43, 45-49 Warriewood Road, Warriewood

Biodiversity Development Assessment Report

Creative Planning Solutions

8 July 2021

Final

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Report No. 21097RP2

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or commendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

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Approved by:	**Dr David Robertson**
Position:	Director
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Date:	12 July, 2021

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Glossary

Term / Abbreviation	Definition
APZ	Asset Protection Zone
asl	Above sea level
Assessment Area	1,500 m buffer surrounding the subject land
BAM	Biodiversity Assessment Method 2020
BAMC	Biodiversity Assessment Method Calculator
BC Act	NSW *Biodiversity Conservation Act 2016*
BC Regulation	NSW *Biodiversity Conservation Regulation 2017*
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan (doc. 21097RP1)
BMP area	Area subject to the management protocols of the Biodiversity Management Plan (doc. 21097RP1)
BOS	Biodiversity Offset Scheme
CPS	Creative Planning Solutions
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DBH	Diameter at Breast Height
DPIE	NSW Department of Planning, Industry and the Environment
EES	Environment, Energy and Science Group
EP&A Act	*Environmental Planning and Assessment Act 1979*
GIS	Geographic Information Systems
ha	Hectares
IPA	Inner Protection Area
LEP	Local Environment Plan
NSW	New South Wales
OEH	Office of Environment and Heritage
PCT	Plant Community Type
SAII	Serious and Irreversible Impact
SEPP	State Environment Planning Policy
study area	43, 45-49 Warriewood Road, Warriewood (Lots 1 and 2 DP 349085)
subject land	Direct impact boundary of the Project, comprising both the construction and operational development footprint
TEC	Threatened Ecological Community
the Project	Proposed development of two residential flat buildings containing thirty-four apartments

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1. Introduction

Cumberland Ecology was engaged by Creative Planning Solutions (CPS) to prepare a Biodiversity Development Assessment Report (BDAR) for a proposed subdivision and redevelopment on a property located at 43, 45-49 Warriewood Road, Warriewood (the 'study area'). This BDAR forms part of the documentation to support the application for development consent under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act). It is understood that consent is sought for development to include a twelve (12) lot residential subdivision, civil works and construction of integrated residential development including two (2) residential flat buildings containing thirty-four (34) apartments (the Project). The area earmarked for development within the study area is hereafter referred to as the 'subject land.'

This BDAR has been prepared in accordance with the Biodiversity Assessment Method 2020 (BAM) (DPIE 2020a).

It is noted that a previous Development Application (DA2020/1517) for the site was submitted to Northern Beaches Council in March 2021 and subsequently withdrawn. A BDAR was prepared by Lesryk Environmental (2020) to accompany the DA that intended to assess the impacts of the project on the biodiversity values of the site, prepared using the since replaced BAM 2017 (NSW Government 2017). Council provided a suite of comments on review of the previous BDAR to be addressed prior to re-submission. Cumberland Ecology understands that the current DA to be submitted is separate to DA2020/1517 and can therefore be assessed using the current BAM 2020. Nevertheless, this BDAR while following the methods of BAM 2020, still seeks to address the comments made by Council on 5 March 2021 for DA2020/1517.

1.1. Requirement for BDAR

Under the NSW *Biodiversity Conservation Act 2016* (BC Act), all development that requires development consent under Part 4 of the EP&A Act that is likely to significantly affect threatened species as set out in Clause 7.2 of the BC Act and Clause 7.1 to 7.3 of the NSW *Biodiversity Conservation Regulation 2017* (BC Regulation) must be assessed using the BAM with the results presented in a BDAR. The project requires clearing of native vegetation within an area mapped on the Biodiversity Values Map and as such, the impacts associated with the project require assessment using the BAM.

This BDAR has been prepared in accordance with the BAM. Under BAM, for projects involving clearing of less than 2 ha of native vegetation on a lot with a minimum lot size of less than 40 ha and not less than 1 ha, the Small Area Streamlined Assessment Module may be used. As a result, this BDAR has been prepared according to the requirements for the Streamlined Assessment Module outlined in Appendix C of the BAM.

1.2. Purpose

The purpose of this BDAR is to document the findings of an assessment undertaken for the project in accordance with Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the BAM.

Specifically, the objectives of this BDAR are to:

- Identify the landscape features and site context (native vegetation cover) within the subject land and assessment area;

- Assess native vegetation extent, plant community types (PCTs), threatened ecological communities (TECs) and vegetation integrity (site condition) within the subject land;
- Assess habitat suitability for threatened species that can be predicted by habitat surrogates (ecosystem credits) and for threatened species that cannot be predicted by habitat surrogates (species credit species);
- Identify potential prescribed biodiversity impacts on threatened species;
- Describe measures to avoid and minimise impacts on biodiversity values and prescribed biodiversity impacts during project planning;
- Describe impacts to biodiversity values and prescribed biodiversity impacts and the measures to mitigate and manage such impacts;
- Identify compliance with the requirements of the Pittwater LEP 2014 (Northern Beaches Council 2014);
- Identify the thresholds for the assessment and offsetting of impacts, including:
    - Impact assessment of potential entities of serious and irreversible impacts (SAII);
    - Impacts for which an offset is required;
    - Impacts for which no further assessment is required;
- Describe the application of the no net loss standard, including the calculation of the offset requirement; and
- Address comments from council for DA2020/1517 received on 5 March 2021.

A compliance table has been provided in **Appendix A** to demonstrate how this BDAR complies with Table 27 of Appendix L of the BAM, which details the minimum information requirements for a BDAR for Small Area Streamlined Assessments.

1.3. Project Description

1.3.1. Location

The project is located at 43, 45-49 Warriewood Road, Warriewood (Lots 1 and 2 DP 349085) (the 'study area'). The study area is currently residential land containing two vacant dwellings and is zoned R3 – Medium Density Residential under the Pittwater Local Environment Plan 2014 (LEP). The subject land is situated in the northern half of the study area and covers approximately 1.34 ha. The study area is surrounded by residential areas to the north, east and west, and a riparian corridor associated with Narrabeen Creek to the south.

A site map and location map have been prepared in accordance with the BAM and are presented in **Figure 1** and **Figure 2**, respectively.

1.3.2. Proposed Development

Consent is sought for development within the study area, including a twelve (12) lot residential subdivision, civil works and construction of integrated residential development including two (2) residential flat buildings containing thirty-four (34) apartments. This includes requirements for partial excavation of areas within the subject land and alterations to the site access. It is understood that the project activities are to be undertaken in collaboration with the extension of Lorikeet Grove.

The project also includes requirements for an Asset Protection Zone (APZ), landscaped areas, a stormwater infiltration basin and management of retained vegetation under a Biodiversity Management Plan (BMP). Documents outlining the details of these requirements will be submitted in association with the DA including the BMP also prepared by Cumberland Ecology (doc. 21097RP1).

1.3.3. Identification of the Development Site Footprint

The layout of the project is shown in **Figure 3**. The development site footprint (hereafter referred to as 'subject land') comprises approximately 1.34 ha of land directly impacted by the project, including the building footprints, associated driveways and additional ancillary infrastructure, landscaping, the required Asset Protection Zone, . (Advanced Bushfire Performance Solutions 2021), as well as any additional areas likely to be impacted by the earthworks. Hence, for the purposes of this assessment, the subject land comprises both the construction footprint and the operational footprint of the project.

1.3.4. General Description of the Subject Land

The subject land is currently residential land containing two vacant dwellings that uniformly slopes in a south-westerly direction from approximately 12 m above sea level (asl) to 4 m asl in the south-west along Narrabeen Creek.

The subject land predominantly comprises previously cleared lands and exotic vegetation with a ground layer infested by introduced weed species. Review of historical aerial imagery (Spatial Services NSW Goverment 2021) indicates the subject land has been cleared of native vegetation since at least 1951. However, as there is no clear aerial imagery for the subject land prior to 1951, it is not clear when the vegetation was cleared, or whether vegetation at the rear of the study area along Narrabeen Creek has been previously cleared. By 1951, tree cover was largely absent due to the previous agricultural land uses of the subject land.

Parts of the subject land appears to have undergone some levelling and fill to facilitate the extension of Lorikeet Grove in a westerly direction. It is understood that these works are currently being undertaken by Sydney Water and are in association with the project such that the road extension will allow access points to the development. It is apparent however, that edge effects have caused a degree of degradation to the native vegetation at the rear of the study area prior to these works.

1.3.5. Databases

Several databases were utilised during the preparation of this BDAR, including:

- Environment, Energy and Science (EES) BioNet Atlas (EES 2021a);

- EES Threatened Biodiversity Data Collection (EES 2021a);
- EES BioNet Vegetation Classification database (EES 2021b);
- Commonwealth Department of Agriculture, Water and the Environment (DAWE) Species Profile and Threat Database (DAWE 2021); and
- DAWE Directory of Important Wetlands in Australia.

1.3.6. Literature

This BDAR has utilised the results and/or spatial data from the following documents:

- Former Office of Environment and Heritage (OEH 2016b) The Native Vegetation of the Sydney Metropolitan Area - VIS_ID 4489;
- Pittwater LEP 2014 mapping (Northern Beaches Council 2014); and
- Department of Planning, Industry and the Environment (DPIE) (DPIE 2020b) State Environmental Planning Policy (Coastal Management) 2018 mapping.

1.3.7. Aerial Photography

The aerial imagery used in this BDAR is sourced from NearMap and is dated 2 June 2021. Additional aerial images available on the NSW Government Historical Imagery Viewer and SixMaps were also consulted where relevant.

1.4. Authorship and Personnel

This document has been prepared under the direction of Dr David Robertson (BAM Accredited Assessor No: BAAS17027). This document and associated field surveys and geographic information systems (GIS) mapping were prepared with the assistance of additional personnel as outlined in **Table 1**. Notwithstanding the assistance of the additional personnel, the assessment presented within this document is Dr Robertson's.

Table 1 Personnel involved in preparation of this BDAR

Name	Tasks	Relevant Qualifications / Training	BAM Accredited Assessor No.
Dr David Robertson	Document review, project direction	Doctor of Philosophy. Ecology, University of Melbourne, 1986 Bachelor of Science (Honours) in Ecology, University of Melbourne, 1980 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS17027
Cecilia Eriksson	Document review	Master of Science (Major in Marine Science and Management). University of Technology Sydney, 2013	BAAS19052

Name	Tasks	Relevant Qualifications / Training	BAM Accredited Assessor No.
		Bachelor of Science (Honours) in Marine Biology, University of Technology Sydney, 2008 BAM Accredited Assessor Training. Muddy Boots, 2017	
Jesse Luscombe	Document preparation, GIS Mapping	Bachelor of Marine Science. Macquarie University, 2013 Certificate III in Conservation and Land Management. TAFE NSW, 2016 BAM Accredited Assessor Training. Muddy Boots, 2018	-
Bryan Furchert	Field surveys, PCT analysis	Bachelor of Biodiversity and Conservation. Macquarie University, 2012 Diploma of Conservation and Land Management. TAFE NSW, 2008 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS18095
Rebeca Violante	Field surveys, Data entry and analysis	Bachelor of Biology, Universidade Paulista, 2015. Bachelor of Communication (Journalism), Universidade Metodista de Sao Paulo, 2008. Advanced Diploma of Business, Bridge College, Sydney, 2020. Diploma of Project Management, Bridge College, Sydney, 2018. BAM Accredited Assessor Training. Muddy Boots, 2019.	-

2. Methodology

2.1. Review of Existing Data

Existing information on biodiversity values within the subject land and assessment area was reviewed, which includes:

- Species data that is held in the BioNet Atlas;
- The following existing reports:
  - Civil Engineering Works prepared by C&M Consulting Engineers (2021)
  - Arboricultural Impact Assessment Report prepared by Creative Planning Solutions (2021a);
  - Landscape Plan prepared by Creative Planning Solutions (2021c);
  - Bushfire Assessment Report prepared by Advanced Bushfire Performance Solutions (2021): and
  - Biodiversity Development Assessment Report for 43, 45-49 Warriewood Road, Warriewood, NSW prepared by Lesryk Environmental (2020)

This existing information was considered and included, where appropriate, into survey design, vegetation mapping and reporting.

2.2. Landscape Features

Landscape features requiring consideration were initially determined via desktop assessment. Field surveys undertaken on 10 June 2021 sought to verify the following landscape features:

- Rivers, streams and estuaries;
- Important and local wetlands;
- Karsts, caves, crevices, cliffs and areas of geological significance; and
- NSW BioNet Landscapes.

No amendments were required to be made to any of these landscape features following field surveys.

2.3. Native Vegetation Survey

2.3.1. Vegetation Mapping

Broad scale vegetation mapping exists for the subject land and surrounds, including the mapping of the Sydney Metropolitan area by the former Office of Environment and Heritage (OEH 2016c). Cumberland Ecology conducted vegetation surveys on 10 June 2021 to verify and update (where required) the vegetation mapping. The vegetation within the subject land and wider study area was ground-truthed to examine and verify the mapping of the condition and extent of the different plant communities. Mapping of plant communities within the subject land was undertaken by random meander surveys through patches of vegetation, noting key

characteristics of areas in similar broad condition states such as similar tree cover, shrub cover, ground cover, weediness or combinations of these. Soils were also inspected.

Records of plant community boundaries were made using a hand-held Global Positioning System and mark-up of aerial photographs. The resultant information was synthesised using GIS to create a spatial database that was used to interpret and interpolate the data to produce a vegetation map of the subject land and wider study area.

2.3.2. Vegetation Integrity Assessment

Vegetation integrity assessments within the subject land were undertaken in accordance with the BAM on 10 June 2021.

Surveys included establishment of 20 x 50 m plots, with an internal 20 x 20 m floristic plot. The following data was collected within each of the plots:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within the 20 m x 20 m floristic 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 the 20 m x 20 m floristic plot;
- Cover of 'High Threat Exotic' weed species within the 20 m x 20 m floristic plot;
- Assessment of function attributes within the 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 <5 cm DBH;
    - 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 each 20 m x 50 m plot; and
- Number of trees with hollows that are visible from the ground within each 20 m x 50 m plot.

Three BAM plots were completed, and their location is shown in **Figure 4**. **Table 2** summarises the plot requirements based on the size and number of vegetation zones in the subject land. Although BAM plots are not required to be surveyed in exotic vegetation, one plot was surveyed in exotic grassland to verify that this vegetation did not conform to a native grassland community. Additionally, the plot associated with Zone 1: 1795_Moderate was placed outside the subject land as the area within the subject land was too small and as such, it was determined on site that the location shown on **Figure 4** for Plot 3 was a more appropriate location to represent the condition of the zone. The minimum number of plots has been completed for all vegetation zones.

Table 2 BAM Plot survey requirements

Vegetation Zone	PCT	Condition	Area within Subject Land (ha)	Minimum Number of Plots Required	Number of Plots Completed
1	1795	Moderate	0.02	1	1
2	1795	Low	0.03	1	1
n/a	Exotic	Exotic grassland	0.51	0	1

2.4. Threatened Flora Species Survey

2.4.1. Habitat Constraints

Desktop assessments and field surveys within the subject land included assessment of habitat constraints and microhabitats for predicted species credit flora species.

2.4.2. Targeted Flora Species Survey

No candidate flora species credit species require further assessment under ***Section 5.3*** of the BAM. Nonetheless, as a precautionary approach, a targeted threatened flora survey was still undertaken within the subject land in order to rule out any threatened species occupation, for species with a recommended survey period that aligned with the flora survey undertaken for the project.

2.4.2.1. Random Meander

A random meander survey and plot survey was undertaken within the subject land and wider study area on 10 June 2021. Due to the small area of potential habitat within the subject land, a random meander was deemed appropriate for the survey, and was supplemented with the required plot survey. The random meander survey and plot survey was undertaken by a botanist and ecologist.

The locations of the random meander shown as survey track, and plots within the subject land are shown in **Figure 4**.

2.5. Threatened Fauna Species Survey

2.5.1. Habitat Constraints

Desktop assessments and field surveys within the subject land included assessment of habitat constraints and microhabitats for predicted species credit fauna species. This included desktop assessment of proximity of the subject land to features such as caves and waterways and field inspection of microhabitats including leaf litter, stick nests and hollowing-bearing trees.

2.5.2. Targeted Species Survey

Under Section 5.2.2 of the BAM, species credit species can be excluded from further assessment, and thereby targeted surveys, if it is determined that none of the species-specific habitat constraints are present within the subject land. Furthermore, under Section 5.2.3 of the BAM, a candidate species credit species can be considered unlikely to occur on the subject land (or specific vegetation zones) if after carrying out a field assessment, the

assessor determines that the habitat is substantially degraded such that the species is unlikely to utilise the subject land (or specific vegetation zones).

No candidate fauna species credit species predicted in the BAMC were determined to need further assessment (see ***Section 5.3***). However, as noted in the previous BDAR prepared for the site by Lesryk Environmental, previous surveys recorded a calling Barking Owl (*Ninox connivens*) within the site. Hence, this species was added to the BAMC for further assessment in accordance with the BAM. Although the BDAR prepared by Lezryk Environmental concluded that no breeding habitat occurred within the subject land for the Barking Owl, comments received from Council on 5 March 2021 suggested that there is some uncertainty as to whether breeding habitat occurs within the study area. As a result, further surveys for the Barking Owl were required and undertaken for this BDAR, as outlined in ***Section 2.5.2.1*** below.

