Peninsula Gardens - 79 Cabbage Tree Road Bayview

Flora and Fauna Assessment

Aveo

12 October 2019

Final

(02) 9868 1933 | PO Box 2474 Carlingford Court NSW 2118 | cumberlandecology.com.au

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Approved by:	David Robertson
Position:	Director
Signed:	
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Glossary

Aveo	Aveo North Shore Retirement Villages Pty Ltd
BAM	Biodiversity Assessment Method
BAM-c	Biodiversity Assessment Method calculator
BBAM	BioBanking Assessment Methodology
BC Act	NSW Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
CCEMF	Central Coast Escarpment Moist Forest
Council	Northern Beaches Council
CWTF	Coastal Warm Temperate Rainforest
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
ELA	EcoLogical Australia
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act
Existing consent	Development Consent no 82-149
FFA	Flora and Fauna Assessment
LEC	NSW Land and Environment Court
LEP	Local Environment Plan
LGA	Local Government Area
NRAR	National Resources Access Regulator
OEH	former NSW Office of Environment and Heritage
PCT	Plant Community Type
S34	Section 34 conference
SoFC	Statement of Facts and Contentions
study area	land within Lot 20 DP 632081
TEC	Threatened Ecological Community
the Transitional Regulations	Biodiversity Conservation (Savings and Transitional) Regulation 2017
TSC Act	NSW Threatened Species Conservation Act 1995

1. Introduction

1.1. Purpose

Cumberland Ecology Pty Ltd (Cumberland Ecology) has been engaged by Aveo North Shore Retirement Villages Pty Ltd (Aveo) to prepare a supplementary Flora and Fauna Assessment (FFA) to augment assessments previously conducted for development of Stage 2 works within the land at 79 Cabbage Tree Road, Bayview NSW (Lot 20 DP 632081; hereafter referred to as the 'study area') (**Figure 1**).

This supplementary ecological assessment is to be provided to Northern Beaches Council (Council) for consideration in relation to the NSW Land and Environment Court (LEC) Proceeding 2018/00295642.

The purpose of this report is to augment the previous ecological assessments with a particular focus on specific ecological concerns raised by Council in the Statement of Facts and Contentions (SoFC) for the proceedings and due consideration to amendments to the development layout since the prior ecological assessments.

The specific objectives of this report are to:

- Describe the vegetation communities within the Stage 2 development area and wider subject land;
- Describe fauna habitats and potential fauna usage within the Stage 2 development area and wider subject land;
- Identify any threatened species, populations or ecological communities (as listed under state and commonwealth legislation) within the Stage 2 development area and wider study area;
- Assess the difference in impacts between the initial pre-Section 34 (S34) conference development layout and the revised plans following the S34 conference and without prejudice meetings;
- Assess the potential impact of the proposed post S34 conference development layout on threatened communities, flora and fauna; and
- Where relevant, recommend mitigation measures to reduce the impacts of the proposed development on biodiversity values.

1.2. Background

1.2.1. Project Status

Aveo is proposing a modification to Development Consent no 82-149 (the 'Existing Consent') to enable construction of Stage 2 of a seniors housing development within the study area.

The Existing Consent was granted on 9 March 1982 by the NSW Land and Environment Court (LEC) and permitted a seniors housing development to be constructed in two stages within the study area. Stage 1 has since been constructed within the central and eastern to south-eastern parts of the study area (**Figure 1**). Stage 2 has not been constructed and the Existing Consent has been modified on several occasions since 1982. These modifications have largely sought to reduce the number of independent living units for Stage 2.

The most recent modification application for Stage 2, was lodged by Aveo with Council on 16 February 2018. The ecological documentation submitted with the February 2018 application comprised a Flora and Fauna Assessment report (FFA) and a Biodiversity Management Plan (BMP) prepared by EcoLogical Australia (ELA). During the assessment process, Council issued a number of referral responses, including one in relation to the ecological impacts on 25 May 2018, which was subsequently updated on 2 August 2018.

Aveo filed an appeal in the LEC against Council's deemed refusal of the modification application on 27 September 2018. A Statement of Facts and Contentions was filed by Council on 26 October 2018. Cumberland Ecology was commissioned by Aveo to serve as ecology experts for the proceedings.

A Section 34 conciliation conference (S34 conference) for the proceedings was held on 8 May 2019 between Council and Aveo. Although the matter was not resolved at the conciliation conference, Aveo and Council continued to have without prejudice discussions to resolve the contentions and determine if the proceedings can be settled by agreement. Cumberland Ecology, serving as ecological experts for Aveo, met Council ecologists onsite on 30 May 2019 for a without prejudice discussion to further determine Council concerns on ecological matters as raised in the SoFC.

In response to Council's concerns, Aveo has amended the proposed development layout. This FFA provides an ecological assessment of the revised development layout provided by Aveo on 26 September 2019, with consideration to concerns raised by Council in the SoFC, during the s34 Conference and the onsite meeting on 30 May 2019.

1.2.2. Site Description

The study area is approximately 7.2 ha in area and is located in the Northern Beaches Local Government Area (LGA). It is bound by lots along to Cabbage Tree Road to the north, lots along to Old Samuel Street to the east, lots along Whipbird Circuit to the south-east and a large area of bushland to the west and south-west (**Figure 1**). A large portion of the land, mainly the central, eastern and south-eastern parts, is currently being utilized as a retirement village.

The study area is located on the eastern edges of a corridor of native bushland that extends from the suburb of Warriewood and Western Mona Vale into Bayview. The Katandra Bushland Reserve is located within the bushland corridor to the south-west of the study area.

The majority of the study area has been mapped as Biodiversity under the Pittwater Local Environment Plan (LEP) 2014, Pittwater being one of the three former LGAs amalgamated into the current Northern Beaches LGA. This layer covers the vegetated areas of the study area, along with existing buildings, cleared areas, and recreational areas (**Figure 2**).

One 1st order watercourse is present in the central to western portion of the study area (**Figure 3**). It arises in the central western portion of the study area and flows eastwards. The central to eastern parts of this watercourse within the study area is currently piped.

1.2.3. Proposed Development

The proposed development involves the construction of an additional 7 buildings with associated new roads, generally in the north-eastern portion of the study area with associated asset protection zones (APZ) (**Figure 3**). The proposed development area comprises areas that are to be fully cleared for hardstand development (including parts of the APZ) and partial clearing/modification in additional APZ areas that do not overlap with the development footprint. These areas will require under-scrubbing (removal) of midstorey vegetation in vegetated areas along with the trimming of tree canopies to achieve appropriate separation. The location of the APZ and development footprint are shown on **Figure 3**.

1.2.4. Ecological Matters Raised in Statement of Facts and Contentions

The ecological matters raised in the SoFC filed by Council include:

- Increase in legislative protections and conservation significance of vegetation within the study area in the 36 years since the original application was approved;
- Assessment of the impacts of the proposed development on *Rhodamnia rubescens* (Scrub Turpentine);
- Potential impacts of the proposal on threatened owl species, in particular Powerful Owl;
- Requirement of compensatory offsets for removal/modification of native vegetation;
- Requirement to avoid, minimise and mitigate impacts of the proposed development on flora and fauna;
- Demonstration that the development layout will not alter creek and riparian vegetation downslope of the development (including an area of Coastal Warm Temperate Rainforest);
- Impacts on existing vegetation as a consequence of the need to comply with the general terms of approval issued by the RFS.

This FFA largely focuses on addressing these matters raised in the SoFC.

1.3. Approval Pathway

Under the NSW Land Management and Biodiversity Conservation reform the NSW *Threatened Species Conservation Act 1995* (TSC Act) has been repealed and has been replaced by the NSW *Biodiversity Conservation Act 2016* (BC Act). The BC Act was originally set to commence on 25 August 2017, however extensions to this commencement date were gazetted which resulted in its commencement within the Northern Beaches LGA on 1 March 2018.

The NSW Government has established transitional arrangements related to biodiversity assessment for development consent or approval that are underway or have already been made. These are set out in the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* (the Transitional Regulations). In particular, Part 7 Clause 28 of the Transitional Regulations states that *"former planning provisions continue to*

apply (and Part 7 of the new Act does not apply) to the determination of a pending or interim planning application."

Part 7 Clause 27 of the Transitional Regulations provides several definitions of pending or interim planning applications. In particular, sub-clause (a) of the definitions defines a pending or interim application as '*an application for planning approval (or for the modification of a planning approval) made before the commencement of the new Act but not finally determined immediately before that commencement*'.

As the modification application for Stage 2 was submitted on 16 February 2018, prior to the formal commencement of the BC Act within the Northern Beaches LGA, and is currently not '*finally determined*' due to the commencement of LEC proceedings, we have been advised that the provisions of the TSC Act currently continue to apply to the modification application. Therefore, this FFA has been prepared in accordance with the provisions of the TSC Act.

With the commencement of the BC Act, all listings for threatened species, populations and communities under the TSC Act were legally transferred to the BC Act. However Clause 31 of the Transitional Regulations states that "*For the purposes of the application of the former planning provisions in accordance with this Part, any change under the new Act to the listings of threatened species and ecological communities is taken to be a corresponding change to the listings under the Threatened Species Conservation Act 1995 referred to in the former planning provisions*".

As the project is being assessed under the transitional provisions for the TSC Act, for the purposes of consistency the TSC Act is referred to for threatened species and community listings within this FFA. However due consideration is given to changes in listings under the BC Act where relevant in accordance with Section 31 of the Transitional Regulation and all mentions of threatened flora and fauna and ecological communities listed under the TSC Act in this report remain under the same listing under the BC Act.

As this project is being assessed under the TSC Act, calculations of compensatory measures utilising the Biodiversity Assessment Method (BAM) and preparation of a Biodiversity Development Assessment Report (BDAR) do not formally apply. However, as the current 'credit market' for offsets is largely trading utilising the new BAM credits under the BC Act, any calculations conducted using provisions of the TSC Act, such as the BioBanking Assessment Methodology (BBAM) require the submission of an 'Application for Reasonable Equivalence' to determine the requisite number of equivalent BAM credits. Therefore, in order to reduce potential errors and time delays associated with a 'Reasonable Equivalence' application, the BAM calculator (BAM-C) has been utilised as the relevant tool for the purposes of calculating offset liabilities only. The calculation of offset credits has been limited to those entities assessed as native flora/fauna requiring offsets under the provisions of the TSC Act.

1.4. Relevant Legislation

1.4.1. Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's key piece of environmental legislation and is administered by the Commonwealth Department of the Environment and Energy (DoEE). It is designed to protect national environmental assets, known as Matters of National Environmental Significance (MNES), which include threatened species of flora and fauna, threatened ecological communities, migratory species as well as other protected matters. Among other things, it defines the categories of threat for threatened flora and fauna, identifies key threatening processes and provides for the preparation of recovery plans for threatened flora, fauna and communities.

Under the EPBC Act, any action (which includes a development, project or activity) that is considered likely to have a significant impact on MNES must be referred to the Commonwealth Minister for the Environment for approval.

1.4.2. Threatened Species Conservation Act 1995

The TSC Act was repealed and replaced by the BC Act which came into force within the Northern Beaches LGA on 1 March 2018. As outlined previously, the amended development proposal comprises a pending or interim application as per the Savings and Transitional Regulations, and therefore the former planning provisions of the TSC Act continue to apply.

Prior to the commencement of the BC Act, the TSC Act was the key piece of legislation in NSW relating to the protection and management of biodiversity and threatened species. The TSC Act aimed to protect and encourage the recovery of threatened species, populations and communities that are listed under the Act through threat abatement and species recovery programs.

Under the TSC Act, projects require consideration of whether a development (Part 4) or an activity (Part 5) is likely to significantly impact threatened species, populations, communities or their habitat. Under the TSC Act, the potential impacts of any developments, land use changes or activities would need to undergo an "Assessment of Significance" under Section 5A of the EP&A Act.

Under the TSC Act, if the results of an Assessment of Significance indicate that a development or activity is likely to significantly affect threatened species, populations or ecological communities, any application for development consent must be accompanied by a Species Impact Statement (SIS), which is a detailed ecological study carried out in accordance with a set of assessment requirements issued by the Director-General of the National Parks and Wildlife Service.

1.4.3. Environmental Planning and Assessment Act 1979

The EP&A Act is the overarching planning legislation in NSW. This act provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the consideration of the environment and biodiversity values should a land use change be proposed. This includes threatened species, communities, habitat and processes as listed under the BC Act (formerly the TSC Act) and *Fisheries Management Act 1994*.

Pursuant to the EP&A Act, a number of State Environmental Planning Policies (SEPPs) have been implemented. These policies provide the planning criteria and development controls for specific environmental matters. SEPPs relevant to the study area have been detailed below.

1.4.4. Biosecurity Act 2015

Under the NSW *Biosecurity Act 2015* (Biosecurity Act) all weeds are required to be controlled by all persons under a "General Biosecurity Duty". The General Biosecurity Duty means that all public and private land owners or managers and all other people who deal with weed species (biosecurity matters) must use the most appropriate approach to prevent, eliminate, or minimise the negative impact (biosecurity risk) of those weeds (DPI 2017).

State-wide management of weeds under the new legislation is directed by the NSW Invasive Species Plan (NSW Local Land Services 2017). This assigns weed responses to four categories:

- Prevention of new weeds establishing;
- Eradication of small and localised infestations where feasible;
- Containment of larger infestation to stop wider spread; and
- Protection of key assets such as threatened plants and agricultural land, to prevent their damage or degradation by weed invasion.

Under the Biosecurity Act some weed species have been prioritised for management by specific regulations and controls under the act. These are known as State Level Priority Weeds.

The state has been divided into 11 regions (each covering a number of LGAs) under the Act, with each region managed by a Regional Weeds Committee. Management actions for weeds within a region are detailed within a Regional Strategic Weed Management Plan. Within each region, additional weed species to the State Level Priority Weeds have been prioritised for management. These species are known as Regional Priority Weeds.

A further set of weeds are identified within the Regional Strategic Weed Management Plans as being "other weeds of regional concern". The Biosecurity Act provides powers to Local Control Authorities to take action in relation to these weeds in particular circumstances, for example where a weed threatens a high value asset, and prevention, elimination or reduction of the risk is feasible and reasonable. Examples of high values assets include the Environment, Human Health, and Agriculture.

All land within the study area occurs within the Greater Sydney Local Land Services region and weed management within the region is to be undertaken under the direction of the South East Regional Strategic Weed Management Plan (Greater Sydney LLS 2017). Appendix 1 of the Weed Management Plan outlines the State Priority Weeds, Regional Priority Weeds, and other weeds of regional concern.

1.4.5. Water Management Act 2000

The *Water Management Act 2000* (WM Act) aims to provide for the sustainable and integrated management of the water sources of NSW for the benefit of both present and future generations. The proposed works

(defined under the EP&A Act) are within 40 m of the top of the bank/bed of a river (i.e. upon 'waterfront land') a therefore a controlled activity approval will be required by the Department of Primary Industries (DPI) Water.

