Beaches LGA.

7 On the basis of strategic investigations and assessment, only one, the 71ha Lizard Rock site [now referred to as the Patyegarang Project] is currently endorsed by MLALC members and the NSW ALC to be actively investigated for land dealing. Whilst fully vegetated, this site contains lower biodiversity values than the other sites, and also contains an important cultural rock engraving that could be better protected and managed with development of the land. This site was deemed the best option to avoid and minimise impacts at the regional scale, whilst meeting project objectives.

Site-scale avoidance and minimisation

8 Biodiversity values within the site were assessed to identify opportunities for further avoidance and minimisation of impacts at the site scale. This resulted in amendment to a previous 2004 concept masterplan for the land, with development substantially pulled back from the more remote southeastern areas not currently bordered by existing development. This reduction in scale and re-positioning of the development also reduced fragmentation of the large local patch of bushland which extends onto adjacent lands to the south and east.

Project-scale avoidance and minimisation

9 Hayes Environmental carried out a more comprehensive biodiversity assessment (following the *Biodiversity Assessment Method 2020*) to inform and refine the project design, and to assess the likely impacts and offset liability.

10 The twenty hectares of avoided land across the southeast was designated as a conservation zone, with ongoing discussions between specialist consultants and the project team to ensure the Structure Plan could be achieved without impacting directly or indirectly upon the conservation zone.

11 The Snake Creek riparian corridor was widened in the south to exceed statutory minimum corridor requirements. This improved opportunities for maintaining water quality downstream, and improved the connectivity values of the Snake Creek riparian corridor.

12 Design of residential precincts included use of perimeter roads, to enable collection and management of stormwater, and to provide opportunities for control of access to community land (particularly the conservation zone).

13 A substantial bushfire APZ (up to 60m in width) would extend beyond the perimeter road, thus providing open space for recreational use, and a buffer to indirect impacts on the conservation zone, including opportunity for installation of stormwater management features and other impact management measures.

14 These design measures combine to provide best practice protection for the conservation zone, avoiding all direct and indirect impacts upon this area.

15 Further discussions between the ecologist and the project team drilled into opportunities for more specific protection of threatened species habitat, tweaking the design to retain habitat for *Tetratheca glandulosa* and the Red-crowned Toadlet, and ensuring the Structure Plan contained sufficient flexibility to enable further refinements during detailed design for the Development Application stage. Many of these details are necessarily conceptual at this level of the planning process.

Precinct-scale avoidance and minimisation

16 Discussions between the ecologist and stormwater consultant have resulted in conceptual design around water quality controls and treatment, and the location and method of discharges. The project team is committed to not only meeting statutory requirements in relation to water quality, but to set a benchmark for improvement of the quality of water being discharged from the site.

17 A range of management plans would be prepared at the development application stage to further manage, minimise and mitigate potential impacts on biodiversity values at the precinct scale (refer to Ch 8.4 of the Preliminary BDAR). These would 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*

In summary, the Structure Plan is the result of a lengthy investigative and assessment process to avoid and minimise impacts on biodiversity values at the regional scale, site scale, and project scale. Additional planning has already commenced to further avoid and minimise impacts at the precinct scale, with these details to be lodged with the development application.

B Underestimation of the extent of impacts.

1. Overestimation of impacts within the Preliminary BDAR

   The Structure Plan specifically addresses lot sizing, road placement and asset protection zone boundaries to facilitate retention of trees and natural rock features within the development.

   Asset Protection Zones would retain native vegetation to the extent that meets statutory APZ requirements. This vegetation would effectively be protected and maintained through a Vegetation Management Plan implemented by the community strata and controlled by Council.

   Residential lots and private spaces would not be cleared and levelled to suit broadscale project home development, but offered as treed sites with restrictions where appropriate, to encourage bespoke house designs similar in character to other residential areas across the Northern Beaches.

   Despite this, the biodiversity assessment has conservatively assumed for the purpose of assessment and calculation of impacts that all land within the development footprint, including APZ inner protection areas, public open space, road verges, and private spaces would be completely cleared of all native vegetation.

   This is an overestimation of the extent of impacts across 44.7 hectares of land.

2. Potential for underestimation of impacts

   The biodiversity assessment has assumed that the APZ outer protection areas (2.67 ha) would retain occasional trees and some native groundcover. This is based on discussions, joint site inspection and site-specific mapping with the bushfire consultant.

   The biodiversity assessment assumes that riparian corridors and the cultural reserve (6.9 ha) would not be directly impacted by the development, but are likely to be subject to indirect impacts. This is based on detailed discussion with the bushfire consultant, stormwater consultant, and broader project team. Indirect impacts require more detailed site plans and management plans to be quantified. It is the intent of the project team to minimise indirect impacts to the extent that additional off-setting is not warranted.

   The biodiversity assessment does not include an assessment of the impacts of infrastructure requirements that are outside of Patyegarang site. The areas being considered for external infrastructure are comparatively small, and are already cleared or highly disturbed. Additional impacts associated with these would be minor.

3. Implications for strategic planning

   In summary, the potential for underestimation of impacts is substantially less than the overestimation of impacts that has been incorporated into the assessment.

   The extent of impacts would be re-calculated on the basis of final detailed plans at the development application stage. The minor queries raised by EHG would not materially alter the outcome of the biodiversity assessment nor compromise the feasibility of the project.

In any case, offset credit calculation and pricing have been regularly changing and updating since the commencement of the BC Act, such that changing credit requirements is an ongoing risk for all strategic planning decisions which necessarily rely on unfinalised BDARs.

Sufficient information has been provided to confidently assess project merits and feasibility for rezoning.

C Identification of threatened ecological communities (TECs), specifically Duffy's Forest EEC and Coastal Upland Swamp

1. Duffys Forest EEC

Consideration of Duffys Forest EEC has been carried out through both qualitative and quantitative comparison with the Final Determination of the NSW Scientific Committee (this being the legal definition of the community).

The quantitative comparison referred to the Smith & Smith (2000) report and method which is specifically referred to for this purpose in the Final Determination. There are cautions and limitations relevant to this method, as with any scientific method. These cautions and limitations, however, have been carefully considered and addressed in the Preliminary BDAR, and do not affect the findings set out in the Preliminary BDAR.

The limitations refer to (i) degraded sites where the species diversity has been reduced, (ii) to situations where seasonal or disturbance-related dormancy might affect species diversity, and (iii) sampling limitations. None of these limitations apply to the Patyegarang site. The site is in good condition, was surveyed during appropriate conditions, and a high species diversity was recorded (meeting the minimum criteria for the method to be used). The issue of sampling limitations is relevant to large sites where random sampling has been used. This does not apply to Patyegarang where the entire area has been traversed on foot and sampling has targeted the most likely areas for this community on the site.

The methods used to assess and identify this community are legally and scientifically robust. The results are consistent with recent regional vegetation maps released by DPE.

2. Coastal Upland Swamp

There is one patch of Coastal Upland Swamp mapped within the site on recent regional mapping. This appears to be a mistake in aerial photo interpretation due to weed invasion, most notably Coral Trees, Privet and Senna. Further details and photos have been added to the Preliminary BDAR.

3. Threatened species associations.

The plant community types associated with Duffys Forest EEC are almost identical to the PCTs used for the BDAR assessment, such that any changes to threatened species associations would be minor. Any newly relevant species would most likely already have been adequately surveyed.

However, threatened species associations to respective PCTs have been regularly changed and updated since commencement of the BC Act, such that this is an ongoing risk for all strategic planning decisions which necessarily rely on unfinalised BDARs.

D Adequacy of targeted surveys for relevant threatened species

1. Fungi

Current legislation and guidelines do not require that variation to survey timing be justified by a listed DPE 'expert'. EHG have erroneously discounted the justification provided in the Preliminary BDAR on this basis. The fungi surveys were conducted by an expert on the genus, after whom one of the species is in fact named.

2. Threatened plants

Targeted parallel traverse surveys for threatened plants have now been completed. These had been delayed due to seasonal survey requirements and so were not included in the July version of the Preliminary BDAR. No new threatened plant species were recorded. Results have been added to the Preliminary BDAR.

3. Threatened fauna

EHG have queried the survey of habitat for several ecosystem credit species (Rosenbergs Goanna, Spotted-tailed Quoll, and non-breeding Bent-wing Bats). These species are appropriately assessed as ecosystem credit species in accordance with the BAM (2020). Further survey or mapping of habitat is not required.