2.5.2.1. Barking Owl (Ninox connivens)

Two nights of nocturnal surveys were completed in accordance with the survey requirements described in the TBDC to determine whether breeding habitat for the Barking Owl was present in the study area. This included initial random meander surveys throughout the study area and subject land, marking tracks with a handheld GPS, to search for suitable habitat trees for the species. The searches were specifically focused on previously identified hollow-bearing trees, as part of the assessment for habitat constraints. Any potential nest trees identified as part of the random meander surveys where then monitored for the two nights, to detect the presence of any owl, and specifically the Barking Owl, using the potential nest tree or demonstrating a behaviour focused on the identified trees. The monitoring also included searching the potential nest tree and immediate surrounds for evidence of occupation, which included searching the ground layer for feathers and owl pellets, undertaking call playback and spotlighting, and a visual analysis of any suitable large hollows.

Two hollows large enough to allow breeding habitat, in two separate trees, were recorded during the survey period that were monitored for occupation and evidence of usage as breeding habitat by the Barking Owl. The details of these hollows are in **Table 3** and shown on **Figure 4**.

Table 3 Hollows assessed for potential breeding habitat

Hollow Label	Easting	Northing	Size
H1	342145	6271191	20 cm x 7 cm
H2	342138	6271140	20 cm x 10 cm

2.6. Weather Conditions

Weather conditions during the field surveys were appropriate for detection of species according to data obtained from BOM Weather Station 66059 (Terrey Hills AWS).

Table 4 Survey weather conditions

Date	Temperature Minimum (°C)	Temperature Maximum (°C)	Rainfall (mm)
10 June 2021	8.8°C	5.5°C	2.0 mm
5 July 2021	4.1°C	14.8°C	0.0 mm
6 July 2021	3.7°C	15.3 °C	0.0 mm

2.7. Biodiversity Assessment Method Calculator

Within the BAMC, the impacts on vegetation Zone 1: 1795_Moderate and vegetation Zone 2: 1795_Low were assessed using the Streamlined assessment module - Small area for the subject land.

3. Landscape Features

3.1. Assessment Area

The subject land is approximately 1.34 ha in area and is shown in **Figure 1**. As the project is being assessed as a site-based project, the assessment area comprises the area of land within a 1,500 m buffer around the outer boundary of the subject land. The assessment area is approximately 815.9 ha in area and is shown in **Figure 2**.

3.2. Landscape Features

Landscape features identified within the subject land and assessment area are outlined below. The extent of these features within the subject land is shown in **Figure 1** and the extent within the assessment area is shown in **Figure 2**.

3.2.1. IBRA Bioregion and IBRA Subregion

The subject land is located within the Sydney Basin IBRA Bioregion and the Pittwater IBRA Subregion.

3.2.2. Rivers, Streams and Estuaries

No watercourses occur within the subject land, however Narrabeen Creek, a 2nd order stream, flows through the southern boundary of the study area. Watercourses in the assessment area are mapped in **Figure 2** and include the Narrabeen Creek and Mullet Creek, which is a second order stream. Several minor tributaries of these creeks, that are first or second order streams, are also present in the assessment area.

The subject land drains towards the Narrabeen Creek and ultimately to Narrabeen Lagoon in the south. Narrabeen Creek, a tributary of Mullet Creek flows in a south-easterly direction and drains into Mullet Creek approximately 1 km south of the subject land. Narrabeen Creek and Mullet Creek form part of the Sydney Metro catchment.

No estuaries occur in the subject land and assessment area.

3.2.3. Wetlands

The subject land contains the edge of a Coastal Wetland mapped under the *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP), as shown on **Figure 1** and **Figure 2**. Additional areas mapped under the Coastal Management SEPP are located within the assessment area downstream along Narrabeen Creek and Mullet Creek. These Coastal Wetlands include areas of Freshwater Wetlands and Freshwater Swamp Forests mapped by the former OEH for the Sydney Metropolitan Area.

There are no wetlands included in the DAWE Nationally Important Wetlands database within the subject land or assessment area.

3.2.4. Habitat Connectivity

The subject land contains a very small amount of native vegetation that is connected with the riparian corridor of Narrabeen Creek. The riparian corridor fringes these river systems but does not extend into the subject land. As mentioned previously however, areas mapped as Coastal Wetlands under the Coastal Management SEPP

occur on the edge of the subject land, which have an associated mapped riparian corridor that extends into the subject land.

The small areas of native vegetation along the southern boundary of the subject land have connectivity with vegetation extending to the north-west and south-east along Narrabeen Creek, which ultimately provides connectivity to Narrabeen Lagoon. In all other directions, the vegetation that remains in the subject land has a limited function as a corridor due to previous clearing, and is now mainly limited to 'stepping-stone' habitat connecting with narrow rows of trees (mostly street trees) that are planted native vegetation, within a predominantly residential setting.

3.2.5. Karsts, Caves, Crevices, Cliffs and Areas of Geological Significance

No karsts, caves, crevices, cliffs or areas of geological significance have been identified within the subject land or assessment area based on searches of available aerial imagery from NearMap, or topographic data available from SixMaps.

3.2.6. Areas of Outstanding Biodiversity Value

No Areas of Outstanding Biodiversity Value (AoBVs) have been mapped within the subject land or assessment area.

3.2.7. NSW (Mitchell) Landscapes

The subject land is located on the southern extent of Belrose Coastal Slopes 'NSW (Mitchell) Landscape.' The assessment area comprises a combination of the 'Belrose Coastal Slopes', and 'Sydney – Newcastle Barriers and Beaches' landscapes.

3.2.8. Soil Hazard Features

The subject land occurs within land designated as 'Low Probability' on the OEH Acid Sulfate Soils Risk mapping (OEH 2016a).

3.3. Native Vegetation Cover

The native vegetation cover was determined using GIS. To map native vegetation cover within the subject land and assessment area, this assessment utilised the detailed vegetation mapping prepared by Cumberland Ecology in conjunction with the Vegetation Mapping of the Sydney Metropolitan Area (OEH 2016b). The native vegetation cover within the assessment area is shown in **Figure 2**. It occupies approximately 165 ha, which represents 20.32% of the assessment area. Therefore, the native vegetation cover value is assigned to the cover class of >10-30%.

No differences between the aerial photographs used in this assessment and the native vegetation cover shown in **Figure 2** have been identified.

4. Native Vegetation

4.1. Native Vegetation Extent

The study area and subject land were subject to detailed surveys by Cumberland Ecology for the purpose of this BDAR. The native vegetation extent within the subject land was determined through aerial photograph interpretation, desktop review and field surveys. The native vegetation extent within the subject land is shown in **Figure 5**. Native vegetation occupies approximately 0.05 ha (4%) of the subject land. The native vegetation extent within the subject land largely comprises native vegetation in the southern extent, with one *Eucalyptus robusta* (Swamp Mahogany) in the north of the subject land. The native vegetation mapped within the study area is largely consistent with local vegetation units in the mapping for the native vegetation of the Sydney Metropolitan Area (OEH 2016b). Specifically, this mapping for the Sydney Metropolitan Area contains equivalent map units approximately 100 m to the north west of the study area along the riparian corridor of Narrabeen Creek.

The remaining areas within the subject land comprises exotic vegetation and cleared lands (**Table 3**). In accordance with Section 4.1.2 of the BAM, these areas do not require further assessment, unless they provide habitat for threatened species or are proposed for restoration as part of an offset. Therefore, these areas do not require further assessment. No differences between the aerial photographs used in this assessment and the native vegetation extent shown in **Figure 5** have been identified.

4.2. Plant Community Types

Identification of the PCTs occurring within the subject land was guided by the results of the Cumberland Ecology surveys. The data collected during surveys of the subject land and wider study area was analysed in conjunction with a review of the PCTs held within the BioNet Vegetation Classification Database. Consideration was given to the following:

- Existing vegetation mapping prepared by the former OEH (2016b) for the subject land and immediate surrounds;
- Occurrence within the Pittwater IBRA subregion;
- Vegetation formation;
- Landscape position, soil and geology;
- The relative abundance of planted and locally indigenous native species; and
- Upper, mid and ground strata species including key diagnostic species detailed within the Native Vegetation of the Sydney Metropolitan Area (OEH 2016b) and BioNet Vegetation Classification Database.

The analysis determined that the native vegetation within the subject land aligned with one PCT held within the BioNet Vegetation Classification database.

Table 4 provides a summary of the PCTs identified within the subject land and wider study area and the approximate areas of each PCT. The distribution of these PCTs is shown in **Figure 6**. Detailed descriptions of these PCTs and the justification for PCT selection is provided in the sections below.

Table 5 PCTs within the study area and subject land

PCT	Condition	BC Act Listing	Study Area (ha)	Subject Land (ha)
PCT1795: Coastal flats Swamp Mahogany Forest	Moderate	EEC	0.57	0.02
PCT1795: Coastal flats Swamp Mahogany Forest	Low	EEC	0.04	0.03
PCT1795: Coastal flats Swamp Mahogany Forest	Revegetation	Not Listed	0.05	0.00
Exotic Vegetation	-		0.68	0.51
Cleared Lands	-		0.79	0.77

4.2.1. PCT1795 Coastal Flats Swamp Mahogany Forest

Vegetation Formation: Forested Wetlands

Vegetation Class: Coastal Swamp Forests

Percent Cleared Value: 50%

4.2.1.1. Condition Class 1 – Moderate

BC Act Status: Endangered Ecological Community - Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

EPBC Act Status: Not listed

This community occurs throughout the southern half of the study area (**Photograph 1**), in small areas on the southern edge of the subject land. The community is consistent with the Coastal Flats Swamp Mahogany Forest community described by the formally named OEH (2016c).

Although this community represents the highest quality native vegetation within the subject land, the occurrence of the community within the site is highly degraded with exotic species forming significant components of the canopy, sub-canopy, and shrub and ground layers, and are sub-dominant to dominant in some strata in some areas. Dominant native species in the canopy are *Casuarina glauca* (Swamp Oak) and *Eucalyptus robusta* (Swamp Mahogany), with *Livistona australis* (Cabbage Palm) occurring to a lesser extent. Native species in the sub-canopy include younger individuals of the canopy species as well as *Melaleuca linariifolia* (Flax-leaved Tea-tree). Exotic species common to sub-dominant in the canopy and sub-canopy are *Erythrina x sykesii* (Coral Tree) and *Erythrina crista-galli* (Cockspur Coral Tree), which are profuse throughout the southern half of the wider study area, and there are occurrences of *Arundo donax* (Giant Reed) in the sub-canopy in the south-western areas of the mapped community.

With the exception of sparsely occurring juvenile individuals of the canopy species, a native shrub layer is absent, although tall herbaceous species such as *Alocasia brisbanensis* (Cunjevoi), *Phragmites australis* (Common Reed), and *Gahnia clarkei* (Tall Saw-sedge) are present, though sparsely distributed throughout the community. Exotic species such as *Lantana camara* (Lantana), *Ludwigia peruviana* (Ludwigia), and *Solanum mauritianum* (Wild Tobacco Bush), are present and dominate the layer in some areas, along with taller herbaceous species such as *Zantedeschia aethiopica* (Arum Lily) and *Cyperus papyrus* (Paper Reed).

Native species are generally scattered in the ground layer, due to dense shading from the upper strata. Species present include the forbs *Persicaria decipiens* (Slender Knotweed) and *Alternanthera denticulata* (Lesser Joyweed), the sedge *Carex appressa* (Tall Sedge), and the ferns *Hypolepis muelleri* (Harsh Ground Fern) and *Telmatoblechnum indicum* (Swamp Water Fern). Exotic species are common in the ground layer, and dominant in some areas, particularly *Tradescantia fluminensis* (Wandering Trad). Other species present include the grasses *Paspalum urvillei* (Vasey Grass) and *Stenotaphrum secundatum* (Buffalo Grass), the sedge *Cyperus albostriatus,* the forbs *Ageratina adenophora* (Crofton Weed) and *Rumex crispus* (Curled Dock), and the vines *Anredera cordifolia* (Madeira Vine) and *Lonicera japonica* (Japanese Honeysuckle).

Photograph 1 PCT1795 – Moderate within the wider study area

4.2.1.2. Condition Class 2 - Low

BC Act Status: Endangered Ecological Community - Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

EPBC Act Status: Not listed

This community occurs as scattered patches within the north (**Photograph 2**) and the south (**Photograph 3**) of the study area, and is represented by a single *Eucalyptus robusta* (Swamp Mahogany) in the north of the subject land and native mid story species in the south. It consists of canopy trees only from PCT 1795 occurring over a nearly entirely exotic understorey or an understorey cleared back to bare earth, such as some areas in the south-west of the site where an access track occurs. The community is consistent with the Coastal Flats Swamp Mahogany Forest community described by the formally named OEH (2016c).

Canopy species present in the community are *Eucalyptus robusta* and *Casuarina glauca*. A native shrub layer is absent from the community. In areas without a cleared understorey, exotic shrub species occur sparsely and include *Rhaphiolepis indica* (Indian Hawthorn), *Ricinus communis* (Castor Oil Plant), and *Cestrum parqui* (Green Cestrum).

The ground layer in areas without a cleared understorey is dominated by exotic grasses including *Paspalum urvillei, Cenchrus clandestinus* (Kikuyu), and *Stenotaphrum secundatum*. Exotic forbs are common and include *Sonchus asper* (Prickly Sowthistle), *Conyza sumatrensis* (Tall Fleabane), and *Modiola caroliniana* (Red-flowered Mallow).

Photograph 2 PCT1795 – Low in the north of the subject land

Photograph 3 PCT1795 - low in the south of the subject land

4.2.1.3. Condition Class 3 - Revegetation

BC Act Status: Not listed

EPBC Act Status: Not listed

This condition consists of an area in the south-east of the study area, outside of the subject land, which was formerly cleared and has recently been revegetated (**Photograph 4**). The species composition indicates the revegetation is intended to recreate PCT 1795. As this area does not contain any remnant native vegetation it is not considered to conform to the Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC.

The plantings are dominated by the native sedge *Juncus kraussii* (Salt Marsh Rush), with the lily *Dianella caerulea* (Blue Flax-lily) also occurring, along with scattered plantings of the small tree species *Melaleuca linariifolia*, though these are currently in a juvenile state and shorter in stature than the surrounding sedges.

Exotic species have colonised the revegetation area, with species including the grass *Paspalum urvillei*, forb *Bidens pilosa* (Cobbler's Pegs), and vine *Ipomoea indica* (Morning Glory).

Photograph 4 PCT1795 – Revegetation within the study area, outside of the subject land

4.2.1.4. Justification for PCT Selection

The Native Vegetation of the Sydney Metropolitan Area (OEH 2016b) maps Coastal Flats Swamp Mahogany Forest immediately to the north-west of the subject land and study area. Within the subject land and study area, the vegetation consists largely of degraded condition classes. However, there are sufficient native species present including canopy trees and midstorey/ground layer species to confidently assign PCT 1795 to the vegetation. The location on a floodplain near Narrabeen Creek in Warriewood is also consistent with the description of this PCT (OEH 2016c).

The two BAM plots within the area mapped as PCT 1795 contained a total of 13 key diagnostic species listed in the description of Coastal Flats Swamp Mahogany Forest (OEH 2016c) (minimum of 8 species required to positively diagnose this PCT at the 95% confidence interval within a 400 m^2 plot). This included the canopy tree species *Eucalyptus robusta*, and the mid story species *Casuarina glauca* and *Melaleuca linariifolia*.

The vegetation was also consistent with the description of PCT 1795 within the Bionet Vegetation Classification, containing the canopy species *Eucalyptus robusta*, three midlayer species (*Casuarina glauca, Acacia longifolia* and *Melaleuca linariifolia*) and seven ground layer species (*Alternanthera denticulate, Centella asiatica, Commelina cyanea, Entolasia marginate, Gahnia clarkei, Hypolepis muelleri* and *Oplismenus aemulus*) listed in the description.

4.2.1.5. Threatened Ecological Community Status

The PCT 1795 corresponds with the EEC Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions listed under the BC Act. The Final Determination for the

TEC (OEH 2017) describes the EEC as being associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Structurally, this TEC typically occurs as open forests with partial clearing occasionally resulting in reduced canopy to scattered trees, and in extreme cases; resembling scrubland. It tends to display an open to dense tree layer of eucalypts and paperbarks, which may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality (OEH 2017).

Within the wider study area, two of the three conditions states of PCT 1795 have been described as conforming to the BC Act listing for the TEC. Specifically, the Moderate and Low condition states ,which both occur in the subject land, display the relevant structural layers and species composition consistent with the final determination (OEH 2017). The area described as regeneration however, does not conform to the TEC listing. This area has been recently cleared and is currently undergoing attempted replanting measures. This area does not display the structural layers to be consistent with the final determination for the TEC and therefore has not been considered to conform to the BC Act listing of Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

The distribution of the TECs within the subject land and study area listed under the BC Act is shown on **Figure 7**.

