Biodiversity Development Assessment Report

for the

Re-subdivision into 11 lots and Construction of 9 houses

at

96-104 Cabarita Road, Avalon

By

Nicholas Skelton, B. Sc. (Hons), M. App. Sc.

and

Sophia Mueller Sewell, B. Sc (Environmental Biology)

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Prepared for

Meraki Developments Pty Ltd

GIS Environmental Consultants

45 Austin Ave, North Curl Curl 2099
Ph: (02) 9939 5129 Fax: (02) 9401 0715 Mobile: 0419 438 672
Email: ecology@ecology.net.au Web: www.ecology.net.au

Executive Summary

Background information

96-104 Cabarita Rd, is a large property on the foreshore of Pittwater (Careel Bay) that is the remains of a large estate. The property currently consists of 4 lots that are mostly covered by a tall native tree canopy with a native and weedy understorey that is habitat for a range of native flora and fauna species.

This report relates to 10 Development Applications, the first being for the re-subdivision of the existing 4 lots into 10 Community Title lots (9 residential and 1 community lot) and 1 torrens title lot (Lot 11) and then concurrently 9 DA's for individual dwelling houses on the Community Title residential lots. The existing house and boat shed are to be retained on Lot 11, which is to be a torrens title lot. The only works proposed on Lot 11 is to re-establish the driveway access within the existing driveway. Lot 11 is within the Development Site but not within the Development Footprint for this assessment.

The vegetation on the site is representative of two Endangered Ecological Communities (BC Act); Pittwater and Wagstaffe Spotted Gum Forest, covering the majority of the site and Swamp Oak Floodplain Forest, that occurs in a small part of the western end of the foreshore.

This proposal meets the requirements for a Streamline BDAR assessment and as a consequence the less dominant vegetation type, Swamp Oak Floodplain Forest is not included in the BAM assessment.

The Pittwater and Wagstaffe Spotted Gum Forest on the site has two levels of condition; medium and low resilience (2 Vegetation Zones). Parts of the site that have a native canopy but have no native understorey or a concrete understory are not considered to be any PCT and are not included in the BDAR assessment. According to the BAM Calculator this ecological community is suitable habitat for thirty-two Threatened flora and fauna species.

Proposal

The southern side of the property is proposed to be protected and managed as an Environment Protection Area as habitat for native animals and plants and the Endangered Pittwater and Wagstaffe Spotted Gum Forest. The proposal includes construction of the 9 houses, driveways, common access road, stormwater treatment, relocation of Council's stormwater pipes, foreshore access stairs, landscaping, bin area and connection of utilities. Areas that will be temporarily disturbed by construction (pipe relocation and buffer area around houses) will have the native Pittwater and Wagstaffe Spotted Gum Forest re-established by planting of a Native Revegetation Area on the western side of the property and behind the upper row of houses. The landscaped areas are divided into three types; the foreshore area that will be planted with at least 80% Swamp Oak Floodplain Forest EEC species (Type A) between and below houses 6,7,8 and 9 that will be planted with at least 80% Pittwater and Wagstaffe Spotted Gum Forest EEC species (Type B) and the core landscaping in the central part of the site that will planted with at least 50% local native species (Type C).

During the planning of this proposal there was a pre-lodgement meeting with Council and there were extensive discussions regarding avoid and minimising the ecological impacts, in particular tree retention and permanent conservation of PWSGF EEC then the offset required for the residual impact was calculated.

The Development Footprint is; the areas impacted by works and construction which will result in the ecological impacts; the permanent removal of some of the ecological communities and the temporary impact during construction to some of the Native Revegetation Area.

An Environment Protection Area and the Native Vegetation Area will be established during construction and maintained by bush regenerators. The conservation and improvement of these areas will counterbalance the impact of the proposal on the ecology of the site.

Summary of Areas

	Description	Area (m^2)	% of Site	Map in Report where shown
Proposal				
Development Site (Site)	Property and land subject to the proposal, 96-104 Cabarita Rd, Avalon	12 700	100%	Figure 1.1
Development Footprint	Part of site impacted by construction and landscaping	8800	69%	Figure 1.4
Vegetation Communities, PCT (on Development Site)				

PWSGF EEC (dominant)	Pittwater and Wagstaffe Spotted Gum Forest EEC (1214)	7421	58%	Figure 3.1
SOFF EEC	Swamp Oak Floodplain Forest EEC (1234)	628	5%	Figure 3.1
Vegetation Zones (PCT and condition type within the Development Footprint)				
Vegetation Zone 1	Medium resilience PWSGF EEC within the development footprint, current integrity score 49.3	2152	17%	Figure 3.1
Vegetation Zone 2	Low resilience PWSGF within the development footprint, current integrity score 28.5	2459	19%	Figure 3.1
Management (Impact) Zones within Vegetation Zones,				
Management Zone 1 (Vegetation Zone 1)	Construction Site, future integrity score 0	1553	15%	Figure 6.1
Management Zone 2 (Vegetation Zone 1)	Temporary construction disturbance, part of Native Revegetation area, future integrity score 34.7	599	2%	Figure 6.1
Management Zone 1 (Vegetation Zone 2)	Construction Site, future integrity score 0	2221	15%	Figure 6.1
Management Zone 2 (Vegetation Zone 2)	Temporary construction disturbance, part of Native Revegetation area, future integrity score 13.1	237	4%	Figure 6.1
Conservation Management Areas (in accordance with the Biodiversity Management Plan)				
Environment Protection Area	Environment protection/bush regeneration	1125	10%	Figure 1.5
Native Revegetation Area	Revegetation/bush regeneration 100% native plants	1641	14%	Figure 1.5
Vegetated Riparian Area	Landscaped areas between and below houses (lots 6-9)	1089	8%	Figure 1.5

Impacts and offsetting summary

The trees on the site are mostly very large with straight tall trunks and create a forest with a sparse canopy approximately 30m high. The property has 320 trees (53 species) of which 216 are native (24 species) (including 4 Threatened *Syzygium paniculatum* trees). The houses, driveways, stormwater and other construction works will remove 20 (and potentially another 5) native trees (incl EEC trees) as identified by the Tree Assessment and Development Impact Report Kyle A Hill (Dec 18). An additional four native trees will be removed due to poor health. The Landscape Plan (Appendix C) proposes to plant 65 local native trees and mostly native gardens.

Native Tree loss	Loss	Likely Loss
PWSGF EEC trees	13	3
SOFF EEC trees	7	0
Other Native trees	4	1
Total	24	4
	Total	**28**

The impact of the two types of disturbance on the two condition zones within the Pittwater and Wagstaffe Spotted Gum Forest parts of the site will require 8 PWSGF ecosystem credits, 8 Southern Myotis species credits, 13 Large Eared Bat species credits and 2 *Syzygium paniculatum* species credits to offset the impacts. No Prescribed Impacts, as described in Section 6.7 of the BAM, were identified for this proposal.

Offset Summary

Biota	Required Total Credits	Offset Cost
Ecosystem Credits		
PCT 1214, Pittwater and Wagstaffe Spotted Gum Forest EEC	8	$26,828.40
Species Credits		
Large Eared Pied Bat	13	$11,432.86
Southern Myotis	8	$7,275.46
Syzygium paniculatum	2	$4,117.38
	Total	**$51,936.61**

Avoiding and minimising impact to the Endangered Ecological Communities on the site was achieved by, avoiding impact to the existing large trees, hollows and threatened trees.

The ecological impact of this proposal will be compensated by a combination of:

- Payment to the Biodiversity Conservation Trust in accordance with the BC Act (BOS)
- Weed control and permanent conservation and management of an Environmental Protection Area (EPA)
- Active protection during construction, restoration and revegetation and conservation of Native Revegetation Area (NRA) adjacent to the new buildings and in the western part of the site.
- The establishment of a Vegetated Riparian Area (VRA) with 80% of the plantings being native species and
- The use of 50% local native species in the core landscaping parts of the site (Type C) including planting 109 canopy trees.

This report also makes recommendations to ameliorate ecological impacts during and after construction. The during construction and ongoing management of these areas is described in the future approved Biodiversity Management Plan (BMP).

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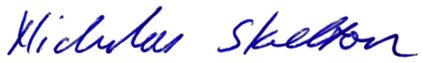
Required Licences:
NSW Department of Primary Industries, Animal Research Authority: 12/4838
Office of Environment and Heritage, Section 132C Scientific Licence: SL101070
Office of Environment and Heritage, BAM Assessor: BAAS17083
Office of Environment and Heritage, Data Licence Agreement: CON97043

Approved for release by Director:



Nicholas Skelton, B.Sc. (Hons), M. App. Sc.
GIS Environmental Consultants

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GIS Environmental Consultants
45 Austin Ave, North Curl Curl, NSW 2099
Phone: (02) 9939 5129
Mobile: 0419 438 672
Email: ecology@ecology.net.au
Web: www.ecology.net.au

Context

A. Background

This report describes the ecological values and constraints at the Development Site, which is Lot 15 DP 858130, Lot 14 DP 858130, Lot 8 DP 629464 and Lot 9 DP 629464 that are collectively known as 96-104 Cabarita Road, Avalon. The importance of the land to the conservation of Threatened flora and fauna species, and ecological communities and the likely impacts of the proposed development on terrestrial biodiversity are assessed as required by Federal, State and Local Government legislation.

An accurate description of the flora and fauna and an assessment of the ecological impact of the proposed development is required when submitting development applications to allow assessment of the application in relation to the following legislation; the NSW *Environmental Planning and Assessment Act 1979*, the *Biodiversity Conservation Act 2016*. In addition, the information in this report is likely to be needed to assess this development with respect to other acts, SEPPs, local government plans (LEPs, DCPs) regulations, orders and policies.

B. Aims of this Report

The aims of this Biodiversity Development Assessment Report are to:

- Determine the site context including native vegetation in the locality and landscape features on the site.
- Record the **findings of an ecological survey** (flora, fauna and ecological communities, and their habitats and vegetation integrity) of the area likely to be impacted by the proposal;
- Provide **ecological information** and **assessment** regarding the importance of the habitat on the site to the conservation of native flora and fauna.
- Determine the ecological constraints of the site and provide advice to the applicant on ways the impact can be **avoided** and **minimised** before finalising the proposal plans as required by the mitigation hierarchy of the Biodiversity Conservation Act regulation 2017;
- To **Assess** the likely **impact** of the proposal on the ecological values of the site in particular the significance of the impact to Threatened species, populations and ecological communities or their habitats in accordance with the requirements of the *Environment Planning and Assessment Act* (EP&A Act) Sections 4.15 (1) a, b and c, the *Biodiversity Conservation Act 2016* and determination of compliance with other relevant NSW legislation including; Acts, regulations SEPPs, LEP and DCPs;
- Determine if the proposal needs **referral** to the Federal government for assessment under the EPBC Act;
- Assess if potential Serious and Irreversible Impacts (SAII) may result from the proposal.
- Determine areas that require **offsetting** under the Biodiversity Conservation Act and calculate the number of offsetting **credits** required and the **cost**.
- Recommend ways the ecological **impacts** can be further **ameliorated** and prescribe appropriate ecological management actions during construction and for the life of the development.
- This report addresses Council legislation (LEP, DCP), the “heads of consideration” in section 4.15 (1) a, b, c of the EP&A Act, SEPPs, other NSW environmental Acts and the Federal EPBC Act 1999.

C. Legislation Addressed by the Report

I. Environment Planning and Assessment Act 1979

The NSW Environment Planning and Assessment Act 1979 is the framework for approval of development in NSW. The proposed development will be assessed under Part 4 of the NSW Environmental Planning and Assessment Act. Section 4.15 (a)(formerly 79C(a)) of the Act requires that consent authorities must take into consideration any environmental planning instruments, LEP, DCP, SEPPs and regulations. Section 4.15 (c) requires assessment of the suitability of the land for development.

Section 4.15 (b) (formerly 79C (b)) requires the assessment of the likely impacts of a development, including environmental impacts on both the natural and built environments including the BC Act threshold test and if necessary a BAM assessment and any required offsetting.

The *Biodiversity Conservation Act 2016* (s 7.13(6)) and the Biodiversity Offset Scheme do not limit the ability of the consent authority to require additional measures in relation to avoiding and minimising biodiversity impacts or to refuse an application on the basis of those impacts.

II. Biodiversity Conservation Act 2016

The primary requirement of the BC Act is that ecological impacts are to be Avoided and Minimised during the planning of a proposal and then any remaining impact are to be offset according to the Biodiversity Offset Scheme (BOS).

The Schedules of the BC Act list Threatened flora and fauna species and define Endangered ecological communities.

Section 7.2 of the BC Act states that a development is likely to have a significant and will require assessment and offsetting effect if any of the following triggers are met;

- the BOS threshold test is triggered (area of disturbance) (see below for details), or
- mapped as Biodiversity Value on the Biodiversity values map.
- a Test of Significance (5 part test) for potential threatened species or ecological communities is positive (see below for details), or
- an Area of Outstanding Biodiversity Value is affected by the proposal (see below for details).

The **BOS Threshold test** is triggered if the area of native vegetation (any plant native to NSW, as defined in the LLS Act) will be disturbed (including bushfire APZ and other disturbance) is more than 0.25ha where the LEP minimum lot size is less than 1ha or if the disturbance area is equal or greater than 0.5ha where the lot size is larger 1ha (section 7.2 of the BC Act regulation).

Mapped on the Biodiversity Values Map is triggered if the proposal will have a direct or indirect impact on an area mapped as "Biodiversity Value" on the Biodiversity Values map.

The **Test of Significance** (section 7.3 of the BC Act) is used to determine if a proposed development or activity is likely to significantly affect Threatened species or ecological communities, or their habitats. Section 7.3 (2) of the BC Act provides guidance on the assessment of the Test of Significance in a guideline document (2018). https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/threatened-species-test-significance-guidelines-170634.pdf

Areas of Outstanding Biodiversity Value are currently mostly also mapped on the Biodiversity Values map.

If any of the triggers are met then the Biodiversity Assessment Method (BAM) must be applied, the ecological impact must be avoided and minimised then the residual impact of the proposal must be offset in accordance with the Biodiversity Offset Scheme and the Biodiversity Assessment Method (BAM) and these need to be applied to determine the types of surveys and assessment required and the amount of offset. Proposals also needs to be assessed to determine if they may cause a Serious And Irreversible Impacts may occur (SAII) as a result of the proposal.

If a Development Application does not meet the threshold or any other triggers, then a smaller ecological report is still required to address the ecologically relevant "heads of consideration" in the section 4.15 (formerly 79C) of the EP&A Act, SEPPs and LEP/DCP requirements. Other Acts such as Federal EPBC Act, Fisheries Act, Water Management Act and Local Land Service's Act requirements may also require an ecological assessment report.

III. Northern Beaches Council (Pittwater) LEP (2014) and (Pittwater 21) DCP (2014)

The Northern Beaches Local Council (Pittwater) Local Environment Plan (PLEP 2014) aims to protect the environment and the quality of life in the Northern Beaches while promoting sustainable development. Both the PLEP and the PDCP 21 must be considered when a determining authority assesses development in this area.

The parts of PDCP 21 and PLEP 2014 that are relevant to the proposed development are as follows:

Clause 7.6 Biodiversity

The site is mapped as containing "biodiversity" on the Biodiversity Figure and therefore this report addresses 7.6 of the Pittwater LEP.

B4.7 Pittwater Spotted Gum Forest Endangered Ecological Community

The site is mapped as containing Pittwater Spotted Gum forest EEC and therefore this report addresses section B4.7 of the PDCP 21.

B4.3 Flora and Fauna Enhancement Category 2 Land

This report is required to address this required as specified in the Pre DA meeting notes from Northern Beaches Council (PLM2018/0084)

IV. Federal Environment Protection and Biodiversity Conservation Act, EPBC Act

This report also identifies "matters of national environmental significance", relevant to the site that are listed under Part 13 Division 1 of the *Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)* (EPBC). Species or communities listed in the Act are considered to be "matters of national environmental significance" and consideration needs to be given as to whether the proposed development will or is likely to have a "significant impact" on any "matters of national environmental significance". In determining whether a "significant impact" will occur, consideration is given to the EPBC Act Administrative guidelines on significance (DEH 2006)

Should the assessment in this report determine that a "significant impact" will occur or is likely to occur on "matters of national environmental significance" the proposed development will need to be referred to the Minister (Cwlth) to determine as to whether or not the proposed development is a "controlled action".

Assessment of a Development Application with respect to the EPBC Act 1999 is not a Council issue but is the responsibility of the proponent. Proponents should be advised by their ecological consultant whether a referral is necessary.

This report addresses the requirements of this legislation.

D. Definitions and Acronyms

5-Part Test of Significance (5-Part Test) - Assessment under Section 7.3 of the BC ACT to determine whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. Only used in the BOS Threshold Test.

APZ – Bushfire hazard fuel reduction Asset Protection Zone, defined in the document '*Planning for Bushfire Protection 2006*' by the NSW Rural Fire Service. Usually consisting of an Inner Protection Area (**IPA**) and an Outer Protection Area (**OPA**)

BAM - Biodiversity Assessment Method is the ecological survey and assessment technique that is required to be used for the **BOS** and it is described in a document by Office of Environment and Heritage **OEH** (August 2017) and referred to by the **BC Act** regulation. The Biodiversity Assessment Reports (**BAR**) that the BAM method produces are a **BDAR**, **BSSAR** and a **BCAR**.

BC Act - NSW Biodiversity Conservation Act 2016 contains the lists of threatened species, the definitions of the threatened ecological communities, the 5-part Test of Significance and the BOS. There are associated Biodiversity Conservation regulations which refers to the BAM.

BOS – Biodiversity Offset Scheme the system of trading biodiversity offset credits or paying for offsets to the Biodiversity Trust.

DCP - Development Control Plan, a local planning guideline for each LGA.

Development Site (Subject Land, property): an area of land that is subject to a proposed **Development Application** for works or an activity within the meaning under Part 4 and Part 5 of the EP&A Act. The term development also includes establishment or maintenance of a bushfire hazard reduction APZ area or environment management area. The Development Site includes the development footprint and any area that is part of the DA(s), including areas that will have lot boundaries adjusted.

Development Footprint: the area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials. The term *development footprint* is also taken to include clearing footprint except where the reference is to a small area development or a major project development.

Ecosystem Credits: a measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.

Direct Impacts - are impacts that directly affect habitat, ecosystems and individuals. They include but are not limited to, death, trampling, poisoning of the animal/plant itself and the removal of vegetation and suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts

of the proposed activity or development during construction. As defined by the 2006 DECC Assessment of significance guidelines.

Indirect Impacts - occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. Indirect impacts may occur after construction during the life of the development, e.g. escape of garden plants, excess nutrients and changes in fire frequency and grazing. As with direct impacts, consideration must be given, to all of the likely indirect impacts of the proposed activity or development (2006 DECC Assessment of Significance Guidelines)

DPI – NSW government of Department of Primary Industries

EPA Act (EP&A Act) – NSW Environment Planning and Assessment Act 1979, controls development in NSW.

EPBC Act – Federal Environment Protection and Biodiversity Conservation Act 1999

IBRA region: a bioregion identified under the Interim Biogeographic Regionalisation for Australia (IBRA) system3, which divides Australia into bioregions on the basis of their dominant landscape-scale attributes.

IBRA subregion: a subregion of a bioregion identified under the IBRA system.

IPA – Bushfire hazard Inner Protection Area, defined in the document '*Planning for Bushfire Protection 2006*'.

LEP – Local Environment Plan, a local planning instrument for each LGA.

LGA- Local Government Area.

OEH – NSW Office of Environment and Heritage, formerly NPWS, DEC, DECC and DECCW. The department responsible for the conservation of native flora and fauna.

OPA – Bushfire hazard Outer Protection Area, defined in the document '*Planning for Bushfire Protection 2006*'.

Property – Adjacent or nearby lot(s) that have the same ownership.

Protected Fauna - refers to any native bird, mammal, reptile or frog in NSW.

TBDC – Threatened Biodiversity Data Collection, OEH database within Bionet.

Threatened Species or Ecological Community - refers to those biotas listed in the schedules of the Biodiversity Conservation Act 2016 as "Critically Endangered ", "Endangered" or "Vulnerable".

The Impact Mitigation Hierarchy

The mitigation hierarchy is a fundamental requirement of the Biodiversity Conservation Act, where the proponent needs to consider, in order, actions to avoid, mitigate and offset impacts. This Hierarchy is described in the Biodiversity Assessment Method document and is established by case law.

> The Chief Justice of the NSW Land and Environment Court has made the following statement (Preston, B J, Biodiversity offsets: adequacy and efficacy in theory and practice (2016) 33 EPLJ 93 at 95-96)
>
> *Avoidance and mitigation measures should be the priority strategies for managing the potential adverse impacts of a proposed development. Avoidance and mitigation measures directly reduce the scale and intensity of the potential impacts of the development. Only then are offsets used to address the residual impacts that remain after avoidance and mitigation measures have been put in place. Adherence to the mitigation hierarchy is central to biodiversity offsetting. Without prior application of the mitigation hierarchy, conservation actions would not qualify as offsets.*

Application of the mitigation hierarchy is also described in the LEC cases Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Limited 2013 NSW LEC 48 (Bulga) at 147 – 153.

E. Assumptions and Limitations

- This report only addresses the impacts of the proposal described in this report and shown in the maps in this report. If there are changes to the DA plans that alter the ecological impact of the proposal, then this report is likely to require recalculating and updating.

- This report describes the habitat and species in the Study Area at the time of the field survey. Vegetation and habitat will change over time, as does legislation. Therefore, the findings of this report are likely to be out of date in 12 months.
- There may be flora and/or fauna species present within the study area that may not have been recorded because they are seasonal, cryptic and/or have large home ranges. Some threatened species may only use the study area as habitat at some time. Assessment of habitat potential is used to address this uncertainty. The conclusions drawn in this report are a result of testing, observation and experience.
- This report assesses only the current proposal and does not consider the cumulative impact of other developments on this property or on adjacent land or the potential edge effects or impacts caused by the occupation of the land.
- This report should be read in its entirety and no part should be taken out of context.
- No responsibility is accepted for the use of any part of this report in any other context or for any other purpose or by third parties.
- This report makes recommendations for protection of bushland habitat, weed control, re-establishment of the bushland in part of the site, planting local native species and applying erosion and nutrient control measures. This report assumes these initial and on-going works will be carried out during and on-going for the life of the development.
- It is assumed that there will be no sediment, nutrients or weeds spreading downslope from the development.

F. Qualifications and Experience of the Field Ecologist and Authors

Nicholas Skelton's formal qualifications include a Bachelor of Science with Honours (B. Sc. (Hons) USyd) and a Masters in Applied Science (M. App. Sc. in Vegetation Management UNSW). Nick has been an environmental scientist for 25 years, including a university lecturer, research ecologist and a bush regenerator for 8 years. His work is focused on the Sydney bioregion and he has published many papers in independently reviewed journals on the ecology of NSW. He has expert knowledge of the local soils, the climate of this area and the local indigenous plants and animals as a result of over 900 ecological surveys. Nick is a member of the relevant professional organisations including a practising member of the Ecological Consultants Association of NSW and Royal Zoological Society. He is licensed by NSW OEH and NSW Department of Primary Industries to carry out surveys on threatened plants and animals and he is a qualified Biodiversity Assessor under the BC Act 2016. Nick was the principal ecologist on all field surveys and was responsible for map making and report editing. Further details can be found at www.ecology.net.au.

Sophia Mueller Sewell has a Bachelor of Science (Environmental Biology UTS). Sophia has been working with GIS Environmental Consultants for over 2 years and has assisted with many ecological surveys and written over 50 reports. Sophia was responsible for project management, assisting with fauna survey, application of the BAM method, recording data for field surveys and report writing.

G. BOS Threshold Assessment

The Biodiversity Conservation Act Regulation (Aug 2017) requires that the Biodiversity Offset Scheme (BOS) threshold test (section 7.1 to 7.3) be applied to all development applications, to determine if the requirement to enter the BOS is triggered. If triggered then the Biodiversity Assessment Method (BAM) needs to be applied and a Biodiversity Development Assessment Report (BDAR) is required to accompany the application.

The Biodiversity Offsets Scheme applies to local developments, major projects or the clearing of native vegetation where the *State* Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 applies.

This proposal as described in this report is considered to meet the BC Act threshold as;

1. The proposal will disturb more than 0.25ha of native vegetation and the minimum lot size is 700m^2 (i.e. is less than 1ha) therefore the proposal triggers this part of the threshold test. Native Vegetation is defined in the LLS act as any native plant whether tree, shrub or ground cover plant.

Therefore, the proposal requires a BAM assessment, a BDAR report and BOS offsetting.

H. BAM Assessment Type

There are two types of BAM assessment that can be used for Part 4 assessments (local developments or DA's); the General Module and the Streamlined Module (which includes Small Area and Paddock Trees sub types).

The Streamlined Assessment Module was used for this proposal as the proposal meets the requirements specified in Appendix 2 of the BAM including the minimum area threshold, the area of clearing for this proposal is less than 1ha which is below the maximum clearing thresholds shown in Table 1 of the BAM (Aug 17). The Development Footprint is not within the area mapped on the biodiversity values map.

Stage 1: Biodiversity Assessment

1 Introduction

1.1 Description of Existing Site

For this proposal the Property and Development Site (Site) are the same and are Lot 15 DP 858130, Lot 14 DP 858130, Lot 8 DP 62964 and Lot 9 DP 62064 which are known as 96 -104 Cabarita Road, Avalon in the Northern Beaches LGA. The Development Site is approximately 1.27ha in size and currently contains a boat shed with accommodation above, concrete driveway, a tall native tree canopy, a mixed native and weedy understory, sandstone retaining walls and paths, lawn along the waterfront and a large cleared area in the centre of the site. The marine habitat of Pittwater (Careel Bay) is to the north-east and there is a small beach with mangrove adjacent to the northern boundary of the site. The site is accessed from Cabarita Road to the south. A recent aerial photograph of the Development Site is provided on the cover of this report.

1.1.1 Location Geographic Co-ordinates

The latitude and longitude of the Study Area is -33.620267° S and 151.319565 °E.

1.1.2 Topography

The Site slopes towards Pittwater to the north. 10m contours of the locality are shown in Figure 1.3.

1.1.3 Drainage

Stormwater drains downslope directly into Pittwater, there are open channels across and down the top part of the property and there is a creek line along the western edge. Drainage in the locality is shown in light blue on Figure 1.2 and 1.3.

1.1.4 Riparian Land

Pittwater (Careel Bay) is an estuary and the *Guidelines for Riparian Corridors on Waterfront Land* (Office of Water DPI 2012) recommend that the Vegetated Riparian Zone for estuaries be 40m from the top of the bank (mean high water mark). The BC Act (BAM Appendix 3) requires a 50m Vegetated Riparian Zone (VRZ) for developments adjacent to estuaries. Both the 40m and 50m Vegetated Riparian Zone are shown in the map in Figure 1.5. Impacts to the Riparian area are described and assessed by the Waterways Impacts Statement (GIS Environmental Consultants, 2018). The Landscape Masterplan (Appendix C) shows how the Vegetated Riparian Zone will be established as fully structured native vegetation with 80% local native species of the two Endangered Ecological Communities that occur in this part of the site. The adjacent estuarine area is described and assessed in a Estuarine Risk Management Report by Horton 2018 and addresses B3.7 and the Estuarine Risk Management Policy.

1.1.5 Geology and Soils

The property is on Watagan Soil Type, which is interbedded laminate and shale with quartz to lithic quartz sandstone (Soil Landscapes, Chapman and Murphy 1989). The soils in the locality are shown in thick light blue outline on Figure 2.1.

1.1.6 Fire History

The site has not been burnt for over 50 years.

1.1.7 Disturbance History

The property was most likely originally disturbed when the large estate including the jetty, boathouse, landscaping, stonework, seawall, waterfront lawn, driveway and the main house were built. The landscaping included many garden paths, terraces and retaining walls. There were gardens around the central house that contained exotic plants. There has been extensive weed invasion mostly of bird dispersed species such as Asparagus Fern and Lantana. A list of all the exotic and native plants on the property in Table 2. The house was removed from the centre of the site in the December 2017. Recently many of the exotic trees have been removed, the weeds thinned and some of the sandstone removed.

Legend

Development Site (12700sqm)

Biodiversity Development Assessment Report (BDAR)

96 - 104 CABARITA RD, AVALON

Figure 1.1
Aerial Photograph of the Site

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

by Nicholas Skelton

Date: 16/11/2018

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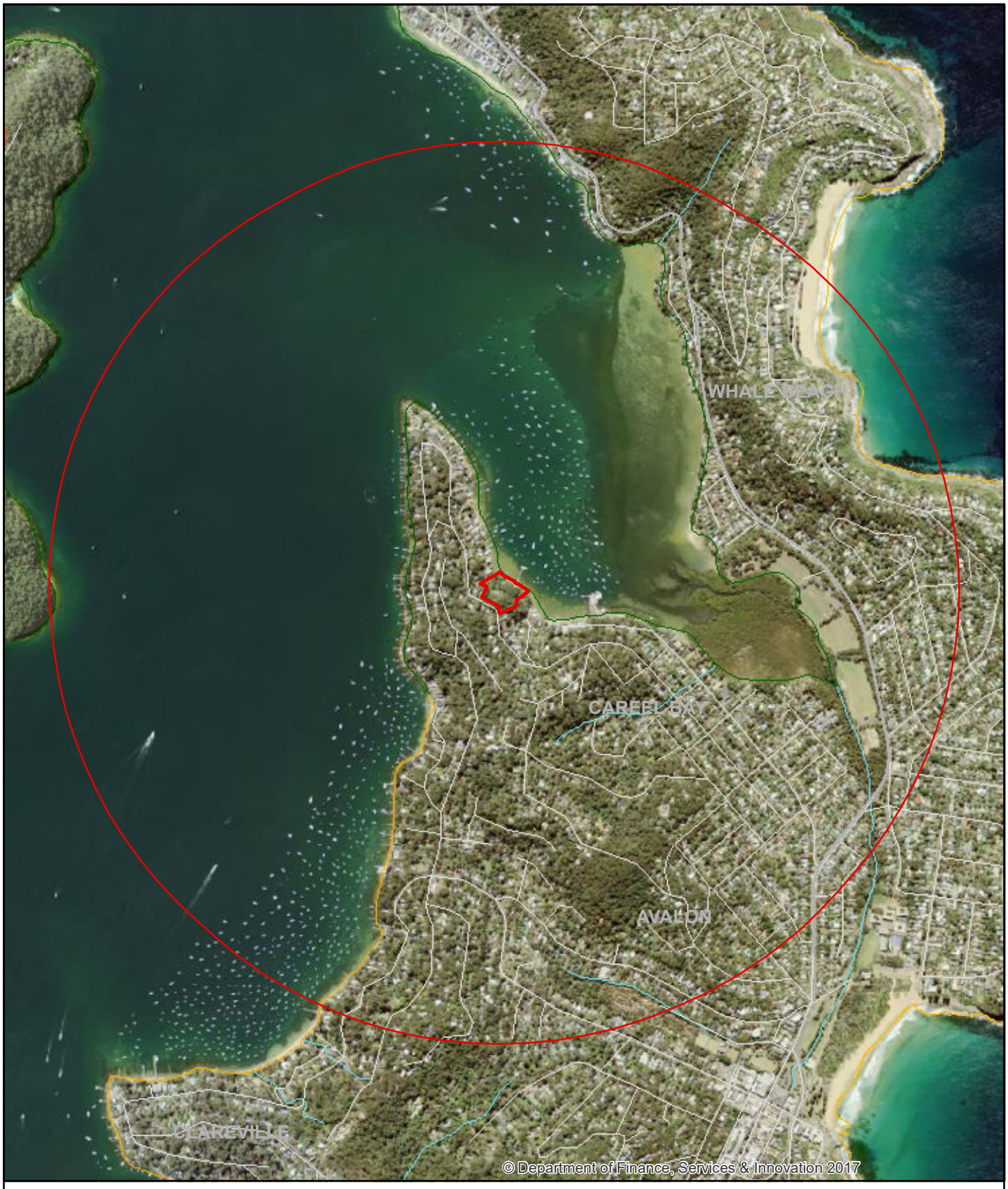

Legend

- Development Site
- Buffer 1.5km
- National Park

Figure 1.2.
Locality Aerial Photograph

96 - 104 Cabarita Rd, Avalon

Date: 14/11/2018

N

0 125 250 500 m

Disclaimer: Mapping is indicative and may contain errors from the source of the data. Information on these maps should only be used at the scale provided. Dimensions need to be determined by a registered surveyor.

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Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

Legend

- Development Site
- Buffer 1.5km
- National Park

Figure 1.3
Locality, Topography and Features

96 - 104 Cabarita Rd, Avalon

Date: 14/11/2018

N

0 125 250 500 m

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Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

1.2 Development Footprint

The Development Footprint is the area that will be directly impacted by the proposal and includes all parts of the site except the existing boat sheds, Lot 11 (that is only impacted by a boundary change, easements and minor driveway works within the footprint of the existing driveway), and the Environment Protection Area (EPA) part of the site that will be bush regenerated. Bush regeneration of the Environment Protection Area part of the site is included in the proposal, however, the ecological habitat values in these areas will not be negatively impacted and therefore will not require offsetting under the BOS.

The development footprint is approximately 8800m^2 in size and is shown in the maps in Figure 1.3.

The operational footprint is not likely to extend further than the development footprint for this development.

1.3 General Description of the Proposal

This report relates to 10 Development Applications, the first being for the subdivision of the land into 10 Community Title lots (9 residential and 1 community lot) and 1 torrens title lot. Lodged concurrently are 9 DA's for individual dwelling houses on the Community Title residential lots. The existing house and boat shed is to be retained on proposed Lot 11, which is to remain a torrens title lot. No works are proposed within this lot.

