

Biodiversity Development Assessment Report

122 Riverview Rd, Avalon Beach

By Ecological Consultants Australia Pty Ltd TA

Kingfisher Urban Ecology and Wetlands

March 2022



About this document

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Statement of Authorship

This study and report was undertaken by Ecological Consultants Australia at Studio 1/33 Avalon Parade, Avalon. The author of the report is Geraldene Dalby-Ball with qualifications BSc. majoring in Ecology and Botany with over 20 years' experience in this field and Luke Johnson with qualifications B EnvSc.

Limitations Statement

Information presented in this report is based on an objective study undertaken in response to the brief provided by the client. Any opinions expressed in this report are the professional, objective opinions of the authors and are not intended to advocate any particular proposal or pre-determined position.

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Executive Summary

Introduction

Ecological Consultants Australia (ECA) has been contracted by Interlock Design & Construction to provide a **Biodiversity Development Assessment Report** for a proposal at 122 Riverview Rd, Avalon Beach within the Northern Beaches Council Local Government Area (LGA).

Trigger for a formal BDAR under the BC Act 2016:

The proposed development area impact areas identified by the Biodiversity Values map published by the Chief Executive of the NSW Office of Environment and Heritage.

Stage 1: Biodiversity Assessment

- On-ground survey took place in March 2022 by Senior Ecologist Geraldene Dalby-Ball.
- Data was gathered across one BAM plot located within the vegetation zone at the site.
- Flora and fauna observations were recorded on-site using binoculars and physical examination. Notes, photos and samples of flora species were taken to assess ecological health and value of the site.
- Bionet searches were performed for flora, fauna and endangered populations to identify if there were previous records of threatened species occurring within the local area using a 10km radius around the site.

Results

Stage 2: Impact Assessment

- The impact calculations were made based on there being direct impacts to vegetation from the proposed development. The impact area and/or areas of modification has been calculated as 0.08ha and includes all areas of vegetation within the proposed Lot 81 site.
- Survey plots were within a vegetation community identified as Pittwater Spotted Gum Forest (PSGF) (PCT1214).
- Nine (9) trees in total are proposed for removal (see Arborist report 1 Dec 2021) to accommodate the proposed dwelling. Five trees were given consent to be removed from the DA2017/1368.
- One tree (T4) has already been removed from the previous consent.
- Four trees proposed to be removed as part of the current DA.
- The site is within Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion (PCT 1214) PCT 1214 is an endangered community at state government level.
- The occurrence of PWSGF is already at risk of extinction. The site contains a significantly modified under and mid story. Previous development and landscaped areas have significantly modified the PWSGF on site. As such, the PSGF community is not in a near natural state.
- The Spotted Gums, *Angophora costata* and Forest She-Oak are all part of the PWSGC.
- The proposal is unlikely to place the community at a greater risk of extinction than what it currently is (pre-development) however tree replanting is essential as is the removal of weeds and facilitation

of natural regeneration on the site. There is ample area outside of the development area to have restored as PWSGC.

- The site is entirely within the biodiversity map. The area of proposed development is largely cleared already, and is within the biodiversity Map.
- While native canopy trees are present the understory and midstory is 99 % exotic / environmental weeds (e.g., Privet, Morning Glory, Asparagus Fern).
- No threatened species were recorded during the site surveys.

The relocation of the driveway and garage requires the removal of an additional 4 native trees. Whilst this is an increased impact on PWSG canopy, the credit obligation associated with the modified design is the same as the original obligations from the previously approved DA (1 Ecosystem Credit for PWSG). The following calculations in the BAM-C were conducted for both designs and resulted in the following change in Vegetation Integrity (VI) scores.

- Revision 0 (driveway relocation) resulted in a Total change in VI = -31.2
- Revision 1 (previous Approved DA) resulted in a Total change in VI = -28.1

Stage 3: Improving Biodiversity values

- Fauna refuge zone
- Delineation of work areas
- Vegetation clearing control measures
- Weed Management and removal
- Native seed collection
- Preservation of habitat
- Nest boxes
- Native species landscaping

See recommendations section for a detailed explanation as to how these recommendations improve biodiversity values.

Conclusions and Recommendations

- The proposed development will have an approximate impact area of 0.08ha on Pittwater Spotted Gum Forest (PSGF) (PCT 1214). The existing vegetation has been significantly altered and degraded from its natural state.
- Currently the site consists of a combination of remnant canopy and dense cover of understorey weeds. Current management practices have resulted in the high abundance of *Ipomea* and several other High Threat Weeds.
- Native vegetation would have once covered the area although due to modification and disturbance, the site has lost many natural attributes. Exotic weed species are dominant across the

ground and midstory of the site and are preventing the recruitment of the original vegetation community.

- The grand total cost to offset both ecosystem credits and species credits generated by this development is \$5,131.78(including GST), assuming payment will be made into the Biodiversity Conservation Fund.
- Measures including but not limited to; nest boxes, native species landscaping, delineation of works zones, weed removal, tree protection and fauna refuge zones should all be used to mitigate any impacts associated with the proposal and increase habitat opportunities in the area.
- The recommended inclusion of canopy tree planting (11 tube-stock) locally sourced being aquired now. Future planting of locally native mid and understory species will be a benefit to the community. Recommended species are *Corymbia maculata* (3), *Angophora costata* (2), *Eucalyptus paniculata* (1), *Banksia integrifolia* (2), *Banksia serrata* (2), *Glochidion ferdinandi* (1).
- The site will be improved with the removal of environmental weeds and plantings, including native Pittwater Spotted Gum species in the mid and understory. A landscape plan has been included with this DA submission (see separate submission also Figure 1.3c).
- Two boxes for micro-bats can be installed in trees being retained. This will assist with the loss of potential hollows that would have started to form in aging trees (no hollows observed).

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Stage 1: Biodiversity Assessment

1 Introduction

Ecological Consultants Australia (ECA) has been contracted by Interlock Design & Construction to provide a **Biodiversity Development Assessment Report** for a proposal at 122 Riverview Rd, Avalon Beach within the Northern Beaches Council Local Government Area (LGA).

1.1 Site information and general description

The Subject Site (the “Site”) is the area of direct and likely indirect impacts and is defined as the whole of the property.

This area has been assessed in the Biodiversity Assessment Method Calculator (BAM-C) from which offset credits have been generated.

Table 1 - Site Administrative Information

Category	Details
Title Reference (Lot/DP)	Proposed Lot 81 DP24563
Lot Area	964.2 m ²
Street Address	122 Riverview Rd, Avalon Beach NSW 2107
LGA	Northern Beaches Council
Land Zoning	C4: Environmental Living



Figure 1.1a. Existing Lot Boundary. Source: SixMaps 2022

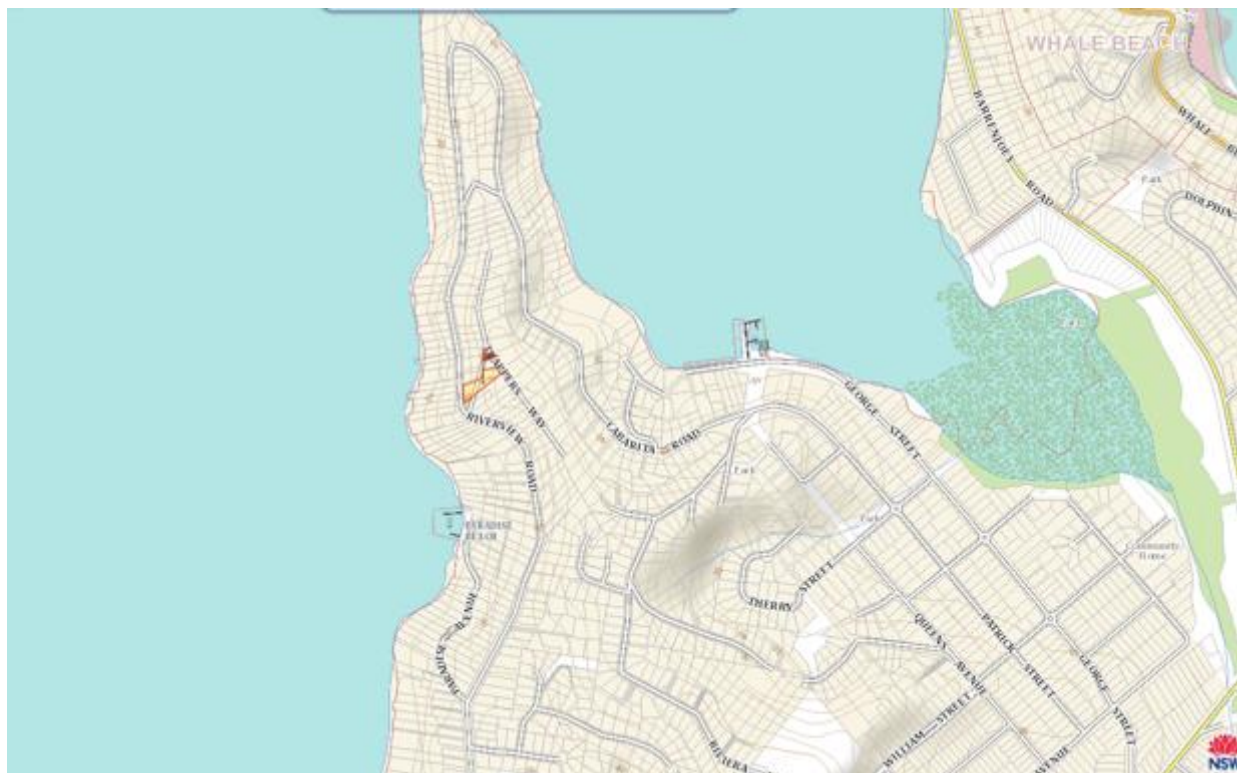


Figure 1.1b. The site in relation to main roads. Source: SixMaps 2022.



Figure 1.1c. Site Boundary. Six Maps, Accessed 2022



Figure 1.1d. Site Boundary. Google Satellite, Accessed 2022



Figure 1.2. Construction and Operational Footprints

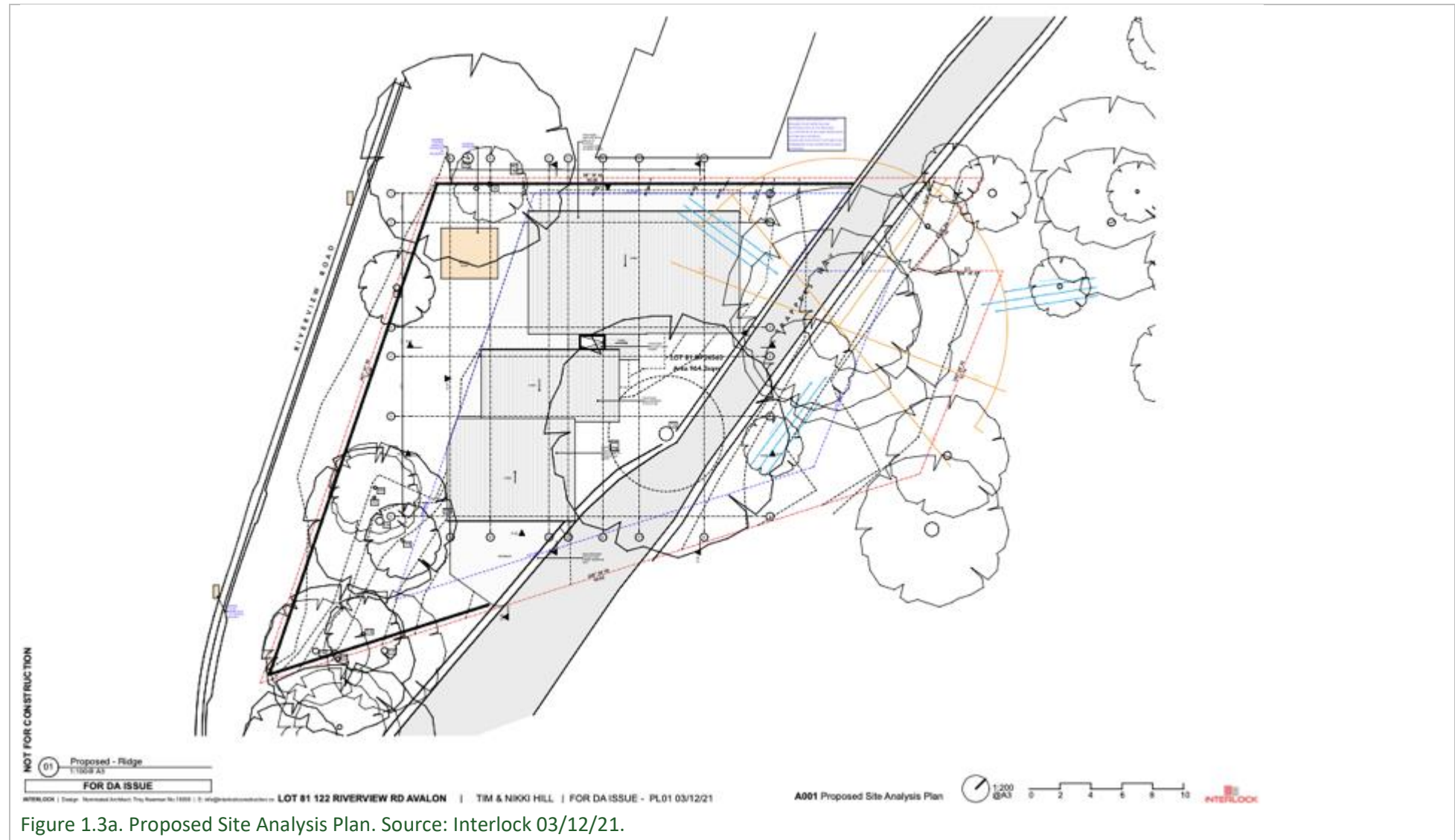
1.2 Site history

Residential development within the surrounding area was commenced around the 1950's. Prior to this the area consisted of native bushland. Currently the site consists of a combination of remnant canopy and understorey regrowth.

Native vegetation would have once covered the area although due to modification and disturbance, the site has lost many natural attributes. Exotic weed species are dominant across the ground and midstory of the site and are preventing the recruitment of the original vegetation community.

1.3 Proposed actions

The proposed project involves construction of new dwelling, deck and garage.



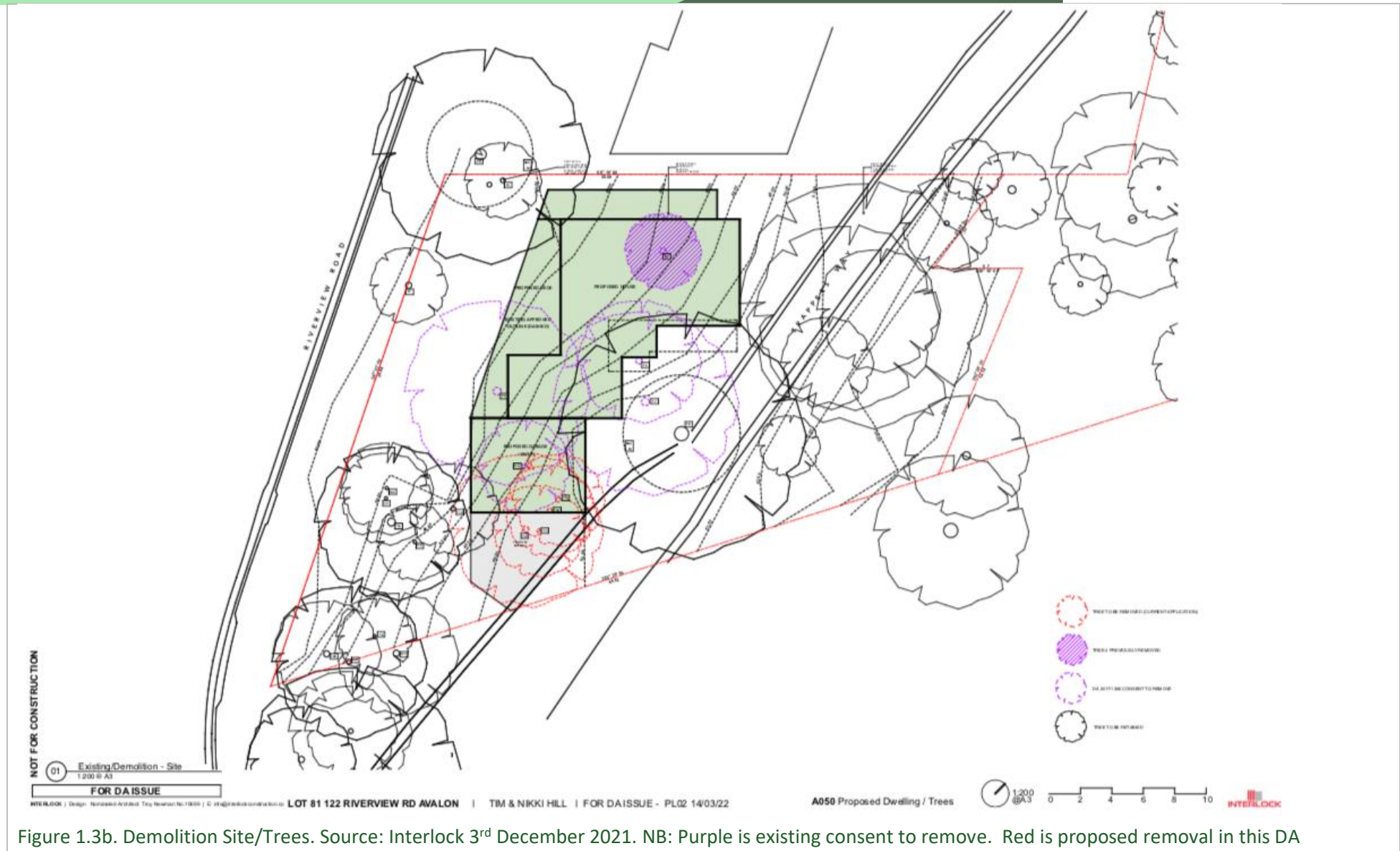
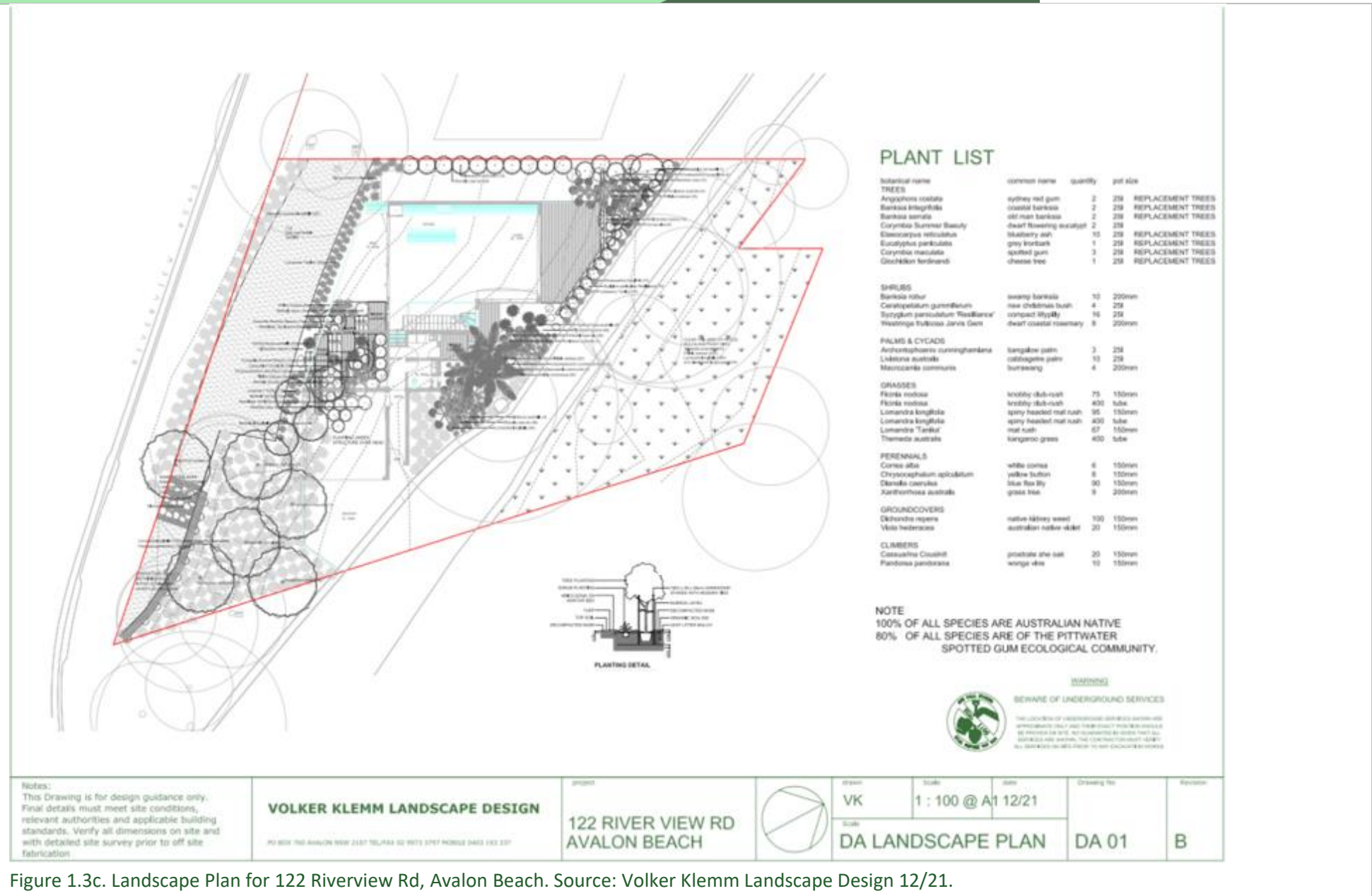