Amphibian surveys were designed and carried out in collaboration with Dr Marion Anstis, a recognised expert on the relevant frog species, and author of technical books relied upon in the ecological industry for identification of frogs and tadpoles. Further detail around the identification of habitat and survey design has been added to the Preliminary BDAR.

Please do not hesitate to contact me with any queries or to seek clarification on any matter.

Kind regards,

Rebecca Hogan
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Accredited BAM Assessor (BAAS17090)
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ECA ECOLOGICAL CONSULTANTS ASSOCIATION of NSW Inc
2023 PRACTISING MEMBER

Table of Responses

	Summary of issue raised	Response	Action
1	Underestimation of extent of impacts.	Biodiversity assessment for the structure plan is based on an overestimation of impacts across 44.7 hectares of land, due to assumption of total clearing of all residential precincts when in fact, the Structure Plan has been specifically design to enable some retention of trees and habitat features, particularly in open space areas and asset protection zones. The alleged underestimation of the extent of impacts (and hence, credit requirements) relates to relatively small areas of the land and is not a significant issue that would compromise the feasibility of the project. Offset credit calculation and pricing have been regularly changing and updating since the commencement of the BC Act, such that changing credit requirements is an ongoing risk for all Planning Proposals which necessarily rely on unfinalised BDARs. The boundaries of the subject land can be confirmed with consent authorities at the time of DA preparation to enable a final accurate and binding calculation of offsets. Sufficient information has been provided to confidently assess project merits and feasibility for rezoning.	No action required.
2	Underestimation of extent of impacts.	Refer to response to Point 1.	No action required.
3	Identification of Duffy's Forest TEC.	Consideration of Duffys Forest EEC has been carried out through both qualitative and quantitative comparison with the Final Determination of the NSW Scientific Committee (this being the legal definition of the community). The quantitative comparison referred to the Smith & Smith (2000) report and method which is specifically referred to for this purpose in the Final Determination. The Smith & Smith (2000) method is a legally valid and useful tool for the identification of Duffys	No action required.

		Forest TEC. There are cautions and limitations relevant to this method, as with any scientific method. These cautions and limitations, however, have been carefully considered and addressed in the Preliminary BDAR, and do not affect the findings set out in the Preliminary BDAR. The limitations refer to (i) degraded sites where the species diversity has been reduced, (ii) to situations where seasonal or disturbance-related dormancy might affect species diversity, and (iii) sampling limitations. None of these limitations apply to the Patyegarang site. The site is in good condition, was surveyed during appropriate conditions, and a high species diversity was recorded (meeting the minimum criteria for the method to be used). The issue of sampling limitations is relevant to large sites where random sampling has been used. This does not apply to Patyegarang where the entire area has been traversed on foot and sampling has targeted the most likely areas for this community on the site. The methods used to assess and identify this community are legally and scientifically robust. The results are consistent with recent regional vegetation maps released by DPE	
4	Identification of Duffy's Forest TEC.	Refer to response to Point 3.	No action required.
5	Identification of Duffy's Forest TEC.	Refer to response to Point 3.	No action required.
6	Identification of Coastal Upland Swamp TEC.	Further detail and photos to be added to the BDAR to explain and justify the PCT identification.	Update to BDAR.
7	Incorrect PCT and TEC identifications undermine threatened species associations	PCTs associated with Duffy's Forest TEC are very similar to the PCTs identified on the subject land. Any changes to the species associations would be minor and unlikely to materially affect assessment results. In any case, threatened species associations have been regularly changed and updated since commencement of the BC Act, such that this is an ongoing risk for all Planning Proposals which necessarily rely on unfinalised BDARs. An updated threatened species assessment would be part of the final BDAR for the development application, and would need to address any new threatened species issues	No action required.

		at this time, whether these arise from new listings, new PCT associations, new IBRA subregion associations, or from amendment of the PCT identifications on the subject land.	
8	Timing of surveys for threatened fungii of the genus *Camarophyllopsis* and *Hygrocybe*.	Current legislation and guidelines do not require that variation to survey timing be justified by a listed DPE 'expert'. EHG have erroneously discounted the justification provided in the Preliminary BDAR on this basis. The survey was conducted on 6th July 2021 – just 6 days outside the designated May-June survey period. This is not a significant divergence. The survey was conducted by Dr Ray Kearney, a recognised and leading expert on these species, with survey timing and methods based on Dr Kearney's advice. Refer to the letter from Dr Ray Kearney (included in Appendix C of the Preliminary BDAR) which sets out his experience and qualifications. It is noted that one of the species, *Camarophyllopsis kearneyi*, was named after him as a result of his work in discovering and describing the species.	No action required.
9	Timing of surveys for other threatened plants.	The Preliminary BDAR clearly states that the extent of threatened plant surveys had not yet fully met the BAM requirements, but that surveys would be completed for production of a final BDAR and calculation of offsets. The surveys have since been completed and the data will be added to the BDAR. It is noted that no further threatened species were found on the land and that the assumptions provided in the Preliminary BDAR are now sustained.	Update to BDAR.
10	Mapping and investigation of caves and crevices.	Caves and crevices within the subject land provide potential habitat for ecosystem credit species such as the Rosenberg's Goanna and Spotted-tailed Quoll, and for the ecosystem (non-breeding) component of habitat for the dual-listed species, the Large Bent-wing Bat and Little Bent-wing Bat. The BAM does not require survey for ecosystem credit species or for the ecosystem component of dual-listed species. Further:	No action required.

		- Rosenberg's Goanna and the Spotted-tailed Quoll use a variety of shelter features, including hollow logs, tree stumps, etc. It would not be sensible to map only one type of shelter feature used by these species. - Breeding caves for both bent-wing bats are uncommon, have very specific requirements, and are typically located within deep limestone cave systems. Field survey did not record either species present during their breeding periods. No caves likely to provide suitable breeding habitat were found on the land. - Non-breeding shelter will include a much wider variety of caves and crevices. Bats move regularly between various roost sites and are not dependent on individual non-breeding caves. It would be impracticable and serve little purpose to attempt to map all possible ecosystem credit cave and crevice habitat across the land, given the micro-scale and abundance of such features across the landscape.	
11	Justification for extent of threatened amphibian surveys.	The Preliminary BDAR *does* provide a justification for how areas of habitat were identified for amphibian surveys. It is stated in Appendix D that the amphibian survey design was identified and guided by amphibian expert, Dr Marion Anstis, with decisions made on the basis of the structure of creeklines and their suitability for occupation by the relevant species. Dr Marion Anstis is a recognised expert on the relevant frog species, and author of technical books relied upon in the ecological industry for identification of frogs and tadpoles. It is also stated that the creeklines do not provide unshaded areas, emergent vegetation, or nearby grassy areas, which are all typical features of Green & Golden Bell Frog habitat. Further detail around the decision-making process will be added to the BDAR.	Update to BDAR.
12	Underestimation of extent of impacts.	Refer to response to Point 1.	No action required.

13	Width of riparian buffers.	The riparian widths for the feeder creeks to Snake Creek currently provided in the Structure Plan are such that they do not require management for bushfire risk. If these riparian widths were to be increased, then the vegetation would become a fire hazard and would need to be managed as an APZ. It is believed this would have a greater adverse impact on the vegetation, habitats, and water quality, than the narrower corridors as proposed. The Preliminary BDAR recognises the potential for indirect impacts on the narrower riparian corridors and proposes that various site management plans and mitigation measures be prepared at the detailed development application stage.	No action required.
14	Assessment of bushfire APZs.	The Preliminary BDAR is based on the DPE BDAR template and sets out the assessment step-by-step in accordance with the template. Table 22 shows the changes in vegetation integrity score for each management zone, and shows that partial loss is applied to the small areas of outer APZ. These are mapped on both Figure 3 and Figure 10. APZs *are* wholly contained within the Subject Land. This is clearly shown on all relevant maps. EHG's statement that "*the institution of APZs are likely to change the PCT integrity to the extent that it may not meet the benchmark requirements to be classified as the community*" is an irrelevant distraction. Firstly, NSW legislation does not include minimum condition criteria for native vegetation to be classed as a PCT or TEC. So, the vegetation would remain the same PCT until it is cleared to the extent it is no longer classed as native vegetation at all. Secondly, the calculation of offsets is based on quantitative loss of integrity from the original PCT values. So even if the altered vegetation was no longer classed as the same PCT, this would not change the assessment of impacts or calculation of offset. Whilst it is common practice and usually appropriate to assign a future integrity score of 0 to all APZs, it is not a requirement of the BC Act or BAM to do so. In cases where the APZ management is to be undertaken in a controlled manner in perpetuity (such as for a strata development), it can be appropriate to rely on only partial loss and so assign a future integrity score greater than 0. It is of course, necessary to justify such cases. The	No action required.