One first order watercourses is present in the central western portion of the study area (**Figure 3**). A first order watercourse requires a 10 m vegetation riparian zone on either side measured from the top of the bank. This equates to a 20 m Riparian Corridor plus the width of the channel.

The associated '*Guidelines for Riparian Corridors on waterfront land*' (DPI 2012) provides further details on requirements for riparian corridors. In particular, non-riparian corridor works and activities can be authorised within the outer riparian corridor, so long as the average width of the vegetated riparian zone can be achieved over the length of the watercourse within the development site. This is referred to as 'the averaging rule'

1.4.6. Pittwater Local Environmental Plan 2014

The study area is located in the Northern Beaches LGA. This LGA was formed on 12 May 2016 when the NSW Government amalgamated Pittwater, Warringah and Manly councils to form the Northern Beaches Council. Despite the amalgamation, existing environmental planning instruments remain in force until they are repealed. Therefore, the Pittwater Council Local Environmental Plan (LEP) 2014 still applies to the study area.

Under the Pittwater LEP, the study area is zoned as RU2 Rural Landscape. The objectives of Zone RU2 are to:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base;
- To maintain the rural landscape character of the land;
- To provide for a range of compatible land uses, including extensive agriculture;
- To ensure that development in the area does not unreasonably increase the demand for public services or public facilities; and
- To minimise conflict between land uses within this zone and land uses within adjoining zones

Clause 7.6 of the LEP is relevant to the management of biodiversity on the study area, as the majority of the study area is mapped as "Biodiversity" on the LEP Terrestrial Biodiversity Map (see **Figure 2**). Clause 7.6 of the LEP outlines matters which must be taken into consideration before consent is granted to a development application on land identified as "Biodiversity" on the Terrestrial Biodiversity Map.

Clause 7.6 states:

(1) The objective of this clause is to maintain terrestrial, riparian and aquatic biodiversity by:

(a) protecting native fauna and flora, and

(b) protecting the ecological processes necessary for their continued existence, and

(c) encouraging the conservation and recovery of native fauna and flora and their habitats.

(2) This clause applies to land identified as "Biodiversity" on the Biodiversity Map.

(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

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

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

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

(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

(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

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

1.4.6.1. SEPP No. 44 – Koala Habitat Protection

SEPP 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas (*Phascolarctos cinereus*) to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline.

SEPP 44 applies to Pittwater LGA, now part of the Northern Beaches LGA and therefore technically applies to the project. However, as impacts on Koalas have not been raised as an issue within the SoFC, assessments of impacts to Koalas and application of SEPP44 is not addressed further within this FFA.

2. Methods

2.1. Introduction

The study area has been the focus of numerous recent ecological investigations including detailed flora and fauna surveys by ELA in 2017 and more recent surveys by Cumberland Ecology in 2019. As the ecological surveys conducted by ELA were conducted less than five years ago and therefore are within the validity period accepted by the former Office of Environment and Heritage (OEH) (now part of Department of Planning, Industry and Environment or DPIE), they are considered to be still current, and the results of these surveys have been included in this assessment.

This section provides details of the flora and fauna surveys that have been undertaken in the study area, including those conducted by ELA in 2017 and Cumberland Ecology in 2019.

2.2. Database Analysis and Literature Review

Database analysis was conducted by ELA in 2017 to support the FFA for the previous development layout (ELA 2017).

As this FFA primarily addresses the ecological matters listed in the SoFC, assessment of database analysis was limited to a review of records and the likelihood of occurrence assessment in the 2017 ELA report with due consideration to the amended development layout.

The following documents associated with the project were reviewed:

- Briefing letter from Allens, dated 9 October 2018;
- Email correspondence from ELA, dated September 2018;
- 79 Cabbage Tree Road – Flora and Fauna Assessment. Prepared for Aveo Pty Ltd (ELA 2017);
- 79 Cabbage Tree Road – Biodiversity Management Plan. Prepared for Aveo Pty Ltd (ELA 2018);
- Preliminary Determination: Critically Endangered Species – Rhodamnia rubescens (NSW Scientific Commitee 2017);
- Final Determination: Critically Endangered Species – *Rhodamnia rubescens* (NSW Scientific Committee 2019)
- Peterson Bushfire (2019): Request to review RFS Bush Fire Safety Authority – Peninsula Gardens
- Sym Studio (2019): Peninsula Gardens – Landscape Masterplan AVE02-SK-003 (F).
- Clause 7.6 of the Pittwater Local Environment Plan 2014; and
- Maps of Biodiversity areas as per the Pittwater LEP.

2.3. Flora Survey

Flora surveys were undertaken across the subject site by ELA in October and November 2017 (Jennie Powell and Mitchell Scott), and in January 2019 by personnel from Cumberland Ecology (David Robertson, Gitanjali Katrak, Rohan Mellick and Elise McCarthy).

Surveys included vegetation mapping, plot surveys, random meander surveys, and targeted threatened flora searches. A further site inspection by Cumberland Ecology (Gitanjali Katrak, Bryan Furchert) was undertaken with Council representatives (Brendan Smith, Andrew Jennings) as part of a without prejudice onsite meeting on 30 May 2019.

Further details of each of the survey methods utilised by both ELA and Cumberland Ecology are provided below.

2.3.1. Vegetation Mapping

A site inspection was undertaken by ELA ecologists on 4 October 2017 and 9 November 2017 to map the existing vegetation of the study area (ELA 2017).

Cumberland Ecology conducted vegetation surveys on 23-24 January 2019 to further revise and update previous vegetation mapping by ELA. The vegetation within the study area was ground-truthed to examine and verify the mapping of the condition and extent of the different vegetation communities. Where vegetation community boundaries were found to differ significantly, records were made of proposed new boundaries using a hand-held Global Positioning System (GPS) and mark-up of aerial photographs.

The resultant information was synthesised using a Geographic Information System (GIS) to create a spatial database that was used to interpret and interpolate the data to produce a vegetation map of the subject land. Vegetation was categorised into communities, taking into account condition of vegetation (i.e. disturbance history).

2.3.2. Rapid Assessment Points

Rapid Assessment Points or Photopoints were undertaken across parts of the study area previously developed/impacted by the existing Stage 1 development for preparation of the vegetation community map. The GPS location of each rapid assessment point was recorded and notes were taken on the canopy species present and where required additional notes on vegetation condition and species occurring in lower strata. Photographs were also taken to record conditions.

The location of the Rapid Assessment Points (Photopoints) is shown in **Figure 4.**

2.3.3. Flora Quadrat Survey

Flora quadrat surveys were undertaken in the study area by ELA in 2017. A total of six biometric (BBAM) plots were surveyed (ELA 2017).

Cumberland Ecology conducted an additional six plots in the study area on 23 and 24 January 2019 (**Figure 4**). Although this project is being assessed under the TSC Act, flora plots were conducted in accordance with the BAM to enable calculation of offsetting requirements utilising the BAM calculator (BAM-C). Further data was also collected using the BBAM methodology within the same plot to allow for BBAM calculations, if required.

BAM plot sampling included establishment of a 20 m x 50 m plot within which data was collected to assess the vegetation integrity and habitat suitability of each vegetation zone. This included collection of the following data:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within a 20 m x 20 m plot;
- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within a 20 m x 20m plot;
- Cover of High Threat Exotic weed species;
- Assessment of function attributes within a 20 m x 50 m plot, including:
    - Count of number of large trees;
    - Tree stem size classes, measured as 'diameter at breast height over bark' (DBH);
    - Regeneration based on the presence of living trees with stems <5cm DBH; and
    - The total length in metres of fallen logs over 10 cm in diameter.
- Assessment of litter cover within five 1 m x 1 m plots evenly spread within the 20 m x 50 m plot; and
- Number of trees with hollows that are visible from the ground within the 20 m x 50 m plot.

Additional BBAM data collected within the 20 m x 50 m plot included:

- The ground cover composition (exotic groundcover, native grasses, native shrubs, every meter along a 50 m transect; and
- Quantum and species of regenerating trees;

The locations of the flora quadrats surveyed by Cumberland Ecology are shown in **Figure 4**.

All vascular plants recorded or collected were identified using keys and nomenclature provided in Harden (1990-1993). Where known, taxonomic and nomenclatural changes have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2019). The data from the flora plots was utilised to assign native vegetation communities to defined Plant Community Types (PCTs) for the purposes of BAM credit calculations.

2.3.4. Targeted Threatened Flora Surveys

Targeted searches for threated flora species were undertaken by ELA ecologists Jennie Powell and Mitchell Scott on 4 October 2017 and 9 November 2017. A total of 6 person hours were conducted, in conjunction with biometric plots, to target threatened flora species with the potential to occur within the study area (ELA 2017).

A further targeted survey for *Rhodamnia rubescens* (Scrub Turpentine) was conducted by ELA on 14 September 2018.

Cumberland Ecology conducted further targeted flora surveys in the study area on 23 and 24 January 2019, specifically targeting *Rhodamnia rubescens* (Scrub Turpentine). The targeted flora surveys consisted of detailed random meander surveys during which 'live' specimens (i.e. individuals with leaves) of *Rhodamnia rubescens* present were recorded, together with details of their condition.

Incidental locations of 'live' individuals were also recorded during the without prejudice onsite meeting with Council in May 2019.

2.4. Fauna Survey

Fauna surveys undertaken within the study area include habitat assessments and targeted fauna surveys for threatened species. Details of the fauna surveys undertaken by Cumberland Ecology in January 2019 and by ELA in 2017/2018 are presented below.

2.4.1. Habitat Assessment

A comprehensive habitat assessment of the study area was conducted during the recent detailed surveys of the study area by Cumberland Ecology during the 23-24 January 2019 surveys. The fauna habitat assessment included consideration of important indicators of habitat condition and complexity including the occurrence of microhabitats such as tree hollows, fallen logs, bush rock and wetland areas such as creeks and soaks. Structural features considered included the nature and extent of the understorey and ground stratum and extent of canopy. The fauna habitat assessment also included an assessment of the presence of habitat features suitable for use by threatened fauna species known from the locality, in particular the Powerful Owl.

2.4.2. Targeted Fauna Surveys

Targeted fauna surveys were conducted by ELA between November 2017 and January 2018 for the preparation of the previous FFA with additional surveys for Powerful Owl conducted in response to Council concerns in August 2018. The targeted fauna surveys conducted by ELA included the following:

- Two (2) microbat ultrasonic recording devices ('Anabats') targeting Southern Myotis (*Myotis macropus*). and deployed for two nights (9 November and 10 November 2017). The anabats were located on the creekline and by a hollow bearing tree within 200m of the creek line;
- Ten (10) nest boxes targeting Eastern Pygmy Possum (*Cercartetus nanus*). Nest boxes were attached to trees sprayed with honey water;
- Six baited arboreal cameras targeting Eastern Pygmy Possum set up for a total of eighteen (18) trap nights;

- Four nights of spotlighting in potential habitat, and call play-back survey targeting the Giant Burrowing Frog (*Heleioporus australiacus*); and
- Four nights of targeted surveys for threatened owls, in particular Powerful Owl (*Ninox strenua*) in August 2018 including call playback, spotlighting surveys and searches for owl wash.

Cumberland Ecology did not conduct targeted fauna surveys as the review of the surveys conducted by ELA were determined that survey effort and timing were appropriate to detect the presence of the targeted species.

2.5. Limitations

Vertebrate fauna and vascular flora of the locality are well known based upon a sizeable database of past records and various published reports. In particular, recent field surveys conducted by ELA furnished a good baseline of current field data. The field survey undertaken by Cumberland Ecology added to the existing database and has helped to provide a clear indication of the likelihood that various species occur or are likely to occur within the study area. The data obtained from database assessment and surveys of the study area furnished an appropriate level of information to support this assessment.

The weather conditions at the time of the Cumberland Ecology flora surveys were generally favourable for plant growth and production of features required for identification of most species. Shrubs, grasses, herbs and creepers were readily identifiable in most instances. Accordingly, it is considered that sufficient information has been collected to assess issues including conservation significance of the flora and likely impact on native vegetation. An assessment of the likelihood of occurrence of threatened flora species recorded within the locality of the study area in the database searches was undertaken to supplement the flora survey.

No targeted fauna survey was undertaken by Cumberland Ecology for this assessment, which has relied on previous recent targeted surveys by ELA as well as database analysis and fauna habitat assessment. In general, opportunistic observations of fauna provide a "snapshot" of some of the fauna present on a site that were active during the time of the survey. The data produced by the surveys is intended to be indicative of the types of species that could occur and not an absolute census of all vertebrate fauna species occurring within the study area. Therefore, not all fauna utilising the subject site are likely to have been recorded during surveys.

3. Results

3.1. Vegetation Communities

The study area is located along the eastern side of a corridor of bushland which contains the Katandra Bushland Reserve. The vegetation within the study area comprises parts of the eastern edge of the wider bushland corridor as the study area is bounded by residential development to the north, east and south to south-east. The remnant native vegetation is largely in a good condition but shows increasing levels of disturbance, primarily weed incursion/infestations, in areas adjacent to the existing development.

The findings of the vegetation mapping by Cumberland Ecology largely concurred with the previous mapping conducted by ELA. However, the boundaries/extent of some communities were altered based on the results of field surveys, and the classification of variants of the vegetation communities was modified to better characterise the vegetation in the study area.

Surveys and data analysis by Cumberland Ecology identified the following vegetation communities within the study area:

- Central Coast Escarpment Moist Forest (CCEMF);
- Central Coast Escarpment Moist Forest – CCEMF Lantana/Exotic Understorey;
- Coastal Warm Temperate Rainforest (CWTR);
- Remnant Central Coast Escarpment Moist Forest Trees over Landscaped Areas;
- Urban Native and Exotic Plantings and Ground Cover; and
- Weeds and Exotics

The proposed development footprint and APZ areas are dominated by CWTR, CCEMF, or CCEMF – lantana/exotic understorey. The areas mapped as Remnant Central Coast Escarpment Moist Forest Trees over Landscaped Areas, Weeds and Exotics and Urban Native/Exotic largely occur within areas developed for the existing Stage 1 retirement village.

The distribution of the vegetation communities as mapped by Cumberland Ecology is provided in **Figure 5**.

3.1.1. Central Coast Escarpment Moist Forest

Relevant PCT: PCT 1565 - Turpentine - Rough-barked Apple - Forest Oak moist shrubby tall open forest of the Central Coast

TSC Act Status: Not listed

EPBC Act Status: Not listed

Extent within Study Area: 2.82 ha

Extent within impact area: 1.07 ha

Central Coast Escarpment Moist Forest (CCEMF) is present in two main sections of the study area: a patch in the south-west corner and a second patch in the north to north-western parts of the study area. It covers a total area of ~2.82 ha across the study area of which 1.07 is located within the development impact area (0.35 ha in the development footprint and 0.72 ha in the APZ).

This community largely occurs in a good condition across the study area (**Photograph 1**). However, vegetation condition is of a higher quality in the western parts of the study area adjoining the bushland corridor with quality progressively degrading towards the east.