The bulk of the impacts relate to the subdivision and this includes the provision of an access road, establishment of building footprint within each lot and provides for the protection of existing vegetation to be retained and enhanced. However, landscaping will form part of the dwelling house DA's and this is also an important aspect of the ecological considerations. This report assess the impact of the Development Footprint which includes impact associated with all 10 DA's.

The proposal is shown in Figure 1.4, includes;

- Subdivision of the existing 4 lots into 2 new lots and then re-subdivision of one of these new lots into 9 new community residential lots and one community lot
- Construction of 9 new 2 two storey houses, one on each of lots 2-10 in the community scheme
- A driveway that links to each building footprint
- Garbage bin collection area and foreshore access steps/path
- Re-alignment of Council stormwater pipe
- Stormwater treatment ponds
- Establishment and maintenance of an Environment Protection Area
- Hard and soft landscaping
- Refurbishment of the existing Boatshed and associated buildings

The site is not mapped as bushfire prone, therefore bushfire fuel hazard reduction is not needed.

The site is mapped on the Pittwater LEP 2014 Biodiversity Map.

The location and extent of these features and the adjacent context are shown in Figures 1.4.

1.3.1 Building Footprints

The 9 two storey buildings have been located in two rows, parallel to the foreshore of Pittwater. The row towards the foreshore is below the driveway and above the 15m foreshore building line. The upper row of houses is on the high side of the driveway and below the Environment Protection Area. The new houses have been located to avoid the existing large Spotted Gum trees and are mostly on suspended concrete slabs to reduce impact to tree roots. The location and size of the building envelopes are shown in Figure 1.4.

1.3.2 Driveway

The southern part of the driveway will be in a similar position to the existing driveway then turn to the west across the slope where there is an existing cleared area. The new driveway alignment in relation to the aerial photo of the site is provided in Figure 1.4. Access will be maintained to the existing house on Lot 11.

1.3.3 Stormwater

The stormwater works consists of; 1. Relocating the large diameter Council stormwater pipe further to the west and 2. A swale along the driveway that connects to water treatment ponds in the western part of the site. These are shown in Figure 1.4.

1.3.4 Environment Protection Area (1125m^2)

There will be establishment and maintenance of a bushland conservation Environment Protection Area on the southern part of the site at the rear of Lots 2 to 5, as shown in Figures 1.4. This area will be protected during construction and managed for the life of the development. The purpose of this EPA is to protect and improve habitat for native flora and fauna and the Endangered Ecological Community.

This area will maintain both the east to west and north to south wildlife corridors and provide a large contiguous area of fully structured Pittwater Wagstaffe Spotted Gum Endangered Ecological Community habitat. Weeds are to be controlled and native plants are to be protected and assisted and where necessary supplemented. There is to be no construction access. Work in this area is to only be supervised by a qualified Bush Regenerator.

The during construction and long-term management of the EPA are to be detailed in a Biodiversity Management Plan.

1.3.5 Native Revegetation Area (1641m^2)

Parts of the site that will not permanently be impacted by construction or landscaping but are not part of the EPA will form the Native Revegetation Area. This area will retain a remnant tree canopy (a mixture of native and planted) and will be planted with local native shrubs and groundcover. Works in this area are restricted and will need to have a temporary environment protection fencing and supervision by the site ecologist.

The during construction and long-term management of the NRA are to be detailed in a Biodiversity Management Plan.

1.3.6 Landscaping

The Landscape Plan by Jamie King (28/11/18, Appendix C) shows the proposed planting in the areas between and below the new houses and provides a schedule lists the proposed species to be planted. Many of the species are part of the Pittwater and Wagstaffe Spotted Forest Endangered Ecological Community. There are 109 canopy trees including 9 Spotted Gum saplings proposed to be planted in the locations shown in the Landscape Plan. See map in Figure 1.5 and Appendix C.

There are three main areas of landscaping on the property

Landscape Area Type A- this area is with the Vegetated Riparian Area and also contains existing Swamp Oak Floodplain Forest EEC. During construction disturbance in these areas will be minimised. There will be soft landscaping only with 80% Swamp Oak Floodplain Forest species to retain EEC and riparian habitat values.

Landscape Area Type B- This area is also part of the Vegetated Riparian Area but contains existing Pittwater and Wagstaffe Spotted Gum Forest EEC. Like area A construction disturbance will be minimised and planting will be with 80% PWSGF species.

Landscape Type C- These are all other landscapes area on the property such as between the houses. Planting in area C will be mostly native species. This area contains the Bioretention Pond and hard landscaping.

See Figure 1.5 for location of landscape areas and Table 1 for landscape area summary.

1.3.7 Other parts of the Proposal

The proposal also includes a garbage bin area, path to street and stairs to the foreshore.

The existing house, boatshed and adjacent building that will be within the new Lot 11 is not part of the proposal, and access along the driveway, connection of facilities and easements will be provided. This house is currently in the same ownership.

1.3.8 Plans and Documents Used for this Report

Title	Author	Rev	DWG./Doc. No./Ref.	Date
Site Plan	Mark Hurcum Design Practice	A	A005	November 2018
Trees to be Removed/ Retained	Mark Hurcum Design Practice	A	A003	November 2018
Driveway Plan	Mark Hurcum Design Practice	A	A006	November 2018
Removed Canopy	Mark Hurcum Design Practice	A	SK208	November 2018
Replacement Canopy	Mark Hurcum Design Practice	A	SK209	November 2018
Tree Assessment and Development Impact Report	Kyle A Hill Consulting Arborist	-	-	December 2018
Pre-lodgement Advice	Northern Beaches Council	-	PLM2018/0084	10/05/18
Landscape Masterplan	Jamie King	C	Sht-101	14/12/18
Biodiversity Management Plan	GIS Environmental Consultants	-	-	December 2018
Waterways Impact Statement	GIS Environmental Consultants	-	-	30/11/18
Estuarine Risk Management Report	Horton Coastal Engineering	-	-	10/12/18

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

by Nicholas Skelton

Date: 10/12/2018

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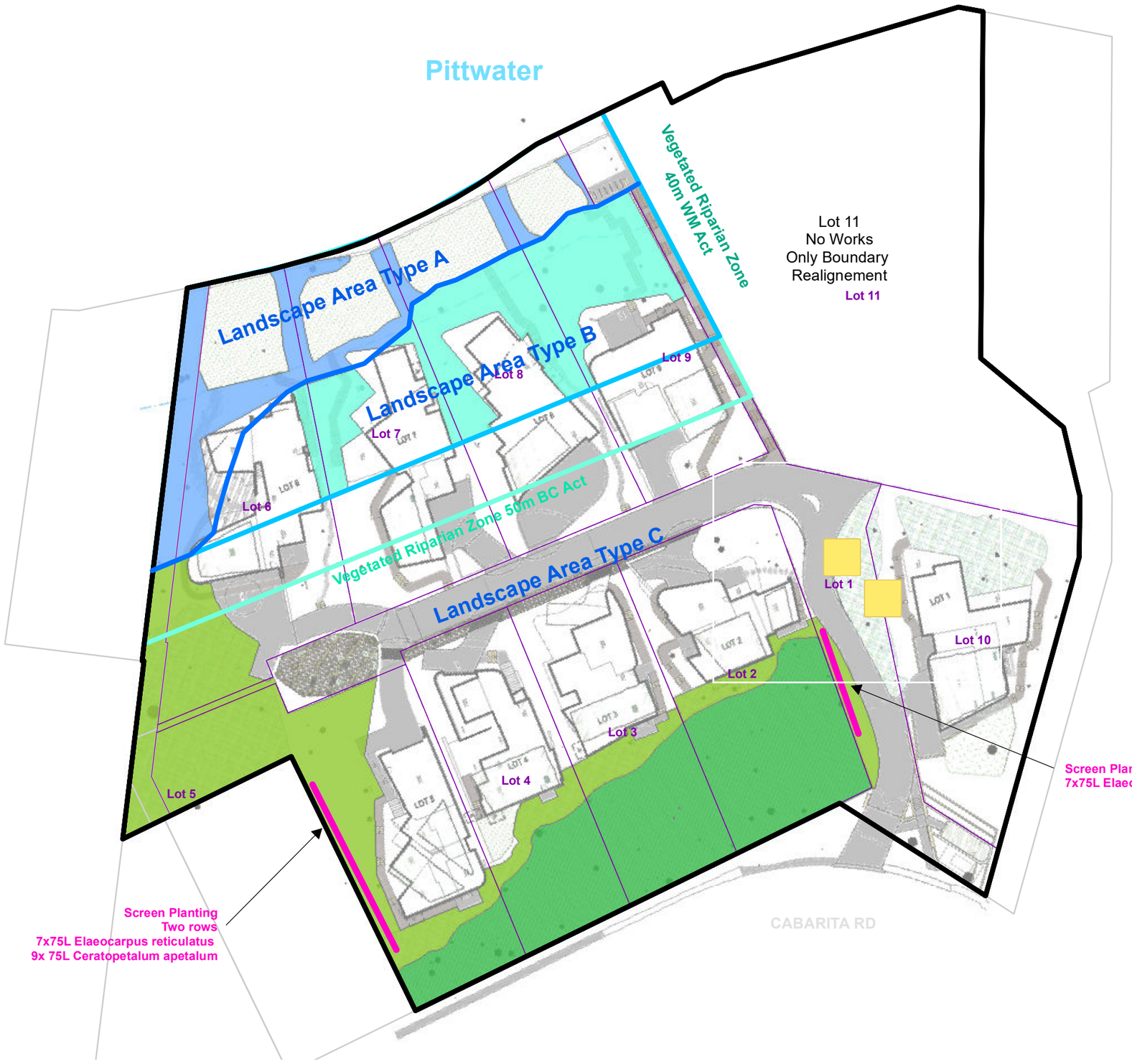
Biodiversity Development Assessment Report (BDAR)

96 - 104 CABARITA RD, AVALON

Figure 1.4
Proposal, Development Site and Footprint



Legend

- Development Site (12700sqm)
- WM Act Vegetated Riparian Zone 40m (2500sqm)
- BC Act Vegetated Riparian Zone 50m

Vegetation Management Areas

- Environment Protection Area (1125sqm)
- Native Revegetation Area (1641sqm)
- Vegetated Riparian Area Landscape Type A (424sqm)
- Vegetated Riparian Area Landscape Type B (667sqm)

Table 1. Summary of Vegetation Management and Landscaping

96 - 104 Cabarita Rd, Avalon

Acronym	Area on Fig 1.5	Size	Objective of Area	Management Document
EPA	**Environment Protection Area**	1125sqm	Protect and improve the endangered forest	Bushland Management Plan
NRA	**Native Revegetation Area**	1641sqm	Protect and improve the endangered forest whilst allowing supervised trenching for utilities and provision of screening planting	Bushland Management Plan
Vegetated Riparian Area VRA 1089sqm	**Landscape Type A, Riparian Zone SOFF EEC**	424sqm	Protect, allow supervised trenching and improve the two endangered forests and riparian corridor	Landscape Plan
	Landscape Type B, Riparian Zone PWSGF EEC	667sqm		
	Landscape Type C	8843sqm including houses and drive	Provide attractive landscaped gardens for the new houses that does not contain invasive species and provides some habitat value.	Landscape Plan

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

by Nicholas Skelton

Date: 29/11/2018

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Figure 1.5
Conservation Management and Landsape Areas

1.4 Literature and Database Search

Relevant information was obtained from literature, local knowledge and established sources such as scientific journals, electronic databases and reports. The data in databases that were consulted included BioNet (5km search area) (including NPWS Atlas of NSW Wildlife records, Australian Museum specimen records and the Royal Botanic Gardens records), TBDC (BioNet), BAM Calculator, ROTAP records and Birds Australia Atlas. Searches were also undertaken on the DOEE – 'protected matters search tool' website to generate a report that will help determine whether matters of national environmental significance or other matters protected by the EPBC Act are likely to occur in the area of interest.

This information was used to ascertain which threatened species are known to occur in or near the study area. The data from within a 5km search area and the Species Credit Species produced by the BAM calculator were then combined with local knowledge and the habitat conditions within the study area to compile a list of Threatened plant and animal candidate species for specific targeting during the fieldwork.

1.5 Field Survey Method

An ecological field survey was carried out for the following purposes:

- general ecological site survey including observations across the whole of the site,
- mapping the extent of native vegetation
- to determine the Vegetation Types (PCT), their extent on the site and adjacent land and condition (disturbance) to determine the Vegetation Zones
- tree survey including; numbering, species, trunk girth, height, canopy diameter and health
- a formal plot based survey using the BAM method including ID of all plant species, percentage cover in each growth form, tree stem diversity and leaf litter cover.
- targeted Threatened species surveys.
- random meander to identify and records other flora and fauna species.

See sections 3 and 4 for field survey effort, season, weather etc. for each survey technique and targeted survey method. There has been extensive surveying of the site over the last 16 years by Nicholas Skelton.

1.5.1 General Field survey

The general field survey involved the following procedures that were carried out throughout the Development Site:

- Initial familiarisation with the Development Site and its extent and surrounding land;
- Assessment of the physical characteristics of the Development Site and location of the proposal;
- Mapping the extent of the existing native vegetation;
- Identification and recording of all flora species and their percentage cover within each 400m^2 plot within the Subject Site and a random meander across the rest of the Development Site;
- Identification of fauna through sightings, calls and potential habitat, scats, remains, nests, dreys, bones, feathers, fur, diggings, scratches, tracks, owl white-wash and food sources. Examination of trees for scratchings, sap-feeding notches and hollows;
- Classification of any vegetation into communities according to their structural and floristic attributes;
- Assessment of the suitability of the habitats within the Development Site;
- Detailed search for targeted Threatened flora and fauna species;
- Assessment of the extent of disturbance and weed invasion;
- Photography of the Development Site

1.5.2 Extent of Native Vegetation

The extent of native vegetation was determined using aerial photography and on ground field verification.

The definition of native vegetation the is required by the BC Act to be used is the same as in the LLS Act. The location and extent of native vegetation on the Development Area is shown in Figure 1.5.

1.5.3 Tree Survey

The field surveys were carried out in January and February 2002, May and June 2015 and in January, March, May, September and October 2018. The recent fieldwork was undertaken by a highly experienced Principal Ecologist Nicholas Skelton (approximately 60%) and the Ecologists; Sophia Mueller Sewell, 25%, Sarah Tuxworth 10% and Joshua Drane 5%.

1.5.4 Determining the Plant Community Type (PCT)

The vegetation within the study area was classified using structural and floristic indicators and was compared with threatened ecological communities listed in Schedule 2 of the BC Act 2016 and with the vegetation classification titled The Native Vegetation of the Sydney Metropolitan Area V3 Volume 2 (OEH 2016) and the PCT VIS vegetation type database (OEH online). Figure 2.1 shows the mapped vegetation in the locality.

The vegetation on the site was also classified according to Threatened Ecological Communities as listed in the schedules of the BC Act. A detailed description of how the importance of the habitat on the site for Threatened Ecological Communities (EEC) was determined, is given in Section 4.4.

1.5.5 BAM Plot Survey

A BAM plot survey was used to determine the integrity (condition) of the vegetation in each vegetation zone. The location of the sample locations are shown in Figure 3.1. The landscape features, vegetation type (PCT) and condition were surveyed using the Biodiversity Assessment Method (BAM) (OEH 2016).

1.5.5.1 Vegetation Integrity (condition) Assessment

A BAM survey was conducted to quantify vegetation integrity for the vegetation zone, including the following plot types:

- 400 m^2 plot (20 m x 20 m), used to assess the composition and structure;
- 1000 m^2 (20 m x 50 m) plot was used to assess functional attributes of the site; and
- 1 m^2 subplots (x5) nested within the 1000m^2 plot used to assess the average percentage leaf litter cover.

1.5.5.2 Composition and Structure

The floristic composition and relative cover were surveyed in the 20m x 20m plot. Information for each plant species within the plots was recorded including species name and the percent projected foliage cover across the plot for each species rooted in or overhanging the plot.

This information was then used to assist in determining the most likely Plant Community Types (PCTs) present and the presence of any endangered ecological communities (EECs) listed in schedule 2 of the BC Act 2016 and the condition of the vegetation at the site.

1.5.5.3 Function

The number of large trees, the presence of tree stem size class, tree regeneration and total fallen log length were recorded in the 20m x 50m plot. The DBH of live trees was measured and trees were assigned to a tree stem size classes from <5, 5-9, 10-19, 20-29, 30-49, 50-79, and 80+cm until all stem size classes were present or all tree measured. Where a tree had multiple stems, the largest stem was measured.

The number of large trees was recorded within the 20m x 50m plot. The definition of a “large tree” varies depending on the PCT that occurs within the plot.

The length of all fallen logs greater than 10 cm in diameter was measured. Only logs that were dead, on the ground, either in part or entirely were measured, and only the part of the log that was inside the plot was measured if the log extended out of the plot.

The percentage litter cover was measured within five 1m x 1m plots. The percentage litter cover includes dead leaves, seeds, twigs, branchlets and branches (<10 cm diameter).

1.5.5.4 Vegetation Integrity Score

The plot and transect survey data were then used to determine the composition score, the structure score and function score, which are used to determine the overall vegetation integrity score.

See section 4 for targeted field survey method and field survey effort for Threatened Flora and Fauna species and Section 3 for field survey effort for the vegetation survey.

1.5.6 Targeted Threatened Species Surveys

During the field surveys, all sections of the study area and some of the surrounding land were traversed on foot. The study area was searched for the presence of the Candidate Threatened flora and fauna species and their habitats using the published OEH guidelines.

- Bat Survey Guidelines, 'Species credit' Threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method OEH 2018
- Plant Survey Guidelines, NSW Guide to Surveying Threatened Plants OEH 2016
- Amphibian and Reptile Survey Guidelines, Threatened species survey and assessment guidelines: field survey methods for fauna, Amphibians DECC 2009
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft DEC 2004

2 Landscape Features

2.1 IBRA Bioregion/Subregion and Landscape Region

Bioregion: Sydney Basin
Sub-region: Pittwater
Mitchel Landscape Region: Belrose Coastal Slopes

2.2 Locality and Adjacent Ecological Values

The adjacent allotments to the south, east and west are fully developed residential properties with a tall native tree canopy of mostly Spotted gums and a mixed native exotic understorey. To the north is a beach on the coast of Pittwater. The proximity of the site to the National Park, development and nearby bushland is shown in Figures 1.1, 1.2 and 1.3.

2.3 Native Vegetation Extent in Locality

In accordance with 4.3.2. of the BAM (OEH, Aug 17) the percentage cover of native woody and non-woody vegetation within the 1.5km buffer area (approx. 780ha) around the site was determined. The percent native vegetation cover is estimated by using the most up to date native vegetation mapping in combination with recent aerial photograph imagery.

Native Vegetation of the Sydney Metropolitan Area V3 2016 is currently the best vegetation mapping for this area. It is a compilation of the best available vegetation maps by various authors. The boundaries of many of the vegetation patches were mostly determined between 2 and 15 years ago. Figure 2.1 shows the vegetation types (ecological communities) in the locality that have been mapped at the regional scale. The Figure legend lists the vegetation types and the map shows their distribution in the locality and in relation to the site. Table 1 summarises the proportion of each vegetation type.

The total amount of mapped native woody and non-woody vegetation within the buffer area is **136.8ha,** this is **18%** of the 776ha buffer area.

A large proportion of the buffer area is sea.

Table 2. Native Vegetation Mapped in Buffer

PCT	Vegetation Type (from NVSMA V3)	Associated TEC	Area (ha) in 1.5km buffer area	Percent of buffer area
771	Coastal Sand Tea-tree Banksia Shrub	N/A	0.17	0.02%
920	Estuarine Mangrove Forest	N/A	13.57	1.75%
1214	Pittwater Spotted Gum Forest	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion EEC	108.16	13.94%
1234	Estuarine Swamp Oak Forest	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions EEC	4.43	0.57%
1557	Central Coast Dry Escarpment Dry Forest	N/A	0.02	0.003%
1776	Coastal Enriched Sandstone Dry Forest	N/A	4.22	0.54%
1794	Coastal Alluvial Bangalay Forest	River-flat Eucalypt Forest on Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions EEC	0.94	0.12%
1795	Coastal Flats Swamp	Swamp Sclerophyll Forest on Coastal	1.41	0.18%

	Mahogany Forest	Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions EEC		
1817	Coastal Headland Clay Heath	N/A	1.21	0.16%
1833	Coastal Escarpment Littoral Rainforest	Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions EEC	1.55	0.20%
1841	Coastal Enriched Sandstone Moist Forest	N/A	1.12	0.14%
1913	Seagrass Meadows	N/A	46.4 (excluded from final calculations)	6% (excluded from final calculations)

2.3.1 Differences Between Mapped Vegetation Extent and Aerial Imagery

There was good correlation between the mapped vegetation and the recent aerial photography. No changes were necessary.

2.4 Cleared Areas

The site has a long history of disturbance including clearing of trees and understorey vegetation, construction of dwelling and driveways, creation of formed garden beds and retaining walls, introduction of fill, establishment of weeds, planting exotic garden species. Approximately 25% (3000m^2) of the site is cleared and contains, a house (to be retained) driveway, bare soil or exotic lawns and only scattered native herbs. The cleared parts of the site are in the central section and the lawn on the foreshore, the driveway and the existing house in Lot 11 (not being disturbed by this proposal).

2.5 Rivers and Streams

The site contains open lined channels running across the site and down the site and a creekline that is partly piped. Pittwater harbour is immediately adjacent to the north east. The property boundary is the mean high water mark. Waterbodies and hydrological processes are a type of Prescribed Impact and need to be specifically addressed in accordance with the BAM.

The impact of the proposal on waterbodies and hydrological process is described in the Prescribed Impact section in Table 16.

2.6 Wetlands

There is no wetland on or immediately adjacent to the property. There is a coastal estuarine wetland in Careel Bay approximately 615m east of the site. The storm water on the site currently drains into Pittwater.

Waterbodies and hydrological processes are a type of Prescribed Impact and need to be specifically addressed in accordance with the BAM.

The impact of the proposal on waterbodies and hydrological process is described in the Prescribed Impact section in Table 16.

The impact of the proposal on connectivity is described in the Prescribed Impact section in Table 16.

2.7 Connectivity Features

The site has medium wildlife corridor value for arboreal and highly mobile fauna. The site has residential properties with a tall tree canopy and patchy mid and ground cover to the east, west and south. To the north is the marine environment of Pittwater. There is an intact native canopy on the surrounding residential properties that connects the tree canopy at the site to areas of native vegetation in the locality including Stapleton Park south of the site. The proximity to National Parks and remnant vegetation in the locality is shown on Figure 1.2.

2.8 Areas of Geological Significance

There are no karsts, caves, crevice's, cliffs or any other item of geological significance at the site. There are some natural sandstone rocks features in the surrounding locality.

No soil hazard features were identified at the site. There is a geotechnical report as part of the DA/s.

The impact of the proposal on karsts, caves, cliffs and rocks is described in the Prescribed Impact section in Table 16.

Legend

- Buffer 1500m
- Cabarita mga
- National Park
- Soils Sydney ed4 DPI

Vegetation of Sydney v3 2016 TSC EEC Only

Endangered Ecological Community

- Littoral Rainforest
- Pittwater Spotted Gum Forest
- River Flat Eucalypt Forest
- Swamp Oak Floodplain Forest
- Swamp Sclerophyll Forest on Coastal Floodplains

Vegetation Type

- S_DSF04: Coastal Enriched Sandstone Dry Forest
- S_FoW01: Coastal Alluvial Bangalay Forest
- S_FoW02: Coastal Flats Swamp Mahogany Forest
- S_FoW08: Estuarine Swamp Oak Forest
- S_HL01: Coastal Headland Clay Heath
- S_HL02: Coastal Sand Tea-tree-Banksia Scrub
- S_RF07: Coastal Escarpment Littoral Rainforest
- S_SW01: Estuarine Mangrove Forest
- S_SW03: Seagrass Meadows
- S_WSF02: Coastal Enriched Sandstone Moist Forest
- S_WSF11: Pittwater Spotted Gum Forest
- S_WSF34: Central Coast Escarpment Dry Forest

Figure 2.1

Locality, Mapped Vegetation Types & Soils

Vegetation Data from; The Native Vegetation of the Sydney Metropolitan Area V3 2016

Date: 21/09/2018

N

0 125 250 500 m

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

3 Native Vegetation

3.1 Vegetation Class

The vegetation on the site is in two classes - Southern Lowland Wet Sclerophyll Forests and Coastal Floodplain Wetlands.

3.2 Native Vegetation Type Classification

The vegetation that occurs on the site was classified using three separate methods;

1. using the indicator species in the classification system in Native Vegetation of the Sydney Metropolitan Area (OEH 2016) which determines the PCT
2. VIS vegetation classification database and
3. The definitions of Threatened Ecological Communities in the Scientific Committee's determinations from the schedules of the Biodiversity Conservation Act.

Field survey results including the floristics (species mixture and relative abundance) and structure of the vegetation on the site was collected and these 3 methods were applied and the results are described in the following sections.

3.3 Plant Species List

The plant species that occur on the site are listed in the following table.

Table 3. Plant Species List

96-104 Cabarita Road, Avalon Beach
Location: MGA 344130 6278673
September 2018
by Nichlas Skelton, GIS Environmental Consultants

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

Summary of Growth Form and Status

Growth Form	Local Native Species	Planted	Threatened	Weed	Total
Fern	5			2	7
Forb	5	1		9	15
Grass	7			7	14
Herb	8	11		16	35
Other	6			2	8
Shrub	9	12		10	31
Tree	33	21	1	4	59
Vine	8	3		1	12
Total	**81**	**48**	**1**	**51**	**181**

Genus and Species	Habit	Common Name	Status
Allocasuarina torulosa	Tree	Forest She-oak	Local Native Species
Acacia floribunda	Tree	White Sallow Wattle	Local Native Species
Acacia implexa	Tree	Hickory	Local Native Species
Acacia longifolia	Shrub	Sydney Golden Wattle	Local Native Species
Acacia longissima	Tree		Local Native Species
Acacia prominens	Tree	Gosford Wattle	Planted
Acalypha wilkesiana	Herb	Beefsteak Plant	Planted
Adiantum aethiopicum	Fern	Maidenhair Fern	Local Native Species
Adiantum hispidulum	Fern	Five Fingered Jack	Local Native Species
Agapanthus orientalis	Herb	Agapanthus	Planted
Agathis robusta	Tree	Queensland Kauri	Planted
Agave americana	Herb	American Cactus	Weed
Agave attenuata	Herb	Century Plant	Weed
Agave sp.	Herb	Centuary Plant	Planted
Ageratina adenophora	Herb	Crofton Weed	Weed
Agonis flexuosa	Tree	Willow Myrtle	Planted
Allocasuarina torulosa	Tree	Forest She-oak	Local Native Species
Aloe saponaria	Herb	Soap Aloe	Planted
Alpinia sp.	Herb	Ornamental Ginger	Planted
Angophora floribunda	Tree	Rough-barked Apple	Local Native Species
Araucaria heterophylla	Tree	Norfolk Island Pine	Planted
Arbutus unedo	Tree	Irish Strawberry	Planted
Archontophoenis cunninghamiana	Other	Bangalow Palm	Local Native Species
Asparagus aethiopicus	Fern	Asparagus Fern	Weed
Asparagus officinalis	Herb	Asparagus	Weed
Atriplex prostata	Forb		Weed
Avicennia marina	Tree	Grey Mangrove	Local Native Species
Avicennia marina var. australasica	Tree		Local Native Species
Banksia integrifolia ssp. integrifolia	Tree	Coastal Banksia	Local Native Species
Bidens pilosa	Herb	Cobbler's Pegs, Pitchforks	Weed
Billardiera scandens	Other	Apple Berry, Dumplings	Local Native Species
Bougainvillea sp.	Shrub	Bougainvillea	Planted
Brachychiton acerifolius	Tree	Flame Tree	Planted
Brachychiton populneum	Tree	Kurrajong	Local Native Species
Brassaia actinophylla	Shrub	Umberella Tree	Weed
Breynia oblongifolia	Shrub	Breynia	Local Native Species
Briza minor	Grass	Shivery Grass	Weed
Bryophyllum delagoense	Forb	Mother-of-millions	Weed
Cakile edentula	Herb		Weed
Callistemon Hybrid	Shrub	Bottle Brush	Planted
Camellia japonica	Tree	Camellia	Planted
Camellia sasanqua	Tree	Camellia	Planted

Genus and Species	Habit	Common Name	Status
Carpobrotus glaucescens	Herb	Pig Face	Local Native Species
Castanospermum australe	Tree	Black Bean	Planted
Casuarina glauca	Tree	Swamp Sheoak	Local Native Species
Cayratia clematidea	Vine	Slender Grape	Local Native Species
Cerastium glomeratum	Forb	Mouse Ear Chick Weed	Weed
Ceratopetalum gummiferum	Tree	NSW Christmas Bush	Local Native Species
Chlorphytum comosum	Herb	Spider Plant	Weed
Chrysanthemoides monilifera	Shrub	Boneseed	Weed
Cinnamomum camphora	Tree	Camphora Laurel	Weed
Cissus antarctica	Vine	Kangaroo Vine	Local Native Species
Cissus hypoglauca	Vine	Native Grape	Local Native Species
Citharexylum spinosum	Tree	Fiddlewood	Planted
Clerodendrum tomentosum	Shrub	Hairy clerodendrum	Local Native Species
Clivea miniata	Herb	Kaffir Lily	Planted
Commelina cyanea	Forb	Creeping Christian	Local Native Species
Conyza bonariensis	Shrub	Fleabane	Weed
Conyza sp.	Herb	Fleabane	Weed
Corymbia gummifera	Tree	Bloodwood	Local Native Species
Corymbia maculata	Tree	Spotted Gum	Local Native Species
Craspedia variabilis	Herb	Billy Buttons	Local Native Species
Crassula multicava	Herb	Fairy Crassula	Weed
Cyanodon dactylon	Grass	Common Couch	Local Native Species
Cyathea cooperi	Fern	Straw Tree Fern	Local Native Species
Cymbidium suave	Herb		Local Native Species
Cynodon dactylon	Grass	Common Couch	Local Native Species
Cyperus sp.	Grass		Weed
Davallia pyxidata	Fern	Hares Foot Fern	Local Native Species
Dendrobium speciosum	Herb		Planted
Dianella caerulea var. producta	Herb	Blue Flax Lily	Local Native Species
Dichondra repens	Herb	Kidney Weed	Local Native Species
Dietes grandiflora	Forb	Dietes	Planted
Digitaria sanguinalis	Grass	Summer Grass	Weed
Dimorphotheca ecklonis	Herb	Sailor Boy Daisy	Planted
Dodonaea triquetra	Shrub	Hop Bush	Local Native Species
Ehrharta erecta	Grass	Ehrharta	Weed
Endiandra sieberi	Tree	Corkwood	Local Native Species
Entolasia marginata	Grass		Local Native Species
Entolasia stricta	Grass	Wiry Panic	Local Native Species
Epidendrum ibaguense	Herb	Crucifix Orchid	Planted
Eriobotrya japonica	Shrub	Loquat	Planted
Erythrina X sykesii	Tree	Coral Tree	Weed
Eucalyptus acmenoides	Tree	White Mahogany	Local Native Species
Eucalyptus botryoides	Tree	Bangalay	Local Native Species
Eucalyptus paniculata ssp. paniculata	Tree	Grey Ironbark	Local Native Species
Eucalyptus punctata	Tree	Grey Gum	Local Native Species
Eucalyptus robusta	Tree	Swamp Mahogany	Local Native Species
Eucalyptus umbra	Tree	Bastard Mahogany	Local Native Species
Eustrephus latifolius	Vine	Wombat Berry	Local Native Species
Ficus benjamina	Tree	Weeping Fig	Planted
Ficus microcarpa	Tree	Fig Cultivar	Planted
Ficus pumila	Tree	Climbing Fig	Planted
Ficus rubiginosa	Tree	Port Jackson Fig	Local Native Species
Freesia refracta	Forb	Freesia	Weed
Geitonoplesium cymosum	Vine	Scrambling Lily	Local Native Species
Geranium homeanum	Herb		Local Native Species
Glochidion ferdinandi var. ferdinandi	Tree	Cheese Tree	Local Native Species
Grevillea robusta	Shrub	Silky Oak	Planted
Harpephyllum caffrum	Tree	Kaffir Plum	Local Native Species
Hedychium gardnerianum	Forb	Ginger Lily	Weed
Hibiscus sp.	Shrub	Hibiscus	Planted

