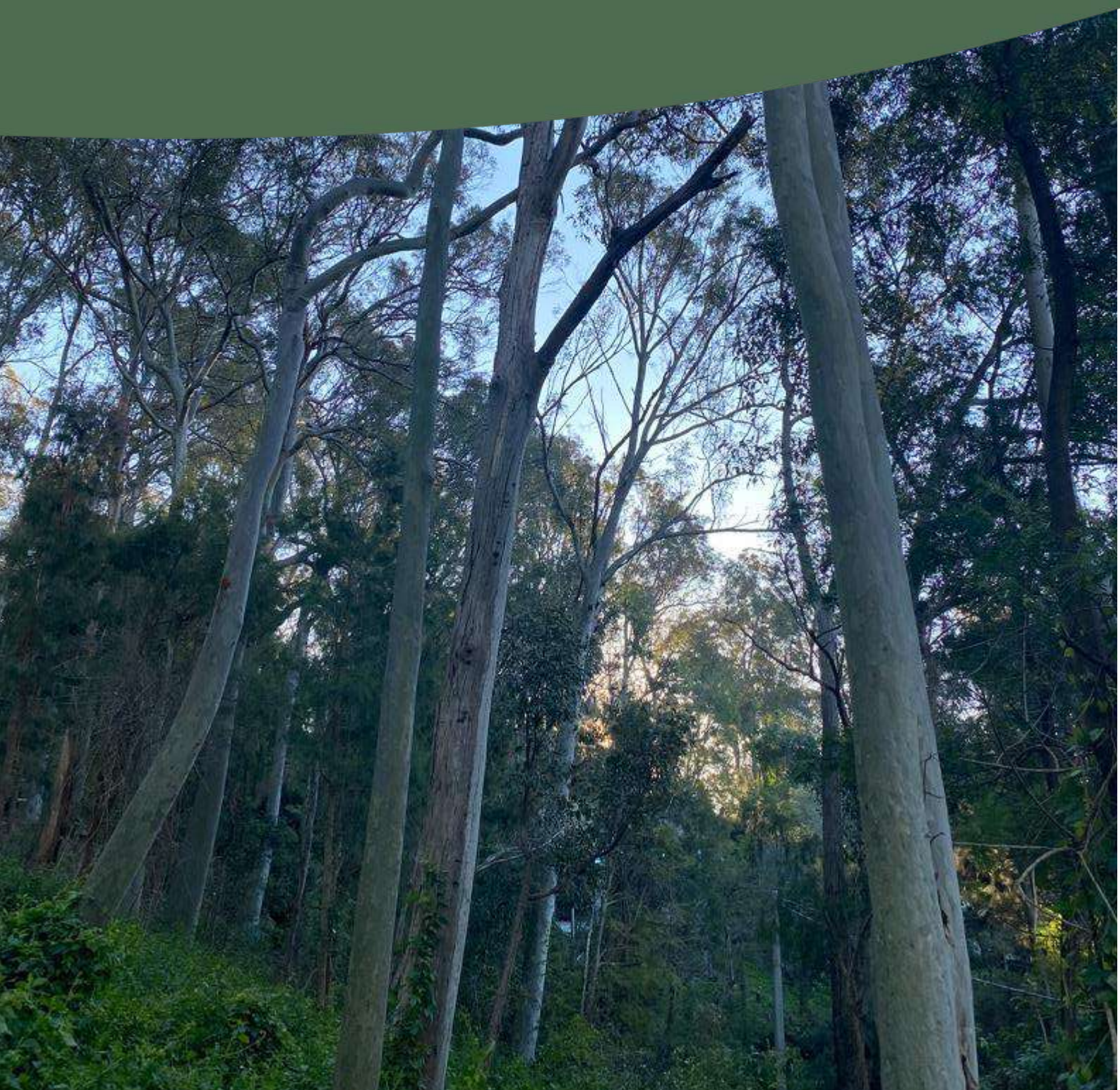
Biodiversity Development Assessment Report

17 Thompson St, Scotland Island

By Ecological Consultants Australia Pty Ltd TA

Kingfisher Urban Ecology and Wetlands

July 2021 updated May 2022



About this document

Copyright Statement©

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.

Document Control Sheet	
Title:	Biodiversity Development Assessment Report 17 Thompson St, Scotland Island
Version:	Final A2
Author:	Myrna Calumpong, Luke Johnson and Geraldene Dalby-Ball
Date:	July 2021, updated May 2022
File location:	C:\Users\Geraldene\Dropbox\ECA 4 Projects\2 Projects\2021-2022\Flora Fauna BAM BDAR\BDARs\ 17 Thompson St Scotland Island
Distribution:	James McHugh Graduate of Architecture B.Arch.(UNSW), M.Arch.(UNSW) P.O Box 293 Church Point 2105 0439404650

Signed: Geraldene Dalby-Ball – Director of Ecological Consultants Australia

Executive Summary

Introduction

Ecological Consultants Australia (ECA) has been contracted by James McHugh to provide a **Biodiversity Development Assessment Report** for a proposal at 17 Thompson St., Scotland Island within the Northern Beaches Council Local Government Area (LGA).

Trigger for a formal BDAR under the BC Act 2016:

The proposal triggers the area clearing threshold as per the BOS entry requirements as the impact area exceeds the clearing area threshold.

Stage 1: Biodiversity Assessment

- On-ground survey took place in August 2021 by Senior Ecologist Geraldene Dalby-Ball.
- Data was gathered across three BAM plots located in each 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 0.14ha and includes the whole of the site.
- Nine trees are proposed for removal to accommodate the proposed dwelling and APZ requirements.
- Survey plots were within a vegetation community identified as Pittwater Spotted Gum Forest (PSGF) (PCT1214).
- PSGF is listed as an Endangered Ecological Community (EEC) under the NSW BC Act (2016).
- Vegetation onsite has been significantly altered such that the site does not reflect the natural structural attributes of the PSGF.
- Vegetation is structurally and functionally poor due to previous clearing onsite and lack of weed management. Thus, the proposed development assessed in this BDAR is not expected to significantly contribute to loss of PSGF.
- No threatened species were recorded during the site surveys.

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
- Offset planting in adjoining council reserve

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 0.14ha on Pittwater Spotted Gum Forest (PSGF) (PCT 1214). This vegetation has been significantly altered and degraded from its natural state.
- Currently the site consists of a combination of remnant canopy and understorey regrowth. The site was purchased for residential use in June of 2020. Prior to this purchase the site was likely left unmanaged resulting in the high abundance of *Lantana camara* 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.

Table of Contents

About this document i

Executive Summary ii

Stage 1: Biodiversity Assessment 1

1 Introduction 1

1.1 Site information and general description 1

1.2 Site history 3

1.3 Proposed actions 4

1.4 Sources of information used in the assessment 9

1.5 Legislative context and statutory requirements 9

1.5.1 NSW Environmental Planning and Assessment Act 1979 9

1.5.2 NSW Biodiversity Conservation Act 2016 and associated documents 9

1.5.3 NSW State Environmental Planning Policy Koala Habitat Protection 2021. 10

1.5.4 Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 10

1.5.5 Pittwater Local Environmental Plan 2014 10

1.6 Biodiversity Offsets Scheme threshold 11

1.6.1 BOS Area Clearing Threshold 11

1.6.2 Biodiversity Values Map 12

2 Landscape features and site context 14

3 Native vegetation 16

3.1 Desktop and Survey results – Plant Community Types (PCTs) 16

3.1.1 Field Survey 16

3.1.2 Site Photos 18

4 Threatened Species 22

4.1 Flora and Flora Field Survey 22

4.1.1 Opportunistic Flora and Fauna survey methods 22

4.1.2 Diurnal Bird Surveys 22

4.1.3 Microbats 22

4.1.4 Mammal Surveys 22

4.1.5 Amphibian Surveys 22

4.1.6 Reptile and Snail surveys 23

4.2 Threatened Flora - Desktop 23

4.3 Threatened Fauna - Desktop 24

4.4 Endangered population 27

5 BAM Calculator 28

5.1 Vegetation Zones and Integrity Scores 28

5.2 Species and Ecosystem Credits 31

5.2.1 Ecosystem Credit Species derived from BAM 31

5.2.2 Species Credit Species derived from BAM 32

Stage 2: Impact Assessment 34

6 Avoid and minimise impacts 34
6.1 Avoid and minimise direct and indirect impacts 34
6.1.1 Project Location and Design 34
Arboricultural Response to Council Referral Response (Arborsaw 22/04/22) 35
6.1.2 Tree Retention 35
7 Direct Impacts 36
7.1 Vegetation disturbance and Loss 36
8 Indirect Impacts 37
8.1 Weed growth and invasion 37
8.2 Introduction of pathogens 37
8.3 Soil disturbance and erosion 37
8.4 Water Quality 38
9 Prescribed Impacts 38
10 Serious and Irreversible Impact Assessment (SAII) 39
10.1.1 Step one - Identify relevant entities at risk of a SAII 39
10.1.2 Step two - Evaluate the extinction risk of the entity to be impacted 40
10.1.3 Step three - Detail measures taken to avoid, minimise and mitigate impacts on the entity 41
10.1.4 Step four - Evaluate a serious and irreversible impact 42
11 Recommendations 43
11.1.1 Native Species Landscaping, Habitat Connectivity Offset Planting in Adjoining Reserve 43
11.1.2 Weed management 43
11.1.3 Delineation of work areas 43
11.1.4 Vegetation clearing control measures 43
11.1.5 Tree Protection 43
11.1.6 Weed Removal Techniques 44
11.1.7 Native Seed Collection 45
11.1.8 Nest boxes 45
11.1.9 Pathogen prevention 45
12 Conclusions 45
13 Appendices 46
13.1 Appendix I – Rationale for Likelihood of Occurrence 46
13.2 Appendix II– Key Weed Removal Methods 54
13.3 Appendix III– Bushland Hygiene Protocols for Phytophthora (Hornsby Council Recommendations) 58
13.4 Appendix IV– BAM –C; Reports and Data 60
13.4.1 Payment Report 60
13.4.2 Credit Summary Report. 63
13.4.3 Predicted species report 65
13.4.4 Candidate species report 67
13.4.5 Biodiversity Credit Report (Like for Like) 69
13.5 Appendix V– Martens assessment of drainage line 73
13.6 Field Data 74
14 Expertise of authors 76