		Preliminary BDAR provides a justification in Ch 8.1.2. The assumption of retained vegetation values is very conservative, and is supported by discussion of how the long-term maintenance of the values would be achieved. The extent of land to which this potential under-estimation applies is 2.67 hectares.	
15	Underestimation of extent of impacts. Specific reference to Ch 8.5 of the Preliminary BDAR.	Refer to response to Point 1. Ch 8.5 addresses uncertain impacts in accordance with the DPE BDAR template – *ie* impacts that are unknowable or cannot be adequately predicted or assessed in a BDAR. You cannot assess what is not known. Ch 8.5 points to the need for an adaptive management strategy, in accordance with the DPE template guidance.	No action required.
16	Assessment of impact due to infrastructure upgrades outside of the subject land boundaries.	There are various options available relating to external infrastructure that would be finalised at the Development Application stage. The areas being considered for external infrastructure are comparatively small, and are already cleared or highly disturbed. Additional impacts associated with these would be minor and would not compromise the feasibility of the project. The final offset requirement would be accurately calculated as part of the final BDAR.	No action required.
17	Underestimation of extent of impacts. Specific reference to Ch 8.5 and Ch 10.2 of the Preliminary BDAR.	Refer to response to Point 15. Ch 10.2 has been addressed in accordance with the DPE BDAR template – it specifically addresses s9.3 of BAM 2020 (with exactly the same heading). Impacts that do not need further assessment for ecosystem credits are areas that do not contain native vegetation. Ch 5.2 of BAM 2020 Operational Manual Stage 2 adds that further assessment is not required for areas of vegetation with integrity scores below certain thresholds. The Preliminary BDAR has conservatively assumed that all areas of vegetation within the subject land (even the weed thickets) are native vegetation with integrity scores above the thresholds. Therefore, all impacts require further assessment. Or, to use the DPE template wording - there are no impacts that do not require further assessment.	No action required.

		It appears that EHG have mis-understood this statement.	
18	Consideration of Serious And Irreversible Impacts	Refer to responses to Points 3, 6, & 7.	No action required.
19	Underestimation of extent of impacts.	Refer to response to Point 1.	No action required.
20	Adequate avoidance and minimisation of impacts.	A comprehensive discussion is provided in the Preliminary BDAR which demonstrates the framework *has* been applied. Further detail and explanation will be added to the BDAR.	Update to BDAR.
21	Incorrect PCT and TEC identifications undermine threatened species associations.	Refer to response to Point 7.	No action required.
22	Underestimation of extent of impacts.	Refer to response to Point 1.	No action required.
23	EHG state they "*previously recommended that at a minimum, assessment of biodiversity values and impacts be undertaken through application of stage 1 and elements of Stage 2 of the BAM*."	Application of '*elements*' of stage 2 would produce an incomplete BDAR. It appears EHG accept that a preliminary or incomplete BDAR can be sufficient for strategic planning decisions. The Preliminary BDAR applies all of Stage 1 except for the time-constrained species surveys (which have since been completed), and virtually all of Stage 2. The additional Stage 1 survey data will be added to the BDAR.	Update to BDAR.
24	Assessment of impacts for the Planning Proposal.	The Preliminary BDAR provides a comprehensive section describing how impacts have been avoided through Structure Plan design, and sets out opportunities for further	Update to BDAR.

		avoidance at the development design stage. Avoidance has not been deferred to the development stage. The Structure Plan is the result of a lengthy investigative and assessment process to avoid and minimise impacts on biodiversity values at the regional scale, site scale, and project scale. Additional planning has already commenced to further avoid and minimise impacts at the precinct scale, with these details to be lodged with the development application. The Preliminary BDAR provides sufficient information for a strategic planning decision to be made. Notwithstanding, the BDAR will be amended to set out the details of avoidance and minimisation of impacts more clearly.	
25	Underestimation of extent of impacts.	Refer to response to Point 1.	No action required.
26	Adequate avoidance and minimisation of impacts.	Refer to response to Point 20.	Update to BDAR.
27	Underestimation of extent of impacts. Specific reference to Ch 10.2 of the Preliminary BDAR.	Refer to response to Point 17. Refer to response to Point 23.	No action required.

28 February 2024

Juliet Grant
Executive Director
GYDE Consulting
E: julietg@gyde.com.au

Dear Juliet

Re: Proposed zoning of deferred lands, Patyegarang Project – Preliminary Biodiversity Development Assessment Report Peer Review

Project no. 38516

Biosis Pty Ltd was commissioned by GYDE Consulting to complete a peer review of a Preliminary Biodiversity Development Assessment Report (BDAR) related to the proposed zoning of deferred lands, Patyegarang Project, Morgan Road, Belrose, New South Wales (NSW). The BDAR was prepared by Ms Rebecca Hogan, accredited BAM Assessor (BAAS17090), from Hayes Environmental, on behalf of GYDE Consulting.

Biosis understands that 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. GYDE Consulting have requested a peer review of the preliminary BDAR to support the planning proposal.

This letter report provides Biosis' peer review of the *Preliminary Biodiversity Development Assessment Report – Proposed zoning of deferred lands, Patyegarang Project* (Hayes Environmental 2024), based on our desktop review of the BDAR, our knowledge of the local fauna and flora of the Northern Beaches locality and our knowledge of state and federal legislative requirements, as they apply to biodiversity.

The objective of this BDAR peer review is to address the minimum information requirements for a BDAR, including Table 24 (Stage 1: Biodiversity assessment) and Table 25 (Stage 2: Impact assessment [biodiversity values]) of Appendix K of the BAM (DPIE 2020) against the Preliminary BDAR (Hayes Environmental 2024).

This peer review has been undertaken by Principal Ecologist and Accredited BAM Assessor (BAAS#17067), Rebecca Dwyer, and reviewed by Senior Ecologist and Accredited BAM Assessor (BAAS #22005) Matthew Hyde. CV's has been provided in Appendix A.

Methodology

Prior to the peer review Biosis reviewed relevant background information, including:

- *Preliminary Biodiversity Development Assessment Report – Proposed zoning of deferred lands, Patyegarang Project* (Hayes Environmental 2024).
- Biodiversity Assessment Method (DPIE 2020).

- Review of Case Number 00026048 in the Biodiversity Assessment Method (BAM) Calculator.

Results

An assessment of the minimum information requirements for a BDAR against the Proposed zoning of deferred lands, Patyegarang Project, Preliminary BDAR (Hayes Environmental 2024) is shown in Table 1 (reporting requirements) and Table 2 (mapping requirements).

Table 1 Assessment of the minimum reporting requirements for a BDAR in relation to Preliminary BDAR – Proposed zoning of deferred lands, Patyegarang Project

Information	Compliance	Comments
Introduction		
Brief description of the proposal.	Compliant	• Brief description of proposal outlined in Section 1.
Identification of subject land boundary, including: • **Operational footprint.** • **Construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure.**	Compliant.	• The subject property is defined in section 1.1.2. • The Proposed development and the subject land are defined in section 1.1.3 including; – the development zone (51.0 ha), being land that would be affected either directly (the subject land, 44.1 ha) or indirectly (retained vegetation, 6.9 ha). – A conservation zone (19.8 ha), being land outside of the development zone that is set aside and managed for conservation. • Biosis understands that given the Preliminary BDAR has been prepared for a Planning Proposal, impacts are uncertain, and will be further refined at the detailed design stage, including: – The Summary states that: *'Additional planning has already commenced to further avoid and minimise impacts at the precinct scale', and that 'the potential for underestimation of impacts is substantially less than the overestimation of impacts that has been incorporated into the assessment.'* – In section 1.1.3, the BDAR states that there will be a: *'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.'* • The assessment area is mentioned in sections 2.1.2 and 2.3.1, and defined in section 3.1.
General description of the subject land.	Compliant.	• Addressed in Section 1 and beginning of Section 2.