Genus and Species	Habit	Common Name	Status
Hydrangea macrophylla	Herb	Hydrangea	Planted
Hypochaeris glabra	Herb	Smooth Cats Ear	Weed
Imperata cylindrica var. major	Grass	Blady Grass	Local Native Species
Jacaranda mimosaefolia	Tree	Jacaranda	Planted
Lantana camara	Shrub	Lantana	Weed
Leptospermum polygalifolium ssp. poly	Shrub	Lemon Scented Tea Tree	Local Native Species
Ligustrum lucidum	Tree	Privet - broad leaved	Weed
Ligustrum sinense	Shrub	Privet - narrow leaved	Weed
Lilium formosum	Herb	Roadside Lilly	Weed
Livistona australis	Tree	Cabbage Tree Palm	Local Native Species
Lolium perenne	Grass	Perennial Rye Grass	Weed
Lomandra longifolia	Forb	Spiny-headed Mat-rush	Local Native Species
Lonicera japonica	Other	Japanese Honeysuckle	Weed
Lophostemon confertus	Tree	Brush Box	Planted
Macrozamia communis	Other	Burrawang	Local Native Species
Magnolia grandifolia	Tree	Evergreen Magnolia	Planted
Marsdenia suaveolens	Vine	Sweet-scented Doubah	Local Native Species
Melaleuca quinquenervia	Tree	Broad-leaved Paperbark	Local Native Species
Melaleuca styphelioides	Shrub	Prickly-leaved Paperbark	Local Native Species
Melia azedarach	Tree	White Cedar	Local native species
Monstera deliciosa	Herb	Swiss Cheese Plant	Weed
Morus alba	Tree	White Mulberry	Planted
Musa sp.	Herb	Banana	Planted
Nandina domestica	Shrub	Sacred Bamboo	Weed
Nephrolepis cordifolia	Fern	Fishbone Fern	Weed
Nerium oleander	Shrub	Oleander	Planted
Notelaea longifolia	Shrub	Nettle	Local Native Species
Notelaea ovata	Shrub	Mock Olive	Local Native Species
Nothoscordum gracile	Forb	Onion Weed	Weed
Ochna serrulata	Shrub	Mickey Mouse Plant	Weed
Olea europa ssp. africana	Shrub	African Olive	Weed
Oplismenus imbecillis	Grass	Basket Grass	Local Native Species
Oxalis rubens	Forb		Local Native Species
Pandorea pandorana	Other	Wonga Wonga Vine	Local Native Species
Parietaria judaica	Herb	Asthma Weed	Weed
Paspalum dilatatum	Grass	Paspalum	Weed
Passiflora herbertiana	Vine	Passionfruit	Planted
Philodendron bipinnatifidum	Forb	Philodendron	Weed
Phoenix canariensis	Other	Canary Island Date Palm	Weed
Physalis peruviana	Herb	Cape Gooseberry	Weed
Pinnus sp.	Tree	Pine	Weed
Pittosporum revolutum	Tree	Rough-fruit Pittosporum	Local Native Species
Pittosporum undulatum	Tree	Sweet Pittosporum	Local Native Species
Plantago lanceolata	Forb	Lamb's Tongues	Weed
Plumeria lutea	Tree	Frangipanni	Planted
Portulacaria afra	Shrub	Jade Plant	Planted
Pratia purpurascens	Herb	White Root	Local Native Species
Prunus sp.	Tree	Stonefruit	Planted
Pseuderanthemum variabile	Forb	Pastel Flower	Local Native Species
Pteridium esculentum	Fern	Bracken	Local Native Species
Rapanea howittiana	Tree	Brush Muttonwood	Local Native Species
Rhododendron sp.	Shrub	Azalea	Planted
Rubus fruticosus	Vine	Blackberry	Weed
Rubus hillii	Vine	Broad-leaved Bramble	Local Native Species
Rubus parvifolius	Other	Native Raspberry	Local Native Species
Scolopia braunii	Tree	Flintwood	Local Native Species
Senecio madagascariensis	Forb	Fire Weed	Weed
Senna pendula	Shrub	Cassia	Weed
Solanum nigrum	Herb	Black-berry Nightshade	Weed
Stenocarpus sinuatus	Tree	Fire Wheel Tree	Planted

Genus and Species	Habit	Common Name	Status
Stenotaphrum secundatum	Grass	Buffalo Grass	Weed
Stephania japonica var. discolor	Vine	Snake Vine	Local Native Species
Strelitzia nicolai	Shrub	Travelers Palm	Planted
Strelitzia sp.	Shrub	Bird of Paradise	Planted
Syagrus romanzoffiana	Tree	Cocos Palm, Queen Palm	Planted
Syncarpia glomulifera	Tree	Turpentine	Local Native Species
Synoum glandulosum	Tree	Scentless Rosewood	Local Native Species
Syzygium paniculatum	Tree	Magenta Lillypilly	Threatened
Tetragonia tetragonoides	Forb	Warrigal Greens, Native Spinach	Local Native Species
Themeda australis	Grass	Kangaroo Grass	Local Native Species
Tibouchina sp.	Shrub	Tibouchina, Lasiandra	Planted
Toxicodendron succedaneum	Shrub	Rhus tree	Weed
Trachelospermum jasminoides	Vine	Star Jasmine	Planted
Tradescantia albiflora	Herb	Wandering Jew	Weed
Vibernum tinus	Shrub	Snowball Tree	Planted
Viola hederacea	Herb	Native Violet	Local Native Species
Wilkiea huegeliana	Shrub	Wilkiea	Local Native Species
Wistaria sinensis	Vine	Wistaria	Planted
Xanthorrhoea arborea	Other	Broad-leaved Grass Tree	Local Native Species

Table 4. Plant Species and Cover Plots Only

96-104 Cabarita Road, Avalon Beach
Location: MGA 344130 6278673
September 2018
by Nichlas Skelton, GIS Environmental Consultants

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

Summary of Growth Form, Status and Cover within each Plot — % Cover

Growth Form		Plot 1	Plot 2	Plot 3
Local Native Species		**106**	**77**	**53**
	Fern	0		0
	Grass	0	2	10
	Shrub	3	1	1
	Tree	99	65	19
	Other	4	8	2
	Forb	0		20
Planted		**27**	**5**	**4**
	Shrub		2	2
	Tree	27		2
	Other	0	2	
	Forb		1	
Weed		**14**	**18**	**27**
	Fern		0	1
	Grass	0	1	25
	Shrub	1	2	0
	Other	0	9	
	Forb	12	5	1
Total		**147**	**100**	**84**

Plot	% cover	Genus and Species	Family	Habit	Order	Common Name	Status
Plot 1	0.1	Adiantum aethiopicum	ADIANTACEAE	Fern	FERN	Maidenhair Fern	Local Native Species
Plot 1	2	Allocasuarina torulosa	CASUARINACEAE	Tree	DICOTYLEDON	Forest She-oak	Local Native Species
Plot 1	10	Asparagus aethiopicus	ASPARAGACEAE	Forb	MONOCOTYLEDON	Asparagus Fern	Weed
Plot 1	2	Brachychiton populneum	STERCULIACEAE	Tree	DICOTYLEDON	Kurrajong	Local Native Species
Plot 1	2	Breynia oblongifolia	EUPHORBIACEAE	Shrub	DICOTYLEDON	Breynia	Local Native Species
Plot 1	0.1	Cissus antarctica	VITACEAE	Other	DICOTYLEDON	Kangaroo Vine	Local Native Species
Plot 1		Cissus hypoglauca	VITACEAE	Other	DICOTYLEDON	Native Grape	Local Native Species
Plot 1	70	Corymbia maculata	MYRTACEAE	Tree	DICOTYLEDON	Spotted Gum	Local Native Species
Plot 1	0.1	Cyperus sp.	CYPERACEAE	Grass	MONOCOTYLEDON		Weed
Plot 1	0.1	Dianella caerulea	PHORMIACEAE	Forb	MONOCOTYLEDON	Blue Flax Lily	Local Native Species
Plot 1	0.1	Ehrharta erecta	POACEAE	Grass	MONOCOTYLEDON	Ehrharta	Weed
Plot 1	3	Endiandra sieberi	LAURACEAE	Tree	DICOTYLEDON	Corkwood	Local Native Species
Plot 1	0.1	Entolasia stricta	POACEAE	Grass	MONOCOTYLEDON	Wiry Panic	Local Native Species
Plot 1	15	Eucalyptus paniculata	MYRTACEAE	Tree	DICOTYLEDON	Grey Ironbark	Local Native Species
Plot 1	0.5	Eustrephus latifolius	LUZURIAGACEAE	Other	MONOCOTYLEDON	Wombat Berry	Local Native Species
Plot 1	7	Ficus microcarpa	MORACEAE	Tree	DICOTYLEDON	Fig Cultivar	Planted
Plot 1	0.1	Freesia refracta	IRIDACEAE	Forb	MONOCOTYLEDON	Freesia	Weed
Plot 1	1	Glochidion ferdinandi var. ferdinandi	EUPHORBIACEAE	Tree	DICOTYLEDON	Cheese Tree	Local Native Species
Plot 1	0.1	Hedychium gardnerianum	ZINGIBERACEAE	Forb	MONOCOTYLEDON	Ginger Lily	Weed
Plot 1	0.1	Imperata cylindrica	POACEAE	Grass	MONOCOTYLEDON	Blady Grass	Local Native Species
Plot 1	0.1	Jacaranda mimosifolia	BIGNONIACEAE	Tree	DICOTYLEDON	Jacaranda	Planted
Plot 1	0.1	Ligustrum sinense	OLEACEAE	Shrub	DICOTYLEDON	Privet - narrow leaved	Weed
Plot 1	0.1	Livistona australis	ARECACEAE	Other	MONOCOTYLEDON	Cabbage Tree Palm	Local Native Species
Plot 1	0.1	Lomandra longifolia	LOMANDRACEAE	Forb	MONOCOTYLEDON	Spiny-headed Mat-rush	Local Native Species
Plot 1	0.1	Lonicera japonica	CAPRIFOLIACEAE	Other	DICOTYLEDON	Japanese Honeysuckle	Weed
Plot 1	20	Lophostemon confertus	MYRTACEAE	Tree	DICOTYLEDON	Brush Box	Planted
Plot 1	2	Macrozamia communis	ZAMIACEAE	Other	CYCADS	Burrawang	Local Native Species
Plot 1	0.1	Nandina domestica	BERBERIDACEAE	Shrub	MONOCOTYLEDON	Sacred Bamboo	Weed
Plot 1		Notelaea longifolia	OLEACEAE	Shrub	DICOTYLEDON	Nettle	Local Native Species
Plot 1	0.5	Notelaea ovata	OLEACEAE	Shrub	DICOTYLEDON	Mock Olive	Local Native Species
Plot 1	1	Ochna serrulata	OCHNACEAE	Shrub	DICOTYLEDON	Ochna, Mickey Mouse Plan	Weed
Plot 1	0.1	Oplismenus aemulus	POACEAE	Grass	MONOCOTYLEDON	Basket Grass	Local Native Species
Plot 1	0.1	Philodendron bipinnatifidum	ARACEAE	Forb	MONOCOTYLEDON	Philodendron	Weed
Plot 1	1	Pittosporum revolutum	PITTOSPORACEAE	Tree	DICOTYLEDON	Rough-fruit Pittosporum	Local Native Species
Plot 1	5	Pittosporum undulatum	PITTOSPORACEAE	Tree	DICOTYLEDON	Sweet Pittosporum	Local Native Species
Plot 1	2	Senecio madagascariensis	ASTERACEAE	Forb	DICOTYLEDON	Fire Weed	Weed
Plot 1	0.1	Senna pendula	CAESALPINIOIDEAE	Shrub	DICOTYLEDON	Cassia	Weed
Plot 1	1	Stephania japonica var. discolor	MENISPERMACEAE	Other	DICOTYLEDON	Snake Vine	Local Native Species
Plot 1	0.1	Syagrus romanzoffiana	ARECACEAE	Other	MONOCOTYLEDON	Cocos Palm, Queen Palm	Planted
Plot 1		Syncarpia glomulifera	MYRTACEAE	Tree	DICOTYLEDON	Turpentine	Local Native Species
Plot 1	0.1	Tradescantia albiflora	COMMELINACEAE	Forb	MONOCOTYLEDON	Wandering Jew	Weed
Plot 3	0.1	Acacia longifolia	FABACEAE	Shrub	DICOTYLEDON	Sydney Golden Wattle	Local Native Species
Plot 3	3	Allocasuarina torulosa	CASUARINACEAE	Tree	DICOTYLEDON	Forest She-oak	Local Native Species
Plot 3	0.1	Bidens pilosa	ASTERACEAE	Forb	DICOTYLEDON	Cobbler's Pegs, Pitchforks	Weed
Plot 3	0.1	Briza minor	POACEAE	Grass	MONOCOTYLEDON	Shivery Grass	Weed
Plot 3	7	Casuarina glauca	CASUARINACEAE	Tree	DICOTYLEDON	Swamp Sheoak	Local Native Species
Plot 3	0.1	Cerastium glomeratum	CARYOPHYLLACEAE	Forb	DICOTYLEDON	Mouse Ear Chick Weed	Weed
Plot 3	0.1	Chlorphytum comosum	LILLIACEAE	Forb	MONOCOTYLEDON	Spider Plant	Weed
Plot 3	0.1	Commelina cyanea	COMMELINACEAE	Forb	MONOCOTYLEDON	Creeping Christian	Local Native Species
Plot 3	0.1	Conyza bonariensis	ASTERACEAE	Shrub	DICOTYLEDON	Fleabane	Weed
Plot 3	6	Corymbia maculata	MYRTACEAE	Tree	DICOTYLEDON	Spotted Gum	Local Native Species
Plot 3	0.1	Cyathea cooperi	CYATHEACEAE	Fern	FERN	Straw Tree Fern	Local Native Species

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Plot	% cover	Genus and Species	Family	Habit	Order	Common Name	Status
Plot 3	10	Cynodon dactylon	POACEAE	Grass	MONOCOTYLEDON	Common Couch	Local Native Species
Plot 3	0.1	Dianella caerulea var. producta	PHORMIACEAE	Forb	MONOCOTYLEDON	Blue Flax Lily	Local Native Species
Plot 3	0.1	Digitaria sanguinalis	POACEAE	Grass	MONOCOTYLEDON	Summer Grass	Weed
Plot 3	10	Ehrharta erecta	POACEAE	Grass	MONOCOTYLEDON	Ehrharta	Weed
Plot 3	0.1	Entolasia stricta	POACEAE	Grass	MONOCOTYLEDON	Wiry Panic	Local Native Species
Plot 3		Eustrephus latifolius	LUZURIAGACEAE	Other	MONOCOTYLEDON	Wombat Berry	Local Native Species
Plot 3	2	Glochidion ferdinandi var. ferdinandi	EUPHORBIACEAE	Tree	DICOTYLEDON	Cheese Tree	Local Native Species
Plot 3	0.1	Harpephyllum caffrum	ANACARDIACEAE	Tree	DICOTYLEDON	Kaffir Plum	Local Native Species
Plot 3	2	Jacaranda mimosifolia	BIGNONIACEAE	Tree	DICOTYLEDON	Jacaranda	Planted
Plot 3	2	Livistona australis	ARECACEAE	Other	MONOCOTYLEDON	Cabbage Tree Palm	Local Native Species
Plot 3	0.1	Lolium perenne	POACEAE	Grass	MONOCOTYLEDON	Perennial Rye Grass	Weed
Plot 3	1	Melaleuca styphelioides	MYRTACEAE	Shrub	DICOTYLEDON	Prickly-leaved Paperbark	Local Native Species
Plot 3	0.5	Nephrolepis cordifolia	DAVALLIACEAE	Fern	FERN	Fishbone Fern	Weed
Plot 3	0.1	Nothoscordum gracile	ALLIACEAE	Forb	MONOCOTYLEDON	Onion Weed	Weed
Plot 3	0.1	Ochna serrulata	OCHNACEAE	Shrub	DICOTYLEDON	Ochna, Mickey Mouse Plan	Weed
Plot 3	0.1	Oxalis rubens	OXALIDACEAE	Forb	DICOTYLEDON		Local Native Species
Plot 3	1	Pittosporum revolutum	PITTOSPORACEAE	Tree	DICOTYLEDON	Rough-fruit Pittosporum	Local Native Species
Plot 3	0.1	Plantago lanceolata	PLANTAGINACEAE	Forb	DICOTYLEDON	Lamb's Tongues	Weed
Plot 3	20	Pratia purpurascens	LOBELIACEAE	Forb	DICOTYLEDON	White Root	Local Native Species
Plot 3	0.1	Solanum nigrum	SOLANACEAE	Forb	DICOTYLEDON	Black-berry Nightshade	Weed
Plot 3	15	Stenotaphrum secundatum	POACEAE	Grass	MONOCOTYLEDON	Buffalo Grass	Weed
Plot 3	0.1	Stephania japonica var. discolor	MENISPERMACEAE	Other	DICOTYLEDON	Snake Vine	Local Native Species
Plot 3	2	Strelitzia nicolai	MUSACEAE	Shrub	DICOTYLEDON	Travelers Palm	Planted
Plot 3	0.1	Tetragonia tetragonoides	AIZOACEAE	Forb	DICOTYLEDON	Warrigal Greens, Native Spi	Local Native Species
Plot 3	0.1	Tradescantia albiflora	COMMELINACEAE	Forb	MONOCOTYLEDON	Wandering Jew	Weed
Plot 2		Acacia floribunda	FABACEAE	Tree	DICOTYLEDON	White Sallow Wattle	Local Native Species
Plot 2	0.1	Acacia implexa	FABACEAE	Tree	DICOTYLEDON	Hickory	Local Native Species
Plot 2	0.1	Acacia longissima	FABACEAE	Tree	DICOTYLEDON		Local Native Species
Plot 2	0.1	Ageratina adenophora	ASTERACEAE	Forb	DICOTYLEDON	Crofton Weed	Weed
Plot 2	3	Asparagus aethiopicus	ASPARAGACEAE	Forb	MONOCOTYLEDON	Asparagus Fern	Weed
Plot 2	1	Bidens pilosa	ASTERACEAE	Forb	DICOTYLEDON	Cobbler's Pegs, Pitchforks	Weed
Plot 2	0.1	Billardiera scandens	PITTOSPORACEAE	Other	DICOTYLEDON	Apple Berry, Dumplings	Local Native Species
Plot 2	0.2	Cayratia clematidea	VITACEAE	Other	DICOTYLEDON	Slender Grape	Local Native Species
Plot 2	0.3	Chlorphytum comosum	LILLIACEAE	Forb	MONOCOTYLEDON	Spider Plant	Weed
Plot 2	0.1	Conyza bonariensis	ASTERACEAE	Shrub	DICOTYLEDON	Fleabane	Weed
Plot 2	60	Corymbia maculata	MYRTACEAE	Tree	DICOTYLEDON	Spotted Gum	Local Native Species
Plot 2	1	Dietes grandiflora	LILLIACEAE	Forb	MONOCOTYLEDON	Dietes	Planted
Plot 2	1	Ehrharta erecta	POACEAE	Grass	MONOCOTYLEDON	Ehrharta	Weed
Plot 2	1	Entolasia marginata	POACEAE	Grass	MONOCOTYLEDON		Local Native Species
Plot 2	2	Geitonoplesium cymosum	LUZURIAGACEAE	Other	MONOCOTYLEDON	Scrambling Lily	Local Native Species
Plot 2	1	Imperata cylindrica	POACEAE	Grass	MONOCOTYLEDON	Blady Grass	Local Native Species
Plot 2	1	Lantana camara	VERBENACEAE	Shrub	DICOTYLEDON	Lantana	Weed
Plot 2	0.2	Ligustrum sinense	OLEACEAE	Shrub	DICOTYLEDON	Privet - narrow leaved	Weed
Plot 2	3	Lonicera japonica	CAPRIFOLIACEAE	Other	DICOTYLEDON	Japanese Honeysuckle	Weed
Plot 2	2	Macrozamia communis	ZAMIACEAE	Other	CYCADS	Burrawang	Local Native Species
Plot 2	0.2	Nephrolepis cordifolia	DAVALLIACEAE	Fern	FERN	Fishbone Fern	Weed
Plot 2	1	Notelaea ovata	OLEACEAE	Shrub	DICOTYLEDON	Mock Olive	Local Native Species
Plot 2	0.5	Ochna serrulata	OCHNACEAE	Shrub	DICOTYLEDON	Ochna, Mickey Mouse Plan	Weed
Plot 2	0.4	Olea europa ssp. africana	OLEACEAE	Shrub	DICOTYLEDON	African Olive	Weed
Plot 2	0.1	Oplismenus aemulus	POACEAE	Grass	MONOCOTYLEDON	Basket Grass	Local Native Species
Plot 2	1	Pandorea pandorana	BIGNONIACEAE	Other	DICOTYLEDON	Wonga Wonga Vine	Local Native Species
Plot 2	6	Phoenix canariensis	ARECACEAE	Other	MONOCOTYLEDON	Canary Island Date Palm	Weed
Plot 2	2	Pittosporum revolutum	PITTOSPORACEAE	Tree	DICOTYLEDON	Rough-fruit Pittosporum	Local Native Species
Plot 2	1	Pittosporum undulatum	PITTOSPORACEAE	Tree	DICOTYLEDON	Sweet Pittosporum	Local Native Species
Plot 2		Pseuderanthemum variabile	ACANTHACEAE	Forb	DICOTYLEDON	Pastel Flower	Local Native Species
Plot 2	2	Rapanea howittiana	MYRSINACEAE	Tree	DICOTYLEDON	Brush Muttonwood	Local Native Species
Plot 2	1	Rubus parvifolius	ROSACEAE S. STR.	Other	DICOTYLEDON	Native Raspberry	Local Native Species
Plot 2	0.1	Senna pendula	CAESALPINIOIDEAE	Shrub	DICOTYLEDON	Cassia	Weed
Plot 2	1	Solanum nigrum	SOLANACEAE	Forb	DICOTYLEDON	Black-berry Nightshade	Weed
Plot 2	2	Stephania japonica var. discolor	MENISPERMACEAE	Other	DICOTYLEDON	Snake Vine	Local Native Species
Plot 2	2	Strelitzia nicolai	MUSACEAE	Shrub	DICOTYLEDON	Travelers Palm	Planted
Plot 2	2	Trachelospermum jasminoides		Other	DICOTYLEDON	Star jasnin	Planted

3.4 Justification for PCT (Vegetation Classification)

3.4.1 Candidate Vegetation Communities

The two most likely vegetation communities (PCTs) and the ones that have been mapped as occurring on or near the site are:

Note: Each PCT has been referred to within each reference with a different name. Therefore each PCT has three different names. This report assesses each PCT using three different references (OEH NVSMA, VIS and EEC determination). The name that each reference uses, is used when assessing under that reference.

- **PCT 1214**
  - **Pittwater Spotted Gum Forest** (NVSMA OEH V3 2016 mapping name, see Figure 2.1)
  - **Spotted Gum-Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion** (VIS Classification, PCT name, name in BAM Calculator)
  - **Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion** (Endangered Ecological Community in Schedule 2 of the BC Act 2016)
- **PCT 1234**
  - **Estuarine Swamp Oak Forest** (NVSMA OEH V3 2016 mapping name, see Figure 2.1)
  - **Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion** (VIS Classification, PCT Name, name in BAM Calculator).
  - **Swamp Oak Floodplain Forest of the NSW North Coast and Sydney Basin Bioregion (**Endangered Ecological Community in Schedule 2 of the BC Act 2016)

Figure 2.1 shows the location and abundance of vegetation communities (using NVSMA.

3.4.2 Assessment using the VIS and the NVSMA 2016

Pittwater Spotted Gum Forest (PCT 1214)

The species and relative abundance information from three 400m^2 plots within different levels of disturbance (Plots 1, 2 and 3)were used for the following assessment. Parts of the site have been mapped as this community.

The positive diagnostic test for Pittwater Spotted Gum Forest in the Native Vegetation of the Sydney Metropolitan Area (OEH 2016) requires 25 or more positive diagnostic in a 400m^2 plot for a positive diagnosis, provided that there are 42 or more native species within the plot.

Plots 1, 2 and 3 (all 400m^2) were located in areas mapped as Pittwater Spotted Gum Forest or that had a canopy of Spotted Gum (*Corymbia maculata*) and other PWSGF tree species. Plot 1, on the site, had 24 native species, of these 18 are positive diagnostic for Pittwater Spotted Gum Forest. Plot 2, on the site, had 19 native species, of these 13 are positive diagnostic species for Pittwater Spotted Gum Forest. Plot 3 had 19 native species, of these 10 are positive diagnostic species. There were not enough native species or positive diagnostic species in any plot for a positive diagnosis for Pittwater Spotted Gum Forest using this method. The lack of native species is likely to due to past disturbance and the presence of weeds and exotics. The plots are considered to contain modified Pittwater Spotted Gum Forest as the remnant native species, including the Spotted Gum dominated tree canopy, best fit this community.

VIS Classification

Spotted Gum-grey Ironbark Open Forest is described in the classification titled Native Vegetation of the Sydney Metropolitan Area (OEH 2016), as a tall open forest dominated by Spotted Gum (*Corymbia maculata*), with Grey Ironbark (*Eucalyptus paniculata*) and Broad-leaved White Mahogany (Eucalyptus umbra) also in the canopy. The mid-storey is a mix of mesic and dry shrub species and the ground layer contains grasses, ferns, small fines and Burrawang (*Macrozamia communis*). The Spotted Gum forest on the site has been disturbed and much of the midstorey and understorey has been removed and replaced by weed, exposed garden species or mulch. The understorey is in slightly better condition in the top (southern) and north-eastern parts of the site. See Figure 3.1.

Estuarine Swamp Oak Forest (PCT 1234)

There is mapping of this community in similar habitat within the 1.5km buffer area.

The lower, north-western corner of the site has a native tree canopy dominated by Swamp She-Oak (*Casuarina glauca)* trees that may be remnant of Estuarine Swamp Oak Forest (PCT 1234 Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion).

The document Native Vegetation of the Sydney Metropolitan Area V3 (OEH 2016) described Estuarine Swamp Oak Forest as vegetation occurring between mangroves and terrestrial vegetation communities. It occurs immediately above the tidal influence on the fringes of saline water bodies. The dominant canopy species is *Casuarina glauca* with salt herbs, rushes and sedges in the groundcover. This community generally has a low species diversity. The lower north-western corner of the site is suitable habitat for this community generally fits the description of this community provided in the NVSMA (2016). The groundcover has been mown and mulched, so native species richness is low. A degraded form of Estuarine Swamp Oak Forest is considered to occur in the north-western corner of the site.

3.4.3 Other Native Vegetation at the Development Site

Parts of the site that have a native canopy but have no native understorey or a concrete understory are not considered to represent any PCT and are not included in the BDAR assessment.

Photo Page 1. Vegetation Plot Photos

Plot 1, looking north-west along centre line of the plot.

Plot 2, looking south-east along centre line of the plot.

Plot 3, Looking south-west along centre line of the plot.

3.5 Presence of Threatened Ecological Communities

3.5.1 Threatened Ecological Communities in the Locality

The NSW Biodiversity Conservation Act, 2016 lists Threatened Ecological Communities (TECs) and Threatened Species that are likely to become extinct in nature unless the circumstances and factors threatening their survival cease to operate. The Threatened communities that are known to occur in the locality are shown with a red diagonal hash pattern on Figure 2.1. Drainage and soil types in the locality are shown in Figure 2.1 and 1.3. Abiotic factors and the site survey were used to determine targeted Threatened Ecological Communities.

3.5.2 Method of Establishing if EEC's Occur on this Study area

To establish if any endangered ecological community occurs within the study area and a combination of three separate methods were used:

Mapping Method: The most accurate and up-to-date vegetation maps that are available were used to determine what is already known about the distribution of vegetation types in the locality. Where more accurate local maps are not available, the 'Vegetation of the Sydney Metropolitan Area' Figure and classification (OEH, 2016) are used. Vegetation mapping has inherent errors such as the spatial accuracy of the mapping, how old the mapping is and classification accuracy, which is limited, due to the amount of field verification that was carried out when they were made. Vegetation maps do not provide a sufficient level of spatial accuracy for the assessment of the impact at the scale of this proposal but are useful in determining the ecological communities that are likely to occur in the vicinity. Fieldwork is necessary to determine the site-specific accurate vegetation mapping.

Correlation Method: Correlations between the species that occur in the study area and the listed characteristic species for the Endangered Ecological Community in; the Final Determination in Part 3 of Schedule 1 of the Threatened Species Conservation Act (1995). The floristics were also compared to the document 'Vegetation of the Sydney Metropolitan Area V3' by OEH 2016.

Comparison Method: Comparison of the ecological features on the site to the environmental description in the legal definition of the Threatened Ecological Community in the Final Determination in Biodiversity Conservation Act (2016). This comparison is essential when determining if the type of ecological community that occurs within a study area is an endangered community. Not all the sections of the determinations need to apply to the study area and the earlier sections are more important and should be given more weight (Preston and Adams).

3.5.3 Occurrence of TECs in this Study Area

Mapping Result

Pittwater and Wagstaffe Spotted Gum Forest EEC

The southern and eastern parts of the site of the site are mapped as Pittwater Spotted Gum Forest (S_WSF11) that is a component of the Endangered Ecological Community Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion. The spatial and classification accuracy of this mapping is limited due to the amount of field verification that was carried out and the time since the mapping in this locality was carried out. These maps have been made for broad scale planning and are useful in determining the ecological communities that are likely to occur in the vicinity. Field verification is needed to verify the boundaries of the community onsite and current conditions and for plant species identification for floristic analysis.

Swamp Oak Floodplain Forest EEC

The site is not mapped as containing Swamp Oak Floodplain Forest. Estuarine Swamp Oak Forest (S_FoW08) is mapped on similar habitat (bank of estuary) near the site. Estuarine Swamp Oak Forest is a component of the Endangered Ecological Community, Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregion.

Correlation Result – Listed Characteristic Species within the TSC Final Determination

Spotted and Wagstaffe Gum Forest EEC

The NSW Scientific Committee, in Section 2 of their final determination for Spotted and Wagstaffe Spotted Gum Forest EEC, has determined that this community is characterised by an assemblage of 65 plant

species, of these, 16 (24.6%) were recorded in Plot 1, 9 (13.8%) were found in Plot 2 and 7 (10.8%) were recorded in Plot 3. This is not considered to be enough species to floristically represent the community.

Swamp Oak Floodplain Forest EEC

The NSW Scientific Committee, in Section 2 of their final determination for Swamp Oak Floodplain Forest EEC, has determined that this community is characterised by an assemblage of 45 plant species, of these, 7 (15.5%) were recorded in the north-western corner of the site. This is not considered to be enough species to floristically represent the community.

Comparison Result – Ecological Features within the TSC Final Determination

Pittwater and Wagstaffe Spotted Gum Forest EEC

The Scientific Committee Determination for Pittwater and Wagstaffe Spotted Gum Forest (PWSGF) EEC has 14 sections of these sections 2, 4, 5, 8, are the most relevant in determining the likely presence of the community.

1. **Section 2.** Floristics- see *Correlation Results* above.
2. **Section 4.** Part of the site is mapped as Pittwater Spotted Gum Forest (S_WSF11), which is listed in section 4 of the determination as a component of PWSGF EEC.
3. **Section 5.** The site has a suitable soil type to support PWSGF EEC. The site is within the geographic distribution for PWSGF EEC (i.e. is within the former Pittwater LGA).
4. **Section 8.** Section 8, states that "*The structure of Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion was originally open-forest however, it now exists outside of reserves as woodland or remnant trees with few large stands remaining.".* Parts of the site contains a remnant tree canopy cover of PWSGF EEC tree species.

The site and the native vegetation in parts of the site fit the description of PWSGF EEC described in the sections of the Scientific Committee final determination.

Swamp Oak Floodplain Forest EEC

The Scientific Committee Determination for Swamp Oak Floodplain Forest (SOFF) EEC has 16 sections of these sections 1, 3, 4, 6 and 7, are the most relevant in determining the likely presence of the community.

1. **Section 1.** For floristics, see the *Correlation Result* section. The lower part of the site is suitable habitat for this community.
2. **Section 3.** The site is within the known distribution for SOFF ECC (i.e. it occurs in the former Pittwater LGA).
3. **Section 4.** The lower north-western corner of the site has a tree canopy dominated by *Casuarina glauca* (Swamp She-oak), with a disturbed understorey that has retained some characteristic groundcover species. Therefore this part of the site generally meets the structural description of SOFF EEC.
4. **Section 6.** The north-western corner of the site has a tree canopy dominated by *Casuarina glauca,* a low abundance of *Eucalyptus* species, some native forbs and graminoids and is on the fringes of an estuary of saline influence. Therefore the vegetation in this part if the site generally meets the distinguishing characteristics for this community.
5. **Section 7.** Section 7 states that "*Swamp Oak Floodplain Forest may adjoin or intergrade with several other endangered ecological communities, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales"* of the EECs that occur along coastal floodplains the native vegetation in the north-western corner most closely fits the description of SOFF EEC.

The site and the native vegetation in parts of the site fit the description of PWSGF EEC described in the sections of the Scientific Committee final determination.

Conclusion Regarding the Occurrence of TECs on the Site

Pittwater and Wagstaffe Spotted Gum Forest EEC

The vegetation on the southern and eastern parts of the site fits the description of Pittwater and Wagstaffe Spotted Gum Forest Endangered Ecological Community as it contains *"remnant trees"* with some remnant native understorey. The PWSGF EEC on the site is in a degraded form.

Swamp Oak Floodplain Forest EEC

The lower north-western corner of the site is considered to contain degraded Swamp Oak Floodplain Forest Endangered Ecological Community as the structure, habitat and remnant native species most closely fit this community.

3.6 Conclusion Regarding the Vegetation Community Types Present

When the methods were applied it was determined that the site contains 2 PCTs, Spotted Gum-Grey Ironbark Open Forest in the Pittwater and Wagstaffe Area, Sydney Basin Bioregion (PCT 1214) and Swamp Oak Swamp Forest Fringing Estuaries, Sydney Basin Bioregion and South East Corner Bioregion (PCT 1234). The other parts of the site that do not contain these PCTs contain bare soil/mulch, concrete, exotic lawn or exotic gardens.