Stage 1: Biodiversity Assessment

1 Introduction

Ecological Consultants Australia (ECA) has been contracted by James McHugh to provide a **Biodiversity Development Assessment Report** for a proposal at 17 Thompson St., Scotland Island 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)	242/-/DP12749
Area (ha)	0.135 ha
Street Address	17 Thompson Street, Scotland Island NSW 2105
LGA	Northern Beaches Council
Land Zoning	C3 (Previously E3): Environmental Management

Figure 1.1. Site of the proposed development. Base Image Source: Google Satelite, Accessed 2022

Figure 1.2 Construction footprint. Base Image Source: Google Satellite, Accessed 2022

Figure 1.3 Operational footprint. Base Image Source: Google Satellite, Accessed 2022

1.2 Site history

Scotland Island was subdivided into individual lots in 1902. Prior to the subdivision Scotland Island had a history of agricultural and production of salt. Permanent residents began building dwellings after electricity was supplied to the island in 1962. Currently the site consists of a combination of remnant canopy and understorey regrowth. The site was purchased for residential use in June of 2020. Prior to this purchase the site was likely left unmanaged resulting in the high abundance of *Lantana camara* 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.

1.3 Proposed actions

The proposed project involves construction of new dwelling and associated works such as:

- Vegetation and tree removal
- APZ maintenance
- Installation of Effluent Management Area (EMA)

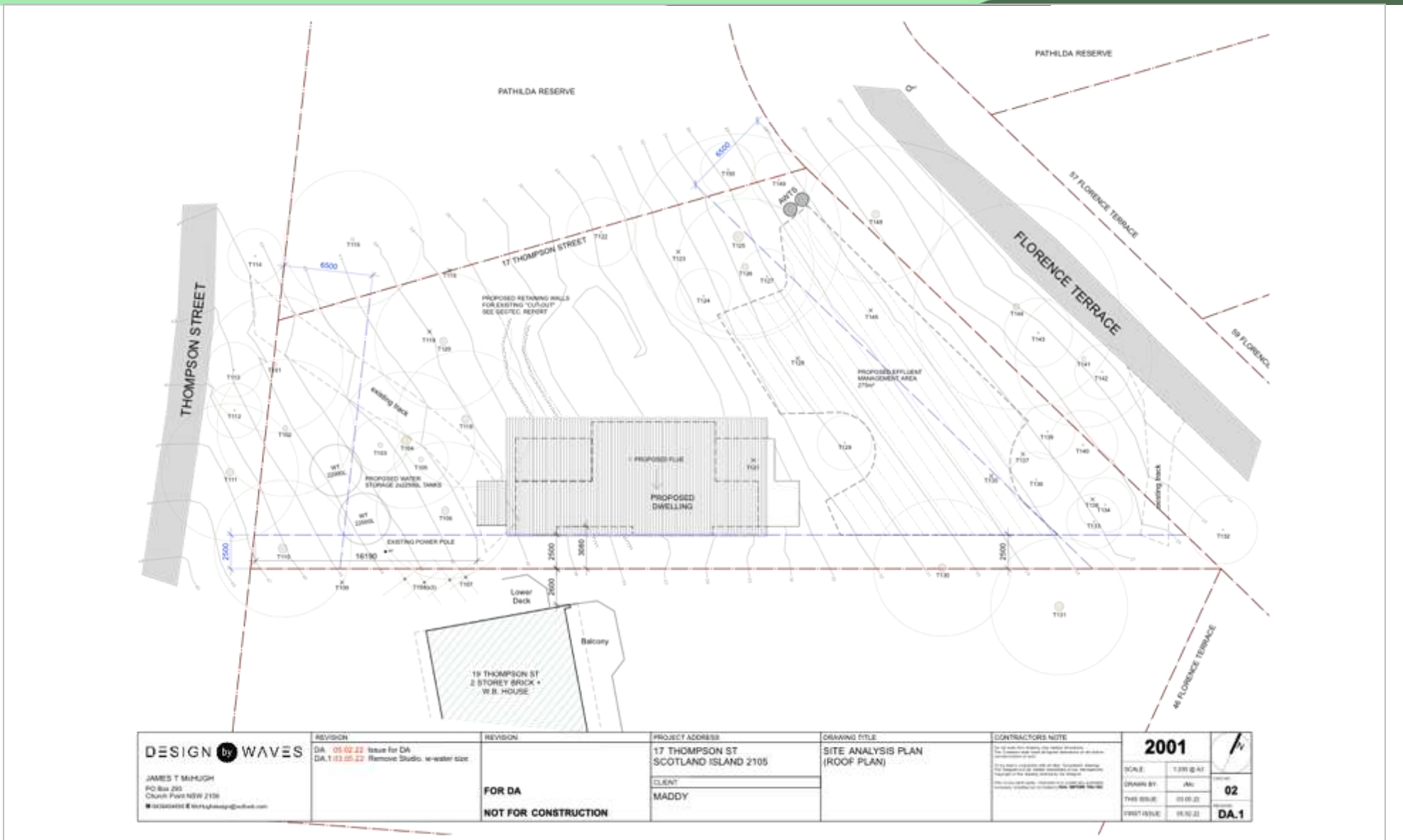


Figure 1.4. Site Plan Roof Plan. Source: Design by Waves. 03.05.22 Rev. A.1.

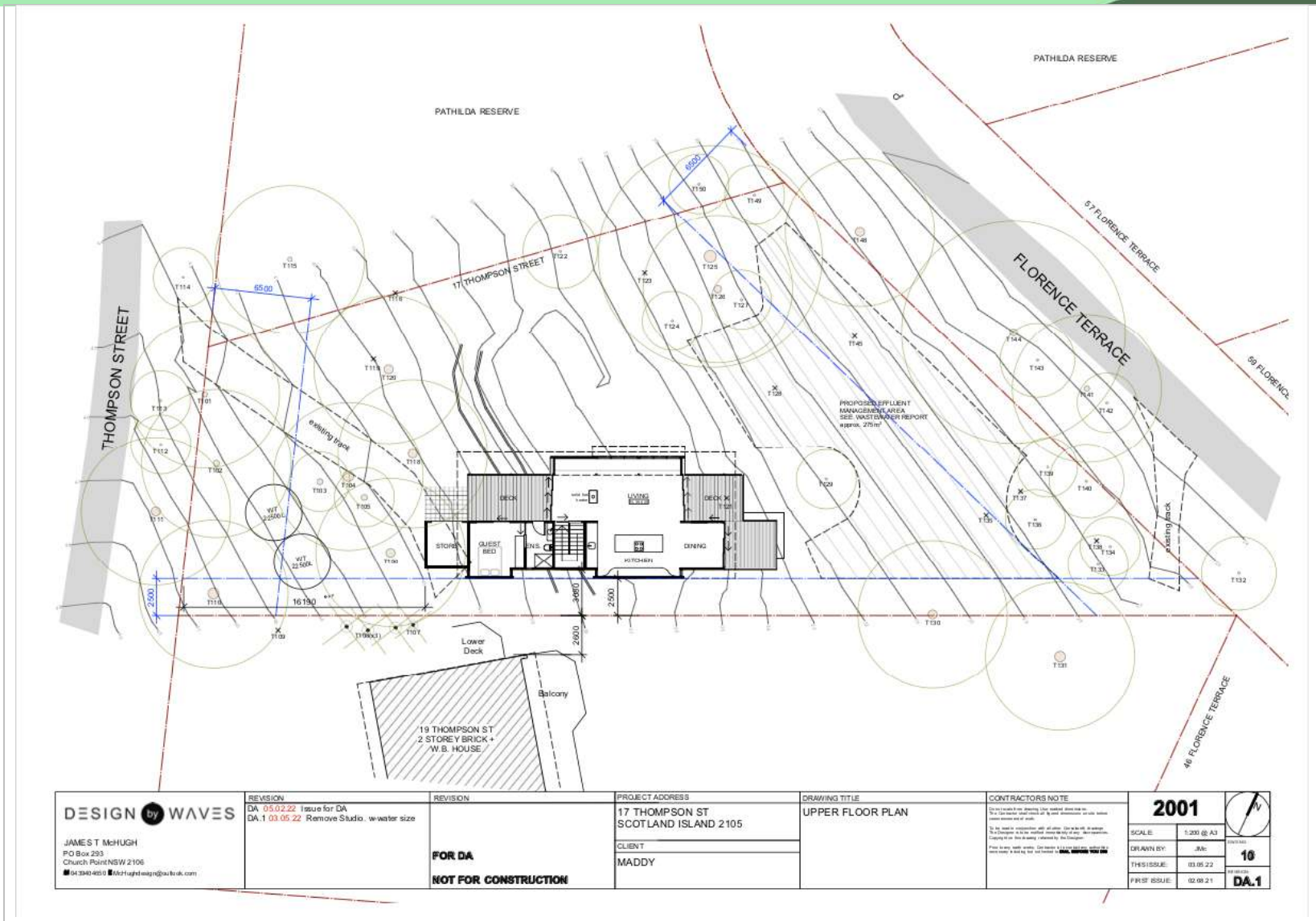


Figure 1.5. Upper Level. Source: Design by Waves. 03.05.22 Rev. A.1.