The canopy within this community is dominated by *Syncarpia glomulifera* (Turpentine) with occurrences of *Eucalyptus paniculata* (Grey Ironbark) and *Angophora costata* (Smooth-barked Apple). The mid-storey species included *Allocasuarina torulosa* (Forest Oak), Myrsine variabilis, *Pittosporum multiflorum* (Orange Thorn), *Gymnostachys anceps* (Settlers' Twine), *Livistona australis* (Cabbage Tree Palm), *Parsonsia straminea* (Common Silkpod), *Calystegia marginata* and *Cissus hypoglauca* (Water Vine). Species in the ground layer included *Adiantum aethiopicium* (Common Maidenhair) *Calochlaena dubia* (Soft Bracken), *Geitonoplesium cymosum* (Scrambling Lily), *Hibbertia dentata* (Trailing Guinea Flower), *Lomandra filiformis* (Wattle Mat-rush), *Oplismenus imbecillis*, *Entolasia marginata* (Bordered Panic), *Pseuderanthemum variabile* (Pastel Flower) and *Smilax australis* (Lawyer Vine).

PCT 1565 is not assocatied with any listed TEC.

Photograph 1: CCEMF in western parts of the study area

3.1.2. Central Coast Escarpment Moist Forest – Lantana/Exotic Understorey

Relevant PCT: PCT 1565 - Turpentine - Rough-barked Apple - Forest Oak moist shrubby tall open forest of the Central Coast

TSC Act Status: Not Listed

EPBC Act Status: Not Listed

Extent within Study Area: 0.78 ha

Extent within impact area: 0.48 ha

This variant of the CCEMF community is largely present in the northern to north-eastern parts of the study area. It covers a total area of ~0.78 ha across the study area of which 0.48 is located within the development impact area (0.09 ha in the development footprint and 0.39 ha in the APZ).

While the canopy is characterised by diagnostic species of CCEMF (**Photograph 2**), the mid-storey is largely dominated by infestations of *Lantana camara* (Lantana) and the ground layer also has a significantly higher proportion of weeds compared to the good quality CCEMF variant. Significant weeds within this community also include: *Ochna serrulata* (Mickey Mouse plant), *Asparagus aethiopicus* (Asparagus Fern) *Ageratina adenophora* (Crofton Weed), *Ligustrum sinense* (Small-leaved Privet) and *Tradescantia fluminensis* (Wandering Jew).

Photograph 2: CCEMF with exotic understorey

3.1.3. Coastal Warm Temperate Rainforest

Relevant PCT: PCT 1529 - Lilly Pilly - Coachwood gully warm temperate rainforest on sandstone ranges of the Sydney Basin

TSC Act Status: Not listed

EPBC Act Status: Not Listed

Extent within Study Area: 0.68 ha

Extent within impact area: 0.36 ha

Coastal Warm Temperate Rainforest (CWTF) is largely present around the creek-line in the western parts of the study area. It covers a total area of ~0.68 ha across the study area of which 0.36 ha is located within the development impact area (0.01 ha in the development footprint and 0.35 ha in the APZ).

The community largely occurs in a moderate to good condition (**Photograph 3**) although the condition progressively degrades towards the southern extent of the community adjacent to existing development.

The canopy is dominated by *Ceratopetalum apetalum* (Coachwood) and *Livistona australis* (Cabbage Tree Palm) with occurrences of *Callicoma serratifolia* (Black Wattle), *Acmena smithii* (Lilly Pilly) and *Notelaea longifolia* (Large Mock-Olive) in the midstorey. Characteristic groundcover species include *Oplismenus imbecillis*, *Dianella carerulea* and *Blechnum cartilagineum* (Gristle Fern).

The PCT 1529 is associated with the listed TEC Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions but a site by site assessment is required to determine of an onsite community conforms to the TEC. The CWTR community in the study area is not considered to conform to the listed TEC despite presence of some characteristic species as it does not occur on high-nutrient geological substrates such as basalts and fine-grained sedimentary rocks (Item 1 of final determination) (NSW Scientific Committee 2006).

Photograph 3: CWTF in western parts of study area

3.1.4. Remnant Central Coast Escarpment Moist Forest Trees over Landscaped Areas

Relevant PCT: n/a

TSC Act Status: Not Listed

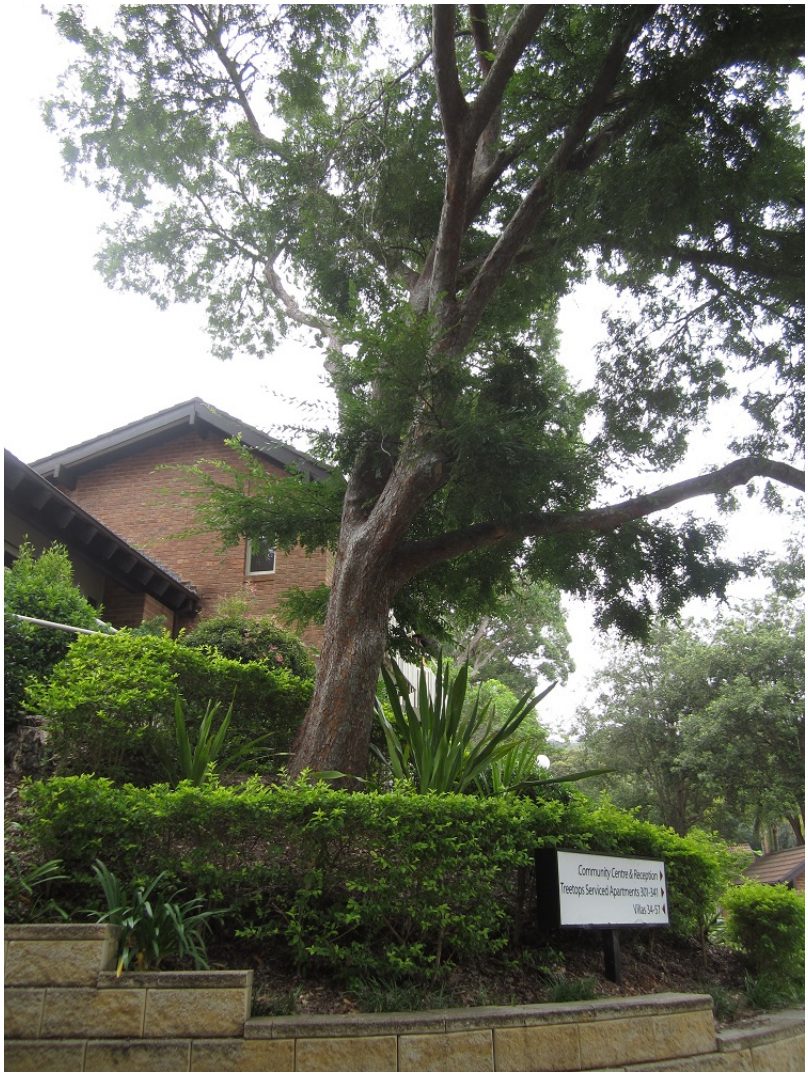
EPBC Act Status: Not Listed

Extent within Study Area: 0.41 ha

Extent within impact area: 0.01 ha

This community largely consists of retained CCEMF trees that have been incorporated into the landscaping of the existing Stage 1 retirement village development (Photograph 4). Although these areas contain scattered trees characteristic CCEMF, they are not considered to conform to any defined native vegetation unit due to the highly modified and landscaped areas in which they occur. As landscaped and/or planted areas are not considered to comprise native vegetation units under the planning provisions of the TSC Act, this vegetation community has not been assigned to a PCT.

Photograph 4: Remnant CCEMF tree over landscaped areas



3.1.5. Urban Native and Exotic Plantings and Ground Cover

Relevant PCT: n/a

TSC Act Status: Not Listed

EPBC Act Status: Not Listed

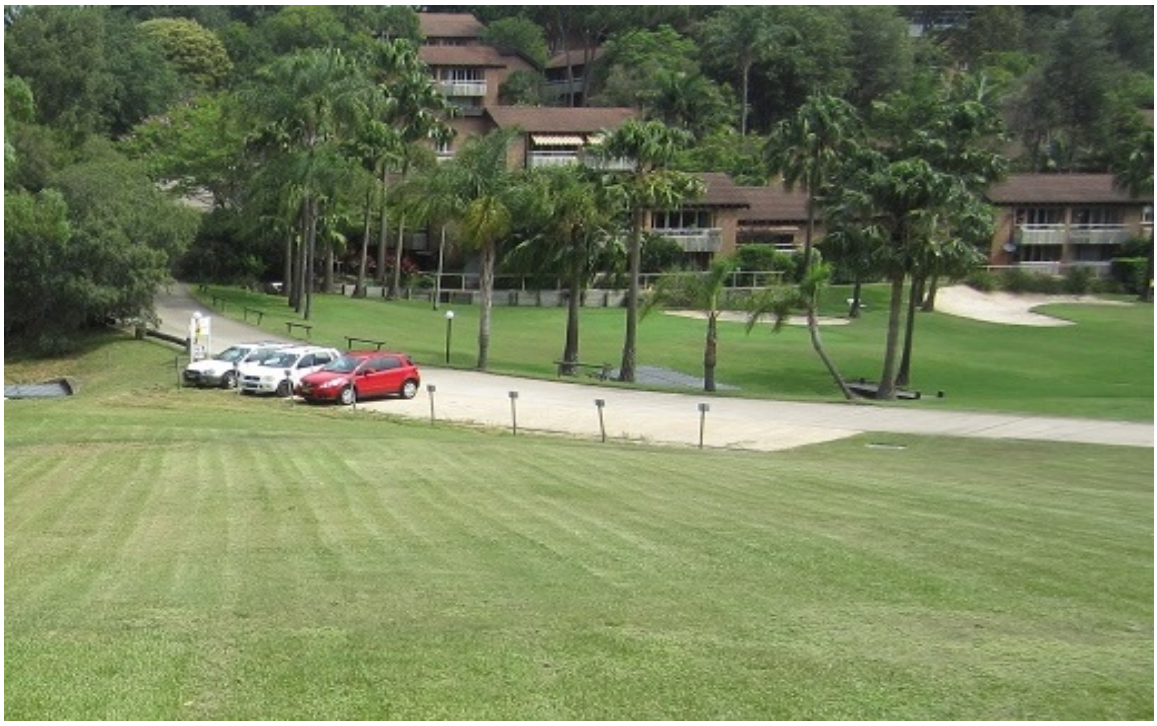
Extent within Study Area: 1.21 ha

Extent within impact area: 0.30 ha

This community largely occurs in areas that have previously been modified as part of the existing Stage 1 retirement village (**Photograph 5**). This includes landscaped gardens around the buildings that contain scattered occurrences of planted natives commonly used in landscaping and the recreational areas of the miniature golf course.

These areas are not considered to comprise native vegetation units under the planning provisions of the TSC Act despite the presence of some planted native species and therefore has not been assigned to a PCT.

Photograph 5: Modified/Landscaped areas with native plantings



3.1.6. Weeds and Exotics

Relevant PCT: n/a

TSC Act Status: Not Listed

EPBC Act Status: Not Listed

Extent within Study Area: 0.06 ha

Extent within impact area: 0.0 ha

An area of approximately 0.06 ha of weeds and exotics occurs within the existing Stage 1 retirement village area. This area comprises small landscaped patches that lack any remnant or planted natives.

3.2. Flora Species

In total, 92 flora species (75 native and 17 exotic) were recorded throughout the study area during surveys by Cumberland Ecology. This is similar to findings of the ELA which recorded a total of 88 flora species (80 natives and 8 exotics).

3.2.1. Threatened Flora Species

One threatened flora species, *Rhodamnia rubescens* has been recorded within the study area. No other threatened flora species have been recorded within the study area and none are considered likely to occur based on the review of the ELA database analyses and surveys. As no further threatened flora issues have been raised within the SoFC, no further assessments of additional threatened flora have been conducted for this FFA.

3.2.1.1. Rhodamnia rubescens

Rhodamnia rubescens is a small tree to shrub species that was listed as Critically Endangered under the TSC Act on 1 February 2019.

The surveys by ELA in November 2018 found approximately 69 individuals across three clusters, predominantly within areas mapped as CCEMF (**Figure 6**). The recorded individuals were described as '*ranging from 2 -10m in height and generally consisted of a narrow main stem with few remaining small branches*'. The majority of the recorded individuals were determined to be dead, likely for some time, while live individuals with remaining leaves all showed heavy symptoms of myrtle rust disease.

The surveys by Cumberland Ecology largely confirmed the findings of the ELA surveys. While some live individuals – i.e. individuals with remaining leaves – were recorded in the westernmost cluster, all recorded live individuals showed heavy symptoms of myrtle rust infection (**Photograph 6**). All individuals in the central and eastern cluster lacked any leaves and appeared to be dead/dying at the time of survey. However, a single seeding was recorded at a new location to the north east of the ELA clusters.

This seedling was determined to be dead/dying during the May 2019 site inspection conducted with Council. However, ~3 individuals in the eastern most cluster were observed to have leaves, albeit heavily infected with myrtle rust, indicating that some live individuals still remained within the eastern cluster recorded by ELA.

Observations in 2016 by Carnegie *et al*., as documented in the Final Determination for *Rhodamnia rubescens*, estimates mortality in infected individuals has increased to over 50% with no evidence of regenerating populations surviving. Mortality in mature *Rhodamnia rubescens* individuals is continuing to increase with the effect being consistent across much of the native range of the species (NSW Scientific Committee 2019). Based on the observations on mortality as listed in the Final Determination and observations of infection levels and conditions of recorded individuals within the study area, it is unlikely that the 'local population' within the study area will remain viable.

Photograph 6: Infected Rhodamnia rubescens in the western parts of the study area

3.2.2. Listed Weeds

A total of ten weeds recorded within the study area are listed under the Greater Sydney Regional Strategic Weed Management Plan 2017-2012 operating under the Biosecurity Act. Three of these species are State Priority Weeds and are also nationally listed as a Weed of National Significance (WoNS). The remaining seven species are listed as Other Weeds of Regional Concern under the Greater Sydney Regional Strategic Weed Management Plan 2017-2012. These weed species are identified in **Table 1**.

Table 1: Significant Weeds recorded within the Study Area

Scientific Name	Common Name	Status
Ageratina adenophora	Crofton Weed	OWRC
Anredera cordifolia	Madeira Vine	SP, WONS
Asparagus aethiopicus	Asparagus Fern	SP, WONS
Lantana camara	Lantana	SP, WONS
Ligustrum sinense	Small-leaved Privet	OWRC
Lonicera japonica	Japanese Honeysuckle	OWRC
Ochna serrulata	Mickey Mouse Plant	OWRC
Senna pendula		OWRC
Solanum mautianum	Wild Tobacco Bush	OWRC
Tradescantia fluminensis	Wandering Jew	OWRC

Key: SP (State Priority Weed), OWRC (Other weed of regional concern), WoNS (Weed of National Significance)

3.3. Fauna

3.3.1. Fauna Habitat

The native vegetation communities within the study area comprise suitable foraging and roosting habitat for a variety of native fauna species, including threatened species. In particular, species such as *Allocasuarina torulosa* which occurs in CCEMF, provide foraging habitat for specialised feeders such as the Glossy Black Cockatoo (*Calyptorhynchus lathami*), which is listed as Vulnerable under the TSC Act/BC Act.