3.7 Area of Each Vegetation Type

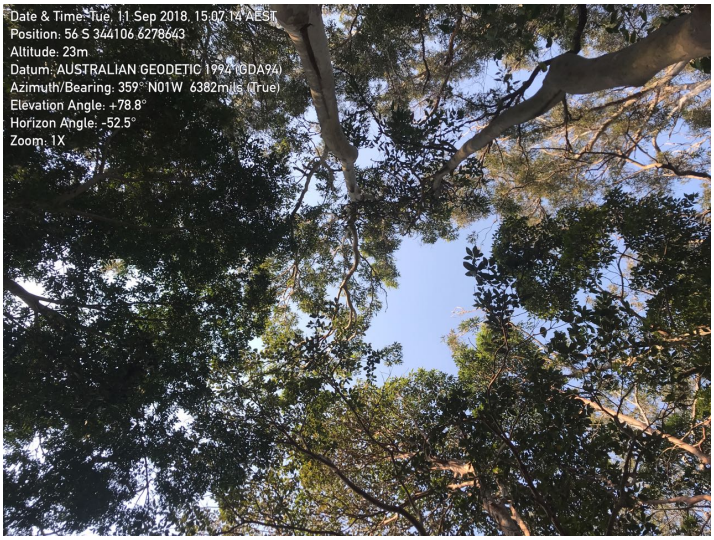
Table 5. The Area of Each Native Vegetation Type

Vegetation Community	PCT Number	Area (On Site)m^2	Percent Cleared
Spotted Gum-Grey Ironbark Open Forest	1214	628	76%
Swamp Oak Swamp Forest	1234	7521	80-95%

Photo Page 2. Spotted Gum Forest on the Development Site
Photos of Pittwater Spotted Gum Forest on the site

Pittwater Spotted Gum Forest, medium resilience.

The tall tree canopy viewed from the end of the jetty, looking south-west.



Pittwater Spotted Gum Forest canopy.

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Legend

- Development Site
- Proposed Sub Division
- Plots

Vegetation Zone

- Vegetation Zone 1, PWSGF Med Resilience
- Vegetation Zone 2, PWSGF Low Resilience

Vegetation Types (PCT)

- Native Tree Cover Over, Hard Surface or Lawn
- Pittwater Spotted Gum Forest EEC
- Swamp Oak Floodplain Forest EEC

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

by Nicholas Skelton

Date: 13/11/2018

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Biodiversity Development Assessment Report (BDAR)

96 - 104 CABARITA RD, AVALON

Figure 3.1
Vegetation Type, Zones and Plot Survey

3.8 Vegetation Integrity Assessment

This assessment type is the small area Streamlined Assessment Module, therefore only the dominant PCT requires assessment under the BAM. The dominant PCT for this site is Spotted Gum Grey Ironbark Open Forest, Sydney Basin Bioregion (PCT 1214) that is also Pittwater and Wagstaffe Spotted Gum Forest (PWSGF) EEC. From this part of the document onwards the dominant PCT at the site will be referred to as Pittwater and Wagstaffe Spotted GUM Forest EEC or PWSGF EEC. There are two disturbance types within the PWSGF EEC; Zone 1 has a native PWGF tree canopy and a partly disturbed understorey and midstorey with medium resilience, Zone 2 has a mostly native PWGFS tree canopy with a highly disturbed understorey and midstorey with low resilience.

Table 6. Vegetation Zones and Patch Size

Vegetation Zone	PCT	Area of Zone (m^2)	Patch Size (ha)
Zone 1- PWSGF medium resilience	1214	2152	<5ha
Zone 2-PWSGF low resilience	1214	2459	25-100ha

Table 7. Vegetation Survey Effort

Date	Person Hours	Weather	Type	Location
September 2001	3	-	Mapping extent of vegetation and disturbance	Across the whole development Site
November 2001	8	-	Identification of trees	Across the whole development Site
February 2002	4	-	Random Meander (Cropper (1993) across each vegetation type	Across the whole development Site
July 2002	2		Inspection of site	Across the whole development Site
7th June 2015	8		Tree survey	Across the whole development Site
8th January 2018	10		Tree survey	Across the whole development Site
10th January 2018	10		Tree survey	Across the whole development Site
11/9/2018	1	Windy, fine 16 - 19°C	Random Meander (Cropper (1993) across each vegetation type	Across the whole of the Development Footprint.
11/9/2017	2	Windy, fine 16 - 19°C	Plot 1 (Zone 1)	See Figure 5
11/9/2017	2	Windy, fine 16 - 19°C	Plot 2 (Zone 1)	See Figure 5
11/9/2017	2	Windy, fine 16 - 19°C	Plot 3 – in PCT 1234 (data not for calculator)	See Figure 5

3.8.1 Composition and Structure

A total of 41 plant species were recorded in Plot 1, of which 24 were local native species, 4 were planted and 13 were weeds. In Plot 2 a total of 37 species were recorded including 19 local native species, 3 planted and 15 weed species. A total of 36 plant species were recorded in Plot 3 including 19 local native species, 2 are planted and 15 are weeds. An additional 24 native species, 10 planted species, 4 weeds and 1 Threatened species (*Syzygium paniculatum*) were recorded outside the plot. (see plant species list in Table 4). The relatively high number of weeds species reflects a history of disturbance at the site. The low species richness in the plots overall reflects the recent disturbances of the understory and shrub layers. This is also reflected in the relatively high proportion of native trees to native groundcover species. The summary of the floristics and structure of the 20x20m plots are given in Table 3.

3.8.2 Function-Habitat Value

The results for tree width diversity, log length and ground cover for the 20m x 50m plot are recorded in the table below.

Table 8. Fauna Habitat Function Summary for Plots

Plot 1 (Zone 1) Function Results		
Tree Stem Size Class		**Log Length Total (m)**
Width Class (cm)		8.33
<5	absent	
5 to 9	present	**Number of large trees (80cm +)**
10 to 19	present	2
20 to 29	present	
30 to 49	present	**Av Leaf Litter % Cover ($1m^2$ plots)**
50 to 79	present	92.4
80+	present	

Plot 2 (Zone 1) Function Results		
Tree Stem Size Class		**Log Length Total (m)**
Width Class (cm)		9.48
<5	absent	
5 to 9	absent	**Number of large trees (80cm+)**
10 to 19	present	4
20 to 29	present	
30 to 49	present	**Av Leaf Litter % Cover ($1m^2$ plots)**
50 to 79	present	93
80+	present	

Plot 3 (Zone 2) Function Results		
Tree Stem Size Class		**Log Length Total (m)**
Width Class (cm)		8.8
<5	present	
5 to 9	absent	**Number of large trees (80cm+)**
10 to 19	present	0
20 to 29	present	
30 to 49	present	**Av Leaf Litter % Cover (1m² plots)**
50 to 79	present	56.6
80+	absent	

Table 9. Vegetation Integrity Score

Vegetation Zone	Composition Score	Structure Score	Function Score	Integrity Score
Zone 1	34.4	53.2	65.3	49.3
Zone 2	33.6	15.5	44.4	28.5

4 Threatened Species

4.1 Requirement for Ecosystem and Species Credit Species

Extract from Section 6.4.1.3 of the BAM (Aug 17)

The assessor must first use the following criteria to predict the threatened species that require assessment at the site:

(a) the distribution of the species includes the IBRA subregion which the subject land is, in the opinion of the assessor, mostly located within, and

(b) the subject land is within any geographic constraints of the distribution of the species within the IBRA subregion, and

(c) the species is associated with any of the PCTs identified by the assessor under Chapter 5 as occurring within the subject land, and

(d) the native vegetation cover within an assessment area 1500m wide surrounding the boundary of the subject site as determined by the assessor in accordance with Subsection 4.3.2 is equal to or greater than the minimum class that is required for the species (unless the development is, or is part of, a linear shaped development), and

(e) the patch size which the vegetation zone is part of, as identified in Subsection 5.3.2 is equal to or greater than the minimum specified for that species, and

(f) the species is identified as an ecosystem or species credit species in the Threatened Biodiversity Data Collection.

A threatened species is predicted as requiring assessment if that species meets all of the criteria a) – f) that are relevant to the species. A criterion is not relevant to a species if the species' profile in the Threatened Biodiversity Data Collection does not contain information for that criterion

If any past surveys undertaken on the subject land, regardless of whether or not the data is within BioNet, have recorded the presence of a threatened species, this species must be identified as being a species that requires assessment at the subject land.

4.2 Ecosystem Candidate Species Assessment & Justification

The list of ecosystem credit species derived (predicted) from the BAM calculator for this proposal are listed below in Table 9. Additional Threatened ecosystem credit species are to be added where they occur on the site, or have been recorded previously at the site or when listed criteria are met.

Ecosystem credit species are those where their likely occurrence can be predicted by habitat surrogates (such as PCT) and landscape features, or for which a targeted survey has a low probability of detection. A targeted survey is not required for ecosystem species.

The listed Threatened species are assessed in accordance with section 6.4 (Steps 1 and 2) of the BAM, to identify any species that should be excluded from the BAM calculation and subsequent ecosystem (PCT, vegetation type) credit generation. The reasons for any exclusions or additions are given in the final column of Table 9.

4.3 Species Candidate Assessment & Justification

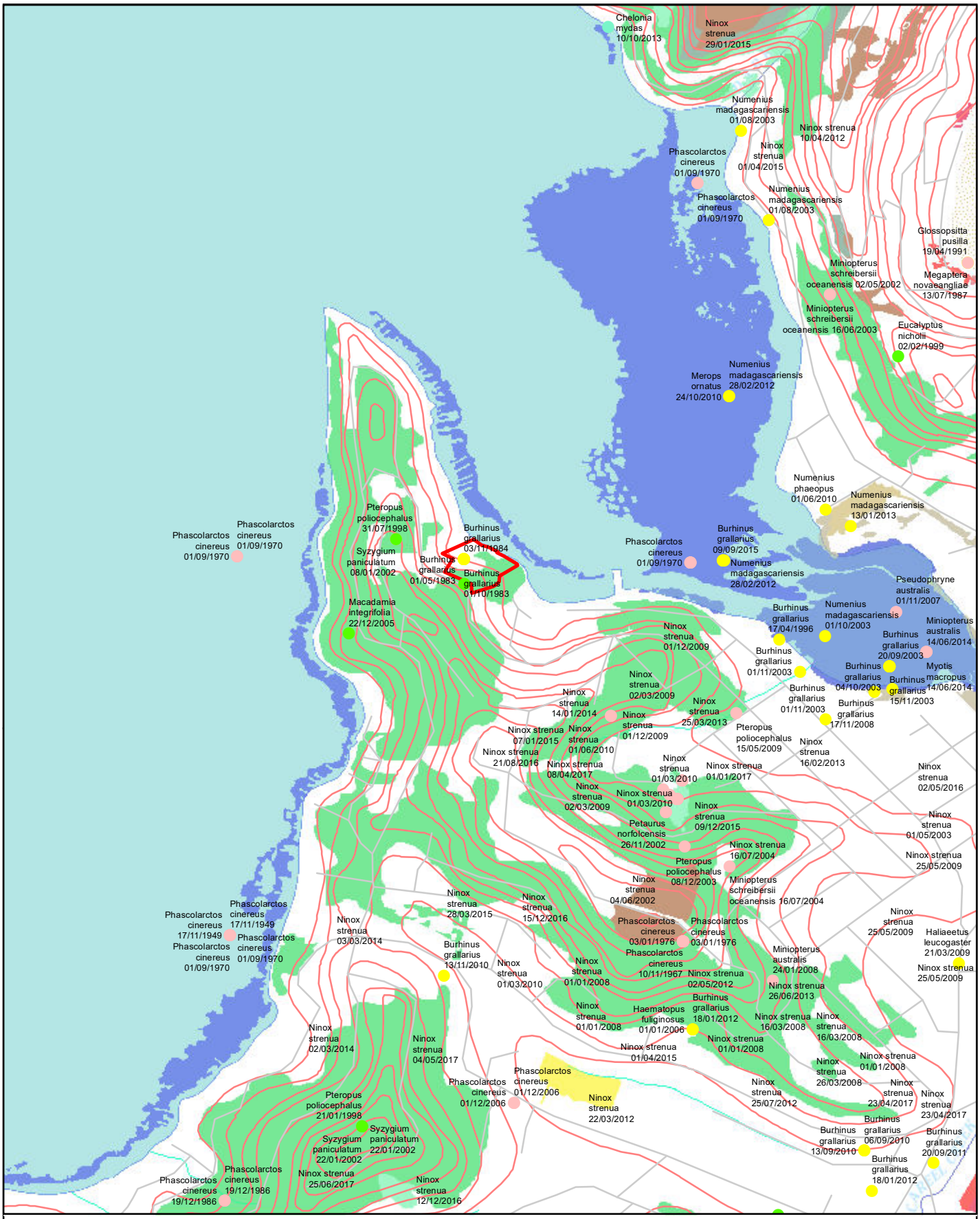
The predicted (potential) candidate Threatened flora and fauna credit species derived from the BAM calculator for this proposal, are listed below in Tables 10 and 11 respectively. Additional Threatened species are to be added where they are likely to occur on the site or when the site contains suitable habitat.

The habitat suitability and geographic constraints for potential candidate flora and fauna species credit species are assessed in the Tables 10 and 11 below. The criteria for identifying the Threatened species that should be added or excluded from further assessment are described in Sections 6.4 of the BAM. The reasons for any exclusions or additions are given in the final column.

The BAM calculator takes into consideration the location of the site and the vegetation community, to create the predicted candidate Threatened Species Credit Species list which is the basis of the table below.

Section 6.4 of the BAM method (OEH 2017) requires 4 steps to be taken to confirm which of these species are Candidate species credit species to target for further assessment. The table below summarises the habitat preferences and requirements for each species, based on information from the Threatened Species Database Collection and other scientific references. The table applies the 4 steps by assessing the suitability of the habitat on the Site based on the findings of the field survey, then provides a justification for including or excluding each species as a Candidate species credit species.

Figure 4.1 shows the location, distribution and abundance of historical records for each predicted Threatened candidate species.



Legend

Threatened Species Records

- Plant
- Bird
- Frog
- Mammal
- Reptile
- Sensitive Species (Not Shown)
- Cabarita Rd, Development Site
- Contours 10m

Vegetation Communities in Locality

- S_DSF04: Coastal Enriched Sandstone Dry Forest
- S_FoW01: Coastal Alluvial Bangalay Forest
- S_FoW02: Coastal Flats Swamp Mahogany Forest
- S_FoW08: Estuarine Swamp Oak Forest
- S_HL01: Coastal Headland Clay Heath
- S_HL02: Coastal Sand Tea-tree-Banksia Scrub
- S_HL05: Coastal Foredune Wattle Scrub
- S_RF07: Coastal Escarpment Littoral Rainforest
- S_SW01: Estuarine Mangrove Forest
- S_SW03: Seagrass Meadows
- S_WSF02: Coastal Enriched Sandstone Moist Forest
- S_WSF11: Pittwater Spotted Gum Forest

Figure 4.1
Threatened Species Records

Threatened species records from NSW Office of Environment and Heritage BioNet Atlas which holds data from a number of custodians.

96-104 Cabarita Rd, Avalon Beach

Date: 11/12/2018

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GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

Photo Page 3. Important Species and Habitat

Protected species, *Macrozamia communis,* that occurs on site.

Threatened Species, *Syzygium paniculatum*, that occurs on site.

Frog spawn found in flooded small shallow concrete pond on site.

Dead tree (stag) containing hollows on the site.

Table 10. Ecosystem Species Assessment

96-104 Cabarita Rd, Avalon Beach

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 Zone	Exclude as Ecosystem Credit Species	Justification for Exclusion
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	Zone 1	No change	
Eastern Freetail-bat	*Mormopterus norfolkensis*	Zone 1	No change	
Eastern Osprey	*Pandion cristatus*	Zone 1	No change	
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Zone 1	No change	
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Zone 1	No change	
Grey-headed Flying-fox	*Pteropus poliocephalus*	Zone 1	No change	
Koala	*Phascolarctos cinereus*	Zone 1	No change	
Little Bentwing-bat	*Miniopterus australis*	Zone 1	No change	
Little Eagle	*Hieraaetus morphnoides*	Zone 1	No change	
Little Lorikeet	*Glossopsitta pusilla*	Zone 1	No change	
Masked Owl	*Tyto novaehollandiae*	Zone 1	No change	
Powerful Owl	*Ninox strenua*	Zone 1	No change	
Regent Honeyeater	*Anthochaera phrygia*	Zone 1	No change	
Rosenberg's Goanna	*Varanus rosenbergi*	Zone 1	No change	
Scarlet Robin	*Petroica boodang*	Zone 1	No change	
Spotted-tailed Quoll	*Dasyurus maculatus*	Zone 1	No change	
Swift Parrot	*Lathamus discolor*	Zone 1	No change	
Varied Sittella	*Daphoenositta chrysoptera*	Zone 1	No change	
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Zone 1	No change	

Table 11. Candidate Species Assessment Flora

96-104 Cabarita Rd, Avalon Beach

		Pittwater Sub Region	Habitat Suitability from TBDC, literature or calculator tick boxes			Historic Records, Local Populations			
		Determining Factor -ve	May be a Determining Factor		May be a -ve Determining Factor			Determining Factor +ve	
Derived (Predicted) Potential Candidate Species	**Habitat Requirements and Preferences (constraints) from species profile and literature**	**Geographic Restrictions (from TBDC)**	**Habitat Reqirements (constraints) within Development Site**	**Habitat Preferences within Development Site**	**Disturbance, Habitat Degredation existing within Development Site**	**Historic Occurance within 5km**	**Historic Occurance in locality (date, location and vegetation type shown in Figure ?)**	**Historic Occurance on or imediately adjacent to Development Site**	**Candidate Species Conclusion & Justification**
Diuris bracteata A Donkey Orchid *Endangered*	**Habitat Requirements:** Dry schlerophyll woodland. **Habitat Preferences:** Dry sclerophyll woodland and forest with a predominantly grassy understorey. All known extant plants occur in the Gosford and Wyong LGAs. **Disturbance Factors:** None documented.	None	Outside known range.	Not a grassy understorey.	None documented	No nearby records	N/A	N/A	**Not a Candidate Species:** The site is not within the geographic restriction and the species is unlikely to occur. No further assessment is required for this species.
Genoplesium baueri Brittle Midge Orchid *Endangered*	**Habitat Requirements:** Shallow soils on sandstone. **Habitat Preferences:** Grows usually in sparse sclerophyll forest and moss gardens over sandstone. Likely to occur in Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. **Disturbance Factors:** None documented.	None	Habitat requirements do not occur on Development Site.	Suitable habitat.	N/A	No nearby records	N/A	N/A	**Not a Candidate Species:** The site is not within the geographic restriction and the species is unlikely to occur. No further assessment is required for this species.
Hygrocybe aurantipes Fungal Colony *Vulnerable*	**Habitat Requirements:** Only know to occur in Lane Cove Bushland Park. **Habitat Preferences:** Occurs in gallery warm temperate forests. Grows on soil, hummus, moss or rarely on rotten wood. Known from Lane Cove National Park and Blue Mountains National Park (Mt Wilson) and Hazelbrook. **Disturbance Factors:** None documented.	Site not within Lane Cove Bushland Park.	N/A	N/A	N/A	N/A	N/A	N/A	**Not a Candidate Species:** The site is not within the geographic restriction and the species is unlikely to occur. No further assessment is required for this species.
Syzygium paniculatum Magenta Lilli Pilly *Endangered*	**Habitat Requirements:** Grows on gravels, sands, silts and clays in riverside gallery rainforests, as well as remnant littoral and subtropical rainforest communities. **Habitat Preferences:** Found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. **Disturbance Factors:** None documented.	None	Suitable habitat occurs in vegetated part of Development Site.	Suitable habitat.	None documented	2 records	2 records within 200m west (2002) and south (2015) of site. Recorded on Pittwater Wagstaffe Spotted Gum Forest.	4 plants occur on site.	**Yes a Candidate species credit species:** This species is known to occur in general location, and suitable habitat occurs on the site, and the site is not too disturbed. A targeted field survey is required or this species can be assumed to occur

96-104 Cabarita Rd, Avalon Beach

		Pittwater Sub Region	Habitat Suitability from TBDC, literature or calculator tick boxes			Historic Records, Local Populations			
		Determining Factor -ve	May be a Determining Factor		May be a -ve Determining Factor			Determining Factor +ve	
Derived (Predicted) Potential Candidate Species	**Habitat Requirements and Preferences (constraints) from species profile and literature**	**Geographic Restrictions (from TBDC)**	**Habitat Reqirements (constraints) within Development Site**	**Habitat Preferences within Development Site**	**Disturbance, Habitat Degredation existing within Development Site**	**Historic Occurance within 5km**	**Historic Occurance in locality (date, location and vegetation type shown in Figure ?)**	**Historic Occurance on or imediately adjacent to Development Site**	**Candidate Species Conclusion & Justification**
Tetratheca glandulosa Glandular Pink Bell *Vulnerable*	**Habitat Requirements:** Restricted to the following Local Government Areas: Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong. **Habitat Preferences:** Found in Sydney Sandstone Ridge top Woodland in sandy or rocky heath scrub. Often associated with a sandstone/shale interface where soils have a stronger clay influence. Seasonal and cryptic. **Disturbance Factors:** None documented.	None	Developments Site is within Pittwater LGA.	Habitat is not suitable due to thg long time since fire.	Understorey is no longer suitable habitat, too disturbed and too shady and wet.	No nearby records	N/A	N/A	**Not a Candidate species credit species:** No suitable habitat occurs in the development site due to high level of disturbance. No further assessment is required for this species.

4.4 Candidate Species Credit Species & Justification: Fauna

4.4.1 Existing Fauna Habitat at Development Site

There are approximately 226 (dead or alive) native trees at the site (see tree Schedule in Appendix A) including spotted gums (*Corymbia maculata*), grey ironbark (*Eucalyptus paniculata),* swamp she-oak (*Casuarina glauca*), sweet pittosporum (*Pittosporum unulatum*) and four Threatened *Syzygium paniculatum* plants that provide habitat to a wide range of native fauna species including foraging, nesting and roosting habitat for birds and possums. The *Casuarina* and *Allocasuarina* are suitable foraging habitat for the Threatened Glossy Black-cockatoo. Some of the large spotted gums contain hollows (see section 4.2.2 below). Microbats may forage over the trees tops.

There is a very large (140cm diameter) *Ficus hillii* that provides good foraging and roosting habitat for the Threatened Grey-headed Flying-fox.

There are sandstone retaining walls throughout the site that provide habitat for small reptiles.

The tidal beach north of the site provides foraging habitat for estuarine birds.

The Site and the locality are shown in Maps 1, 2, 3 and 4.

4.4.2 Habitat Trees

Nine (9) habitat trees with hollows were recorded in the site during the field survey. See Figure 5.1.

The tree hollows were found in trees 3c, 12, 15, 16, 31, 38, 100, 101, 114 and 140b. All hollows were located in dead or alive Spotted Gums. Trees 12 and 140b are within dead trees but will require retention as they have a high habitat value. If those trees or any other hollows that are not proposed to be removed are removed then the impact to Threatened fauna in this report will need to be assessed.

Of these trees, 3c is proposed to be removed by the development. Trees 31 and 101 has more than 10% of their Tree Protection Zone (TPZ) impacted by the development and may need to be removed in the future. Tree 3c, 31 and 101 are suitable for medium sized birds such as parrots and possible microbats. A pair of Rainbow Lorikeets were observed nesting in the hollow in tree 3c during a site visit.

The majority of the other hollows at the site have similar dimensions to 3c. The hollow in tree 140b is a large chimney hollow that is suitable for the Masked Owl and cockatoos.

Tree hollows are often missed during ground based inspections and the true number of hollows may be much larger. There was no evidence of gliders using the tree trunks for sap. Two Grey Gums (*Eucalyptus punctata*) had deep scratches on the trunk. *Eucalyptus punctata* are a favoured food tree of the Koala, however Koalas have not been recorded recently (last 30 years) in the locality. A Brushtail Possum was observed climbing the tree during the field survey.

Table 12. Candidate Species Assessment Fauna

96-104 Cabarita Rd, Avalon Beach

		Pittwater Sub Region	Habitat Suitability from TBDC, literature or calculator tick boxes			Historic Records, Local population			
		Determining Factor -ve	May be a Determining Factor		May be a -ve Determining Factor			Determining Factor +ve	
Derived (Predicted) Potential Candidate Species	**Habitat Requirements and Preferences (constraints) from species profile and literature**	**Geographic Restrictions (from TBDC)**	**Habitat Reqirements (constraints) within Development Site**	**Habitat Preferences within Development Site**	**Disturbance, Habitat Degredation existing within Development Site**	**Historic Occurance within 5km**	**Historic Occurance in locality (date, location and vegetation type shown in Figure ?)**	**Historic Occurance on or imediately adjacent to Development Site**	**Candidate Species Conclusion & Justification**
Anthochaera Phrygia Regent Honey Eater **(Breeding only)** *Critically Endangered*	**Habitat Requirements:** Main breeding sites in NSW are in Capertee Valley and Bundarra-Barraba Regions. **Habitat Preferences:** Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Mainly feeds on the nectar from a wide range of eucalypts and mistletoes. When nectar is scarce lerp, honeydew and insects comprise a large proportion of the diet. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests. **Disturbance Factors:** None documented. **Breeding:** Main breeding sites in NSW are in Capertee Valley and Bundarra-Barraba Regions. A shrubby understorey is an important source of insects and nesting material.	None	The site does not fall within the two known breeding areas.	N/A	N/A	N/A	N/A	N/A	**Not a Candidate species credit species:** This species requirements (constraints) do not occur on this site and the species is unlikely to occur. No further assessment is required for this species.
Burhinus grallarius Bush Stone-curlew *Endangered*	**Habitat Requirements:** Fallen/standing dead timber including logs. **Habitat Preferences:** Occurs in open forests and woodlands with a sparse grassy groundlayer and fallen timber. Feed on insects and small vertebrates, such as frogs, lizards and snakes. **Disturbance Factors:** Fallen/standing dead timber including logs. **Breeding**: Nests on the ground in a scrape or small bare patch.	None	Sparse fallen/standing dead timber including logs.	Open forests and woodlands with a sparse grassy groundlayer and fallen timber occur on Site.	Fallen logs and timber have previously been removed from the site.	45 records	7 records within 700m east of the site. The records occur between 1996 and 2018. See figure 5.	1 record on site (30/5/1981).	**Yes a Candidate species credit species:** This species has historically been found in or near this site, a targeted field survey is required or this species can be assumed to occur. Further assessment is required for this species.
Callocephalon fimbriatum Gang-Gang Cockatoo **(Breeding only)** *Vunerable*	**Habitat Requirements:** The only known breeding areas in the Sydney region are within the Hornsby and Kur-ring-gai LGAs which is also an endangered population. **Habitat Preferences:** Occurs in tall mountain forests and woodlands during spring and summer. In autumn and winter it moves to lower altitudes in drier more open eucalypt forests or in coastal areas. Often found in urban areas. **Disturbance Factors**: None documented. **Breeding:** Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	None	The site does not occur within known breeding areas in the Sydney region.	N/A	N/A	N/A	N/A	N/A	**Not a Candidate species credit species:** This species requirements (constraints) do not occur on this site and the species is unlikely to occur. No further assessment is required for this species.
Calyptorhynchus lathami Glossy Black-Cockatoo **(Breeding only)** Vunerable	**Habitat Requirements:** Dependent on large hollow-bearing eucalypts for nest sites. **Habitat Preferences:** Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. **Disturbance Factors:** None documented. **Breeding:** Nests in large hollow-bearing eucalypts.	None	Large Hollows in eucalypts do occur within Development Footprint.	Several *Allocasuarina torulosa* trees were recorded on Site.	None documented	41 records	N/A	N/A	**Yes a Candidate species credit species**: This species has historically been found in or near this site, a targeted field survey is required or this species can be assumed to occur. Further assessment is required for this species.

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Derived (Predicted) Potential Candidate Species	Habitat Requirements and Preferences (constraints) from species profile and literature	Pittwater Sub Region: Geographic Restrictions (from TBDC) — Determining Factor -ve	Habitat Suitability (from TBDC, literature or calculator tick boxes): Habitat Reqirements (constraints) within Development Site — May be a Determining Factor	Habitat Suitability: Habitat Preferences within Development Site	Habitat Suitability: Disturbance, Habitat Degredation existing within Development Site — May be a -ve Determining Factor	Historic Records, Local population: Historic Occurance within 5km	Historic Occurance in locality (date, location and vegetation type shown in Figure ?)	Historic Occurance on or imediately adjacent to Development Site — Determining Factor +ve	Candidate Species Conclusion & Justification
Cercartetus nanus Eastern Pygmy-possum	**Habitat Requirements:** None documented. **Habitat Preferences:** Found in dense rainforests, wet and dry sclerophyll forests, woodlands, mallee scrub and coastal heathlands, but in most areas woodlands and heath appear to be preferred. dense midstorey canopy needs to be present. Large foraging range and feeds largely on nectar and pollen collected from Banksias, Eucalypts and Bottlebrushes. **Disturbance Factors:** Managment on APZ likley to remove habitat. **Breeding:** Tree hollows are favoured for nesting but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Most births occur between late spring and early autumn.	None	N/A	Few Eucalypts Bottlebrushes and Banksias currently present.	highly degraded, not sufficent midstorey canopy to support population.	16 records (mostly occur in the Ku-ring-gai Chase National Park but across Pittwater).	N/A	N/A	**Not a Candidate species credit species:** No suitable habitat occurs in the development site due to high level of disturbance. No further assessment is required for this species.
Chalinolobus dwyeri Large-eared Pied Bat *Vunerable*	**Habitat Requirements:** Cliffs, within 2km of rocky areas containing caves, overhangs, escarpments, outcrops, crevices and old mines or tunnels. **Habitat Preferences:** It is generally rare with a very patchy distribution in NSW. Found in well-timbered areas containing gullies. Probably forages for small, flying insects below the forest canopy. **Disturbance Factors:** None documented. **Breeding:** Roosts in caves, crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Hirundo ariel).	None	Cliffs. Within 2km of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices or within 2km of old mines or tunnels.	A large forest canopy occurs on site which would be suitable for foraging.	None documented	No records found within 5km	N/A	N/A	**Yes a Candidate species credit species:** This species is known to occur in general location, and suitable habitat occurs on the site, and the site is not too disturbed. A targeted field survey is required or this species can be assumed to occur.
Hieraaetus morphnoides Little Eagle **(Breeding only)** *Vunerable*	**Habitat Requirements:** Nests in Tall trees. **Habitat Preferences:** Nests in open eucalypt forest, woodland or open woodland. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion. **Disturbance Factors:** None documented. **Breeding:** Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer.	None	Suitable tall nesting trees occur on Site.	Suitable prey occurs on site.	None documented	3 records	N/A	N/A	**Yes a Candidate species credit species:** This species has historically been found in or near this site, a targeted field survey is required or this species can be assumed to occur. Further assessment is required for this species.
Lathamus discolor Swift Parrot **(Breeding only)** *Vunerable*	**Habitat Requirements:** Breeds in Tasmania. **Habitat Preferences:** 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 E. albens. **Disturbance Factors:** Feed trees. **Breeding:** Breeds in Tasmania during spring and summer.	None	The site does not fall within the two known breeding areas.	N/A	N/A	N/A	N/A	N/A	**Not a Candidate species credit species:** This species requirements (constraints) do not occur on this site and the species is unlikely to occur. No further assessment is required for this species.

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Derived (Predicted) Potential Candidate Species	Habitat Requirements and Preferences (constraints) from species profile and literature	Pittwater Sub Region	Habitat Suitability from TBDC, literature or calculator tick boxes			Historic Records, Local population			Candidate Species Conclusion & Justification
		Determining Factor -ve	May be a Determining Factor		May be a -ve Determining Factor			Determining Factor +ve	
		Geographic Restrictions (from TBDC)	Habitat Reqirements (constraints) within Development Site	Habitat Preferences within Development Site	Disturbance, Habitat Degredation existing within Development Site	Historic Occurance within 5km	Historic Occurance in locality (date, location and vegetation type shown in Figure ?)	Historic Occurance on or imediately adjacent to Development Site	
Litoria brevipalmata Green-thighed Frog *Vulnerable*	**Habitat Requirements:** Temporary or permanent water bodies. **Habitat Preferences:** Occurs in rainforest, moist eucalypt forest, dry eucalypt forest and heath where water gathers after rain. The frogs are thought to forage in leaf-litter. **Disturbance Factors:** Leaf litter and water quality. **Breeding:** Occurs following heavy rainfall from spring to autumn, with larger temporary pools and flooded areas preferred.	None	No temporary or permanent water bodies on site.	N/A	N/A	N/A	N/A	N/A	**Not a Candidate Species.** No suitable habitat in the development site due to high level of disturbance to the groundcover and leaf litter and lack of nearby records. No further assessment is required for this species.
Miniopterus australis Little Bentwing-bat **(Breeding only)** *Vunerable*	**Habitat Requirements:** Caves. **Habitat Preferences:** Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. **Disturbance Factors:** None documented. **Breeding:** Breeds in caves in large maternity colonies, often along side eastern bent wing bats.	None	No Caves occur on site.	N/A	N/A	N/A	N/A	N/A	**Not a Candidate species credit species:** This species requirements (constraints) do not occur on this site and the species is unlikely to occur. No further assessment is required for this species.
Miniopterus schreibersii oceanensis Eastern Bentwing-bat **(Breeding only)** *Vunerable*	**Habitat Requirements:** Caves. **Habitat Preferences:** Hunt in forested areas, catching moths and other flying insects above the tree tops. **Disturbance Factors:** None documented. **Breeding:** Caves are the primary maternity roosts but derelict mines, storm-water tunnels, buildings and other man-made structures will be used.	None	No caves or other breeding habitat occurs on site.	N/A	N/A	N/A	N/A	N/A	**Not a Candidate Species.** Species constraints do not occur on this site and the species is unlikely to occur. No further assessment is required for this species.
Myotis macropus Southern Myotis *Vunerable*	**Habitat Requirements:** Within 200m of suitable waterbody that is atleast 3m wide and can be a river, creek, billabong, lagoon, dam, estuary or coastal lake. It does not include ocean, beach or marine harbour. Hollow bearing trees, caves, bridges or artificial structures within 200m of suitable water body. **Habitat Preferences:** Forage over streams and pools, catching insects and small fish on the water surface. **Disturbance Factors:** None documented. **Breeding:** Generally roost in groups of 10-15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.	None	The site is within 200m of Pittwater estuary.	Suitable tree hollows for rossting occur on the site and within 200m of a suitable water body.	N/A	4 records	1 record from 2014 was recorded 1km west in Careel Creek.	N/A	**Yes a Candidate species credit species:** This species is known to occur in general location, and suitable habitat occurs on the site, and the site is not too disturbed. A targeted field survey is required or this species can be assumed to occur.