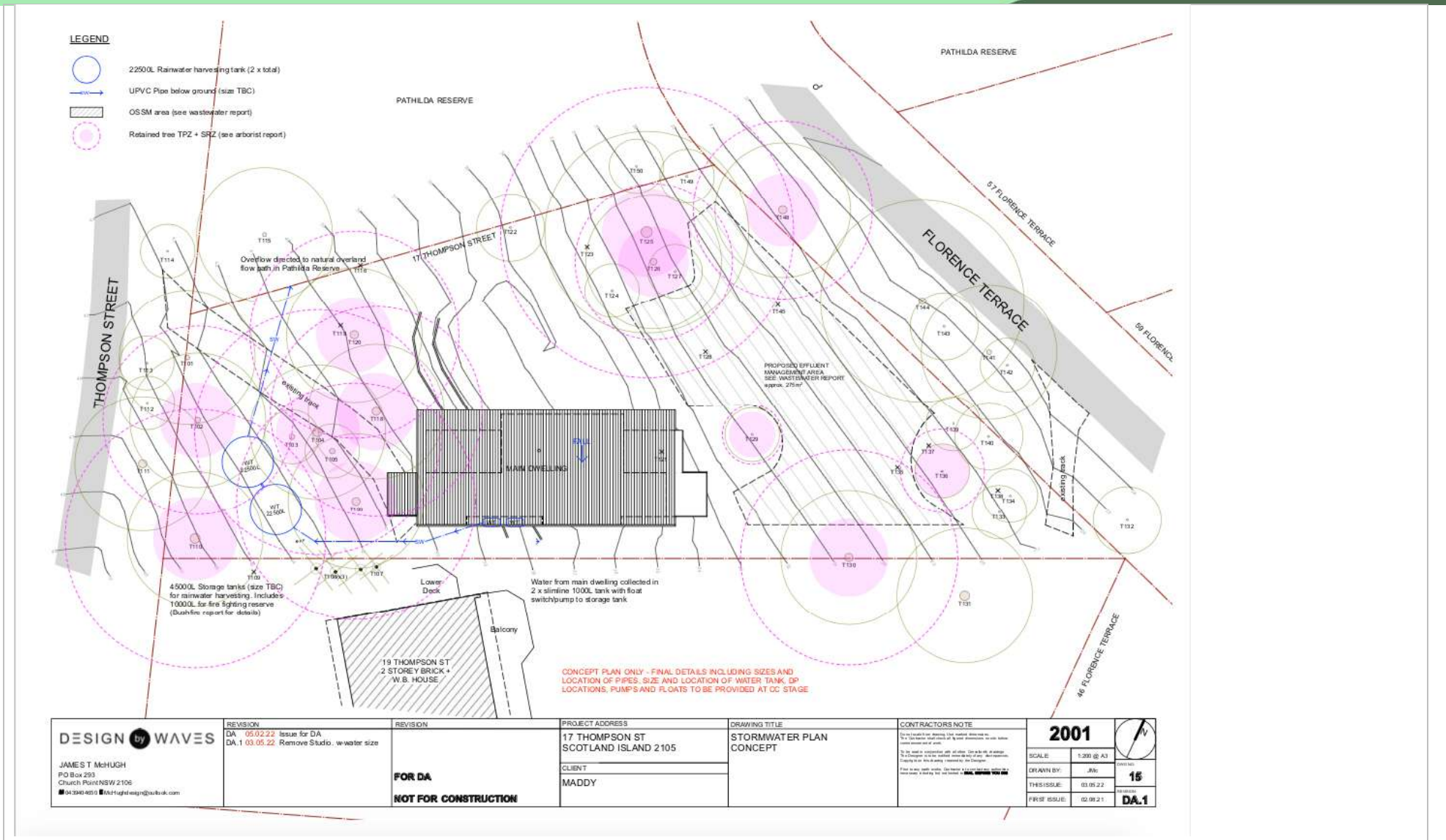


Figure 1.6. Stormwater Plan. Source Design by Waves. 03.05.22 Rev. A.1.

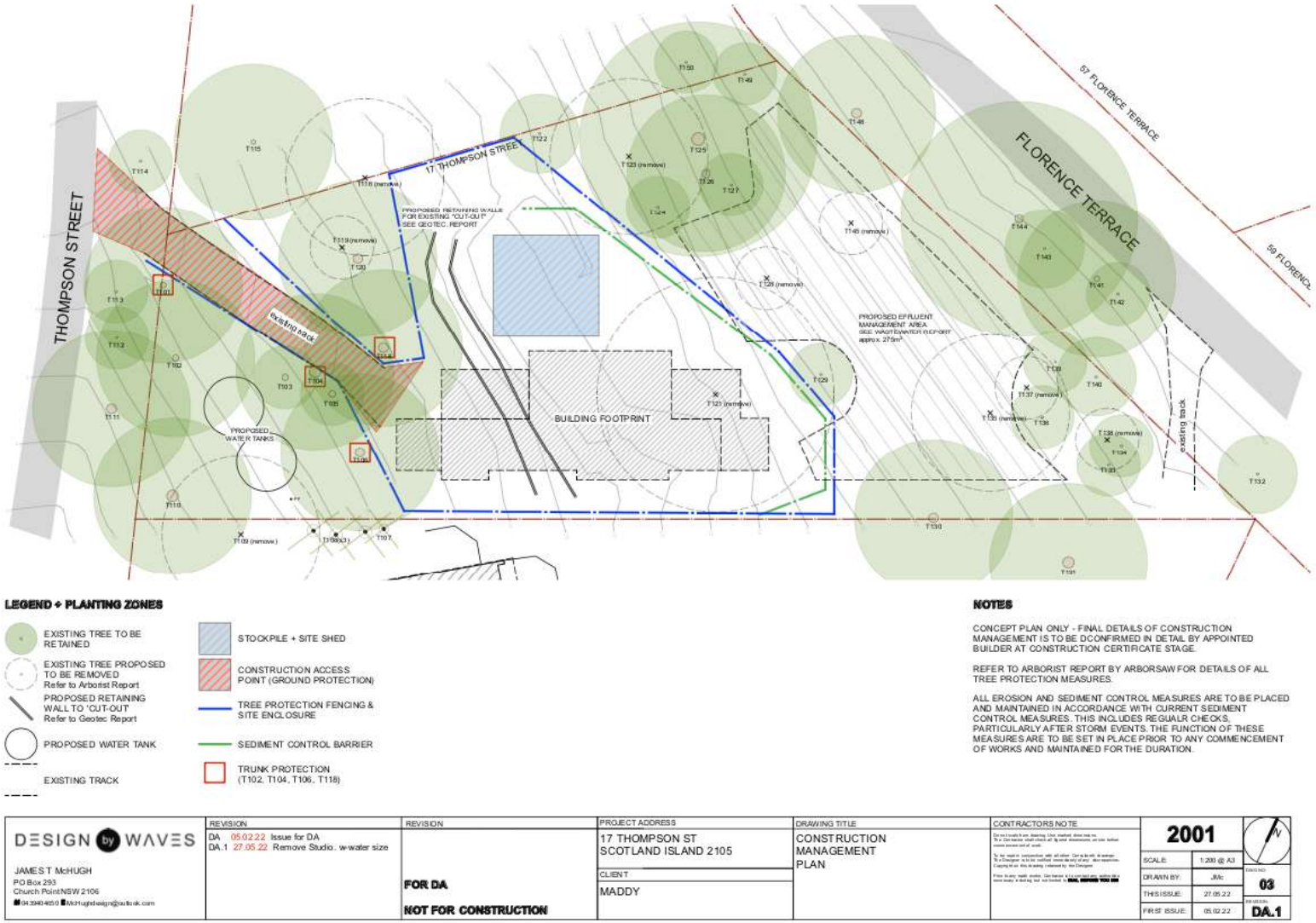


Figure 1.7. Construction Management Plan and Tree Protection Plan. Source Design by Waves. 03.05.22 Rev. A.1.

1.4 Sources of information used in the assessment

The following sources of information were used for this assessment:

- SeedMaps 2021
- SydneyMetroArea_v3.1_2016_E-VIS_4489
- BioNet DPIE (2021)
- Planning for Bush Fire Protection (PBP) NSW RFS 2019.
- Upper Level Plan. Design by Waves, Rev.A.1 03/05/22.
- Site Plan Roof Plan. Design by Waves. 03.05.22 Rev. A.1.
- Stormwater Plan. Source Design by Waves. 03.05.22 Rev. A.1.
- Construction Management Plan and Tree Protection Plan. Design by Waves 03.05.22 Rev. A.1.
- Arboricultural Impact Assessment. Arborsaw. May 2022 V4
- Bushfire Assessment Report. Building Code & Bushfire Hazard Solutions Pty Ltd 11 Nov 2021.
- Onsite Wastewater Assessment. Martens Consulting Engineers, May 2022.

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 as 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 is 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.