Figure 1.3b. Demolition Site/Trees. Source: Interlock 3rd December 2021. NB: Purple is existing consent to remove. Red is proposed removal in this DA



1.4 Sources of information used in the assessment

The following sources of information were used for this assessment:

- SeedMaps 2022
- SydneyMetroArea_v3.1_2016_E-VIS_4489
- BioNet DPIE (2021)
- Planning for Bush Fire Protection (PBP) NSW RFS 2019.
- Plans – Master Set. Interlock 03/12/21.
- Landscape Plan. Volker Klemm Landscape Design, 12/21.
- Stormwater Plans. NB Consulting Engineers, Dec. 21.
- Survey Plan. Byrne & Associates, 27/05/16.
- Arboricultural Impact Report. Landscape Matrix Pty Ltd, 22/12/21.
- BASIX Certificate. Interlock Construction, 21/12/21.
- Biodiversity – Ecological Letter and 5-part test. ECA Pty Ltd 11/11/21.
- Geotechnical Risk Management Policy for Pittwater. White Geotechnical Grp Pty Ltd, 19/11/21.
- Statement of Environmental Effects. Interlock Design + Construction, 22/12/21.
- Waste Management Plan, 25 Oct 2016.

1.5 Legislative context and statutory requirements

1.5.1 NSW Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* and the *Environmental Planning and Assessment Regulation 2000* institutes and sets out a system for environmental planning and assessment in NSW and includes Part 4 which deals with development applications on private land.

This proposal falls under a Part 4 development and requires development consent and associated environmental assessment.

1.5.2 NSW Biodiversity Conservation Act 2016 and associated documents

The *Biodiversity Conservation Act 2016* (BC Act 2016) is the key legislation that enables the conservation of biodiversity within the state of New South Wales. The BC Act 2016 facilitates the assessment and on-going protection of flora and fauna, including threatened species and ecological communities. The BC Act 2016 outlines assessment and offsetting requirements for activities with the potential to impact on threatened species and ecological communities in NSW, and the clearing of native vegetation which exceeds the threshold.

The BC Act also:

- Outlines the licences required under the BC Act to harm protected flora and fauna;
- Lists Threatened species and ecological communities in Schedules 1 and 2;

- Sets out monetary and imprisonment penalties for offences relating to the harming of protected flora and fauna;
- Under Part 7 (s7.4), introduces a list of activities/proposal that exceeds the biodiversity offsets scheme threshold.

The NSW *Biodiversity Conservation Regulation 2017* sets out the Biodiversity Offsets Scheme entry threshold for Part 4 developments under the EP&A Act 1979. If the development triggers at least one (1) entry threshold, the development must be assessment under The BC Act using the Biodiversity Assessment Method (BAM) (OEH 2017). See also <https://www.environment.nsw.gov.au/biodiversity/entryrequirements.htm>

The development triggers the Biodiversity Offsets Scheme entry threshold as the whole of the site is identified on the Biodiversity Values (BV) map. The assessment type used in the BAM-C is Part 4 Developments (Small Area). Vegetation zones have annexed the appropriate areas of native vegetation which will be modified or removed. Thus, an adequate BDAR has been provided to the consent authority.

1.5.3 NSW State Environmental Planning Policy Koala Habitat Protection 2021.

The State Environmental Planning Policy (SEPP) (Koala Habitat Protection) 2021 applies to the proposed development as there is no approved Koala Plan of Management which applies. The subject land is less than one hectare and is not considered to constitute core koala habitat. The area to be impacted does contain “Koala Use Trees”, however a KMP is not required.

1.5.4 Commonwealth Environmental Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is applicable if it was considered that an impact on a 'matter of National Environmental Significance (NES)' were likely, thus providing a trigger for referral of the proposal to the Department of Environment and Heritage.

Matters of national environmental significance identified in the Act are:

- world heritage properties;
- national heritage places;
- Ramsar wetlands;
- nationally threatened species and communities;
- migratory species protected under international agreements;
- the Commonwealth marine environment; and
- nuclear actions.

The Commonwealth Government has published Significant Impact Guidelines (DE 2013) to assist in the determination of whether an action is likely to have a significant impact on a matter of NES. The proposal is not expected to significantly impact any MNES.

1.5.5 Pittwater Local Environmental Plan 2014

The site is identified as “biodiversity” on the Terrestrial Biodiversity Map as published by Pittwater Council. (Map Identification Number: 6370_COM_BIO_010_010_20140217).

As identified in PLEP (2014) the aim of part 7, clause 7.6 is to maintain terrestrial, riparian and aquatic biodiversity by—

- (a) protecting native fauna and flora, and
- (b) protecting the ecological processes necessary for their continued existence, and
- (c) encouraging the conservation and recovery of native fauna and flora and their habitats.

The proposal will include revegetation areas and biodiversity strategies which will satisfy and contribute to the objectives of the PLEP. Mitigation measures are outlined in section 10 of this report.

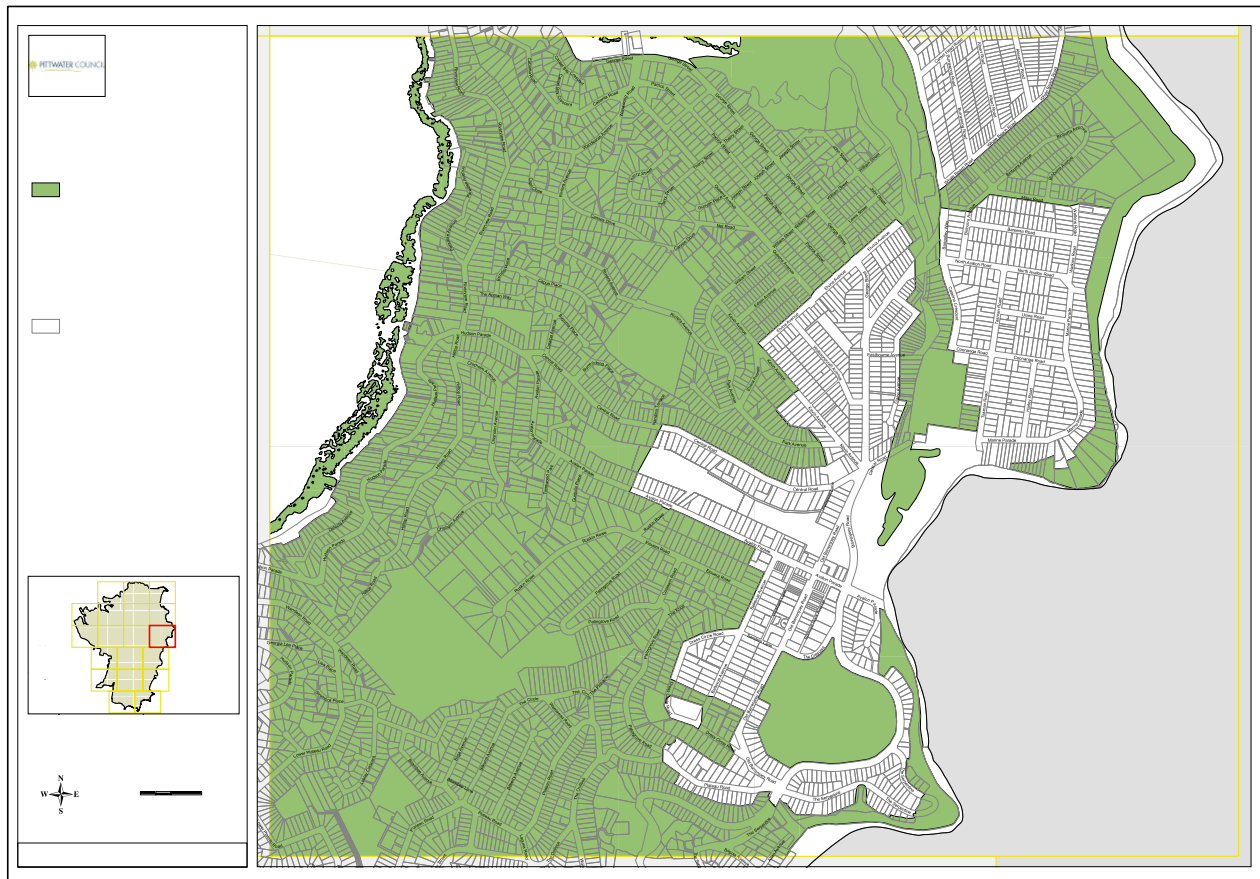


Figure 1.3. The site is situated on “Biodiversity” on the Terrestrial Biodiversity Map as published by Pittwater Council.

1.6 Biodiversity Offsets Scheme threshold

The Biodiversity Offsets Scheme applies to:

local development (assessed under Part 4 of the Environmental Planning and Assessment Act 1979) that triggers the Biodiversity Offsets Scheme threshold (see section 1.6) or is likely to significantly affect threatened species based on the test of significance in section 7.3 of the Biodiversity Conservation Act 2016.

1.6.1 BOS Area Clearing Threshold

The proposal fails to trigger the area clearing threshold as per the BOS entry requirements as the impact area exceeds the clearing area threshold for actual lot size. Area clearing thresholds are determined by minimum lot size and guidelines outlined in BAM (OEH 2017) (figure 1.8).

Table 1.1. Minimum lot size and threshold which the development exceeds.

Minimum lot size as per Northern Beaches Council LEP	700m ² /0.07ha
Actual lot size	964.2m ² /0.0964ha
Threshold for clearing, above which the BAM and offsets scheme apply (per actual lot size)	0.25ha
Impact area	0.08ha

Area clearing threshold

The area threshold varies depending on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan (LEP)), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP).

Minimum lot size associated with the property	Threshold for clearing, above which the BAM and offsets scheme apply
Less than 1 ha	0.25 ha or more
1 ha to less than 40 ha	0.5 ha or more
40 ha to less than 1000 ha	1 ha or more
1000 ha or more	2 ha or more

Figure 1.4. The area clearing threshold as per the BOS entry requirements.

1.6.2 Biodiversity Values Map

The proposed development area impact areas identified by the Biodiversity Values map published by the Chief Executive of the NSW Office of Environment and Heritage.

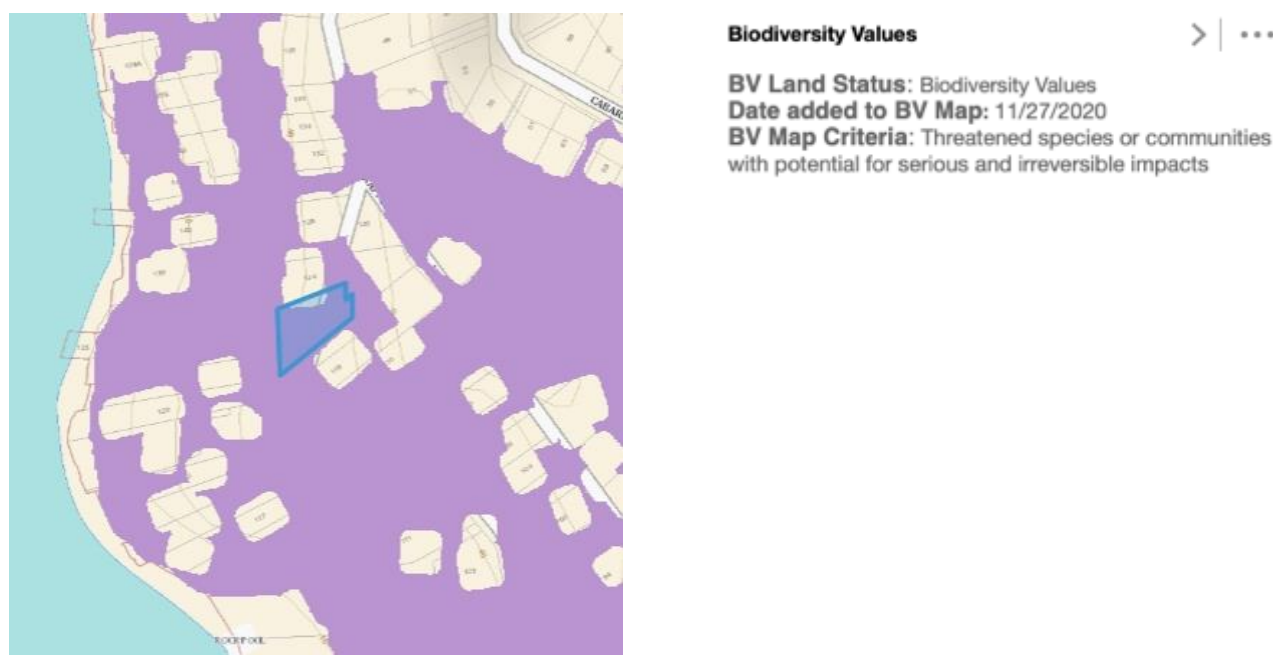



Figure 1.5. Biodiversity Map – Site in red. Source: <https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap> 2022

2 Landscape features and site context

The site is located within low density environmental living setting. The surrounding properties are made up of single dwelling lots with a high percentage of native canopy and patches of native bushland.

Table 2.1 - Site Biodiversity Information

Category	Details
Interim Biogeographic Regionalisation for Australia (IBRA)	Sydney Basin
IBRA Sub Region	Pittwater
NSW Landscape	<p>Belrose Coastal Slopes Bsl</p> <p>★ Mitchell Landscapes v3.1 - Ecosystem Meso Grouping</p> <p>Ecosystem Meso Grouping: SB Pittwater Landscape Code: Bsl Landscape Name: Belrose Coastal Slopes Over Cleared Status: Estimate Fraction Cleared: 0.59</p> 
% Native vegetation cover	20% in the 1500m radius circle See Figure 2.3
Landscape features	
Rivers and streams	No rivers or streams are located within the site or the surrounding lots. The steep slope and proximity to Pittwater results immediate dispersal of storm water runoff.
Wetlands	No wetlands occur within the site or within proximity to the proposed development.
Connectivity features	Vegetation on site is connected to adjoining bushland via canopy trees and gardens.
Areas of geological significance and soil hazard features	No
Areas of Outstanding Biodiversity Value identified under the BC Act	No

Geology and Soil



Figure 2.1. Soil Landscape. Source: eSpade v2.1 2022.

“Watagan” is the identified soil landscape for the site as per eSpade2.0 (DPIE, 2021).

Watagan soil landscapes are categorized by very steep hills on fine-grained Narrabeen Group sediments. Local relief 60–120 m, slopes >25%. Narrow, convex crests and ridges, steep colluvial sideslopes, occasional sandstone boulders and benches.