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		Pittwater Sub Region	Habitat Suitability from TBDC, literature or calculator tick boxes			Historic Records, Local population			
		Determining Factor -ve	May be a Determining Factor		May be a -ve Determining Factor			Determining Factor +ve	
Derived (Predicted) Potential Candidate Species	**Habitat Requirements and Preferences (constraints) from species profile and literature**	**Geographic Restrictions (from TBDC)**	**Habitat Reqirements (constraints) within Development Site**	**Habitat Preferences within Development Site**	**Disturbance, Habitat Degredation existing within Development Site**	**Historic Occurance within 5km**	**Historic Occurance in locality (date, location and vegetation type shown in Figure ?)**	**Historic Occurance on or imediately adjacent to Development Site**	**Candidate Species Conclusion & Justification**
Ninox connivens Barking Owl **(Breeding only)** *Vunerable*	**Habitat Requirements:** Tree hollows along creeklines. **Habitat Preferences:** Inhabits eucalypt woodland, open forest, swamp woodlands along watercourses. Feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals during breeding. Roosts along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or the dense clumps of canopy leaves in large Eucalypts. **Disturbance Factors:** None documented. **Breeding:** Two or three eggs are laid in hollows of large, old trees. Living eucalypts are preferred though dead trees are also used.	None	No large hollows within along creekline.	N/A	N/A	N/A	N/A	N/A	**Not a Candidate species credit species:** This species requirements (constraints) do not occur on this site and the species is unlikely to occur. No further assessment is required for this species.
Ninox strenua Powerful Owl **(Breeding only)** *Vunerable*	**Habitat Requirements:** Tree hollows within 100m of a creekline. **Habitat Preferences:** Inhabits large tracts (but can occur in fragmented landscapes) of forest in a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. **Disturbance Factors:** Most prey species require hollows and a shrub layer. **Breeding:** Nests in large tree hollows along creeks.	None	No large hollows within 100m of creekline.	N/A	N/A	N/A	N/A	N/A	**Not a Candidate species credit species:** This species requirements (constraints) do not occur on this site and the species is unlikely to occur. No further assessment is required
Pandion cristatus Eastern Osprey **(Breeding only)** *Vunerable*	**Habitat Requirements:** Tall dead or live trees. **Habitat Preferences:** Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. **Disturbance Factors:** None documented. **Breeding:** Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	None	Suitable living and dead trees for breeding.	Site occurs adjacent to Pittwater and is close to the ocean.	None documented	3 records	N/A	N/A	**Yes a Candidate species credit species:** This species is known to occur in general location, and suitable habitat occurs on the site, and the site is not too disturbed. Further assessment is required for this species.
Petaurus norfolcensis Squirrel Glider Vunerable	**Habitat Requirements:** Tree hollows. **Habitat Preferences:** Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein. **Disturbance Factors:** Midstorey abundance. **Breeding:** Require abundant tree hollows for refuge and nest sites.	None	Several hollows and suitable foraging habitat are avilable.	Acacia and Euclaypt species are a suitable food source on site.	Disturbed mid and understorey.	3 records	1 record from 2002 was recorded within 1 km south-east of the site on Pittwater Wagstaffe Spotted Gum Forest.	N/A	**Yes a Candidate species credit species:** This species is known to occur in general location, and suitable habitat occurs on the site, and the site is not too disturbed. Further assessment is required for this species.
Phascolarctos cinereus Koala **(Breeding only)** *Vunerable*	**Habitat Requirements:** There needs to be a breeding colony. **Habitat Preferences:** Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Females breed at two years of age and produce one young per year. **Disturbance Factors:** None documented. **Breeding:** Breeding relys on good quality suitable habitat.	None	No breeding colony.	N/A	N/A	N/A	N/A	N/A	**Not a Candidate species credit species:** This species requirements (constraints) do not occur on this site and the species is unlikely to occur. No further assessment is required for this species.

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Derived (Predicted) Potential Candidate Species	Habitat Requirements and Preferences (constraints) from species profile and literature	Pittwater Sub Region	Habitat Suitability from TBDC, literature or calculator tick boxes			Historic Records, Local population			Candidate Species Conclusion & Justification
		Determining Factor -ve	May be a Determining Factor		May be a -ve Determining Factor			Determining Factor +ve	
		Geographic Restrictions (from TBDC)	**Habitat Reqirements (constraints) within Development Site**	**Habitat Preferences within Development Site**	**Disturbance, Habitat Degredation existing within Development Site**	**Historic Occurance within 5km**	**Historic Occurance in locality (date, location and vegetation type shown in Figure ?)**	**Historic Occurance on or imediately adjacent to Development Site**	
Pseudophryne australis Red-crowned Toadlet *Vulnerable*	**Habitat Requirements:** Periodically wet drainage line. **Habitat Preferences:** Occurs in open forests. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. **Disturbance Factors:** Water quality. **Breeding:** Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Eggs are laid in moist leaf litter, from where they are washed by heavy rain.	None	No permanent drainage line.	N/A	No suitable habitat due to high level of disturbance at the site and lack of permanent drainage lines.	N/A	N/A	N/A	**Not a Candidate species credit species:** No suitable habitat in the development site due to high level of disturbance to the groundcover and leaf litter and lack of nearby records. No further assessment is required for this species.
Pteropus poliocephalus Grey-headed Flying-fox **(Breeding only)** *Vunerable*	**Habitat Requirements:** Breeds close to fresh water body. **Habitat Preferences:** Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. **Disturbance Factors:** None documented. **Breeding: Site fidelity to camps is high.** Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.	None	No fresh water body close to site.	N/A	N/A	N/A	N/A	N/A	**Not a Candidate species credit species:** This species requirements (constraints) do not occur on this site and the species is unlikely to occur. No further assessment is required for this species.
Turnix maculous Red-backed Button-quail *Vunerable*	**Habitat Requirements:** Grassland, heath or crop habitat. **Habitat Preferences:** In NSW, said to occur in grasslands, heath and crops. Prefers sites near water, including grasslands and sedgelands near creeks, swamps and springs, and wetlands. **Disturbance Factors:** None documented. **Breeding:** breed in dense grass near water, and nests are made in a shallow depression sparsely lined with grass and ground litter.	None	Suitable habitat does not occur on site.	N/A	N/A	N/A	N/A	N/A	**Not a Candidate species credit species:** This species requirements (constraints) do not occur on this site and the species is unlikely to occur. No further assessment is required for this species.
Tyto novaehollandiae Masked Owl **(Breeding only)** *Vulnerable*	**Habitat Requirements:** Tree hollows greater than 40cm wide and 100cm deep and more than 3m above the ground, in Eucalypt trees atleast 90cm (DEC 2006) or caves. **Habitat Preference:** Lives in dry eucalypt forests and woodlands from sea level to 1100 m. Hunts tree-dwelling and ground mammals, especially rats along the edges of forests, including roadsides. **Disturbance Factors:** None documented. **Breeding:** Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	None	Suitable tree hollows occur on site.	Moist eucalypt forest occur on site.	None documented	2 records	N/A	N/A	**Yes a Candidate species credit species:** This species is known to occur in general location, and suitable habitat occurs on the site, and the site is not too disturbed. Further assessment is required for this species.

4.5 Field Survey Effort

4.5.1 Threatened Flora Field Survey Effort

Date	Person Hours	Weather	Type	Location	Targeted species
September 2001	3	-	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.
November 2001	8	-	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.
February 2002	4	-	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.
July 2002	2	-	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.
May 2015	4	-	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.
June 2015	8	-	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.
January 2018	5	-	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.
January 2018	5	-	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.
March 2018	4	-	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.
May 2018	4	-	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.
September 2018	1	Windy, fine 16 - 19°C	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.
October 2018		Fine 13-19°C	Threatened flora and habitat searches	Across the whole development Site	All threatened flora that has suitable habitat.

4.5.2 Threatened Fauna Field Survey Effort

Date	Time of day	Person Hours	Weather	Type	Location	Targeted Species
September 2001	Day	3	-	Threatened fauna habitat searches	Across the whole development Site	All threatened fauna ıat has suitable habitat.
November 2001	Day	8	-	Threatened fauna habitat searches	Across the whole development Site	All threatened fauna ıat has suitable habitat.
January 2002	2:30-5pm	2.5	Fine 20-25°C	Diurnal survey and habitat search	Across the whole development Site	All Threatened fauna ıat has suitable habitat.

January 2002	2-2:30pm	1	Fine 20-25°C	Hollow inspection	See Figure 4.2 for hollows.	Hollow using fauna (Gliders, Glossy Black-ckatoo, Southern Myotis)
January 2002	8-8:30pm	0.5	Drizzle 15-20°C	Stag watching	Hollows. See figure 4.2	Squirrel Glider, Masked Owl, Southern Myotis
January 2002	8:30-10pm	0.5	Drizzle 15-20°C	Spotlighting	Across the whole development Site	Nocturnal Threatened fauna Bush Stone Curlew, Glider, Owls
February 2002	7:30-9am	3	Fine 20-25°C	Diurnal survey and habitat search	Across the whole development Site	All Threatened fauna ıat has suitable habitat.
February 2002	9-9:30am	0.5	Fine 20-25°C	Hollow Inspection	See Figure 4.2 for hollows.	Hollow using fauna (Gliders, Glossy Black-ckatoo, Southern Myotis)
February 2002	3-5:30pm	2.5	Fine 25-30°C	Diurnal survey and habitat search	Across the whole development Site	All Threatened fauna ıat has suitable habitat.
February 2002	5:30-6pm	0.5	Fine 25-30°C	Hollow Inspection	See Figure 4.2 for hollows.	Hollow using fauna (Gliders, Glossy Black-ckatoo, Southern Myotis)
February 2002	10-10:30pm	0.5	Breeze 20-25°C	Stag watching	Hollows. See figure 4.2	Squirrel Glider, Masked Owl, Southern Myotis
February 2002	10:30pm -12am	1.5	Breeze 20-25°C	Spotlighting	Across the whole development Site	Nocturnal Threatened fauna Bush Stone Curlew, Glider, Owls
June 2015	Day	8	-	Diurnal survey and habitat search	Across the whole development Site	All Threatened fauna ıat has suitable habitat.
January 2018	Morning-afternoon	5	-	Diurnal survey and habitat search	Across the whole development Site	All Threatened fauna ıat has suitable habitat.
January 2018	Morning-afternoon	5	-	Diurnal survey and habitat search	Across the whole development Site	All Threatened fauna ıat has suitable habitat.
March 2018	Morning-afternoon	4	-	Diurnal survey and habitat search	Across the whole development Site	All Threatened fauna ıat has suitable habitat.
May 2018	Morning-afternoon	4	-	Diurnal survey and habitat search	Across the whole development Site	All Threatened fauna ıat has suitable habitat.
September 2018	Afternoon	4	Windy, fine 16 - 19°C	Threatened Diurnal survey and habitat search	Across the whole development Site	All threatened flora that has suitable habitat.
October 2018	24hours	7 days	Fine 13-19°C	8 Motion Detecting Camera	See Figure 4.2	Squirrel Glider and Bush Stone Curlew

4.6 Candidate Species Presence

Step 5 of Section 6.4 determines if each species is present (or assumed present) on the site. A map of the location or a count of the number of individuals is also given.

Table 13. Candidate Species Presence

96-104 Cabarita Rd, Avalon Beach

Step 5, 6.4.1.26-34 and Step 6. 6.4.1.35-37

Derived (Predicted) Potential Candidate Species	Biodiversity Risk Weighting	Time of Year Surveyed and Suitability	Presence On Site or Assumed Presence or Expert Report	Vegetation Zone	Habitat Component that is Present	Area of Habitat or Count Impacted including patrs of buffers of features outside impact area
Burhinus grallarius Bush Stone-curlew *Endangered*	2.00	October (Suitable)	Not found, no further assesment or offsetting required.	Zone 1	Fallen and standing logs.	N/A
Calyptorhynchus lathami Glossy Black-Cockatoo **(Breeding only)** Vunerable	2.00	August (Not Suitable)	Not found, no further assesment or offsetting required.	Zone 1	Hollows present including 115 and 116.	N/A
Chalinolobus dwyeri Large-eared Pied Bat *Vunerable*	3.00	Assumed Present	Assumed Present	Zone 1	Large forest canopy, within 2km of potential roosting habitat.	0.47ha
Hieraaetus morphnoides Little Eagle **(Breeding only)** *Vunerable*	1.50	September, October (Suitable)	Not found, no further assesment or offsetting required.	Zone 1	Tall suitable nesting trees.	N/A
Myotis maropus Southern Myotis *Vulnerable*	2.00	Assumed Present	Assumed Present	Zone 1	Potential roosting and breeding habitat	Whole site
Pandion cristatus Eastern Osprey **(Breeding only)** *Vunerable*	1.50	September, October (Suitable)	Not found, no further assesment or offsetting required.	Zone 1	Tall suitable nesting trees.	N/A
Petaurus norfolcensis Squirrel Glider Vunerable	2.00	September, October (Suitable)	Not found, no further assesment or offsetting required.	Zone 1	Tree hollows and foraging habitat.	N/A
Syzygium paniculatum Magenta Lilli Pilly *Endangered*	2.00	September, October (Suitable)	4 individuaks found on site	Zone 1		Two of the four Syzygium paniculatum trees will be removed as part of the development and will require offsetting.
Tyto novaehollandiae Masked Owl **(Breeding only)** *Vulnerable*	2.00	October (Suitable)	Not found, no further assesment or offsetting required.	Zone 1		No suitable hollows being removed.

Table 14. Non-threatened Fauna Found

Common Name	Scientific Name	Evidence	Date
Birds			
Australian Brush-turkey	*Alectura lathami*	Observed, Camera 1	11/09/18, 12/10/18
Australian Magpie	*Cracticus tibicen*	Observed	2002, 2018
Australian Pelican	*Pelecanus conspicillatus*	Observed	2002, Oct 2018
Australian Raven	*Corvus coronoides*	Observed	2002
Australian Wood duck	*Chenonetta jubata*	Observed, Camera 8	2002, 13-16/10/18
Australian White Ibis	*Threskiornis molucca*	Observed	2002
Black Shouldered Kite	*Elanus axillaris*	Observed	2002
Buff-rumped Thornbill	*Acanthiza reguloides*	Observed	2002
Common Myna*	*Acridotheres tristis*	Observed	2002
Crimson Rosella	*Platycercus elegans*	Observed	2002
Eastern Rosella	*Platycerus eximius*	Observed	2002
Galah	*Eolophus roseicapilla*	Observed	2002, Sept 2018
Great Egret	*Ardea alba*	Observed	Sept 2018
Grey Butcherbird	*Cracticus torquatus*	Observed	2018
Grey Fantail	*Rhipidura fuliginosa*	Observed	2002
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	Observed	2002
Laughing Kookaburra	*Dacelo novaeguineae*	Observed	2002, 2018
Little Black Cormorant	*Phalacrocorax sulcirostris*	Observed	2002, 2018
Little Corella	*Cacatua sanguiea*	Observed	2002
Little Pied Cormorant	*Phalacrocorax melanoleucos*	Observed	2002, 2018
Little Wattlebird	*Anthochaera chrysoptera*	Observed	2002
Mallard*	*Anas platyrhunchos*	Observed	2002
Noisy Miner	*Manorina melanocephala*	Observed, Camera 6	2002, 2018
Magpie-lark	*Grallina cyanoleuca*	Observed	2002,2018
Pied Cormorant	*Phalacrocorax*	Observed	2002
Pied Currawong	*Strepera graculina*	Observed	2002, 2018
Pacific Black Duck	*Anas superciliosa*	Observed, Camera 8	2002 Sept-Oct 18
Rainbow Lorikeet	*Trichoglossus haematodus*	Observed, Nesting	2002,2018
Red-browed Finch	*Neochmia temporalis*	Observed	2002
Red Wattlebird	*Anthochaera carunculata*	Observed, heard	2002, Oct 2018
Silver Gull	*Larus novaehollandiae*	Observed	2002,2018
Short Billed Corella	*Cacatua sanguinea*	Heard	2018
Spotted Pardalote	*Pardalotus punctatus*	Observed	2002
Spotted Turtle-Dove*	*Streptopelia chinensis*	Observed	2002
Spur Winged Plover	*Vanellus miles*	Observed, Camera 8	2002, 2018
Sulphur-crested Cockatoo	*Cacatua galerita*	Observed, Heard	2002, 2018
Superb Fairy-wren	*Malurus cyaneus*	Observed	2002

Common Name	Scientific Name	Evidence	Date
Tree Martin	*Hirundo nigricans*	Observed	2002
Welcome Swallow	*Hirundo neoxena*	Observed, Camera 8	2002, 2018
White-faced Heron	*Egretta novaehollandiae*	Observed	2002
Whistling Kite	*Haliastur sphenurus*	Observed	2002
White-browed Scrubwren	*Sericornis frontalis*	Observed	2002
Willie Wagtail	*Rhipidura leucophrys*	Observed	2002
Variegated Fairy-wren	*Malurus lamberti*	Observed	2002
Mammals			
Brush-tailed Possum	*Trichosurus vulpecula*	Camera 4&6	2002, 12-21/10/18
Cat*	*Felis catus*	Observed, Camera 1	2002, 16/10/18
Common Ringtail Possum	*Pseudocheirus peregrinus*	Observed	2002
Black Rat*	*Rattus rattus*	Observed	2002
Grey-headed Flying-fox	*Pteropus poliocephalus*	Observed (foraging only)	2002
Long-nosed Bandicoot	*Perameles nastuta*	Camera 1, Diggings	2002, 12, 21/10/18
Dog*	*Canis lupus familiaris*	Observed	2002, Jan-May 2018
Fox*	*Vulpes vulpes*	Camera 1,3 & 8	12-14 Oct 18
Rabbit*	*Oryctolagus cuniculus*	Scat	2002
Amphibians			
Common Eastern Froglet	*Crinia signifera*	Heard	2002
Frog Spawn (unknown species)	*Unknown species*	Observed	2018
Reptiles			
Eastern Water Dragon	*Physignathus lesueurii*	Observed	2002, 2018
Eastern Water Skink	*Eulamprus quoyii*	Observed	2002
Dark-flecked Garden Sunskink	*Lampropholis delicata*	Observed	2002, 2018
Pale-flecked Garden Sunskink	*Lamphropholis guichenoti*	Observed	2002, 2018
Weasel Skink	*Saproscincus mustelinus*	Observed	2002
Eastern Blue-tongued Lizard	*Tiliqua scincoides*	Observed	2002

*Introduced species

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Figure 4.2
Threatened Species Survey, Habitat and Perscribed Impact Features

Stage 2: Impact Assessment

5 Avoid and Minimisation of Impacts

5.1 Steps Taken to Avoid and Minimise Ecological Impact

The need to Avoid and Minimise is a consideration the consent authority needs to take into consideration when assessing Site Suitability in s79C (now s 4.15).

The Biodiversity Conservation Act 2016 and Biodiversity Conservation Regulation (2017) require that all developments "Avoid" then "Minimise" ecological impacts.

Chapter 8 of the BAM requires that the measures that were taken to Avoid and Minimise are documented.

The *Biodiversity Conservation Act 2016* (s 7.13(6)) allows the consent authority discretion over what measures are required in relation to avoiding and minimising impacts.

Once all possible impact minimisation and avoidance has been undertaken, then offsetting can be used to mitigate the residual impacts of the proposal on the environment. This report describes ecological constraints on this site that were provided to the planning team for the use in planning and to avoid and minimise the impacts.

The main ecological constraints that have been identified at the site are the

- Pittwater and Wagstaffe Spotted Gum Forest Endangered Ecological Community and Swamp Oak Floodplain Forest Endangered Ecological Communities.
- Four Threatened *Syzygium paniculatum* trees.
- Habitat for Threatened species including hollow bearing trees.
- Vegetated Riparian Zone (Riparian Corridor).

Table 15. Steps Taken to Avoid and Minimise Impact

Avoid and Minimise	Outcome	Timing	Participants
Reduce number of house lots from 11 to 10 and the number of building footprint building footprints from 10 to 9.These are well within the permissible planning limits.	Reducing the impact to the PWSGF and habitat by approximately 1200m^2.	DA Design	Ecologist and Architect/Planner
Modify and reduce the footprint of the dwellings to avoid trees and the extensive use of suspended buildings to minimise root impact.	Reduce impact to native trees and hollows.	DA Design	Ecologist and Architect
Design new driveway within footprint of existing driveway footprint and cleared area	Minimise impact to PWSGF EEC including trees and habitat hollows.	DA Design	Ecologist and Architect
Propose an Environment Protection Area (EPA) in the southern and western parts of the site. Establish in accordance with the Biodiversity Management Plan.	Protect and improve the habitat value and condition of 1125m^2 of PWSGF EEC and maintain east-west wildlife corridor.	Pre DA, to be established during construction and managed in the long-term	Ecologist and owner
Propose a Native Revegetation Area (NRA) in the southern part of the site in accordance with the Biodiversity Management Plan.	Revegetate 1641m^2 of the site that is disturbed during construction to minimise impact to EEC and habitat and north-south wildlife corridor.	Pre DA, to be established during construction and managed in the long-term	Ecologist, Landscaper and owner

Conduct root investigations on trees that could potentially be retained	Possibly retain some native trees	Prior to tree removal	Arborist
Avoid impact to the majority of dead and alive habitat trees	Retain hollows that are suitable for Threatened and native fauna	DA Design	Ecologist to map and discuss with Architect to modify plans to avoid habitat trees where possible.
Bioretention Basin in accordance with the Biodiversity Management Plan.	Reduce impact of nutrients and sediment into Pittwater estuarine environment.	DA Design, during construction	Hydraulic Engineer and Ecologist
Location of Relocated Council pipes and stormwater pipes.	Reduce tree loss.	DA Design	Architect
Using local native species in landscaping including planting 109 canopy trees.	Reduce impact to habitat in landscaped areas and replace some of the native tree canopy in landscaped areas.	DA Design, to be managed in the long term.	Landscape Architect/ Bush regenerator
Retaining trees and native planting in a Vegetated Riparian Area in accordance with the Biodiversity Management Plan.	Reduce impact to habitat in 1090m^2 (43%) of the Vegetated Riparian Zone	DA Design	Ecologist and Landscape Architect/ Bush regenerator

Recommendations have been made in Part 3 of this report to further minimise the ecological impact from the proposal.

5.1.1 Avoiding Impact to the Vegetated Riparian Zone

The Development Site adjoins to Pittwater estuary (Careel Bay).

The BAM (Appendix 3) requires a 50m Vegetated Riparian Zone (VRZ) for developments adjacent to estuaries The WM Act requires 40m wide VRZ. A 40m Vegetated Riparian Corridor is shown on the map in Figure 1.5.

The Water Management Act 2000, the BC Act BAM, the LEP and DCP all require DAs to avoid and minimise impact to the ecology of the Vegetated Riparian Zone (Riparian Corridor). A Waterway Impact Statement (WIS) (GIS Environmental Consultants, Nov 2018) has been prepared in accordance with the Water Management Act 2000.

The northern third of the Development Site is within a Vegetated Riparian Zone (Riparian Corridor) Parts of Lots 6 to 9 and associated houses and landscaping will occur within the VRZ.

The WM Act requires that a Controlled Activity Approval be obtained before commencing the activity and a Vegetation Management Plan be prepared and approved as part of the integrated Development Application. Section 8.2.2 (d) of the BAM requires the project to be located to avoid and minimise impact to the Riparian corridor and section 9.3.2.3 (f) required temporary fencing to mitigate impact of the Riparian Zone.

To avoid and minimise impact to the Vegetated Riparian Zone on this site, the existing native trees and native plants will be retained where possible and local native plants will be planted as part of the landscaping in a Vegetated Riparian Area (see Figure 1.5). A Water Impact Statement (WIS) and Biodiversity Management Plan are included as part of the DA/s to describe the establishment and maintenance of the fully structured native vegetation in the Vegetation Riparian Area.

5.2 Residual Direct and Indirect Impacts

Table 16. Summary of Residual Direct and Indirect Impacts

Type	Frequency	Intensity	Duration	Consequence
Permanent removal of 4328m^2 of medium and low resilience native vegetation for building and landscaping see section 5.2.1	Once, during construction	High	Impact permanent	Impact to 2 Endangered Ecological Communities
Temporary impact to up to 1000m^2 within the Native Revegetation Area, where there is construction impact.	During Construction	Med	Disturbed area to be planted with local native species following construction.	Partial impact to an Endangered Ecological Community
Removal of 30 non-exempt trees (20 EEC trees, 4 native and 6 planted) See section 5.2.2	During construction	High	Impact permanent	Impact to an Endangered Ecological Community and habitat for native species
Removal of 1 hollow bearing tree and potential removal of 2 more See section 5.2.3	During construction	Med	Impact permanent	Impact to nesting/roosting habitat for native & Threatened species
Removal of Threatened Species and their habitat	During construction	Med	Impact permanent	Impact to 1 threatened tree and reduction Threatened microbat habitat in the locality
Impact to wildlife corridors	During Construction	Low	Area to be planted with local native species following construction.	Partial impact to an Endangered Ecological Community
Sedimentation and nutrients in Pittwater	Indirect Ongoing	Low	During Construction and potentially ongoing	Potential impacts to marine life in Pittwater

5.2.1 Vegetation Loss

There is approximately 9466m^2 of low to medium quality native vegetation at the site. This includes 7521m^2 of Pittwater and Wagstaffe Spotted Gum Forest EEC ranging from medium to low quality, 628m^2 of low quality Swamp Oak Floodplain Forest EEC and areas with a native tree canopy but hard surface or lawn underneath (1317m^2).

The proposed 9 building footprints, driveway extension, landscaping and drainage works will impact 5239m^2 of this native vegetation including 4611m^2 of PWSGF EEC and 628m^2 of SOFF EEC (impact to SOFF EEC not assessed in Streamlined assessment module).

Existing trees within the landscaped area will be retained and 65 local native trees will be planted. The landscaped areas are split into three types. Type A will be planted with 80% Swamp Oak Floodplain Forest EEC species, Type B will be planted with at least 80% Pittwater and Wagstaffe Spotted Gum Forest EEC species and Type C will be planted with at least 50% local native species. Type A and B are within the Vegetated Riparian Area.

Some of the1641m^2 Native Revegetation Area (see Figure 1.4) will be disturbed during construction for trenching for services and due to the close proximity of construction. The disturbance is to be minimised by supervision by the Site Ecologist and temporary fencing during construction. The disturbance areas

will be mulched and revegetated with local native groundcovers and shrubs during construction. The impact to PWSGF EEC in these areas will not be complete removal and has been made into separate management zones for Vegetation Zones 1 and 2 with a future integrity score of 34.7 (VZ1) and 13.1 (VZ2).

There will be no loss of vegetation in the 1125m^2 Environment Protection Area is proposed within existing medium quality PWSGF EEC to be retained and improved. The vegetation in the EPA will be protected during construction and conserved and managed as an EEC and habitat in the long-term. There is to be a Biodiversity Management Plan that outlines measures to protect, manage and improve the quality of the vegetation in the Native Revegetation Area and Environment Protection Area.

5.2.2 Tree Loss

A total of 320 have been recorded at the development site these include 158 PWSGF EEC trees, 17 SOFF EEC trees, 4 Threatened trees (*Syzygium paniculatum*) 10 habitat tree (hollows), 27 local native trees, 24 planted, 63 exempt and 10 dead trees.

There are 103 Spotted Gum *Corymbia maculata* at the site, which is the most dominant tree canopy species at the site. The site contains eight other Pittwater and Wagstaffe Spotted Gum Forest EEC characteristic species including *Allocasuarina torulosa* (12), *Corymbia gummifera* (2), *Eucalyptus botryoides* (4), *Eucalyptus paniculata* (15), *Eucalyptus umbra* (6), *Glochidion ferdinandi* (10), *Livistonia australis* (2) and *Pittosporum undulatum.* The site also contains three Swamp Oak Floodplain Forest EEC characteristic tree species the most dominant being *Casuarina glauca* where there are 15 recorded at the site. There is also a *Melaleuca quinquenervia* and a *Melaleuca stypheliodes.*

Figures 5.1, 5.2 and 5.3 show the location and states of all trees on the Development Site. Appendix A lists all trees at the site including species name, status, tree diameter, canopy spread and height. The summary table (Appendix A) summarises the count for each species and their status. See the map in Figure 5.2 for the location of all non-exempt tree at the site.

The Tree Assessment and Development Impact Report by Kyle A. Hill (December 2018), assessed 146 trees that were in close proximity to the houses and infastructure. Health, vigour, retention value and construction impact were determined for each tree. The report determined that a total of 30 (non-exempt) tree are to be removed due to construction or poor health, this includes 13 PWSGF EEC trees, 7 SOFF EEC trees, 4 native trees and 6 planted trees. An additional 3 PWSGF EEC trees, 1 planted and 1 local native tree have their TPZ impacted and will need further root investigation to determine if they can be retained.

The trees to be removed include a total of thirteen non-exempt species (both native and planted). The Pittwater and Wagstaffe Spotted Gum EEC characteristic tree species to be removed include Spotted Gums *Corymbia maculata* (8), Forest Oak *Allocasuarina torulosa* (3) and Cheese Tree *Glochidion ferdinandi* (2).

The area of native tree canopy impact and retention is shown in the map in Figure 5.2. The areas shown in red on Figure 2 are where there will be no native tree canopy following construction. The green areas are where there will be one or more layers of tree canopy retained. Any tree trimming due branches overhanging building is not known and is not shown on Figure 5.2.

All other non-exempt trees and dead trees will hollows are to be retained onsite.

The Landscape Masterplan by Jamie King Sht-101 (28/11/18) includes planting of 109 canopy trees including 35 PWSGF EEC trees.

Tree Planting in the EPA and NRA

50 canopy tree saplings are to be planted in canopy gaps in the Environment Protection Area and for screening planting in the Native Revegetation Area. There will also be additional trees planted in the EPA as seedlings. There is 109 canopy trees shown on the landscape plan to be planted in the landscape areas, most of these are local native species.

A double row of screen planting tree is to be planted along the western boundary of Lot 5 to screen the new house from the adjacent existing house. The first row is to consist of 7 *Elaeocarpus reticulatus* (Blueberry Ash) plants in 75litre pots planted at 4m centres. The second row in this screening is to consist of 9 *Ceratopetalum apetalum* (NSW Christmas Bush) trees in 75litres planted at 3m centres.

The second screening planting area is on the western side of the main access driveway to screen the rear of the house on lot 2 from the cars entering the site. The screen is to consist of a row of 7 *Elaeocarpus reticulatus* (Blueberry Ash) plants in 75litre pots planted at 3m centres.

The remaining trees are to be saplings in 150mm pots and are to be planted in locations where there is a gap in the tree canopy in the Environment Protection Area. These are: 20 *Corymbia maculata, 3 Eucalyptus paniculata, 2 Eucalyptus umbra and 2 Eucalyptus punctata*.

There is also likely to be additional trees planted as tubestock as in the revegetation of the EPA and NRA areas. These plants will be likely to have a low level of survivorship to maturity but will be stronger and healthier trees as the roots are less likely to be deformed by the pots.

5.2.3 Hollows

Tree hollows were found in trees 3c, 12, 15, 16, 31, 38, 100, 101, 114 and 140b (see Figure 5.1). There may be many more hollows not visible from the ground. All hollows were located in dead or alive Spotted Gums. Trees 12 and 140b are within dead trees and will require retention as they have a high habitat value. If those trees or any other hollows that are not proposed to be removed are removed then the impact to Threatened fauna in this report will need to be assessed.

Of these trees with hollows, 3c is proposed to be removed by the development. Trees 31 and 101 will have more than 10% of their Tree Protection Zone (TPZ) impacted by the development and may need to be removed in the future. Hollows in tree 3c, 31 and 101 are suitable for medium sized birds such as large parrots and possible microbats. A pair of Rainbow Lorikeets were observed nesting in the hollow in tree 3c during a site visit.

5.2.4 Impact to Threatened Species and their Habitat

The vegetation to be removed is suitable foraging or breeding habitat for several Threatened fauna species (ecosystem credit species). The Ecosystem Credits species and Species Credit Species (flora and fauna) are listed in Table 10, 11 and 12.

Candidate Species

Large Eared Pied Bat

The PWSGF EEC on the site is potentially foraging habitat to the Large Eared Pied Bat. The proposal will remove 0.47ha of this foraging habitat for this species. The site does not contain any potential roosting or breeding habitat for the Large Eared Pied Bat.