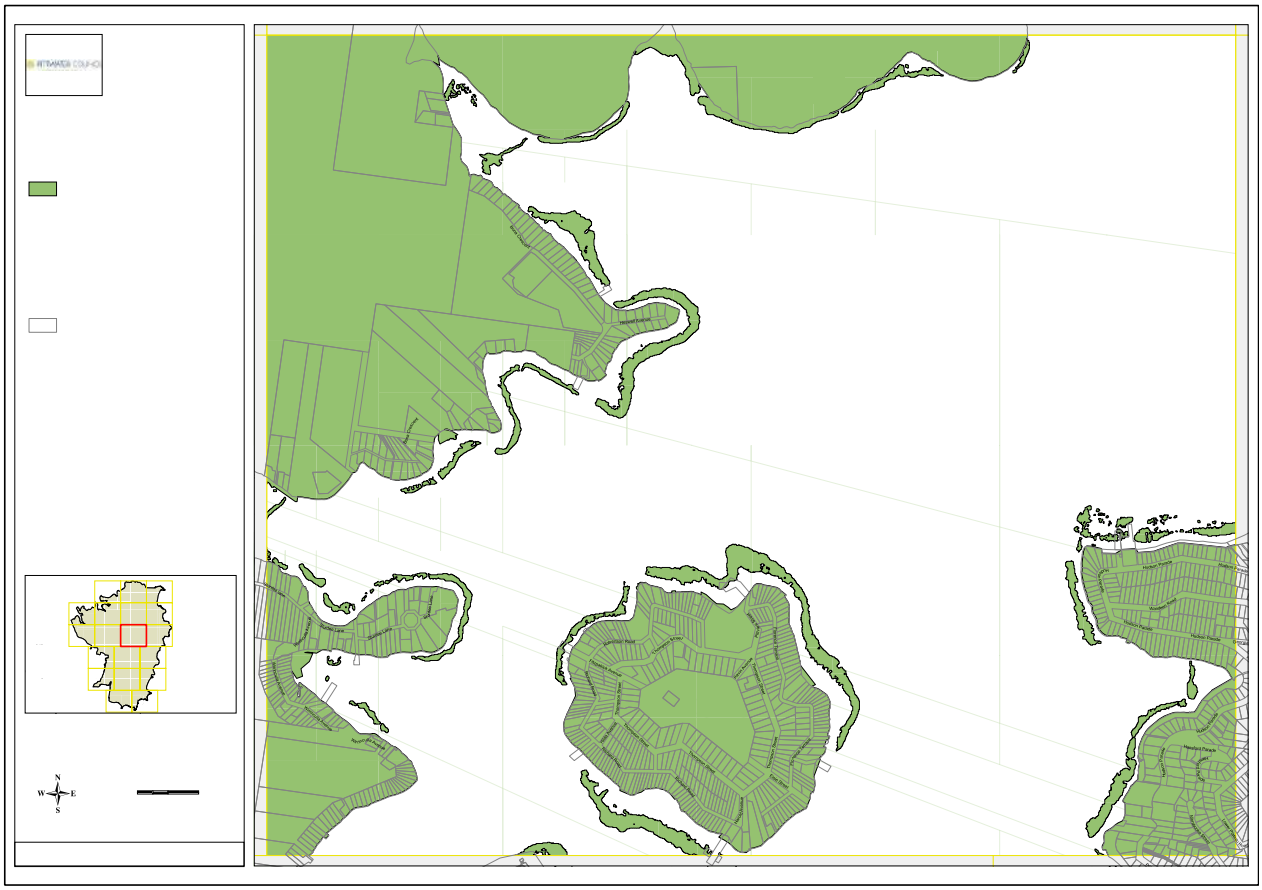


Figure 1.7 - The site is situated on "Biodiversity" on the Terrestrial Biodiversity Map as published by Pittwater Council.

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	**5800m^2**
Actual lot size	**0.14ha**
Threshold for clearing, above which the BAM and offsets scheme apply (per actual lot size)	**0.25ha**
Impact area	**0.14ha**

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 1.8. 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.

Biodiversity Values

BV Land Status: Biodiversity Values
Date added to BV Map: 11/27/2020
BV Map Criteria: Threatened species or communities with potential for serious and irreversible impacts

Figure 1.9. Biodiversity Map – Site in red. Source: https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap 2021

2 Landscape features and site context

The site is located within low density environmental living setting. The surrounding properties are made up 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 	Belrose Coastal Slopes Bsl 
% Native vegetation cover	15% in the 1500m radius circle See Figure 2.1
Landscape features	
Rivers and streams	No rivers or streams are located within the site of the surrounding lots. The steep slope and proximity to Careel Bay 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	"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 2.1. Red circle showing the 1500m 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.

Approximately 80% of the vegetation onsite has been previously disturbed through inundation of high threat weeds. The canopy is discontinuous onsite with scattered canopy trees. The mid stratum is primarily absent within site boundaries. The ground stratum has been highly disturbed, with much of the site dominated 'High Threat Exotic' (HTE) species. Pockets of vegetation onsite is displaying signs of natural regeneration through the presence of resilient native ground species as a result of the weed removal conducted by the property owner. Natural regeneration across the majority of the site this is being hindered by the abundance of exotic weed coverage and current land use practices.

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. 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 (400m^2). Due to the small area of the site, for assessing structure and composition a centre line extending to the site boundary to create a polygon plot (1000m^2) to assess function (see figure 3.2). 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 3.1. Subject site within mapped vegetation surrounding the property SydneyMetroArea_v3.1_E_VIS_4489 OEH (2016) . Source: SEED Maps, 2021.

Figure 3.2. 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.

Plate 2.

Plate 3.

Plate 4.

Plate 5.

Plate 6.

Plate 7.

Plate 8.

Plate 9.

Plate 10.

Plate 11.

Plate 12.

Plate 13.

Plate 14.

Plate 15.

Plate 16.

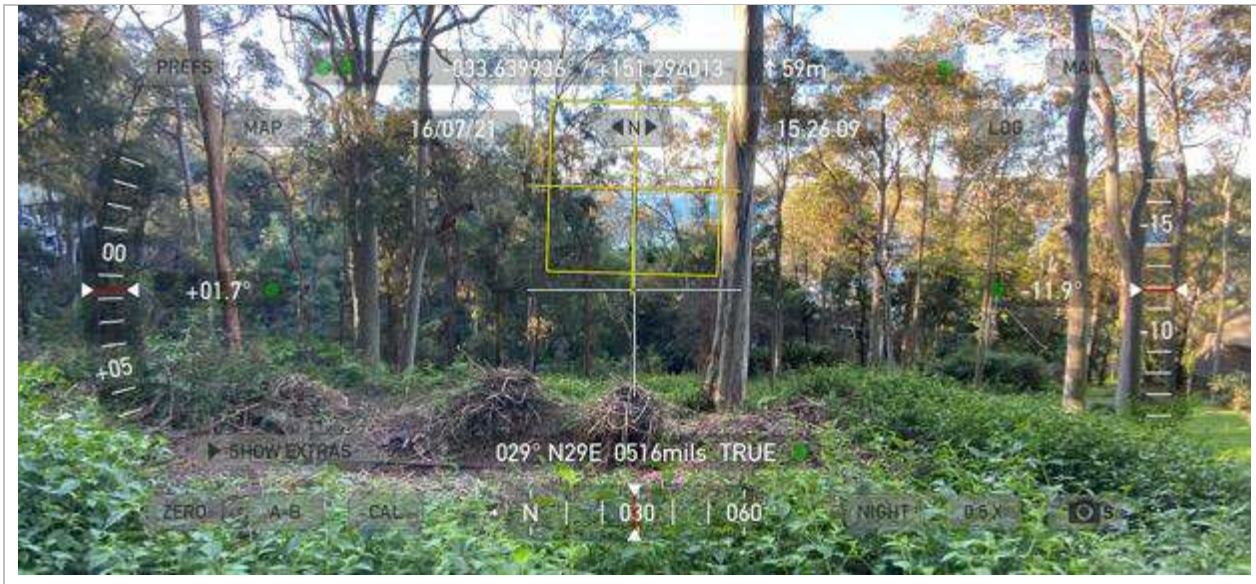


Plate 17.

Plate 18.

Plate 19.

4 Threatened Species

4.1 Flora and Flora Field Survey

No threatened flora or fauna species were identified during Kingfisher 2021 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 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 18 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	*Boronia umbellata*	Orara Boronia	V,P	V	1
Myrtaceae	*Callistemon linearifolius*	Netted Bottle Brush	V,3		5
Euphorbiaceae	*Chamaesyce psammogeton*	Sand Spurge	E1		7
Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue Orchid	V,P,2	V	1
Myrtaceae	*Eucalyptus camfieldii*	Camfield's Stringybark	V	V	8
Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	4
Orchidaceae	*Genoplesium baueri*	Bauer's Midge Orchid	E1,P,2	E	1
Grammitidaceae	*Grammitis stenophylla*	Narrow-leaf Finger Fern	E1,3		1
Proteaceae	*Grevillea caleyi*	Caley's Grevillea	E4A,3	CE	197
Myrtaceae	*Kunzea rupestris*		V	V	1

Family	Scientific Name	Common Name	NSW status	Comm. status	Records
Malvaceae	*Lasiopetalum joyceae*		V	V	2
Proteaceae	*Macadamia integrifolia*	Macadamia Nut		V	7
Orchidaceae	*Microtis angusii*	Angus's Onion Orchid	E1,P,2	E	156
Proteaceae	*Persoonia hirsuta*	Hairy Geebung	E1,P,3	E	5
Thymelaeaceae	*Pimelea curviflora* var. *curviflora*		V	V	1
Myrtaceae	***Rhodamnia rubescens***	**Scrub Turpentine**	E4A		31
Myrtaceae	***Syzygium paniculatum***	**Magenta Lilly Pilly**	E1	V	16
Elaeocarpaceae	*Tetratheca glandulosa*		V		25

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

4.3 Threatened Fauna - Desktop

A total of 58 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	*Heleioporus australiacus*	Giant Burrowing Frog	V,P	V	58
Amphibia	*Litoria aurea*	Green and Golden Bell Frog	E1,P	V	2
Amphibia	*Pseudophryne australis*	Red-crowned Toadlet	V,P		64
Aves	*Anthochaera phrygia*	Regent Honeyeater	E4A,P	CE	37
Aves	*Ardenna carneipes*	Flesh-footed Shearwater	V,P	J,K	1
Aves	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P		5
Aves	*Burhinus grallarius*	Bush Stone-curlew	E1,P		50