Soils—shallow to deep (30–200 cm)

Lithosols/Siliceous Sands (Uc1.24) and Yellow Podzolic Soils (Dy3.21, Dy3.41, Dy4.11) on sandstones; moderately deep (100–200 cm) Brown Podzolic Soils (Db1.11), Red {Podzolic Soils (Dr2.21) and Gleyed Podzolic Soils (Dg2.21) on shales.

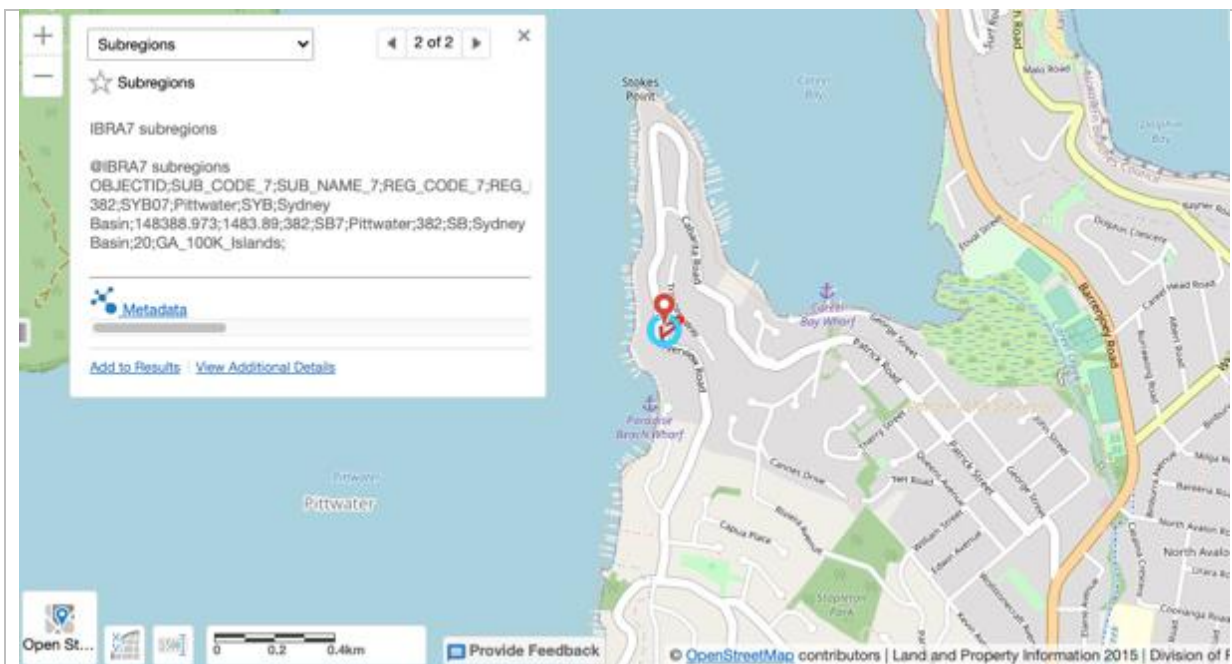


Figure 2.2. Location site within the Pittwater IBRA Subregion. Source: SEED 2022.

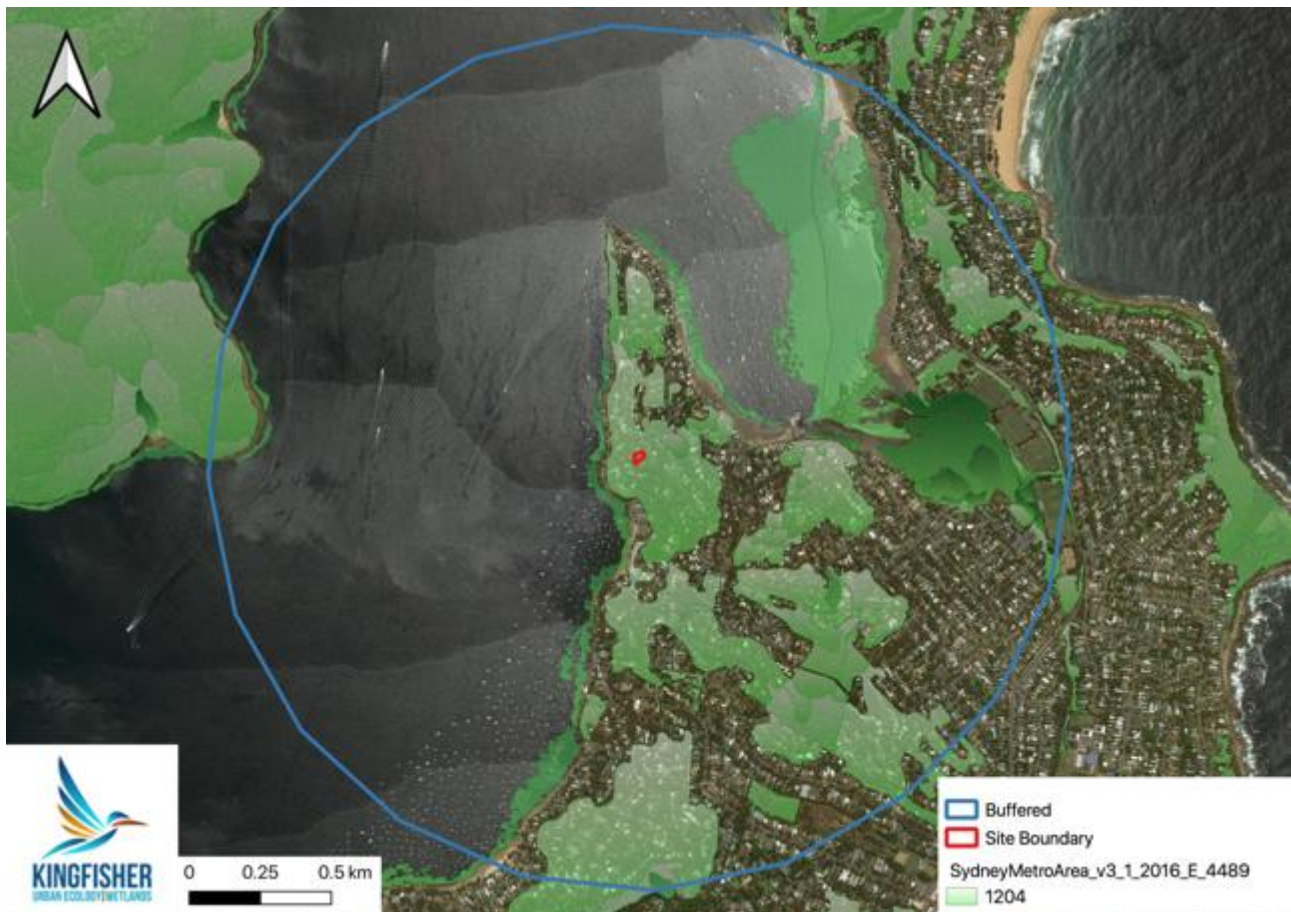


Figure 2.3. Blue circle showing the 1.5km buffer around the site.

3 Native vegetation

3.1 Desktop and Survey results – Plant Community Types (PCTs)

A review of the most up-to-date vegetation mapping, SydneyMetroArea_v3.1_2016_E_VIS_4489, identified one (1) plant community type (PCT) within site. The PCT are identified as; *Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion (PCT 1214)*.

Table 3.1 – Table of vegetation community synonyms as per NSW and Commonwealth legislation.

NSW PCT Code	NSW PCT Name	BC Act 2016	EPBC Act 1999
1214	Pittwater Spotted Gum Forest	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion State Conservation: Endangered Ecological Community (EEC)	-

3.1.1 Field Survey

The field survey assisted in verifying the distribution and quality of vegetation at the site. Pittwater Spotted Gum Forest (PSGF) (PCT1214) is mapped across the site via SydneyMetroArea_v3.1_2016_E_VIS_4489 (figure 3.2)

Approximately 90% of the vegetation onsite has been previously disturbed through previous clearing and inundation of high threat weeds. The majority of the site consists of a cleared understory of exotic turf, with discontinuous native canopy. The mid stratum is primarily absent within site boundaries, albeit the presence of a few native shrubs such as *Glochideon ferdinandi*, Native Mock Olive and *Acacia spp.* The ground stratum has been highly disturbed, with much of the site dominated 'High Threat Exotic' (HTE). Sections of the site consisting of >80% *Ipomea purpurmea*. Vegetation onsite is displaying signs of natural regeneration through the presence of persistent native ground species (*Hardenburgia violace*) although this is being hindered by current land use practices.

Vegetation condition across the site is mapped in Figure 3.1. The orange shaded area consists of a ground stratum of dense weed coverage and scattered native canopy species. The purple shaded area provides the greatest biodiversity value within the site with the highest quality of native species composition. Whilst these areas reflect different conditions, they have been assigned to the same vegetation zone for calculation purposes. This is due to the relatively small area of the site and inability to differentiate between the conditions using the BAM 20x20 or 10x40 plots.



Figure 3.1 Vegetation Condition on site.

PCT assessment

Vegetation has been assessed as Pittwater Spotted Gum Forest (PSGF) (PCT1214) in the BAM-C. This finding was concluded following desktop investigations and field assessments. The canopy strata of *Corymbia maculata*, *Angophora costata* and *Eucalyptus paniculata* are all species associated with PSGF. Using the precautionary principle, it's expected that the original PCT would recover in both areas (see figure 3.1) with assisted regeneration. See section 5 for a description of vegetation zones and section 6 for impact assessment.

Stratification and plot dimensions

Plots were as per the BAM Method with 20x20 plots (400m²). Due to the small area of the site, for assessing structure and composition a centre line extending beyond the site boundary to create a plot larger than (>1000m²) to assess function, as the site contained built on areas and cleared ground (see figure 3.3). See Biodiversity Assessment Method Operational Manual – Stage 1 (OEH 2018) page 26-28 for methods used.

<https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-operational-manual-stage-1-180276.pdf>



Figure 3.2. Subject site within mapped vegetation surrounding the property SydneyMetroArea_v3.1_E_VIS_4489 OEH (2016). Source: SEED Maps, 2022.



Figure 3.3. Vegetation plot location. Base Map source: Google Satellite, Accessed 2022.

3.1.2 Site Photos

Included are photos of vegetation zones and the general condition of vegetation at the site.



Plate 1. Access from Riverview Rd



Plate 2. Close up of highest quality area. Proposed for retention and rehabilitation.



Plate 3. Looking up (south) mid plot



Plate 4. Section of highest quality PWSGF



Plate 5. Large areas of weed - Morning Glory



Plate 6. Weed (morning glory)



Plate 7. Native vine - *Hardenbergia violacea*

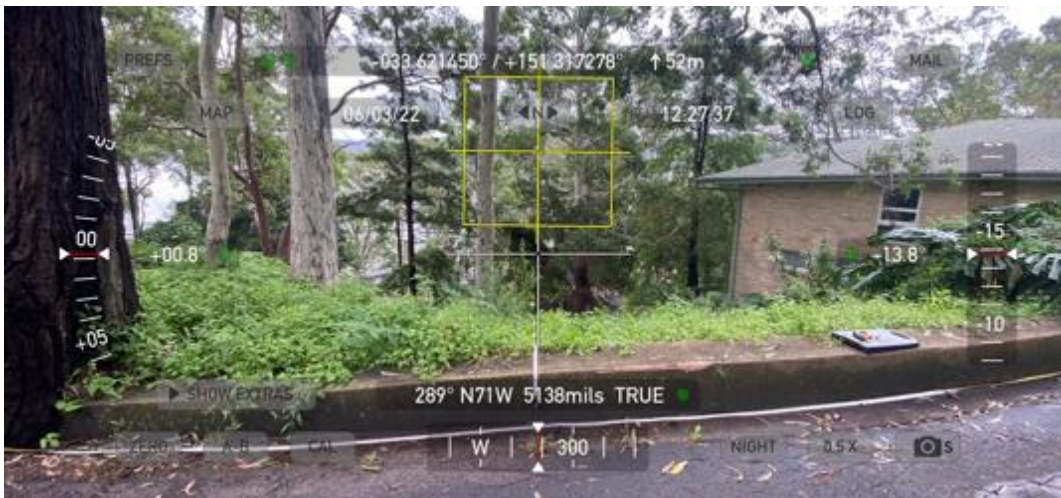


Plate 8. From top of 20x20 plot.



Plate 9. Looking from Trappers Way (Road bisecting site) to rear part of property. Weed understory.

Images below are from site inspection by ecologists and extracts from the Arborist report.



Plate 10. Ironbark and Spotted Gum on high side of Trappers Way (no dev. here – only weed removal and landscape plan.



Plate 11. Existing dwelling on the low side of Trappers Way. Proposed development area.



Plate 12. Native canopy. Mid and ground story weed.



Plate 13. Condition of land around existing dwelling.



Plate 14. The site's vegetated areas are either turf or weed species. Native species are present (as can be seen in this photo with Native grass under Ivy. Native Grape is also on-site growing through weeds.





Plate 15. Lantana, Provet and Asparagus Fern are common.



Plate 16. Sandstone floaters are present on-site and are to be retained. The can be relocated on-site if found within a building footprint.



Plate 17. Existing tree protection – for a nearby approved development.



Plate 18. Tree # 5 – Illustrating the moderate levels of dieback. Angophora proposed or removal.



Plate 19. Tree # 10 – Illustrating the dieback.

4 Threatened Species

4.1 Flora and Flora Field Survey

No threatened flora or fauna species were identified during Kingfisher 2022 field surveys.

4.1.1 Opportunistic Flora and Fauna survey methods

During opportunistic surveys, notes and photos were taken of the vegetation types and flora and fauna present onsite were recorded. Surveys were general and opportunistic in nature and were performed by traversing the site.

4.1.2 Diurnal Bird Surveys

Diurnal bird surveys occurred during mid-afternoon. Opportunistic observations of birds were made during vegetation surveys. Several species which are known to nest in hollows were predicted at the site and a dedicated effort was made to traverse the impact area to understand if hollows are present and if they are suitable for predicted bird species.

The site survey for birds primarily focused on their breeding habitat requirements such as hollows, waterways onsite, nests that are present and other features which BAM identified bird species may use for breeding purposes. It was concluded that the impact area hosts potential foraging habitat for all birds species listed in the BAM calculator. Therefore, all bird species identified in the BAM calculator were retained in the assessment for foraging purposes.

However, it is unlikely that threatened avifauna would use the impact area for breeding purposes, due to the lack of optimal breeding habitat (suitable hollows, suitable waterways). Justification for species exclusion in the BAM-C can be found in appendix I. Searches were conducted for forest owls however no individuals were recorded on site.

4.1.3 Microbats

The impact area hosts marginal foraging habitat for threatened microbat species which are identified in the BAM calculator for the site. All microbat species have been retained in the BAM calculator for foraging purposes. The site survey for microbats primarily focused on their breeding habitat requirements such as caves, outcrops, hollows and other features which microbat species may use for breeding purposes.

It has been concluded that while microbat species may use the site for foraging purposes they are unlikely to use the site for breeding purposes due to lack of optimal breeding opportunities within the impact area. Therefore, impact assessment on microbat breeding habitat has been excluded from the BAM assessment.

4.1.4 Mammal Surveys

Mammal surveys occurred during the mid-afternoon. The proposed development is not expected to significantly impact upon breeding or foraging purposes for any mammal species identified in the BAM Calculator as there are no optional habitat features within the development area.

4.1.5 Amphibian Surveys

Amphibian surveys occurred during the mid-afternoon. Opportunistic observations of amphibians were made during vegetation surveys. Any potential habitat features were investigated however no threatened

amphibian species identified in the BAM calculator were identified onsite. Habitat requirements for all threatened amphibian species identified in the BAM calculator are marginal within the impact area.

4.1.6 Reptile and Snail surveys

Reptile and Snail surveys were undertaken by thorough investigation of potential habitat including:

- Leaf litter
- Bark litter
- Stick piles
- Native ground cover vegetation
- Rocks
- Rubbish

No threatened Reptile or Snail species were identified during site investigations.

4.2 Threatened Flora - Desktop

A total of 16 threatened flora species have been recorded within 10km of the study site according to BioNet records. These species are currently listed as vulnerable or endangered under state and/or commonwealth legislation (see Table 4.1). The vulnerable and endangered species to focus on-site searches for can be seen in Table 4.1 below highlighted in bold. This is based on likelihood of occurrence.

Table 4.1. Threatened flora observed in previous ecological surveys within a 10km radius of the study site. NSW DPIE Bionet 2021.

Family	Scientific Name	Common Name	NSW status	Comm. status	Records
Rutaceae	<i>Boronia umbellata</i>	Orara Boronia	V,P	V	1
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V,3		4
Euphorbiaceae	<i>Chamaesyce psammogeton</i>	Sand Spurge	E1		7
Orchidaceae	<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V,P,2	V	1
Myrtaceae	<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	V	V	7
Myrtaceae	<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	3
Orchidaceae	<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E1,P,2	E	1
Proteaceae	<i>Grevillea caleyi</i>	Caley's Grevillea	E4A,3	CE	2
Myrtaceae	<i>Kunzea rupestris</i>		V	V	1
Proteaceae	<i>Macadamia integrifolia</i>	Macadamia Nut		V	7

Family	Scientific Name	Common Name	NSW status	Comm. status	Records
Orchidaceae	<i>Microtis angusii</i>	Angus's Onion Orchid	E1,P,2	E	25
Proteaceae	<i>Persoonia hirsuta</i>	Hairy Geebung	E1,P,3	E	5
Thymelaeaceae	<i>Pimelea curviflora</i> var. <i>curviflora</i>		V	V	1
Myrtaceae	<i>Rhodamnia rubescens</i>	Scrub Turpentine	E4A		32
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1	V	16
Elaeocarpaceae	<i>Tetratheca glandulosa</i>		V		16

Note: E = Endangered, V = Vulnerable, P = Protected.

4.3 Threatened Fauna - Desktop

A total of 54 threatened fauna species have been recorded within 10km of the study site according to BioNet records. These species are currently listed as vulnerable or endangered under state and/or commonwealth legislation (see Table 4.2). The vulnerable and endangered species to focus on-site searches for can be seen in Table 4.2 below highlighted in bold. This is based on likelihood of occurrence.

