



Photo provided by Taronga Zoo

Streamlined Biodiversity Development Assessment Report

Reptile and Amphibian Conservation Centre at Taronga Zoo Sydney

Report prepared by Narla Environmental Pty Ltd

For the Taronga Conservation Society Australia

July 2021



NARLA

environmental

Report:	Streamlined Biodiversity Development Assessment Report
Prepared for:	Taronga Conservation Society Australia
Prepared by:	Narla Environmental Pty Ltd
Project no:	Tazo5
Version:	Final v1.0

Disclaimer

The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of the Engagement for the commission. This report and all information contained within is rendered void if any information herein is altered or reproduced without the permission of Narla Environmental. Unauthorised use of this document in any form whatsoever is prohibited. This report is invalid for submission to any third party or regulatory authorities while it is in draft stage. Narla Environmental Pty Ltd will not endorse this report if it has been submitted to council while it is still in draft stage. This document is and shall remain the property of Narla Environmental Pty Ltd. The sole purpose of this report and the associated services performed by Narla Environmental was to undertake a Biodiversity Development Assessment in association with a development application (DA) in accordance with the scope of services set out in the contract between Narla Environmental and the client who commissioned this report. That scope of services, as described in this report, was developed with the client who commissioned this report. Any survey of flora and fauna will be unavoidably constrained in a number of respects. In an effort to mitigate those constraints, we applied the precautionary principle described in the methodology section of this report to develop our conclusions. Our conclusions are not therefore based solely upon conditions encountered at the site at the time of the survey. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Narla Environmental has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law. This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Narla Environmental for use of any part of this report in any other context. The review of legislation undertaken by Narla Environmental for this project does not constitute an interpretation of the law or provision of legal advice. This report has not been developed by a legal professional and the relevant legislation should be consulted and/or legal advice sought, where appropriate, before applying the information in particular circumstances. This report has been prepared on behalf of, and for the exclusive use of, the client who commissioned this report, and is subject to and issued in accordance with the provisions of the contract between Narla Environmental and the client who commissioned this report. Narla Environmental accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party. Narla Environmental Pty Ltd has completed this assessment in accordance with the relevant federal, state and local government legislation as well as current industry best practices including guidelines. Narla Environmental Pty Ltd accepts no liability for any loss or damages sustained as a result of reliance placed upon this report and any of its content or for any purpose other than that for which this report was intended.

Narla Environmental Pty Ltd
www.narla.com.au

Report Certification

Works for this report were undertaken by:

Staff Name	Position
Jack Tatler <i>BSc (Hons) PhD</i>	Narla Environmental General Manager and Senior Ecologist BAM Accredited Assessor (BAAS21006)
Sarah Cardenzana <i>BEnvSc</i>	Narla Environmental Project Manager and Ecologist
Chris Moore <i>BBioCon</i>	Narla Environmental Project Manager and Ecologist
Ellena Tsanidis <i>BEnvMgmt (Hons)</i>	Narla Environmental Ecologist

Document Control

Revision	Document Name	Issue Date	Internal Document Review
Draft v1.0	Streamlined Biodiversity Development Assessment Report - Reptile and Amphibian Conservation Centre at Taronga Zoo Sydney	June 2021	Jack Tatler
Final v1.0	Streamlined Biodiversity Development Assessment Report - Reptile and Amphibian Conservation Centre at Taronga Zoo Sydney	June 2021	Chris Moore

Table of Contents

1. Introduction	10
1.1 Overview	10
1.2 The Proposed Development	10
1.3 Site Location and Description	11
1.4 Sources of Information Used	11
1.5 Aim and Approach	15
2. Landscape Context	16
2.1 IBRA Bioregion and Subregion	16
2.2 Topography, Geology and Soils	16
2.3 Areas of Geological Significance and Soil Hazards.....	16
2.4 Hydrology.....	16
2.5 Native Vegetation Cover and Connectivity.....	16
2.6 Areas of Outstanding Biodiversity Value	17
3. Native Vegetation	24
3.1 Plant Community Types (PCTs) Identified within the Subject Land.....	24
3.1.1 Historically Mapped Vegetation	24
3.1.2 Plant Community Type Selection Process.....	24
3.1.3 Final PCT and Vegetation Zone Selection	29
3.2 Assessing Patch Size.....	33
3.3 Vegetation Integrity Survey (VIS) Plots.....	35
3.3.1 Determining future vegetation integrity scores	35
4. Threatened Species	38
4.1 Candidate Ecosystem Credit Species	38
4.2 Historically Recorded Threatened Fauna.....	39
4.3 Candidate Species Credit Species Summary	42
4.4 Targeted Species Credit Surveys.....	47
4.4.1 Fauna Species Credit Survey	47
4.4.1.1 Assumed Present Fauna.....	47
4.4.2 Flora Species Credit Survey.....	47
4.5 Species Polygons.....	47
5. Prescribed Impacts	50
6. Avoid and Minimise Impacts	52
6.1 Impact Mitigation and Minimisation Measures	52
7. Assessment of Impacts	55
7.1 Direct Impacts.....	55

7.1.1	Full Clearing	55
7.2	Prescribed Impacts	55
7.3	Indirect Impacts	56
8.	Thresholds for Assessing and Offsetting	63
8.1	Impacts on Native Vegetation	63
8.2	Impacts on Threatened Species	63
8.3	Serious and Irreversible Impacts (SAII's).....	63
9.	Biodiversity Offset Credit Requirements	65
9.1	Offset Requirement for Ecosystem Credits	65
9.2	Offset Requirement for Species Credits	65
10.	Other Relevant Legislation and Planning Policies	66
10.1	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005.....	66
10.2	State Environmental Planning Policy (Koala Habitat Protection) 2021	66
10.3	State Environmental Planning Policy No 19—Bushland in Urban Areas	67
10.4	State Environmental Planning Policy (Coastal Management) 2018	67
11.	References.....	68
12.	Appendices.....	70