Southern Myotis

The site does not contain any suitable foraging habitat for the southern Myotis. The one hollow tree to be removed is potential roosting habitat for the Southern Myotis. The hollow to be removed is considered to be medium value roosting habitat as is not located near foraging habitat and is used as a nesting site for Rainbow lorikeets. Two other hollows that may potentially be removed are also potential roosting habitat for the Southern Myotis. 10m radius buffer was put around each hollow bearing tree to be removed to calculate the impact to potential roosting habitat.

Syzygium paniculatum

The site contains 4 Threatened *Syzygium paniculatum* plants that are considered to be naturally occurring. Communal access stairs show impact to one of these plant species. One of the trees is within close proximity to the new stairs and may be impacted by the development.

5.2.5 Potential Indirect Impacts

The Bioretention basin will reduce the amount of nutrients and sediment entering Pittwater. There is potential for sediment and nutrient to enter the harbour during construction and an in the ongoing use in the lower lots, the potential impact is likely to be low.

Excess nutrients in the soil may lead to weed problems which will reduce habitat value and potentially cause health problems. It is recommended that weed control be regularly conducted across the property and no environmental weed species be planted at the property.

5.2.6 Prescribed Biodiversity Impacts

Prescribed Biodiversity Impacts are impacts in addition to native vegetation clearing and can be sued by the determining authority to make Condition of Consent, add credits or refuse an application.

Prescribed Biodiversity Impact are described in section 6.7 of the BAM and include impact to cliffs, Karsts, caves, rocks, manmade structures, non-native vegetation, waterbodies & hydrological processes, connectivity features, wind turbine strikes and vehicle strikes. Prescribed Impacts are assessed in Table 17 below.

Table 17. Identificaton and Assessment of Prescribed Impacts

96-104 Cabarita Road, Avalon

This table addresses section 9.2 of the BAM.
OEH species profile and TBDC were used to assess the impact on the species.

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

Feature	Present	Prescribed Impact on Site	Species Likley to use Habitat	Importance of Habitat	Nature, Extent and Duration of Impacts	Prediction of Consequences of Impact	Justification of Prediction
Karst, caves, crevices, cliffs or other geologically significant feature	No	No karsts, caves, crevices, cliffs or other geologically significant features are present on the site.	See section 9.2.1.1 of the BAM.	See section 9.2.1.1 of the BAM.	See section 9.2.1.1 of the BAM.	See section 9.2.1.1 of the BAM.	See section 9.2.1.1 of the BAM.
Rocks	No	No rock or rock features occur on the site.	See section 9.2.1.2 of the BAM.	See section 9.2.1.2 of the BAM.	See section 9.2.1.2 of the BAM.	See section 9.2.1.2 of the BAM.	No justification required.
Human-made structure	No	There is no man-made structures present on the site.	See section 9.2.1.3 of the BAM.	See section 9.2.1.3 of the BAM.	See section 9.2.1.3 of the BAM.	See section 9.2.1.3 of the BAM.	No justification required.
Non-native vegetation	No	There is no non-native vegetation on the site.	See section 9.2.1.4 of the BAM.	See section 9.2.1.4 of the BAM.	See section 9.2.1.4 of the BAM.	See section 9.2.1.4 of the BAM.	No justification required.
Hydrological process sustaining/interacting with rivers, streams or wetlands	No	There is no hydrological processes, rivers, streams or wetlands on the site.	See section 9.2.1.5 of the BAM.	See section 9.2.1.5 of the BAM.	See section 9.2.1.5 of the BAM.	See section 9.2.1.5 of the BAM.	No justification required.
Water bodies and water quality	Yes	The Development Site occurs on the foreshore of an estuary.	Bush Stone-curlew and Black Bittern	The estuarine area currently contains a small rock wall, drainage outlet and open grass area with a few scatteres allocasurina species within 20m of the foreshore. The permanent waterbody on site provides some foraging habitat for the Black BIttern but the vegetation density is not dense enough for the species to roost. The esturine area privides suitable habitat for the Bush Stone-curlew	The dveleopment will include works on the rockwall which may be habitat for some non threatened reptile species. All lots will have access to the foreshore and this will increase human activity in the area. The sewerlines from the houses will be connected to the main sewer line that occurs in the estuary which will need to be dug up as part of the connection. If during construction there is a heavy rain event sediment from the site may enter the estuarine waterbody.	There may be impacts to the water quality from sediment entering the estuary in a heavy rain event but it is reccomended that there be sediment fences in place to reduce this impact. The works on the rock wall will not effect the entirelty of the rock wall and the rock wall remain as part of the dvelopment. Trenching for the sewer may increase the turbidity and and waterquality in that section of the estuary but this is likely to only be a short term issue. The vegetation management in the Riparian Zone of the property will be 95% local native species and will improve the habitat for the Black Bittern and the Bushstone curlew.	No justification required.
Wind farm development	No	There is no windfarm present on the site.	See BAM section 9.2.1.8 of the Bam	See BAM section 9.2.1.8 of the Bam	See BAM section 9.2.1.8 of the Bam	See BAM section 9.2.1.8 of the Bam	No justification required.
Connectivity	Yes	See section 2.1.5 of this document for a description of the connectivity features on the site.	All candidate species (see table table 12).	The site has medium north-south wildlife corridor value and good east-west corridor value. See Figures 1.1 and 1.2. There is an intact native canopy on the surrounding residential properties that connects the tree canopy at the site to areas of native vegetation in the locality.	As part of the proposal there will be approximatley 0.34ha of native vegetation on the site cleared for the development that will take place during constrction. An Environmental Protection Area, Native Revegetation area and Vegetated Riparian Area will be included in the proposal and will likely increase the connectivity and habitat value of these areas.	The impact of the removal of 0.34ha of native vegetation wil be ameliorated by the Environmental Protection Area, Native Revegetationn area, Vegetated Riparian Area and Landscaping with approximatley 95% local native species. The areas of management make up a larger area than what is being removed as part of the proposal and the managment areas will likely increase the structure and value of habitat on the site.	No Justification required.
Migration	No	The site is not a known habitat for migrating species.	See section 9.2.1.6 of the BAM.	See section 9.2.1.6 of the BAM.	See section 9.2.1.6 of the BAM.	See section 9.2.1.6 of the BAM.	No Justification required.
Vehichle stikes (Road Proposals)	No	The DA is not for a road proposal and vehicle strikes are not an impact. See BAM section 9.2.1.9 of the Bam	See BAM section 9.2.1.9 of the Bam	See BAM section 9.2.1.9 of the Bam	See BAM section 9.2.1.9 of the Bam	See BAM section 9.2.1.9 of the Bam	No Justification required.
Other	No	No other habitat features occur on the site	No additonal prescribed impacts identified	No additonal prescribed impacts identified	No additonal prescribed impacts identified	No additonal prescribed impacts identified	No Justification required.

Biodiversity Development Assessment Report (BDAR)

96 - 104 CABARITA RD, AVALON

Figure 5.1
Tree Status (320 trees)

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

by Nicholas Skelton

Date: 14/11/2018

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N

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

by Nicholas Skelton

Date: 13/12/2018

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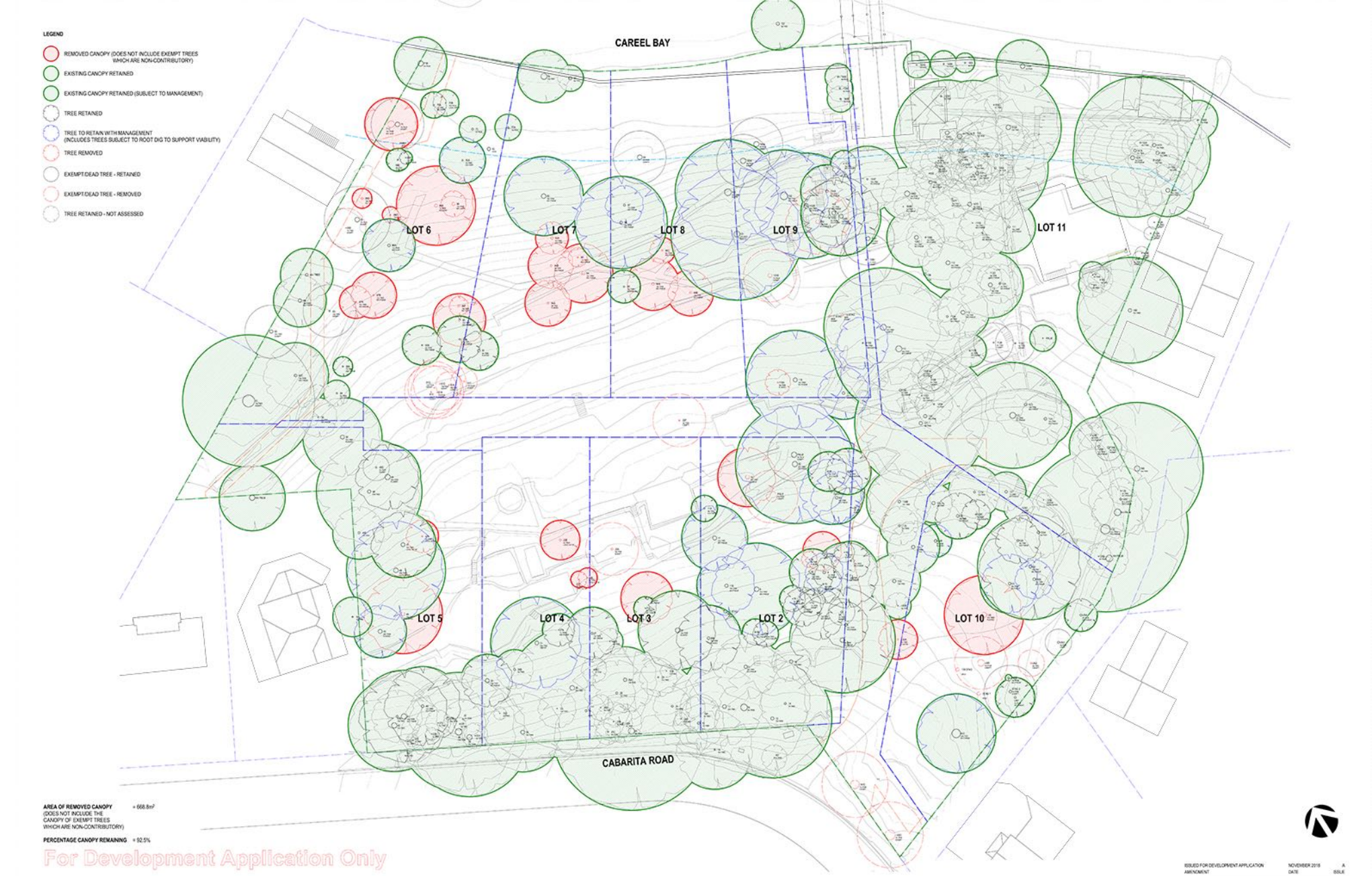
Biodiversity Development Assessment Report (BDAR)

96 - 104 CABARITA RD, AVALON

Figure 5.2
Native Tree Impact



REMOVED CANOPY

Figure 5.3. Non-exempt Tree Canopy Impact

RESIDENTIAL SUBDIVISION

96-104 CABARITA ROAD AVALON BEACH

ISSUED FOR DEVELOPMENT APPLICATION — NOVEMBER 2018 — A
AMENDMENT — DATE — ISSUE

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1:250 @ A1 1:500 @ A3

NOVEMBER 2018

MERAKI DEVELOPMENTS PTY LIMITED

MARK HURCUM DESIGN PRACTICE ARCHITECTS
LEVEL 2 373 ALFRED STREET NORTH NORTH SYDNEY NSW 2060
FACSIMILE (02) 9955 5603
TELEPHONE (02) 9955 5600

1801 AK000 Trees Current.vwx

Monday, 10 December 2018

6 Impact Summary

6.1 Potential SAII Serious And Irreversible Impacts

A guide to assist a decision-maker to determine a serious and irreversible impact (OEH Aug 2017) lists 5 steps to determine whether an impact is classified as a potential Serious and Irreversible Impact (SAII).

Step 1. Identify Relevant Potential Entities

Potential SAII entities are species or ecological communities that meet the criteria in Appendix 1 of the Guide. Appendix 2 of the guide lists some potential entities that are considered to meet the criteria

The potential listed SAII entities that are likely to be impacted by this development include

- Pittwater and Wagstaffe Spotted Gum Forest EEC
- Large Eared Pied Bat (breeding habitat)
- No additional SAII entities are likely to be affected by the proposal

Step 2. Evaluate the nature of Impact on a Potential Entity

These are potential residual impacts on Potential Entities after steps have been taken to avoid and mitigate impact.

- Impact to a total of 4611m^2 of Pittwater and Wagstaffe Spotted Gum Forest EEC.
- Impact to 4611m^2 of potential Large Eared Pied Bat foraging habitat but no impact to roosting or breeding habitat.

Step 3. Determine if Impacts Exceed Threshold

Impact assessment information from steps 1 and 2 can be compared to the impact threshold for the SAII entity. Impact thresholds are for potential SAII entities are in the Threatened Biodiversity Data Collection (not yet available).

- There is no available clearing threshold for Pittwater and Wagstaffe Spotted Gum Forest.
- The proposal will not impact Large Eared Pied Bat breeding habitat and is therefore not considered to be an SAII for this entity.

Steps 4 and 5 *are for the decision-maker to decide whether they consider the potential SAII to be a SAII and the steps required to be undertaken once that decision has been reached.*

6.2 Impacts Requiring Offset

Table 17. Impacts to Vegetation and Ecosystem Credit

PCT	Vegetation Zone	Existing Integrity Score	Management Zone	Area of Impact	Future Integrity Score
1214	1 (PWSGF med resilience)	49.3	MZ1- Construction Footprint	0.16ha	0 (removal)
1214	1 (PWSGF med resilience)	49.3	MZ2- Temporary disturbance and Native Revegetation Area	0.06ha	40.9 (NRA)
1214	2 (PWSGF low resilience)	28.5	MZ1-Construction Footprint	0.22 ha	0 (removal)
1214	2 (PWSGF low resilience)	28.5	MZ2- Temporary disturbance and Native Revegetation Area	0.02ha	13.1 (NRA)

6.2.1 Justification for future integrity scores

Management Zones within Impact Area

- **Management Zone 1 within construction and landscape area (within Vegetation Zones 1 and 2)** the areas in red and purple in Figure 6.1 include the building footprints, landscaped area driveway and drainage and will have a future integrity score of 0 as the habitat and vegetation is likely to be permanently removed from these areas.

- **Management Zone 2 within the Native Revegetation Area (within Vegetation Zones 1 and 2)** the areas in blue and green in Figure 6.1 are the areas (within the Native Revegetation Area) that will have the impact minimised by the Site Ecologist supervision and all disturbed will be revegetated with suitable local native understorey and shrubs. The future integrity score in these areas is expected to be higher than zero and some of the existing trees and native vegetation will be retained and protected. This area will also be revegetated with native species and managed in the long-term including weed control.
- The NRA is estimated to have a future integrity score of 34.7 (VZ1) or 13.1 (VZ2). The future integrity score was calculated by reducing the composition, future and function scores to reflect the actions in the future approved Biodiversity Management Plan
- Management Zone 2 in Vegetation Zone 1 will be disturbed by edge effects from construction of houses 2, 3 and 4 and construction of retaining walls. The impact will be reduced by the requirements of the BMP, site induction, temporary fencing, signage and supervision of any work in this area by a qualified site ecologist.
- Management Zone 2 in Vegetation Zone 2 will be disturbed by trenching for stormwater pipes and sewer pipes and edge effects from construction of houses 5 and 6. The impact will be reduced by the requirements of the BMP, site induction, temporary fencing, signage and supervision of any work in this area by a qualified site ecologist.

The adjustment of integrity scores was done by an ecologist with 25 years of experience with experience in this vegetation type and this type of development.

There is a Biodiversity Management Plan (GIS Environmental Consultants Dec 18) that describes in detail the required during construction amelioration measures.

Species Credit Species	Associated Vegetation Zone	Total Area of Impact or Count
Large-eared Pied Bat	Zone 1 and 2	0.47ha
Southern Myotis	Zone 1	0.47ha
Syzygium paniculatum	Zone 1 and 2	1 Tree

For the impact to the Southern Myotis that is roosting habitat only (i.e hollows), the “area” of impact was calculated by putting a buffer of 100m around each hollow to be removed (or potentially be removed), as per the Threatened Bat Survey Guidelines. Due to the small size of the site the area of habitat to be removed includes the entire area of both vegetation zones (i.e 0.47ha).

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

by Nicholas Skelton

Date: 13/12/2018

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Figure 6.1
Impact To Be Offset

6.3 Impacts Not Requiring Offsetting

Impacts that do not require offsetting include parts of the site that have native vegetation but the integrity score is less than the following minimum requirements;

- An integrity score of 15 where the PCT is representative of an Endangered or Critically Endangered Ecological Community
- An integrity score of 17 if the PCT is associated with Threatened species habitat (for ecosystem credit species) or is representative of a Vulnerable Ecological Community.
- An integrity score of 20 if the PCT is not representative of a TEC or Threatened species habitat.

Both vegetation zones in the Development Footprint are within the PWSGF EEC that have an integrity score above the minimum integrity score of 15 for Endangered Ecological Communities and therefore both require offsetting.

6.4 Areas Not Requiring Assessment

There is no construction proposed for Lot 11, this Lot is not included as part of the assessment.

There are parts of the site that have a native Spotted Gum tree canopy cover but have concrete, roof, landscaping lawn or clearing for the ground cover, these areas do not require assessment.

This report does not assess the loss of habitat due to removal of exempt trees.

The Development Site does not include any Bio certified Land.

The central part of the Development Site is disturbed with no native vegetation and does not require assessment.

6.5 Additional Impacts and Indirect Impacts that are not Offset

This assessment uses the Streamlined Assessment Module and therefore impacts to other PCTs that are not the dominant PCT are not offset. The proposal will impact up to 628m^2 of the Endangered Ecological Community Swamp Oak Floodplain Forest that is not offset. The Swamp Oak Floodplain Forest to impacted is degraded. Part of the SOFF EEC to be impacted is with the Native Revegetation Area and will be restored following construction.

Indirect impacts such as potential sedimentation and nutrients in Pittwater (Careel Bay) and the spread of weeds are not offset, however these impacts from the proposal are likely to be low due to sediment control measures and proposed Bush Regeneration and landscaping.

The assessment of **Prescribed Impacts** is in Table 17 of this report.

6.6 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) would only be relevant if the proposal was to be or impact a Matter of National Environmental Significance (MNES), thus triggering referral to the Federal Department of the Environment and Water Resources.

A Protected Matters search was conducted within a 10km radius of the site. A Protected Matters search is a broad scale assessment that includes World Heritage Properties, National Heritage Places, Wetlands of International Importance, Great Barrier Reef Marine Park, Commonwealth Marine Areas, Listed Threatened Ecological communities, Listed Threatened Species and Listed Migratory Species. The only relevant categories to this report are Threatened species, Threatened Ecological Communities and Migratory species.

The report lists the following ecologically relevant items:

- 75 Threatened Ecological Communities
- 79 Threatened species
- 57 Migratory Species

Most of the migratory and aquatic bird species, as well as the fish, sharks and marine mammals are not assessed in this report. This report addresses terrestrial species, which are likely to have potential habitat on the site.

The EPBC Act Threatened species that have potential habitat onsite have been assessed under BC Act criteria in this Flora and Fauna Impact Assessment report. The assessments concluded that no significant impacts are likely to occur to those species as a result of the proposal and a similar conclusion was also reached after consideration of the Commonwealth criteria. The vegetation on the site does not meet the definition of any EEC under the EPBC Act.

It is recommended that this proposal (see Figure 6) does not need to be referred to Environment Australia.

6.7 Pittwater LEP 2014 and DCP 21 2014 Assessment

6.7.1 Part 7.6 Biodiversity

(3)Before determining a development application for development on land to which this clause applies, the consent authority must consider:

(a)whether the development is likely to have:

*(i)any **adverse impact on the condition, ecological value and significance** of the fauna and flora on the land, and*

Response: The Development Site contains medium and low resilience Pittwater Spotted Gum Forest, with a native tree canopy and weedy/native mid and understorey, and degraded Estuarine Swamp Oak Forest, with a native canopy and a weedy mown understorey. An Environmental Protection Area (0.11ha) has been included to protect part of the PWSGF community that occurs adjacent to Cabarita Road (see Figure 1.5, and 3.1).

The proposed building footprint, driveway and landscaping has an area of 8800m^2 and will remove or modify 5239m^2 of native vegetation. Tree Assessment and Development Impact Report by Kyle A. Hill (December 2018), determined that a total of 30 (non-exempt) tree are to be removed due to construction or poor health, this includes 13 PWSGF EEC trees, 7 SOFF EEC trees, 4 native trees and 6 planted trees. An additional 3 PWSGF EEC trees, 1 planted and 1 local native tree have their TPZ impacted and will need further root investigation to determine if they can be retained.

One of the trees to be removed (and 2 potentially to be removed) contains a hollow suitable for parrots and microbats (see Tree Table in Appendix A). Dead trees with hollows are to be retained as nesting habitat for threatened species.

The Environmental Protection Area (EPA) will likely improve the condition of the PWSGF within that area of the site. The proposed Native Revegetation Area will revegetate 1641m^2 of native vegetation that will be impacted during construction which will minimise the total impact to PWSGF EEC at the site (see Figure 1.5). The Landscaping includes the planning of 80% EEC species in the lower riparian part of the site and 50% local native species in the central part of the site see Landscape Masterplan by Jamie King (28/11/18) in Appendix C.

*(ii)any **adverse impact** on the **importance of the vegetation** on the land to the **habitat and survival of native fauna**, and*

Response: The site contains Pittwater and Wagstaffe Spotted Gum Forest with a native tree canopy and weedy/native mid and understorey. Several of the tall tree species contain hollows suitable for habitat and large canopies for foraging. The understorey is a mix of weeds and natives and provides habitat to a range of native fauna. The construction will remove 5239m^2 of native but the proposed EPA will retain 1125m^2 and likely improve the quality of the habitat (see Figure 1.5). 1641m^2 of native vegetation that will be impacted during construction is proposed to be restored following construction in the Native Revegetation Area (see Figure 1.5). The Landscape Masterplan by Jamie King (see Appendix C) includes the planting of 109 canopy trees (see Appendix D for tree replacement map). The BMP also describes the planting of 50 local native canopy trees in the EPA and NRA. The removal of a small amount of degraded vegetation and the implementation of the EPA is not likely to significantly affect the importance of the land to the survival of native fauna.

*(iii)any potential to **fragment, disturb or diminish** the **biodiversity structure, function and composition** of the land, and*

Response: The construction will remove or modify 5239m^2 of habitat including 24 native trees. The Tree Table, in appendix A, and lists the native trees to be removed as part of the proposal as per the Tree Assessment and Development Impact Report by Kyle A Hill (December 2018). See Figure 5.2 for location of native trees to be removed.

The construction is within the northern three quarters of the site and the EPA may maintain the east-west corridor along the southern part of the site. The Native Revegetation Area will retain the north-south corridor at the site (see Figure 1.5). Movement of highly mobile fauna such as birds and bats are not likely to be affected by the proposal.

*(iv)any **adverse impact** on the **habitat elements** providing **connectivity on the land**, and*

Response: The EPA at the southern part of the site will maintain the PWSGF and will keep intact the east-west corridor. The Native Revegetation Area will retain the north-south corridor at the site. Movement of highly mobile fauna such as birds and bats are not likely to be affected by the proposal (see Figure 1.5).

*(b)any **appropriate measures proposed to avoid, minimise or mitigate** the impacts of the development.*

(4)Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

*(a)the development is designed, sited and will be managed to **avoid** any significant adverse environmental impact, or*

Response: The proposal cannot avoid some impact to the vegetation on the site. The location of the proposed building footprint and driveway avoids some habitat features and the Environment Protection Area will avoid impact to that part of the site (see Figure 1.4 and 1.5). Impact to habitat features (hollows) have been avoided where possible. See section 5.2.4.

*(b)if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to **minimise** that impact, or*

Response: The Environment Protection Area and Native Revegetation Area (see Figure 1.5)will impact to the Endangered Ecological Community and native species habitat at the site. See recommendation section in *Ameliorative Conditions and Recommendations*.

*(c)if that impact cannot be minimised—the development will be managed to **mitigate** that impact.*

Response: Long Term management of the bushland to remain, including weed control and retention of habitat features, is recommended in *Ameliorative Conditions and Recommendations* of this report and a Biodiversity Management Plan.

6.7.2 B4.7 Pittwater Spotted Gum Forest – Endangered Ecological Community

Outcomes:

- Conservation of intact Pittwater Spotted Gum Forest EEC.
- Regeneration and/or restoration of fragmented and/or degraded Pittwater Spotted Gum Forest EEC.
- Reinstatement of Pittwater Spotted Gum Forest to link remnants.
- Long-term viability of locally native flora and fauna and their habits through conservation, enhancement and/or creation of habitats and wildlife corridors.

Controls require:

1. Development shall not have an adverse impact on Pittwater Spotted Gum Endangered Ecological Community.
2. Development shall restore and/or regenerate Pittwater Spotted Gum Endangered Ecological Community and provide links between remnants.
3. Development shall be in accordance with any Pittwater Spotted Gum Forest Recovery Plan.
4. Development shall result in no significant onsite loss of canopy cover or a net loss in native canopy trees.
5. Development shall retain and enhance habitat and wildlife corridors for locally native species, threatened species and endangered populations.
6. Caretakers of domestic animals shall prevent them from entering wildlife habitat.
7. Fencing shall allow the safe passage of native wildlife.
8. Development shall ensure that at least 80% of any new planting incorporates native vegetation (as per species found on the site or listed in Pittwater Spotted Gum Endangered Ecological Community).
9. Development shall ensure any landscaping works are outside areas of existing Pittwater Spotted Gum Endangered Ecological Community and do not include Environmental Weeds.

Responses:

1. The proposal will remove an area of 4611m^2 of Pittwater Spotted and Wagstaffe Gum Forest. An Environmental Protection Area (1125m^2) (see Figure 1.5) has been added as part of the proposal that will likely improve the quality of the Pittwater and Wagstaffe Spotted Gum Forest. A 1641m^2 Native Revegetation Area is proposed within the impact area to improve the value of the vegetation in those parts of the site following construction and minimise the impact to PWSGF EEC. The Landscape Plan by Jamie King (see Appendix C) includes the planting of 80% PWSGF EEC species in Landscape Area B, some PWSGF EEC species in Landscape Area C and 35 PWSGF EEC trees across the landscaped parts of the site (see Appendix D for tree replacement map). The BMP also describes the planting of 50 local native canopy trees in the EPA and NRA.
2. The Environmental Protection Area will improve the quality and long-term condition of the Pittwater and Wagstaffe Spotted Gum Forest in the upper southern part of the site. The Native Revegetation Area will minimise the impact the Pittwater and Wagstaffe Spotted Gum Forest in those parts of the site to be temporarily impacted during construction.
3. No recovery plan or threat abatement plan exists for this EEC.
4. The development will remove 13 trees that occur as part of the Pittwater and Wagstaffe Spotted Gum Forest community and potentially 3 more. The Landscape Plan proposes to plant 35 PWSGF EEC trees at the site including 9 *Corymbia maculata, 24 Livistonia australis,* and 2 *Angophora costata* (see Appendix C) (see Appendix D for tree replacement map). The BMP also describes the planting of 50 local native canopy trees in the EPA and NRA.
5. Two management areas will be added as part of the proposal, The Environmental Protection Area runs along the southern border of the property, linking vegetation on adjacent properties, and will improve the quality of the corridor running east to west along the property. The corridor running north to south along the western border of the property will be disturbed during construction, after the disturbance the area will be managed as a Native Revegetation and will be enhanced.
6. It is not known if the owners will own any domestic animal.
7. There is no fencing included within the proposal.
8. The Landscape Plan by Jamie King (see Appendix C) includes the planting of 80% PWSGF EEC species in Landscape Area B, some PWSGF EEC species in Landscape Area C and 35 PWSGF EEC trees across the landscaped parts of the site. Planting in the EPA and Native Revegetation Area will be with 100% Pittwater and Wagstaffe Spotted Gum Forest species and is to be outlined in a Biodiversity Management Plan for the site.
9. The landscaping will take place in existing Pittwater and Wagstaffe Spotted Gum Forest (see Figure 1.5). The landscaping does not include any Environmental weeds.

6.7.3 B4.2 Flora and Fauna Conservation Category 1 and Wildlife Corridor

Outcomes

The long-term viability of locally native flora and fauna and their habitats and the retention and enhancement of wildlife corridors in the Pittwater LGA.

Controls Require:

1. Development shall retain and enhance habitat for threatened species, endangered populations, endangered ecological communities and other locally native species.
2. Development shall provide wildlife corridors via creation, restoration, and / or regeneration of habitat.
3. Development shall result in no significant onsite loss of canopy cover and no net loss in native canopy trees.
4. Development shall ensure 80% of the area that is not covered by buildings or associated structures, is native vegetation either through retention of existing bushland or planting with locally native plant species (as per species listed in Native Plants for Your Garden available on the Pittwater web page). Landscaping is to be outside areas of core bushland and not include environmental weeds.
5. Development shall provide an adequate buffer to wildlife corridors. Caretakers of domestic animals shall prevent them from entering wildlife habitat areas.

6. Fencing, where permitted, shall be passable by native wildlife.

Responses:

1. The proposal will remove an area of 4611m^2 of Pittwater and Wagstaffe Spotted Gum Forest EEC, 628m^2 of Swap Oak Floodplain Forest EEC, potentially 1 Threatened *Syzygium paniculatum* tree and habitat for Threatened fauna.

   An Environmental Protection Area (0.11ha) (see Figure 1.5) has been added as part of the proposal that will likely improve the quality of the Pittwater and Wagstaffe Spotted Gum Forest and Threatened Species habitat. A 1641m^2 Native Revegetation Area (see Figure 1.5) is proposed within the impact area to improve the value of the vegetation in those parts of the site following construction and minimise the impact to PWSGF and SOFF EEC.

2. The corridor running east-west across the Development Site will be enhanced as part of the Environmental Protection Area and will be managed by bush regeneration. The corridor running north to south on the western border of the property will be disturbed during construction but will then be regenerated and managed as a Native Revegetation Area.
3. The development will remove 24 native trees and potentially 5 more (see Figure 5.2). The Landscape Plan (see Appendix C) proposes to plant 109 canopy trees at the site (see Appendix D for tree replacement map). The BMP also describes the planting of 50 local native canopy trees in the EPA and NRA.
4. The development site is 1.27ha, the development footprint (buildings, stormwater, drive and landscaping) is 8800m^2 and the Environmental Protection Area is 0.11ha and the Native Revegetation Area 0.14ha. The landscaping does not contain any Environmental weeds.
5. The proposed houses do not meet the boundary of the Environmental Protection Area. There is no fencing around wildlife areas. There is no fencing included within the proposal

7 Offsets

The ecological impact of this proposal will be offset by a combination of:

- Payment to the Biodiversity Conservation Trust in accordance with the BC Act (BOS)
- Weed control and permanent conservation and long-term management of a 1125m^2 Environmental Protection Area (EPA). See dark green areas on Figure 1.5.
- Active protection during construction, restoration and revegetation, conservation and long-term management of areas adjacent to the new buildings in a Native Revegetation Area (NRA) 1641m^2 in size. See light green areas on Figure 1.5.
- Vegetated Riparian Area (VRA) 1090m^2 in size with 80% of the plantings being native species. See Landscape Plan and blue areas on Figure 1.5.
- The inclusion of 50% local native species in the landscaping in the central part of the site including native tree replacement planting.

This report also makes recommendations to ameliorate ecological impacts during and after construction as described in the future approved Biodiversity Management Plan (BMP).

7.1 BOS Offset Credits Required

Ecosystem Credits

Vegetation Zone	PCT	Total Area of Impact	Change in Integrity Score	Credits Required
Zone 1	1214	0.22ha	-46.7	5
Zone 2	1214	0.25ha	-24.3	3
			Total	**8**

Species Credits

Species Credit Species	Associated Vegetation Zone	Area of Impact or Count	Credits Required
Large-eared Pied Bat	Zone 1 and 2	0.47ha	13
Southern Myotis	Zone 1	0.47ha	8
Syzygium paniculatum	Zone 1 and 2	1 Tree	2

7.2 Other Offsets

In addition to the BOS offsets, the DA proposal includes conservation and improvement of extensive areas of the site as shown in Figure 1.5. These are:

- Environmental Protection Area (EPA), 1125m^2 (dark green areas)
- Native Revegetation Area (NRA) 1641m^2 (light green areas)
- Vegetated Riparian Area (VRA) 1090m^2 (blue areas)
- The inclusion of 50% local native species in the landscaping in the central part of the site
- Planting of 109 canopy trees including 9 Spotted Gums in the landscaping area

7.2.1 *Environment Protection Area (EPA)*

- Details of the during construction works and ongoing management of this area is described in the Biodiversity Management Plan (GIS Environmental Consultants).
- The southern part of the site (1125m^2) is to be conserved and managed as Endangered Ecological Community habitat in the long-term including restrictions on the use and access. This area is shown as the Environment Protection Area (EPA).
- Weeds are to be regularly controlled by primary weed control at the start of construction and then 3-monthly weeding during construction, then every 6 months after construction. There is to <5% weed cover is to be established by primary weeding and maintained and monitored every 3-months during construction and 6-months following construction.
- There is to be no construction access to the Environment Protection Area.
- All bush regeneration works (during construction then ongoing every 6 months following construction) within the Environment Protection Area are to be carried out by a qualified Bush Regenerators. Planting can be carried out by laboured that are closely supervised by a qualified Bush Regenerator.
- There are not be no exotic plant species within the EPA.
- There is to be no disturbance to the soil surface within the EPA.
- External lighting is not to shine into the EPA.
- The soil surface is to be kept covered with natural leaf litter and no soil is be left bare as it causes further weed problems.
- There is to be no disturbance to existing native plant and animal species. All *Macrozamia communis* plants are to be retained.
- Any planting within the EPZ is to be Pittwater and Wagstaffe Spotted Gum species propagated from local stock and is to be established and managed in accordance with a Biodiversity Management Plan for the property.
- Appropriate management and restrictions on use within the Environment Protection Area are outlined in the Biodiversity Management Plan.