4.2.2. Exotic Vegetation

BC Act Status: Not listed

EPBC Act Status: Not listed

This community consists of areas dominated nearly exclusively by exotic species. In the northern half of the subject land and study area this includes scattered exotic trees such as *Liquidambar styraciflua* (American Sweetgum) and *Araucaria heterophylla* (Norfolk Island Pine) (**Photograph 5**) and large wasteland areas dominated by exotic shrubs and grasses (**Photograph 6**), which formerly comprised the yards of residential dwellings within the subject land. In the south, with the exception of one small area dominated by exotic grasses and forbs (**Photograph 7**), which appear to have grown over a formerly cleared area, probably a track, the community consists of dense occurrences of the exotic trees *Erythrina x sykesii* and *Erythrina crista-galli* (**Photograph 8**), with a scattered layer of exotic shrubs such as *Senna pendula* var. *glabrata* and *Ligustrum sinense* (Small-leaved Privet), and a ground layer where present generally dominated by *Tradescantia fluminensis*.

Photograph 5 Exotic trees in the north of the subject land and study area

Photograph 6 Exotic shrubs and herbaceous species in the north of the subject land and study area

Photograph 7 Exotic herbaceous species in the south of the study area

Photograph 8 *Erythrina* spp. dominated area in the south of the study area

4.3. Vegetation Integrity Assessment

The native vegetation identified within the subject land was assigned to a vegetation zone based on PCTs and their broad condition state. Patch sizes were subsequently assigned for each vegetation zone. The extent of vegetation zones within the subject land is shown in **Figure 8**.

Each vegetation zone was assessed using survey plots/transects (see ***Section 2.3.2***) to determine the vegetation integrity score. A summary of BAM plot data utilised within the BAM Calculator (BAMC) to determine the vegetation integrity score is provided in **Appendix B**.

Vegetation zones, patch sizes and vegetation integrity scores for the subject land are summarised in **Table 6**.

Table 6. Vegetation integrity of PCTs within the subject land

Vegetation Zone	PCT #	PCT Name	Condition Name	Subject land (ha)	Patch Size Class	Vegetation Integrity Score
1	1795	Coastal flats Swamp Mahogany Forest	Moderate	0.02	>101 ha	54.9 (Composition: 39.6 Structure: 61.6 Function: 68.0)
2	1795	Coastal flats Swamp Mahogany Forest	Low	0.03	>101 ha	10.7 (Composition: 16.3 Structure: 18.9 Function: 4.0)

5. Threatened Species

5.1. Identifying Threatened Species for Assessment

The BAM Calculator (BAMC) generates a list of threatened species requiring assessment utilising several variables. The following criteria have been utilised to predict the threatened species requiring further assessment in the BAMC:

- IBRA subregion: Pittwater;
- Geographic limitations and habitat constraints that were selected as present: None;
- Associated PCTs: 1795;
- Percent native vegetation cover in the assessment area: 20%;
- Patch size: >101 ha; and
- Credit type: Ecosystem and/or Species Credit species.

Based on the above variables, the BAMC generated a list of 23 ecosystem credit species and seven species credit species. These totals include five dual credit species, which are considered as ecosystem credit species for their foraging habitat and as species credit species for their breeding habitat. The BAMC generation of species credit species was limited to species listed as candidate entities for Serious and Irreversible Impacts (SAII) under the Streamlined assessment module-Small area.

5.2. Ecosystem Credit Species

Table 7 lists the predicted ecosystem credit species for the vegetation zones within the subject land and the associated PCT. No ecosystem credit species were removed from consideration. The highest sensitivity class of these species is "High Sensitivity to Potential Gain", which has subsequently been utilised by the BAMC for the calculation of ecosystem credits.

Table 7 Ecosystem credit species requiring further assessment

Common Name	Scientific Name	Habitat Constraint	Sensitivity to Gain Class	Predicted PCTs	Retained in Assessment?	Justification if Not Retained
Regent Honeyeater (Foraging)	*Anthochaera phrygia*	-	High	1795_Moderate 1795_Low	Yes	-
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	-	Moderate	1795_Moderate 1795_Low	Yes	-
Glossy Black-Cockatoo (Foraging)	*Calyptorhynchus lathami*	Presence of Allocasuarina and Casuarina species	High	1795_Moderate 1795_Low	Yes	-
Varied Sittella	*Daphoenositta chrysoptera*	-	Moderate	1795_Moderate 1795_Low	Yes	-
Spotted-tailed Quoll	*Dasyurus maculatus*	-	High	1795_Moderate 1795_Low	Yes	-
Little Lorikeet	*Glossopsitta pusilla*	-	High	1795_Moderate 1795_Low	Yes	-
White-bellied Sea-Eagle (Foraging)	*Haliaeetus leucogaster*	Waterbodies, and Within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	High	1795_Moderate 1795_Low	Yes	-
Little Eagle (Foraging)	*Hieraaetus morphnoides*	-	Moderate	1795_Moderate 1795_Low	Yes	-
White-throated Needletail	*Hirundapus caudacutus*	-	High	1795_Moderate 1795_Low	Yes	-

Common Name	Scientific Name	Habitat Constraint	Sensitivity to Gain Class	Predicted PCTs	Retained in Assessment?	Justification if Not Retained
Black Bittern	*Ixobrychus flavicollis*	Waterbodies, and Land within 40 m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation.	Moderate	1795_Moderate 1795_Low	Yes	-
Swift Parrot (Foraging)	*Lathamus discolor*	-	Moderate	1795_Moderate 1795_Low	Yes	-
Square-tailed Kite (Foraging)	*Lophoictinia isura*	-	Moderate	1795_Moderate 1795_Low	Yes	-
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	-	High	1795_Moderate 1795_Low	Yes	-
Little Bent-winged Bat (Foraging)	*Miniopterus australis*	-	High	1795_Moderate 1795_Low	Yes	-
Large Bent-winged Bat (Foraging)	*Miniopterus orianae oceanensis*	-	High	1795_Moderate 1795_Low	Yes	-
Barking Owl (Foraging)	*Ninox connivens*	-	High	1795_Moderate 1795_Low	Yes	-
Powerful Owl (Foraging)	*Ninox strenua*	-	High	1795_Moderate 1795_Low	Yes	-
Eastern Osprey (Foraging)	*Pandion cristatus*	-	Moderate	1795_Moderate 1795_Low	Yes	-
Koala (Foraging)	*Phascolarctos cinereus*	-	High	1795_Moderate	Yes	-

Common Name	Scientific Name	Habitat Constraint	Sensitivity to Gain Class	Predicted PCTs	Retained in Assessment?	Justification if Not Retained
				1795_Low		
Grey-headed Flying-fox (Foraging)	*Pteropus poliocephalus*	-	High	1795_Moderate 1795_Low	Yes	-
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	-	High	1795_Moderate 1795_Low	Yes	-
Masked Owl (Foraging)	*Tyto novaehollandiae*	-	High	1795_Moderate 1795_Low	Yes	-
Rosenberg's Goanna	*Varanus rosenbergi*	-	High	1795_Moderate 1795_Low	Yes	-

5.3. Species Credit Species

5.3.1. Assessment of Habitat Constraints and Microhabitats

Table 8 lists the flora and fauna species credit species predicted for the vegetation zones within the subject land, and whether they have been retained within the assessment following consideration of habitat constraints, geographic limitations, vagrancy and quality of microhabitats.

All of the candidate species credit species predicted by the BAMC comprise candidate entities for SAII. As per the requirements of the Small area module of the BAM, candidate species credit species that are not at risk of an SAII and are not incidentally recorded on the subject land do not require further assessment. The previous BDAR prepared for the site by Lesryk Environmental (2020) recorded a calling Barking Owl (*Ninox connivens*) and as such, this species has been added to the list of Species Credit Species within the BAMC and in **Table 6.**

Under Section 5.2.3 of the BAM, further species credit species can be excluded from further assessment if an assessment of habitat constraints and microhabitats determines that the habitat within the subject land is substantially degraded such that the species credit species is unlikely to occur.

Habitat assessments of the site were undertaken as described in ***Section 2.4.2***. The habitat assessments focussed on habitat features relevant to species credit species predicted to occur. This included determining the presence/absence of the habitat constraints identified for the predicted threatened species and the condition of these habitat constraints and other microhabitats.

The habitat assessment surveys conducted focussed on determining if habitat for any potential species credit species (or relevant breeding component for dual credit species) was either not present or substantially degraded such that the species is unlikely to utilise the subject land or a specific vegetation zone in accordance with the requirements of Section 5.2.3 of the BAM. Habitat features recorded during the survey period are shown on **Figure 9**.

Based on the results of the survey, all species credit species generated in the BAMC except for the Barking Owl were removed from consideration in accordance with Step 3 of Section 5.2.3 of the BAM, and are justified in **Table 8** below. As mentioned in **Chapter 2**, further assessment in the form of targeted surveys were undertaken for the Barking Owl (*Ninox connivens*) due to it being recorded previously within the site and the presence of potential breeding habitat in the wider study area.

Table 8 Species credit species requiring further assessment

Common name	Scientific name	Sensitivity to Gain Class	Retained in Assessment	Justification if Not Retained
Regent Honeyeater (Breeding)	*Anthochaera phrygia*	High	No	The species is a SAII entity for breeding habitat only, as defined by mapped important areas., As the subject land is not located within a mapped important area, the species does not require further assessment.
Large-eared Pied Bat	*Chalinolobus dwyeri*	Very High	No	The species is a SAII entity for breeding habitat only, which is described as PCTs associated with the species within 100 m of rocky areas containing caves, overhangs or crevices, cliffs or escarpments, or old mines, tunnels, culverts or derelict concrete buildings. Since there is no suitable breeding habitat within 100 m of the subject land, the species does not require further assessment.
Swift Parrot (Breeding)	*Lathamus discolor*	Moderate	No	The species is a SAII entity for breeding habitat only, as defined by mapped important areas. As the subject land is not located within a mapped important area, the species does not require further assessment.
Little Bent-winged Bat (Breeding)	*Miniopterus australis*	Very High	No	The species is a SAII entity for breeding habitat only, described as caves, tunnels, mines, culverts or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature. As the subject land does not contain suitable breeding habitat, the species does not require further assessment.
Large Bent-winged Bat (Breeding)	*Miniopterus orianae oceanensis*	Very High	No	The species is a SAII entity for breeding habitat only, described as caves, tunnels, mines, culverts or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature. As the subject land does not contain suitable breeding habitat, the species does not require further assessment.

Common name	Scientific name	Sensitivity to Gain Class	Retained in Assessment	Justification if Not Retained
Barking Owl (Breeding)	*Ninox connivens*	High	Yes	Calling individual recorded as part of the previous BDAR prepared by Lesryk Environmental.

5.3.2. Presence of Candidate Species

A summary of the species credit species surveyed within the subject land, including whether they were recorded in the subject land, is provided in **Table 9** below. As mentioned previously, Barking Owl (*Ninox connivens*) was added to the list of candidate species as due to it being previously recorded within the study area as described in the Lesryk Environmental BDAR (2020). The Barking Owl is the only candidate species credit species requiring further assessment.

Two hollows in two separate trees were assessed as potential suitable breeding habitat for the species, which both displayed no evidence of Barking Owl occupation. In fact, both hollows contained a resident Common Brush-tail Possum (*Trichosurus vulpecula*). As such, it is concluded that no breeding habitat for the Barking Owl is present within the subject land or wider study area, and therefore no species polygon or calculation of species credits for the Barking Owl is required.

Further details on the methodology of targeted surveys for Barking Owl (*Ninox connivens*) undertaken is included in ***Section 2.5.2.1***.

Table 9 Species credit species assessed within the subject land

Species	Present in subject land	Method of identification	Biodiversity Risk Waiting
Barking Owl (Breeding)	No	Survey	2.00

6. Prescribed Impacts

6.1. Prescribed Impacts

Prescribed impacts are identified in Clause 6.1 of the *Biodiversity Conservation Regulation 2017*. Prescribed impacts are those that are additional to the clearing of native vegetation and associated habitat. These include:

- Development on the habitat of threatened species or ecological communities associated with:
  - karst, caves, crevices, cliffs, rock outcrops and other geological features of significance;
  - human-made structures;
  - non-native vegetation;
- Development on areas connecting threatened species habitat, such as movement corridors;
- Development on water quality, water bodies and hydrological processes that sustain threatened species and TECs (including from subsidence or "upsidence" from underground mining);
- Wind turbine strikes on threatened and protected animals; and
- Vehicle strikes on threatened species or on animals that are part of a TEC.

An assessment of the relevance of these prescribed impacts to the project is provided in **Table 10**. The location of prescribed impacts is shown in **Figure 10**.

Table 10 Relevance of prescribed impacts

Prescribed Impact	Relevance to the Project
Karst, caves, crevices, cliffs, rock outcrops and other geological features of significance	Small sandstone boulders were recorded within the subject land that may provide marginal habitat for commonly occurring species such as Garden Skinks. These minor rock features will be removed as part of the project. No karsts, caves, crevices, cliffs, rock outcrops or areas of geological significance have been identified within the subject land.
Human-made structures	Human made structures are present within the subject land in the form of vacant dwellings and garden sheds. It is apparent that these structures have been vacant for an extended period as they display significant dilapidation. While these provide potential habitat for microbats (ecosystem credit species), the habitat assessment conducted on 10 June 2021 found no evidence of occupation for the species credit species listed in **Table 6**. Minor areas of concrete rubble and log piles are present within the wider study area, outside the subject land.
Non-native vegetation	Non-native vegetation occurring within the subject land comprises areas of exotic vegetation. This vegetation may provide some low-value habitat for native fauna species, including ecosystem credit species such as threatened birds and bats, on occasion. Impacts to non-native vegetation would occur during the construction phase of the project and result in a long-term impact.

Prescribed Impact	Relevance to the Project
Habitat connectivity	The subject land contains native vegetation in the southern extent that connects to a riparian corridor. The proposed development will not fragment or break the riparian corridor but will result in a slight reduction to the width of the native vegetation by a matter of individual trees. This corridor is likely utilised by a number of native fauna species, including a number of ecosystem credit species.
Waterbodies, water quality and hydrological processes	Hydrological process relevant to the project include mapped Coastal Wetlands and the location of Narrabeen Creek, a second order stream that flows on the southern boundary of the study area. Land mapped as Coastal Wetlands under the Coastal Management SEPP occurs in the study area, as shown in **Figure 9**; with a small portion extending into the subject land. Additionally, a small section of Narrabeen Creek falls within the study area on the southern boundary with no occurrences within the subject land. The subject land does however drain in a south-westerly direction towards Narrabeen Creek. According to the Civil report (CPS 2021b), a stormwater infiltration basin will be constructed on the southern boundary of the subject land which will minimise the impact of any additional run-off as a result of the project on these hydrological processes. Further erosion and sediment control measures as discussed in ***Section 8.5*** will also be implemented as part of the project that will act to minimise these impacts.
Wind farm developments	Not relevant. The project does not comprise a wind farm development
Vehicle strikes	Not relevant. Although the Project includes the construction of accessways to buildings, vehicle movement within the subject land are not anticipated to exceed current levels and no further impacts to threatened species are predicted.

7. Avoid and Minimise Impacts

This section includes demonstration of efforts to avoid and minimise impacts on biodiversity values identified within the study area and subject land, which includes assessment of direct, indirect and prescribed impacts. Any mentioning of the development footprint within this chapter is synonymous with the subject land.

7.1. Avoid and Minimise Direct and Indirect Impacts on Native Vegetation and Habitat

Under the BAM, measures taken to avoid and minimise impacts on biodiversity values from the development need to be documented. As described in previous chapters of this BDAR, the study area contains vegetation conforming to a TEC that would require consideration of avoidance. The area mapped as a TEC is also part of a riparian corridor associated with a second order watercourse and is mapped as a Coastal Wetland under the Coastal Management SEPP.

Through the implementation of several avoidance and minimisation measures, the project has been designed and situated to allow for the operational requirements of the site while avoiding and minimising impacts to areas containing the majority of biodiversity values. As a result, approximately 91% of the TEC will be retained in the study area, with only relatively small areas (0.05 ha) of native vegetation requiring clearance along the edge of the mapped occurrence.

The development footprint is positioned over an area within the study area containing the lowest biodiversity values, consisting predominately of existing vacant dwellings, previously cleared areas, and exotic dominated vegetation and weedy areas. Additionally, the southern portion of the study area which comprise the highest biodiversity values of the site, will be managed and rehabilitation under a Biodiversity Management Plan. In doing so, the project has considered the biodiversity values of the study area and has demonstrated reasonable steps to avoid and minimise impacts based upon the project location and design.

Avoidance and minimisation measures relevant to the project location and design are outlined in subsequent sections, whilst a summary table of the measures considered for this project is outlined in **Table 11**.

7.1.1. Project Location

Section 7.1.1 of the BAM states that knowledge of biodiversity values should inform the decision-making process relating to the location of a project. Measures to avoid or minimise impacts from clearing native vegetation and threatened species habitat can include locating the project in areas lacking or with low biodiversity values, avoiding areas mapped on the important habitat map, or avoiding native vegetation that is a TEC.