Table 4.2. Threatened fauna observed in previous ecological surveys within a 10km radius of the study site. NSW DPIE Bionet 2021.

Class	Scientific Name	Common Name	NSW Status	Comth. Status	No. of records
Amphibia	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V,P	V	26
Amphibia	<i>Pseudophryne australis</i>	Red-crowned Toadlet	V,P		32
Aves	<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A,P	CE	35
Aves	<i>Ardenna carneipes</i>	Flesh-footed Shearwater	V,P	J,K	1
Aves	<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V,P		2
Aves	<i>Burhinus grallarius</i>	Bush Stone-curlew	E1,P		48
Aves	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V,P,3		1
Aves	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V,P,2		74
Aves	<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E1,P,2	E	1
Aves	<i>Diomedea exulans</i>	Wandering Albatross	E1,P	E	4

Class	Scientific Name	Common Name	NSW Status	Comth. Status	No. of records
Aves	<i>Diomedea gibsoni</i>	Gibson's Albatross	V,P	V	1
Aves	<i>Esacus magnirostris</i>	Beach Stone-curlew	E4A,P		1
Aves	<i>Glossopsitta pusilla</i>	Little Lorikeet	V,P		7
Aves	<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V,P		4
Aves	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V,P		43
Aves	<i>Hieraaetus morphnoides</i>	Little Eagle	V,P		4
Aves	<i>Hirundapus caudacutus</i>	White-throated Needletail	P	V,C,J,K	7
Aves	<i>Ixobrychus flavicollis</i>	Black Bittern	V,P		1
Aves	<i>Lathamus discolor</i>	Swift Parrot	E1,P,3	CE	9
Aves	<i>Lophoictinia isura</i>	Square-tailed Kite	V,P,3		3
Aves	<i>Macronectes giganteus</i>	Southern Giant Petrel	E1,P	E	1
Aves	<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V,P		1
Aves	<i>Neophema pulchella</i>	Turquoise Parrot	V,P,3		1
Aves	<i>Ninox connivens</i>	Barking Owl	V,P,3		21
Aves	<i>Ninox strenua</i>	Powerful Owl	V,P,3		426
Aves	<i>Numenius madagascariensis</i>	Eastern Curlew	P	CE,C,J,K	8
Aves	<i>Onychoprion fuscata</i>	Sooty Tern	V,P		1
Aves	<i>Pandion cristatus</i>	Eastern Osprey	V,P,3		6
Aves	<i>Petroica boodang</i>	Scarlet Robin	V,P		1
Aves	<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	V,P		3
Aves	<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V,P		2
Aves	<i>Thalassarche cauta</i>	Shy Albatross	V,P	V	3
Aves	<i>Thalassarche melanophris</i>	Black-browed Albatross	V,P	V	1
Aves	<i>Tyto novaehollandiae</i>	Masked Owl	V,P,3		4
Mammalia	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V,P		84
Mammalia	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V,P	V	13
Mammalia	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V,P	E	3

Class	Scientific Name	Common Name	NSW Status	Comth. Status	No. of records
Mammalia	<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern)	E1,P	E	37
Mammalia	<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V,P		7
Mammalia	<i>Miniopterus australis</i>	Little Bent-winged Bat	V,P		36
Mammalia	<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V,P		46
Mammalia	<i>Myotis macropus</i>	Southern Myotis	V,P		13
Mammalia	<i>Petauroides volans</i>	Greater Glider	P	V	1
Mammalia	<i>Petaurus norfolcensis</i>	Squirrel Glider	V,P		3
Mammalia	<i>Phascolarctos cinereus</i>	Koala	V,P	V	76
Mammalia	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	P	V	9
Mammalia	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V,P	V	105
Mammalia	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V,P		5
Mammalia	<i>Vespadelus trougtoni</i>	Eastern Cave Bat	V,P		1
Reptilia	<i>Caretta caretta</i>	Loggerhead Turtle	E1,P	E	4
Reptilia	<i>Chelonia mydas</i>	Green Turtle	V,P	V	9
Reptilia	<i>Dermochelys coriacea</i>	Leatherback Turtle	E1,P	E	1
Reptilia	<i>Eretmochelys imbricata</i>	Hawksbill Turtle	P	V	4
Reptilia	<i>Varanus rosenbergi</i>	Rosenberg's Goanna	V,P		16

Note: E = Endangered, V = Vulnerable, P = Protected.

4.4 Endangered population

Two endangered populations have been recorded to occur within 10km of the site. Table 4.3 outlines these populations. It is unlikely that either of these populations would occur at the site due to habitat requirements and site accessibility. See Appendix I for rationale.

Table 4.3. Endangered populations in the LGA. Source: NSW OEH Bionet 2021.

Endangered Population	Scientific Name	NSW Status	Comth. Status	No. of records
Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	<i>Petaurus norfolcensis</i>	E2,V,P		1

Endangered Population	Scientific Name	NSW Status	Comth. Status	No. of records
Koala in the Pittwater Local Government Area	<i>Phascolarctos cinereus</i>	E2,V,P	V	76

Likelihood of occurrence

See Appendix I for a 'Rationale for Likelihood of Occurrence', which outlines why species have been retained or omitted from BAM calculations. Reasons for inclusion or removal are based on species habitat preferences, site investigations, species survey, Bionet records and expert opinion. During the survey, none of the above threatened species were observed on-site. Marginal foraging habitat for several species is present onsite. Thus, all predicted species were retained in the BAM-C and several candidate species were assessed for habitat suitability due to the impact on potential foraging habitat.

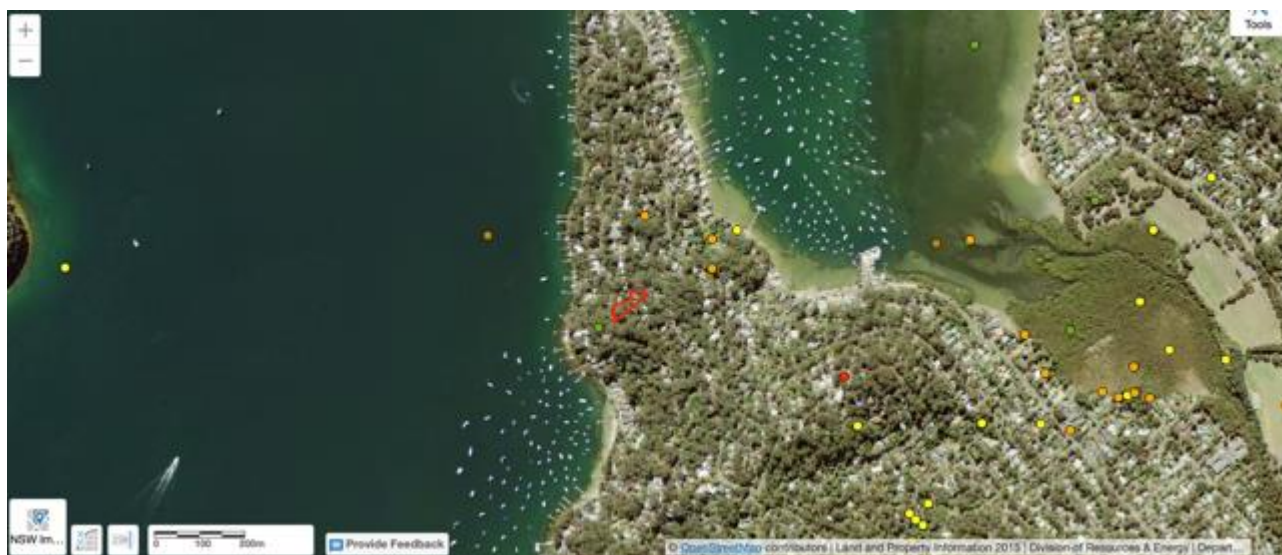


Figure 4.1. Sighted threatened species. Source: SEED 2022.

Stage 2: Impact Assessment

5 BAM Calculator

5.1 Vegetation Zones and Integrity Scores

Vegetation zones were determined on species composition at the site. The vegetation zone cover areas in which native vegetation is proposed for removal and/or modification. The single vegetation zone has been divided into management zones.

Future vegetation integrity (F-VI) scores in the BAM-C, for APZ management zones are reflective of Inner Protection Area (IPA) maintenance practices as outlined in Planning for Bush Fire Protection (PBP) NSW RFS (2019). Within the APZ, species diversity is expected to remain as per current survey results. However, the structural attributes of the vegetation will be modified in the APZ, therefore F-VI scores were adjusted accordingly. The complete vegetation removal management zones have a F-VI score of 0.

Data for the BAM-C was gathered one BAM plot located within the operational footprint of the site.

Zone One

Zone one is assessed as the entire site, as the whole of the site is proposed to undergo vegetation modification to facilitate the landscaping design and bush replanting requirements associated with the development (see figure 1.3c, Landscape Plan, 2021) and has an area of 0.08 ha.

Vegetation across the zone is in two conditions (both poor), however due to area limitations of the BAM method the site was left as a single vegetation zone within the BAM-C (refer to section 3.1 for further details). The ground staturum is dominated by high threat exotic species including *Asparagus fern* and *Ipomea purpurmea*. Weed removal has occurred, however weed cover within the site remains at <90%. Canopy cover is dominated by *Corymbia maculata* with mature individuals spread throughout the site. The poor structural diversity is reflected in the low vegetation integrity score. Vegetation is mapped and identified as PSGF, although it is highly degraded and does not reflect the natural attributes of the PSGF community. Exotic species have prevented regrowth of the native vegetation community.

This vegetation has been assessed as Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion (PCT1214) in the BAM-C. This finding was concluded following desktop investigations and field plot-based assessments and the experience of the assessing ecologist with vegetation in this area of NSW. A precautionary approach was taken and assumed that if managed correctly the seedbank of the original PCT would be likely to exist and vegetation was assessed as Pittwater Spotted Gum Forest (PSGF) TEC, in the BAM -C, albeit in poor condition.

Patch size assigned to the vegetation zone was concluded to be 100 ha. Vegetation on site is less than 100 m from native vegetation of the adjoining properties. Scattered remnant trees are common across the surrounding area.

The vegetation zone has been divided into three management zones within the BAM-C. This will reflect the future actions; complete vegetation removal building footprint (0.03ha); Exotic Turfed Lawn Area (0.01ha); Native Landscaping (0.04ha).

Table 5.1. Table of current vegetation integrity scores for vegetation zones on site.

PCT	Vegetation Zone	Area (ha)	Vegetation Integrity (VI) Score	PCT Percentage Cleared
1214 (PSGF)	1. 1214_Poor	0.08	36.5	71%



Figure 5.1. Vegetation zone and BAM plot locations on site.

Table 5.2. Management zone breakdown and Vegetation Integrity Scores

Veg Zone	Management Zone	Area (ha)	Change in Vegetation Integrity (VI) Score
1	Footprint (complete vegetation removal)	0.03	-28
1	Exotic Turfed Lawn	0.01	-36.5
1	Native Landscaping	0.04	-28.1
	Total	0.08	-31.2



Figure 5.2. Management zones on site.

5.2 Species and Ecosystem Credits

The grand total cost to offset both ecosystem credits and species credits generated by this development is \$5,131.78 (including GST), assuming payment will be made into the Biodiversity Conservation Fund. A credit is a unit used to measure the impact of a development. Credits have a price and are traded by the Biodiversity Conservation Trust (BCT) under the Biodiversity Conservation Scheme (BOS). A credit may be created due to a number of factors including but not limited to, amount of vegetation removed, critical habitat removed and alteration of the landscape.

5.2.1 Ecosystem Credit Species derived from BAM

The development and associated works generated one (1) ecosystem credits for the site. This is a reflection of the poor vegetation integrity and the small area of the site. See below, figure 5.3 for the ecosystem credit summary.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Pittwater	1214 - Pittwater Spotted Gum forest	Yes	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	18.83%	\$120.18	1.5516	\$3,690.56	1	\$3,690.56
Subtotal (excl. GST)									\$3,690.56
GST									\$369.06
Total ecosystem credits (incl. GST)									\$4,059.62

Figure 5.3. Ecosystem credit summary from the BAM calculator.

5.2.2 Species Credit Species derived from BAM

The development and associated works generated 1 species credit for Large-eared Pied Bat. This is due to the highly degraded nature of the site and lack of key habitat features associated with the listed candidate species. Refer to Appendix VII for Species Polygon.

In total the cost to offset the species credits generated will be \$1,072.16 (including GST). A list of candidate species generated by the BAM-C can be seen below in Table 5.4.

Table 5.4 Candidate species generated by the BAM-C.

Species Name	Justification in the BAM-C (see appendix I for assessment)
<ul style="list-style-type: none"> <i>Rhodamnia rubescens</i> (Scrub Turpentine) 	Surveyed
<ul style="list-style-type: none"> <i>Genoplesium baueri</i> (Bauer's Midge Orchid) 	Habitat Degraded
<ul style="list-style-type: none"> <i>Diurid bracteata</i> 	Habitat Degraded
<ul style="list-style-type: none"> <i>Hygrocybe aurantipes</i> 	Habitat Constraints
<ul style="list-style-type: none"> <i>Miniopterus orianae oceanensis</i> (Large Bent-winged Bat) 	Habitat Constraints
<ul style="list-style-type: none"> <i>Chalinolobus dwyeri</i> (Large-eared Pied Bat) 	Retained in BAM-C
<ul style="list-style-type: none"> <i>Miniopterus australis</i> (Little Bent-winged Bat) 	Habitat Constraints
<ul style="list-style-type: none"> <i>Anthochaera phrygia</i> (Regent Honeyeater) 	Habitat Constraints
<ul style="list-style-type: none"> <i>Lathamus discolor</i> (Swift Parrot) 	Habitat Constraints

It has been concluded that not all land within the impact area holds suitable habitat for threatened species. Thus, some species have been excluded due to severe habitat degradation. References used for the rationale table are species records from Bionet and information from the relevant DPIE species profile for each species and from the Threatened Biodiversity Data Collection.

Appendix I lists the species credit species predicted by the BAM Calculator and details whether the species have been further assessed based on site suitability (I.e. Habitat constraints and/or habitat degradation within the development site). Under Section 6.4.1.13 of the BAM, further species credit species can be excluded from further assessment if an assessment of habitat constraints and microhabitats determines that the habitat within the development site is substantially degraded such that the species credit species is unlikely to occur.

6 Direct Impacts

6.1.1 Vegetation disturbance and Loss

Native vegetation will be removed to accommodate for the proposed development footprint. However, the area that makes up the current building footprint is substantially degraded and provides the most suitable location for the proposed dwelling. Efforts were made to avoid impacts to trees within the site (see section 10) and integrate the current native canopy into the building design. Areas of potential habitat for PSGF will be lost (0.03ha), although the previous clearing and uncontrolled weed growth would have had greater impact on the remnant community.

This area is currently dominated by high threat exotic species and the future management practices (Exotic Turfed Lawn) will continue to modify an area (0.01ha) of potential PSGF and hinder native recovery of the original plant community. The majority of native canopy will not be impacted in this area and is planned to be protected and retained.

The remaining vegetation in zone 1 will be managed as native landscaping (0.04ha) within the property boundary. Native species planting post construction is expected to improve the species diversity within the site. Therefore, as a precautionary approach this management zone has been assessed within the BAM-C for complete removal of ground and mid-story species and the reduction of 17% of the current canopy cover.

Tree Removal

A total of nine trees are proposed for removal.

5 Trees were given consent to be removed from DA 2017/1368

1 Tree has already been removed (T4) from previous consent

4 Trees proposed to be removed as part of the current DA (see Aboricultural Impact Assessment, Landscape Matrix Pty Ltd 2021 for impact details). Of the trees proposed for removal 8 are species associated with the PWSG EEC.

It is noted that the following 5 trees have already been approved for removal through the earlier Development Consent DA2017/1368:

- **Tree #4 – *Tristaniopsis laurina* (Water Gum) already removed due to poor health and stability concern**

- Tree #5 – *Angophora costata* (Smooth Barked Apple, Sydney Red Gum)
- Tree #6 – *Corymbia maculata* (Spotted Gum)
- Tree #7 – *Corymbia maculata* (Spotted Gum)
- Tree #13 – *Corymbia maculata* (Spotted Gum)

Four additional trees are proposed for removal due to impacts associated with the developments garage/driveway.

- Tree #9 *Allocasuarina torulosa* (Forest Oak)
- Tree #10 Unidentified tree (possibly *Angophora floribunda*-Rough Barked Apple)
- Tree #11 *Corymbia maculata* (Spotted Gum)
- Tree #12 *Corymbia maculata* (Spotted Gum)

7 Indirect Impacts

7.1.1 Weed growth and invasion

Weed species are present and must be properly managed so they do not spread.

At the direct works zone weeds are to be managed by stopping seed spread on machinery, tools, equipment and worker clothes (e.g. boots). Additionally, after weed removal around the perimeter area of the construction, there must be continuous maintenance of the site otherwise it may result in increased weed growth, exacerbated by the high abundance of weeds present pre-works.

Weeds will colonize and pioneer on any cleared grounds so must be managed throughout the duration of the project as well as on-going post works

7.1.2 Introduction of pathogens

The introduction of pathogens may occur into the site, and surrounding remnant bushland, via machinery, tools, equipment and worker clothing (e.g. boots). Diseases to watch out for include Phytophthora (also known as Root Rot – type of water mold) and Myrtle Rust (*Puccinia psidii* – type of fungus). See Appendix for Bushland Hygiene Protocols for Phytophthora.

7.1.3 Soil disturbance and erosion

The removal of vegetation and trees can result in soil disturbance. The soil appears to be sodic thus erosion can occur at a faster rate. Soil compaction could occur from machinery use. It is recommended that soil compaction in non-built upon areas is to be avoided and not to occur within the trees to be retained. Replacement of woody debris and a covering of organic matter over the cleared site will prevent erosion and thus is highly recommended.