Information	Compliance	Comments
Sources of information used in the assessment, including reports and spatial data.	Compliant.	• Addressed in section 1.1.4 and section 1.5.
Landscape context		
General description of subject land topographic and hydrological setting, geology and soils.	Compliant.	• Landscape features including hydrology, topography and geology have been described in section 3. • A general description of the soil profile has been provided, including the dominant the Mitchell Landscapes used for the assessment.
Percent native vegetation cover in the assessment area (as described in BAM Section 3.2).	Compliant.	• Addressed in section 3.3 Table 3.
IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.)).	Compliant.	• Addressed in section 3.2.1.
Rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3.) and Appendix E).	Compliant.	• Rivers, streams, estuaries and wetlands discussed in Section 3.2.2.
Wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(3.)).	Compliant.	• Waterways addressed collectively in section 3.2.2, and also mentions 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. However, this has not been reviewed as part of this peer review.
Connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.)).	Compliant.	• Addressed in section 3.2.3.
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.).	Compliant.	• Addressed in section 3.2.4.
Areas of outstanding biodiversity value occurring on the subject land and assessment area (as described in BAM Subsection 3.1.3(8–9.)).	Compliant.	• Addressed in section 3.2.5.
Any additional landscape features identified in any SEARs for the proposal.	Compliant.	• No SEARs for the development. Addressed in section 3.2.7.
NSW (Mitchell) landscape on which the subject land occurs.	Compliant.	• Addressed in section 3.2.6. Two Mitchel landscapes with Belrose Coastal Slopes (Bsl). being the dominant used for the assessment.
Native vegetation		

Information	Compliance	Comments
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).	Compliant.	• Previous mapping of the subject land is discussed in section 2.2.1 and native vegetation extent and use of aerial imagery discussed in section 2.2.2. • The subject land does not contain any cleared land.
Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM Subsection 4.1.2).	Compliant.	• The entire subject land contains native vegetation as discussed 2.2.1
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).	Compliant.	• Addressed in section 2.1 and 2.2 of the BDAR.
Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2.	Compliant.	• Preliminary and site stratification and BAM plots discussed in sections 2.2.3 and 4.5.1, and mapped in Figure 5.
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).	Compliant.	• The BDAR does not indicate the use of local data.
For each PCT within the subject land, describe: • **Vegetation class.** • **Extent (ha) within subject land.** • **Evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM Section 4.2(1–3.)).** • **Plant species relied upon for identification of the PCT and relative abundance of each species.** • **If relevant, TEC status including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2(1–2.)).** • **Estimate of percent cleared value of PCT (BAM Subsection 4.2.1(5.)).**	Compliant.	• An overview of each PCT is provided in section 4.2

Information	Compliance	Comments
Describe the vegetation integrity assessment of the subject land, including: • **Identification and mapping of vegetation zones (as described in BAM Subsection 4.3.1).** • **Assessment of patch size (as described in BAM Subsection 4.3.2).** • **Survey effort (i.e. number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4(1–2.).** • **Use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3(5.)).**	Compliant.	• Vegetation zones identified in section 4.4 and shown in Figure 7. • Assessment of patch size and assignment to a patch size class in accordance with the BAM outlined in section 4.4 and Table 8. • Survey effort (number of BAM Plots) outlined in section 4.5.1, and mapped in Figure 5. – The number of plots meet the minimum requirements under the BAM. • No benchmark data has been used.
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).	Compliant.	• The BDAR does not indicate the use of local benchmark data as discussed in section 4.5.3.
Table of current vegetation integrity scores for each vegetation zone within the site and including: • **Composition condition score** • **Structure condition score** • **Function condition score** • **Presence of hollow bearing trees**	Compliant.	• Vegetation Integrity score is provided throughout the BDAR. • Composition condition score, structure condition score, function condition and presence of hollow bearing trees included within section 4.5 and Table 9.
Table of patch size areas (as described in BAM Subsection 4.3.2).	Compliant.	• Table 8 and Figure 2 reflect vegetation zones and patch size class (>100 ha).

Threatened species		
Identify ecosystem credit species likely to occur on the subject land, including: • **List of ecosystem credit species derived from the BAM-C (as described in BAM Subsection 5.1.1 and Section 5.2(1.)).** • **Justification and supporting evidence for exclusion of any ecosystem credit species based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2).** • **Justification for addition of any ecosystem credit species to the list.**	Compliant.	• Addressed in section 5.1.1. • List of ecosystem credit species derived from BAM-C provided in section 5.1.1 Table 10 of the BDAR. • Section 2.3.1 states that *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).* • Table 10 indicates the ecosystem credit species that were included in the assessment, with 13 species having a 'Partial' inclusion when a species is retained within one vegetation zone but not another. – 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.
Identify species credit species likely to occur on the subject land, including: • **List of species credit species derived from the BAM-C (as described in BAM Subsection 5.1.1).** • **Justification and supporting evidence for exclusions based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2).** • **Justification and supporting evidence for exclusions based on degraded habitat constraints and/or microhabitats on which the species depends (as described in BAM Subsection 5.2.2).** • **Justification for addition of any species credit species to the list.**	Compliant.	• Addressed in section 5.1.2. • List of species credit species derived provided in section 5.1.2 Table 11 of the BDAR. • A review of the BAM-C for the project confirms Table 11 and 12 provide the correct list of candidate species as provided by the BAM-C for a Part 4 Development BDAR. • No predicted flora species have been added to assessment. • Two flora species have been excluded from the assessment (*Diuris bracteata* and *Deyeuxia appressa*) with suitable justification provided in section 5.1.2. • Five flora species have been excluded from further assessment on the basis of geographic limitations and suitable justification provided. • The Sooty Owl has been added to the list on the basis of known records nearby. • Three endangered populations and five threatened fauna species have been excluded from further assessment on the basis of geographic limitations or habitat constraints and suitable evidence provided. • Dural Land Snail has been excluded from further assessment on the basis of vagrancy and suitable evidence provided.

From the list of candidate species credit species, identify: • **Species assumed present within the subject land (if relevant) (as described in BAM Subsection 5.2.4(2.a.)).** • **Species present within the subject land on the basis of being identified on an important habitat map for a species (as described in BAM Subsection 5.2.4(2.d.)).** • **Species for which targeted surveys are to be completed to determine species presence (Subsection 5.2.4(2.b.)).** • **Species for which an expert report is to be used to determine species presence (Subsection 5.2.4(2.c.)).**	Compliant.	• Addressed in section 5.2 and Table 13. – *Cryptostylis hunteriana* has been assumed present within the subject land. – Table 13 and 14 of the BDAR lists the candidate species credit species and the method used to determine presence. – No important habitat mapping occurs within the subject land, as identified in Table 12. – Section 5.4 indicates no expert reports were used. – Biosis agrees with the species ruled out as candidate species, based on geographic limitations or habitat constraints.
Present the outcomes of species credit species assessments from: • **Threatened species survey (as described in BAM Section 5.2.4).** • **Expert reports (if relevant) including justification for presence of the species and information used to make this determination (as described in BAM Section 5.2.4 and 5.3, Box 3).**	Compliant.	• Outcomes of threatened species survey outlined in Section 5.3 (Table 15 and 16) and section 5.6. • No expert reports were used.
Where survey has been undertaken include detailed information on: • **Survey method and effort, (as described in BAM Section 5.3).** • **Justification of survey method and effort (e.g. citation of peer-reviewed literature) if approach differs from the Department's taxa-specific survey guides or where no relevant guideline has been published.** • **Timing of survey in relation to requirements in the TBDC or the Department's taxa-specific survey guides. Where survey was undertaken outside these guides include justification for the timing of surveys.** • **Survey personnel and relevant experience.** • **Describe any limitations to surveys and how these were addressed/overcome.**	Compliant.	• Survey method outlined throughout Section 5.3 (Table 15 and 16). • All surveys have been undertaken in accordance with relevant guidelines, or justification for survey occurring outside suitable survey periods. • Personnel involved listed along with their qualification/relevant experience in the beginning of the document. • Limitations to surveys and how they were addressed has been outlined in Section 2.6.