Class	Scientific Name	Common Name	NSW Status	Comth. Status	No. of records
Aves	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V,P,3		1
Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		85
Aves	*Dasyornis brachypterus*	Eastern Bristlebird	E1,P,2	E	1
Aves	*Diomedea exulans*	Wandering Albatross	E1,P	E	2
Aves	*Diomedea gibsoni*	Gibson's Albatross	V,P	V	1
Aves	*Esacus magnirostris*	Beach Stone-curlew	E4A,P		1
Aves	*Glossopsitta pusilla*	Little Lorikeet	V,P		9
Aves	*Haematopus fuliginosus*	Sooty Oystercatcher	V,P		6
Aves	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V,P		43
Aves	*Hieraaetus morphnoides*	Little Eagle	V,P		5
Aves	***Hirundapus caudacutus***	**White-throated Needletail**	P	V,C,J,K	11
Aves	***Ixobrychus flavicollis***	**Black Bittern**	V,P		1
Aves	*Lathamus discolor*	Swift Parrot	E1,P,3	CE	20
Aves	*Lophoictinia isura*	Square-tailed Kite	V,P,3		3
Aves	*Macronectes giganteus*	Southern Giant Petrel	E1,P	E	1
Aves	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V,P		1
Aves	*Neophema pulchella*	Turquoise Parrot	V,P,3		2
Aves	*Ninox connivens*	Barking Owl	V,P,3		21
Aves	*Ninox strenua*	Powerful Owl	V,P,3		450
Aves	*Numenius madagascariensis*	Eastern Curlew	P	CE,C,J,K	8
Aves	*Onychoprion fuscata*	Sooty Tern	V,P		1
Aves	*Pandion cristatus*	Eastern Osprey	V,P,3		6
Aves	*Petroica boodang*	Scarlet Robin	V,P		1
Aves	*Ptilinopus regina*	Rose-crowned Fruit-Dove	V,P		3
Aves	*Ptilinopus superbus*	Superb Fruit-Dove	V,P		2
Aves	*Thalassarche cauta*	Shy Albatross	V,P	V	3

Class	Scientific Name	Common Name	NSW Status	Comth. Status	No. of records
Aves	*Thalassarche chrysostoma*	Grey-headed Albatross	P	E	1
Aves	*Thalassarche melanophris*	Black-browed Albatross	V,P	V	1
Aves	*Tyto novaehollandiae*	Masked Owl	V,P,3		4
Mammalia	*Cercartetus nanus*	Eastern Pygmy-possum	V,P		299
Mammalia	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	V	16
Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	5
Mammalia	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		2
Mammalia	*Isoodon obesulus obesulus*	Southern Brown Bandicoot (eastern)	E1,P	E	60
Mammalia	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V,P		12
Mammalia	*Miniopterus australis*	Little Bent-winged Bat	V,P		43
Mammalia	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V,P		71
Mammalia	*Myotis macropus*	Southern Myotis	V,P		17
Mammalia	*Petauroides volans*	Greater Glider	P	V	1
Mammalia	***Petaurus norfolcensis***	**Squirrel Glider**	V,P		5
Mammalia	*Phascolarctos cinereus*	Koala	V,P	V	81
Mammalia	*Pseudomys novaehollandiae*	New Holland Mouse	P	V	9
Mammalia	***Pteropus poliocephalus***	**Grey-headed Flying-fox**	V,P	V	123
Mammalia	***Saccolaimus flaviventris***	**Yellow-bellied Sheathtail-bat**	V,P		1
Mammalia	***Scoteanax rueppellii***	**Greater Broad-nosed Bat**	V,P		7
Mammalia	*Vespadelus troughtoni*	Eastern Cave Bat	V,P		1
Reptilia	*Caretta caretta*	Loggerhead Turtle	E1,P	E	4
Reptilia	*Chelonia mydas*	Green Turtle	V,P	V	9
Reptilia	*Dermochelys coriacea*	Leatherback Turtle	E1,P	E	1
Reptilia	*Eretmochelys imbricata*	Hawksbill Turtle	P	V	3
Reptilia	*Varanus rosenbergi*	Rosenberg's Goanna	V,P		30

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	*Petaurus norfolcensis*	E2,V,P		1
Koala in the Pittwater Local Government Area	*Phascolarctos cinereus*	E2,V,P	V	80

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.

5 BAM Calculator

5.1 Vegetation Zones and Integrity Scores

Vegetation zones were determined on species composition at the site. The vegetation zones 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 construction footprint of the site.

Zone One

Zone one is assessed as the entire site, as the whole of the site is required to be managed as APZ - Inner Protection Area (see Bushfire Assessment Report, 2021) and has an area of 0.137 ha (0.14 ha in the BAM-C).

Vegetation across the zone is consistent. The ground and mid-statum are dominated by high threat exotic species including *Lantana camara* and *Ipomea*. 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 54 ha. Vegetation on site is less than 100 m from native vegetation of the adjoining properties. Scattered remnant trees are common across the whole island.

The vegetation zone has been divided into three management zones within the BAM-C. This will reflect the future actions; complete vegetation removal within the construction footprint (0.03ha); Effluent Management Area (0.02ha); and Asset Protection Zone (APZ) (0.09ha).

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

PCT	Vegetation Zone	Area (ha)	Vegetation Integrity (VI) Score
1214 (PSGF)	1. 1214_Poor	0.137	18.6

Figure 5.1. Vegetation zones 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	Vegetation Removal (complete vegetation removal)	0.02	-18.6
1	Effluent Management Area (retention of canopy)	0.03	-18.6
1	APZ (inner protection area)	0.09	-18.6
	Total	**0.14**	**-18.6**

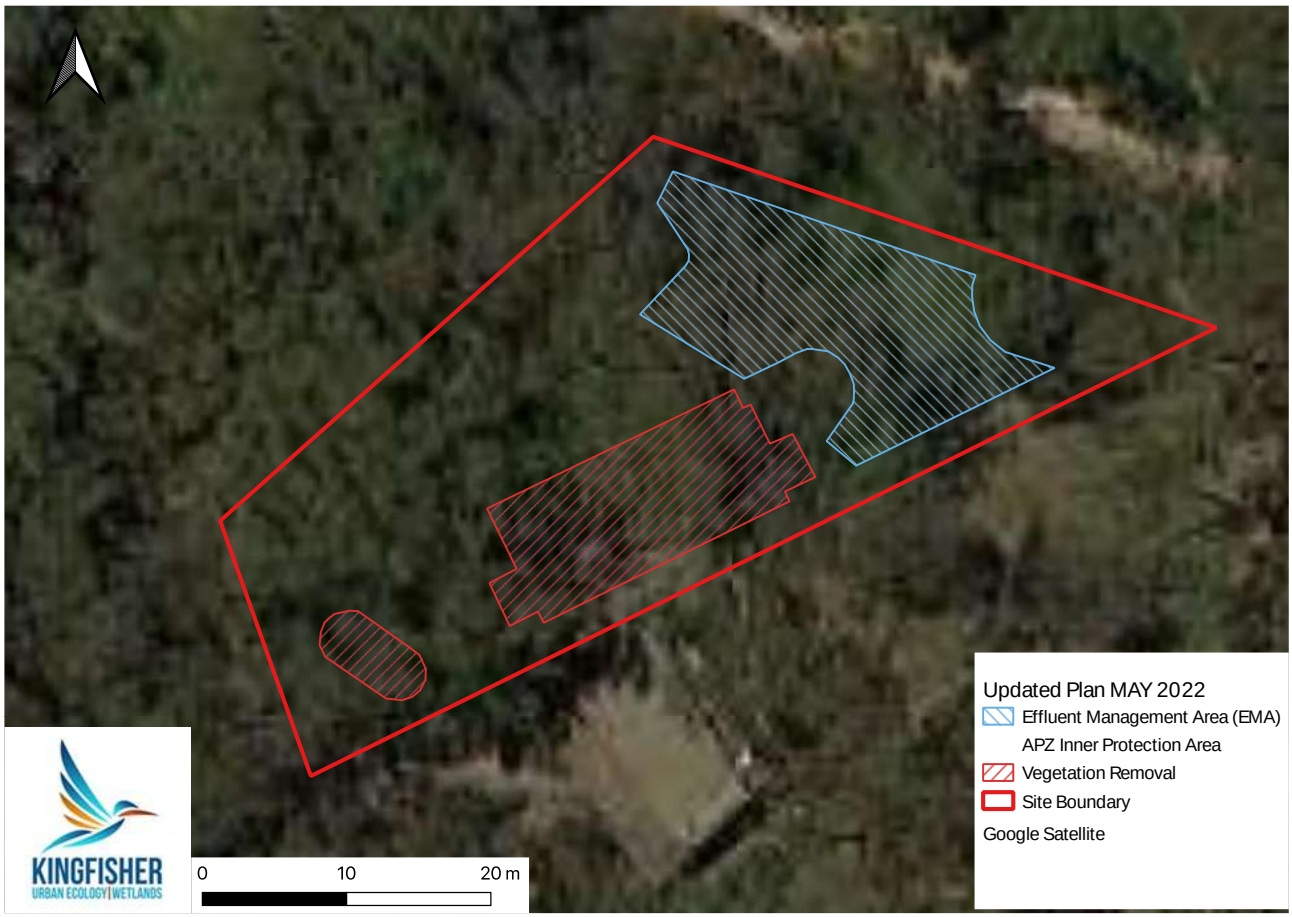


Figure 5.2. Management zones on site.

5.2 Species and Ecosystem Credits

The grand total cost to offset both ecosystem credits and species credits generated by this development is $4,059.62 (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 failed to generate species credits for the proposed works. This is due to the highly degraded nature of the site and lack of key habitat features associated with the species.