7.1.4 Water Quality

There are no streams present onsite however the proposed actions may result in transport of sediment from the work zones because of increased storm water runoff to areas downstream. Which may impact

water quality, riparian vegetation and aquatic fauna. Recommendations to maintain and improve water quality on site have been listed in section 10 below.

8 Serious and Irreversible Impact Assessment (SII)

The following section provides details which address section 10.2 of the Biodiversity Assessment Method (BAM) and thus has referenced the guiding document *Guidance to assist a decision-maker to determine a serious and irreversible impact* in order to satisfy BAM requirements.

The document *Guidance to assist a decision-maker to determine a serious and irreversible impact* outlines the steps taken determine serious and irreversible impacts in section 3.2. The steps are as follows;

1. Step one: Identify relevant entities at risk of a SII
2. Step two: Evaluate the extinction risk of the entity to be impacted
3. Step three: Detail measures taken to avoid, minimise and mitigate impacts on the entity
4. Step four: Evaluate a serious and irreversible impact
5. Step five decision making

8.1.1 Step one - Identify relevant entities at risk of a SII

Following 3.2.1 in *Guidance to assist a decision-maker to determine a serious and irreversible impact*;

The Biodiversity Assessment Report (BAR) will identify species or ecological communities at risk of a SII that are likely to be affected by the proposal. These entities are identified in the BAM Calculator (BAM-C). The front page of the credit report provided by the BAM-C will also identify all the entities that are considered to be at risk of a SII and are impacted on by the proposal.

The BAM-C Credit report can be found in appendix IV.

The following section identifies SII entities recognised by the BAM Calculator as being at risk of a serious and irreversible impact. Description of the principles for the Listed entities are available in the *Guidance to assist a decision-maker to determine a serious and irreversible impact* and are summarised as:

- Principle 1 – species or ecological community currently in a rapid rate of decline
- Principle 2 – species or ecological communities with a very small population size
- Principle 3 – species or area of ecological community with very limited geographic distribution
- Principle 4 – species or ecological community that is unlikely to respond to management and is therefore irreplaceable

The list of SII entities identified by the document was accessed via;

<https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/biodiversity-offsets-scheme/serious-and-irreversible-impacts>

Table 8. All SAI entity recognised by the BAM Calculator for the site.

Scientific Name	Common Name	Principles			
		1	2	3	4
Pittwater Spotted Gum Forest (PSGF) (PCT1214).	Pittwater Spotted Gum Forest (PSGF) (PCT1214).	X	X		
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat				X

8.1.2 Step two - Evaluate the extinction risk of the entity to be impacted

- **Large eared pied bat (*Chalinolobus dwyeri*)**

Habitat removal for the Large eared pied bat (*Chalinolobus dwyeri*) is a serious concern as the species is unlikely to respond to management (Principle 4). Maternity or breeding habitat is not present for the species within the impact area or the site. Breeding habitat such as caves, outcrops, suitable hollows and other features which microbat species may use for breeding purposes for were not identified within the impact area or onsite.

The impact area hosts marginal foraging habitat for microbats in the form of canopy cover and insect abundance. Nine native canopy trees are proposed for removal, resulting in a loss of foraging habitat and a reduction in future potential roosting habitat in the form of hollows. Alterations and degradation of habitat onsite pre BDAR would have caused a greater disruption to the species than the proposed development.

Foraging habitat will be lost, however it is expected that the trees are not significantly contributing towards the long-term survival of the species, as it is considered to be marginal habitat, only to be used occasionally or opportunistically. It is expected that the local population of Large-eared pied bat (*Chalinolobus dwyeri*) will not be significantly affected by the proposed development as they are highly mobile and may only use the site occasionally.

- **Pittwater Spotted Gum Forest (PSGF)**

Pittwater Spotted Gum Forest (PSGF) satisfies Principle 1 and 2 of SAI criteria;

- Principle 1 – species or ecological community currently in a rapid rate of decline
- Principle 2 – species or ecological communities with a very small population size

The proposed development will have an approximate impact area of 0.08ha within the 23.78ha local patch of PSGF. Vegetation due to be impacted on site has been significantly altered such that the site does not reflect the natural structural attributes of PSGF as the area is currently cleared of ground and mid-story native species and covered by THE and exotic turfed garden. Vegetation marginally reflects attributes of the PWSG community, this is primarily due historical actions on site including; clearing, erosion, and uncontrolled spread of exotic species. A majority of vegetation on site is regrowth. Exotic species are dominant across the site, current management and uses are preventing the recruitment of the original vegetation community.

Thus, the proposed development is not expected to significantly contribute to loss of PSGF due to the degraded nature of the site.

8.1.3 Step three - Detail measures taken to avoid, minimise and mitigate impacts on the entity

- **Large eared pied bat (*Chalinolobus dwyeri*)**

It has been established that maternity or breeding habitat is not present within the impact area for the Large-eared pied bat (*Chalinolobus dwyeri*). The impact area hosts marginal foraging habitat for the species in the form of canopy cover and insect abundance. To avoid additional disturbance on potential foraging habitat, only vegetation which requires removal because of proximity to the proposed building or the need to conform the landscaping requirements will be removed or modified.

Two microbat nest boxes are recommended for installation within the site boundaries. This will increase the potential for microbats to roost in the area post development. Native species landscaping across the site is also proposed to increase potential habitat area for the Large-eared pied bat (*Chalinolobus dwyeri*).

- **Pittwater Spotted Gum Forest (PSGF)**

The proposal is expected to have a negligible impact upon PSGF as core habitat for PSGF will not be removed. The vegetation proposed for removal is in poor condition and it is unlikely that the original vegetation community would recover without assistance.

The proposed dwelling has been designed in order to retain as much native canopy as possible. A corridor along the east property boundaries will undergo weed removal and native revegetated using species selected from the PSGF planting list. Delineation of works areas and exclusion zones for all vegetation to remain have been recommended. Tree protection for retained trees is also planned (see AIA, 2021 for specific details).

8.1.4 Step four - Evaluate a serious and irreversible impact

- **Large eared pied bat (*Chalinolobus dwyeri*)**

Maternity or breeding habitat is not present for the species within the impact area or onsite. The impact area hosts marginal foraging habitat for microbats in the form of canopy cover and insect abundance. Foraging habitat will be lost, however it is expected that the trees are not significantly contributing towards the long-term survival of the species, as it is considered to be marginal habitat, only to be used occasionally or opportunistically. It is expected that the proposal will not cause a disruption to the lifecycle of the Large eared pied bat (*Chalinolobus dwyeri*). Therefore, the species will not be placed at risk of a serious or irreversible impact.

- **Pittwater Spotted Gum Forest (PSGF)**

The proposed development assessed in this BDAR is not expected to significantly contribute to loss of PSGF due to the poor condition of vegetation onsite. A total area of 0.04ha of potential PWSG forest will be impacted due to the building footprint and planned turfed lawn area, however vegetation is both structurally and functionally poor due to historical actions on site. It is unlikely that this proposal would place PSGF at risk of extinction or cause a serious or irreversible impact.

Stage 3: Improving Biodiversity Values

9 Avoid and minimise impacts

The development will not significantly impact features outlined in table 9.1 below. The proposed actions will not affect water quality as there will be erosion and silt management controls onsite to prevent runoff. Below is a table showing the potential impact the development would have on features that threatened species or communities can be dependent on.

Table 9.1. Expected impact on potential habitat onsite.

Feature	Present	Description of feature characteristics and location	Potential Impact	Threatened species or community using or dependent on feature	Section of the BAR where prescribed impact is addressed.
Karst, caves, crevices, cliffs or other geologically significant feature	No	N/A	N/A	N/A	N/A
Rocks	Yes	Scattered throughout	Negligible	N/A	N/A
Human made structure	No	N/A	N/A	N/A	N/A
Non-native vegetation	Yes	Scattered throughout	Negligible	N/A	N/A

Building Location

The proposed location of the development is the most suitable location within the subdivided lot. The building footprint is located predominantly in an area of cleared land consisting of exotic turf grass and HTE. The previous approved design and excavation area associated with DA2017/1368 would have resulted in impact on the SRZ of the four additional trees proposed for removal. The new proposed location results in improved vehicle access and reduces the area of excavation.

Construction Methods

The proposed development utilises a combination of construction methods in order to minimise impacts on onsite canopy. Engagement of a Geotechnical consultant was undertaken to ensure the viability of the site for the pier support. The integration of pier support and elevated design is planned to be utilised and any works within TPZ will be supervised by the appointed project Arborist.

Minimising credit offset obligations

The relocation of the driveway and garage requires the removal of an additional 4 native trees. Whilst this is an increased impact on PWSG canopy, the credit obligation associated with the modified design is the same as the original obligations from the previously approved DA (1 Ecosystem Credit for PWSG). The following calculations in the BAM-C were conducted for both designs and resulted in the following change in Vegetation Integrity (VI) scores.

- Revision 0 (driveway relocation) resulted in a Total change in VI = -31.2
- Revision 1 (previous Approved DA) resulted in a Total change in VI = -28.1

Refer to Appendix VI for BAM-C credit and payment report comparison.

10 Recommendations

10.1.1 Wildlife corridor/ Revegetation

Pittwater Spotted Gum Forest (PSGF) species community list. Species plantings should aim to restore and improve the maximum diversity at the site. This will provide greater foraging and nesting habitat for native species and will deliver greater biodiversity gain outcomes. These species should be selected in consultation with an ecologist for the greatest ecological outcome.

This can be implemented whilst also ensuring the areas satisfy any bushfire protection requirements. Such measures will also increase habitat connectivity of the surrounding landscape. Shrub and ground covers will also increase the habitat area for other wildlife including small insectivores and insectivorous birds.

Planting of threatened flora species within revegetation areas is also recommended. Such actions will increase biodiversity within the site and the immediate landscape.

10.1.2 Weed management

Low impact bushland regeneration methods should be utilised to meet weed control performance criteria in all areas of remnant native vegetation, to prevent unnecessary impacts to native vegetation and disturbance to soil. Low impact bush regeneration methods include the manual removal of herbaceous weeds and their propagules by hand and with hand tools. All bush regeneration activities requiring the use of chemicals must be performed in accordance with the NSW *Pesticides Act 1999*. Herbicides must not be applied whilst exotic plants are setting seeds.

10.1.3 Delineation of work areas

During construction, impacts to the site and adjacent vegetation should be minimised by the delineation of works zones. Access to the site would be best restricted to the development footprint only. An environmental exclusion zone is proposed for vegetation outside work areas.

10.1.4 Vegetation clearing control measures

Pre-clearance inspection is required prior to vegetation removal to reduce the likelihood of injuring fauna. If results of the pre-clearance survey indicate the possibility of fauna within vegetation to be removed, an ecologist or fauna handler must be on site during vegetation clearing.

10.1.5 Tree Protection

Tree protection will be consistent with the Tree Survey. Main trees to be managed are trees within close proximity to building works NB: see final tree survey for details and tree numbers.

Extract from Arborist report (Dec 22nd 2021). NB: Trees are summarised in the following tables. See Arborist report for full plan.

Nine (9) trees are proposed for removal including:

The remaining four (4) trees identified and approved for removal under previous DA2017/1369 including:

T5, T6, T7 and T13

Four (4) trees proposed for removal under current DA2021/2624 to accommodate dwelling redesign including:

T9, T10, T11 and T12.

Table 5: Trees requiring removal to facilitate construction of the proposed residential development

TREE NO.	SCIENTIFIC AND COMMON NAME	COMMENTS
4	<i>Tristanopsis laurina</i> (Water Gum)	Within the footprint of the proposed dwelling and nominated for removal. NB: This tree has been removed since the original assessment.
5	<i>Angophora costata</i> (Smooth Barked Apple, Sydney Red Gum)	Immediately adjacent to the footprint of the proposed dwelling and will require removal.
6	<i>Corymbia maculata</i> (Spotted Gum)	Immediately adjacent to the footprint of the proposed dwelling and will require removal.
7	<i>Corymbia maculata</i> (Spotted Gum)	Immediately adjacent to the footprint of the proposed dwelling and will require removal.
9	<i>Allocasuarina torulosa</i> (Forest Oak)	Within the footprint of the proposed dwelling and will require removal.
10	Unidentified tree (possibly <i>Angophora floribunda</i> - Rough Barked Apple)	Within the footprint of the proposed dwelling and will require removal.
11	<i>Corymbia maculata</i> (Spotted Gum)	Immediately adjacent to the footprint of the proposed dwelling and will require removal.
12	<i>Corymbia maculata</i> (Spotted Gum)	Immediately adjacent to the footprint of the proposed dwelling and will require removal.
13	<i>Corymbia maculata</i> (Spotted Gum)	Within the footprint of the proposed dwelling and will require removal.

NB: the Pine is noted as being able to be retained as needed. There is no ecological impact either way. This species is not favored by Glossy Black Cockatoos.

Summary tables below are from the original reports and provide information on tree health – this was taken into consideration with 5-part test along with the proposed removals of the Dec 22nd report.

In Summary:

- The proposed works are outside the identified tree protection zone for tree numbers 1, 17, 18, 19, 20, 21 and 22 and no impact of substance is anticipated for these trees.
- The proposed works will impact on less than 10% of the identified TPZs of tree numbers 2, 3, 15 and 16 - this is a low level of impact and within an acceptable threshold.
- The proposed works will impact on 20 to 25% of the identified TPZ of tree number 14 – while this is a moderate to high level of encroachment the actual impact and will be minimised as it is an elevated structure supported by isolated piers. The tree will need to be very carefully managed during construction with trunk and ground protection installed (Fig. 4 of AS4970-2009) prior to commencement of works and maintained in good working order through the entire construction period.
- The proposed works will impact on 25 to 35% of the identified TPZ of tree number 8 – while this is in the high range the actual impacts will be significantly reduced as the majority of the encroachment is an elevated structure supported by isolated piers. The tree will need to be very carefully managed during

construction with trunk and ground protection installed (Fig. 4 of AS4970-2009) prior to commencement of works and maintained in good working order through the entire construction period.

Generic protection measures are recommended in section 8 of this report to minimise potential impacts to the trees to be retained.

As noted above, tree numbers 8 and 14 will need to be very carefully managed during construction with trunk and ground protection installed (in accordance with Fig. 4 of AS4970-2009) prior to commencement of works with this protection maintained in good working order through the entire construction period.

APPENDIX B - TREE DATA SUMMARY - 122 RIVERVIEW ROAD AVALON BEACH

Tree No.	Genus, Species (Common Name)	Height (m)	Canopy (m)	DBH (mm)	DBH for TPZ	DGL for SRZ	Foliage Condition	Age Class	Trunk	Trunk Lean	Crown balance	Past Pruning	Stability	Branch Attachment	Health	Vigour	Dead Wood	Pest or disease	ULE	Landscape Significance	Retention Value*	Comments
1	<i>Pinus radiata</i> (Monterey Pine, Radiata Pine)	13	7	340	340	380	Good foliage condition	Semi Mature	Single trunk	Upright	Balanced canopy area	Mid canopy branches pruned for OH wires on west	Appears stable	Sound branch attachment	Good health	Good vigour	<5%	No visual evidence of significant pest or disease	1 Long (> 40 years)	Moderate landscape significance	2	
2	<i>Eucalyptus saligna</i> (Sydney Blue Gum)	27	16	720	720	780	Good foliage condition	Mature	Single trunk	Upright	Balanced canopy area	No evidence of significant past pruning	Appears stable	Fair branch attachment	Good health	Good vigour	<5%	No visual evidence of significant pest or disease	1 Long (> 40 years)	High landscape significance	1	Located on adjoining property.
3	<i>Callistemon viminalis</i> (Weeping Bottlebrush)	6	7	Up to 160 (260 above root flare)	290	290	Good foliage condition	Mature	Multi trunked	Upright	Majority of canopy to the north	Lower limbs pruned in past to 2.5 metres for clearance from garage	Appears stable	Fair branch attachment	Good health	Fair vigour	5%	No visual evidence of significant pest or disease	2 Medium (15 to 40 years)	Moderate landscape significance	2	The tree's past canopy development has been suppressed. At the time of inspection the tree was of fair vigour and exhibited low levels of dieback.
4	<i>Tristanopsis laurina</i> (Water Gum)	7	4	Up to 90 (480 above root flare)	480	480	Good foliage condition	Mature	Multi trunked	Upright	Balanced canopy area	Tree previously cut to 0.6 metre stump	Appears stable	Poor branch attachment	Good health	Good vigour	<5%	Minor decay in pruning wounds	3 Short (5 to 15 years)	Low landscape significance	4	The tree displays poor branch attachment with multiple, poorly attached epicormic shoots following severe past pruning (cut to 0.6 metre stump in past). NB: Tree has been removed since the original assessment.
5	<i>Angophora costata</i> (Smooth Barked Apple, Sydney Red Gum)	22	8 x 12	560	560	580	Fair foliage condition	Mature	Single trunk	Upright	Majority of canopy to the west	No evidence of significant past pruning	Appears stable	Fair branch attachment	Moderate health	Fair vigour	10%	No visual evidence of significant pest or disease	2 Medium (15 to 40 years)	Moderate to high landscape significance	2	The tree's past canopy development has been suppressed. At the time of inspection the tree was of moderate health and fair vigour and exhibited moderate levels of dieback. Located on the high side of a past cut for the existing driveway - stability should be monitored.
6	<i>Corymbia maculata</i> (Spotted Gum)	13	9	380	380	390	Poor foliage condition	Mature	Single trunk	Upright	All canopy to the NW	No evidence of significant past pruning	Appears stable	Fair branch attachment	Poor health	Poor vigour	15 to 20%	No visual evidence of significant pest or disease	3 Short (5 to 15 years)	Moderate landscape significance	3	The tree's past canopy development has been significantly suppressed. At the time of inspection the tree was of poor health and poor vigour and exhibited very high levels of dieback and epicormic growth - short ULE
7	<i>Corymbia maculata</i> (Spotted Gum)	24	15	680	680	740	Good foliage condition	Mature	Single trunk	Slight trunk lean to the west	Majority of canopy to the SW	No evidence of significant past pruning	Appears stable	Fair branch attachment	Moderate health	Fair vigour	10 to 15%	No visual evidence of significant pest or disease	3 Short (5 to 15 years)	High landscape significance	3	The tree's past canopy development has been suppressed. At the time of inspection the tree was of moderate health and fair vigour and exhibited moderate to high levels of dieback and epicormic growth - short ULE
8	<i>Eucalyptus paniculata</i> (Grey Ironbark)	34	19	860	860	980	Good foliage condition	Mature	Single trunk	Upright	Majority of canopy to the north	No evidence of significant past pruning	Displays signs of instability	Fair branch attachment	Good health	Fair vigour	5%	Moderate to high levels of termite mudding in lower trunk	2 Medium (15 to 40 years)	High landscape significance	1	Slight canopy bias to north. There are moderate to high levels of termite mudding in lower trunk indicative of an internal termite nest in the lower trunk or root crown - further investigation and testing is required to determine the extent of damage (if any) and potential impacts on the tree's structural integrity (e.g. stability) - ULE rating subject to outcome of such investigations. There is evidence of past mechanical damage to lower trunk tissue consistent with vehicle impacts (located on edge of road access). At the time of inspection the tree was of fair vigour and exhibited low levels of dieback.
9	<i>Allocasuarina torulosa</i> (Forest Oak)	11	6	190	190	240	Good foliage condition	Mature	Single trunk	Upright	Majority of canopy to the north	Lower limbs pruned in past to 2.5 metres	Appears stable	Sound branch attachment	Good health	Fair vigour	5%	No visual evidence of significant pest or disease	1 Long (> 40 years)	Moderate landscape significance	2	The tree's past canopy development has been suppressed. At the time of inspection the tree was of fair vigour and exhibited low levels of dieback. Female specimen with cones.
10	Unidentified tree (possibly <i>Angophora floribunda</i> - Rough Barked Apple)	15	8	260	260	310	Poor foliage condition	Mature	Single trunk	Upright	Majority of canopy to the south	No evidence of significant past pruning	Appears stable	Fair branch attachment	Poor health	Poor vigour	15%	No visual evidence of significant pest or disease	3 Short (5 to 15 years)	Moderate landscape significance	3	The tree's past canopy development has been suppressed. At the time of inspection the tree was of poor health and poor vigour and exhibited very high levels of dieback and epicormic growth - short ULE. Unidentified - bark typical of <i>Angophora floribunda</i> , foliage typical of <i>Eucalyptus umbra</i> - no fruit observed to assist identification.
11	<i>Corymbia maculata</i> (Spotted Gum)	8	4	190	190	210	Fair foliage condition	Semi Mature	Single trunk	Upright	Majority of canopy to the SE	No evidence of significant past pruning	Appears stable	Fair branch attachment	Good health	Fair vigour	10 to 15%	No visual evidence of significant pest or disease	2 Medium (15 to 40 years)	Low to moderate landscape significance	3	The tree's past canopy development has been suppressed. At the time of inspection the tree was of fair vigour and exhibited moderate levels of dieback.