In determining the location of the final development footprint, the project has sought to avoid and minimise direct and indirect impacts on native vegetation and habitat by:

- Locating the project predominantly within the areas comprising the lowest biodiversity values, represented by previously cleared areas and exotic dominated vegetation;
- Locating the project so as to remove only a small area (0.05 ha) of native vegetation, which avoids 91% of the native vegetation in the study area;

- Situating the project in areas with low vegetation integrity scores, with 60% (0.03 ha) of the native vegetation to be cleared having a vegetation integrity score of 10.7;
- Locating the project outside of the riparian corridor associated with Narrabeen Creek, to minimise impacts to the watercourse;
- Situating the project so as to predominantly only impact native vegetation on the edge of a larger patch in the study area, to minimise impacts to the existing habitat linkage associated with the riparian corridor.

7.1.2. Project Design

In determining the design of the final development footprint, the project has sought to avoid and minimise direct impacts on native vegetation and habitat by:

- Incorporation of suitable tree protection zones in the project design, as outlined in the CPS Arboricultural Report (2021c);
- Design considerations to incorporate the entire required Asset Protection Zone within the subject land, predominately outside areas of native vegetation, to minimise the overall requirement of clearing of native vegetation for the project;
- Preparation and implementation of a Biodiversity Management Plan (doc. 21097RP1 (Cumberland Ecology 2021)), which will provide for ongoing management, rehabilitation, and restoration of 0.50 ha of retained Swamp sclerophyll forest on coastal floodplains EEC in the study area;
- Preparation and implementation of a site-specific stormwater drainage plan to mitigate potential impacts associated with stormwater run-off and sedimentation, to minimise impacts on the Coastal Wetland and Narrabeen Creek;
- Implementation of a suite of mitigation measures as part of the project (**Sections 8.4-8.5**), to minimise the impacts on biodiversity, including:
    - Weed management;
    - Tree protection measures and construction site delineation;
    - Pre-clearance surveys and clearance supervision;
    - Nest box installation;
    - Landscaping including local native species;
    - Placement of rock in landscaping areas; and
    - Sedimentation control measures.

7.1.3. Consideration of Requirements under the Local Planning Provisions

When considering the project layout and extent, the existing mapping for the site under the following planning provisions were also considered:

- *Pittwater Local Environment Plan 2014*; and
- *State Environment Planning Policy (Coastal Management) 2018*.

The study area partly contains areas mapped as 'Biodiversity,' under the Pittwater LEP, and Coastal Wetlands under the Coastal Management SEPP, likely in association with the existing mapping of native vegetation within the riparian corridor. Broadly, the objective of these provisions in the areas mapped is to maintain terrestrial, riparian and aquatic biodiversity, and manage development to guide decision-making.

The spatial mapping layers for Biodiversity under the Pittwater LEP is unavailable however, it is assumed that the impacts associated with native vegetation in this BDAR are an accurate surrogate for impacts to areas mapped as Biodiversity. As such, impacts to areas mapped as Biodiversity under the Pittwater LEP have largely been avoided and limited to a relatively small area (0.05 ha) that is confined to the edges of an existing patch of native vegetation. Similarly, the Coastal Wetlands mapping very closely mirrors the mapping of the native vegetation within the study area as shown on **Figure 9**. Hence, direct impacts to areas mapped as Coastal Wetlands have been largely avoided and limited to as little as 0.05 ha.

Additionally, a suite of mitigation measures has been proposed for the project to minimise indirect impacts on the area mapped as Biodiversity under the Pittwater LEP and the Coastal Wetlands, including tree protection measures and sedimentation control measures. Mitigation measures are discussed in detail in **Section 8.6.**

Table 11. Summary table of options considered for the project to avoid and minimise impacts on biodiversity

Action	Adopted (Yes/No/In part)	Justification	Timing (if adopted)	Responsibility (if adopted)	Outcome (if adopted)
Incorporation of suitable technologies and design configurations to minimise overall development footprint	Yes	As part of the design process of the project, careful consideration has been given to various design elements to reduce the overall development footprint. This includes the inclusion of a multi-level design with internal parking. Access roads have been designed with consideration of 'sight lines' and will result in no vehicle strike impacts. Stormwater drainage and collection in an infiltration basin will minimise impacts from stormwater run-off. Installation of the infiltration basin in areas mapped as exotic vegetation will minimise impacts to native vegetation, riparian corridors and Coastal Wetlands. Use of appropriate materials and toughened glass to BAL 12.5 standards will minimise the area of vegetation to be modified for the APZ.	During design and approval	Proponent and consultant team	Minimise impacts on biodiversity and minimise stormwater run-off. Reduced modification of vegetation within APZs and intrusion into retained areas.
Implementation of a suite of mitigation measures	Yes	To minimise the impacts on biodiversity, a suite of mitigation measures will be implemented such as the delineation of clearing areas, erosion and sedimentation control, timing of vegetation clearance, pre-clearance surveys, clearance supervision, nest box installation, weed	Pre and post construction and during operation phase	Proponent and consultant team	Minimise impacts on biodiversity

Action	Adopted (Yes/No/In part)	Justification	Timing (if adopted)	Responsibility (if adopted)	Outcome (if adopted)
		management, tree protection measures and inclusion of native species in landscaping.			
Design amendments to various elements of the project design	Yes	Several design amendments have been implemented for the project to avoid and minimise impacts on biodiversity. These include consideration of arborists assessment, bushfire assessment, stormwater drainage and landscaping plans.	During design and approval	Proponent and consultant team	Avoid and minimise impacts to trees within landscaping areas. Minimise impacts associated with stormwater drainage. Minimise vegetation modification within APZs
Partial development of the study area to avoid/minimise impacts on biodiversity and achieve greater tree retention	No	The subject land has been designed to include impacts to areas predominantly outside native vegetation and habitat. This will allow for retained vegetation to be managed and rehabilitated to improve biodiversity values of the study area. Hence, partial development is not considered to be required as the majority of impacts to native vegetation have been avoided for the project, with additional measures implemented to minimise any indirect impacts.			
'Do-nothing' option to avoid all impacts on biodiversity	No	The do-nothing option for the project would maintain current tree cover on site but would not enable redevelopment to achieve the zonal	-	-	-

Action	Adopted (Yes/No/In part)	Justification	Timing (if adopted)	Responsibility (if adopted)	Outcome (if adopted)
		objectives. Under a no-go option, trees would remain and continue to grow and age, potentially to form hollows. However, there would be no requirement to replant or maintain native plant species on the site. Furthermore, if a tree dies or is damaged in a storm there would be no requirement for the tree to be replaced. Therefore, over time, there is potential for the existing canopy area to be reduced and for the native vegetation to be further degraded through ongoing weed invasion.			
Consideration of alternative sites and layouts for development within the property	No	Alternative design layouts were only considered for areas within the subject land resulting in impacts predominantly located outside areas of native vegetation. No ecosystems, species or habitat that has a high threat status is present and as such, no further project design layouts need consideration.			
Consideration of alternative locations for the development to avoid impacts on biodiversity	No	The client does not have alternative locations available for this project. The use of an alternative site is considered unwarranted given the compatibility with the density objectives of site zoning, the impact avoidance and minimisation measures proposed and the biodiversity offsets which will be provided (**Chapter 9**) for the residual			

Action	Adopted (Yes/No/In part)	Justification	Timing (if adopted)	Responsibility (if adopted)	Outcome (if adopted)
		impacts. The study area is already partially developed, with two existing residential dwellings. Furthermore, as already explained in detail above, the entire study area is currently zoned R3 Medium Density Residential pursuant to the Pittwater LEP, hence have been identified as suitable for housing types within a medium density residential environment in accordance with the zoning objectives.			

7.2. Avoid and Minimise Prescribed Impacts

7.2.1. Karst, caves, crevices, cliffs, rock outcrops and other geological features of significance

Small sandstone boulders were recorded within the subject land that may provide marginal habitat for commonly occurring species such as Garden Skinks. These minor rock features are not able to be avoided as part of the project and will need to be removed. Neverthless, the boulders requiring removal will be salvaged and placed into the BMP area to minimise the impact. No karsts, caves, crevices, cliffs, rock outcrops or areas of geological significance have been identified within the subject land.

Artificial rock outcrops could also be placed in the BMP area, to create additional habitat. Other measures to minimise impacts include restricting all excavation and placement of fill and soil to within the development footprint.

7.2.2. Human-made Structures

Human made structures are present within the subject land in the form of vacant dwellings and garden sheds. It is apparent that these structures have been vacant for an extended period as they display significant dilapidation. While these provide potential habitat for microbats, it is not feasible to retain these structures as part of the project due to their very poor condition.

7.2.3. Non-native Vegetation

Areas of non-native vegetation within the subject land are predominantly in the form of low-biodiversity value exotic grasslands. Some exotic trees are present however, these likely do not form important habitat.

Although the non-native vegetation may provide some minor habitat value for native fauna in terms of shelter and foraging resources, these areas are unlikely to be favoured over the adjoining forest habitats outside of the subject land. Nevertheless, the location of the project and development design have been focused on avoiding and minimising impacts on areas of high biodiversity value, with a specific focus on the connected patch of native vegetation in the southern part of the study area. As a result, the proposed development covers the majority (0.51 ha) of the exotic vegetation within the subject land, with the remainder (0.17 ha) to be included in the BMP area. As such, impacts to the areas of non-native vegetation are not able to be further avoided as part of the project.

7.2.4. Habitat Connectivity

Impacts to habitat connectivity have been largely avoided as part of the project design. The vast majority of native vegetation that allows for this connectivity is within retained areas (0.61 ha) and will be managed as part of the BMP. The small area of PCT 1795 to be impacted as part of the project has a connected and overlapping tree canopy with connectivity to native vegetation in the southern portion of the study area. This vegetation has connectivity to native vegetation, including vegetation within a riparian corridor. The project will have a very minor impact on habitat connectivity as the trees to be impacted are located on the edge of an existing patch of native vegetation and therefore does not require further avoidance.

7.2.5. Waterbodies, Water Quality and Hydrological Processes

There are no waterbodies or mapped watercourses occurring within the subject land and as such, no direct impacts to these entities are anticipated or need to be avoided. The subject land drains to the south-west towards Narrabeen Creek and includes areas that are mapped as Coastal Wetlands under the Coastal Management SEPP. Minor impacts to areas mapped as Coastal Wetlands have been anticipated and have been avoided where possible. These areas mapped as Coastal Wetlands are likely associated with the native vegetation in the southern portion of the study area and have been largely avoided as part of the project with as little as 0.05 ha of PCT 1795 requiring removal.

Surface run-off would be unlikely once construction is complete, due to levelling associated with cut and fill and the design of stormwater drainage with collection and storage of stormwater in on-site Infiltration Basin. Any impact to run-off from retained areas would be minor, and likely very similar to under current conditions. As such, potential indirect impacts to water quality would primarily be because of sediment inputs during construction and cannot be completely avoided. Erosion and sediment control measures will be implemented during construction following Managing Urban Stormwater: Soils and Construction ("the Blue Book") (Landcom 2004a).

8. Impact Assessment

8.1. Direct Impacts

8.1.1. Native Vegetation Clearing

One PCT, PCT 1795 present in two condition states will be impacted by the project. A total of approximately 0.05 ha of this will be completely cleared within the subject land. A further 0.61 ha of this PCT will be retained in the wider study area within areas to be managed by a BMP. A further 1.29 ha of exotic vegetation and cleared lands will also be removed as part of the project.

The direct impact resulting from the proposed development is the loss of vegetation and associated habitat within the subject land. **Table 12** identifies the extent of clearing impacts to vegetation within the subject land and for context, the areas to be retained and managed under the BMP in the wider study area.

Table 12 Extent of clearing impacts

Vegetation Zone	PCT #	PCT Condition Class	BC Act Status	Cleared (ha)	Retained and Managed (ha)
1	1795	Moderate	EEC	0.02	0.54
2	1795	Low	EEC	0.03	0.01
-	1795	Revegetation	-	0.00	0.05
-	-	Exotic Vegetation	-	0.51	0.17
-	-	Cleared Lands	-	0.77	0.02
Total				**1.34***	**0.84****

**Totals may not be consistent due to rounding*

***'Retained and Managed' area total includes the infiltration basin that will be subject to rehabilitation works under the BMP*

8.1.2. Loss of Specific Habitat Features

The main habitat for native fauna in the subject land is in the areas of native vegetation. In addition to native vegetation, specific habitat features identified within the subject land and wider study area include rocks, hollow-bearing trees, log piles, human-made structures and a watercourse.

The Project will result in the loss of habitat features within the subject land, comprising three rocks, three log piles, one hollow-bearing tree with one small hollow and all human-made structures.

Overall, the removal of these specific habitat features is considered to have only minor implications for native fauna species due to the modified ecological context within which most of the subject land occurs, and the high mobility of the species likely to utilise these habitats. Only one tree to be removed contains a small hollow that could provide habitat for native fauna..

8.1.3. Change in Vegetation Integrity Score

Table 13 details the change in vegetation integrity score for each vegetation zone and management zone. The direct impacts of the project only involve one management zone, being the total clearing of vegetation within the subject land.

Table 13. Change in vegetation integrity score

Vegetation Zone	PCT #	PCT Name	Current VI Score	Future VI Score	Change in VI Score
1	1795	Coastal Flats Swamp Mahogany Forest	54.9	0	-54.9
2	1795	Coastal Flats Swamp Mahogany Forest	10.7	0	-10.7

8.2. Indirect Impacts

Table 14 outlines the indirect impacts to native vegetation and habitat. Due to the existing highly modified nature of the vegetation both within and adjacent to the subject land, the indirect impacts of the project are not considered to be significant.

Table 14 Indirect impacts of the project

Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
Inadvertent impacts on adjacent habitat or vegetation	Construction activities may result in inadvertent impacts on vegetation surrounding the subject land, such as increase sedimentation.	Native vegetation surrounding the subject land	Short term (during construction) and potential long term	Ecosystem credit species	Reduced condition of the adjoining vegetation
Reduced viability of adjacent habitat due to edge effects	Minor impact as subject land is within a fragmented residential area already subjected to edge effects	Native vegetation to the south of the subject land within the study area	Long-term	Ecosystem credit species	Reduced condition of the adjoining vegetation
Reduced viability of adjacent habitat due to noise, dust or light spill	The construction activities associated with the project are likely to increase the noise, dust and light above current levels within and immediately adjacent the subject land.	Native vegetation surrounding the subject land	Short term (during construction)	Ecosystem credit species	Short term disruption of fauna habitat usage during construction.
Transport of weeds and pathogens from the site to adjacent vegetation	Several high threat exotic weeds are known to occur within the study area and subject land and may be inadvertently spread to surrounding vegetation.	Native vegetation surrounding the subject land	Potential long-term	Ecosystem credit species	Reduced condition of adjoining vegetation.
Increased risk of starvation,	Impact unlikely. The project is unlikely to cause	-	-	-	-

Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
exposure and loss of shade or shelter	displacement of fauna such that it increases the risk of starvation, exposure and loss of shade or shelter.				
Loss of breeding habitats	The project is unlikely to result in the loss of breeding habitat within adjacent areas.	-	-		-
Trampling of threatened flora species	Impact unlikely. No threatened flora species have been observed and none are likely to occur, considering the nature of the subject land.	-	-	-	-
Inhibition of nitrogen fixation and increased soil salinity	While the proposed development would remove nitrogen fixing species from the disturbance footprint, impacts beyond this on nitrogen fixing species or soil salinity are considered unlikely	-	-	-	-
Fertiliser drift	Impact unlikely, fertiliser use would be limited to landscaping areas during plant establishment and would not be expected to drift. A BMP will be	-	-	-	-

Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
	implemented that will control the use of fertiliser.				
Rubbish dumping	Construction activities and occupation of the subject land may result in rubbish dumping within adjoining areas of native vegetation.	Native vegetation surrounding the subject land	Potential long term	Ecosystem credit species	Reduced condition of the adjoining native vegetation
Wood collection	Impact unlikely to occur, due to location in a residential area.	-	-	-	-
Bush rock removal and disturbance	The project will require the removal of minor areas of rocky habitat. Indirect impacts to bush rock in adjacent areas are considered unlikely.	Adjacent retained landscaping areas	Short-term during landscaping	Ecosystem credit species -	Short term disruption of fauna habitat usage during construction.
Increase in predatory species populations	Impact unlikely. The proposed development is considered unlikely to result in an increase in predatory species populations.	-	-	-	-
Increase in pest animal populations	Impact unlikely. The project is considered unlikely to result in an increase in pest animal populations.	-	-	-	-

Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
Increased risk of fire	Impact unlikely. The project is unlikely to increase the risk of bushfire.	-	-		-
Disturbance to specialist breeding and foraging habitat	The subject land contains one hollow bearing tree containing one small hollow that will require removal, but it not expected to impact on specialist breeding and foraging habitat in adjacent areas. Better quality habitat will be retained in the BMP Area and beyond the study area.	Native vegetation surrounding the subject land	Short term (construction)	Ecosystem credit species	Short term disruption of fauna habitat usage during construction.

8.3. Prescribed Impacts

The project has been assessed as potentially resulting in five prescribed impacts (see ***Section 6.1***). An assessment of these prescribed impacts is provided below in accordance with Section 8.3 of the BAM.

8.3.1. Karst, caves, crevices, cliffs, rock outcrops and other geological features of significance

8.3.1.1. Nature

While no karsts, caves, crevices, cliffs or areas of geological significance have been identified within the subject land, minor areas of rocky habitat are present within the subject land.

8.3.1.2. Extent

The subject land contains three areas of rocky habitat in the form of bush rock. These will be removed from the subject land as a result of the project.