In total the cost to offset the species credits generated will be $1,072.16 (including GST). See below, figure 5.4 for the Species credit summary.

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	***Chalinolobus dwyeri*** (Large-eared Pied Bat)	Vulnerable	$741.31	20.6900%	$80.00	1	$974.69
						Subtotal (excl. GST)	**$974.69**
						GST	**$97.47**
						Total species credits (incl. GST)	**$1,072.16**

Figure 5.4. Candidate species generated by the Bam-C.

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.

Stage 2: Impact Assessment

6 Avoid and minimise impacts

6.1 Avoid and minimise direct and indirect impacts

6.1.1 Project Location and Design

The proposed development was designed in consultation with Bushfire and Arboricultural expertise. The following information is provided to council to demonstrate the efforts to avoid and minimise impacts on native vegetation within the property and are supplied to council in response to Northern Beaches Council Landscape and Natural Environment Referral Responses. The following extracts should be read in conjunction with relevant documentation and reports.

The proposal has removed the Stage 2 (Studio Office) from the proposal in order to reduce the building footprint. This area is required to be managed as both an APZ and EMA. Reducing the proposed vegetation removal from 0.03ha to 0.02ha.

Bushfire Response to Council

Re: PROPOSED SOLE OCCUPANCY DWELLING & HOME OFFICE
LOT 242 DP 12749 / 17 THOMPSON STREET, SCOTLAND ISLAND NSW 2105
ADDITIONAL INFORMATION

Dear Sir / Madam,

Northern Beaches Council (Council) have released the Natural Environment Referral Response – Biodiversity for this matter which does not support the proposal in its current form and consequently seeks additional information on four items, being;

1. *Owners consent for the removal of T107 & 109, located within 19 Thompson Street, Scotland Island,*
2. *Redesign, or justification as to how the proposed dwelling has been sited to avoid biodiversity impacts,*
3. *Technical clarifications and updates to the BDAR, and*
4. *A Tree Retention Plan depicting the location of all trees to be retained in perpetuity, and those required for removal as a part of the proposed APZ.*

To assist Council I provide information in relation to items 2 and 4 above.

The applicant was cognizant of both the environmental sensitivity of the subject site and surrounding landscape and bushfire constraints at the design phase of this project. The bushfire constraints and subsequently mitigation measures aim to protect human life and minimise impacts on property.

In this regard the proposed dwelling was positioned on the southern side of the property where mutually supportive APZs are provided from established neighbouring development and the maximum separation is available from Pathilda Reserve, which presents the bushfire hazard.

The position of the proposed dwelling also utilised a largely cleared area within the site.

In relation to the trees proposed for removal and retention I have reviewed the Landscape Plan prepared by Design by Waves (dwg no 16, rev DA, dated 05.02.22) and in consideration of the nature of the hazard and height of mature canopy trees am satisfied that those trees nominated for retention will satisfy the requirements for an Asset Protection Zone.

I am available to meet either Council should the need arise.

Should you have any enquiries regarding this project please contact me at our office.

Figure 6.1. Extract from Additional information request letter. Building Code and Bushfire Hazard Solutions Pty Ltd. 19th April 2022.

Arboricultural Response to Council Referral Response (Arborsaw 22/04/22)

6.1.2 Tree Retention

Tree 121

"Following the Pre development Tree Survey, the Architect was instructed to attempt to include Tree 121 within the design, as it is the dominant site tree and has a High Retention Value. All proposed designs conflicted with tree retention primarily due to the proximity to the trunk, multiple key pier holes within the SRZ and the majority of the canopy overhanging the roof line which conflicts with the APZ requirements. Pleases see the Additional information from the Bushfire Consulted for further reasoning regarding the positioning of the dwelling."

Tree 128

"Tree 128 *Allocasuarina littoralis* (Forest oak) is a small semi mature tree that is goring independently in the middle of the site. Due to its small size and despite it being a species from Pittwater Spotted Gum Forest, the tree has low landscape significance as it is considered easily replaceable in the short term. The tree has a 2.2m radius TPZ resulting in 14m2 of area. The tree is positioned in the middle of the transpiration bed. Creating a gap in the transpiration bed will not be sufficient as the surrounding increased nutrient rich water flow is still likely to lead to swift decline in tree health. Furthermore, altering the transpiration bed layout puts more pressure on other site trees nominated for retention such as Tree 125. Removing Tree 128 and replacing it elsewhere onsite is considered the most reasonable approach considering the constraints of the site."

Tree Root Investigations and Tree Root Map

"The retaining wall is a recommendation from the Geotech engineers is to help retain the existing cut-out on the site. Two 900mm high walls are proposed which run through the TPZ (Outside The SRZ) of tree numbers T118 & 120. The pier holes are flexible in location at this area and no other excavation is planned to accommodate the proposed walls. The pier holes use insignificant TPZ area.

In line with section 3.3.2 of AS 4970:2009, a 10% incursion to a TPZ is considered a minor encroachment. Any more than 10% is considered a major incursion and special measures should be taken to minimise impact on the retained trees and the Arborist must demonstrate that the tree will remain viable post construction. The pier holes do not take up more than 10% of TPZ area, therefore special measures such as root mapping do not need to be undertaken."

Building Design

The entire house is raised on piers and not touching the ground in the TPZ. The dwelling has been specifically situated so that no piers are located in the SRZ of any tree. Six(6) Pier holes are planned in the TPZ's of Trees T104, T106 & T118. It is only the pier holes that result in a loss of TPZ area. There may be some minor excavation under the house for clearance, outside the TPZ areas.

If the floating floor level was included, the TPZ encroachment calculation of the encroaching floor area within the TPZ is still considered minor as follows;

• T104 - 4% • T106-11% • T118-10% • T130 - 10% • T136 – 6%

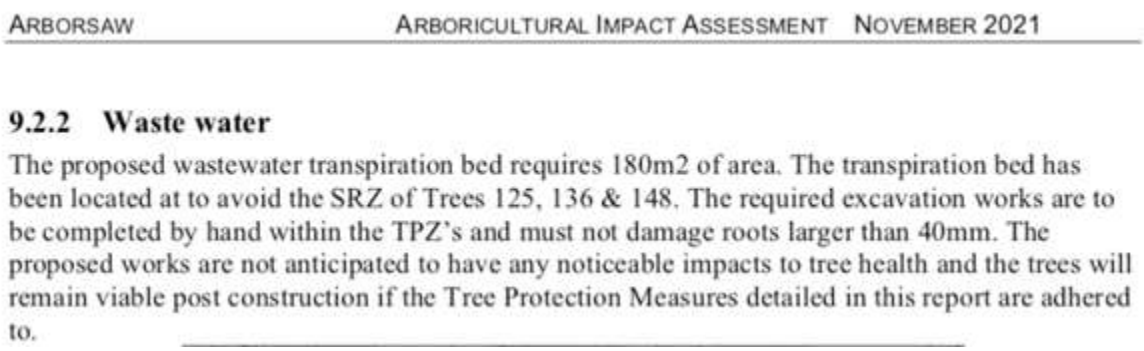
As the Six (6) pier locations are outside the SRZ and take up <10% of the TPZ, In line with section 3.3.2 of AS 4970:2009, a <10% incursion to a TPZ is considered a minor encroachment. Any more than 10% is considered a major incursion and special measures should be taken to minimise impact on the retained trees and the Arborist must demonstrate that the tree will remain viable post construction. The pier holes do not take up more than 10% of TPZ area, therefore special measures such as root mapping do not need to be undertaken.

7 Direct Impacts

7.1 Vegetation disturbance and Loss

Native vegetation will be removed to accommodate for the proposed development footprint. However, the area that makes up the current construction 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 and integrate the current native canopy into the building design, as is common for the area. Areas of potential habitat for PSGF will be lost (0.02ha), although the site has been unmanaged and impacted by uncontrolled weed growth and subject to modification for over 50 years.

The installation and dispersal of wastewater into the EMA will impact and modify a total area of 0.03ha of ground story vegetation. Aboricultural assessment notes that the operation of this dispersal area is unlikely to affect the health of mature canopy vegetation see figure 6.1. The EMA area is also required to be managed as an APZ (IPA).



ARBORSAW ARBORICULTURAL IMPACT ASSESSMENT NOVEMBER 2021

9.2.2 Waste water

The proposed wastewater transpiration bed requires 180m2 of area. The transpiration bed has been located at to avoid the SRZ of Trees 125, 136 & 148. The required excavation works are to be completed by hand within the TPZ's and must not damage roots larger than 40mm. The proposed works are not anticipated to have any noticeable impacts to tree health and the trees will remain viable post construction if the Tree Protection Measures detailed in this report are adhered to.

Figure 6.2. Extract from AIA. Arborsaw November, 2021.

This area is currently dominated by high threat exotic species and the future management practices (APZ) will continue to impact an area (0.09ha) 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 an APZ (0.09ha) within the property boundary. The majority of the vegetation does not require modified in order to facilitate the creation of an APZ, as the site's APZ is already established and managed as such. Whilst native species planting post construction is expected to improve the species diversity within the site, the likely hood of continued impact within the APZ is expected through slashing and mowing. Therefore, as a precautionary approach this management zone has also been assessed within the BAM-C for complete removal of ground and mid-story species and the reduction of 5% of the current canopy cover.

A total of ten(10) trees are proposed for removal. (see Aborcultural Impact Assessment, Austin 2021 for impact details). Of the trees proposed for removal six(6) are locally native species associated with PWSGF.

- **T109 – *Corymbia maculata*.** On adjoining land. Owners consent has been given and will be provided in writing to council.
- **T116 – *Corymbia maculata***
- **T119 – Dead Tree**
- **T121 – *Corymbia maculata***
- **T123 – *Corymbia maculata***
- **T128 – Allocasuarina littoralis**
- **T135 – *Corymbia maculata***
- **T137 – Dead Tree**
- **T138 – Dead Tree**
- **T150 – Dead Tree**

8 Indirect Impacts

8.1 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 woks

8.2 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 Phytophora.