Tree No.	Genus, Species (Common Name)	Height (m)	Canopy (m)	DBH (mm)	DBH for TPZ	DBH for SPZ	Foliage Condition	Age Class	Trunk	Trunk Lean	Crown balance	Past Pruning	Stability	Branch Attachment	Health	Vigour	Dead Wood	Pest or disease	ULE	Landscape Significance	Retention Value*	Comments
12	Corymbia maculata (Spotted Gum)	19	9	380	380	420	Fair foliage condition	Mature	Single trunk	Upright	Majority of canopy to the south	No evidence of significant past pruning	Appears stable	Fair branch attachment	Moderate health	Fair vigour	10%	No visual evidence of significant pest or disease	2 Medium (15 to 40 years)	Moderate to high landscape significance	2	Slight canopy bias to south. At the time of inspection the tree was of moderate health and fair vigour and exhibited reduced foliage density and moderate levels of dieback.
13	Corymbia maculata (Spotted Gum)	14	6 x 7	ca. 250	250	300	Fair foliage condition	Semi Mature	Single trunk	Upright	All canopy to the west	No evidence of significant past pruning	Appears stable	Fair branch attachment	Poor health	Poor vigour	35%	No visual evidence of significant pest or disease	3 Short (5 to 15 years)	Low to moderate landscape significance	3	The tree's past canopy development has been suppressed. At the time of inspection the tree was of poor health and poor vigour and exhibited very high levels of dieback and epicormic growth - short ULE
14	Corymbia maculata (Spotted Gum)	17	4 x 5	ca. 210	210	250	Fair foliage condition	Semi Mature	Single trunk	Upright	Majority of canopy to the west	No evidence of significant past pruning	Appears stable	Fair branch attachment	Poor health	Poor vigour	25%	No visual evidence of significant pest or disease	3 Short (5 to 15 years)	Low to moderate landscape significance	3	The tree's past canopy development has been suppressed. At the time of inspection the tree was of poor health and poor vigour and exhibited very high levels of dieback and epicormic growth - short ULE
15	Allocasuarina torulosa (Forest Oak)	16	5	ca. 350	350	600	Fair foliage condition	Mature	Single trunk	Upright	Balanced canopy area	No evidence of significant past pruning	Displays signs of instability	Sound branch attachment	Moderate health	Poor vigour	10 to 15%	High levels of English Ivy growing on and over the tree	3 Short (5 to 15 years)	Moderate landscape significance	3	At the time of inspection the tree was of moderate health and poor vigour with moderate to high levels of dieback and high levels of English Ivy growing on and over the tree - short ULE. In addition, there is high levels of reaction wood in the basal trunk possibly indicative of decay - if present this will increase the risk of tree failure when combined with the Ivy growth.
16	Corymbia maculata (Spotted Gum)	22	12	ca. 400	400	500	Fair foliage condition	Mature	Single trunk	Upright	Majority of canopy to the west	No evidence of significant past pruning	Appears stable	Fair branch attachment	Moderate health	Fair vigour	10%	No visual evidence of significant pest or disease	2 Medium (15 to 40 years)	Moderate to high landscape significance	2	The tree's past canopy development has been suppressed. At the time of inspection the tree was of moderate health and fair vigour and exhibited reduced foliage density and low to moderate levels of dieback.
17	Corymbia maculata (Spotted Gum)	22	9	420	420	430	Good foliage condition	Semi Mature	Single trunk	Upright	Balanced canopy area	No evidence of significant past pruning	Appears stable	Fair branch attachment	Good health	Fair vigour	5 to 10%	No visual evidence of significant pest or disease	1 Long (> 40 years)	Moderate to high landscape significance	2	At the time of inspection the tree was of fair vigour and exhibited low levels of dieback.
18	Angophora costata (Smooth Barked Apple, Sydney Red Gum)	8	6	ca. 200	200	240	Good foliage condition	Semi Mature	Single trunk	Upright	Majority of canopy to the north	No evidence of significant past pruning	Appears stable	Fair branch attachment	Good health	Fair vigour	10%	No visual evidence of significant pest or disease	1 Long (> 40 years)	Low to moderate landscape significance	3	At the time of inspection the tree was of fair vigour and exhibited low to moderate levels of dieback.
19	Corymbia maculata (Spotted Gum)	16	6 x 12	290	290	310	Fair foliage condition	Semi Mature	Single trunk	Upright	Majority of canopy to the NW	No evidence of significant past pruning	Appears stable	Fair branch attachment	Good health	Fair vigour	5 to 10%	No visual evidence of significant pest or disease	1 Long (> 40 years)	Moderate landscape significance	2	At the time of inspection the tree was of fair vigour and exhibited low to moderate levels of dieback.
20	Eucalyptus paniculata (Grey Ironbark)	19	8 x 9	340	340	400	Good foliage condition	Mature	Single trunk	Upright	All canopy to the north	No evidence of significant past pruning	Displays signs of instability	Sound branch attachment	Moderate health	Fair vigour	10%	No visual evidence of significant pest or disease	2 Medium (15 to 40 years)	Moderate landscape significance	2	The tree's past canopy development has been significantly suppressed. At the time of inspection the tree was of moderate health and fair vigour and exhibited moderate to high levels of dieback and epicormic growth. Ivy growing on trunk should be removed to prevent impacts on tree in future. Located on the high side of a past cut for the existing driveway - stability should be monitored.
21	Corymbia maculata (Spotted Gum)	14	5 x 6	240	240	260	Fair foliage condition	Semi Mature	Single trunk	Slight trunk lean to the west	Majority of canopy to the west	No evidence of significant past pruning	Displays signs of instability	Fair branch attachment	Good health	Fair vigour	10%	No visual evidence of significant pest or disease	2 Medium (15 to 40 years)	Moderate landscape significance	2	The tree's past canopy development has been suppressed. Located on the high side of a past cut for the existing driveway - stability should be monitored. At the time of inspection the tree was of fair vigour and exhibited low to moderate levels of dieback.
22	Corymbia maculata (Spotted Gum)	14	5 x 6	180	180	210	Fair foliage condition	Semi Mature	Single trunk	Slight trunk lean to the north	Majority of canopy to the NW	No evidence of significant past pruning	Displays signs of instability	Fair branch attachment	Moderate health	Fair vigour	10%	No visual evidence of significant pest or disease	2 Medium (15 to 40 years)	Moderate landscape significance	2	Located on the high side of a past cut for the existing driveway - stability should be monitored. At the time of inspection the tree was of fair vigour and exhibited low to moderate levels of dieback.
ca = approximate diameter at breast height (DBH) estimated from nearest property boundary or fence where trees were located on adjoining properties																						
* Retention Values: 1 - High (Priority for retention); 2 - Moderate (Consider for retention); 3 - Low or short ULE (Not warranting specific design consideration) and 4 - Remove (very short ULE, structurally unsound, weed species etc.)																						

Figure 10.1. Tree Data Summary. Source: Arboricultural Impact Report, Landscape Matrix Pty Ltd. Rev 22 Dec, 21.

10.1.6 Weed Removal Techniques

Weed removal proposed for the site will consist of hand removal techniques, manual/mechanical removal using bush regenerator tools and winter thermal (flame) weeding. This approach will reduce the amount of herbicide used and reduce the amount of off-target damage through spot on application.

Woody perennial weeds less than 2 metres in height will require cut and paint or scrape and paint bush regenerator techniques based on the germinating/epicormic behaviour of the plant (especially plants that tend to coppice or sucker).

It is recommended that seed heads are removed prior to commencement of primary works. This would be best performed carefully by hand with secateurs with the aim of avoiding the spread flowers or seeds into planting zones.

See Appendix III for further details. For key weed photo guide see Appendix II.

10.1.7 Native Seed Collection

Any native trees or shrubs being removed for the construction works should be checked for seeds during removal works. If seeds are present, they should be collected and used off-site, location to be determined with council.

10.1.8 Nest boxes

Installation of a 2 nest boxes designed for microbats should be added to the site to increase roosting opportunities in the area.

Image from: nestboxes.com.au



10.1.9 Pathogen prevention

To prevent the introduction of pathogens, Bushland Hygiene Protocols outlined in Appendix III should be followed. The site is considered to be an area which may promote the spread of Phytophthora (a group of fungus-like diseases affecting plants) due to its moist soil and proximity to water. It is recommended that Bushland Hygiene Protocols be followed closely.

11 Conclusions

The proposed development will have an approximate impact area of 0.08ha on Pittwater Spotted Gum Forest (PSGF) (PCT1214). This vegetation has been significantly altered and degraded from its natural state. Vegetation onsite has been significantly altered such that the site does not reflect the natural structural attributes of PSGF. The total cost to offset both ecosystem credits and species credits generated by this development is \$5,131.78 (including GST) assuming payment will be made into the Biodiversity Conservation Fund.

12 Appendices

12.1 Appendix I – Rationale for Likelihood of Occurrence

Rationale for Likelihood of Occurrence all Species Credit Species (candidate species) predicted by the BAM Calculator (BAM-C) and details whether the species have been retained or omitted from the calculator.

Where a species has a specific habitat constraint, which is not present within the subject land, or if the species is a vagrant within the IBRA subregion, the species is considered unlikely to occur and no further assessment is required. Additionally, in accordance with section 6.4.1.17 of the BAM, a candidate species credit species can be considered unlikely to occur within the subject land (or specific vegetation zones) where habitat is substantially degraded such that the species is unlikely to utilise area. As discussed in Sections 2 and 3, much of the vegetation within the subject land and 1,500 m buffer has been previously cleared, fragmented and is subject to ongoing disturbance.

A predicted candidate species credit species that is not considered to have suitable habitat on the subject land (or specific vegetation zones) in accordance with section 6.4.1.17 of the BAM does not require further assessment on the subject land (or specific vegetation zones). The reasons for determining that a predicted species credit species is unlikely to have suitable habitat on the subject land (or specific vegetation zones) has been included below for each Candidate Species for the BDAR.

Table 12. Potential Species Credit Species generated by the BAM-C, all the following species were candidate threatened species for the site. All BAM-C predicated species were retained.

Scientific Name	Common Name	Habitat/ Geographic Constraints	Retained in BAM Calculator	Reason for Inclusion or Removal
Flora				
<i>Diuris bracteata</i>	<i>Diuris bracteata</i>	For over 100 years <i>Diuris bracteata</i> was known only from the original collection made near Gladesville in northern Sydney. The complete absence of records for most of the 20th Century resulted in this species being listed as 'presumed extinct' on Part 4 of Schedule 1 of the Threatened Species Conservation	No	Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area.

		<p>Act 1995. This listing status was updated in 2005 to Endangered under the Act after several specimens were found in the Sydney Basin (Duffy's Forest, Mount White and Kulnura).</p> <p>In recent years, however, these specimens are considered to have been incorrectly identified and are considered to be <i>Diuris platichila</i> (Peter Weston May 2013).</p> <p>The species is considered to be extinct, though the listing status under the <i>Biodiversity Conservation Act 2016</i> does not yet reflect this status.</p>		<p>Areas of suitable habitat are not present within the site boundaries as the site has been significantly altered and degraded from its original state. A dense coverage of exotic grasses and vines are prohibiting growth of native vegetation. Further decreasing the chances of the species being present within the site boundaries.</p> <p>The species was not recorded during site surveys and no recording on Bionet within 10 Km radius. Species is not present and is unlikely to be present on the subject land. No further assessment required.</p>
<i>Rhodamnia rubescens</i>	Scrub Turpentine	<p>Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of <i>R. rubescens</i> typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m above sea level in areas with rainfall of 1,000-1,600 mm.</p> <p>Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.</p>	No	<p>Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area.</p> <p>Areas of suitable habitat are not present within the site boundaries as the site has been significantly altered and degraded from its original state. A dense coverage of exotic grasses and vines are prohibiting growth of native vegetation. Further decreasing the</p>

		This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.		<p>chances of the species being present within the site boundaries.</p> <p>Additionally, targeted surveys were conducted. The species was not recorded during site surveys. Species is not present and is unlikely to be present on the subject land. No further assessment required.</p>
<i>Genoplesium baueri</i>	Bauer's Midge Orchid	<p>The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. Currently the species is known from just over 200 plants across 13 sites. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments.</p> <p>Grows in dry sclerophyll forest and moss gardens over sandstone.</p>	No	<p>Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area.</p> <p>Areas of suitable habitat are not present within the site boundaries as the site has been significantly altered and degraded from its original state. A dense coverage of exotic grasses and vines are prohibiting growth of native vegetation. Further decreasing the chances of the species being present within the site boundaries.</p> <p>The species was not recorded during site surveys. Species is not present and is unlikely to be present on the subject land. No further assessment required.</p>

		Flowers February to March.		
<i>Hygrocybe aurantipes</i>	<i>Hygrocybe aurantipes</i>	<p>Occurs in gallery warm temperate forests dominated by Lilly Pilly (<i>Acmena smithii</i>), Grey Myrtle (<i>Backhousia myrtifolia</i>), Cheese Tree (<i>Glochidion ferdinandi</i>) and Sweet Pittosporum (<i>Pittosporum undulatum</i>).</p> <p>Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible.</p> <p>Occur as individuals or in groups, terrestrial rarely on wood and only if extremely rotten; substrates include soil, humus, or moss.</p> <p>Does not produce above ground fruiting bodies (fungus) all year round. Fruiting bodies begin appearing mid May to mid July sometimes to August</p>	No	<p>Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area.</p> <p>Areas of suitable habitat are not present within the site boundaries as the site has been significantly altered and degraded from its original state. A dense coverage of exotic grasses and vines are prohibiting growth of native vegetation. Further decreasing the chances of the species being present within the site boundaries.</p> <p>The species was not recorded during site surveys. Species is not present and is unlikely to be present on the subject land. No further assessment required.</p>
Fauna				
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Large-eared Pied Bat roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Petrochelidon ariel</i>), frequenting low to mid-	Yes	<p>There is a moderate likelihood of occurrence for the species. Previously recorded sightings on Bionet atlas have been sighted within 10km's of the site.</p> <p>The site presents marginal habitat for the species in the form of foraging</p>


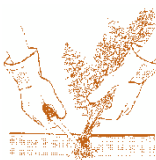

		elevation dry open forest and woodland close to these features.		opportunities from eucalyptus and other flowering natives. Whilst no hollows recorded on site. Species utilise cracks and caves in cliff faces for roosting habitat. These features do not occur within the site. Further Assessment of SAI conducted.
<i>Lathamus discolor</i>	Swift Parrot	On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>Eucalyptus robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> , and White Box [^] . Commonly used lerp infested trees include Grey Box <i>E. microcarpa</i> , Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i> . Return to home foraging sites on a cyclic basis depending on food availability.	Foraging – Yes Breeding - No	There is a moderate likelihood of occurrence. It is expected that the species may use the site for foraging and thus the species was retained as a Predicted threatened species (Ecosystem credits) in the BAM-C. The site presents marginal foraging habitat for the species in the form of canopy vegetation. The development site does not contain areas of important breeding habitat for the species, as per the DPIE BV map. Habitat constraints in BAM-C are based on this BV map and as such, Habitat constraints are N/A. Species not recorded during site survey. No further assessment or consideration is required.