8.3.1.3. Duration

Impacts to rock would occur during the construction phase of the project. The removal of is a long-term impact.

8.3.1.4. Threatened Entities Affected

No threatened entities likely impacted as a result of the removal of rock. Minor loss in habitat to commonly occurring species such as garden skinks is likely.

8.3.1.5. Consequences

The project will not impact on an area of geological significance, and the rocky habitat within the subject land removed is unlikely to represent foraging habitat for threatened species. Similar habitat features will be retained in retained areas of the study area, and this could be enhanced by habitat feature salvage.

8.3.2. Human-made Structures

8.3.2.1. Nature

Human-made structures occur within the subject land in the form of dilapidated dwellings. These features occur within cleared lands as shown in **Figure 6**.

8.3.2.2. Extent

The proposed development will clear all human -made structures from the subject land.

8.3.2.3. Duration

Impacts to human-made structures would occur during the construction phase of the project. Their removal will be permanent.

8.3.2.4. Threatened Entities Affected

The habitat provided by human-made structures could provide some roosting habitat for ecosystem credit species such as microchiropteran bats and birds. However, no evidence of occupation was recorded during the survey period.

8.3.2.5. Consequences

The project will result in the removal of all human-made structures from the subject land. The reduction of this small area of habitat is not considered to significantly impact upon the potentially affected threatened entities as other areas of suitable habitat will remain immediately adjacent the subject land and within the assessment area.

8.3.3. Non-native Vegetation

8.3.3.1. Nature

Non-native vegetation is proposed to be cleared for the project. Non-native vegetation includes areas of Exotic Vegetation as shown in **Figure 6**.

8.3.3.2. Extent

The proposed development will clear a total of 0.51 ha of non-native vegetation in the form of Exotic Vegetation. A further 0.17 ha of non-native vegetation is included in the retained areas.

8.3.3.3. Duration

Impacts to non-native vegetation would occur during the construction phase of the project. The removal of the non-native vegetation is a long-term impact, although 0.17 ha will be retained and rehabilitated in the BMP area.

8.3.3.4. Threatened Entities Affected

The habitat provided by non-native vegetation may provide some foraging habitat for ecosystem credit species, such as microchiropteran bats and birds. However, the non-native vegetation is not considered suitable breeding/nest habitat due to lack of hollows and structural features, other than some minor woody weeds.

8.3.3.5. Consequences

The project will result in a reduction in non-native vegetation by 0.51 ha. The reduction of this small area of habitat is not considered to significantly impact upon the potentially affected threatened entities as other areas of suitable habitat, in the form of both native and non-native vegetation, will remain immediately adjacent the subject land and within the assessment area.

8.3.4. Habitat Connectivity

8.3.4.1. Nature

The native woody vegetation within the subject land connects to a riparian corridor located along Narrabeen Creek. The width of this area of native vegetation will be reduced marginally (0.05 ha). The primary impact to connectivity will be a slight reduction in the width of the riparian corridor. The proposed construction would not be a measurable impediment to the movement of fauna species.

8.3.4.2. Extent

Habitat connectivity will be reduced through the removal of 0.05 ha of native vegetation. Much of the existing connectivity will be retained and rehabilitated in the study area under a BMP.

8.3.4.3. Duration

Direct impacts to habitat connectivity would occur during the construction and operational phase of the project. The reduction of habitat connectivity is a long-term impact. However, the retention and enhancement of native vegetation within the BMP area as part of the project will maintain much of the existing connectivity along the riparian corridor of Narrabeen Creek.

8.3.4.4. Threatened Entities Affected

The habitat provided by native vegetation may provide foraging habitat for ecosystem credit species, such as the Grey-headed Flying-fox, microchiropteran bats and birds. Some species such as the Grey-headed Flying-fox, and threatened owl and eagle species would be able to fly over the proposed building and would only be impacted through the direct loss of foraging habitat.

8.3.4.5. Consequences

The project will result in the direct reduction in native vegetation by 0.05 ha. Although the clearing of the subject land will result in a slight reduction of the width of the existing corridor, the reduction of this small area of habitat is not considered to significantly impact the movement of mobile fauna species as better-quality habitat is located in the adjacent native vegetation. For example, the Grey-headed Flying-fox forages opportunistically, often at distances up to 30 km from camps, and occasionally up to 60-70 km per night, in response to patchy food resources (NSW Scientific Committee 2004). It is considered unlikely that native fauna would be solely reliant on the habitat within the subject land for movement between different areas of habitat. It is more likely that species would forage in vegetation within Warriewood Wetlands and other adjoining reserves.

8.3.5. Waterbodies, Water Quality and Hydrological Processes

8.3.5.1. Nature

The subject land slopes towards Stringybark Creek to the south-west and contains a small area mapped as Coastal Wetlands. Due to the installation of the infiltration basin and the need to undertake excavation, the proposed development will result in limited surface run-off into these waterbodies once constructed. There will be some minor surface run-off from the BMP area where native vegetation will be retained and enhanced however, this is unlikely to increase beyond current levels.

8.3.5.2. Extent

A small amount of native vegetation will be removed that forms part of the riparian corridor for Narrabeen Creek and is associated with areas mapped as Coastal Wetlands. The extent of this native vegetation is in the form of the edge of the area of PCT 1795 within the subject land. This area comprises Casuarina individuals and covers a total of 0.05 ha. As such, the extent of impacts would be minor.

8.3.5.3. Duration

Impacts to waterbodies would be most likely to take place during construction. These will be managed through erosion and sediment control measures to prevent sediment laden run-off from leaving the construction site. Changes to surface run-off will be permanent if the development is constructed. Further, the retained areas of the study area will be subject to rehabilitation under the BMP, which will improve the condition of the riparian corridor and areas mapped as Coastal Wetlands.

8.3.5.4. Threatened Entities Affected

Due to the small area impacted, any changes to waterbodies, water quality and hydrological processes are unlikely to affect threatened entities within the subject land.

8.3.5.5. Consequences

The consequences of impacts to waterbodies, water quality and hydrological processes are likely to be negligible and would primarily take place during construction. These impacts can be managed and mitigated through implementation of erosion and sediment control measures.

8.4. Assessment of Impacts to Coastal Wetlands

8.4.1. Mapped Coastal Wetlands

Land mapped as Coastal Wetlands under the Coastal Management SEPP occurs in the study area, as shown in **Figure 2**; with a small portion extending into the subject land. Additional areas of Coastal Wetlands occur outside the subject land and study area along Narrabeen Creek to the south.

While small areas mapped as Coastal Wetlands occur within the subject land and will be impacted as part of the project, this area is minimal and occurs on the edge of a larger area of wetland vegetation. The trees to be removed that are associated with the Coastal Wetland mapping comprises stands of juvenile Casuarina glauca (*Swamp Oak*), and several *Erythrina crista-galli* (Coral Tree). As mentioned previously, the actual ground-truthed areas to be impacted in association with the mapping of Coastal Wetlands can be estimated using the verified vegetation mapping of this BDAR. As such, the direct impacts to mapped Coastal Wetlands as part of the project is confined to an area of 0.05 ha of already modified vegetation.

There is also the potential for some indirect impacts to occur to the Coastal Wetland within and surrounding the subject land, through erosion and sedimentation caused by construction works or runoff of stormwater and inappropriate disposal of waste-water. These potential indirect impacts will be managed through the implementation of appropriate mitigation measures, such as erosion and sedimentation control measures and a detailed stormwater design. These measures are described in more detail in the Civil Engineering report (CPS 2021b), and discussed further in **Chapter 9** of this BDAR. With the implementation of these measures, negative impacts on the nearby areas of Coastal Wetlands are unlikely to occur.

8.4.2. Mapped Proximity Area to Coastal Wetlands

The subject land includes land mapped as 'Proximity Area' to the Coastal Wetlands, which acts effectively as a buffer area to the Coastal Wetland.

Under the Coastal Management SEPP, development can be carried out in areas mapped "proximity area for coastal wetlands" if the consent authority is satisfied that the proposed development will not significantly impact on the biophysical, hydrological and ecological integrity of the coastal wetland or the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland.

The clearing of vegetation within the proximity areas in the subject land is not expected to significantly impact the ecological integrity of the Coastal Wetland beyond current conditions, as these areas have previously been heavily modified during the construction of the existing dwellings and previous agricultural land uses.

The quality of water entering the wetlands is expected to be equal or improved beyond current conditions, due to the improved active management of stormwater run-off proposed as part of the Project (CPS 2021b). This will ensure that although works are proposed in the Proximity Area, indirect impacts on Coastal Wetlands will not be exacerbated. As a result, no significant impact on the hydrological integrity is expected on the Coastal Wetland (CPS 2021b).

Furthermore, the proposed development is not expected to have any impacts on the groundwater, hence changes to the ground water table or the quantity and quality of groundwater, as a result of the Project, and associated potential impacts on the Coastal Wetland, are considered unlikely to occur (CPS 2021b).

8.5. Mitigation of Impacts to Native Vegetation and Habitat

A range of mitigation measures have been developed for the project to mitigate the impacts to native vegetation and habitat that are unable to be avoided. These include a range of measures to be undertaken before, during and after construction to limit the impact of the project. Each mitigation measure is discussed in detail below, and a summary is provided in **Table 15**.

8.5.1. Weed Management

In order to minimise the spread of weeds throughout the subject land and adjoining areas, appropriate weed control activities will be undertaken prior to vegetation clearing in accordance with the Greater Sydney Management Region and is subject to the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 (LLS: Greater Sydney 2019) under the NSW *Biosecurity Act 2015*.

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds and high risk activities, as provided in the Appendices of the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 (LLS: Greater Sydney 2019). To comply with the objectives of the Greater Sydney Regional Strategic Weed Management Plan, it is recommended the following measures be implemented as part of weed management for the subject land.

i. Prevention

Appropriate construction site hygiene measures will be implemented to prevent entry of new weeds to the area such as the cleaning of equipment prior to entering the subject land.

ii. Eradication

Initial weed management will be carried out within the subject land according to best-practice methods under the direction of a suitably qualified bush regenerator. The targeted species will be those listed under

Appendices 1 and 2 of the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 (Landcom 2004b, LLS: Greater Sydney 2019). Initial weed treatment will include eliminating woody species and targeting large dominant infestations of exotic herbs. This may be achieved via a combination of manual weed removal and herbicide use. Weed management will focus on the removal of targeted species from within landscaping areas.

Best-practice bush regeneration should undertake measures to avoid adverse impacts to retained vegetation within the subject land, including not over clearing (remove only targeted species), employment of minimal disturbance techniques to avoid soil and surrounding vegetation disturbance, and replacement of disturbed mulch/leaf-litter.

iii. Containment

Follow-up monitoring and maintenance should be undertaken in landscaping areas following construction, to contain any re-emergence of weed species.

8.5.2. Delineation of Clearing Limits

The current limits of clearing will be marked either by high visibility tape on trees or metal/wooden pickets, fencing or an equivalent boundary marker that will be installed prior to clearing. To avoid unnecessary or inadvertent vegetation and habitat removal or impacts on fauna, disturbance must be restricted to the delineated area and no stockpiling of equipment, machinery, soil, rock or vegetation will occur beyond this boundary.

8.5.3. Tree Protection Measures

As trees to be retained have the potential to be impacted during the construction of the proposed development, tree protection measures are proposed to be implemented to avoid inadvertent impacts to trees that are marked for retention. These measures include the implementation of Tree Protection Devices, tree protection fencing, and relevant signage.

8.5.4. Pre-clearance Surveys

To minimise impacts to fauna species during construction, pre-clearance surveys will be conducted in all areas of vegetation that are required to be cleared. Pre-clearing surveys will be undertaken within one week of clearing activities by a qualified ecologist.

Habitat features to be identified include:

- Hollow-bearing trees;
- Human-made structures;
- Rock; and
- Log Piles.

Such features have the potential to contain native species. All habitat features will be identified, recorded and flagged with fluorescent marking tape and trees will have an "H" spray painted with marking paint on two sides of the tree.

8.5.5. Staging of Clearing

The clearing will be conducted using a two-stage clearing process as follows:

Stage 1: Clearing will commence following the identification of potential habitat features by a qualified ecologist. Hollow-bearing trees marked during pre-clearing will not be cleared during the first stage. However, all vegetation around these trees will be cleared to enable isolation of the feature. Other habitat features, such as hollow-bearing logs, can be removed during Stage 1 only if done under supervision by a qualified ecologist. Identified hollow-bearing trees will be left at a minimum overnight after Stage 1 clearing to allow resident fauna to voluntarily move from the area.

Stage 2: After hollow-bearing trees have been left overnight, the trees will be cleared using the following protocols:

- Trees marked as containing hollows will be shaken by machinery prior to clearing to encourage any animals remaining to leave the hollows and move on;
- Use a bulldozer or excavator to start pushing the tree over. Move the bulldozer over the roots and continue gently pushing the tree over;
- Remove branches with hollows and sections of trunk and set aside for immediate transfer to a storage area for placement within retained vegetation; and
- All hollows will be investigated by an ecologist for the presence of fauna following felling of the tree.

The felled habitat tree will be left overnight to allow any remaining fauna time to leave the hollows and move on.

The two-stage clearing process enables fauna a chance to self-relocate upon nightfall, when foraging typically occurs.

Provisions will be made to protect any native fauna during clearing activities by the following means:

- All staff 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 will be assisted to move to 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 euthanised).

Provision of a report following the completion of clearing works will be provided detailing the total number and species of individuals recorded and details of their release/health.

8.5.6. Sedimentation Control Measures

The project may result in erosion and transport of sediments because of soil disturbance during construction. In order to prevent this impact, construction activities will be undertaken in accordance with "The Blue Book" (Landcom 2004a) and the Civil Engineering Works report for the project (CPW 2021b).

According to the Civil Engineering Works report, all sediment and erosion control methods shall be made consistent with the Northern Beaches Council guidelines and the Department of Housing's 'Managing Urban Stormwater; Soils and Construction Manual' (Landcom 2004b). Additionally, no construction works will commence until all sediment and erosion control measures have been inspected by the principal certifying authority, and will be regularly inspected to ensure the measures' correct and efficient function throughout the duration of the construction activities until the principal certifying authority is satisfied that the measures can be removed. Further measures include dust control for the entirety of the construction activities, and all stockpiles are to be clear of all retained trees and drainage lines such that they are protected from erosion.

8.5.7. Habitat Feature Salvage

Where present, fauna habitat features including hollow-bearing trees and rock will be salvaged from the subject land during clearing and stockpiled for future use in restoration of the BMP Area. The placement of salvaged items will increase habitat complexity as such items are used by a variety of invertebrate and vertebrate species as microhabitat areas.

Habitat features are to be stored until such time as restoration of the BMP Area commences. Storage must be undertaken within designated stockpile areas, with onsite contractors made aware material is to be retained, to prevent loss of stored habitat features prior to utilisation. Placement of stored habitat features within the BMP Area will be undertaken in co-ordination with an ecologist.

Tree limbs containing hollows felled during the clearing process will be relocated within the BMP Area. These will be used for habitat reconstruction within the BMP Area. Hollows will be trimmed by a tree removal specialist and will be relocated to trees within the BMP Area. When the relocation of a hollow is not possible, a nest box will be placed in a tree in the BMP Area to ensure that all lost arboreal habitat is either relocated or replaced.

Hollows to be translocated will be those that are structurally sound to the extent that they survive the trees felling and subsequent translocation. The suitability of each hollow is to be determined during pre-clearance surveys by an ecologist.

8.5.8. Biodiversity Management Plan

Areas of the study area that will be retained will be rehabilitated and managed in the longer term under a Biodiversity Management Plan. The rehabilitation of Coastal Flats Swamp Mahogany Forest includes a 0.84 ha area that will be managed and revegetated where appropriate using a full suite of species indicative of the TEC, and a range of these species of shrubs and groundcovers will be prioritised across landscaped areas of the site.

It is understood that following an initial period of five years, the area within 25 m of the rear boundary of the study area along Narrabeen Creek will be dedicated to Northern Beaches Council.

A Biodiversity Management Plan has been prepared as part of the project (21097RP1).

8.5.9. Landscaping with Coastal Flats Swamp Mahogany Forest Species

Where possible, it is recommended that native plant species characteristic of Coastal Flats Swamp Mahogany Forest be incorporated into the landscape plan for the subject land. A recommended species list is provided in the BMP (doc. 21097RP1). All native re-plantings should be sourced from local nurseries or come from seed sourced from the property.

Table 15 Summary of mitigation measures

Mitigation Measure	Proposed Techniques	Timing	Frequency	Responsibility	Risk of Failure	Risk and Consequences of Residual Impacts
Weed management	Appropriate weed control activities will be undertaken in accordance with the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 (LLS: North Coast 2017).	Construction	Prior to construction, following vegetation clearing	Contractor	High	Spread of weeds throughout the study area.
Delineation of clearing limits	Clearing limits marked either by high visibility tape on trees of metal/wooden pickets, fencing or an equivalent boundary marker. Disturbance, including stockpiling, restricted to clearing limits.	Construction	Once	Contractor/ Arborist	High	Unnecessary damage to retained trees in the BMP area or adjacent properties.
Tree Protection Measures	Implementation of tree protection measures	Construction	Prior to construction and vegetation clearing	Contractor/ Arborist	High	Unnecessary damage to retained trees in the study area or adjacent properties.
Pre-clearance survey	Pre-clearance surveys will be conducted in all areas of	Construction	Once	Project ecologist	Moderate	Increased and unnecessary

Mitigation Measure	Proposed Techniques	Timing	Frequency	Responsibility	Risk of Failure	Risk and Consequences of Residual Impacts
	vegetation that are required to be cleared. Pre-clearing surveys will be undertaken within one week of clearing. Habitat features will be marked during the pre-clearing survey.					mortality of native fauna.
Staging of clearing	Vegetation clearing will be conducted using a two-stage clearing process. Animals disturbed or dislodged during the clearance but not injured will be assisted to move to adjacent bushland or other specified locations 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	Construction	Once	Contractor/ project ecologist	High	Increased and unnecessary mortality of native fauna.