Where an expert report has been used in place of survey (as described in BAM Section 5.3, Box 3), include: • **Justification of the use of an expert report.** • **Identify the expert, provide evidence of their expert credentials and Departmental approval of expert status.** • **All requirements of Box 3 have been addressed in the expert report.**	Compliant.	• Expert report not used in place of survey, addressed in Section 5.4.
Where use of local data is proposed (BAM Subsection 1.4.2): • **Identify relevant species.** • **Identify data to be amended.** • **Identify source of information for local data, e.g. published literature, additional survey data, etc.** • **Justify use of local data in preference to VIS Classification or TBDC data.** • **Provide written confirmation from the decision-maker that they support the use of local data.**	Compliant.	• Use of local data not applicable, addressed in section 5.5.
Species polygon completed for species credit species present within the subject land ensuring that: • **The unit of measure for each species is documented.** • **For species assessed by area as described in BAM Subsection 5.2.5(3.)):** – **The polygon includes the extent of suitable habitat for the target species within the subject land.** – **A description of, and evidence-based justification for, the habitat constraints, features or microhabitats used to map the species polygon including reference to information in the TBDC for that species and any buffers applied.** • **For species assessed by counts of individuals:** – **The number of individual plants present on the subject land .** – **The method used to derive this number and evidence-based justification for the approach.** – **The polygon includes all individuals located on the subject land with a buffer of 30 m around the individuals or groups of individuals.**	Compliant.	• Species polygon completed for four candidate species: Eastern Pygmy-possum, Red-crowned Toadlet, *Tetratheca glandulosa* and *Cryptostylis hunteriana.* • Extent (ha) of suitable habitat (species polygon) present on site provided in Table 17 and shown in Figure 9. • The polygon for *Tetratheca glandulosa* 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. • Description and evidence to justify the species polygon is also provided in Table 17. • No species assessed by counts of individuals.

Identify the biodiversity risk weighting for each species credit species identified as present within the subject land (as described in BAM Section 5.4).	Compliant.	• Biodiversity risk weighting for PCTs and species credit species provided in Table 24 and 25.
Table showing ecosystem credit species in accordance with BAM Section 5.1.1, and identifying: • **The ecosystem credit species removed from the list.** • **The sensitivity to gain class of each species.**	Compliant.	• Section 5.1.1 and Table 10 identifies the ecosystem credit species removed from the list and sensitivity to gain class for each species.
Table detailing species credit species in accordance with BAM section 5.2 and identifying: • **The species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or micro habitat features are not present.** • **The candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map.**	Compliant.	• Section 5.1.2 Table 11 includes a complete list of species credit species in accordance with section 5.2 of the BAM. • Section 5.1.2 and Table 12 identifies the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or micro habitat features are not present, with suitable justification provided. • Tables 13 and 14 list the candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map. • Table 15 and 16 provide further discussion regarding targeted surveys for these species, and how this was undertaken i.e., method and guidelines followed.
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).	Compliant.	• Table detailing species credit species recorded or assumed as present within the subject land habitat constraints or microhabitats associated with the species, provided in Section 5.6 Tables 15 and 16 • Extent of suitable habitat present on site and biodiversity risk weighting is also provided in Tables 17 and 18.

Prescribed impacts		
Identify potential prescribed biodiversity impacts on threatened entities, including: • **Karst, caves, crevices, cliffs, rocks and other geological features of significance (as described in BAM Subsection 6.1.1).** • **Occurrences of human-made structures and non-native vegetation (as described in BAM Subsection 6.1.2).** • **Corridors or other areas of connectivity linking habitat for threatened entities (as described in BAM Subsection 6.1.3).** • **Water bodies or any hydrological processes that sustain threatened entities (as described in BAM Subsection 6.1.4).** • **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).**	Compliant.	• All prescribed impacts identified in Section 6 Table 19. • Prescribed impacts identified include Karst, caves, crevices, cliffs, rocks or other geological features of significance, Habitat connectivity, Waterbodies, water quality and hydrological processes and vehicle strikes. • These prescribed impacts are also mentioned throughout the report.
Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts.	Compliant.	• Table 19 identifies a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts.
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).	Compliant.	• Importance of habitat features to the threatened entities addressed in Table 19.

Avoid and minimise impacts		
Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative: • **Modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology.** • **Routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route.** • **Alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location.** • **Alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site.**	Compliant.	• Measures to avoid and minimise impacts addressed in section 7. A detailed discussion regarding the efforts to avoid and minimize impacts has been provided, including: – Project location: Biodiversity values within the site were assessed to identify opportunities for further avoidance and minimisation of impacts at the site scale. This resulted in amendment to a previous 2004 concept. Documents relevant to the site selection are provided in section 7.1.1. – Review of external strategic regional planning documents: 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, in order to apply avoidance to areas of high biodiversity value. – Project design: 19.8 ha of avoided land to be zoned C2, retention of the riparian corridor along Snake Creek (130 m to 400 m wide) to provide connectivity through the landscape. management of indirect impacts on the conservation zone and Snake Creek. – Avoidance of threatened species habitat. • Given the project is a Rezoning Application, further precinct-scale avoidance and minimization, including: – Further retention of native vegetation and significant trees, through a range of management plans would be prepared at the development application stage to further manage, minimise and mitigate potential impacts on biodiversity values.
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).	Compliant.	• Prescribed impacts and avoidance measures discussed in section 7.1 and 7.2. • Avoidance through project design is provided in section 7.1. • A range of management plans would also be prepared at the development application stage to further manage, minimise and mitigate potential impacts on biodiversity values during project design and construction.

Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal (as described in BAM Section 7.2.1(3.)).	Compliant.	• Provided in section 7.3. No other broad measures at the Structure Plan scale were considered and not selected for implementation.
Table of measures to be implemented to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility.	Compliant.	• Table of measures to be implemented included in section 7.4 (Table 20).
Assessment of impacts		
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).	Compliant.	• Section 8.1 Table 21 describes residual direct impacts to native vegetation, including a table summarising impacts to PCTs and threatened species. • Biosis understands that the impacts are an overestimation and impacts will be reduced following detailed design at the precinct planning level.
Assessment of indirect impacts on vegetation and threatened species and their habitat including (as described in BAM Section 8.2): • **Description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal.** • **Documenting the consequences to vegetation and threatened species and their habitat including evidence-based justifications.** • **Reporting any limitations or assumptions, etc. made during the assessment.** • **Identification of the threatened entities and their habitat likely to be affected.**	Compliant.	• Section 8.2 Table 23 provides an assessment of residual indirect impacts. The table includes all the relevant information as described in BAM section 8.2. • Section 8.2 notes that indirect impacts would be minimised through a range of design features and through implementation of a range of detailed management plans. These features and plans have been designed to avoid indirect impacts to the extent that no further offsetting is required.

Assessment of prescribed biodiversity impacts (as described in BAM Section 8.3) including: • **Assessment of the nature, extent and duration of impacts on the habitat of threatened species or ecological communities associated with:** – **Karst, caves, crevices, cliffs, rocks and other features of geological significance.** – **Human-made structures.** – **Non-native vegetation.** – **Connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range.** – **Movement of threatened species that maintains their life cycle.** – **Water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities.**	Compliant.	• Addressed in section 8.3. All the relevant information as described in BAM section 8.3 have been addressed.
Assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC.		• Addressed in section 8.3.4.
Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts.		• Table displaying the change in vegetation integrity score included in section 10.1.1 Table 24.
Mitigation and management of impacts		
Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Sections 8.4 and 8.5 including: • **Techniques, timing, frequency and responsibility.** • **Identify measures for which there is risk of failure.** • **Evaluate the risk and consequence of any residual impacts.** • **Document any adaptive management strategy proposed.**	Compliant.	• Mitigation of impacts are addressed in section 8.4. • Various site management plans and mitigation measures would be prepared for the detailed development application stage. A discussion accordance with the recommendations in BAM Sections 8.4 and 8.5 has been provided for each plan in this section.

Identification of measures for mitigating impacts related to: • **Displacement of resident fauna (as described in BAM Subsection 8.4.1(2.)).** • **Indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.)).** • **Mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2).**	Compliant.	• Outlined in section 8.4. Various site management plans and mitigation measures would be prepared for the detailed development application stage. • Details of how each management plan will mitigate the displacement of resident fauna, indirect impacts on native vegetation and habitat, and mitigating prescribed biodiversity impacts is also provided in section 8.4.
Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5).	Compliant.	• Addressed in section 8.5. • Biosis understand that the impacts in the BDAR are an overestimation. Suggest adding a statement here that an adaptive management strategy will be required to further reduce impacts to biodiversity and the detailed design stage.
Table of measures to be implemented to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility.	Compliant.	• Section 7.4 and Section 8.4 outlines tables of measures to avoid and minimise direct, indirect and prescribed impacts.