<i>Miniopterus australis</i>	Little Bent-winged Bat	Moist eucalypt forest, rainforest or dense coastal banksia scrub. Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters. In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats (<i>M. schreibersii</i>) and appears to depend on the large colony to provide the high temperatures needed to rear its young.	Foraging – Yes Breeding - No	<p>There is a moderate likelihood of occurrence. It is expected that the species may use the site for foraging and thus the species was retained as a Predicted threatened species (Ecosystem credits) in the BAM-C. The site presents foraging habitat for the species.</p> <p>The development site would not be considered breeding habitat for the species. The impact area lacks key Habitat constraints including; Caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding, as per the BAM-C. No further assessment or consideration is required.</p>
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	Primarily roosts in caves but will utilise mine shafts, storm-water tunnels, buildings and other man-made structures. Forms colonies within a maternity cave and disperse within a 300km range. Forage in forested areas in the tree canopy.	Foraging – Yes Breeding - No	<p>There is a moderate likelihood of occurrence. It is expected that the species may use the site for foraging and thus the species was retained as a Predicted threatened species (Ecosystem credits) in the BAM-C. The site presents foraging habitat for the species.</p> <p>The development site would not be considered breeding habitat for the</p>

				species. The impact area lacks key Habitat constraints including; Caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding, as per the BAM-C. No further assessment or consideration is required.
<i>Anthochaera phrygia</i>	Regent Honeyeater	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. This species has been seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests.	Foraging – Yes Breeding - No	<p>There is a moderate likelihood of occurrence. It is expected that the species may use the site for foraging and thus the species was retained as a Predicted threatened species (Ecosystem credits) in the BAM-C. The site presents marginal foraging habitat for the species in the form of canopy vegetation.</p> <p>The development site does not contain areas of important breeding habitat for the species, as per the DPIE BV map. Habitat constraints in BAM-C are based on this BV map and as such, Habitat constraints are N/A. Species not recorded during site survey. No further assessment or consideration is required.</p>

12.2 Appendix II– Key Weed Removal Methods

Physical removal

Technique	Method	Equipment
Hand Removal 	<p>Seedlings and smaller weed species where appropriate will be pulled out by hand, without risk of injury to workers. The size that this can occur varies throughout the treatment area. Generally, it ranges from post seed to approximately 300mm in height.</p> <p>Rolling and raking is suitable for larger infestations of Wandering Jew. The weed can be raked and stems and plants parts rolled. The clump of weed material can then be bagged and removed from site.</p>	<p>Tools: Gloves, Rakes, Knife and</p> <p>Weed Bags</p>
Crowning 	<p>Plants that possess rhizomes or bulbs might not respond to various removal techniques and may need to be treated with crowning.</p> <p>A knife, mattock or trowel is to be driven into the soil surrounding the bulb or rhizome at an angle of approximately 45 degrees with surrounding soil, so as to cut any roots that may be running off. This is to occur in 360 degrees around the bulb/rhizome. The rhizome or bulb is to be bagged and removed from the site and disposed of at an appropriate waste recycling facility</p> <p>Soil disturbance is to be kept to a minimum when using this technique.</p>	<p>Tools: Knife, mattock, trowel, impervious gloves, and all other required P.P.E.</p>
Cut and Paint Stems 	<p>Weed species deemed unsuitable for hand removal shall be cut. Those that have persistent of vigorous growth will be cut and painted with Roundup® Biactive Herbicide or equivalent.</p> <p>Juvenile and smaller weed species will be cut with secateurs at base of plant, and herbicide applied via applicator bottle. Stem to be cut horizontally as close to the ground as possible, using secateurs, loppers or a pruning saw. Horizontal cuts to be made on top of stem to prevent the herbicide running off the stump.</p> <p>Apply herbicide to the cut stem immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. Herbicide is not to reach sediment or surrounding non-targeting plants.</p>	<p>Tools: loppers, secateurs, pruning saw, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide and all other required P.P.E.</p>

Technique	Method	Equipment
Scrape and Painting 	<p>More resilient weed species, where other techniques are less reliable are to be scraped with a knife or chisel and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current herbicide license.</p> <p>Weed species will be scraped with a knife or chisel up the length of the trunk, and herbicide applied via applicator bottle. Scrape the trunk from as close to the ground as possible to approximately ¾ of the plants height. Where trunk diameters exceed approximately 5 cm a second scrape shall be made on the other side of the trunk.</p> <p>Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. All care must be taken by the contractor not to spill herbicide onto sediment or surrounding non-targeting plants.</p> <p>Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.</p>	<p>Tools: knife, chisel, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.</p>
Cut with a Chainsaw and Paint 	<p>Larger size weed species, too large for cutting with hand tools, shall be cut with a chainsaw and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current chainsaw and herbicide license.</p> <p>Larger weed species will be cut with a chainsaw at base of plant, and herbicide applied via applicator bottle. Cut the stem horizontally as close to the ground as possible, using the chainsaw. Remove upper branches to reduce bulk of plant.</p> <p>If cutting at the base is impractical, cut higher to get rid of the bulk of the weed, then cut again at the base and apply herbicide. Make cuts horizontal to prevent the herbicide running off the stump. Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. Ensure there is no runoff of poison. All care must be taken by the contractor not to spill herbicide into water, onto sediment, or surrounding non-targeting plants.</p> <p>Follow up treatment will be required. If plants resprout, cut and paint the shoots using the same method.</p>	<p>Tools: chainsaw, ear muffs, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.</p>

Technique	Method	Equipment
Spot Spraying	<p>Spot spraying involves spraying non-seeding annuals and grasses, and for regrowth of weeds once an area has been cleared or brushcut. Works to be carried out by a contractor with a current herbicide license.</p> <p>Herbicide will be mixed up according to the manufacturer's directions for the particular weed species being targeted. Mixed herbicide shall be applied to the targeted weed species with a backpack sprayer. All care must be taken by the contractor not to spill herbicide onto sediment or surrounding non-targeting plants.</p>	<p>Tools: protective clothing, safety glasses, herbicide sprayer, impervious gloves, Herbicide, and all other required P.P.E.</p>

Flame Weeding

Thermal (flame) weeding is a method where high temperatures are applied to weeds, causing the plant to die. Thermal weeding is particularly useful in situations where conservation or health considerations are high and weed density is low such as waterways where herbicide use is not permitted.

While flame weeding is not suited to most streetscapes due to the fire hazard nor can it be used on materials such as soft fall and similar playground equipment it is noted that 'flame' weeding in waterways allows weed management in areas where herbicides are not permitted.

Also for native vegetation areas thermal weeding, with a flame weeder, has been shown to stimulate germination of native plants while killing the seeds of annual weeds such as Devils Pitchfork, *Bidens pilosa*. Flame weeding is also effective in killing persistent weeds like Mother of Millions.

Best results are obtained when follow up weed control is undertaken 4-6 weeks after treatment. In addition, weed control should be conducted periodically after that for example to control weeds over a period of a year it is likely that between 3-5 applications will be necessary, depending on rainfall and the extent of the weed seed bank. This method is most effective on young annual weeds and least effective on older perennial weeds. In some cases, control of perennial weeds will be ineffective however this depends on the species present and its age.

FLAME WEEDER – ECO BURN

Case Study: Weed
Mgt and Eco-burn
Glenorie in the
Hills Shire Council



Images provided by Dragonfly
Environmental

Flame weeding should be undertaken outside of the fire seasons. Flame weeding allows for the mimicking of a burn in areas where a control burn could not be undertaken. See native plants regenerating after flame weeding.



12.3 Appendix III– Bushland Hygiene Protocols for Phytophthora (Hornsby Council Recommendations)

- Always assume that the area you are about to work in is free of the disease and therefore needs to be protected against infection.
- And, always assume that the activity you are about to undertake has the potential to introduce the disease.
- Arrive at site with clean shoes, i.e.: no dirt encrusted on them.
- If you arrive with shoes that are encrusted with dirt, they will have to be completely soaked in metho or disinfectant and allow a few minutes to completely soak in. NEVER scrape untreated dirt off your shoes onto the ground.
- Before you move onto the site spray the bottom of your shoes with 70 % metho. Bleach solution (1% strength) or household/commercial disinfectant (as per label) are also suitable.
- Check all tools and equipment that comes in contact with soil are clean before entering the area (they should have been cleaned on site at the end of the previous work session). If there is any dirt on them, spray them with 70% metho.
- Clean all tools at the end of each work session while still on site ensuring this is done away from drainage lines and adjacent work areas. Knock or brush off encrusted dirt and completely spray with 70 % metho. Replace in storage/transport containers.
- Preferably compost all weed material on site.
- Never drag vegetation with exposed roots and soil through bushland.
- When removing weeds from site, remove as much soil as possible from them in the immediate work area and carefully place vegetative material into plastic bags.
- Try not to get the bag itself dirty; don't put it on/in a muddy area.
- Always work from the lower part of a slope to the upper part.
- Always work in areas known to be free of the pathogen before working in infected areas.
- Minimise activities wherever possible when the soil is very wet.
- Vehicles should not be driven off track or into reserves (unless vehicle decontamination is carried out before and after entering a single work site)
- Only accredited supplies of plants/mulch to be used.

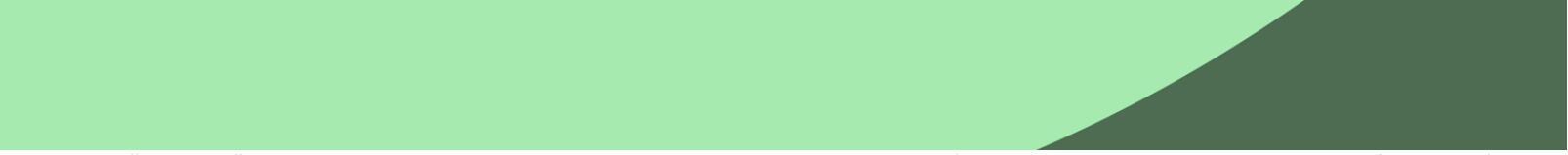
Kit should contain: 1 bucket, 1 scrubbing brush, 1 spray bottle (metho 70% solution), 1 bottle tap water, 1 bottle methylated spirits.

Contact Hornsby Bushcare if you require any refills or replacements of your Phytophthora Kits on 9484 3677 or bushcare@hornsby.nsw.gov.au

Facts about Phytophthora

Phytophthora cinnamomi (Phytophthora) is a microscopic, soil borne, water-mould that has been implicated in the death of remnant trees and other plants in Australian bushland. Phytophthora is not native to Australia. It is believed to have been introduced sometime after European settlement. Phytophthora is a national problem and is listed as a key threatening process under the Commonwealth's Environmental Protection and Biodiversity Conservation Act 1999.

Symptoms including Dieback



"Dieback" simply means dying or dead plants. There are many causes of dieback; Phytophthora is just one of them. Often dieback is the result of a combination of factors such as; changed drainage patterns and nutrient loads (e.g.: increased stormwater run-off) or changed soil conditions (e.g.: dumped fill or excavation of/near root zone). Plants that are stressed are more vulnerable to Phytophthora.

Initial symptoms of Phytophthora include; wilting, yellowing and retention of dried foliage, loss of canopy and dieback. Infected roots blacken and rot and are therefore unable to take-up water and nutrients. Severely infected plants will eventually die. Symptoms can be more obvious in summer when plants may be stressed by drought. If you suspect that Phytophthora is on your site, please contact the Bushcare team to collect a soil sample to be lab tested. This is usually done in the warmer months where conditions are optimum for the disease.

Infection

There is no way of visually telling if Phytophthora is present in the soil as its structures and spores are microscopic (invisible to the naked eye). Phytophthora requires moist soil conditions and warm temperatures for infection, growth and reproduction. Spores travel through moist soil and attach to plant roots. Once Phytophthora has infected a host plant it can grow inside plant root tissue independent of external soil moisture conditions. After infection, Phytophthora grows through the root destroying the tissue which is then unable to absorb water and nutrients.

12.4 Appendix IV– BAM –C; Reports and Data

12.4.1 Payment Report.



Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00031666/BAAS19008/22/00031667		2	11/03/2022
Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Geraldene Susan Dalby-Ball	BAAS19008	122 Riverview Rd Avalon	Finalised
Assessment Type	Date Finalised	BOS entry trigger	
Part 4 Developments (Small Area)	11/03/2022	BOS Threshold: Biodiversity Values Map	

PCT list

Price calculated	PCT common name	Credits
Yes	1214 - Pittwater Spotted Gum forest	1

Species list

Price calculated	Species	Credits
Yes	<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	1

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Assessment Id	Proposal Name
00031666/BAAS19008/22/00031667	122 Riverview Rd Avalon

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Biodiversity payment summary report

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Pittwater	1214 - Pittwater Spotted Gum forest	Yes	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	18.83%	\$120.18	1.5516	\$3,690.56	1	\$3,690.56
Subtotal (excl. GST)									\$3,690.56
GST									\$369.06
Total ecosystem credits (incl. GST)									\$4,059.62

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10157	<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	Vulnerable	\$741.31	20.6900%	\$80.00	1	\$974.69
Subtotal (excl. GST)							\$974.69

Assessment Id

00031666/BAAS19008/22/00031667

Proposal Name

122 Riverview Rd Avalon

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Biodiversity payment summary report

	GST	\$97.47
Total species credits (incl. GST)		\$1,072.16
Grand total		\$5,131.78

Assessment Id

00031666/BAAS19008/22/00031667

Proposal Name

122 Riverview Rd Avalon

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12.4.2 Credit Summary Report.



BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00031666/BAAS19008/22/00031667	122 Riverview Rd Avalon	24/11/2021
Assessor Name	Report Created	BAM Data version *
Geraldene Susan Dalby-Ball	11/03/2022	50
Assessor Number	BAM Case Status	Date Finalised
BAAS19008	Finalised	11/03/2022
Assessment Revision	Assessment Type	BOS entry trigger
2	Part 4 Developments (Small Area)	BOS Threshold: Biodiversity Values Map

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Ecosystem credits
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Assessment Id: 00031666/BAAS19008/22/00031667
Proposal Name: 122 Riverview Rd Avalon

Page 1 of 2

BAM Credit Summary Report

Pittwater Spotted Gum forest

1	1214_Poor	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	36.5	31.2	0.08	PCT Cleared - 71%	High Sensitivity to Potential Gain	Endangered Ecological Community	Not Listed	2.00	TRUE	1
											Subtotal	1
											Total	1

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAI	Species credits
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)									
1214_Poor	31.2	31.2	0.04			Vulnerable	Vulnerable	True	1
								Subtotal	1

12.4.3 Predicted species report.



BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00031666/BAAS19008/22/00031667	122 Riverview Rd Avalon	24/11/2021
Assessor Name	Report Created	BAM Data version *
Geraldene Susan Dalby-Ball	11/03/2022	50
Assessor Number	Assessment Type	BAM Case Status
BAAS19008	Part 4 Developments (Small Area)	Finalised
Assessment Revision	BOS entry trigger	Date Finalised
2	BOS Threshold: Biodiversity Values Map	11/03/2022

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Threatened species reliably predicted to utilise the site. No surveys are required for these species. Ecosystem credits apply to these species.

Common Name	Scientific Name	Vegetation Types(s)
Barking Owl	Ninox connivens	1214-Pittwater Spotted Gum forest
Dusky Woodswallow	Artamus cyanopterus cyanopterus	1214-Pittwater Spotted Gum forest
Eastern Coastal Free-tailed Bat	Micronomus norfolkensis	1214-Pittwater Spotted Gum forest
Eastern Osprey	Pandion cristatus	1214-Pittwater Spotted Gum forest
Gang-gang Cockatoo	Callocephalon fimbriatum	1214-Pittwater Spotted Gum forest
Glossy Black-Cockatoo	Calyptorhynchus lathami	1214-Pittwater Spotted Gum forest
Grey-headed Flying-fox	Pteropus poliocephalus	1214-Pittwater Spotted Gum forest
Koala	Phascolarctos cinereus	1214-Pittwater Spotted Gum forest
Large Bent-winged Bat	Miniopterus orianae oceanensis	1214-Pittwater Spotted Gum forest
Little Bent-winged Bat	Miniopterus australis	1214-Pittwater Spotted Gum forest

BAM Predicted Species Report

Little Eagle	Hieraetus morphnoides	1214-Pittwater Spotted Gum forest
Little Lorikeet	Glossopsitta pusilla	1214-Pittwater Spotted Gum forest
Masked Owl	Tyto novaehollandiae	1214-Pittwater Spotted Gum forest
New Holland Mouse	Pseudomys novaehollandiae	1214-Pittwater Spotted Gum forest
Powerful Owl	Ninox strenua	1214-Pittwater Spotted Gum forest
Regent Honeyeater	Anthochaera phrygia	1214-Pittwater Spotted Gum forest
Rosenberg's Goanna	Varanus rosenbergi	1214-Pittwater Spotted Gum forest
Scarlet Robin	Petroica boodang	1214-Pittwater Spotted Gum forest
Spotted-tailed Quoll	Dasyurus maculatus	1214-Pittwater Spotted Gum forest
Swift Parrot	Lathamus discolor	1214-Pittwater Spotted Gum forest
Varied Sittella	Daphoenositta chrysoptera	1214-Pittwater Spotted Gum forest
White-throated Needletail	Hirundapus caudacutus	1214-Pittwater Spotted Gum forest
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1214-Pittwater Spotted Gum forest

Threatened species Manually Added

None added

Threatened species assessed as not within the vegetation zone(s) for the PCT(s)

Refer to BAR for detailed justification

Common Name	Scientific Name	Justification in the BAM-C
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12.4.4 Candidate species report



BAM Candidate Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00031666/BAAS19008/22/00031667	122 Riverview Rd Avalon	24/11/2021
Assessor Name	Report Created	BAM Data version *
Geraldene Susan Dalby-Ball	11/03/2022	50
Assessor Number	Assessment Type	BAM Case Status
BAAS19008	Part 4 Developments (Small Area)	Finalised
Assessment Revision	Date Finalised	BOS entry trigger
2	11/03/2022	BOS Threshold: Biodiversity Values Map

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

List of Species Requiring Survey

Name	Presence	Survey Months
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	Yes (assumed present)	<input checked="" type="checkbox"/> Jan <input type="checkbox"/> Feb <input type="checkbox"/> Mar <input type="checkbox"/> Apr <input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug <input type="checkbox"/> Sep <input type="checkbox"/> Oct <input checked="" type="checkbox"/> Nov <input checked="" type="checkbox"/> Dec <input type="checkbox"/> Survey month outside the specified months?
<i>Rhodamnia rubescens</i> Scrub Turpentine	No (surveyed)	<input type="checkbox"/> Jan <input type="checkbox"/> Feb <input checked="" type="checkbox"/> Mar <input type="checkbox"/> Apr <input type="checkbox"/> May <input type="checkbox"/> Jun <input type="checkbox"/> Jul <input type="checkbox"/> Aug <input type="checkbox"/> Sep <input type="checkbox"/> Oct <input type="checkbox"/> Nov <input type="checkbox"/> Dec <input type="checkbox"/> Survey month outside the specified months?