Mitigation Measure	Proposed Techniques	Timing	Frequency	Responsibility	Risk of Failure	Risk and Consequences of Residual Impacts
	unlikely to survive, it will be humanely euthanized)					
Sedimentation control	Construction activities will be undertaken in accordance with "The Blue Book" (Landcom 2004a). These include implementation of measures detailed in Preliminary Erosion and Sediment Control Plan (Costin and Roe Consulting 2021)	Construction	Throughout construction period	Contractor	High	Sedimentation into adjoining vegetation.
Habitat Feature Salvage	Habitat Feature Salvage or Installation of nest boxes in retained trees in the BMP area	Prior to vegetation clearing	Once	Project ecologist	Low	Reduction in available fauna habitat
Biodiversity Management Plan	Rehabilitation works will commence following the construction phase in accordance with the BMP.	Operation	Post construction	Contractor	Moderate	Loss of vegetation and connectivity.
Landscaping with Coastal Flats Swamp Mahogany Forest Species	Select appropriate species for use in landscaping	Operation	Post construction	Contractor	Moderate	Reduction in species composition of the study area

8.6. Mitigation of Prescribed Impacts

The following mitigation measures, described in ***Section 8.4***, are relevant to the prescribed impacts relevant to the project:

- Delineation of clearing limits;
- Tree protection measures;
- Pre-clearance survey;
- Staging of clearing;
- Sedimentation control measures;
- Habitat Feature Salvage;
- Biodiversity Management Plan; and
- Landscaping with Coastal Flats Swamp Mahogany Forest Species.

No additional mitigation measures are proposed for prescribed impacts.

8.7. Adaptive Management for Uncertain Impacts

The project is considered unlikely to result in any uncertain impacts that require adaptive management.

8.8. Use of Biodiversity Credits to Mitigate or Offset Indirect or Prescribed Impacts

Due to the small scale of indirect and prescribed impacts, the project does not propose to use additional biodiversity credits to mitigate or offset these impacts.

9. Thresholds of Assessment

9.1. Introduction

The assessment thresholds that must be considered include the following:

- Impacts on an entity that is at risk of a serious and irreversible impact;
- Impacts for which the assessor is required to determine an offset requirement; and
- Impacts for which the assessor is not required to determine an offset requirement; and
- Impacts that do not require further assessment by the assessor.

The following sections outline these assessment thresholds and their relevance to the project.

9.2. Impacts on Serious and Irreversible Impact Entities

The project is not considered to have any impact on SAII entities, as identified in the Threatened Biodiversity Data Collection. Specifically:

- PCT 1795 Coastal Flats Swamp Mahogany Forest is not an SAII entity; and
- Habitat constraints for threatened fauna species that are an SAII entity are not present in the subject land.

9.3. Impacts that Require an Offset

9.3.1. Native Vegetation

In accordance with the BAM, an impact to biodiversity requires offsets for the clearing of native vegetation when the following criteria are met:

- A vegetation zone that has a vegetation integrity score ≥15 where the PCT is representative of an EEC or CEEC;
- A vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or is representative of a vulnerable ecological community; or
- a vegetation zone that has a vegetation integrity score ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.

The PCT and vegetation zones requiring offsets is documented in **Table 16**. This area is mapped in **Figure 11**. As the Low condition vegetation zone of PCT 1795 (zone 2) proposed for removal within the subject land has a vegetation integrity score of ≤15 (10.7), credit retirement is not required to offset impacts to this zone.

Table 16 Summary of impacts to native vegetation requiring an offset

Vegetation Zone	PCT #	PCT Name	Biodiversity Risk Waiting	Area (ha)	Patch Size Class	Vegetation Integrity Score
1_Moderate	1795	Coastal Flats Swamp Mahogany Forest	2	0.02	>101 ha	54.9

9.3.2. Threatened Species

No species credit species have been identified as requiring an offset.

9.4. Impacts that do not Require Offsets

As mentioned previously, the Low condition vegetation zone of PCT 1795 (zone 2) proposed for removal within the subject land has a vegetation integrity score of ≤15 (10.7). As such, credit retirement is not required to offset impacts to this zone. The PCT and vegetation zone that does not require offsets is documented in **Table 17**. This area is mapped in **Figure 11**.

Table 17 Summary of impacts to native vegetation that do not require offsets

Vegetation Zone	PCT #	PCT Name	Biodiversity Risk Waiting	Area (ha)	Patch Size Class	Vegetation Integrity Score
1_Low	1795	Coastal Flats Swamp Mahogany Forest	2	0.03	>101 ha	10.7

9.5. Impacts that do not Require Further Assessment

Impacts to areas identified as Exotic Vegetation and Cleared Lands that occur within the subject land do not require further assessment or offsetting. These areas comprise approximately 1.29 ha and include all areas not mapped as a PCT/Vegetation Zone.

9.6. Application of the No Net Loss Standard

The BAM sets a standard that will result in no net loss of biodiversity values where the impacts on biodiversity values are avoided, minimised and mitigated, and all residual impacts are offset by retirement of the required number of biodiversity credits.

The ecosystem credit requirement for the project is summarised in **Table 18**, whilst the 'like for like' offsetting options for the ecosystem credits are provided in **Table 19.**

A credit summary report from the BAMC has been included in **Appendix C**.

Table 18. Summary of ecosystem credit liability

Zone	Vegetation Zone Name	BC Act Listing	Sensitivity to Gain	Area (ha)	Credits Required
1	1795_Moderate	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC)	High sensitivity to potential gain	0.02	1

Table 19. Like for like offsetting options for PCT 1795

Class	Containing Hollow-bearing Trees?	In the below IBRA Subregions	Credits
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 837, 839, 926, 971, 1064, 1092, 1227, 1230, 1231, 1232, 1235, 1649, 1715, 1716, 1717, 1718, 1719, 1721, 1722, 1723, 1724, 1725, 1730, 1795, 1798	Yes	Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo Or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site	1

10. References

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APPENDIX A :

Compliance Table: Streamline Assessment Module - Small Area

Table 20 Minimum information requirements for the Biodiversity Development Assessment Report: Streamlined assessment module – Small Area

Report section	BAM ref.	Information	Location Addressed in BDAR
Introduction	Chapters 2 and 3	INFORMATION Introduction to the biodiversity assessment including:	
		brief description of proposed development	Section 1.3.2
		identification of subject land boundary, including: operational footprint construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure	Section 1.3.3
		general description of the subject land	Section 1.3.4
		sources of information used in the assessment, including reports and spatial data	Section 1.3.5-1.3.7
		Identification of assessment method applied (i.e. linear or site-based)	Section 3.1
		MAPS and TABLES (in document)	
		Map of the subject land boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure (if BDAR)	Figure 1 and 2
		DATA (to be supplied)	BAMC
Landscape	Sections 3.1 and 3.2, Appendix E	INFORMATION Identification of site context components and landscape features at the proposed site, including:	
		general description of subject land topographic and hydrological setting, geology and soils	Sections 1.3.4, 3.2.2, 3.2.7, and 3.2.8
		percent native vegetation cover in the assessment area (as described in BAM Subsection 3.2(4.)	Section 3.3

Report section	BAM ref.	Information	Location Addressed in BDAR
		IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.))	Section 3.2.1
		Other relevant landscape features which may include:	
		rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3–4.) and Appendix E)	Section 3.2.2
		wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(4.))	Section 3.2.3
		connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.))	Section 3.2.4
		areas of geological significance and soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(10.)	Section 3.2.5
		areas of outstanding biodiversity value occurring on the subject land and assessment area (as described in BAM Subsection 3.1.3(8–9.))	Section 3.2.6
		MAPS and TABLES (in document)	
		Site Map boundary of subject land cadastre of subject land landscape features identified in BAM Subsection 3.1.3 areas of outstanding biodiversity value within the subject land	Figure 1
		Location Map digital aerial photography at 1:1,000 scale or finer boundary of subject land 1500 m buffer area *or* 500 m buffer for linear development landscape features identified in BAM Subsection 3.1.3 additional detail (e.g. local government area boundaries) relevant at this scale	Figure 2

Report section	BAM ref.	Information	Location Addressed in BDAR
		areas of outstanding biodiversity value within the assessment area	
		Landscape features identified in BAM Subsection 3.1.3 and to be shown on the Site Map and/or Location map include: IBRA bioregions and subregions rivers, streams and estuaries wetlands and important wetlands connectivity of different areas of habitat areas of geological significance and soil hazard features	Figure 2
		DATA (to be supplied)	
		All report maps as separate jpeg files Individual digital shape files of: subject land boundary assessment area (i.e. buffer area) boundary cadastral boundary of subject land areas of native vegetation cover areas of habitat connectivity	BAMC
Native vegetation, TECs and vegetation integrity	Chapter 4	INFORMATION	
		Patch size (in accordance with BAM Subsection 4.3.2)	Table 6
		Identification of the dominant PCT on the subject land and extent (ha) with justification of method used (existing information or plot-based survey data)	Section 4.2.1
		Identification of any TEC associated with the PCT (BAM Subsection 4.2.2)	Section 4.2.1.5
		Estimate of percent cleared value of dominant PCT (BAM Subsection 4.2.1(5.)	Section 4.2.1

Report section	BAM ref.	Information	Location Addressed in BDAR
		Identification of any TEC on site that is not associated with the dominant PCT (Note: This TEC is required to be assessed and offset.)	N/A
		Equivalence with mapping units of previous vegetation maps reviewed as part of the assessment (i.e. equivalent mapping units)	Section 4.1
		Vegetation integrity of the PCT(s) on the subject land as individual vegetation zones	Table 6
		Justification for how this was determined (i.e. qualitatively by observing values for the condition attributes set out in Table 2 of the BAM or quantitatively by collecting field data for the condition attributes at a plot in accordance with BAM Subsection 4.3.4)	Section 4.3
		Use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsections 4.3.3(5.)) Where use of more appropriate local benchmark data is proposed (as described in BAM Subsection 1.4.2, BAM Subsection 4.3.3(5.) and BAM Appendix A):	N/A
		identify the PCT or vegetation class for which local benchmark data will be applied	N/A
		identify published sources of local benchmark data (if benchmarks obtained from published sources)	N/A
		describe methods of local benchmark data collection (if reference plots used to determine local benchmark data)	N/A
		provide justification for use of local data rather than BioNet Vegetation Classification benchmark values	N/A
		MAPS and TABLES (in document)	
		Map of native vegetation extent for the subject land (as described in BAM Section 3.1)	Figure 5
		Map of PCT/vegetation zones within the subject land (as described in BAM Section 4.2(1.)	Figures 6 and 8
		Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCT boundaries	Figure 4

Report section	BAM ref.	Information	Location Addressed in BDAR
		Map of TEC distribution on the subject land	Figure 7
		Patch size of native vegetation (as described in BAM Subsection 4.3.2) Table of current vegetation integrity scores for vegetation zone within the site including: composition condition score structure condition score function condition score	Figure 2 Table 6
		Report from BAM-C (Small area module) including vegetation integrity scores (BAM Section 4.4)	Appendix B
		DATA (to be supplied)	
		All report maps as separate jpeg files	BAMC
		Plot field data (MS Excel format)	Appendix B and BAMC
		Digital shape files for all maps and spatial data	BAMC
		Field data sheets (if relevant) for determining vegetation integrity (BAM Subsection 4.3.4)	BAMC
Habitat suitability for threatened species	Chapter 5 and Section 9.1	INFORMATION	
		Describe the review of existing information and any field survey undertaken to assess habitat constraints and microhabitats for threatened species within the subject land	Section 2.1, 2.5.1, 2.5.2.1 and Section 5.3.1
		Determination of the suite of threatened species likely to occur on or use the proposed site according to Steps 1 and 2 in BAM Section 5.2 including species to be assessed for ecosystem credits and the list of species to be assessed for species credits	Table 7 and Table 8
		List of ecosystem credit species derived from the TBDC (as described in BAM Subsections 5.2.1 and 5.2.2) with justification for the exclusion of any ecosystem credit species based on habitat constraints (as described in BAM Subsection 5.2.2)	Table 7

Report section	BAM ref.	Information	Location Addressed in BDAR
		Identification of candidate species credit species that are at risk of an SAII and therefore, must be further assessed (BAM Section 9.1)	Table 8
		Note: Candidate species credit species that are not at risk of an SAII and not incidentally recorded on the subject land do not require further assessment.	
		For candidate species credit species that are at risk of an SAII, a description of the species, any habitat constraints or microhabitats associated with the species on the subject land and information used to create the species polygon/s in accordance with Steps 3 to 5 of BAM Section 5.2 including:	Section 5.3.2
		justification for determining that a candidate species credit species at risk of an SAII is unlikely to have suitable habitat on the subject land or specific vegetation zone (based on a field assessment of the subject land and published literature or an expert report prepared in accordance with Box 3 of the BAM)	Table 7
		determination of the presence of remaining candidate species credit species at risk of an SAII (by assuming presence, conducting a threatened species survey or an expert report).	Section 5.3.2
		Note: If the subject land is mapped on an important habitat map for a species, or for a component of its habitat, the subject land is considered to have suitable habitat for the species to be present.	
		species polygons identifying the location and area of suitable habitat for each candidate threatened species at risk of an SAII that is recorded on the subject land and is measured by area, OR species polygons identifying the area of suitable habitat and targeted surveys identifying the count and location of individuals on the subject land for each candidate threatened flora species at risk of an SAII that is recorded on the subject land and is measured by count	N/A
		species polygons for each threatened species identified on the subject land that is not at risk of an SAII (i.e. incidentally observed during site visit)	N/A

Report section	BAM ref.	Information	Location Addressed in BDAR
		Determination of habitat condition within species polygon/s for each threatened species (measured by area) at risk of an SAII or incidentally observed during the site visit (Step 6 of BAM Section 5.2)	N/A
		For flora species credit species at risk of an SAII or incidentally observed during site visit, provide a count, or an estimation, of the number of individual plants present on the subject land (as described in BAM Subsection 5.2.5(4.))	N/A
		MAPS and TABLES (in document)	
		Table showing ecosystem credit species in accordance with BAM Subsection 5.1.1, and: identifying any ecosystem credit species removed from the list of species on the basis of further assessment in accordance with BAM Subsections 5.2.2 and 5.2.3 identifying the sensitivity to gain class of each species (BAM Section 5.4)	Table 7
		Table detailing species credit species within the subject land at risk of an SAII (BAM Section 9.1) or incidentally observed during the site visit including any associated habitat feature/components and its abundance (flora)/extent of habitat (flora and fauna) and biodiversity risk weighting (BAM Sections 5.2–5.4)	Table 8
		Map of species credit species records within the subject land and species polygons for flora and fauna species at risk of an SAII or incidentally observed during the site visit (as described in BAM Subsection 5.2.5(1–7.))	N/A
		DATA (to be supplied)	
		Digital shape files of species polygons Species polygon map in jpeg format	N/A
		Expert reports and any supporting data used to support conclusions of the expert report	N/A
		Field data sheets (if relevant) for threatened species surveys	BAMC

Report section	BAM ref.	Information	Location Addressed in BDAR
Prescribed impacts	Chapter 6	INFORMATION	
		Any prescribed impacts from the small area proposal must be set out in the BDAR consistent with Appendix K	Table 10
		MAPS and TABLES (in document)	
		If relevant, maps showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human- made structures, etc.)	Figure 10
		DATA (to be supplied)	
		If relevant, digital shape files of prescribed impact feature locations	BAMC
		Prescribed impact features map in jpeg format	BAMC
Avoid and minimise impacts	Chapter 7	INFORMATION	
		Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative:	Section 7.1 and Section 7.2
		modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology	Chapter 7, Table 11
		alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location	Section 7.1.1 and Table 11
		alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site	Table 11
		Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design (as described in BAM Subsections 7.1.2 and 7.2.2	Section 7.1.2

Report section	BAM ref.	Information	Location Addressed in BDAR
		Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal (as described in BAM Subsection 7.2.1(3.)	Section 7.1.3
		MAPS and TABLES (in document)	
		Table of measures to be implemented before, during and after construction to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility	Table 11
		Map of final proposal footprint, including construction and operation	Figure 1
		Maps demonstrating indirect impact zones where applicable	N/A
		DATA (to be supplied)	
		Digital shape files of: final proposal footprint direct and indirect impact zones	BAMC
		Maps in jpeg format	BAMC
Assessment of Impacts	Chapter 8. Sections 8.1 and 8.2	INFORMATION Determine the impacts on threatened species habitat, including:	
		description of direct impacts of clearing of native vegetation, threatened ecological communities and threatened species habitat (as described in BAM Sections 8.1)	Section 8.1.1-8.1.2
		description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal (as described in BAM Subsection 8.2	Table 14
		Any prescribed impacts from the small area proposal must be set out in the BDAR consistent with Appendix K	Section 8.3
		MAPS and TABLES (in document)	