Impact summary		
Identification and assessment of impacts on TECs and threatened species that are at risk of a serious and irreversible impacts (SAII, in accordance with BAM Section 9.1) including: • **Addressing all criteria in Subsection 9.1.1 for each TEC listed as at risk of an SAII present on the subject land.** • **Addressing all criteria in Subsection 9.1.2 for each threatened species at risk of an SAII present on the subject land.** • **Documenting assumptions made and/or limitations to information.** • **Documenting all sources of data, information, references used or consulted.** • **Clearly justifying why any criteria could not be addressed.**	Compliant.	• Addressed in Section 9 – BDAR does not identify any threatened entities at risk of serious and irreversible impacts. • Six candidate species that are identified in the Threatened Biodiversity Data Collection as being at risk of SAII occur within the subject land. However, 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.
Identification of impacts requiring offset in accordance with BAM Section 9.2.	Compliant.	• Addressed in section 10.1. • Table 24 includes the ecosystem credits required to offset. • Table 25 indicates species credits requiring offsets. • A statement has been provided that: *It has conservatively been assumed that all areas of the development footprint contain native vegetation of sufficient integrity to require an offset. This is an overestimation of the extent of impact across most of the subject land.* It is understood that the credits/impacts will be revised at the detailed design stage.
Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.).	Compliant.	• Impacts not requiring offset in accordance with the BAM has been addressed in Section 10.1.1.
Identification of areas not requiring assessment in accordance with BAM Section 9.3.	Compliant.	• Addressed in section 10.2.

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).** • **Change in vegetation integrity score (BAM Subsection 8.1.1).** • **Number of required ecosystem credits for the direct impacts of the proposal on each vegetation zone within the subject land (BAM Subsection 9).** • **Number of required species credits for each candidate threatened species that is directly impacted on by the proposal (BAM Subsection 10.1.3).**	Compliant.	• Addressed in section 10.1 Table 24 and 25. • VI Score has been cross checked with the BAM-C, and is correct. • Offset credits required are correct.
Table of PCTs requiring offset and the number of ecosystem credits required.	Compliant.	• Addressed in Table 24.
Table of threatened species requiring offset and the number of species credits required.	Compliant.	• Addressed in Table 25.
Biodiversity credit report		
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).	Compliant.	• Addressed in Table 26.
Table of credit class and matching credit profile.	Compliant.	• Addressed in Table 27.

Table 2 Assessment of the minimum mapping requirements for a BDAR

Information		Comments
Introduction		
Map of the subject land boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure (if BDAR).	Compliant.	• Provided in Figure 1.

Landscape context		
Site Map: • **Boundary of subject land.** • **Cadastre of subject land.** • **Landscape features identified in BAM Subsection 3.1.3.**	Compliant.	• Provided on Figure 1 and Figure 2. • Waterways, are shown on Figure 1, habitat connectivity and Mitchel Landscapes are shown on Figure 2. • There is a note next to Figure 1 and 2 that states: The entire map area is within the Northern Beaches LGA, and is within the Pittwater IBRA subregion (SYB07), however this is not shown on the maps. • Geological features have not been displayed on any figures, however section 3.2.4 of the BDAR states that '*Geological features such as rock platforms and outcrops, are common across the landscape and unable to be mapped. There are no relevant threatened species within the subject site specifically associated with these geological features and therefore mapping of these features is not required.*'
Location Map: • **Digital aerial photography at 1:1,000 scale or finer.** • **Boundary of subject land.** • **Assessment area, (i.e. the subject land and either 1500 m buffer area or 500 m buffer for linear development.** • **Landscape features identified in BAM Subsection 3.1.3.** • **Additional detail (e.g. local government area boundaries) relevant at this scale.**	Compliant.	• Scale appears correct. • Subject land boundary shown on all Figures. • 1,500m buffer mapped on Figure 2. • Some landscape features displayed on Figures 1 and 2, such as waterways, Mitchell Landscape and habitat connectivity. IBRA region has been displayed as a note next to Figure 1 and 2, but not shown on map. • Geological features have not been displayed on any figures, however section 3.2.4 of the BDAR states that '*Geological features such as rock platforms and outcrops, are common across the landscape and unable to be mapped. There are no relevant threatened species within the subject site specifically associated with these geological features and therefore mapping of these features is not required.*'

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.** • **Rivers, streams and estuaries.** • **Wetlands and important wetlands.** • **Connectivity of different areas of habitat.** • **Karst, caves, crevices, cliffs, rocks and other geological features of significance and if required, soil hazard features.** • **Areas of outstanding biodiversity value occurring on the subject land and assessment area.** • **Any additional landscape features identified in any SEARs for the proposal.** • **NSW (Mitchell) landscape on which the subject land occurs.**	Compliant.	• Landscape features identified in BAM Subsection 3.1.3 and shown on the Site Map and/or Location map include: – Habitat connectivity. – Waterways. – IBRA region has been displayed as a note next to Figure 1 and 2. – NSW (mitchell) Landscape • Geological features have not been displayed on any figures, however the BDAR states that '*Geological features such as rock platforms and outcrops, are common across the landscape and unable to be mapped. There are no relevant threatened species within the subject site specifically associated with these geological features and therefore mapping of these features is not required.*' • There are none of the following within the subject land: – AOBVs – Important wetlands.
Native vegetation		
Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of cleared areas (as described in BAM Section 4.1(1–3.)) and all parts of the subject land that do not contain native vegetation (BAM Subsection 4.1.2).	Compliant.	• Map of native vegetation included as Figure 7. • There are no areas of the subject land that do not contain native vegetation.
Map of PCTs within the subject land (as described in BAM Section 4.2(1.)).	Compliant.	• Map of PCTs provided in Figure 7.
Map of vegetation zones within the subject land (as described in BAM Subsection 4.3.1).	Compliant.	• Vegetation zones shown on Figure 7. The BDAR states that all areas of PCT 1250, 1783 and 1824, are classed as a single condition state, therefore the condition state has not been specifically provided on the figure.
Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCTs boundaries.	Compliant.	• Map of floristic plots and vegetation integrity plots included in Figure 5a.
Map of TEC distribution on the subject land and table of TEC listing, status and area (ha).	N/A	• The subject land does not contain any TECs.
Map of patch size locations for each native vegetation zone (as described in BAM Subsection 4.3.2).	N/A	• Not mapped – all zones are part of the same patch with patch size >100 ha.
Threatened Species		

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).	Compliant.	• Map indicating the GPS coordinates of all individuals of each species recorded within the subject land and the species polygon for each species shown on Figure 9. • Species polygons for Eastern Pygmy-possum and Leafless Tongue Orchid have mapped been based on the associated PCT for each species on Figure 9. Noting that a 1 ha polygon for Leafless Tongue Orchid is assumed present within PCT 1783.
Prescribed impacts		
Map showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human-made structures, etc.).	Compliant.	• Streams, connectivity and roads are shown on various Figures. • Appendix A of the BDAR states *that rock areas are widespread and not mapped.* Suggest the major rock features are added.
Avoid and minimise impacts		
Map of alternative footprints considered to avoid or minimise impacts on biodiversity values; and of the final proposal footprint, including construction and operation.	Compliant.	• Map of alternative footprints considered to avoid or minimize impacts has been referenced in Section 7.1.1 and provided in Appendix F.
Maps demonstrating indirect impact zones where applicable.	Compliant.	• The draft structure plan and potential indirect impacts are shown on Figure 3 and Figure 11.
Assessment of impacts		
No mapping requirements.		
Mitigation and management of impacts		
No mapping requirements.		
Impact summary		
Map showing the extent of TECs at risk of an SAII within the subject land.	N/A	• No TECs or SAIIs identified in BDAR, thus maps are not required.
Map showing location of threatened species at risk of an SAII within the subject land.	N/A	• No SAIIs identified in BDAR, thus maps are not required.

Map showing location of: • **Impacts requiring offset.** • **Impacts not requiring offset.** • **Areas not requiring assessment.**	Compliant.	• Figure 9 displays species credits requiring offsets. Species polygons mapped for Eastern Pygmy-possum or Leafless Tongue Orchid have been mapped in accordance with the associated PCT for each species and further discussed in the BDAR. • Figure 10 displays mapped PCT areas requiring offset. • Areas excluded from assessment are not applicable. • Areas not requiring offset are not applicable.
Biodiversity credit report		
No mapping requirements.		