A total of 7 hollow-bearing trees (HBTs) were recorded within the study area by ELA. Further HBTs were recorded by Cumberland Ecology (**Figure 7**). Based on the proximity of location of the HBTs recorded by Cumberland Ecology to existing ELA records, it is likely that these comprise the same individual HBTs recorded by ELA. The hollows vary in size from small hollows suitable for microchiropteran bats to medium to large hollows suitable for large avian species such as owls, including threatened species such as the Powerful Owl.

A small drainage line enters the study area near the central west boundary extending approximately 60m into bushland within the study area. This stream and associated riparian corridor provides suitable habitat for semi-aquatic species such as amphibians and may provide suitable habitat for the Giant Burrowing Frog (Vulnerable under TSC Act/BC Act).

Based on the low levels of flow, the drainage line is not considered to comprise suitable habitat for fish and therefore it is unlikely to provide only marginal foraging habitat for the Southern Myotis (Vulnerable under TSC Act/BC Act).

3.3.2. Fauna Species

One threatened fauna species, the Powerful Owl was recorded in the immediate vicinity of the study area during call playback surveys by ELA in 2018.

No other threatened fauna species have been recorded within the study area. While there is potential habitat for some threatened species such as microchiropteran bats and the Glossy Black Cockatoo, none are considered to be fully dependent on habitats within the study area based on the review of the ELA database analyses and surveys. As no further threatened fauna issues have been raised within the SoFC, no further assessments of additional threatened fauna have been conducted for this FFA.

3.3.2.1. Powerful Owl

A Powerful Owl heard calling from offsite prior to commencement of call playback on 20 August 2018 and continued to move closer to site over the duration of the surveys but remained just outside the study area boundary. No further calls were heard during the subsequent three nights of survey.

The Powerful Owl requires large tracts of forest or woodland habitat but can also occur in fragmented landscapes. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats (OEH 2017). The native vegetation within the development footprint and APZ comprises suitable roosting/foraging habitat for this species, although the quality varies between the different condition classes of CCEMF and CWTR.

Although this species was not recorded from the study area, due to the close proximity of recorded calls, the presence of suitable roosting/foraging habitat in the study area and the known large territory requirements of this species, it is considered likely to utilise the subject site as part of its range.

Despite the presence of owl activity within the study area, no indications of potential owl breeding were recorded within the larger hollows present onsite. That notwithstanding, correspondence from ELA indicates that a confirmed active breeding hollow for Powerful Owl is present in the adjacent Katandra reserve ~150-175m west of the study area. As male Powerful Owls can roost within a 10-200m radius of a breeding hollow while the female and young are in the nest (OEH 2017), the vegetation of the study area would occur within this roosting area.

4. Impact Assessment

This chapter discusses the potential impacts of the proposed project on the biodiversity values of the study area, with a focus on matters raised in the SoFC. In particular, a comparison of the impacts from the updated development footprint (as at September 2019), following refinement to address Council concerns and the original layout as per the February 2018 DA submission has been conducted. A number of avoidance, mitigation and compensatory measures have been proposed to address the impacts of the proposed project, and are provided in **Chapter 5.**

4.1. Direct Impacts

4.1.1. Vegetation Removal

The primary impact resulting from the proposed development includes the removal/modification of vegetation communities and associated fauna habitat. A total of ~5.9 ha of vegetated areas occurs within the study area, comprising ~4.28 ha of native vegetation and ~1.62 ha of exotic, planted or landscaped areas. Of this, a total of 2.23 ha occurs within the impact area (development footprint + APZ) for the updated September 2019 layout. Within the development footprint, all vegetation will be removed to enable the construction of dwellings. Within the additional APZ areas that do not overlap with development footprint, the vegetation will only be partially cleared/modified for the purposes of reducing fuel for bushfire protection purposes, mainly removal of mid-storey vegetation and thinning of the canopy to maintain separation between tree crowns.

The areas of vegetation to cleared/modified under the current September 2019 layout are summarised in **Table 2** below

Table 2: Impact Areas under current 2019 development layout

Vegetation Community	PCT	Study Area	Development Footprint	APZ	Total impact area
Central Coast Escarpment Moist Forest	1565	2.82	0.35	0.72	1.07
Central Coast Escarpment Moist Forest – Lantana/Exotic understorey	1565	0.78	0.09	0.39	0.48
Coastal Warm Temperate Rainforest	1529	0.68	0.01	0.35	0.36
Remnant Central Coast Escarpment Moist Forest Trees over Landscaped Areas	n/a	0.41	0.01		0.01
Urban native and exotic plantings and ground cover	n/a	1.21	0.30		0.30
Urban Surfaces	n/a		0.10		0.10
Total Native		***4.28***	***0.45***	***1.46***	***1.91***
Total Landscaped/exotic		***1.62***	***0.31***	***0.00***	***0.32***
Total vegetated		***5.90***	***0.76***	***1.46***	***2.23***

The revised layout has reduced the level of development in the western parts of the Stage 2 area resulting in a reduction of the extent of vegetation to be cleared. The revised layout has also reduced the extent of APZ areas, thereby fully avoiding any modification/partial clearing in the westernmost parts of the Stage 2 area. In particular, there is a reduction in the area of clearing and modification of the CCEMP and CWTR vegetation units which represent the better-quality vegetation within the Stage 2 area. The revised layout is therefore in accordance with the matters discussed during the 30 May onsite meeting as the level of impact on the better-quality vegetation in the western parts of the site has been reduced.

The amendments to development layout following the S34 conference and without prejudice discussions has resulted in increased native vegetation retention, thus reducing impacts compared to previous proposed plans. A comparative summary of impacts between the original February 2018 layout and current September 2019 layout is provided in **Table 3**. It is acknowledged that vegetation map units by Cumberland Ecology differ from those in the FFA prepared by ELA. However, despite the change in vegetation mapping units, areas mapped as native vegetation within the development layouts remains largely the same.

Table 3: Comparison of vegetation clearing areas between original and current proposed development layout

Vegetation Type	Development Footprint		APZ	
	Feb 2018 layout	*Sep 2019 layout*	*Feb 2018 layout*	*Sep 2019 layout*
Native Vegetation	0.89	0.45	1.71	1.46
Landscaped/Planted/Exotic	0.18	0.31	0.74	0
Total vegetated area	1.07	0.76	2.45	1.46

No TECs as listed under the TSC Act and/or EPBC Act occur within the study area. Therefore, the proposed development will not have any significant impact on state or federally listed TECs.

Although the vegetation to be removed does not comprise a TEC, it is considered to be locally significant based on its location on the edges of a bushland corridor and its mapping as 'Terrestrial Biodiversity' under the Pittwater Local Environment Plan. Therefore, while the clearing/modification of the vegetation for the development footprint and APZ, does not constitute a significant impact in terms of the Assessment of Significance under the TSC Act, it is appropriate that compensatory measures, such as the purchase and retirement of suitable biodiversity offset credits, are provided to offset for the impacts of clearing/modifying native vegetation. The offsetting of the vegetation communities will also result in offsets for removal of habitat for threatened ecosystem credit species with potential to occur within the study area. Further details on offsetting requirements are provided in **Chapter 5**.

4.1.2. Impacts on Fauna Habitat

Overall, less than 1 ha of native vegetation, comprising a mix of good quality vegetation and vegetation that is degraded due to weed incursion/infestation will be fully cleared for the proposed development. While the quality of some areas of native vegetation will be reduced due to removal of understorey vegetation for the APZ, clearing of understorey layers in the more degraded areas is considered to have some beneficial effects

on native fauna and flora as it will entail removal of weed incursions/infestations, in particular removal of *Lantana camara* (Lantana).

All hollow-bearing trees recorded within the study area are located outside of the development footprint and are proposed to be retained within the APZ areas. Therefore, no hollow-bearing trees will be removed as part of the proposed development. Thus, habitat for hollow-dependent fauna, including threatened species with potential to occur within the study area will be retained.

Clearing of vegetation will result in removal of habitat features for native fauna, including potential threatened species, such as fallen logs, roosting habitat and food/foraging trees. However, areas of roosting and foraging habitat will be retained within the APZ as well as in retained bushland in the south-western parts of the study area. These areas are proposed to be managed under a Biodiversity Management Plan (BMP).

4.1.3. Impacts on Creekline

An averaging 10 m riparian buffer will be established from the top of each bank of the 1st order stream in the western parts of the study area, in accordance with the requirements of the *Water Management Act 2000* and associated 'averaging rule' for riparian corridors.

Although parts of the APZ overlap with the riparian buffer, the bushfire assessments conducted by Peterson Bushfire indicate that removal of understorey/reduction of fuel loads are not required within the proposed riparian buffer. Therefore, the requisite 10m riparian corridor required for the 1st order stream will comprise a fully structured Vegetated Riparian Zone (VRZ) that will be managed under the BMP, thus maintaining the long-term integrity of the watercourse.

Nonetheless a conservative approach has been taken and the parts of the 10m riparian corridor that overlap with the APZ have been included in the total area of native vegetation to be modified for the APZ for the purposes of calculating offset requirements for impacts to riparian vegetation under the TSC Act.

4.2. Impacts to Threatened Flora Species

The alteration to the APZ as a result of the revised layout has resulted in complete avoidance of the westernmost cluster of *Rhodamnia rubescens* individuals (**Figure 6**), thus providing an improved outcome compared to the original layout. The vegetation within this area is proposed to be included within the area to be managed under a BMP. The majority of 'live' individuals detected to date occur within the western cluster and will be retained and managed under the BMP.

However, the current proposed layout will still result in the removal of the central and eastern clusters. Due to the variable levels of leaf retention across months in the infected individuals, an accurate count of the total number of 'live' individuals that will be removed as a result of the proposed development is yet to be determined. To date approximately 3-4 live individuals, albeit heavily infected by myrtle rust, have been in the eastern cluster and no live individuals have been recorded in the central cluster.

As the onsite population of *Rhodamnia rubescens* is heavily affected by myrtle rust (all live individuals recorded to date show infection), it is considered unlikely to be viable in the long term. Based on this lack of viability,

the impacts of the proposed development on this species are not considered to be significant in terms of the Assessments of Significance (7 part -test) under the TSC Act. Nonetheless, given the current Critically Endangered status for this species, it is recommended that compensatory measures for this species are included as part of the development proposal.

To date, no effective or practical chemical, biological or management control is currently available for protecting populations of *Rhodamnia rubescens* in natural ecosystems and the recommended conservation priority is to seek resources for genetic and physiological research into the resistance and susceptibility of *Rhodamnia rubescens* (NSW Scientific Committee 2019). Therefore, funding for research on methods that would aid in the conservation and recovery of this species is considered to be the most viable, long-term offsetting strategy. Further details on the proposed offsetting strategy are discussed in **Chapter 5**.

An Assessment of significance for this species is provided in **Appendix A**. This assessment concludes that the proposed development is not likely to result in a significant impact on *Rhodamnia rubescens* provided the recommended avoidance, mitigation and compensation measures are implemented.

No other threatened flora species were recorded from the study area and none are considered likely to occur. Therefore, the proposed project is unlikely to impact on any threatened flora species listed under the TSC Act or EPBC Act.

4.3. Impacts to Threatened Fauna Species

One threatened fauna species, the Powerful Owl, has been recorded in the immediate vicinity of the study area and is considered likely to utilise the study area as part of a larger territory.

Powerful Owls are known to have high fidelity to a large territory, which varies from 400ha in good habitats to up to 4000 ha in degraded areas (OEH 2017). Based on the occurrence of a known breeding hollow within the adjacent Katandra reserve ~150m from the western to southwestern boundary of the study area and lack of indications of owl hollow usage of large hollows within the study area, the vegetation within the development footprint is considered to constitute foraging and roosting habitat for Powerful Owl but not breeding habitat.

Less than 1 ha of potential foraging/roosting habitat for the Powerful Owl will be fully cleared within the development footprint. Although it is acknowledged that the quality of some areas of roosting habitat within the APZ area are likely to decrease due to removal of understorey, the quality in other areas is considered likely to improve due to the removal of weed incursions, particularly removal of Lantana, and active management. Furthermore, as this species is known to forage in disturbed areas, the modification of vegetation for the APZ is not considered to significantly impact upon this species. Further roosting and foraging habitat for the Powerful Owl will be retained in the south-western parts of the study area and will managed under the BMP thus retaining suitable habitat for this species within the study area.

Furthermore, the eastward relocation of the development layout and avoidance of impacts on the better quality vegetation in the western parts of the study area will result in a larger 'buffer' zone (>150m) between the development areas and the known breeding hollow in Katandra reserve.

An Assessment of significance for this species is provided in **Appendix A**. This assessment concludes that the proposed development is not likely to result in a significant impact on Powerful Owl.

Under BBAM and the provisions of the TSC Act, the Powerful Owl comprises an ecosystem credit species, i.e. a species that can predicted by vegetation surrogates and landscape features. Thus, the recommended offsets for removal of vegetation will also allow for offsetting of impacts, albeit non-significant, to Powerful Owl. Under the BAM, the BC Act, the Powerful Owl is listed as a dual (ecosystem/species) credit species whereby breeding habitat is subject to separate 'species credits' while roosting and foraging habitat remains to be covered by ecosystem credits. No breeding habitat for Powerful Owl will be impacted by the proposed development and therefore offsets for removal of vegetation will also allow for offsetting of impacts, albeit non-significant, to Powerful Owl. Therefore, the recommended offset measures are considered suitable even when the dual credit listing of Powerful Owl under BAM is considered.

4.4. Indirect Impacts

The proposed development has the potential to indirectly impact on vegetation within the wider subject land. These include:

4.4.1.1. Sedimentation and erosion

The retained vegetation has potential to be impacted by sedimentation and erosion during the construction. Eroded sediment can smother retained vegetation if appropriate control measures are not implemented. Smothering can cause dieback of herbs and shrubs and reduce regeneration of groundcover species. Sediment and eroded material can also contain weed matter and nutrients, and movement of this material into the retained vegetation can facilitate the spread of weeds.

4.4.1.2. Weed invasion

Alterations to habitat conditions often favour introduced and/or hardy native plant and animal species that can proliferate in disturbed conditions. Such species have potential to impact upon the original local native plant and animal species. Weeds such as exotic grasses and other introduced plants have potential to outcompete regenerating native plant species and result in changes to community composition.

4.4.1.3. Physical damage

The remaining vegetation communities and associated habitat outside the development footprint have potential to be damaged physically by human activities. This can include trampling of vegetation, soil compaction and disturbance, especially during transport of materials. These activities can alter regeneration of species within the vegetation communities and result in an alteration to community composition and structure. These impacts are likely to occur if access is not restricted to authorising trails and walking paths

These indirect impacts are not considered to be significant and can be managed. Mitigation measures and recommendations are provided in Chapter 5 to help avoid these impacts.