Report section	BAM ref.	Information	Location Addressed in BDAR
		Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts	Tables 13 and 16
		DATA (to be supplied) – N/A	
Mitigation and Management of Impacts	Chapter 8, Sections 8.4 and 8.5	INFORMATION	
		Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Subsections and 8.4.2, including (as described in BAM Subsection 8.4.1(2.):	Section 8.5
		Techniques, timing, frequency and responsibility	Table 15
		Identify measures for which there is risk for failure	Table 15
		Evaluate the risk and consequence of any residual impacts	Table 15
		Document any adaptive management strategy proposed	Section 8.7
		Identification of measures for mitigating impacts related to:	
		displacement of resident fauna (as described in BAM Subsection 8.4.1)	Table 15
		indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.))	Table 15
		mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2)	Section 8.6
		Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5)	Section 8.7
		MAPS and TABLES (in document)	
		Table of measures to be implemented before, during and after construction to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility	Table 16
		DATA (to be supplied) – N/A	

Report section	BAM ref.	Information	Location Addressed in BDAR
Thresholds for assessing and offsetting the impacts of the proposal	Chapter 9	INFORMATION	
		Information from the TBDC and/or other sources to report on the current status of threatened species, threatened populations at risk of an SAII and TEC/s for the proposal, and	Section 9.2
		Report on impacts of the proposal on TEC/s in accordance with BAM Subsection 9.2.1	Section 9.3.1 and Table 18
		Report on impacts of the proposal on threatened species and/or threatened populations at risk of an SAII in accordance with BAM Section 9.1	Section 9.2.2
		Identification of impacts requiring offset in accordance with BAM Section 9.2	Section 9.3
		Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.)	Section 9.4
		Identification of areas not requiring assessment in accordance with BAM Section 9.3	Section 9.5
		MAPS and TABLES (in document)	
		Map showing the extent of TECs at risk of an SAII within the subject land	N/A
		Map showing the location of threatened species at risk of an SAII within the subject land	N/A
		Map showing location of: impacts requiring offset impacts not requiring offset areas not requiring assessment	Figure 11
		DATA (to be supplied)	
		Digital shape files of: extent of TECs at risk of an SAII within the subject land threatened species at risk of an SAII within the subject land boundary of impacts requiring offset boundary of impacts not requiring offset	BAMC

Report section	BAM ref.	Information	Location Addressed in BDAR
		boundary of areas not requiring assessment	
		Maps in jpeg format	BAMC
Applying the no net loss standard	Chapter 10	INFORMATION	
		Description of the impact on PCTs/TECs	Table 18
		Description of the impact on threatened species at risk of an SAII or incidentally observed via site visit	N/A
		Number of ecosystem credits required for impacts on biodiversity values according to BAM Subsection 9	Table 18
		Number of species credits required for impacts on biodiversity values according to BAM Subsection 10.1.3, including any species credit species that has been incidentally observed on the subject land	N/A
		Note: Species credits for any species at risk of an SAII are calculated in the event that the decision-maker forms the opinion that the proposed impact is unlikely to be serious and irreversible and therefore can be offset.	
		Identification of credit class for ecosystem credits and species credits according to BAM Section 10.2 (this can be generated from BAM-C)	Table 19
		MAPS and TABLES (in document)	
		Table showing biodiversity risk weightings	Table 16 and Table 17
		Table of BC Act listing status for PCTs and threatened species requiring offset	8
		Table of PCTs requiring offset and number of ecosystem credits required (Subsection 10.2.1)	Table 18

Report section	BAM ref.	Information	Location Addressed in BDAR
		Table of species at risk of an SAII or incidentally observed on site assessed for species credits and the number of credits required	N/A
		BAM-C credit report	Appendix C
		DATA (to be supplied) – N/A	

APPENDIX B :
BAM Plot Data

plot	pct	area	patchsize	conditionclass	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	strucShrub	strucGrass	strucForbs	strucFerns	strucOther	funLargeTrees	funHollowtrees	funLitterCover	funLenFallenLogs	funTreeStem5to9	funTreeStem10to19	funTreeStem20to29	funTreeStem30to49	funTreeStem50to79	funTreeRegen	funHighThreatExotic
1	1795	0.03	101	Low	56	342338	6271306	225	3	0	1	2	0	0	15.4	0.0	5.0	0.2	0.0	0.0	1	1	3.2	0.0	0	0	0	0	0	0	6.1
2	Exotic Vegetation	N/A	N/A	N/A	56	342286	6271331	203	0	0	3	1	0	0	0.0	0.0	0.3	0.1	0.0	0.0	1	0	2.6	5.5	0	0	0	0	0	0	7.4
3	1795	0.02	101	Moderate	56	342202	6271189	225	2	1	3	3	1	3	35.0	2.0	31.0	0.6	1.0	5.0	1	1	72.2	135.0	1	1	1	1	1	1	5.0

APPENDIX C :
BAM Credit Report

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00026271/BAAS17027/21/00026272	21097 Warriewood Road Warriewood	10/06/2021
Assessor Name	Report Created	BAM Data version *
David Robertson	07/07/2021	45
Assessor Number	BAM Case Status	Date Finalised
BAAS17027	Finalised	02/07/2021
Assessment Revision	Assessment Type	BOS entry trigger
0	Part 4 Developments (Small Area)	BOS Threshold: Biodiversity Values Map

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

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

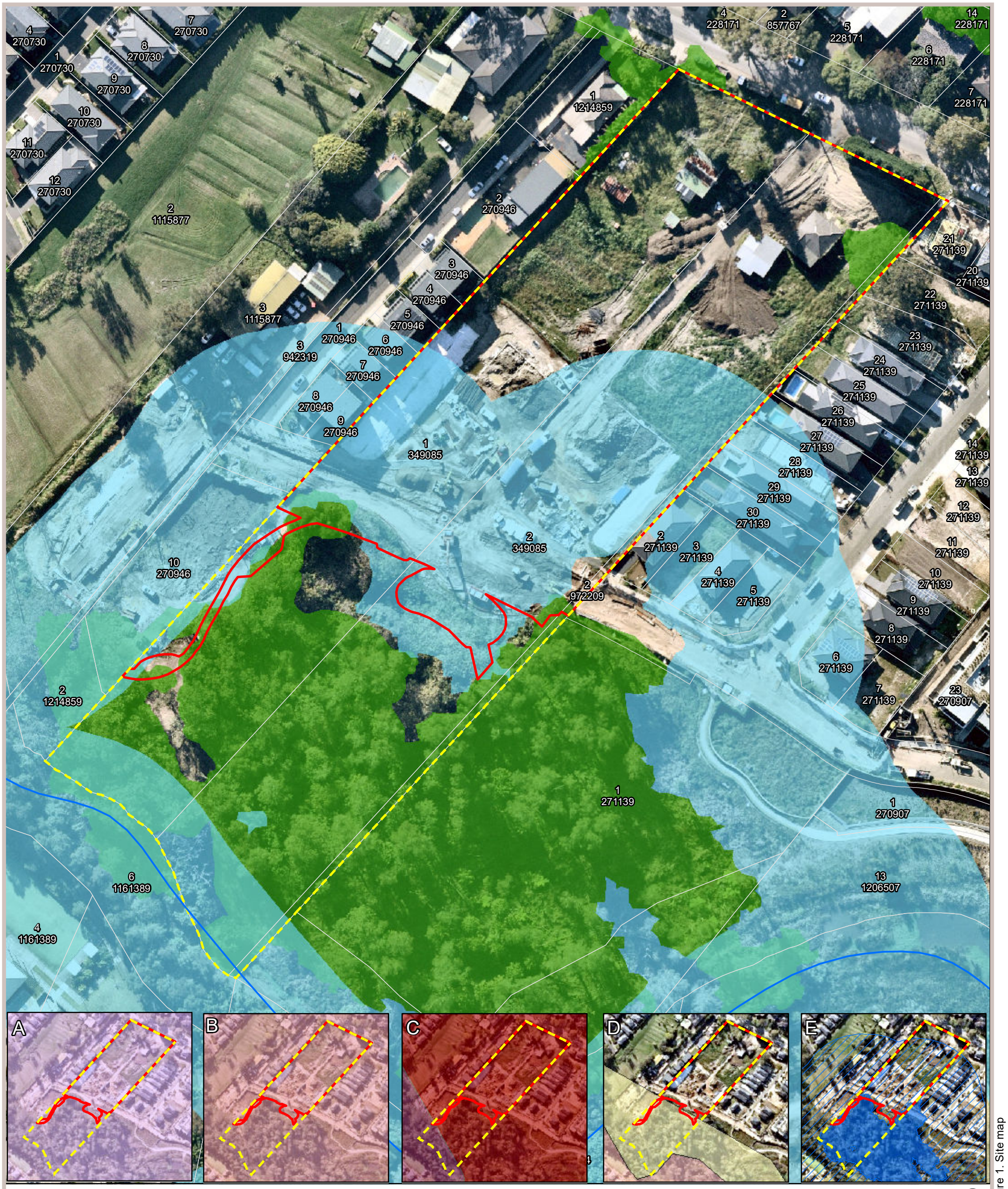
Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Coastal flats Swamp Mahogany forest											
1	1795_Moderate	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	54.9	54.9	0.02	Endangered Ecological Community	Not Listed	High Sensitivity to Potential Gain	2.00		1
2	1795_Low	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	10.7	10.7	0.03	Endangered Ecological Community	Not Listed	High Sensitivity to Potential Gain	2.00		0
										Subtotal	**1**
										Total	**1**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Species credits

FIGURES



Legend

- Subject Land
- Study Area
- Cadastre
- Native Vegetation Cover
- Riparian Corridor

Watercourses

- 2nd Order Stream

IBRA Region (Inset A)

- Sydney Basin

IBRA Subregion (Inset B)

- Pittwater

NSW (Mitchell) Landscapes (Inset C)

- Belrose Coastal Slopes
- Sydney - Newcastle Barriers and Beaches

Acid Sulfate Soil Risk (Inset D)

- High probability of occurrence
- Low probability of occurrence

Coastal Wetlands (Inset E)

- Coastal Wetlands (Inset E)
- Proximity Area to Coastal Wetlands

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMap 2021
Dated: 2/6/2021

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

DECCW (2008). Landscapes (Mitchell) of NSW - Version 3.

DSEWPaC (2012). Interim Biogeographic Regionalisation for Australia (IBRA) - Version 7.

Acid Sulfate Soils Risk (2021) Department of Planning, Industry and Environment

Coastal Management SEPP © State Government of NSW and Department of Planning, Industry and Environment 2018"

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I:\...\21097\Figures\RP2\20210712\Figure 1. Site map

Figure 1. Site map

0 40 m

A

B

C

D

E

Legend

- Subject Land
- Study Area
- Assessment Area
- Native Vegetation Cover
- Patch Size
- Local Wetlands
- Riparian Corridor

Watercourses

- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream

IBRA Region (Inset A)

- Sydney Basin

IBRA Subregion (Inset B)

- Pittwater

NSW (Mitchell) Landscapes (Inset C)

- Belrose Coastal Slopes
- Sydney - Newcastle Barriers and Beaches

Acid Sulfate Soil Risk (Inset D)

- High probability of occurrence
- Low probability of occurrence

Coastal Wetlands (Inset E)

- Coastal Wetlands (Inset E)
- Proximity Area to Coastal Wetlands

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMap 2021
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Acid Sulfate Soils Risk (2021) Department of Planning, Industry and Environment

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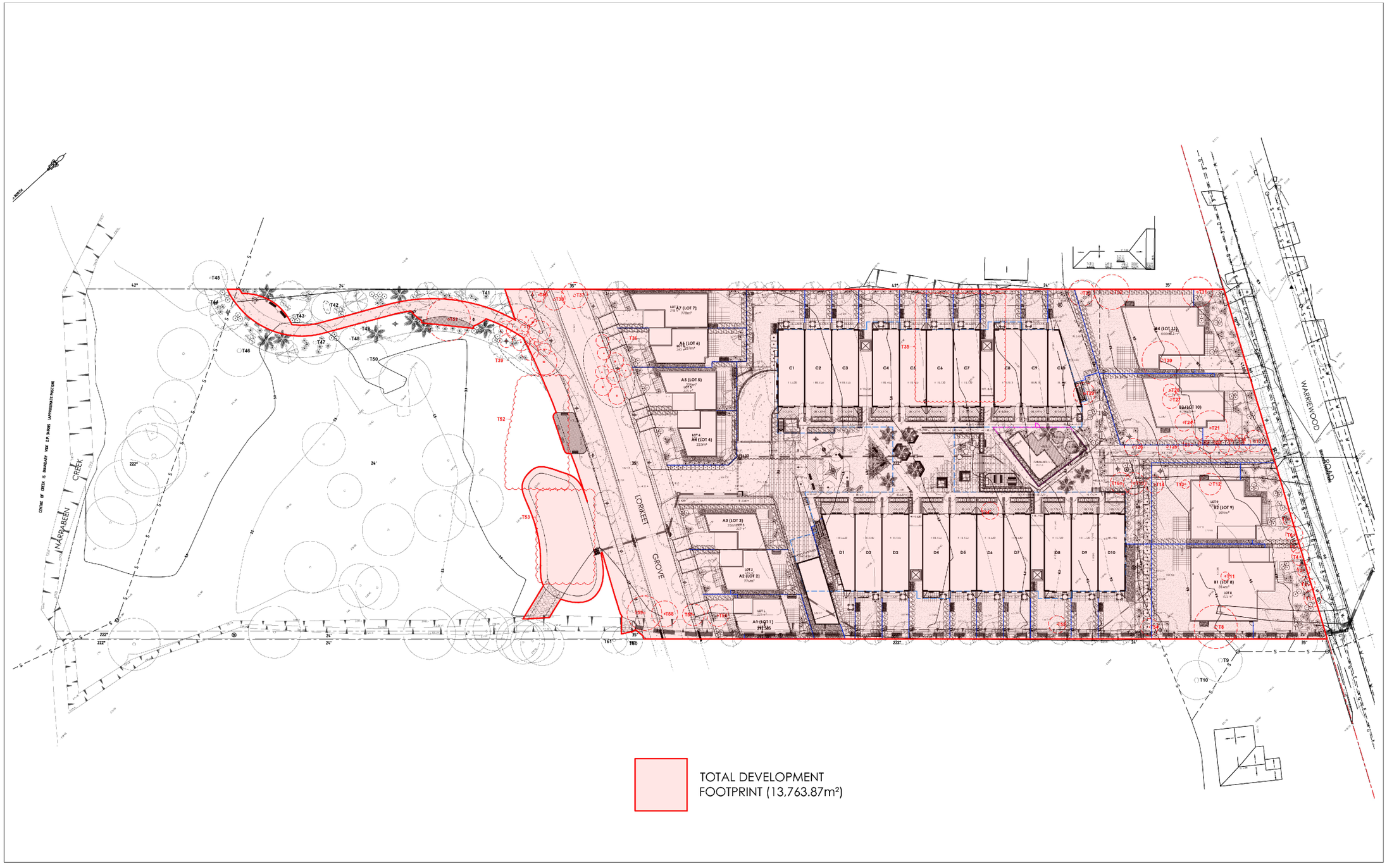
I:\...\21097\Figures\RP2\20210712\Figure 2. Location map

Figure 2. Location map

0 750 1,500 2,250 3,000 m



CPS
CREATIVEPLANNINGSOLUTIONS

LEVEL 3
397 RILEY STREET
SURRY HILLS NSW 2010
PO BOX 1074 BROADWAY NSW 2007
TEL: + (61) 2 8039 7461
INFO@CPSPLANNING.COM.AU
CPSPLANNING.COM.AU

DIMENSIONS :
All dimensions are in millimetres unless otherwise noted. Do not scale from this drawing.
Verify all dimensions on site prior to construction.

CIVIL, STRUCTURAL, HYDRAULIC, ELECTRICAL AND SPECIALIST WATER FEATURE WORKS :
Refer to specialist and consultant's drawings for all information contained within these documents relating to and nominated as specialist and consultant work. Specialist and consultant drawing information contained in the landscape documents are indicative only and not for construction or certification purposes.