Threatened species Manually Added

None added

Threatened species assessed as not on site

Refer to BAR for detailed justification

Assessment Id	Proposal Name	Page 1 of 2
00031666/BAAS19008/22/00031667	122 Riverview Rd Avalon	

BAM Candidate Species Report

Common name	Scientific name	Justification in the BAM-C
Bauer's Midge Orchid	Genoplesium baueri	Habitat degraded
Diuris bracteata	Diuris bracteata	Habitat degraded
Hygrocybe aurantipes	Hygrocybe aurantipes	Habitat constraints
Large Bent-winged Bat	Miniopterus orianae oceanensis	Habitat constraints
Little Bent-winged Bat	Miniopterus australis	Habitat constraints
Regent Honeyeater	Anthochaera phrygia	Habitat constraints
Swift Parrot	Lathamus discolor	Habitat constraints

12.4.5 Credit Summary Report (Like for like)



BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00031666/BAAS19008/22/00031667	122 Riverview Rd Avalon	24/11/2021
Assessor Name	Assessor Number	BAM Data version *
Geraldene Susan Dalby-Ball	BAAS19008	50
Proponent Names	Report Created	BAM Case Status
Tim Hill	11/03/2022	Finalised
Assessment Revision	Assessment Type	Date Finalised
2	Part 4 Developments (Small Area)	11/03/2022
BOS entry trigger	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	
BOS Threshold: Biodiversity Values Map		

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	Endangered Ecological Community	1214-Pittwater Spotted Gum forest
Species		
Chalinolobus dwyeri / Large-eared Pied Bat		

Additional Information for Approval

Assessment Id	Proposal Name	Page 1 of 4
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BAM Biodiversity Credit Report (Like for like)

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT

No Changes

Predicted Threatened Species Not On Site

Name

No Changes

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1214-Pittwater Spotted Gum forest	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	0.1	1	0	1

Assessment Id

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Proposal Name

122 Riverview Rd Avalon

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BAM Biodiversity Credit Report (Like for like)

1214-Pittwater Spotted Gum forest

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion This includes PCT's: 1214, 1589	-	1214_Poor	Yes	1	Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Chalinolobus dwyeri / Large-eared Pied Bat	1214_Poor	0.0	1.00

Credit Retirement Options

Like-for-like credit retirement options

Chalinolobus dwyeri / Large-eared Pied Bat	Spp	IBRA subregion
	Chalinolobus dwyeri / Large-eared Pied Bat	Any in NSW



BAM Biodiversity Credit Report (Like for like)

Assessment Id

00031666/BAAS19008/22/00031667

Proposal Name

122 Riverview Rd Avalon

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12.5 Appendix V – Field Data

Species	Growth code	Cover %	Abund
<i>Eucalyptus saligna</i> (Blue Gum)	Tree	5	1
<i>Angophora costata</i>	Tree	2	2
<i>Corymbia maculata</i> (Spotted Gum)	Tree	15	6
<i>Eucalyptus paniculata</i> (Ironbark)	Tree	7	1
<i>Allocasuarina torulosa</i>	Tree	5	3
<i>Glochidion ferdinandi</i> (Cheese Tree)	Tree		
<i>Notelaea venosa</i> (Mock Olive)	Shrub	<1	1
<i>Tristanopsis laurina</i> (Water Gum)	Tree	<1	1
<i>Angophora floribunda</i>	Tree	<1	1
<i>Oplismenus</i>	Grass & grass like	<1	100
<i>Commelina cyanea</i>	Forb	<4	1000
<i>Entolasia marginata</i>	Grass & grass like	<1	100
<i>Acacia</i> sp. 1	Shrub	<1	7
<i>Acacia</i> sp. 2	Shrub	<1	3
<i>Hardenbergia violacea</i>	Other (Vine)	2	10
<i>Lomandra longifolia</i>	Grass & grass like	1	7
<i>Dianella caerulea</i>	Forb	1	6
<i>Macrozamia communis</i> (Burrawang)	Other (Palm)	1	2
<i>Kennedia rubicunda</i>	Other (Vine)	1	1
Weeds/exotics in 20x20			
Jasmine		1	20
<i>Pinus radiata</i> (Pine)		2	1
<i>Ehrharta erecta</i>		20%	1000+
Morning Glory		80%	1000+
Asparagus Fern		10%	100+
Fishbone Fern		5%	50+
<i>Turkey rhubarb</i>		4%	15+
<i>Clivia</i>		1%	50+
<i>Monstera</i>		1%	25+
<i>Ochna</i>		1%	10+
Ivy		1%	10+
Large Leaf Privet		2%	<10
<i>Lantana</i>		2%	10+
<i>Senna pendula</i> (Cassia)		1%	10+
<i>Strelitzia</i>		1%	10+
Small Leaf Privet		1%	10

Code	Sum Value	Cover
Tree	8	37
Shrub	3	3
Grass	3	3
Forb	2	5
Fern	0	0
Other	3	4

Bam Attribute (1000m ² Plot)	
DBH	Tree stem count
<5cm	0
5 – 9	0
10 – 19	5
20 – 29	6
30 – 49	5
50 – 79	0
80+	1
Fallen Logs	0.5

-033.621450 / +151.317278
ECA mob: 0488 481 929 ecologicalca@outlook.com

122 Riverview Road

BAM Site - Field Survey Form

Site Sheet no: 192

Date		Survey Name		Zone ID		Recorders	
6 3 22		98 Prime Attitude		1		GOS + DS	
Zone	Datum	Plot ID	Plot dimensions		Photo #		
---	---	1	20x50 20x20				
Easting	Northing	IBRA region	Midline bearing from 0 m				
---	---	Sydney	289° N 71° W				
Vegetation Class		Plant Community Type		EEC: <input checked="" type="checkbox"/>		Confidence: H M L (B) (M) (L)	
		PSGF transition to Ang.					

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m ² plot)		Sum values
Count of Native Richness	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Cover of native vascular plants by growth form group	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed cover		

BAM Attribute (1000 m ² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	1 (Ironbark)	Angophora
50 - 79 cm		possibly one hollow
30 - 49 cm		inc blue gum
20 - 29 cm		inc tree.
10 - 19 cm		
5 - 9 cm		
< 5 cm		n/a
Length of logs (m) (≥10 cm diameter, >50 cm in length)		0.5 m

Counts apply when the number of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30, ..., 100, 200, 300, ...). For a multi-stemmed tree, only the largest living stem is included in the count/estimate. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	10 5 5 5 25	0 0 0 0 30	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	10	6	0	0

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

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

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type
W 10-30	damp W	clay → org	- deep Pittwater.

Plot Disturbance	Severity code	Age code	Observational evidence:
Clearing (inc. logging)			Existing house, next to area with
Cultivation (inc. pasture)			remnant canopy + mid story.
Soil erosion			One section 10x20 no trees (previous erosion)
Firewood / CWD removal			Section 10x20 canopy trees
Grazing (identify native stock)			Section upslope of Trappers Way - 2 trees etc
Fire damage			
Storm damage			
Weediness	3	0	Canopy includes planted natives
Other			

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe
Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Small section to Re-hab as Bushland.

122 Riverview Rd A

400 m² plot: Sheet 2 of 2

Date	Survey Name	Plot Identifier	Recorders
6/3/22	Wattlebark	1	KDB DJ

GF Code	Top 3 native species in each growth form group: Full species name mandatory All other native and exotic species: Full species name where practicable	N, E or HTE	400m ² Cover	Abund	stratum	voucher
T	1 Blue Gum (1000 not 400)	N	5	10	T	
T	2 Pinus radiata - Pine	E	2	1	T	
T	3 Angophora costata.	N	2	2	T	
T	4 Callistha maculata (Spotted Gum)	N	15	6	T	
T	5 E. paniculata (Ironbark)	N	7	1	T	
T	6 Allocasuarina tortuosa.	N	5	3	T	
S	7 Glichideon Funardi (Cheektree)	N			mid	
S	8 Mock olive.	N	24	1	Sh.	
S	9 Tristaniopsis laurina (Water Gum)	N	<1	1	mid.	
	10 Angophora floribunda.	N	<1	1	mid.	
G	12 Oplismenus (Grass)	N	<1	100	G	
F	13 Comolana cyanea (Fruit)	N	<4	1000	G	
G	14 Entolasia marginata (grass)	N	<1	100	G	
S	15 Acacia sp ①	N	<1	7	mid	
S	16 Acacia sp ②	N	<1	3	mid.	
Sh.	17 Hardenbergia violacea	N	2	10	ground	
Sh.	18 Lomandra longifolia	N	1	7	ground	
Sh.	19 Dianella caerulea	N	1	6	ground	
Sh.	20 Burrumang - Macrozamia communis	N	1	2	ground	
Sh.	21 Kennedya rubicunda	N	1	1	ground	
	22					
	23					
	24					
	25 Jasmine	E	1	20		
	26 Echarata erecta.	E	20%			
	27 Morning Glory	E	80%	1000		
	28 Asparagus Fern	E	10%			
	29 Fishbone Fern	E	5%			
	30 Turkey Rubber	E	4%			
	31 Clivia	E	1%			
	32 Monstera	E	1%			
	33 Ochna.	E	1%			
	34 Asparagus Fern	E	5%			
	35 Ivy	E	1%			
	36 Large leaf Privet	E	2%			
	37 Lantana	E	2%			
	38 Cassia = Senna pendula	E	1%			
	39 Strelitzia	E	1%			
	40 Small leaf Privet	E	1%	10		

GF Code: see Growth Form definitions in Appendix 1

N: native, E: exotic, HTE: high threat exotic

GF - circle code if 'top 3'

Cover: 0.1, 0.2, 0.3, ..., 1.2, 3, ..., 10, 15, 20, 25, ..., 100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

12.6 Appendix VI – Calculation Variations and offset obligations

12.6.1 Assessment revision 0 - Updated Proposed design (Driveway and garage relocation) Credit Calculation



Biodiversity payment summary report

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Pittwater	1214 - Pittwater Spotted Gum forest	Yes	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	18.83%	\$120.18	1.5516	\$3,690.56	1	\$3,690.56
Subtotal (excl. GST)									\$3,690.56
GST									\$369.06
Total ecosystem credits (incl. GST)									\$4,059.62

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
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No species available

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BAM Credit Summary Report

Proposal Details

Assessment ID 00031666/BAAS19008/22/00031667	Proposal Name 122 Riverview Rd Avalon	BAM data last updated * 24/11/2021
Assessor Name Geraldene Susan Dalby-Ball	Report Created 11/03/2022	BAM Data version * 50
Assessor Number BAAS19008	BAM Case Status Open	Date Finalised To be finalised
Assessment Revision 0	Assessment Type Part 4 Developments (Small Area)	BOS entry trigger BOS Threshold: Biodiversity Values Map

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Ecosystem credits
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Assessment ID 00031666/BAAS19008/22/00031667	Proposal Name 122 Riverview Rd Avalon	Page 1 of 2
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BAM Credit Summary Report

Pittwater Spotted Gum forest

1	1214_Poor	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	36.5	31.2	0.08	PCT Cleared - 71%	High Sensitivity to Potential Gain	Endangered Ecological Community	Not Listed	2.00	TRUE	1
											Subtotal	1
											Total	1

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAI	Species credits
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12.6.2 Assessment revision 1 - Previous Approved Design Credit Calculation



Biodiversity payment summary report

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Pittwater	1214 - Pittwater Spotted Gum forest	Yes	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	18.83%	\$120.18	1.5516	\$3,690.56	1	\$3,690.56
Subtotal (excl. GST)									\$3,690.56
GST									\$369.06
Total ecosystem credits (incl. GST)									\$4,059.62

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
--------------------	---------	---------------	------------------	--------------	---------------------	------------------------	---------------------

No species available

Assessment Id
00031666/BAA519008/22/00031667

Proposal Name
122 Riverview Rd Avalon

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BAM Credit Summary Report

Proposal Details

Assessment Id 00031666/BAA519008/22/00031667	Proposal Name 122 Riverview Rd Avalon	BAM data last updated * 24/11/2021
Assessor Name Geraldene Susan Dalby-Ball	Report Created 11/03/2022	BAM Data version * 50
Assessor Number BAA519008	BAM Case Status Open	Date Finalised To be finalised
Assessment Revision 1	Assessment Type Part 4 Developments (Small Area)	BOS entry trigger BOS Threshold: Biodiversity Values Map

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area loss (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAIL	Ecosystem credits
------	----------------------	----------	------------------------------------	--	----------------	-------------------------------------	-----------------------------------	-----------------------	-------------------------	-----------------------------	----------------	-------------------

Assessment Id
00031666/BAA519008/22/00031667

Proposal Name
122 Riverview Rd Avalon

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BAM Credit Summary Report

Pittwater Spotted Gum forest												
1	1214_Poor	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	36.5	28.1	0.08	PCT Cleared - 71%	High Sensitivity to Potential Gain	Endangered Ecological Community	Not Listed	2.00	TRUE	1
											Subtotal	1
											Total	1

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAI	Species credits

Assessment ID
00031666/BAAS19008/22/00031667

Proposal Name
122 Riverview Rd Avalon

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12.7 Appendix VII – Species Polygon Large-eared Pied Bat



13 Expertise of authors

With over 20 years wetland and urban ecology experience, a great passion for what she does, and extensive technical and on-ground knowledge make Geraldene a valuable contribution to any project.

Geraldene has over 8 years local government experience as manager of environment and education for Pittwater Council. Geraldene presented papers on the topic at the NSW Coastal Conference, Sydney CMA and Hawkesbury Nepean forums. Geraldene is a Technical Advisor Sydney Olympic Park Wetland Education and Training (WET) panel.

Geraldene has up to date knowledge of environmental policies and frequently provides input to such works. Geraldene was a key contributor to the recent set of Guidelines commissioned by South East Queensland Healthy Waterways Water Sensitive Urban Design Guidelines. Geraldene's role included significant contributions and review of the Guideline for Maintaining WSUD Assets and the Guideline for Rectifying WSUD Assets.

Geraldene is a frequent contributor to many community and professional workshops on ecological matters particularly relating to environmental management. She is an excellent Project Manager.

Geraldene is a joint author on the popular book Burnum Burnum's Wildthings published by Sainty and Associates. Author of the Saltmarsh Restoration Chapter Estuary Plants of East Coast Australia published by Sainty and Associates (2013). Geraldene's early work included 5 years with Wetland Expert Geoff Sainty of Sainty and Associates. Geraldene is an expert in creating and enhancing urban biodiversity habitat and linking People with Place.

Geraldene Dalby-Ball DIRECTOR



SPECIALISATIONS

- Urban Ecology – and habitat rehabilitation and re-creation.
- Urban waterway management – assessing, designing and supervising rehabilitation works
- Saltmarsh and Wetland re-creation and restoration – assessment, design and monitoring
- Engaging others in the area of environmental care and connection
- Technical Advisor – environmental design, guidelines and policies
- Sound knowledge and practical application of experimental design and statistics
- Project management and supervision
- Grant writing and grant assessment
- Budget estimates and tender selection
- Expert witness in the Land and Environment Court

CAREER SUMMARY

- **Director and Ecologist**, Ecological Consultants Australia. 2014-present
- **Director and Ecologist**, Dragonfly Environmental. 1998-present
- **Manager** Natural Resources and Education, Pittwater Council 2002-2010
- **Wetland Ecologist** Sainty and Associates 1995-2002

QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of Science with 1st Class Honors**, Sydney University
- WorkCover WHS General Induction of Construction Industry NSW White Card.
- Senior First Aid Certificate.
- **Practicing member and vice president** Ecological Consultants Association of NSW

Luke Johnson

ECOLOGIST



Luke is a passionate ecologist who has experience across both the government and private sectors to deliver sustainable environmental outcomes. He has contributed to projects with major construction contractors and has been able to deliver creative environmental solutions on time and within budget.

Luke's passion for fauna was discovered through volunteer work handling microbats in Victoria. Those skills have been honed through the work with ECA as a fauna spotter during vegetation clearing activities in NSW.

As an undergraduate student, he interned with the Bureau of Meteorology to conduct research identifying traditional ecological knowledge of severe weather events in communities in the Pacific.

He has exceptional customer communication skills and builds long lasting professional relationships with his clients. He has a working knowledge of current NSW and Commonwealth environmental legislation. He is also competent in the practical application of flora and fauna surveying and monitoring techniques.

Key Projects Include:

- Monitoring of Endangered Species, various locations of NSW and VIC
- Fauna spotter during vegetation clearing
- Conducted environmental impact assessments for state infrastructure projects and Department of Defence
- Passion for traditional ecological knowledge including researching for the Bureau of Meteorology's COSPAC program

SPECIALISATIONS

- Urban and landscape ecology
- Environmental Impact Assessments (EIA)
- Flora and Fauna Assessments
- Habitat tree assessment, marking and mapping
- GIS mapping
- Fauna spotting

CAREER SUMMARY

- **Ecologist**, Ecological Consultants Australia. 2020-present
- **Environmental Consultant**, Hibbs & Associates. 2019-2020
- **Field Ecologist**, Biosis 2018-2019
- **Volunteer**, Microbat box monitoring and handling including assisting in tagging

QUALIFICATIONS AND MEMBERSHIPS

- Bachelor of Environmental Management and Ecology, Victoria University
- First aid certificate
- Asbestos awareness training
- WHS General Induction of Construction Industry NSW White Card