5. Mitigation Measures

5.1. Introduction

This chapter presents the avoidance, mitigation and offset measures proposed to ameliorate the impacts of the project on flora and fauna. Mitigation measures for the project have been developed in accordance with the following principles:

- Avoid: to the extent possible, developments should be designed to avoid or minimise ecological impacts;
- Mitigate: where certain impacts are unavoidable through design changes, mitigation measures should be introduced to ameliorate the ecological impacts of the proposed development; and
- Compensate: the residual impacts of the project, following the implementation of mitigation measures, should be compensated for in some way to offset what would otherwise be a net loss of habitat.

5.2. Avoidance Measures

The following measures to avoid impacts to biodiversity have been implemented within the design of the current proposed development layout:

- The original 1982 approval allowed for development in the south-west corner of the subject land. Under the proposed development, this vegetation (~1.5ha) will be retained and managed under a BMP.
- The current September 2019 layout has shifted the development footprint eastwards and reduced the number of buildings compared to the original February 2018 layout, thus avoiding better quality vegetation in the western parts of the study area.
- The resultant shifts in the APZ areas results in complete avoidance of areas supporting the highest number of 'live' *Rhodamnia rubescens* individuals.
- The development layout has been sited to avoid all recorded hollow-bearing trees which will be retained. The resultant shift in the APZ location also results in avoidance of under-scrubbing around the majority of recorded hollow-bearing trees.
- The Bushfire analysis indicates that under-scrubbing to reduce fuel loads is not required within the riparian buffer area which can be retained as a fully-structured VRZ, thus maintaining the long-term integrity of the existing creekline.

5.3. Mitigation Measures

A range of mitigation measures will be implemented for the proposed project. These measures will be implemented to minimise impacts to biodiversity values, and to provide ongoing management of native fauna species and retained and replanted vegetation, and to guide the overall management of the open space corridors and other landscape elements.

The following mitigation measures will be implemented to minimise any adverse effects of the propose project on biodiversity:

- Implementation of a Biodiversity Management Plan;
- Vegetation Clearance and Fauna Management Protocols; and
- Weed Control Measures.

In addition to these measures, inductions for contractors and visitors are recommended to address the locations of sensitive flora and fauna and outline their roles and responsibilities for the protection and/or minimisation of impacts to biodiversity values.

The proposed mitigation measures are discussed in more detail below.

5.3.1. Biodiversity Management Plan

A Biodiversity Management Plan (BMP) has been prepared for the original February 2018 layout by ELA. Although the BMP will need to be updated for the new development layout, the overall objective of the BMP to enhance retained native vegetation within the study area, specifically within the APZ and in the south-west of the study area remains unchanged. The BMP includes provision for the following in the area of retained native vegetation:

- Weed control;
- Supplementary planting;
- Installation of signs and fencing; and
- Monitoring

5.3.2. Vegetation Clearance and Fauna Management Protocols

5.3.2.1. Delineation of Clearing Areas

To avoid unnecessary removal or damage to vegetation adjacent to the proposed development area, the clearing area should be clearly demarcated and signed, where appropriate, to ensure no vegetation beyond these boundaries is removed.

Areas that require clearance will be flagged and clearly delineated by temporary fencing to ensure that no areas intended for conservation will be inadvertently cleared during the construction process. No machinery will be parked on areas beyond the temporary fencing and no access will be allowed during construction. Ancillary facilities such as stockpile sites, site compounds and construction zones will not be located beyond the limits of clearing.

5.3.2.2. Pre-clearance and Clearance Surveys

Pre-clearing surveys are to be undertaken by a suitably qualified ecologist. Pre-clearing surveys will include:

- Demarcation of key habitat features as hollow-bearing trees, fallen logs and bushrock;
- Checking trees for the presence of bird nests and arboreal mammals, such as possums, gliders and bats, prior to felling;
- Animals found to be occupying trees and habitat will be safely removed before the clearing of trees and relocated into nearby woodlands; and
- Provision of a report following the completion of a pre-clearing survey, detailing the location and type of each habitat feature.

To minimise impacts to native fauna species, clearing should be undertaken in the following two-stage process under the supervision of a suitably qualified ecologist:

- The initial phase of clearing will involve clearing around identified habitat features and leaving the features overnight;
- The second stage will involve clearing of the habitat features left overnight followed by an inspection;

An ecologist should investigate all fallen trees for the presence of hollows not detected prior to clearing. Inspections should be undertaken of these hollows for native fauna.

An ecologist should be present while clearing to rescue animals injured during the clearance operation. Provisions will be made to protect any native fauna during clearing activities by the following means:

- All persons working on the vegetation clearing will be briefed about the possible fauna present and should avoid injuring any present;
- Animals disturbed or dislodged during the clearance but not injured should be assisted to move to the adjacent bushland or other specified locations; and
- If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized).

5.3.3. Weed Control Measures

In order to minimise the spread of weeds throughout the site and spread of weeds present in the site to areas outside of the site, appropriate weed control activities will be undertaken. Prior to construction, weeds present in the development footprint will be identified and controlled if necessary to prevent spread. Of particular focus will be *Anredera cordifolia* (Madeira vine), *Asparagus aethiopicus* (Asparagus fern) and *Lantana camara* (Lantana) which are listed as a WoNS.

A wash-down station will be established and all construction vehicles entering and leaving the site will be required to be washed down to prevent weed seeds entering or leaving the site. These procedures will also assist in preventing the introduction and or spread of soilborne pathogens carried in contaminated soil.

5.3.4. Other Relevant Measures

In addition to the foregoing mitigation measures, the following mitigation measures will be undertaken in accordance with relevant best practise methods during the construction/operational phase:

- Dust management - to minimise the impacts to vegetation and habitat quality;
- Noise management - to minimise impacts to fauna species; and
- Erosion and sedimentation controls - to minimise the impact to adjacent vegetation and downstream environments.

5.4. Offsets

5.4.1. Vegetation Communities

Although removal of vegetation does not comprise a significant impact in terms of the Assessments of Significance under the TSC Act as no TEC vegetation is to be removed, the vegetation is considered to be locally significant due to its location on the edges of a significant bushland corridor and comprises potential habitat for a variety of native fauna species, including threatened species.

As the current 'credit market' for offsets is largely trading utilising the new BAM credits under the BC Act, any calculations conducted using provisions of the TSC Act, such as the BioBanking Assessment Methodology (BBAM) require the submission of an 'Application for Reasonable Equivalence' to determine the requisite number of equivalent BAM credits. Therefore, in order to reduce potential errors and time delays associated with a 'Reasonable Equivalence' application, the BAM calculator (BAM-C) has been utilised as the relevant tool for the purposes of calculating offset liabilities only.

As this project has been assessed under the provision of the TSC Act, calculation of offsets has been limited to vegetation that has been classified as 'native' (i.e. vegetation that has been assigned to a PCT). Landscaped and planted areas containing native species have not been assigned to a PCT and have not been included in the credit calculations.

Although the riparian buffer is proposed to be retained as fully structured vegetation, a conservative approach has been taken in the event of potential future adjustment to APZ requirements and all areas of the riparian buffer that overlap with the APZs have been included as 'modified' for the purposes of credit calculations.

The calculated credit liability for removal of native vegetation is summarised in **Table 4**. In the event that the requisite BAM credits are not available for purchase, an appropriate payment into the Biodiversity Conservation Trust will be made. Based on the current credit prices, a total payment of $54,515.47 (incl GST) will be required

for ecosystem credits (i.e. for PCT 1529 and PCT 1565). The BAM-C credit report and payment report are provided in **Appendix B**. A summary of BAM plot data utilised for the BAM-C is provided in **Appendix C**.

Table 4: Ecosystem Credit Liability

Vegetation Community	PCT*	Development Footprint	APZ	Total impact area	Credits Required	Trust payment (ex GST)
Central Coast Escarpment Moist Forest	1565_Moderate	0.35	0.72	1.07	18	$39,647.62
Central Coast Escarpment Moist Forest – Lantana/Exotic understorey	1565_Poor	0.09	0.39	0.48	6	
Coastal Warm Temperate Rainforest	1529_Moderate	0.01	0.35	0.36	6	$9,911.90

** note: Terms poor and moderate are utilised to distinguish between vegetation zones in the BAM-C and do not necessarily reflect actual condition of the vegetation*

5.4.2. Rhodamnia rubescens

As previously stated in **Section 4.2**, to date, no effective or practical chemical, biological or management control is currently available for protecting populations of *Rhodamnia rubescens* in natural ecosystems and the recommended conservation priority is to seek resources for genetic and physiological research into the resistance and susceptibility of *Rhodamnia rubescens* (NSW Scientific Committee 2019).

Therefore, funding for research on methods that would aid in the conservation and recovery of this species is considered to be the most viable, long-term offsetting strategy. As biodiversity credits for *Rhodamnia rubescens* are calculated on a count of number of individuals impacted rather than area of habitat removed, the provision of funds for research should be based on the total number of live individuals removed.

As the BAM-C currently does not have a base price for *Rhodamnia rubescens* credits (**Appendix B**), an appropriate 'base price' per live individual removed will need to be negotiated between Aveo and Council in consultation with the Royal Botanic Gardens and the Biodiversity Conservation Trust.

Due to the degraded conditions from heavy myrtle rust infection, *Rhodamnia rubescens* individuals were considered to be 'live' if some foliage was detected on individuals during surveys. To date, approximately 3-4 'live' individuals have been conclusively detected within the eastern cluster during inspections by Cumberland Ecology (Jan 2019 and May 2019) and no 'live' individuals have been recorded in the central cluster. Further detailed surveys will be required to determine the final number of 'live' Rhodamnia individuals for the purposes of calculating a total fund for research purposes.

However, for the purposes of the current FFA and determining a base number of credits required for removal of a single *Rhodamnia rubescens* individual, it was assumed that 10 individuals would be removed. The BAM-

C calculator indicates removal of 10 individuals would require a total of 30 species credits, which equates to 3 credits per individual.

6. Conclusion

The proposed development will require the clearing and/or modification of native vegetation that forms suitable habitat for some threatened fauna species. Approximately 0.45 ha of native vegetation will be fully cleared for the development footprint with an additional ~1.46 ha modified for APZs. An additional 0.31 ha of landscaped/planted vegetation that does not conform to a native vegetation unit will also be removed from the development footprint.

Although the removal of vegetation is not considered to have a significant impact in terms of an Assessment of Significance under the TSC Act, with due consideration to the mapping of these areas as 'Biodiversity' under the Pittwater LEP and location on the eastern edges of a bushland corridor, compensatory offset measures will form part of the proposal.

No TECs listed under the TSC Act or EPBC Act will be impacted by the proposed development.

One threatened flora species, *Rhodamnia rubescens* is present within the study area and some individuals will be removed for the development. Based on the recommendations in the Final Determination for this species, the impacts on *Rhodamnia rubescens* are proposed to be offset via provisions of funds for research into *Rhodamnia rubescens* conservation.

While the study area does comprise potential habitat for several threatened fauna species, in particular the Powerful Owl, the development area is not considered to constitute core habitat for these threatened species or exclusively support a local population. Therefore, no significant impact is predicted to occur to threatened fauna species, populations or communities as a result of the proposed development.

As the proposed development is considered unlikely to significantly affect threatened species, populations or ecological communities, or their habitats, a Species Impact Statement (SIS) under clause 2, Part 1, Schedule 1 of the NSW *Environmental Planning and Assessment Regulation 2000* is not required to assess the impacts of the proposed development under the TSC Act. As the proposed development is unlikely to have a significant impact on a threatened species or ecological community listed under the EPBC Act, a referral to the Commonwealth Department of the Environment and Energy is not warranted.

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APPENDIX A : Assessments of Significance

A.1. Rhodamnia rubescens

A.1.1. Background

Rhodamnia rubescens is listed as Critically Endangered under the TSC Act/BC Act. It is a shrub or small tree up to 25 m high with reddish/brown, fissured bark. Young stems are densely covered in fine hairs

This species occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of *R. rubescens* typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm

It is found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust which affects all plant parts

A.1.2. Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Rhodamnia rubescens occurs in three clusters within the subject site. The population within the site is heavily infected with Myrtle rust and the majority of individuals within the subject site are considered to be dead/dying based on the absence of foliage. The majority of live individuals (~10-12) recorded to date occur within the western most of the three clusters. To date 3-4 live individuals have been recorded in the eastern cluster and none within the central cluster.

Based on the conditions of individuals, the existing population within the site is not considered to be viable in the long term due to the extent of infection. Nonetheless the proposed development will retain the majority of the known live individuals via avoidance of the western cluster.

As the 'local population' within the study area is not considered to be viable despite the retention of majority of live individuals in the western cluster, the proposal is not likely to place a viable local population of the species at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Approximately 0.35 ha of CCEMF and 0.01 ha of CWTR will be cleared with an additional 0.72 ha of CCEMF and 0.35 ha of CWTR modified for APZ purposes. This represents a relatively small area of potential habitat within the locality for the species. The vegetation to be removed occurs at the eastern edges of a significant bushland corridor which also offers suitable habitat for the species.

The habitat occurring within the study area and immediate surrounds is unlikely to become fragmented as areas of vegetation adjacent to the bushland corridor will be retained and managed.

The proposed action will not remove, modify, fragment or isolate important habitat. The habitat within the subject to be retained occurs on the edges of a significant bushland corridor and will allow for genetic connectivity and spread to potential occurrences of the species in the wider locality. However, based on the levels of Myrtle rust infection, the population is not considered to be viable in the long-term as myrtle rust is known to affect all part of this species and reproduction/survivorship of infected individuals is very low.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No critical habitat for the species has currently been identified.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No specific recovery plan or threat abatement plans have been prepared for the species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The following key threatening processes are relevant to the proposed development:

- Clearing of native vegetation; and
- Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae

The key threatening process of 'Clearing of native vegetation' will directly affect this species via removal of individuals and clearing of associated habitat. However, the vegetation to be removed is not considered to constitute significant habitat for the species, due to the small area of vegetation to be removed in the local context. As potential habitat will be retained and managed within the site, the clearing of native vegetation is not likely to significantly impact habitat for this species.

The existing population within the site is currently heavily infected by Myrtle rust indicating an existing establishment of exotic rust fungi in the area. The proposed mitigation measures for the site include hygiene protocols to prevent the further spread of pathogens outside of the site. Therefore, the proposal will not result in the operation or increase the extent of this Key Threatening Process.

Conclusion

Approximately 0.36 ha of potential habitat for this species will be cleared with an additional 1.07 ha modified for APZ purposes for the proposed development. Due to the heavy levels of Myrtle rust infection, the population within the site is not considered to be viable in the long-term, despite the proposed retention of majority of the known live individuals within the site. Contribution of funds for research into conservation for this species is proposed as an offsetting measure for residual impacts associated with removal of live individuals. With due consideration to the avoidance, mitigation and compensation measures, the proposed development is considered unlikely to have a significant impact on *Rhodamnia rubescens*.

A.2. Powerful Owl

A.2.1. Background

The Powerful Owl (*Ninox strenua*) is distributed from Mackay to south western Victoria, mainly on the coastal side of the Great Dividing Range. This species occurs in many vegetation types from woodland and open sclerophyll to tall open wet forest and rainforest. It requires large tracts of native vegetation but can survive in fragmented landscapes. It roosts in dense vegetation and nests in large tree hollows (OEH 2017). The Powerful Owl is listed as Vulnerable under the TSC Act.