Conclusions and recommendations

Based on the above peer review, the Preliminary BDAR meets the requirements of Table 24 (Stage 1: Biodiversity assessment) and Table 25 (Stage 2: Impact assessment [biodiversity values]) of Appendix K of the BAM (DPIE 2020).

I trust that this advice is of assistance to you, however, please contact me if you would like to discuss any elements of this ecological advice further.

Yours sincerely,

R Goodwin

Rebecca Goodwin

Principal Ecologist / Accredited BAM Assessor

References

DPIE 2019. Guidance to assist a decision-maker to determine a serious and irreversible impact,.

DPIE 2020. Biodiversity Assessment Method (BAM), Department of Planning, Industry & Environment, https://www.environment.nsw.gov.au/research-and-publications/publications-search/biodiversity-assessment-method-2020.

Hayes Environmental 2024. Preliminary Biodiversity Development Assessment Report – Proposed zoning of deferred lands, Patyegarang Project.

Appendix A Curriculum Vitaes

Curriculum vitae

Rebecca Goodwin

Position

Principal Ecologist /Team Leader - Botany (NSW)

Qualifications

- Bachelor of Landscape Management & Conservation
- NSW BioBanking Assessor No. 0095
- NSW BAM Assessor BAAS17067

Other qualifications and training

- Senior First Aid
- Rail Industry Safety Induction Card
- Advanced 4WD driving and vehicle recovery
- Occupational Health and Safety General Induction for Construction Work in NSW, Work Cover

Professional experience

Rebecca has over 16 years' on-ground experience in ecology. She has been involved in a large number of ecological studies of varying scales throughout Australia. Rebecca has highly developed skills in research, project management, teamwork and effective communication, and these skills are complemented by her field skills with flora and fauna survey on a variety of small and large scale projects.

Rebecca is also an Accredited Biodiversity Assessment Method (BAM) Assessor, and Biobanking Assessor in NSW. She has delivered a number of Biodiversity Assessment Reports (BDAR), Biodiversity Stewardship Assessments (BSA) and feasibility studies for both private and government sectors.

Technical skills include including botany identification, flora and fauna habitat assessments, floristic composition and identification of Plant Community Types, targeted threatened species surveys and monitoring, environmental impact assessment, BAM, BioCertification preparation of management plans. Rebecca is also experienced in providing expert evidence in the Land and Environment Court.

Rebecca provides an innovative approach to project methodology to deliver high quality advice and pragmatic solutions. Rebecca is a skilled decision maker, adept at using a wide range of information to provide the best advice and solutions for the client in a timely and cost-effective manner.

Key project experience

Technical Director /Principal Ecologist

Picton Road Upgrade

Rebecca provided technical guidance and assisted with the field work and report writing for the Picton Road Upgrade Project Stage 1-3 Biodiversity Assessment Report (BAR) for Transport for NSW. This project included assessment of the project under multiple pieces of legislation including the NSW BC Act, Commonwealth EPBC Act, Cumberland Plain Conservation Plan, Transports Biodiversity Offset Policy and Tree Replacement Policy. The surveys included collection of data in accordance with the BAM which involved field assessment of vegetation communities including Cumberland Plain Woodland and Shale Sandstone Transition Forest CEECs, and targeted threatened species surveys for threatened flora, amphibians, large forest owls, arboreal mammals, microbats, Koalas and Cumberland Plain Land Snail.

Project Manager/Principal Ecologist

Cumberland Plain Conservation Plan – Strategic Assessment

Rebecca managed the technical mapping and analysis components of the Western Sydney Strategic Assessment process. Rebecca oversaw the project team in undertaking large scale mapping and habitat assessments. Rebecca also assisted in writing the Integrated Assessment Framework for the project that addresses the requirements of both relevant State and Commonwealth legislation. The project involved detailed mapping over 100,000 hectares of native vegetation, species modelling for threatened flora and fauna species, and TEC mapping across the Cumberland Plain IBRA sub-region. Our mapping method used the key principles of the Biodiversity Assessment Method (2017) while maximising the use of existing data and using modern data collection techniques to minimise the need for field investigation, consistent with landscape scale assessment approaches. Rebecca ensured the project ran smoothly and delivered the project outputs within the Department of Planning Industry and Environment (DPIE) required timeframes.

BAM Assessor / Expert Witness

Narellan Road BDAR / LEC

Rebecca prepared a BDAR and represented the client in Land and Environment Court (LEC) as an Ecology Expert Witness, for a proposed industrial subdivision in Narellan, NSW. The site consisted of 3.85 hectares of native vegetation within the development site, of which 2.28 hectares (moderate and scattered trees) is consistent with the CEEEC Cumberland Plain Woodland. Rebecca provided technical guidance for the client throughout the project and hearing in relation to avoiding and minimising impacts to biodiversity, which resulted in the avoidance of protection and

Accredited BAM Assessor

Beach Road Berry BSSAR

Rebecca managed and undertook a Biodiversity Stewardship Site assessment of two lots at Beach Road, Berry NSW. Biosis applied the BAM and provided a Biodiversity Stewardship Site Assessment Report and completed a Biodiversity Stewardship Agreement application. This project included collection of data in accordance with the BAM which involved field assessment of vegetation communities including Freshwater Wetlands and Swamp Oak Floodplain Forest TECS, and threatened species habitat, as well as targeted

rehabilitation of approx. 1 ha of Cumberland Plain Woodland in perpetuity within the subject site, resulting in no net loss for the project and approval of the project by the court.

Principal Ecologist / Expert Witness

Koona Ave Albion Park FFA and LEC

Rebecca provided detailed advice and prepared a Flora and Fauna Assessment Addendum and Vegetation Management Plan, to address Shoalhaven City Councils, Statement of Facts and Contentions on behalf of A&G Holdings for the proposed residential sub-division at Koona Ave Albion Park Rail. Rebecca guided A&G Holdings through the response to submissions and provided solutions to support the LEC Case, which resulted in all ecological contentions being resolved and retracted by Council.

fauna survey for Green and Golden Bell Frog and Southern Brown Bandicoot, and nocturnal fauna.

Project Director/Senior Ecologist

Hunter Region Scoping Study

Rebecca provided technical advice and guidance for the Hunter Region Scoping study on behalf of DPIE. The project involved detailed mapping of native vegetation, species modelling for threatened flora and fauna species, and TEC mapping across the Hunter sub-region. The detailed mapping was collated to provide DPIE with a constraints model of the study area as high moderate and low, to inform the Hunter Strategic Assessment and Biocertification project.

Professional affiliations and memberships

Environment Institute of Australia and New Zealand (EIANZ) Committee Member

Curriculum vitae

Matthew Hyde

Team Leader – Zoology (NSW)

Qualifications

- Bachelor of Science (Honours) Conservation Biology and Management
- NSW BAM Assessor BAAS22005

Other qualifications and training

- 4W Driving and recovery.
- Rail Industry Safety Induction Card
- Senior First Aid – St Johns Ambulance
- General Construction Induction (white card)

Professional experience

Matthew has eight years' experience in the environmental sector working in both ecology and environmental management in NSW and WA. He has been involved in many ecological studies, both as a field zoologist and project manager, and is particularly experienced in managing large transport infrastructure projects.

Matthew is an Accredited Assessor under the NSW Biodiversity Assessment Methodology (BAM) and has managed and undertaken numerous surveys to support the preparation of Biodiversity Development Assessment Reports (BDARs), Biodiversity Stewardship Site Assessment Reports (BSSARs), and Biodiversity Certification Assessment Reports (BCARs). These surveys have included broad-scale fauna habitat survey as well as targeted surveys for a wide range of threatened fauna species in accordance with relevant survey guidelines. His experience also extends to the preparation of these reports as well as the calculation of offset credits utilising the BAM Calculator (BAM-C).

In addition to targeted fauna survey, Matthew's technical skills include the provision of preclearance assessments, constraints assessments, dam dewatering and fauna salvage, aquatic macroinvertebrate survey, project planning and management, and technical report writing. He has experience across a range of projects, including residential developments and subdivisions, state significant road infrastructure and construction developments, mining projects, renewable energy developments, and water infrastructure projects. He is also skilled in the provision of project ecologist services having provided such services for large state significant infrastructure (SSI) and state significant development (SSD) projects.