8.3 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.

8.4 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 11 below.

9 Prescribed 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
Habitat Connectivity	Yes	Inconsistent vegetation throughout	Reduction in canopy within construction footprint and APZ	Large-eared Pied Bat (foraging Habitat)	Section 11

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.
Waterbodies, water quality and hydrological processes	No	N/A	Negligible	N/A	N/A

10 Serious and Irreversible Impact Assessment (SAII)

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 SAII
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

10.1.1 Step one - Identify relevant entities at risk of a SAII

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 SAII 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 SAII and are impacted on by the proposal.*

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

The following section identifies SAII 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 SAII 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 SAII 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	
	Large-eared Pied Bat				X

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

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

Pittwater Spotted Gum Forest (PSGF) satisfies Principle 3 of SAII criteria;

Principle 3: The impact is made on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.

The proposed development will have an approximate impact area of 0.06ha within the 15.6ha local patch of PSGF. Of the 0.06ha impact, approximately 0.02ha is proposed to be removed to facilitate the proposal design. This equates to a total removal of 0.13% of the 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 used for footpath access and turfed garden. However, outside of the Reserve system PSGF usually occurs as canopy only. The local patch of PWSG has been subject to disturbance for a number of decades, this is primarily due historical actions on the Island including; clearing, erosion, grazing 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 small impact area and degraded nature of the site.

- **Large-eared Pied Bat**

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 foraging habitat for microbats in the form of canopy cover and insect abundance. Ten Total trees are proposed for removal including six dead trees. Canopy cover will be restricted to 30% within the site, resulting in a loss of marginal foraging habitat and a reduction in future potential roosting habitat in the form of hollows.

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 foraging 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.

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

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

The proposal is expected to have a relatively small impact upon the local occurrence of PSGF. The vegetation proposed for removal is currently in typical condition of PSGF on residential land. Whilst the presence of resilient ground natives are occurring on site, the high abundance of weed coverage results in the unlikelihood that the original vegetation community would further recover without assistance through bush regeneration and ongoing weed removal.

The proposed dwelling has been designed in order to retain as much native canopy as possible. Implications of changing the dwelling orientation on canopy retention have been detailed in section 6 of this report. Changes to the orientation and location of the dwelling resulted in a similar impact on PWSG within the site. A canopy corridor along the outer east and west property boundaries will be retained. Delineation of works areas and exclusion zones for all vegetation to remain have been recommended.

- **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 bushfire protection requirements will be removed or modified.

Four 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 recommended to increase potential foraging habitat area for the Large-eared Pied Bat (Chalinolobus dwyeri).

10.1.4 Step four - Evaluate a serious and 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. 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.

- **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 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 to the Large-eared Pied Bat (*Chalinolobus dwyeri*). Therefore, the species will not be placed at risk of a serious or irreversible impact.

11 Recommendations

11.1.1 Native Species Landscaping, Habitat Connectivity Offset Planting in Adjoining Reserve

It is expected that with ongoing weed removal, natural regeneration of native ground species is likely. Native recruitment should be supported with native landscape planting in-line with PBP. Due to the sites APZ requirements, its recommended that supplementary native planting can be implemented in the adjoining council bush land. The property owner has proposed to undertake native canopy planting in the adjoining Council bushland in order to offset impacts on canopy as a result of the development. 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 council's landscape/biodiversity team for the greatest ecological outcome.

This can be implemented whilst also ensuring the areas satisfy 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 threated flora species within revegetation areas is also recommended. Such actions will increase biodiversity within the site and the immediate landscape.

11.1.2 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.

11.1.3 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.

11.1.4 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 of fauna handler must be on site during vegetation clearing.

11.1.5 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.

14.1 Tree Protection Plan

Figure 35: The Tree Protection Plan (Source: Proposed Plans by Design Waves, Rev A, 21/09/21modified by Austin)

Tree Protection Plan Key

Tree Protection Fence Stage 1

Tree Protection Fence Studio

Ground Protection (Trees 101, 102, 106, 104, 118 & 120.)

Trunk Protection (102, 104, 106 & 118 + (130 & 133 studio stage))

Figure 10.1. Tree Protection Plan. Extracted from Arborcultural Impact Assessment. Arborsaw, 2021.

11.1.6 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 II and III for further details.

11.1.7 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.

11.1.8 Nest boxes

Installation of a 4 nest boxes designed for microbats should be added to the site to increase roosting opportunities in the area.

Image from: nestboxes.com.au

11.1.9 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.

12 Conclusions

The proposed development will have an approximate impact area of 0.14ha 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.

13 Appendices

13.1 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				
Diuris bracteata	*Diuris bracteata*	For over 100 years *Diuris bracteata* 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.

		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). In recent years, however, these specimens are considered to have been incorrectly identified and are considered to be *Diuris platichila* (Peter Weston May 2013). The species is considered to be extinct, though the listing status under the *Biodiversity Conservation Act 2016* does not yet reflect this status.		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 weeds is prohibiting growth of native vegetation. Further decreasing the chances of the species being present within the site boundaries. 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.
Rhodamnia rubescens	Scrub Turpentine	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of *R. rubescens* typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m above sea level in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	No	Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area. 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 is prohibiting growth of native vegetation. Further decreasing the

		This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.		chances of the species being present within the site boundaries. 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.
Genoplesium baueri	Bauer's Midge Orchid	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. Grows in dry sclerophyll forest and moss gardens over sandstone.	No	Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area. 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 is prohibiting growth of native vegetation. Further decreasing the chances of the species being present within the site boundaries. 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.

		Flowers February to March.		
Hygrocybe aurantipes	*Hygrocybe aurantipes*	Occurs in gallery warm temperate forests dominated by Lilly Pilly (*Acmena smithii*), Grey Myrtle (*Backhousia myrtifolia*), Cheese Tree (*Glochidion ferdinandi*) and Sweet Pittosporum (*Pittosporum undulatum*). Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible. Occur as individuals or in groups, terrestrial rarely on wood and only if extremely rotten; substrates include soil, humus, or moss. Does not produce above ground fruiting bodies (fungus) all year round. Fruiting bodies begin appearing mid May to mid July sometimes to August	No	Likelihood of occurrence for the species is low. Habitat is substantially degraded such that the species is unlikely to utilise area. 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 is prohibiting growth of native vegetation. Further decreasing the chances of the species being present within the site boundaries. 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.
Fauna				
Chalinolobus dwyeri	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 (*Petrochelidon ariel*), frequenting low to mid-	Foraging – Yes, non accessible Breeding – No	There is a low likelihood of occurrence for the species. Previously recorded sightings on Bionet atlas have been sighted within 10km's of the site. The site presents marginal habitat for the species in the form of foraging

		elevation dry open forest and woodland close to these features.		opportunities from eucalyptus and other flowering natives. No hollows recorded on site. Species utilise cracks and caves in cliff faces for roosting habitat. Areas with these features are known to exist within the Pittwater, however the species has not been previously recorded on Scotland Island. It is likely the species is inhibited from the potential foraging habitat due to the surrounding bay. The proposed development is not considered as a SAII. One Credit has been generated for the Large-eared Pied Bat. No further assessment required.
Lathamus discolor	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 *Eucalyptus robusta,* Spotted Gum *Corymbia maculata,* Red Bloodwood *C. gummifera,* Mugga Ironbark *E. sideroxylon,* and White Box ˆ. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E.*	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

		pilularis. Return to home foraging sites on a cyclic basis depending on food availability.		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.
Miniopterus australis	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 (*M. schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear its young.	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 foraging habitat for the species. 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.
Miniopterus orianae oceanensis	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	Foraging – Yes Breeding - No	There is a moderate likelihood of occurrence. It is expected that the species may use the site for foraging

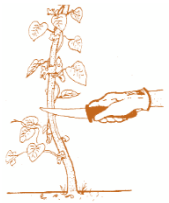
		and disperse within a 300km range. Forage in forested areas in the tree canopy.		and thus the species was retained as a Predicted threatened species (Ecosystem credits) in the BAM-C. The site presents foraging habitat for the species. The development site would not be considered breeding habitat for 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.
Anthochaera phrygia	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	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.

13.2 Appendix II– Key Weed Removal Methods

Physical removal

Technique	Method	Equipment
Hand Removal 	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. 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.	Tools: Gloves, Rakes, Knife and Weed Bags
Crowning 	Plants that possess rhizomes or bulbs might not respond to various removal techniques and may need to be treated with crowning. 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 Soil disturbance is to be kept to a minimum when using this technique.	Tools: Knife, mattock, trowel, impervious gloves, and all other required P.P.E.
Cut and Paint Stems 	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. 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. 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.	Tools: loppers, secateurs, pruning saw, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide and all other required P.P.E.

Technique	Method	Equipment
Scrape and Painting 	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. 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. 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. Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.	Tools: knife, chisel, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.
Cut with a Chainsaw and Paint 	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. 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. 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. Follow up treatment will be required. If plants resprout, cut and paint the shoots using the same method.	Tools: chainsaw, ear muffs, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.

Technique	Method	Equipment
Spot Spraying	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. 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.	Tools: protective clothing, safety glasses, herbicide sprayer, impervious gloves, Herbicide, and all other required P.P.E.

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.

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.

13.3 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.