The species is known to occur in the immediate vicinity of the study area as it was recorded near the site boundary, indicating that the study area forms part of a large territory.

A.2.2. Assessment of Significance

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Powerful Owl is considered likely to utilise the study area as foraging and roosting habitat but is unlikely to utilise it as breeding habitat based on the lack of indicators owl usage of large hollows within the site and the proximity of a known breeding hollow outside of the study area.

It is a highly mobile species that can access resources from across a wide area and would not depend upon resources contained in the study area for its survival. Therefore, the proposal is not likely to place a viable local population of the species at risk of extinction. Further potential foraging and roosting habitat, that is connected to a significant bushland corridor will be retained and managed within the study area. Furthermore, the species is known to utilise fragmented and disturbed areas.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) *In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) *In relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Approximately 0.45 ha of native vegetation and 0.31 ha of landscaped/modified areas will be cleared for the proposed development. A further 1.46 ha of native vegetation will be modified for APZ purposes. This represents a relatively small area of potential foraging and roosting habitat within the locality for this species.

The habitat within the study area occurs along the eastern edges of a significant bushland corridor and is largely surrounded by existing developments to the east. Vegetation to be retained within the study area will remain connected to the bushland corridor and will be managed under a BMP. As this species is known to utilise fragmented habitats, potential foraging and roosting habitat for this species will be retained within the APZ. The proposed development will not fragment or significantly reduce habitat for this species. The Powerful Owl is highly mobile and would be able to move across areas of retained bushland and proposed landscaped areas within the site.

The proposed action will not remove, modify, fragment or isolate important habitat. Habitat on the study area is not important for the species in the locality as it would forms part of a much wider foraging range along the

bushland corridor. It is therefore considered that the habitat within the subject site is not important for the long-term survival of the species in the wider locality.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No critical habitat for the species has currently been identified.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

A recovery plan has been prepared for large forest owls, including the Powerful Owl (DEC (NSW) 2006). The ultimate aim of the recovery plan is to ensure that the species it covers persist in the wild in NSW in each region where they presently occur. The proposal is not considered to threaten the objectives of that Recovery Plan. No threat abatement plan exists for this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The following Key Threatening Processes (KTP) are listed under the TSC Act and are likely to affect this species.

- Loss of habitat due to land clearance; and
- Loss of hollow-bearing trees; and
- Removal of dead trees and dead wood

Clearing of 0.45 ha of native vegetation and 0.31 ha of landscaped/modified and modification of 1.46 ha of native vegetation forms part of a key threatening processes for this species. Due to the large size of habitats required by this species, the loss of a <1ha of vegetation for the development footprint is considered insignificant. Habitat for this species will be maintained within the APZ areas with potential improvement via removal of weed infestations.

All hollow-bearing trees, in particular trees with large hollows, will be retained within areas to be managed under a BMP. Further areas of vegetation connected to the bushland corridor will be retained within the site and managed under a BMP. As such, the clearing of a small area of native vegetation is not likely to significantly impact habitat for the Powerful Owl.

A.2.3. Conclusion

A total of 0.45 ha of native vegetation and 0.31 ha of landscaped/modified vegetation will be cleared for the proposed development along with modification of 1.46 ha of native woody vegetation comprising known habitat for the Powerful Owl. No significant habitat for this species will be removed within the subject site, as all hollow-bearing trees and vegetation connected to the bushland corridor will be retained. The proposal is not likely to place a viable local population of the species at risk of extinction. The species is highly mobile and is expected to move between areas of remaining habitat within the immediate vicinity of the study area and wider locality.

APPENDIX B :

BAM credit calculations and payment calculations

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00017859/BAAS17027/19/00017860	18171 Aveo	27/09/2019
Assessor Name	Report Created	BAM Data version *
	11/10/2019	15
Assessor Number	BAM Case Status	Date Finalised
	Open	To be finalised
Assessment Revision	Assessment Type	
0	Part 4 Developments (General)	

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

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Lilly Pilly - Coachwood gully warm temperate rainforest on sandstone ranges of the Sydney Basin								
3	1529_Moderate	46.5	0.4	0.25	High Sensitivity to Potential Gain	1.50		6
							Subtotal	**6**

Turpentine - Rough-barked Apple - Forest Oak moist shrubby tall open forest of the Central Coast								
1	1565_Moderate	45.5	1.1	0.25	High Sensitivity to Potential Gain	1.50		18
2	1565_Poor	32.7	0.5	0.25	High Sensitivity to Potential Gain	1.50		6
							Subtotal	**24**
							Total	**30**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Rhodamnia rubescens / Scrub Turpentine (Flora)						
1565_Moderate	N/A	10	0.25	3	True	30
					Subtotal	**30**

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00017859/BAAS17027/19/00017860	61	0	11/10/2019

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
		18171 Aveo	Open

Assessment Type	Date Finalised
Part 4 Developments (General)	To be finalised

PCT list

Include	PCT common name	Credits
Yes	**1565 -** Turpentine - Rough-barked Apple - Forest Oak moist shrubby tall open forest of the Central Coast	24
Yes	**1529 -** Lilly Pilly - Coachwood gully warm temperate rainforest on sandstone ranges of the Sydney Basin	6

Species list

Include	Species	Credits
Yes	***Rhodamnia rubescens*** (Scrub Turpentine)	30

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	**1565 -** Turpentine - Rough-barked Apple - Forest Oak moist shrubby tall open forest of the Central Coast **Warning: This PCT has NO trades recorded**	$1,360.10			19.99%	$20.00	1.0000	$1,651.98	24	$39,647.62
Pittwater	**1529 -** Lilly Pilly - Coachwood gully warm temperate rainforest on sandstone ranges of the Sydney Basin **Warning: This PCT has NO trades recorded**	$1,360.10			19.99%	$20.00	1.0000	$1,651.98	6	$9,911.90

Subtotal (excl. GST)	**$49,559.52**
GST	**$4,955.95**
Total ecosystem credits (incl. GST)	**$54,515.47**

Species credits for threatened species

Biodiversity payment summary report

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
20341	***Rhodamnia rubescens*** (Scrub Turpentine)	Critically Endangered	Not listed	-	$0.00	30	Contact BCT for pricing

Subtotal (excl. GST)	**Contact BCT for pricing**
GST	**Contact BCT for pricing**
Total species credits (incl. GST)	**Contact BCT for pricing**
Grand total	**Contact BCT for pricing**

APPENDIX C :
Flora Data

Scientific Name	Common Name	Exotic	BAM Growth Form Group	Q1 (PCT 1529)		Q2 (PCT 1565)		Q3 (PCT 1565-Poor)		Q4 (PCT 1565)		Q5 (PCT 1565)		Q6 (PCT 1565)	
				C	A	C	A	C	A	C	A	C	A	C	A
Acmena smithii	Lilly Pilly		Tree (TG)	1	2					0.25	1				
Adiantum aethiopicum	Common Maidenhair		Fern (EG)			0.5	30			1	100				
Ageratina adenophora	Crofton Weed	HTE						0.5	10						
Alectryon subcinereus	Wild Quince		Shrub (SG)			0.5	1			0.5	5				
Allocasuarina torulosa	Forest Oak		Tree (TG)	10	1	25	15	5	1	30	10	5	5	15	10
Anredera cordifolia	Madeira Vine	HTE								0.25	10				
Asparagus aethiopicus	Asparagus Fern	HTE				0.25	10	0.5	25			0.25	15	1	35
Asplenium australasicum	Bird's Nest Fern		Fern (EG)	0.25	1										
Astrotricha floccosa			Shrub (SG)			0.5	2								
Bidens pilosa	Cobbler's Pegs	E						2	50						
Billardiera scandens	Hairy Apple Berry		Other (OG)			0.5	20			0.25	5			0.25	25
Brachychiton acerifolius	Illawarra Flame Tree		Tree (TG)							0.25	1	0.25	1		
Breynia oblongifolia	Coffee Bush		Shrub (SG)							0.5	10	0.5	10		
Callicoma serratifolia	Black Wattle		Shrub (SG)	5	1										
Calochlaena dubia	Rainbow Fern		Other (OG)	0.5	5					2	25			5	-

Scientific Name	Common Name	Exotic	BAM Growth Form Group	Q1 (PCT 1529)		Q2 (PCT 1565)		Q3 (PCT 1565-Poor)		Q4 (PCT 1565)		Q5 (PCT 1565)		Q6 (PCT 1565)	
				C	A	C	A	C	A	C	A	C	A	C	A
Calystegia marginata			Other (OG)	0.5	20	1	50	0.25	10	0.25	25	0.25	25	0.25	20
Cardiospermum halicacabum var. halicacabum	Small Balloon Vine	E						0.25	10	0.25	20				
Cayratia clematidea	Native Grape		Other (OG)	0.25	2										
Ceratopetalum apetalum	Coachwood		Tree (TG)	40	5			10	1						
Ceratopetalum apetalum	Coachwood		Tree (TG)	1	10	3	5								
Cissus hypoglauca	Giant Water Vine		Other (OG)	0.5	5			1	30	0.5	35	0.25	1	1	50
Claoxylon australe	Brittlewood		Shrub (SG)	10	5									2	15
Clematis aristata	Old Man's Beard		Other (OG)									1	100		
Clerodendrum tomentosum	Hairy Clerodendrum		Tree (TG)									1	2	0.5	1
Commelina cyanea	Native Wandering Jew		Forb (FG)	1	25			0.5	30	1	100				
Cryptostylis erecta	Tartan Tongue Orchid		Forb (FG)							0.25	35				
Cymbopogon refractus	Barbed Wire Grass		Grass & grasslike (GG)									1	30		

Scientific Name	Common Name	Exotic	BAM Growth Form Group	Q1 (PCT 1529)		Q2 (PCT 1565)		Q3 (PCT 1565-Poor)		Q4 (PCT 1565)		Q5 (PCT 1565)		Q6 (PCT 1565)	
				C	A	C	A	C	A	C	A	C	A	C	A
Cyperus tetraphyllus			Grass & grasslike (GG)					0.5	55						
Dianella caerulea	Blue Flax-lily		Forb (FG)	0.25	1			0.5	2	1	20	1	25		
Doodia aspera	Prickly Rasp Fern		Fern (EG)			0.5	20	1	25						
Doryphora sassafras	Sassafras		Tree (TG)	0.5	1										
Ehrharta erecta	Panic Veldtgrass	HTE						1	100						
Elaeodendron australe			Shrub (SG)	10	3	2	30	10	1						
Entolasia marginata	Bordered Panic		Grass & grasslike (GG)			0.5	35							0.25	25
Eucalyptus paniculata	Grey Ironbark		Tree (TG)									10	2	35	2
Eustrephus latifolius	Wombat Berry		Other (OG)					0.25	15			0.25	10		
Ficus coronata	Creek Sandpaper Fig		Shrub (SG)	1	2										
Gahnia aspera	Rough Saw-sedge		Grass & grasslike (GG)			1	20			1	15				
Galium binifolium			Forb (FG)									1	30		
Geitonoplesium cymosum	Scrambling Lily		Other (OG)	0.25	10	0.5	20			0.5	70	0.25	25	0.5	50

Scientific Name	Common Name	Exotic	BAM Growth Form Group	Q1 (PCT 1529)		Q2 (PCT 1565)		Q3 (PCT 1565-Poor)		Q4 (PCT 1565)		Q5 (PCT 1565)		Q6 (PCT 1565)	
				C	A	C	A	C	A	C	A	C	A	C	A
Glochidion ferdinandi	Cheese Tree		Tree (TG)			10	3							3	20
Guioa semiglauca	Guioa		Tree (TG)							0.25	1				
Gymnostachys anceps	Settler's Twine		Forb (FG)	0.5	5	0.5	10	1	5	2	50			1	10
Hibbertia dentata	Twining Guinea Flower		Other (OG)	0.25	10	0.5	15			0.25	5	0.25	25		
Homalanthus populifolius			Shrub (SG)	0.25	10	0.25	25	0.5	15						
Hydrocotyle laxiflora	Stinking Pennywort		Forb (FG)							0.5	100			1	100
Ilex aquifolium	English Holly	E										2	2		
Jasminum polyanthum	White Jasmine	E						0.25	2						
Lantana camara	Lantana	HTE				1	20	25	-	50	-	0.5	5	2	35
Lepidosperma latens			Grass & grasslike (GG)									2	35	0.5	5
Leucojum spp.		E						0.25	1						
Ligustrum sinense	Small-leaved Privet	HTE						1	10						
Livistona australis	Cabbage Palm		Other (OG)	5	1	2	30	1	10	3	2	0.5	1	20	5
Lomandra filiformis	Wattle Matt-rush		Grass & grasslike (GG)			0.25	1					0.5	15		

Scientific Name	Common Name	Exotic	BAM Growth Form Group	Q1 (PCT 1529)		Q2 (PCT 1565)		Q3 (PCT 1565-Poor)		Q4 (PCT 1565)		Q5 (PCT 1565)		Q6 (PCT 1565)	
				C	A	C	A	C	A	C	A	C	A	C	A
Lomandra longifolia	Spiny-headed Mat-rush		Grass & grasslike (GG)			0.25	5	1	3	2	15	1	2	0.5	2
Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush		Grass & grasslike (GG)									0.5	15		
Lonicera japonica	Japanese Honeysuckle	HTE				2	50							0.5	35
Melicope micrococca	Hairy-leaved Doughwood		Shrub (SG)			0.25	1							0.5	1
Myrsine variabilis			Shrub (SG)	0.5	5	0.5	15			1	15				
Nandina domestica	Japanese Sacred Bamboo	E										0.25	1		
Notelaea longifolia	Large Mock-olive		Tree (TG)	1	5	10	15	1	2	15	5	0.5	1	25	12
Ochna serrulata	Mickey Mouse Plant	HTE		0.5	5	2	30	5	-	0.5	20	0.25	5	3	10
Oplismenus aemulus			Grass & grasslike (GG)			0.25	25	0.5	35	1	100				
Oplismenus imbecillis			Grass & grasslike (GG)	0.25	15	1	100	0.5	35	0.5	50	1	30	1	100
Oxalis perennans			Forb (FG)							0.5	100				
Pandorea pandorana	Wonga Wonga Vine		Other (OG)					0.25	20	1	100	0.5	50		