Issue	Code	Issue Description	By	Chk	Date
P1	CA	FOR COORDINATION	TP	GT	21.06.21

PRE - Preliminary CA - Council Approval T - Tender CON - Construction

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT & SUBDIVISION
43, 45 & 49 WARRIEWOOD RD
WARRIEWOOD

DRAWING TITLE
LANDSCAPE PLAN:
DEVELOPMENT FOOTPRINT

CLIENT
ARCHIDROME

Drawn : TP
Designed : TP
Project No. : D221
Bar Scale
0 5 10 15 20 25 metres
1:400 @ A1 / 1:800 @ A3

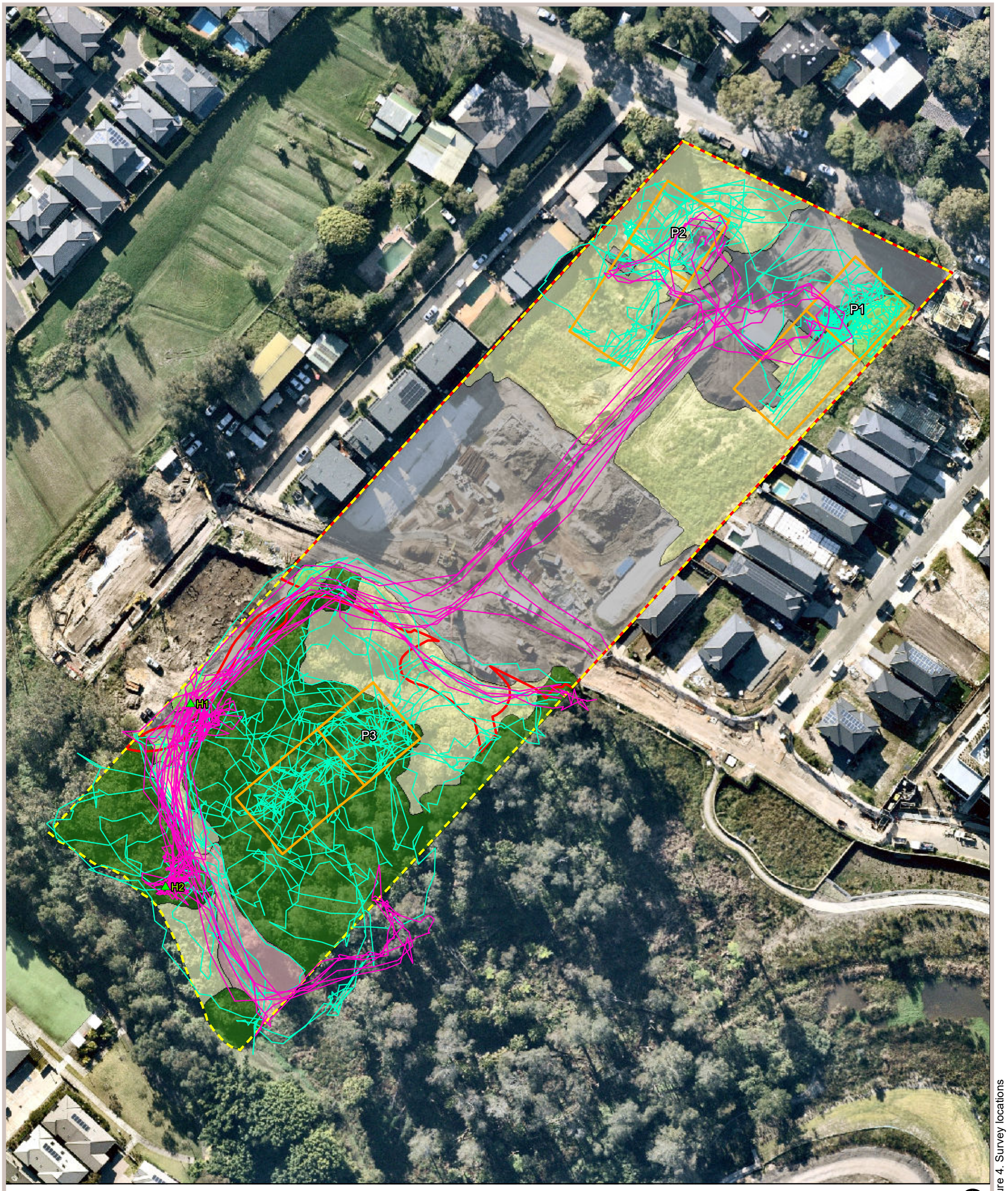
SHEET NUMBER
D221_LP_01

REVISION
P1

I:\...\21097\Figures\RP2\20210712\Figure 3. Project layout

Figure 3. Project layout

Image Source: CPS 2021



Legend

Subject Land

Study Area

Vegetation Zone

PCT 1795 (Moderate)

PCT 1795 (Low)

PCT1795 (Revegetation)

Exotic Vegetation

Cleared Land

Survey Locations

BAM Plot Locations

Survey Tracks - 10 June 2021

Survey Tracks - 5-6 July 2021

Hollows assessed for potential Barking Owl breeding habitat

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMap 2021
Dated: 2/6/2021

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

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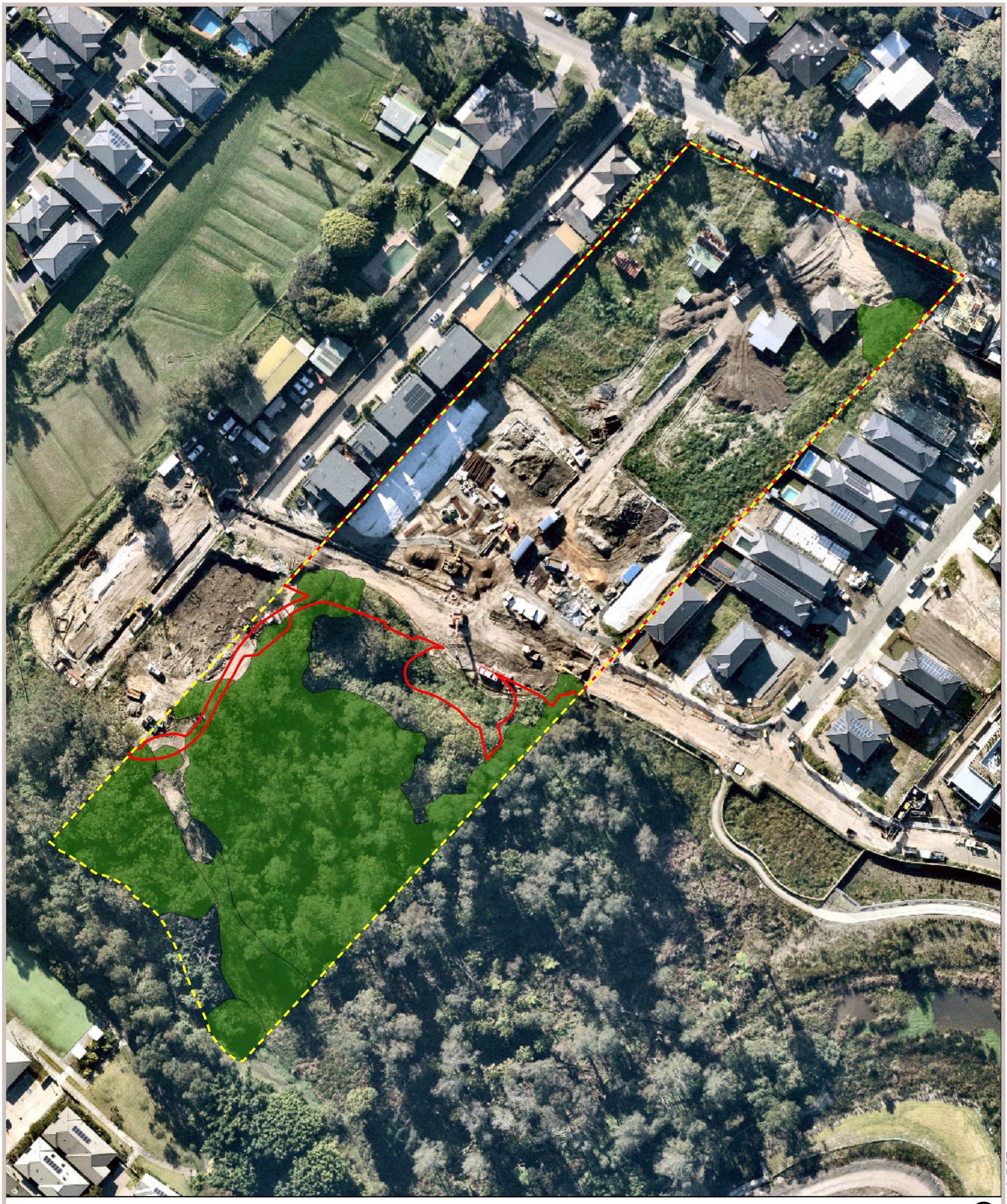
I:\...\21097\Figures\RP2\20210712\Figure 4. Survey locations

Figure 4. Survey locations

0 40 m

Figure 5. Native vegetation extent



Legend

Subject Land

Study Area

Plant Community Type

PCT1795: Coastal Flats Swamp Mahogany Forest

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
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Dated: 2/6/2021

Data Source:
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I:\...\21097\Figures\RP2\20210712\Figure 6. PCTs

Figure 6. Plant Community Types

0 40 m

Legend

Subject Land

Study Area

Threatened Ecological Community

Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMap 2021
Dated: 2/6/2021

Data Source:
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I:\...\21097\Figures\RP2\20210712\Figure 7. TECs

Figure 7. Threatened Ecological Communities

0 40 m

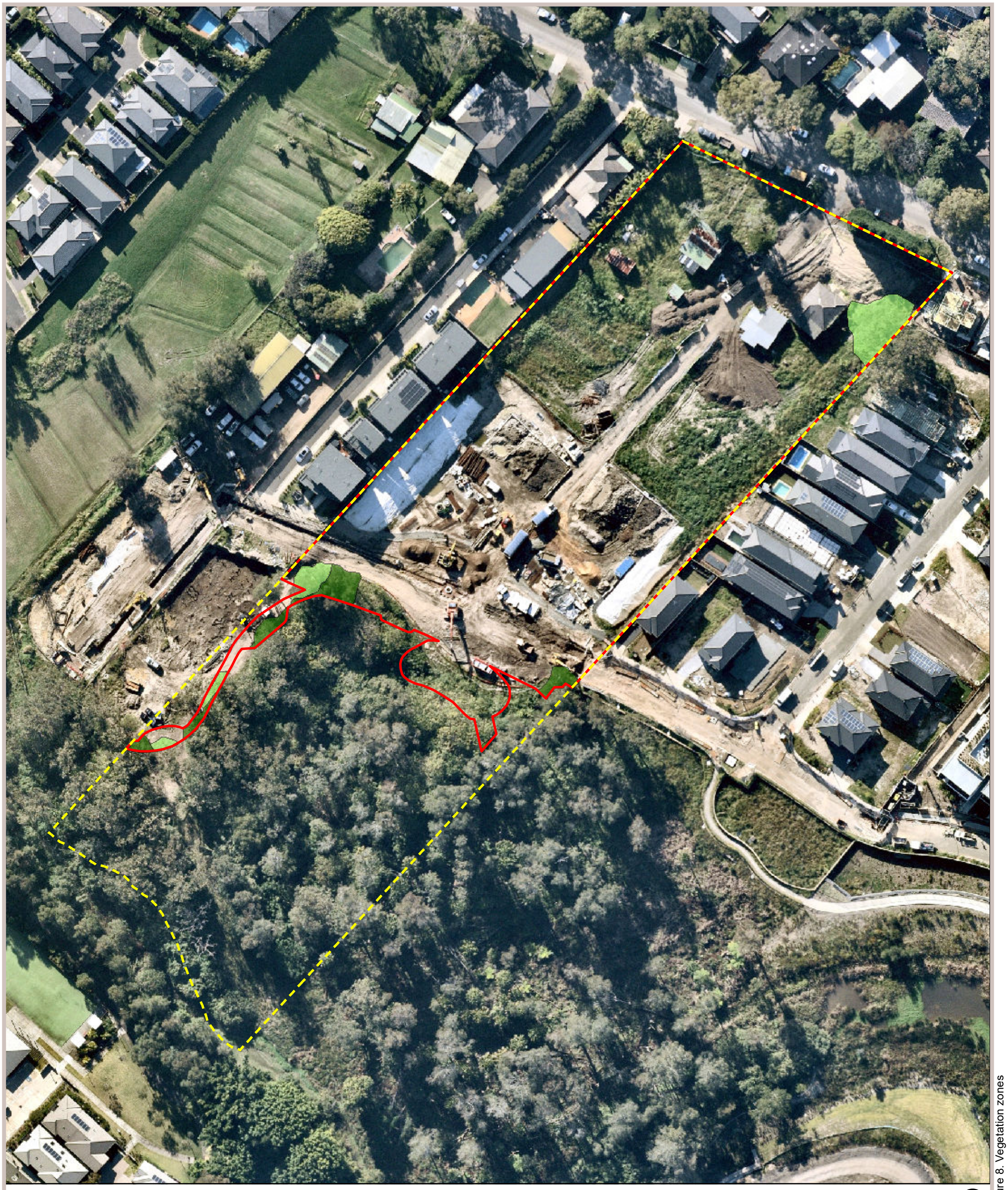

Figure 8. Vegetation zones

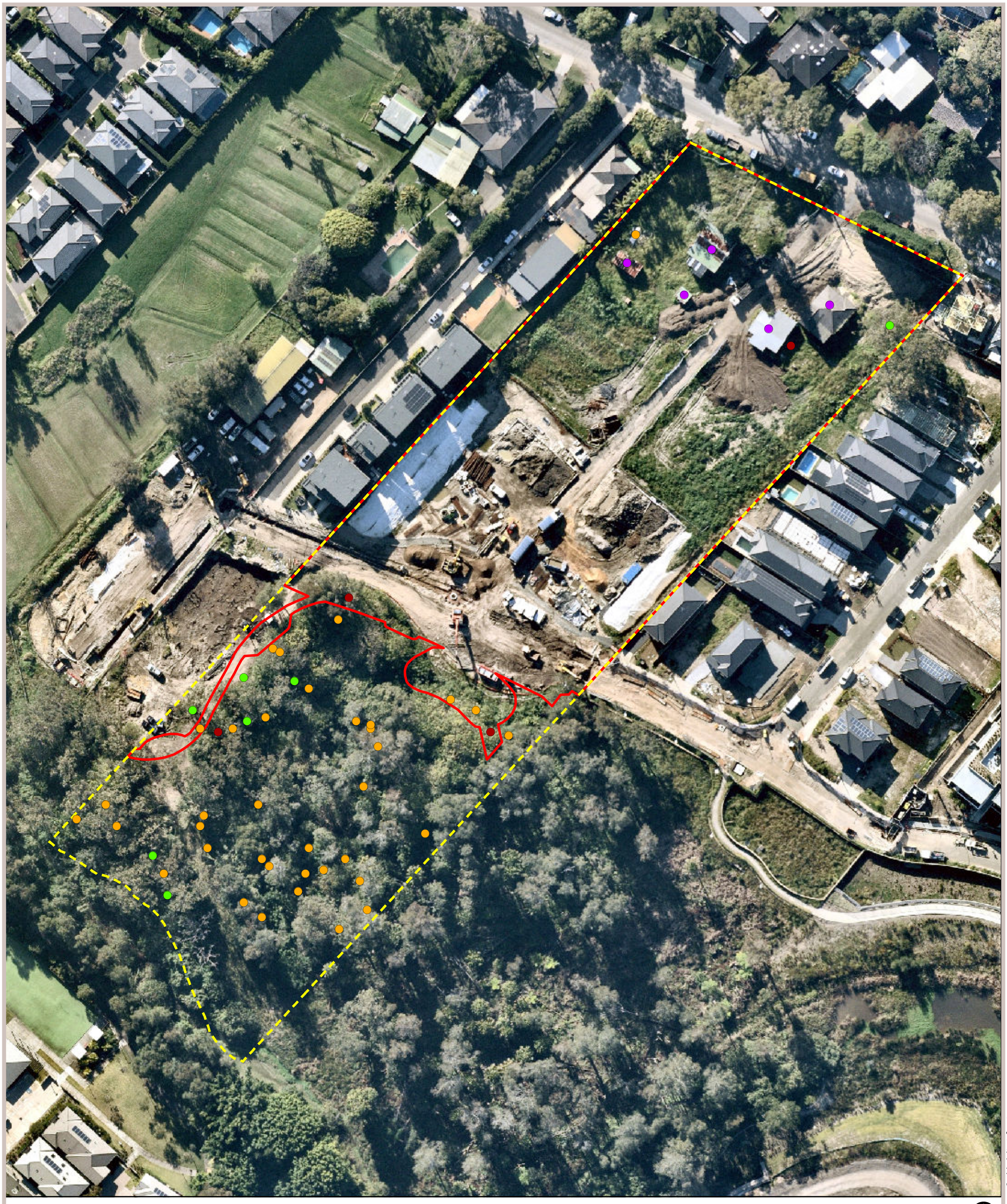

Figure 9. Habitat features within the study area

Legend

Subject Land

Study Area

Prescribed Impacts

Non-native Vegetation

Coastal Wetlands

Habitat Connectivity

Human-made Structure

Rock

Coordinate System: MGA Zone 56 (GDA 94)

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Dated: 2/6/2021

Data Source:
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0 40 m

I:\...\21097\Figures\RP2\20210712\Figure 10. Prescribed impacts

Figure 10. Prescribed impacts

Legend

Subject Land

Study Area

Impacts that require offsets

Zone 1: 1795_Moderate

Impacts that do not require offsets

Zone 2: 1795_Low

Impacts that do not require further assessment

Exotic Vegetation

Cleared Land

Coordinate System: MGA Zone 56 (GDA 94)

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Data Source:
NSW Government Spatial Services
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Northern Beaches LGA

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0 40 m

I:\...\21097\Figures\RP2\20210712\Figure 11. Thresholds of assessment

Figure 11. Thresholds of assessment