7.2.2 *Native Revegetation Area (NRA)*

- The Native Revegetation Area (NRA) (1641m^2) is to be protected (where possible) during construction and any disturbed areas are to be revegetated immediately after disturbance.
- This area is to be managed as Endangered Ecological Community and habitat in the long-term.
- During construction works within the NRA are restricted. During construction works in this area is to have a temporary Environment Protection Fence and signage (the location to be determined by the Site Ecologist) to minimise disturbance to surrounding vegetation. Works including disturbance to native vegetation in the Native Revegetation Area are to be supervised by the Site Ecologist.
- *Macrozamia communis* are to be retained.
- Disturbance to the natural soil levels and topsoil is to be minimised.
- Area within the Native Revegetation Area, that are disturbed during construction are to be revegetated and mulched following the disturbance. Revegetation is to be with PWSGF EEC or SOFF EEC species in accordance with the Biodiversity Management Plan for the property.
- No soil is to let bare within the NRA as it can lead to soil erosion and weed problems.
- There are to be erosion control measures within the NRA during construction and in the long-term.
- The during construction and long-term management of the NRA is to be detailed in a Biodiversity Management Plan.

Tree Planting in the EPA and NRA

- 50 canopy tree saplings are to be planted in canopy gaps in the Environment Protection Area and for screening planting in the Native Revegetation Area. There will also be additional trees planted in the EPA as seedlings. There is 109 canopy trees shown on the landscape plan to be planted in the landscape areas, most of these are local native species.
-
- A double row of screen planting tree is to be planted along the western boundary of Lot 5 to screen the new house from the adjacent existing house. The first row is to consist of 7 *Elaeocarpus reticulatus* (Blueberry Ash) plants in 75litre pots planted at 4m centres. The second

row in this screening is to consist of 9 *Ceratopetalum apetalum* (NSW Christmas Bush) trees in 75litres planted at 3m centres.

- The second screening planting area is on the western side of the main access driveway to screen the rear of the house on lot 2 from the cars entering the site. The screen is to consist of a row of 7 *Elaeocarpus reticulatus* (Blueberry Ash) plants in 75litre pots planted at 3m centres.
- The remaining trees are to be saplings in 150mm pots and are to be planted in locations where there is a gap in the tree canopy in the Environment Protection Area. These are: 20 *Corymbia maculata, 3 Eucalyptus paniculata, 2 Eucalyptus umbra and 2 Eucalyptus punctata*.
- There is also likely to be additional trees planted as tubestock as in the revegetation of the EPA and NRA areas. These plants will be likely to have a low level of survivorship to maturity but will be stronger and healthier trees as the roots are less likely to be deformed by the pots.

7.2.3 Vegetated Riparian Area (VRA)

- The Vegetated Riparian Area (VRA) is shown as Landscape Type A and B (blue areas) on Figure 1.5.
- The Vegetated Riparian Area (VRA) is to be protected (where possible) during construction and revegetated after construction into fully structured native vegetation. Landscape Type A is to be established and managed in the long-term as Swamp Oak Floodplain Forest Endangered Ecological Community and Landscape Type B as Pittwater and Wagstaffe Spotted Gum Forest EEC.
- Existing native vegetation including *Macrozamia communis* is to be retained where possible.
- Area within the VRZ, that are disturbed during construction are to be revegetated and mulched following the disturbance. Revegetation is to be with PWSGF EEC (Type B) or SOFF EEC (Type A) species in accordance with the Landscape Plan (see Appendix C).
- No soil is to let bare within the NRA as it can lead to soil erosion and weed problems.
- There are to be erosion control measures within the VRA during construction and in the long-term.
- The long-term management of the VRA is to be detailed in a Biodiversity Management Plan.

7.2.4 Other Landscaping

- The inclusion of at least 50% local native species in the landscaping in the central part of the site and the planting 109 canopy trees are shown in the landscaping plan (issue C, dated 28/11/2018) by Jamie King that is submitted with this DA. The Landscape Plan (Appendix C) contains 3 planting schedules that lists the species, pot size and quantity of each species to be planted and the plan shows the location where they are proposed to be planted.

Table 1. Summary of Vegetation Management and Landscaping

96 - 104 Cabarita Rd, Avalon

Acronym	Area on Fig 1.5	Size	Objective of Area	Management Document	Management Actions	Planting Specification
EPA	**Environment Protection Area**	1125sqm	Protect and improve the endangered forest	Bushland Management Plan	No Access by builder, weed control and supplemental planting by qualified bushregerators	Planting density 3/sqm tubestock. Species mixture to be 100% Local providence PWSGF EEC species. Species mixture as specified in BMP.
NRA	**Native Revegetation Area**	1641sqm	Protect and improve the endangered forest whilst allowing supervised trenching for utilities and provision of screening planting	Bushland Management Plan	No access except supervised construction access, temporary protection fencing, light cover of native mulch where needed, weed control and planting by qualified bushregerators	Planting density 5/sqm tubestock. 100% Local providence PWSGF EEC species. Species mixture as specified in BMP. Screening planting in designated areas.
Vegetated Riparian Area VRA 1089sqm	**Landscape Type A, Riparian Zone SOFF EEC**	424sqm	Protect, allow supervised trenching and improve the two endangered forests and riparian corridor	Landscape Plan	Only supervised construction access, temporary protection fencing, weed control and planting supervised by qualified bushregerator. Protect and retain all existing native plants, avoid disturbance of the soil surface.	Minimum 80% Swamp Oak Floodplain Forest Endangered Ecological Community (SOFF EEC) species. See Schedule B
	Landscape Type B, Riparian Zone PWSGF EEC	667sqm				Minimum 80% Pittwater Wagstaff Spotted Gum Forest Endangered Ecological Community (PWSGF EEC) species. See Schedule A
	Landscape Type C	8843sqm including houses and drive	Provide attractive landscaped gardens for the new houses that does not contain invasive species and provides some habitat value.	Landscape Plan	Hard and soft landscaping, earthworks and construction. Building of; bio retension pond, garden, houses, drive, retaining walls, stairs, bin area and kayak storage. By builder and landscaping contractor	Landscape Plan shows specific locations and quantities of each species to be planted . 50% local providence species.

Notes: Recovery of native plants from Landscape Type C areas to to be planted within the EPA area prior to construction is recommended.

Stage 3. Ameliorative Conditions & Recommendations

7.3 During Construction

- All native trees that are not shown as being removed in the Tree Assessment and Development Impact Report (Kyle A.Hill December 18) and described in this report as being removed are to be retained onsite. Trees to be retained are to be protected as per the Tree Assessment and Development Impact Report (Kyle A.Hill Dec 18).
- Cabbage Tree Palms and Macrozamias not on the building footprint are to be retained and protected with temporary fencing.
- All trees with hollows (see Appendix A) that are not specified in this report as being removed, are to be retained. Dead trees with hollows (Tree numbers 140b and 12) are to be retained as they are important habitat feature for native and Threatened fauna species. If additional hollows (other than those specified in this report as being removed) are being removed that the impact to Threatened species will need to be reassessed.
- The locations of Environment Protection Fencing is to be specified by the Site Ecologist. Construction works within the NRA are to be supervised by the Site Ecologist. There is to be no construction access to the EPA. Section 9.3.2.3 (f) of the Water Management Act requires temporary fencing to mitigate impact to the Vegetated Riparian Zone.
- These recommendations and ameliorative conditions should be read in conjunction with the Biodiversity Management Plan for this development which outlines environment protection and management of the bushland parts of the site during construction and in the long-term.

7.4 Ongoing Management

- Weed control is to be carried out across the property to improve habitat and wildlife corridor value, reduce the medical conditions caused by weeds and to improve aesthetics. The presence of weeds in an area decreases the aesthetic and habitat value of the study area as weeds compete with the native plants and cause medical problems such as asthma, hay fever, allergies, ticks and the dense vegetation creates a fire hazard. The sight of weeds also decreases the perception of an areas value. Landowners are required by the Biosecurity Act to control weeds on their land. Weed level control is achieve a percentage foliage cover of less than 5%.
- No environmental weeds are to be planted in any part of the property.
- Native mulches should be used wherever mulching is required.
- There should be no lighting directed into the bushland habitat, any path lighting should be low intensity and only directed down.
- These recommendations and ameliorative conditions should be read in conjunction with the Biodiversity Management Plan for this development which outlines environment protection and management of the bushland parts of the site during construction and in the long-term.

8 References

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9 Appendices

Appendix A: Tree Schedule

Appendix B: BAM Calculator Reports

Appendix C: Landscape Master Plan by Jamie King 14 dated December 2018

Appendix D: Tree Replacement Canopy Figure by Mark Hurcum Design Practice

Appendix A. Tree Schedule

96 - 104 Cabarita Rd, Avalon

GIS Environmental Consultants
ecology@ecology.net.au
Ph: 9939 5129, Mob: 041 943 8672

Updated: 30th October 2018

GIS Environmental Consultants
Ph: (02) 9939 5129, Mobile: 0419 438 672
ecology@ecology.net.au, ecology.net.au

Summary Table

	Endangered Community Trees				Other non exempt		Exempt or outside					
Species	Endangered Species	EEC PWSGF	EEC SOFF	Habitat Tree	Local Native	Planted	Exempt	Dead importance yet to be assessed	Outside	Count	To be removed	potenially removed
Acacia implexa					5					5		
Acacia podalyriifolia						1				1		
Acacia prominens						1		1		2		
Agathis robusta						3				3		1
Agonis flexuosa						2				2	1	
Allocasuarina torulosa		12								12	3	
Angophora floribunda								1		1		
Arbutus unedo						1				1		
Archontophoenix cunninghamiana					2					2		
Avicennia marina					1					1		
Banksia intergrifolia					1					1		
Bauhinia divaricata						1				1	1	
Brachychiton acerifolium							2			2		
Brachychiton populneus					2					2		
Buckinghamia celissima						1				1	1	
Callistemon hybrid						1				1	1	
Castanospermum australe							1			1		
Casuarina glauca			15					1		16	6	
Ceratopetalum gummiferum					3					3	2	
Cinnamomum camphora							1			1		
Citharexylum spinosum							3			3		
Corymbia gummifera		2								2		
Corymbia maculata		89		9				4	1	103	8	3
Cupressus Sp.							2			2		
Endriandra sieberi					1					1		
Erythrina crista-galli							2			2		
Eucalyptus botryoides		4								4		
Eucalyptus paniculata		13						2		15		
Eucalyptus punctata				1	2					3		
Eucalyptus umbra		6								6		
Exocarpos cupressiformis					1					1		
Ficus hillii							2			2		
Ficus rubiginosa					4					4	1	
Garden plant						6				6		
Glochidion ferdinandi		10								10	2	
Grevillea robusta							4			4		
Harpephyllum caffrum							6			6		
Jacaranda mimosifolia							33			33		
Leptospermum polygalifolium						1				1		
Ligustrum lucidum							3			3		
Livistona australis		2								2		
Lophostemon confertus						3				3	1	
Magnolia grandiflora						1				1	1	
Melaleuca quinquenervia			1							1	1	
Melaleuca styphelioides			1							1		
Not identified									6	6		
Phoenix canariensis							2			2		
Pittosporum undulatum		20								20		
Plumeria sp.						2				2		
Schefflera actinophylla							2			2		
Scolopia braunii					1					1	1	
Syncarpia glomulifera					4					4		1
Syzygium paniculatum	4									4		1
Unknown								1		1		
Count	4	158	17	10	27	24	63	10	7	320	30	6

Tree ID	Botanical Name	Common Name	Status	Diameter (cm)	Canopy Spread (m)	Height (m)	Impact (non exempt only)
1	Corymbia maculata	Spotted Gum	EEC PWSGF	26	6	10	
1b	Grevillea robusta	Silky Oak	Exempt	15	03	07	
2	Corymbia maculata	Spotted Gum	EEC PWSGF	29.5	10	10	
3	Corymbia maculata	Spotted Gum	EEC PWSGF	23.5	6	10	Remove
3b	Callistemon hybrid	Bottle Brush	Planted	7.5	2.5	5	Remove
3c	Corymbia maculata	Spotted Gum	habitat	54	9	14	Remove
3d	Corymbia maculata	Spotted Gum	EEC PWSGF	79	18	20	
3e	Eucalyptus botryoides	Bangalay	EEC PWSGF	26	6	09	

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Tree ID	Botanical Name	Common Name	Status	Diameter (cm)	Canopy Spread (m)	Height (m)	Impact (non exempt only)
3f	Syzygium paniculatum	Magenta Lillypilly	Endangered	35	10	14	
3g	Corymbia maculata	Spotted Gum	EEC PWSGF	34	08	14	
3h	Syzygium paniculatum	Magenta Lillypilly	Endangered	18	7	08	
3i	Jacaranda mimosifolia	Jacaranda	Exempt	20	06	05	
4	Eucalyptus botryoides	Bangalay	EEC PWSGF	39.5	6	12	
4b	Corymbia maculata	Spotted Gum	EEC PWSGF	25.5	7	10	
5	Corymbia maculata	Spotted Gum	EEC PWSGF	39.5	08	16	
5b	Jacaranda mimosifolia	Jacaranda	Exempt	20	04	05	
6	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	71	20	20	
6b	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	19	06	05	
7	Eucalyptus botryoides	Bangalay	EEC PWSGF	42	08	12	
7c	Corymbia maculata	Spotted Gum	EEC PWSGF	24.5	6	12	
7d	Corymbia maculata	Spotted Gum	EEC PWSGF	26	5	11	
7e	Corymbia maculata	Spotted Gum	Dead	12	2	5	
7f	Corymbia maculata	Spotted Gum	EEC PWSGF	17.5	04	08	
8	Corymbia maculata	Spotted Gum	EEC PWSGF	62	14	20	
9	Corymbia maculata	Spotted Gum	EEC PWSGF	34	04	12	
9b	Corymbia maculata	Spotted Gum	EEC PWSGF	19	04	12	
9c	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	11	02	03	
9d	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	12.5	02	03	
10	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	51	14	18	
11	Corymbia maculata	Spotted Gum	EEC PWSGF	55	10	14	Potential remove
11b	Corymbia maculata	Spotted Gum	EEC PWSGF	50.5	9	16	
11a	Glochidion ferdinandi	Cheese Tree	EEC PWSGF	11	04	04	
12	Corymbia maculata	Spotted Gum	Habitat	80	5	10	Keep for Habitat
13	Corymbia maculata	Spotted Gum	EEC PWSGF	49.5	14	14	
14	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	31.5	08	09	
15	Eucalyptus punctata	Grey Gum	Habitat	45	18	16	
16	Corymbia maculata	Spotted Gum	Habitat	90	18	25	
17	Corymbia maculata	Spotted Gum	EEC PWSGF	53	12	20	
18	Corymbia maculata	Spotted Gum	Outside	28	8	14	
19	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	46	08	12	
19a	Endriandra sieberi	Corkwood	Local Native	18.5	06	06	
19b	Cinnamomum campho	Camphor Laurel	Exempt	19	08	06	
20	Lophostemon confert	Brush Box	Planted	60	10	16	
20b	Lophostemon confert	Brush Box	Planted	40	10	10	
21	Eucalyptus paniculata	Grey Ironbark	Dead	26	4	10	
21a	Glochidion ferdinandi	Cheese Tree	EEC PWSGF	11	3.5	05	
22	Allocasuarina torulosa	Forest Oak	EEC PWSGF	41	8	10	Remove
22a	Harpephyllum caffrum	Kaffir Plum	Exempt	22	08	05	
22b	Ceratopetalum gummi	NSW Christmas Bush	Local Native	13	3	07	Remove
22c	Ceratopetalum gummi	NSW Christmas Bush	Local Native	13	2.5	07	Remove
22d	Ligustrum lucidum	Large-leaf Privet	Exempt	25.5	04	07	
22e	Ficus rubiginosa	Port Jackson Fig	Local Native	21	6	06	Remove
22f	Plumeria sp.	Frangipani	Planted	15	08	04	
23	Corymbia maculata	Spotted Gum	EEC PWSGF	26	06	10	
23b	Corymbia maculata	Spotted Gum	EEC PWSGF	13	02	06	
24	Corymbia maculata	Spotted Gum	EEC PWSGF	34.5	06	10	
24a	Brachychiton populne	Kurrajong	Local Native	14	02	04	
25	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	82	24	20	
25a	Jacaranda mimosifolia	Jacaranda	Exempt	19	06	08	
25b	Jacaranda mimosifolia	Jacaranda	Exempt	14.5	06	07	
25c	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	12.5	04	04	
26	Corymbia maculata	Spotted Gum	EEC PWSGF	33.5	10	14	
26b	Eucalyptus punctata	Grey Gum	Dead	30.5	8	12	
26c	Ficus hillii	Weeping Fig	Exempt	11	04	07	
26d	Brachychiton populne	Kurrajong	Local Native	12.5	04	05	
27	Corymbia maculata	Spotted Gum	EEC PWSGF	35.5	6	12	
27a	Allocasuarina torulosa	Forest Oak	EEC PWSGF	13	5	07	
27b	Schefflera actinophyll	Umbrella Tree	Exempt	15.5	03	05	
27c	Jacaranda mimosifolia	Jacaranda	Exempt	10	03	03	
27d	Cupressus Sp.	Conifer	Exempt	15	06	05	
29	Eucalyptus paniculata	Grey Ironbark	Dead	25	2	10	
30	Corymbia maculata	Spotted Gum	EEC PWSGF	78	20	20	
31	Corymbia maculata	Spotted Gum	Habitat	101	14	26	Potential Remove
31b	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	28	06	05	

Tree ID	Botanical Name	Common Name	Status	Diameter (cm)	Canopy Spread (m)	Height (m)	Impact (non exempt only)
33	Eucalyptus punctata	Grey Gum	Local Native	20	06	10	
34	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	47	12	14	
35	Acacia prominens	Gosford Wattle	Dead	20	06	12	
35b	Acacia prominens	Gosford Wattle	Dead	20	2	5	
35d	Grevillea robusta	Silky Oak	Exempt	10	02	04	
36	Corymbia maculata	Spotted Gum	EEC PWSGF	57	8	18	
36b	Citharexylum spinosum	Fiddlewood	Exempt	17	06	08	
36c	Citharexylum spinosum	Fiddlewood	Exempt	20	06	08	
36d	Jacaranda mimosifolia	Jacaranda	Exempt	16	05	06	
37	Corymbia maculata	Spotted Gum	EEC PWSGF	20	02	05	
37a	Jacaranda mimosifolia	Jacaranda	Exempt	10	04	05	
37b	Allocasuarina torulosa	Forest Oak	EEC PWSGF	17	02	04	
37c	Corymbia maculata	Spotted Gum	EEC PWSGF	36	12	16	
37e	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	14	02	04	
37f	Allocasuarina torulosa	Forest Oak	EEC PWSGF	12	02	05	
37g	Exocarpos cupressifor	Native Cherry	Local Native	12	04	04	
38	Corymbia maculata	Spotted Gum	Habitat	140	20	32	
39	Corymbia maculata	Spotted Gum	EEC PWSGF	89	18	20	
40	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	40	8	14	
40b	Allocasuarina torulosa	Forest Oak	EEC PWSGF	18	03	08	
40c	Allocasuarina torulosa	Forest Oak	EEC PWSGF	16	03	04	
40d	Jacaranda mimosifolia	Jacaranda	Exempt	12	04	04	
40e	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	12	05	07	
41	Corymbia maculata	Spotted Gum	EEC PWSGF	91	14	20	
42	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	64	14	20	
42b	Jacaranda mimosifolia	Jacaranda	Exempt	32	08	10	
44	Lophostemon confert	Brush Box	Planted	48	16	7	Remove
45	Agathis robusta	Queensland Kauri	Planted	89	08	20	Potential Remove
46	Syncarpia glomulifera	Turpentine	Local Native	71	15	20	Potential Remove
47	Syncarpia glomulifera	Turpentine	Local Native	56	10	12	
47a	Scolopia braunii	Flintwood	Local Native	32	5		Remove
48	Syncarpia glomulifera	Turpentine	Local Native	51	16	20	
48b	Jacaranda mimosifolia	Jacaranda	Exempt	31	08	10	
48d	Jacaranda mimosifolia	Jacaranda	Exempt	12	06	04	
49	Agathis robusta	Queensland Kauri	Planted	66	10	20	
49b	Jacaranda mimosifolia	Jacaranda	Exempt	30	08	08	
49c	Grevillea robusta	Silky Oak	Exempt	21	04	12	
49d	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	12	04	05	
50	Jacaranda mimosifolia	Jacaranda	Exempt	15	06	07	
50a	Acacia implexa	Hickory Wattle	Local Native	8	2	3	
51b	Jacaranda mimosifolia	Jacaranda	Exempt	23	06	07	
51c	Jacaranda mimosifolia	Jacaranda	Exempt	29	06	07	
52	Allocasuarina torulosa	Forest Oak	EEC PWSGF	29	4	10	
54	Allocasuarina torulosa	Forest Oak	EEC PWSGF	19	04	08	
55	Glochidion ferdinandi	Cheese Tree	EEC PWSGF	15	06	06	
56	Agathis robusta	Queensland Kauri	Planted	64	10	22	
58b	Jacaranda mimosifolia	Jacaranda	Exempt	12.5	06	07	
58c	Jacaranda mimosifolia	Jacaranda	Exempt	22	06	08	
58d	Jacaranda mimosifolia	Jacaranda	Exempt	23	06	08	
61	Ficus hillii	Weeping Fig	Exempt	140	82	01	
62	Ligustrum lucidum	Large-leaf Privet	Exempt	35	5	4	
62a	Jacaranda mimosifolia	Jacaranda	Exempt	19	08	10	
62c	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	22	10	10	
62d	Jacaranda mimosifolia	Jacaranda	Exempt	23	06	12	
62e	Syncarpia glomulifera	Turpentine	Local Native	10	06	06	
63	Jacaranda mimosifolia	Jacaranda	Exempt	25	08	10	
64	Ligustrum lucidum	Large-leaf Privet	Exempt	31	10	08	
65	Jacaranda mimosifolia	Jacaranda	Exempt	31	10	08	
66	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	50	08	10	
66b	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	9	03	03	
67	Angophora floribunda	Rough-barked Apple	Dead	12	0	5	
67a	Glochidion ferdinandi	Cheese Tree	EEC PWSGF	30	5	10	Remove
67b	Glochidion ferdinandi	Cheese Tree	EEC PWSGF	25	7	12	Remove
67c	Jacaranda mimosifolia	Jacaranda	Exempt	16.5	06	06	
68	Jacaranda mimosifolia	Jacaranda	Exempt	10.5	06	06	
68b	Castanospermum aus	Black Bean	Exempt	16	06	07	

Tree ID	Botanical Name	Common Name	Status	Diameter (cm)	Canopy Spread (m)	Height (m)	Impact (non exempt only)
68c	Jacaranda mimosifolia	Jacaranda	Exempt	29.5	10	07	
68d	Jacaranda mimosifolia	Jacaranda	Exempt	23.5	02	07	
69a	Casuarina glauca	Grey She-Oak	EEC SOFF	32	08	10	
69c	Casuarina glauca	Grey She-Oak	EEC SOFF	19	2.5	12	Remove
69d	Casuarina glauca	Grey She-Oak	EEC SOFF	34	3	10	Remove
69e	Casuarina glauca	Grey She-Oak	EEC SOFF	23	3.5	08	
69f	Harpephyllum caffrum	Kaffir Plum	Exempt	70	08	10	
69g	Allocasuarina torulosa	Forest Oak	EEC PWSGF	12	2	10	
69h	Brachychiton acerifoliu	Flame Tree	Exempt	22	5	8	
70a	Casuarina glauca	Grey She-Oak	EEC SOFF	27	04	08	
70b	Archontophoenix cunn	Bangalow Palm	Local Native	17.5	5	13	
71	Phoenix canariensis	Canary Island Palm, Phonix	Exempt	80	00	81	
71c	Casuarina glauca	Grey She-Oak	EEC SOFF	48	13	10	Remove
75	Livistona australis	Cabbage Tree Palm	EEC PWSGF	28	8	10	
77a	Livistona australis	Cabbage Tree Palm	EEC PWSGF	29	8	10	
79	Casuarina glauca	Grey She-Oak	EEC SOFF	41	08	10	
80	Casuarina glauca	Grey She-Oak	EEC SOFF	16	04	06	
82	Casuarina glauca	Grey She-Oak	Dead	47	0	7	
82a	Melaleuca styphelioid	Paperbark	EEC SOFF	23	7	06	
84b	Casuarina glauca	Grey She-Oak	EEC SOFF	19.5	12	07	Remove
85	Casuarina glauca	Grey She-Oak	EEC SOFF	33	08	12	
86	Casuarina glauca	Grey She-Oak	EEC SOFF	45.5	4	14	Remove
88	Harpephyllum caffrum	Kaffir Plum	Exempt	43	08	07	
89	Grevillea robusta	Silky Oak	Exempt	38	08	16	
89b	Harpephyllum caffrum	Kaffir Plum	Exempt	38	10	10	
89c	Jacaranda mimosifolia	Jacaranda	Exempt	20.5	06	10	
89f	Casuarina glauca	Grey She-Oak	EEC SOFF	24	3	10	Remove
89g	Allocasuarina torulosa	Forest Oak	EEC PWSGF	20	08	10	
89h	Harpephyllum caffrum	Kaffir Plum	Exempt	27.5	04	07	
89i	Jacaranda mimosifolia	Jacaranda	Exempt	19	04	07	
89k	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	16.5	03	07	
89l	Jacaranda mimosifolia	Jacaranda	Exempt	15.5	10	10	
90	Allocasuarina torulosa	Forest Oak	EEC PWSGF	40	8	12	Remove
90a	Glochidion ferdinandi	Cheese Tree	EEC PWSGF	15	6	7	
90b	Glochidion ferdinandi	Cheese Tree	EEC PWSGF	22.5	06	09	
90c	Jacaranda mimosifolia	Jacaranda	Exempt	19.5	06	04	
91	Leptospemum polyga	Lemon Scented Tea-tree	Planted	48	6	09	
91f	Archontophoenix cunn	Bangalow Palm	Local Native	20	6	14	
92	Corymbia maculata	Spotted Gum	EEC PWSGF	72	12	16	
92a	Melaleuca quinquene	Broad-leafed Paperbark	EEC SOFF	33	05	08	remove
93	Corymbia maculata	Spotted Gum	EEC PWSGF	32	3	12	Remove
94	Corymbia maculata	Spotted Gum	EEC PWSGF	56	9	16	Remove
94a	Magnolia grandiflora	Evergreen Magnolia	Planted	24	7	08	Remove
94b	Allocasuarina torulosa	Forest Oak	EEC PWSGF	14	7	04	Remove
95	Corymbia maculata	Spotted Gum	EEC PWSGF	33	5	10	
95a	Corymbia maculata	Spotted Gum	EEC PWSGF	29	8	16	Remove
95b	Corymbia maculata	Spotted Gum	EEC PWSGF	33	7	14	Remove
95c	Corymbia maculata	Spotted Gum	EEC PWSGF	21	04	09	Remove
96	Corymbia maculata	Spotted Gum	EEC PWSGF	44	14	14	
97	Corymbia maculata	Spotted Gum	EEC PWSGF	30	06	11	
100	Corymbia maculata	Spotted Gum	Habitat	96	16	62	
101	Corymbia maculata	Spotted Gum	Habitat	87	20	20	Potential Remove
102	Corymbia maculata	Spotted Gum	EEC PWSGF	110	30	61	
102a	Corymbia maculata	Spotted Gum	EEC PWSGF	70	16	20	
103	Corymbia maculata	Spotted Gum	EEC PWSGF	53	10	06	Remove
104	Corymbia maculata	Spotted Gum	EEC PWSGF	74	10	16	Monitor for health
104a	Corymbia maculata	Spotted Gum	EEC PWSGF	35	8	12	
104c	Glochidion ferdinandi	Cheese Tree	EEC PWSGF	18	04	03	
104d	Corymbia maculata	Spotted Gum	EEC PWSGF	23	3	16	Monitor for health
104e	Corymbia maculata	Spotted Gum	EEC PWSGF	61	12	16	Monitor for health
104f	Corymbia maculata	Spotted Gum	EEC PWSGF	21	10	10	
105	Corymbia maculata	Spotted Gum	EEC PWSGF	39	12	12	
105a	Corymbia maculata	Spotted Gum	EEC PWSGF	56	16	12	
106	Corymbia maculata	Spotted Gum	EEC PWSGF	35	12	16	
106a	Corymbia maculata	Spotted Gum	EEC PWSGF	30	8	15	
106b	Corymbia maculata	Spotted Gum	EEC PWSGF	20	6	10	

Tree ID	Botanical Name	Common Name	Status	Diameter (cm)	Canopy Spread (m)	Height (m)	Impact (non exempt only)
106c	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	56	08	10	
106d	Ficus rubiginosa	Port Jackson Fig	Local Native	22	6	16	
106e	Eucalyptus umbra	Bastard Mahogany	EEC PWSGF	31	06	04	
106f	Ficus rubiginosa	Port Jackson Fig	Local Native	11	06	06	
107	Corymbia maculata	Spotted Gum	EEC PWSGF	50	12	18	
107a	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	17.5	5	12	
107b	Corymbia maculata	Spotted Gum	EEC PWSGF	12	06	10	
107c	Corymbia maculata	Spotted Gum	EEC PWSGF	16	06	08	
107d	Corymbia maculata	Spotted Gum	EEC PWSGF	51	12	18	
107f	Corymbia gummifera	Bloodwood	EEC PWSGF	11.5	4	10	
108	Corymbia maculata	Spotted Gum	EEC PWSGF	28	10	14	
108a	Eucalyptus umbra	Bastard Mahogany	EEC PWSGF	37	10	14	
108b	Corymbia maculata	Spotted Gum	EEC PWSGF	14	04	07	
108c	Corymbia maculata	Spotted Gum	EEC PWSGF	50	16	14	
108d	Corymbia maculata	Spotted Gum	EEC PWSGF	48.5	16	14	
108e	Corymbia maculata	Spotted Gum	EEC PWSGF	24	7	14	
108h	Jacaranda mimosifolia	Jacaranda	Exempt	21	08	10	
108i	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	15	4	5	
108j	Ficus rubiginosa	Port Jackson Fig	Local Native	26	06	04	
109	Corymbia maculata	Spotted Gum	Dead	30	1	7	
110	Corymbia maculata	Spotted Gum	EEC PWSGF	53	06	08	
111	Corymbia maculata	Spotted Gum	EEC PWSGF	37	12	16	
111a	Corymbia maculata	Spotted Gum	EEC PWSGF	27	8	12	
111b	Corymbia maculata	Spotted Gum	EEC PWSGF	16	06	10	
112	Corymbia maculata	Spotted Gum	EEC PWSGF	49	10	16	
112a	Glochidion ferdinandi	Cheese Tree	EEC PWSGF	26	06	06	
112b	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	14	4	4	
112c	Jacaranda mimosifolia	Jacaranda	Exempt	21	05	04	
112d	Glochidion ferdinandi	Cheese Tree	EEC PWSGF	21	6	7	
113	Corymbia maculata	Spotted Gum	EEC PWSGF	62	10	16	
113a	Eucalyptus umbra	Bastard Mahogany	EEC PWSGF	34	10	16	
113b	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	9.5	06	04	
114	Corymbia maculata	Spotted Gum	Habitat	110	18	20	
115	Corymbia maculata	Spotted Gum	EEC PWSGF	94	20	20	
115a	Syzygium paniculatum	Magenta Lillypilly	Endangered	34	9	12	
115b	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	35	04	08	
115c	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	21	06	06	
115d	Corymbia maculata	Spotted Gum	EEC PWSGF	20.5	06	08	
115e	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	27	8	5	
116	Corymbia maculata	Spotted Gum	Dead	22	2	6	
117	Corymbia maculata	Spotted Gum	Dead	35	1	8	
118	Corymbia maculata	Spotted Gum	EEC PWSGF	67	15	16	
118a	Buckinghamia celissin	Ivory Curl Flower	Planted	16	04	05	Remove
119	Corymbia maculata	Spotted Gum	EEC PWSGF	46	8	14	
119b	Syzygium paniculatum	Magenta Lillypilly	Endangered	32	8	5	Potential Remove
120	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	52	15	18	
120a	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	14	06	05	
121	Corymbia maculata	Spotted Gum	EEC PWSGF	48	14	18	
122	Corymbia maculata	Spotted Gum	EEC PWSGF	92	20	20	
123	Corymbia maculata	Spotted Gum	EEC PWSGF	40	08	12	
124	Corymbia maculata	Spotted Gum	EEC PWSGF	34	08	12	
124b	Corymbia maculata	Spotted Gum	EEC PWSGF	13	04	06	
125	Corymbia maculata	Spotted Gum	EEC PWSGF	18	5	10	
125b	Corymbia maculata	Spotted Gum	EEC PWSGF	42	06	12	
125c	Eucalyptus botryoides	Bangalay	EEC PWSGF	35	12	10	
125d	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	14.5	04	03	
125e	Pittosporum undulatur	Sweet Pittosporum	EEC PWSGF	16.5	04	06	
126	Corymbia maculata	Spotted Gum	EEC PWSGF	100	27	02	
127	Eucalyptus umbra	Bastard Mahogany	EEC PWSGF	32	06	07	
127a	Corymbia maculata	Spotted Gum	EEC PWSGF	33	08	12	
128	Corymbia gummifera	Bloodwood	EEC PWSGF	21	06	12	
128b	Corymbia maculata	Spotted Gum	EEC PWSGF	47	10	14	
129	Eucalyptus umbra	Bastard Mahogany	EEC PWSGF	31	7	09	
129a	Citharexylum spinosum	Fiddlewood	Exempt	30	08	09	
129c	Acacia implexa	Hickory Wattle	Local Native	8	02	03	
129d	Agonis flexuosa	Willow Myrtle	Planted	14	03	03	