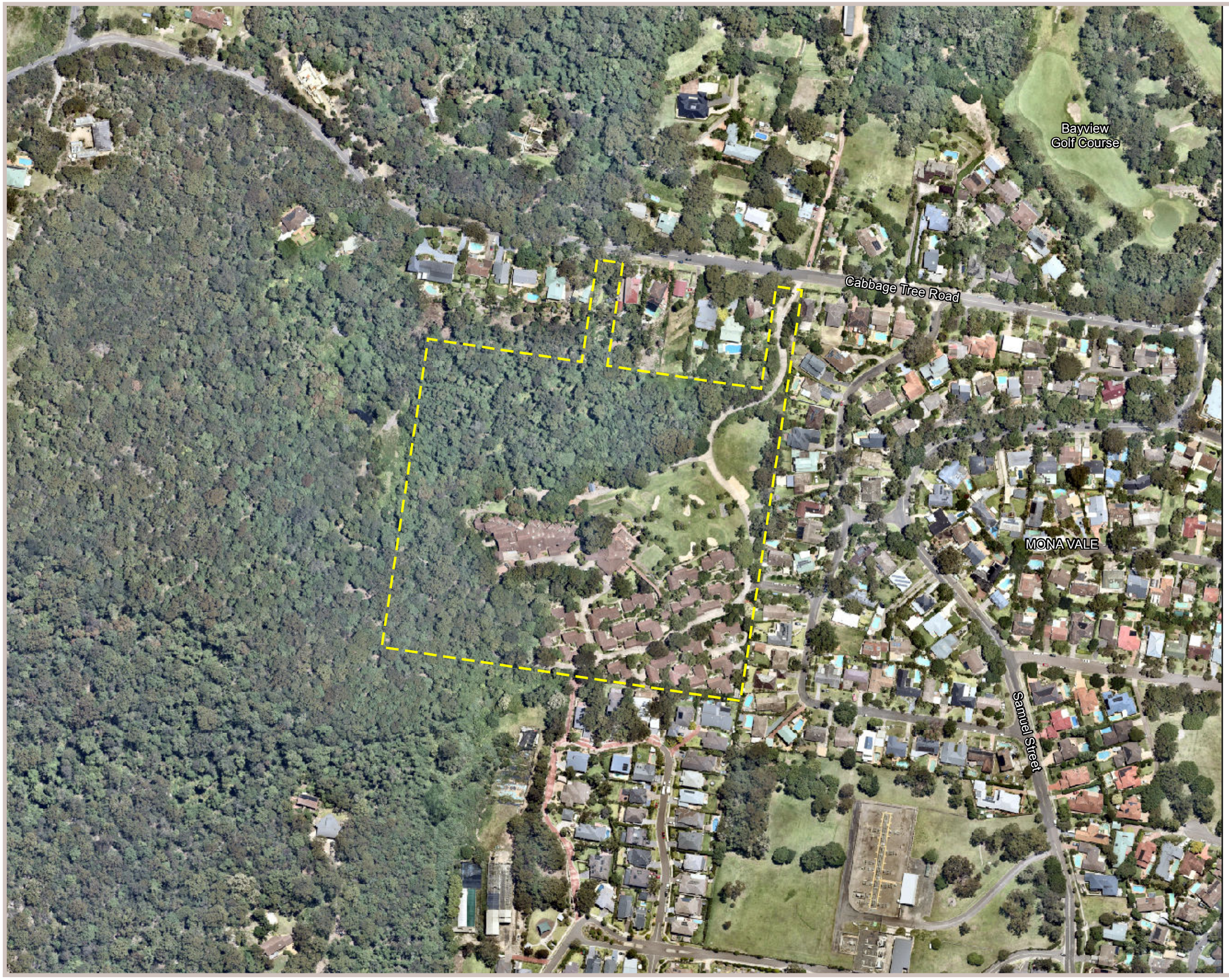
Scientific Name	Common Name	Exotic	BAM Growth Form Group	Q1 (PCT 1529)		Q2 (PCT 1565)		Q3 (PCT 1565-Poor)		Q4 (PCT 1565)		Q5 (PCT 1565)		Q6 (PCT 1565)	
				C	A	C	A	C	A	C	A	C	A	C	A
Parsonsia straminea	Common Silkpod		Other (OG)			1	30			0.5	35			0.25	35
Passiflora herbertiana			Other (OG)									0.25	2		
Pellaea falcata	Sickle Fern		Fern (EG)					0.5	15						
Phaeophyceae spp.								0.25	1						
Phragmites australis	Common Reed		Grass & grasslike (GG)									1	10		
Pittosporum multiflorum	Orange Thorn		Shrub (SG)									1	10		
Pittosporum undulatum	Sweet Pittosporum		Shrub (SG)	0.5	1	2	2	5	2					5	2
Plectranthus neochilus		E		1	15										
Pratia purpurascens	Whiteroot		Forb (FG)			0.25	25			0.25	30	0.25	5	0.25	15
Pseuderanthemum variabile	Pastel Flower		Forb (FG)	0.25	2	1	100					0.25	15		
Pteridium esculentum	Bracken		Fern (EG)	3	25	30	-	1	20	40	-			45	-
Sarcopetalum harveyanum	Pearl Vine		Other (OG)					0.25	10						
Schizomeria ovata	Crabapple		Tree (TG)	0.5	1										
Senecio linearifolius	Fireweed Groundsel		Forb (FG)			0.25	10	0.25	5	0.25	5				

Scientific Name	Common Name	Exotic	BAM Growth Form Group	Q1 (PCT 1529)		Q2 (PCT 1565)		Q3 (PCT 1565-Poor)		Q4 (PCT 1565)		Q5 (PCT 1565)		Q6 (PCT 1565)	
				C	A	C	A	C	A	C	A	C	A	C	A
Senna pendula var. glabrata		E		0.25	5	1	20	0.5	15	2	50			1	25
Smilax australis	Lawyer Vine		Other (OG)	1	20	0.1	35	1	15					0.25	20
Smilax glyciphylla	Sweet Sarsparilla		Other (OG)			0.25	10			0.5	40				
Stephania japonica	Snake vine		Other (OG)	1	20	1	50	0.5	10	0.5	35	0.25	10	0.25	20
Syncarpia glomulifera	Turpentine		Tree (TG)			35	10	10	2	10	3	30	4	5	1
Tradescantia fluminensis	Wandering Jew	HTE						1	30	0.25	10				
Trochocarpa laurina	Tree Heath		Tree (TG)			2	3								
Tylophora barbata	Bearded Tylophora		Other (OG)	0.25	2					0.25	10				
Viola hederacea	Ivy-leaved Violet		Forb (FG)							0.25	50				
Wilkiea huegeliana	Veiny Wilkiea		Shrub (SG)	0.5	1	0.25	3			3	2			3	5
Zieria cytisoides	Downy Zieria		Shrub (SG)									0.25	10		

Key: C = Cover, A = Abundance, E = Exotic, HTE = High Threat Exotic

Note: Zone 1: PCT 1565-Moderate required a minimum of two plots in the BAM-C. As Q4 and Q5 lie outside of the impact footprint, data in the BAM-C for Zone 1 was limited to Q2 and Q6.

FIGURES



Legend

Study Area

Image Source:
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Dated: 28/12/2019

Data Source:
NSW Government Spatial Services
SIX Maps 'Clip and Ship'
Northern Beaches LGA

Coordinate System: MGA Zone 56 (GDA 94)

cumberland ecology

0 50 100 m

I:\...\18171\Figures\RP1\20191011\Figure 1. Location of the study area

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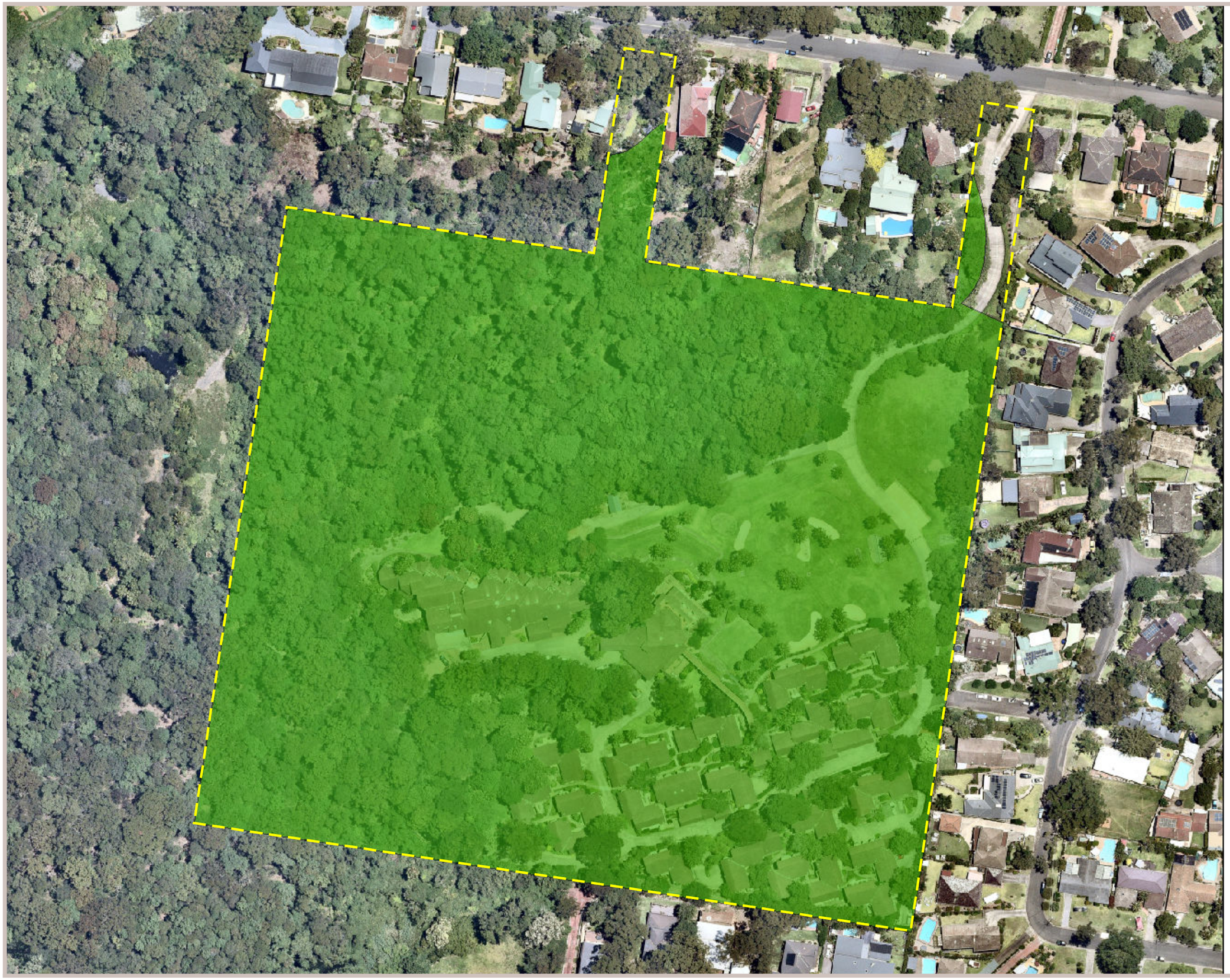

Legend

- Study Area
- Terrestrial Biodiversity

Image Source:
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I:\...\18171\Figures\RP1\20191011\Figure 2. Terrestrial biodiversity

Figure 2. Terrestrial biodiversity layer within study area

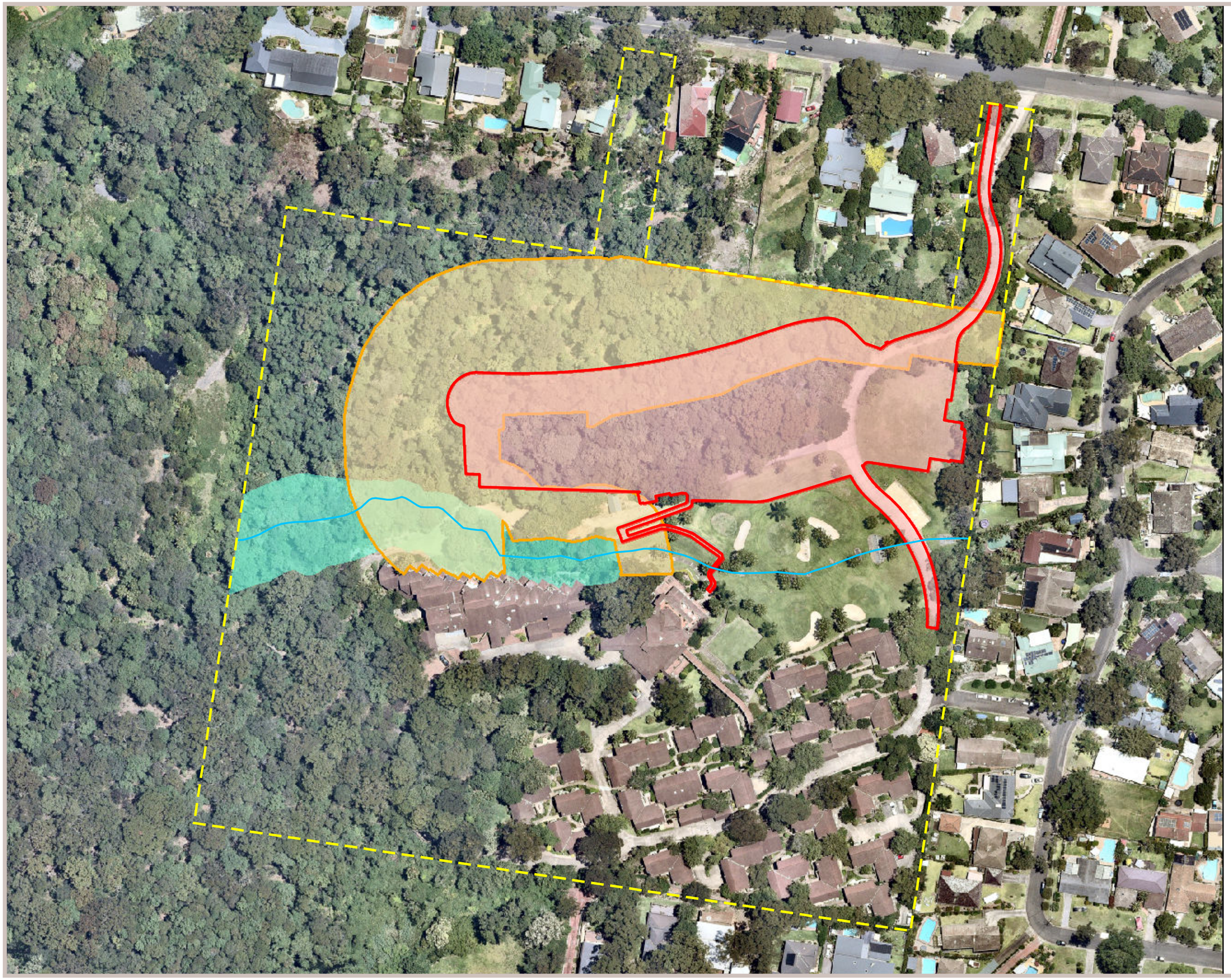
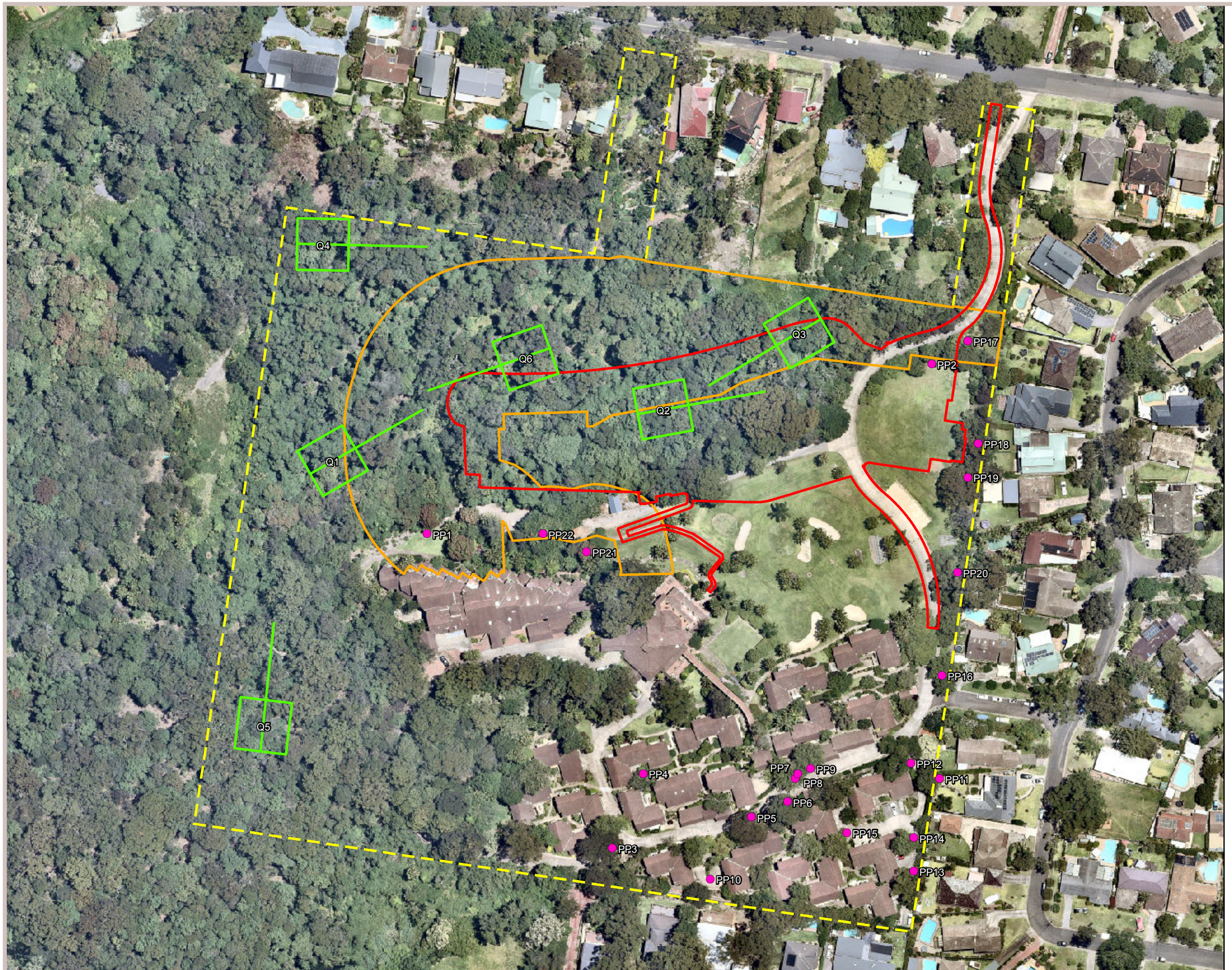