Key project experience

Project Manager/Senior Zoologist

Ecological constraints assessment of the Western Sydney Freight Line Stage 2 and associated corridor options for Mott Macdonald (on behalf of TfNSW).

Project tasks included project management, fieldwork planning, candidate threatened species assessment, constrains assessment, preliminary offset calculations (using the Biodiversity Offset Payment Calculator), desktop aquatic assessments, and reporting outputs. The project also included a second constraints assessment of a proposed Intermodal facility in Kemps Creek.

Project Manager/Zoologist

Project ecologist services for Stage 2 and 3 of M4 Smart Motorway Upgrade in Western Sydney on behalf of Seymour Whyte Constructions.

Ecologist services included preclearance assessments, consistency assessments, mapping of priority weeds, hollow-bearing tree inspections and clearing supervision, and microbat culvert inspections.

Project Manager/Zoologist

Project ecologist services for the Northern Beaches Hospital Connectivity and Network Enhancement Project in French's Forest, NSW on behalf of Ferrovial.

Ecologist services included nest-box inspections, Red-crowned Toadlet targeted surveys, preclearance assessments, and microbat inspections.

Project Manager/Senior Zoologist

Ecological impact assessment and advice for the Stage 1 Master Plan of the Western Sydney Aerotropolis Precinct (Bradfield).

Project tasks have included existing conditions biodiversity assessment, aquatic assessments, Existing Native Vegetation assessment (as per the Sydney Region Growth Centers biodiversity certification order), biodiversity strategy and impact assessment, attendance at master-planning workshops, and provision of ecological advice.

Project Manager/Zoologist

Biodiversity Certification Assessment for the Western Sydney Corridor Project on behalf of TfNSW.

Project tasks included project management and survey planning, broad-scale fauna habitat assessment of proposed corridor alignments, undertaking BAM plots, preparation of assessment reports, and liaison and engagement of species experts.

Project Manager/Senior Zoologist

BDAR for the Blackheath to Little Hartley Great Western Highway Upgrade on behalf of AECOM (and TfNSW).

Responsible for designing, managing and implementing fieldwork surveys, BAM-C calculations, BDAR reporting and provision of technical advice to AECOM and ultimately TfNSW.

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10th August 2024

GYDE Consulting
Level 6, 120 Sussex Street
Sydney NSW 2000

Att: Juliet Grant
julietg@gyde.com.au

Dear Juliet,

RE: Planning Proposal Patyegarang (PP-2022-3802) - response to peer review of BDAR

I have reviewed the recent amendments to the draft structure plan, lot size map, and zoning map for the Patyegarang project as they relate to the Preliminary Biodiversity Development Assessment Report (BDAR) prepared by Hayes Environmental (version 4, dated 18th February 2024).

Amendments to the site plans include:

1. Showing of connections to two sections of perimeter road;
2. Extension of the C2 Environmental Conservation zone north along the Snake Creek corridor and along two feeder streams on the western side;
3. Introduction of a 450m^2 minimum lot size adjacent to the Snake Creek corridor; and
4. Provision of a strip of RE2 Private Recreation zone (to function as an APZ) adjacent to the property at 20 Morgan Rd.
5. Changing the zoning of the bushfire asset protection zone which runs along the southern boundary of the development from R2 Low Density Residential to RE2 Private Recreation.

These changes listed above would not increase the assessed impact on biodiversity values and would not alter the findings of the preliminary biodiversity assessment for the project.

The changes seek to increase the certainty of avoidance and mitigation measures proposed for the project, as set out in the BDAR.

Please do not hesitate to contact me if further clarification is required on these matters.

Kind regards,

Rebecca Hogan
BSc (environmental biology) MEngMngt MECA (NSW)
Accredited BAM Assessor (BAAS17090)
Principal, Hayes Environmental

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ECA ECOLOGICAL CONSULTANTS ASSOCIATION of NSW Inc
2024 PRACTISING MEMBER

GYDE

31 October 2024

Planning Proposal Authority
Department of Planning, Housing and Infrastructure
4 Parramatta Square, 12 Darcy Street
Parramatta NSW 2150

Attn. Louise McMahon

Dear Louise,

Patyegarang Planning Proposal – response from Department of Climate Change, Energy, the Environment and Water – Biodiversity, Conservation and Science (BCS)

Thank you for the opportunity to respond to the BCS letter (dated 18 September 2024) regarding the Patyegarang Planning Proposal.

Preliminary Biodiversity Development Assessment Report (BDAR)

The preliminary BDAR is highly comprehensive and includes extensive documentation detailing the surveys, fieldworks and analysis which inform the conclusions and recommendations. Hayes Environmental have confirmed the preliminary BDAR meets the requirements set out under the *Biodiversity Conservation Act 2016* (BC Act), and all assumptions made in the BDAR are consistent with the current BC Act.

Further, a peer review was conducted in February 2024 confirms that the preliminary BDAR meets the requirements of Table 24 (Stage 1: Biodiversity assessment) and Table 25 (Stage 2: Impact assessment [biodiversity values]) of Appendix K of the Biodiversity Assessment Method.

In relation to BCS's concern around assessments, I refer to our previously commentary (December 2023) which addresses the adequacy of targeted surveys for relevant threatened species and identification of threatened ecological communities (TECs). Subsequently, the preliminary BDAR has been updated to confirm there is no uncertainty over the identification of Plant Community Types (PCTs) on the site. Considerable work was done across the site to specifically ground-truth and map PCTs. Threatened species associations are linked to PCTS, not TECs, and were correct as at the date of the preliminary BDAR. It is acknowledged that threatened species associations have changed regularly since commencement of the BC Act and are expected to continue to change. Technically a BDAR is only valid for 14 days, so it will need to be updated to accompany any future development application.

The preliminary BDAR sets out the avoidance and minimisation measures undertaken to meet the necessary thresholds. This is supported by significant strategic mapping of biodiversity values across the site and was used to inform the development of the indicative structure plan.

In relation to the zoning and structure plan design, the preliminary BDAR assumes a "worst case" total loss of vegetation within the development footprint. Therefore, the assessment outcomes of potential impacts will not be altered due to changes in location of zoning between the R2 and RE2 zoned land, or the design within the developable area. At this stage it is also not practical to design the structure plan to a finer scale of biodiversity values mapping. There is flexibility in the structure plan for detailed and nuanced avoidance of potential values at the detailed design stage. Any future development application will be subject to an assessment regarding the sufficient avoidance and minimisation of potential impacts on biodiversity.

Additional permitted uses (APU) in the C2 Environmental Conservation zone

It is acknowledged the PP documentation refers to the introduction of APUs in the C2 zone to permit *environmental management works, utilities and services and stormwater services*. BCS raises concern that these uses would be counterintuitive to the purposes of the C2 zone.

We note that '*environmental protection works'* and '*roads'* are permissible in the C2 zone under Warringah Local Environmental Plan (WLEP) 2011.

Our intention for the Snake Creek corridor, as stated in the PP, is to improve water quality and overall environment in the Snake Creek corridor (including the protection of environmentally sensitive flora fauna) through the management of stormwater and the implementation of WSUD initiatives. Upon review, it is anticipated these works could be characterised as '*environmental protection works'*.

Accordingly, there is no need to reference additional permitted uses in the C2 zone and the request from BCS to avoid APUs in the C2 zone can be accommodated.

Development near zone boundaries

Section 5.1 of the updated Planning Proposal includes a proposal to modify WLEP 2011 clause 5.3 regarding development near zone boundaries, such that it will apply to the R2, RE2, and C2 zones.

It is acknowledged that the *Standard Instrument – Principal Local Environmental Plan (2006)* states:

> *" (3) This clause does not apply to— (a) land in Zone RE1 Public Recreation, Zone C1 National Parks and Nature Reserves, Zone C2 Environmental Conservation, Zone C3 Environmental Management or Zone W1 Natural Waterways, or"*

Accordingly, to respond to the concerns raised by BCS and to comply with the Standard Instrument Order, we agree to remove the reference to C2 zoned land within the proposed clause, so to only apply between the RE2 Private Recreation and R2 Low Density Residential zones.

If you would like to discuss this further, please do not hesitate to contact me.

Yours sincerely

Juliet Grant
Executive Director
julietg@gyde.com.au