Tree ID	Botanical Name	Common Name	Status	Diameter (cm)	Canopy Spread (m)	Height (m)	Impact (non exempt only)
130	Corymbia maculata	Spotted Gum	EEC PWSGF	48	9	14	
130b	Banksia intergrifolia	Coastal Banksia	Local Native	30	6	10	
131	Corymbia maculata	Spotted Gum	EEC PWSGF	45	9	16	
132	Harpephyllum caffrum	Kaffir Plum	Exempt	42	10	08	
133	Eucalyptus paniculata	Grey Ironbark	EEC PWSGF	37	7	12	
134	Agonis flexuosa	Willow Myrtle	Planted	41	08	07	
134b	Arbutus unedo	Irish Strawberry	Planted	24	5	08	
134c	Brachychiton acerifoliu	Flame Tree	Exempt	8.5	04	04	
135	Casuarina glauca	Grey She-Oak	EEC SOFF	32	06	09	
136	Eucalyptus umbra	Bastard Mahogany	EEC PWSGF	49.5	08	16	
136a	Bauhinia divericata	Butterfly Orchid Tree	Planted	12.5	06	04	Remove
136b	Ceratopetalum gummi	NSW Christmas Bush	Local Native	8	04	03	
137	Jacaranda mimosifolia	Jacaranda	Exempt	33	08	08	
137b	Schefflera actinophylla	Umbrella Tree	Exempt	14	04	05	
139b	Corymbia maculata	Spotted Gum	EEC PWSGF	26	1	10	Monitor for health
140	Corymbia maculata	Spotted Gum	EEC PWSGF	85	23	02	
140b	Corymbia maculata	Spotted Gum	Habitat	110	1	12	Keep for Habitat
140c	Erythrina crista-galli	Coral Tree	Exempt	29	31	7	
140d	Erythrina crista-galli	Coral Tree	Exempt	46	51	9	
141a	Cupressus Sp.	Conifer	Exempt	14	02	09	
144a	Corymbia maculata	Spotted Gum	EEC PWSGF	49	12	16	
145a	Corymbia maculata	Spotted Gum	EEC PWSGF	24	08	10	
146a	Corymbia maculata	Spotted Gum	EEC PWSGF	49	16	16	
147a	Corymbia maculata	Spotted Gum	EEC PWSGF	50	10	10	
148b	Casuarina glauca	Grey She-Oak	EEC SOFF	22	06	07	
148c	Casuarina glauca	Grey She-Oak	EEC SOFF	18	5	12	
150a	Acacia implexa	Hickory Wattle	Local Native	11.5	04	04	
151a	Corymbia maculata	Spotted Gum	EEC PWSGF	43	14	16	
152a	Corymbia maculata	Spotted Gum	EEC PWSGF	58	16	16	
153a	Acacia implexa	Hickory Wattle	Local Native	16	4	6	
154a	Acacia implexa	Hickory Wattle	Local Native	13	4	5	
155a	Phoenix canariensis	Canary Island Palm, Phonix	Exempt	70	16	16	
155b	Plumeria sp.	Frangipani	Planted	14	4	4	
155d	Acacia podalyriifolia	Queensland Silver Wattle	Planted	11.5	03	03	
156	Unknown		Dead		0		
157	Avicennia marina	Grey Mangrove	Local Native		5	3	
158	Garden plant	Garden plant	Planted	10	2	2	
159	Garden plant	Garden plant	Planted	10	02	03	
160	Garden plant	Garden plant	Planted	10	02	09	
161	Garden plant	Garden plant	Planted	10	02	08	
162	Garden plant	Garden plant	Planted	10	04	03	
163	Garden plant	Garden plant	Planted	10	04	03	
164	Not identified		Outside	10	04	04	
165	Not identified		Outside	10	04	04	
166	Not identified		Outside	10	04	04	
167	Not identified		Outside	10	04	06	
168	Not identified		Outside	20	04	04	
169	Not identified		Outside	20	04	05	

BAM Predicted Species Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00012453/BAAS17083/18/00012514	Cabarita	07/11/2018
Assessor Name	**Report Created**	**BAM Data version ***
Nick Skelton	14/12/2018	4
Assessor Number	* 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.	
BAAS17083		

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)
Eastern Bentwing-bat	Miniopterus schreibersii oceanensis	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Eastern Freetail-bat	Mormopterus norfolkensis	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Eastern Osprey	Pandion cristatus	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Gang-gang Cockatoo	Callocephalon fimbriatum	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Glossy Black-Cockatoo	Calyptorhynchus lathami	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Grey-headed Flying-fox	Pteropus poliocephalus	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Koala	Phascolarctos cinereus	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Little Bentwing-bat	Miniopterus australis	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Little Eagle	Hieraaetus morphnoides	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Little Lorikeet	Glossopsitta pusilla	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Masked Owl	Tyto novaehollandiae	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion

Powerful Owl	Ninox strenua	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Regent Honeyeater	Anthochaera phrygia	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Rosenberg's Goanna	Varanus rosenbergi	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Scarlet Robin	Petroica boodang	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Spotted-tailed Quoll	Dasyurus maculatus	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Swift Parrot	Lathamus discolor	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Varied Sittella	Daphoenositta chrysoptera	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion

BAM Candidate Species Report

Proposal Details

Assessment Id
00012453/BAAS17083/18/00012514

Proposal Name
Cabarita

BAM data last updated *
07/11/2018

Assessor Name
Nick Skelton

Report Created
14/12/2018

BAM Data version *
4

Assessor Number
BAAS17083

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List of Species Requiring Survey

Name	Presence	Survey Months
Burhinus grallarius Bush Stone-curlew	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Calyptorhynchus lathami Glossy Black-Cockatoo	No (surveyed)	Mar Apr May Jun Jul Aug
Chalinolobus dwyeri Large-eared Pied Bat	Yes (assumed present)	Jan Feb Mar Sep Oct Nov Dec
Myotis macropus Southern Myotis	Yes (assumed present)	Jan Feb Mar Nov Dec
Pandion cristatus Eastern Osprey	No (surveyed)	Apr May Jun Jul Aug Sep Oct Nov
Petaurus norfolcensis Squirrel Glider	No (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Syzygium paniculatum Magenta Lilly Pilly	Yes (surveyed)	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Tyto novaehollandiae Masked Owl	No (surveyed)	Jan Feb Mar Apr **May** **Jun** **Jul** **Aug** Sep Oct Nov Dec
Hieraaetus morphnoides Little Eagle	No (surveyed)	Jan Feb Mar Apr May Jun Jul **Aug** **Sep** **Oct** Nov Dec

List of Species Not On Site

Name
Cercartetus nanus Eastern Pygmy-possum
Hygrocybe aurantipes Hygrocybe aurantipes
Lathamus discolor Swift Parrot
Litoria brevipalmata Green-thighed Frog
Miniopterus australis Little Bentwing-bat
Miniopterus schreibersii oceanensis Eastern Bentwing-bat
Ninox strenua Powerful Owl
Phascolarctos cinereus Koala
Pseudophryne australis Red-crowned Toadlet
Pteropus poliocephalus Grey-headed Flying-fox
Tetratheca glandulosa Tetratheca glandulosa
Anthochaera phrygia Regent Honeyeater
Genoplesium baueri Bauer's Midge Orchid
Callocephalon fimbriatum Gang-gang Cockatoo
Diuris bracteata Diuris bracteata
Turnix maculosus Red-backed Button-quail

BAM Vegetation Zones Report

Proposal Details

Assessment Id
00012453/BAAS17083/18/00012514

Assessment name
Cabarita

BAM data last updated *
07/11/2018

Assessor Name
Nick Skelton

Report Created
14/12/2018

BAM Data version *
4

Assessor Number
BAAS17083

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Vegetation Zones

#	Name	PCT	Condition	Area	Minimum number of plots	Management zones
1	1214_Zone1	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion	Zone1	0.22	1	MZ1 (0.16 ha) MZ2 (0.06 ha)

BAM Vegetation Zones Report

2	1214_Zone2	1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion	Zone2	0.25	1	MZ1 (0.23 ha) MZ2 (0.02 ha)

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00012453/BAAS17083/18/00012514

Proposal Name
Cabarita

BAM data last updated *
07/11/2018

Assessor Name
Nick Skelton

Assessor Number
BAAS17083

BAM Data version *
4

Proponent Name(s)

Report Created
14/12/2018

* 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.

Candidate Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

BAM Biodiversity Credit Report (Variations)

No Changes

Ecosystem Credit Summary

PCT	TEC	Area	Credits
1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	0.5	7.00

Credit classes for 1214

Like-for-like options

Any PCT with the below TEC	Containing HBT	In the below IBRA subregions
Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion (including PCT's 1214, 1589)	Yes	Pittwater,Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Any PCT in the below Formation	And in any of below trading groups	Containing HBT	In the below IBRA regions/subregions
Wet Sclerophyll Forests (Grassy sub-formation)	Tier 3 or higher	Yes (including artificial)	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Variations)

Species Credit Summary

Species	Area	Credits
Chalinolobus dwyeri / Large-eared Pied Bat	0.5	11.00
Myotis macropus / Southern Myotis	0.5	7.00
Syzygium paniculatum / Magenta Lilly Pilly	1.0	2.00

Chalinolobus dwyeri/ Large-eared Pied Bat	1214_Zone1	**Like-for-like options**		
		Only the below Spp	In the below IBRA subregions	
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Any Spp in the below Kingdom	Any species with same or higher category of listing under Part 4 of teh BC Act showb below	In the below IBRA subregions
		Fauna	Vulnerable	Pittwater,Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1214_Zone2	**Like-for-like options**		
		Only the below Spp	In the below IBRA subregions	

		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
		Variation options		
		Any Spp in the below Kingdom	Any species with same or higher category of listing under Part 4 of teh BC Act showb below	In the below IBRA subregions
		Fauna	Vulnerable	Pittwater,Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Myotis macropus/ Southern Myotis	1214_Zone1	**Like-for-like options**		
		Only the below Spp	In the below IBRA subregions	
		Myotis macropus/Southern Myotis	Any in NSW	
		Variation options		
		Any Spp in the below Kingdom	Any species with same or higher category of listing under Part 4 of teh BC Act showb below	In the below IBRA subregions

		Fauna	Vulnerable	Pittwater,Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1214_Zone2	**Like-for-like options**		
		Only the below Spp	In the below IBRA subregions	
		Myotis macropus/Southern Myotis	Any in NSW	
		Variation options		
		Any Spp in the below Kingdom	Any species with same or higher category of listing under Part 4 of teh BC Act showb below	In the below IBRA subregions
		Fauna	Vulnerable	Pittwater,Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Syzygium paniculatum/ Magenta Lilly Pilly	1214_Zone1	**Like-for-like options**		
		Only the below Spp	In the below IBRA subregions	
		Syzygium paniculatum/Magenta Lilly Pilly	Any in NSW	

Syzygium paniculatum/ Magenta Lilly Pilly	1214_Zone1	**Variation options**		
		Any Spp in the below Kingdom	Any species with same or higher category of listing under Part 4 of teh BC Act showb below	In the below IBRA subregions
		Flora	Endangered	Pittwater,Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Biodiversity payment summary report

Assessment Id	Payment data version	Revision number	Report created
00012453/BAAS17083/18/00012514	41	0	13/11/2018

PCT list

Include	PCT common name	Credits
Yes	**1214 -** Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion	8

Species list

Include	Species	Credits
Yes	***Chalinolobus dwyeri*** (Large-eared Pied Bat)	13
Yes	***Myotis macropus*** (Southern Myotis)	8
Yes	***Syzygium paniculatum*** (Magenta Lilly Pilly)	2

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

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00012453/BAAS17083/18/00012514

Proposal Name
Cabarita

BAM data last updated *
07/11/2018

Assessor Name
Nick Skelton

Assessor Number
BAAS17083

BAM Data version *
4

Proponent Names

Report Created
14/12/2018

* 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.

Candidate Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

BAM Biodiversity Credit Report (Like for like)

No Changes

Ecosystem Credit Summary

PCT	TEC	Area	Credits
1214-Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion	Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion	0.5	7.00

Credit classes for 1214

Like-for-like options

Any PCT with the below TEC	Containing HBT	In the below IBRA subregions
Pittwater and Wagstaffe Spotted Gum Forest in the Sydney Basin Bioregion (including PCT's 1214, 1589)	Yes	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	Area	Credits
Chalinolobus dwyeri / Large-eared Pied Bat	0.5	11.00

Myotis macropus / Southern Myotis	0.5	7.00
Syzygium paniculatum / Magenta Lilly Pilly	1.0	2.00

Chalinolobus dwyeri/ Large-eared Pied Bat	1214_Zone1	**Like-for-like options**	
		Only the below Spp	In the below IBRA subregions
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
	1214_Zone2	**Like-for-like options**	
		Only the below Spp	In the below IBRA subregions
		Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW
Myotis macropus/ Southern Myotis	1214_Zone1	**Like-for-like options**	
		Only the below Spp	In the below IBRA subregions
		Myotis macropus/Southern Myotis	Any in NSW

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00012453/BAAS17083/18/00012514	Cabarita	07/11/2018
Assessor Name	Report Created	BAM Data version *
Nick Skelton	14/12/2018	4
Assessor Number	* 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.	
BAAS17083		

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Candidate SAII	Ecosystem credits
Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion								
1	1214_Zone1	38.1	0.2	0.25	High Sensitivity to Potential Gain	2.00	TRUE	4
2	1214_Zone2	27.5	0.3	0.25	High Sensitivity to Potential Gain	2.00	TRUE	3
							Subtotal	**7**
							Total	**7**

BAM Credit Summary Report

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Candidate SAII	Species credits
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)						
1214_Zone1	38.1	0.22	0.25	3	True	6
1214_Zone2	25.9	0.25	0.25	3	True	5
					Subtotal	**11**
Myotis macropus / Southern Myotis (Fauna)						
1214_Zone1	38.1	0.22	0.25	2	False	4
1214_Zone2	25.9	0.25	0.25	2	False	3
					Subtotal	**7**
Syzygium paniculatum / Magenta Lilly Pilly (Flora)						
1214_Zone1	N/A	1	0.25	2	False	2
					Subtotal	**2**

Biodiversity payment summary report

Assessment Id	Payment data version	Revision number	Report created
00012453/BAAS17083/18/00012514	41	0	14/12/2018

PCT list

Include	PCT common name	Credits
Yes	**1214 -** Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion	7

Species list

Include	Species	Credits
Yes	***Chalinolobus dwyeri*** (Large-eared Pied Bat)	11
Yes	***Myotis macropus*** (Southern Myotis)	7
Yes	***Syzygium paniculatum*** (Magenta Lilly Pilly)	2

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

Biodiversity payment summary report

IBRA sub region	PCT common name	Baseline price	Dynamic coefficient	Market coefficient	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Pittwater	**1214 -** Spotted Gum - Grey Ironbark open forest in the Pittwater and Wagstaffe area, Sydney Basin Bioregion **Warning: This PCT has NO trades recorded**	$2,602.71			33.10%	$20.00	1.0000	$3,484.21	7	$24,389.45

Subtotal (excl. GST)	**$24,389.45**
GST	**$2,438.94**
Total ecosystem credits (incl. GST)	**$26,828.40**

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	$816.33	24.8700%	$20.00	11	$11,432.86
10549	***Myotis macropus*** (Southern Myotis)	Vulnerable	$816.33	24.8700%	$20.00	7	$7,275.46
10794	***Syzygium paniculatum*** (Magenta Lilly Pilly)	Endangered	$1,632.65	24.8700%	$20.00	2	$4,117.38

Subtotal (excl. GST)	**$22,825.70**

Biodiversity payment summary report

	GST	**$2,282.57**
Total species credits (incl. GST)		**$25,108.27**
	Grand total	**$51,936.67**

Landscape Master Plan
1:300@A1 1:600@A3.

No existing native plants are to be removed from the VRA (Vegetated Riparian Areas)

See separate report and design by GIS Environmental for EPA and NRA

See separate report and design by GIS Environmental for EPA and NRA

No existing native plants are to be removed from the EPA or NRA

All turf areas at existing ground level. No changes to existing soil levels

Legend

- MULCH AREA
- NATIVE GRASS REVEGETATION ARE
- TURF AREA
- TIMBER DECKING
- CONCRETE PAVING
- NATURAL STONE BOULDERS
- NATURAL STONE STEPPERS
- STONE STAIRS
- TIMBER STAIRS
- STAIRS
- PEBBLE
- BIO-SWALES
- TIMBER
- WATER
- EXISTING TREE LOCATION
- MASONRY RETAINING WALL
- STONE RETAINING WALL
- TIMBER RETAINING WALL
- BOULDER RETAINING WALL
- SITE OR WORKS BOUNDARY
- + 88.88 PROPOSED LEVEL
- +TW 88.88 TOP OF WALL LEVEL
- Paving 1 MATERIAL NAME
- Fall SURFACE FALL DIRECTION
- SURFACE DRAINS
- +88.88 SURVEY (50% GREY LINES)
- NATIVE REVEGETATION AREA (NRA)
- ENVIRONMENT PROTECTION AREA
- VRA LANDSCAPE AREA TYPE A
- VRA LANDSCAPE AREA TYPE B

Plant Schedule - Landcape Area Type A

ID	Quantity	Latin Name	Common Name	Plantlist Name	Scheduled Size	Mature Height	Mature Spread
13	839	13	13	13	13	13	13
CasGl	10	Casuarina glauca	Grey (Swamp) She-oak	Casuarina glauca	45L	over 30m	10 - 15m
Cor mac	1	Corymbia maculata	Spotted Gum	Corymbia maculata	75L	20-30m	8-10m
CrPe	11	Crinum pedunculatum	Swamp Lily, River Lily	Crinum pedunculatum	300mm	1.5 - 3m	0.9 - 1.2m
DiaCae	100	Dianella caerulea	Paroo Lily, Blue Flax-lily	Dianella caerulea	Tube-stock	0.45 - 0.6m	0.3 - 0.6m
DoTr	17	Dodonaea triquetra	Common Hop Bush	Dodonaea triquetra	200mm	3 - 5m	2.0 - 3.5m
DoryExc	9	Doryanthes excelsa	Gymea Lily, Giant Lily	Dory excel	25lt	1.5 - 3m	1.2 - 2.0m
HaSe	21	Hakea sericea	Needlebush	Hakea sericea	200mm	3 - 5m	2.0 - 3.5m
Junc usi	299	Juncus usitatus	Common Rush	Jun usi	Viro-cell	0.9 - 1.5m	0.6 - 0.9m
LomLong	331	Lomandra longifolia	Spiny-headed Mat-Rush	Lomandra longi	150mm	0.75 - 0.9m	0.9 - 1.2m
Macro comm	3	Macrozamia communis	Burrawang	Macrozamia communis	300mm	1.0m	1.5m
MeEr	9	Melaleuca ericifolia	Swamp Paperbark	Melaleuca ericifolia	45L	9m	6m
West fru	10	Westringia fruticosa	Coastal Rosemary	Wes fru	150mm	0.9 - 1.5m	0.9 - 1.2m
XanMac	18	Xanthorrhoea macronema	Bottlebrush Grass Tree	Xanth mac	45lt	0.90 - 1.50m	0.9 - 1.2m

Plant Schedule - Landcape Area Type B

ID	Quantity	Latin Name	Common Name	Plantlist Name	Scheduled Size	Mature Height	Mature Spread
16	979	16	16	16	16	16	16
AcFlo	30	Acacia floribunda	White Sally Wattle	Acacia floribunda	200mm	3 - 5m	2.0 - 3.5m
CasGl	5	Casuarina glauca	Grey (Swamp) She-oak	Casuarina glauca	45L	over 30m	10 - 15m
CoAlb	13	Correa alba	White Correa	Correa alba	300mm	3 - 5m	2.0 - 3.5m
CrPe	43	Crinum pedunculatum	Swamp Lily, River Lily	Crinum pedunculatum	300mm	1.5 - 3m	0.9 - 1.2m
DiaCae	293	Dianella caerulea	Paroo Lily, Blue Flax-lily	Dianella caerulea	Tube-stock	0.45 - 0.6m	0.3 - 0.6m
DoTr	19	Dodonaea triquetra	Common Hop Bush	Dodonaea triquetra	200mm	3 - 5m	2.0 - 3.5m
DoryExc	35	Doryanthes excelsa	Gymea Lily, Giant Lily	Dory excel	25lt	1.5 - 3m	1.2 - 2.0m
E. reticulatus	16	Elaeocarpus reticulatus	Blueberry Ash	E reticulatus	25lt	5 - 10m	3.5 - 6m
HaSe	30	Hakea sericea	Needlebush	Hakea sericea	200mm	3 - 5m	2.0 - 3.5m
Junc usi	78	Juncus usitatus	Common Rush	Jun usi	Viro-cell	0.9 - 1.5m	0.6 - 0.9m
LivAust	2	Livistona australis	Cabbage-tree Palm	Livistona aust	45L	15 - 20m	6 - 10m
LomLong	331	Lomandra longifolia	Spiny-headed Mat-Rush	Lomandra longi	150mm	0.75 - 0.9m	0.9 - 1.2m
Macro comm	51	Macrozamia communis	Burrawang	Macrozamia communis	300mm	1.0m	1.5m
MyAc	11	Myoporum acuminatum	Boobialla	Myoporum acuminatum	150mm	3 - 5m	2.0 - 3.5m
West fru	9	Westringia fruticosa	Coastal Rosemary	Wes fru	150mm	0.9 - 1.5m	0.9 - 1.2m
XanMac	13	Xanthorrhoea macronema	Bottlebrush Grass Tree	Xanth mac	45lt	0.90 - 1.50m	0.9 - 1.2m

Plant Schedule - Landcape Area Type C

ID	Quantity	Latin Name	Common Name	Plantlist Name	Scheduled Size	Mature Height	Mature Spread
39	4565	39	39	39	39	39	39
AcFlo	97	Acacia floribunda	White Sally Wattle,	Acacia floribunda	200mm	3 - 5m	2.0 - 3.5m
AcLo	40	Acacia longifolia var. longifolia	Sydney Golden Wattle	Acacia longifolia var. longi	300mm	3 - 5m	2.0 - 3.5m
Alp red	20	Alpinia 'red back'	Red back Ginger	Alp redback	200mm	0.9 - 1.5m	0.9 - 1.2m
A. Cost	2	Angophora costata	Sydney Red Gum, Smooth-bar	A. costata	100lt	15 - 20m	6 - 10m
BaSpHa	22	Banksia spinulosa	Hairpin Banksia	Banksia spinulosa	300mm	3 - 5m	2.0 - 3.5m
BlIn	13	Blechnum indicum	Swamp Water Fern	Blechnum indicum	150mm	0.9m	0.9m
CalSa	2	Callistemon salignus	Willow Bottlebrush	Callistemon salignus	45L	10m	10m
CaAp	55	Carex appressa	Tall Sedge	Carex appressa	Tubestock	1.5 - 3m	0.9 - 1.2m
Carpo brot	27	Carpobrotus glaucescens	Coastal Moonflower, Pigface, I	Carp bro	Viro-cell	0.0 - 0.3m	1.2 - 2.0m
CeGu	12	Ceratopetalum gummiferum	NSW Christmas Bush	Ceratopetalum gummiferu	45Lt	8 - 13m	4 - 6m
CoAlb	11	Correa alba	White Correa	Correa alba	300mm	3 - 5m	2.0 - 3.5m
Cor mac	8	Corymbia maculata	Spotted Gum	Corymbia maculata	75L	20-30m	8-10m
CrPe	33	Crinum pedunculatum	Swamp Lily, River Lily	Crinum pedunculatum	300mm	1.5 - 3m	0.9 - 1.2m
Cup ana	29	Cupaniopsis anacardioides	Tuckeroo	Cupaniopsis anacardioides	45lt	10 - 15m	3.5 - 6m
DiaCae	456	Dianella caerulea	Paroo Lily, Blue Flax-lily	Dianella caerulea	Tubestock	0.45 - 0.6m	0.3 - 0.6m
Dic sil	26	Dichondra 'Silver falls'	Silver falls	Dic silv	150mm	0.0 - 0.3m	0.9 - 1.2m
DoTr	17	Dodonaea triquetra	Common Hop Bush	Dodonaea triquetra	200mm	3 - 5m	2.0 - 3.5m
DoryExc	46	Doryanthes excelsa	Gymea Lily, Giant Lily	Dory excel	25lt	1.5 - 3m	1.2 - 2.0m
Drac drac	1	Dracaena draco	Dragon tree	Draco draco	100lt	Height	Spread
E. reticulatus	26	Elaeocarpus reticulatus	Blueberry Ash	E reticulatus	25lt	5 - 10m	3.5 - 6m
FicNod	639	Ficinia nodosa	Knobby Club Rush	Ficinia nodosa	150mm	0.5m	0.4m
Grevillea Sup	5	Grevillea x 'Superb'	Superb Grevillea	Grevillea Superb	200mm	1.5 - 3m	1.2 - 2.0m
HaSe	17	Hakea sericea	Needlebush	Hakea sericea	200mm	3 - 5m	2.0 - 3.5m
IsIn	66	Isolepis inundata	Swamp Club-rush	Isolepis inundata	Tubestock	1.5 - 3m	0.9 - 1.2m
Junc usi	119	Juncus usitatus	Common Rush	Jun usi	Viro-cell	0.9 - 1.5m	0.6 - 0.9m
Lepto sper	8	Leptospermum laevigatum	Coast Tea-Tree	Lepto spe	250mm	1.5 - 3m	1.2 - 2.0m
LivAust	22	Livistona australis	Cabbage-tree Palm	Livistona aust	45L	15 - 20m	6 - 10m
LomLong	544	Lomandra longifolia	Spiny-headed Mat-Rush	Lomandra longi	150mm	0.75 - 0.9m	0.9 - 1.2m
Macro comm	16	Macrozamia communis	Burrawang	Macrozamia communis	300mm	1.0m	1.5m
MeAl	1	Melaleuca alternifolia	Narrow Leaf Paperbark	Melaleuca alternifolia	25L	3-6m	2-4m
MeEr	5	Melaleuca ericifolia	Swamp Paperbark	Melaleuca ericifolia	45L	9m	6m
MyAc	9	Myoporum acuminatum	Boobialla	Myoporum acuminatum	150mm	3 - 5m	2.0 - 3.5m
Pand pand	45	Pandorea pandorana	Wonga Wonga Vine	Pand pandor	150mm	3 - 5m	0.6 - 0.9m
PhilMyop	3	Philotheca myoporoides	White Wax Flower	Philotheca myoporoides	300mm	1.5 - 2.0m	1.0 - 1.5m
PoaKing	954	Poa poiformis	coastal poa	Poa Kingsdale	Viro Cell	0.75 - 0.9m	0.3 - 0.6m
ThAu	1104	Themeda australis/triandra	Kangaroo Grass	Themeda australis/triandra	Tubestock	1.0m	0.6m
Tri Lau	9	Tristaniopsis laurina 'Luscious'	Kanooka, Water Gum	Tri laur	45lt	12 - 15m	3.5 - 6m
West fru	30	Westringia fruticosa	Coastal Rosemary	Wes fru	150mm	0.9 - 1.5m	0.9 - 1.2m
XanMac	26	Xanthorrhoea macronema	Bottlebrush Grass Tree	Xanth mac	45lt	0.90 - 1.50m	0.9 - 1.2m
	0						

Note:- Dwelling houses subject to separate DA's
- See separate landscape plans for each lot for planting information

ISSUE	DATE	REVISION
C	28/11/18	Issue C for DA
B	29/10/18	DRAFT Issue B
A	9/10/18	DRAFT Issue for review

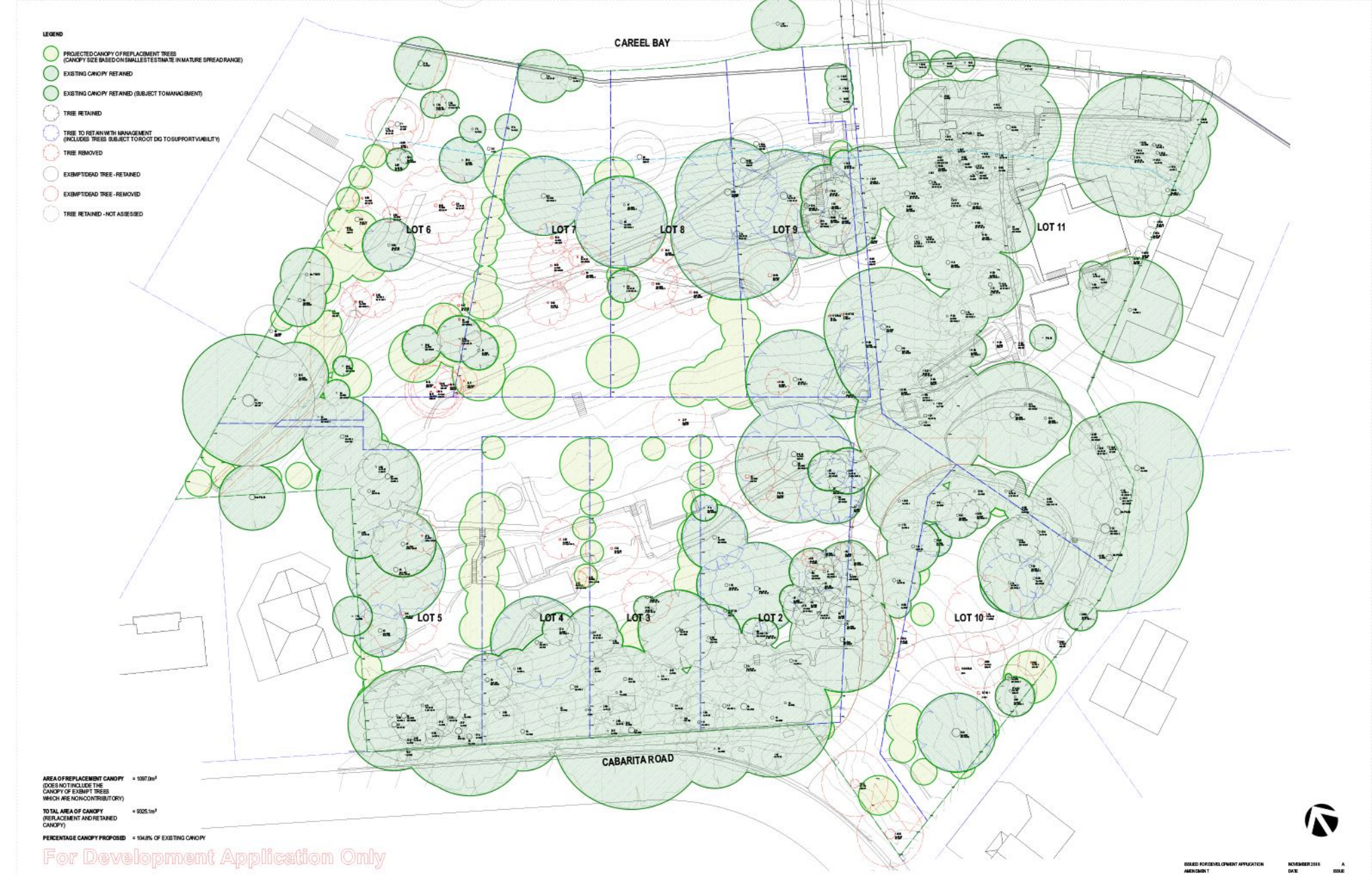
Notes:
>Do not scale off plan.
>Contractors to check all measurements onsite before quoting or commencing work.
>If abnormalities arise, contact the Landscape Architect.
>This design is copyright and is not to be reproduced in anyway without written consent of Jamie King Landscape Architect

north

JAMIE KING
LANDSCAPE ARCHITECT
DESIGN • APPROVE • MANAGE

PROJECT	96 Cabarita Rd, Avalon Beach		PROJECT # 1916
CLIENT	Meraki Developments	DATE # See above / SCALE @A1 See plan	DWG # Sht-101
DWG	Landscape Masterplan	DRAWN LA/SA / CHKD JK	REVISION

Jamie King Landscape Architect
84 Palmgrove Rd, Avalon, NSW, 2107 T: 0421 517 991
W: www.jamieking.com.au
E: designer@jamieking.com.au



REPLACEMENT CANOPY

RESIDENTIAL SUBDIVISION

96-104 CABARITA ROAD AVALON BEACH

1801 SK209 A

1:250 @ A1 1:500 @ A3

NOVEMBER 2018

MERMAID DEVELOPMENTS PTY LIMITED

ISSUED FOR DEVELOPMENT APPLICATION NOVEMBER 2018 A
AMENDMENT DATE ISSUE

MARK HURCUM DESIGN PRACTICE ARCHITECTS
LEVEL 2 371 ALFRED STREET NORTH
NORTH SYDNEY NSW 2060
FACSIMILE 02) 9955 5963
TELEPHONE 02) 9955 5488

DESIGN PRACTICE

Monday, 10 December 2018