Figure 3. Proposed development layout



Legend

- Study Area
- Proposed Development Footprint
- Asset Protection Zone

Flora Survey Locations

- Plot Locations
- Transect Locations
- Photopoints

Image Source:
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0 50 m

I:\...\18171\Figures\RP1\20191011\Figure 4. Survey locations

Figure 4. Survey locations

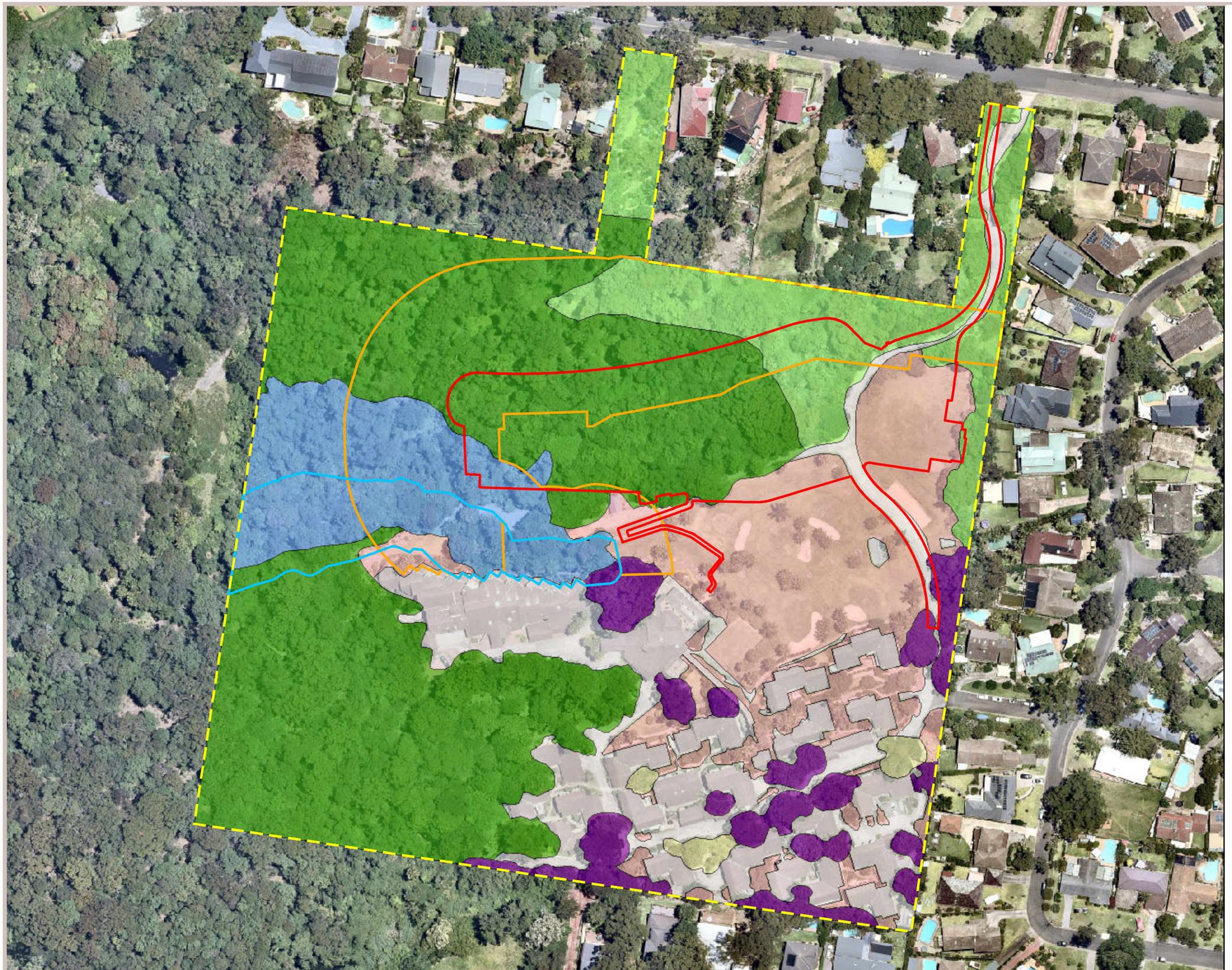

Figure 5. Vegetation communities in the study area

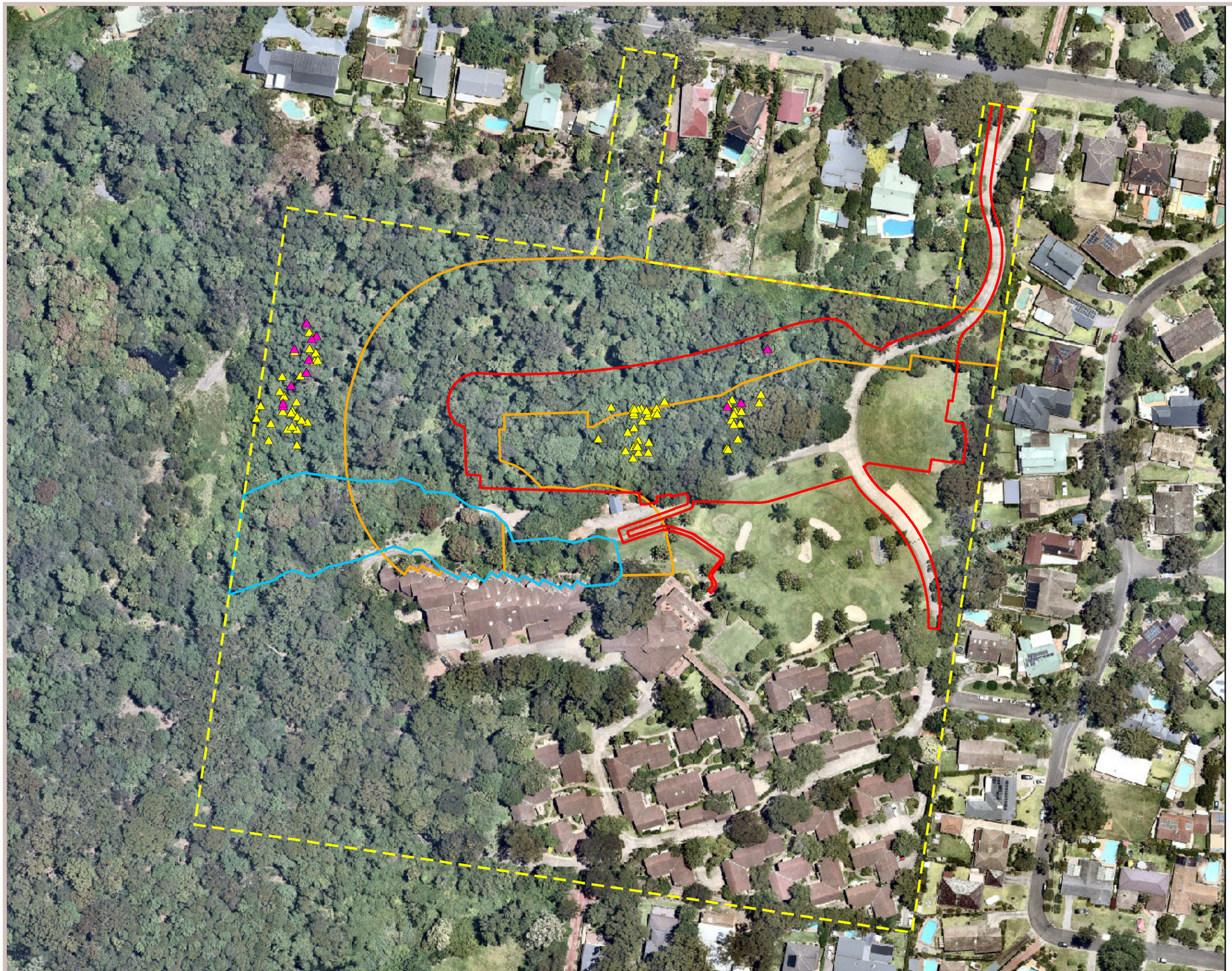

Figure 6. Threatened species recorded from the study area

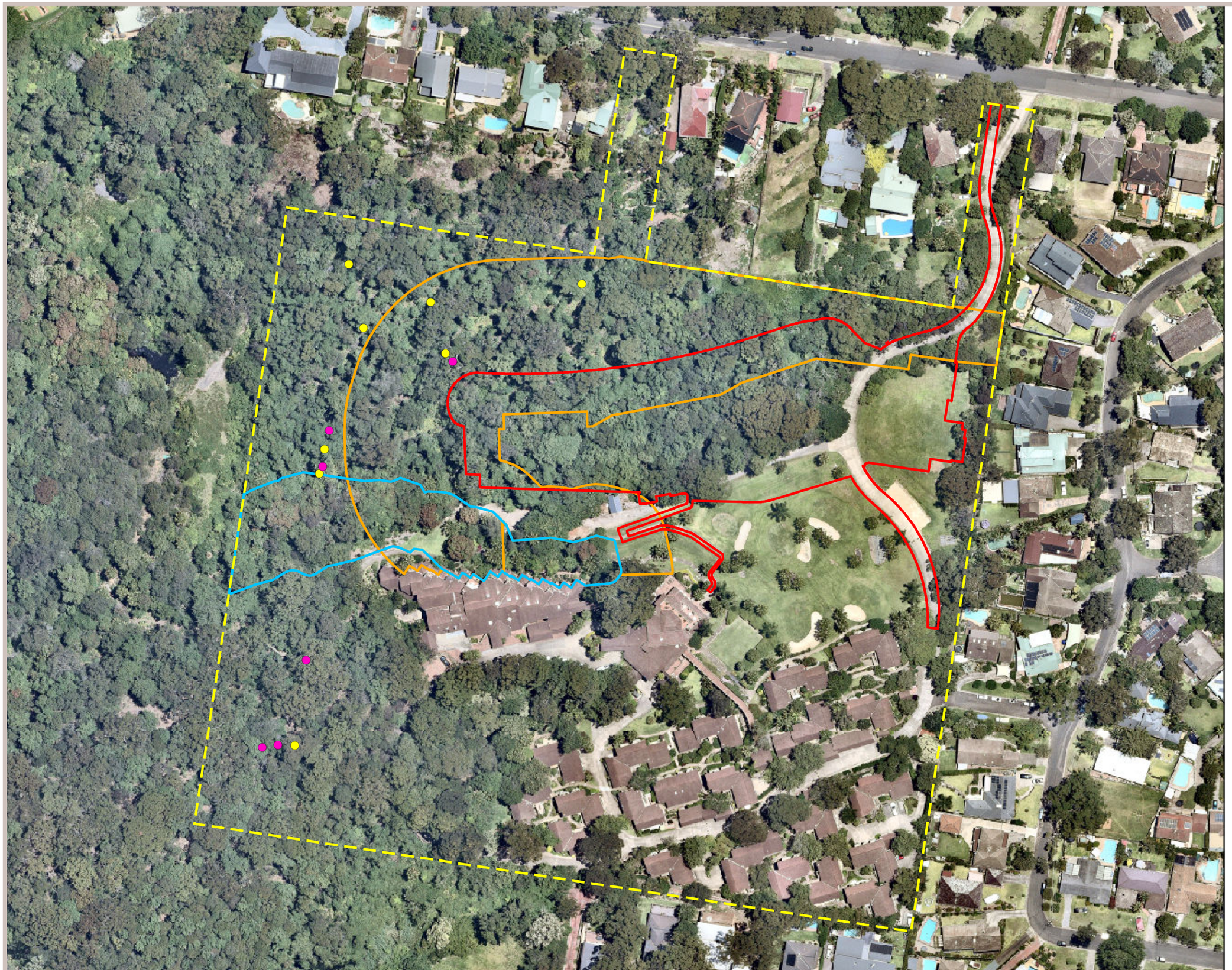

Figure 7. Habitat trees recorded from the study area