13.4 Appendix IV– BAM –C; Reports and Data

13.4.1 Payment Report.

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00030333/BAAS19008/22/00030334		2	30/05/2022

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
Geraldene Susan Dalby-Ball	BAAS19008	17 Thompson Street Scotland Island	Finalised

Assessment Type	Date Finalised	BOS entry trigger
Part 4 Developments (Small Area)	30/05/2022	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	***Chalinolobus dwyeri*** (Large-eared Pied Bat)	1

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

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	***Chalinolobus dwyeri*** (Large-eared Pied Bat)	Vulnerable	$741.31	20.6900%	$80.00	1	$974.69

Subtotal (excl. GST)	**$974.69**

Assessment Id
00030333/BAAS19008/22/00030334

Proposal Name
17 Thompson Street Scotland Island

NSW GOVERNMENT

Biodiversity payment summary report

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

Assessment Id	Proposal Name	Page 3 of 3
00030333/BAAS19008/22/00030334	17 Thompson Street Scotland Island	

13.4.2 Credit Summary Report.

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00030333/BAAS19008/22/00030334	17 Thompson Street Scotland Island	24/11/2021
Assessor Name	Report Created	BAM Data version *
Geraldene Susan Dalby-Ball	30/05/2022	50
Assessor Number	BAM Case Status	Date Finalised
BAAS19008	Finalised	30/05/2022
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 SAII	Ecosystem credits

NSW GOVERNMENT

BAM Credit Summary Report

Pittwater Spotted Gum forest											
1	1214_Poor	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	18.6	18.6	0.14	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 SAII	Species credits
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)									
1214_Poor	18.6	18.6	0.1			Vulnerable	Vulnerable	True	1
								Subtotal	**1**

Assessment Id
00030333/BAAS19008/22/00030334

Proposal Name
17 Thompson Street Scotland Island

13.4.3 Predicted species report.

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00030333/BAAS19008/22/00030334	17 Thompson Street Scotland Island	24/11/2021
Assessor Name	**Report Created**	**BAM Data version ***
Geraldene Susan Dalby-Ball	30/05/2022	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	30/05/2022

* 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

NSW GOVERNMENT

BAM Predicted Species Report

Little Eagle	Hieraaetus 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

13.4.4 Candidate species report

NSW GOVERNMENT

BAM Candidate Species Report

Proposal Details

Assessment Id 00030333/BAAS19008/22/00030334	Proposal Name 17 Thompson Street Scotland Island	BAM data last updated * 24/11/2021
Assessor Name Geraldene Susan Dalby-Ball	Report Created 30/05/2022	BAM Data version * 50
Assessor Number BAAS19008	Assessment Type Part 4 Developments (Small Area)	BAM Case Status Finalised
Assessment Revision 2	Date Finalised 30/05/2022	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.

List of Species Requiring Survey

Name	Presence	Survey Months
Chalinolobus dwyeri Large-eared Pied Bat	Yes (assumed present)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☐ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Survey month outside the specified months?
Rhodamnia rubescens Scrub Turpentine	No (surveyed)	☐ Jan ☐ Feb ☐ Mar ☐ Apr ☐ May ☐ Jun ☑ Jul ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ 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

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

13.4.5 Biodiversity Credit Report (Like for Like)

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00030333/BAAS19008/22/00030334	17 Thompson Street Scotland Island	24/11/2021
Assessor Name	Assessor Number	BAM Data version *
Geraldene Susan Dalby-Ball	BAAS19008	50
Proponent Names	Report Created	BAM Case Status
James McHugh	30/05/2022	Finalised
Assessment Revision	Assessment Type	Date Finalised
2	Part 4 Developments (Small Area)	30/05/2022
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

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	0	1	1

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	No	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**	0.1	1.00

Credit Retirement Options

Like-for-like credit retirement options

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

Assessment Id: 00030333/BAAS19008/22/00030334

Proposal Name: 17 Thompson Street Scotland Island

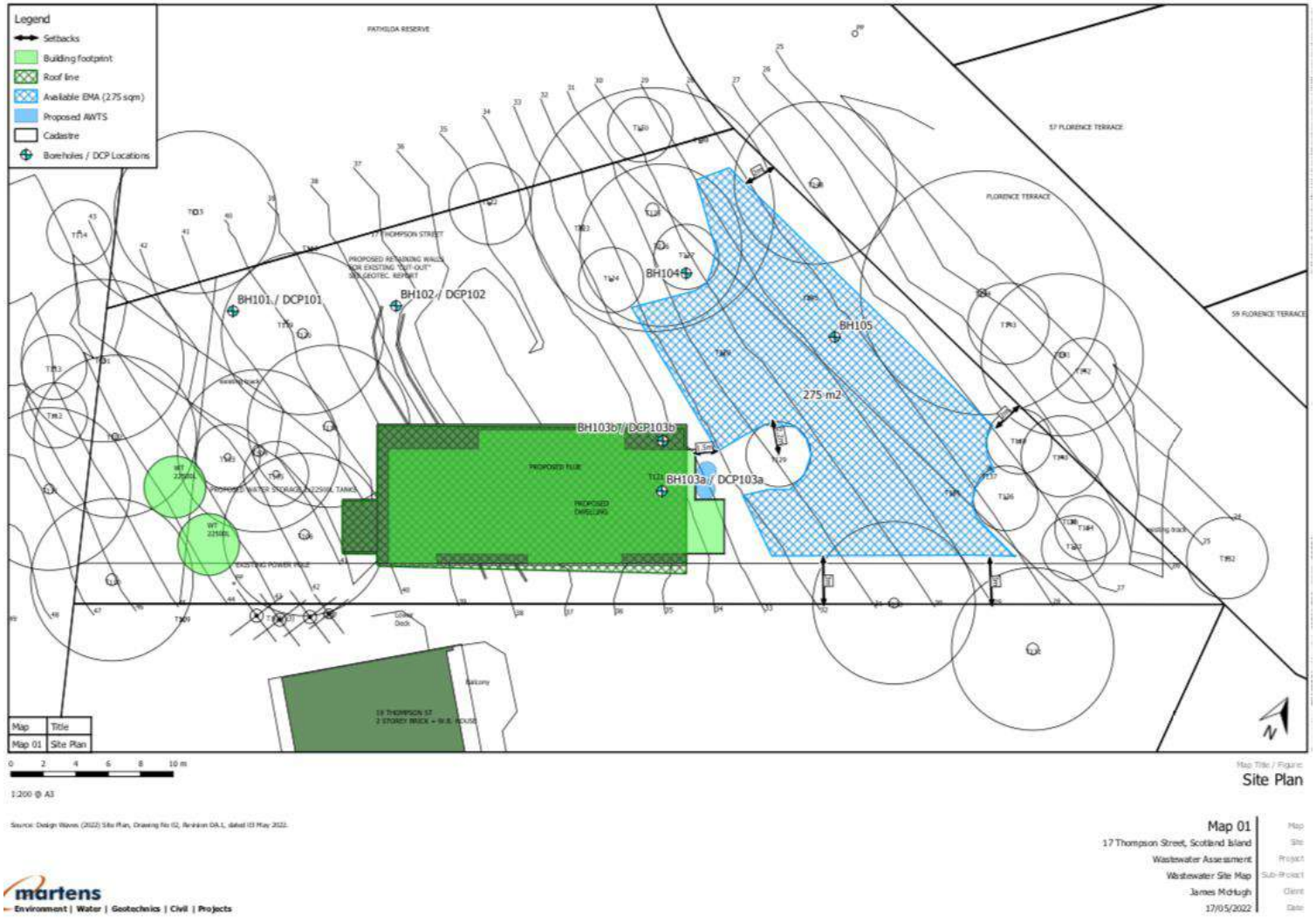
Page 3 of 4

NSW GOVERNMENT

BAM Biodiversity Credit Report (Like for like)

Assessment Id	Proposal Name	Page 4 of 4
00030333/BAAS19008/22/00030334	17 Thompson Street Scotland Island	

13.5 Appendix V– Martens assessment of Wastewater Site Plan



Source - Preliminary Onsite Wastewater Assessment: 17 Thompson St, Scotland Island. (Martens, Nov 2021

13.6 Field Data

Species	Growth code	Cover	Abund
Corymbia maculata (Spotted Gum)	Tree	15	3
Commelina cyanea (Native trad)	Forb	<1	10+
Acacia implexa seedling <2cm	Shrub	<1	1
Pteridium esculentum (Bracken)	Fern	~3	100+
Lomandra longifolia	Grass & grasslike	<1	5
Rubus (Native Raspberry)	Shrub	<1	3
Oplismenus (Basket Grass)	Grass & grasslike	<1	10+
Sigesbeckia orientalis	Forb	<1	10+
Glochidion ferdinandi (Cheese tree seedling) (1cm)	Tree	<1	2
Blechnum (Rasp Fern)	Fern	<1	10+
Weeds in 20x20			
Ipomea (Morning glory)		90	1000++
Lantana camara		25	50++
Tradescantia		10	100+
Ehrharta erecta		10	100+
Blackberry		5	5+
Bidens pilosa		2	50+
Solanum sp. *Exotic*			
In whole site 1000m2			
Outside 20x20 but in site			
Allocasuarina torulosa	Tree	<5	3
Corymbia maculata (Spotted Gum - some dying)	Tree	10	3
Acacia implexa (5cm dbh)	Shrub	<1	3
Glochidion ferdinandi (Cheese tree)	Tree	<2	3
Blechnum (Rasp Fern)	Fern	<1	7
Microlaena stipoides	Grass & grasslike	<1	100

Code	Sum Value	Cover
Tree	2	16
Shrub	2	2
Grass	2	2
Forb	2	2
Fern	2	4
Other	0	0

Bam Attribute (1000m^2 Plot)	
DBH	**Tree stem count**
80 +	2
50 – 79	1
30 – 49	4
20 – 29	3
10 – 19	7
5 – 9	1
< 5	1
Length of Logs	0.5

14 Expertise of authors

Geraldene Dalby-Ball
DIRECTOR

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.

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 though 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