Figures

Figure 1.	Proposed Site Plan – Existing/Demolition (DWP 2021).	12
Figure 2.	The location of the Subject Land within the Subject Property.	13
Figure 3.	The location of the Subject Land within the locality.....	14
Figure 4.	IBRA Bioregion and Subregion of the Subject Land, and within a 1500m buffer.	18
Figure 5.	Rivers and streams (with associated riparian buffers) occurring within the 1500m buffer.	19
Figure 6.	Areas mapped under the Coastal Management SEPP in relation to the Subject Land and general locality.	20
Figure 7.	Areas mapped under the Coastal Management SEPP within the Subject Land.	21
Figure 8.	The extent of native vegetation and habitat connectivity within the 1500m buffer.	22
Figure 9.	The extent of native vegetation and habitat connectivity within the Subject Land.	23
Figure 10.	Narla field validated vegetation mapping and location of BAM plots within the Subject Land.....	32
Figure 11.	Patch size identified within the Subject Land.	34
Figure 12.	Management zones within the Subject Land.....	36
Figure 13.	Historically recorded species credit species within the Subject Property.....	41
Figure 14.	Southern Myotis species polygon.....	48
Figure 15.	Targeted survey effort for species credit species within the Subject Land.....	49
Figure 16.	Impacts on native vegetation and offset requirements.	64

Tables

Table 1. Area limits for application of small area development threshold on land not shaded on the biodiversity value map. Dark border indicated clearing threshold relevant to this report.	10
Table 2. Output from the PCT Filter Tool (DPIE 2021c) and subsequent shortlisting of candidate PCTs. Green shading indicates the PCTs from the output that occur within the distribution of the Subject Land.	24
Table 3. PCT Selection Criteria. Green indicates the selected PCT.	28
Table 4. Vegetation zones identified within the Subject Land.	29
Table 5. Patch size classes of each PCT and associated vegetation zones.	33
Table 6. Vegetation integrity scores for each identified zone.	37
Table 7. Candidate ecosystem credits predicted to occur within the Subject Land.	38
Table 8. Candidate fauna credit species predicted to occur within the Subject Land.	42
Table 9. Candidate Flora Credit Species predicted to occur within the Subject Land.	46
Table 10. Prescribed and uncertain impacts associated with the proposed development.	50
Table 11. Mitigation and minimisation of impacts associated with the proposed development.	52
Table 12. Prescribed and uncertain impacts associated with the proposed development.	55
Table 13. Indirect impacts associated with the proposed development.	56
Table 14. Ecosystem credits required to offset the proposed development.	65
Table 15. Species credits required to offset the proposed development.	65

Plates

Plate 1. Representative photo of PCT 1778 (Vegetation Zone 1) in the Subject Land.	31
---	----

Glossary

Acronym/ Term	Definition
Accredited Biodiversity Assessor	Individuals accredited by the Department of Planning, Industry and Environment (DPIE) to apply the Biodiversity Assessment Method.
BAM	The NSW Biodiversity Assessment Method
BAMC	The NSW Biodiversity Assessment Method Calculator
BC Act	New South Wales Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
Biodiversity credit report	The report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified.
Biodiversity Offsets	Management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity from the impacts of development.
Biodiversity values	The composition, structure and function of ecosystems, including threatened species, populations and ecological communities, and their habitats.
BOS	NSW Biodiversity Offset Scheme
DPIE	NSW Department of Planning, Industry and Environment (formerly OEH)
Ecosystem credit	The class of biodiversity credit that relates to a vegetation type and the threatened species that are reliably predicted by that vegetation type (as a habitat surrogate).
EEC	Endangered Ecological Community
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ha	Hectares
HTE	High Threat Exotic
km	Kilometres
LGA	Local Government Area
Locality	A 1500m buffer area surrounding the Subject Land
m	metres
Native Vegetation	Means any of the following types of plants native to New South Wales: (a) trees (including any sapling or shrub), (b) understorey plants, (c) groundcover (being any type of herbaceous vegetation), (d) plants occurring in a wetland.
NSW	The State of New South Wales
OEH	Office of Environment and Heritage (now DPIE)
PCT	NSW Plant Community Type
Proposal	The development, activity or action proposed.
SAIL	Serious and Irreversible Impacts
SAIL entity	Species and ecological communities that are likely to be the subject of serious and irreversible impacts (SAILs)
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
Species credit	The class of biodiversity credit that relate to threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
SSDA	State Significant Development Application
Subject Land	The location of the proposed works within the Taronga Zoo Site
Subject Property	Taronga Zoo Sydney; Bradleys Head Rd, Mosman NSW 2088 (Lot 22/DP843294)
Threatened species, populations and	Species, populations and ecological communities specified in Schedules 1 and 2 of the BC Act 2016.

Acronym/ Term	Definition
ecological communities	
TPZ	Tree Protection Zone: A specified area above and below ground and at a given distance from the trunk set aside for the protection of a tree's roots and crown to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development
VIS Plot	Vegetation Integrity Survey Plot

Executive Summary

Narla Environmental Pty Ltd (Narla) was commissioned by Taronga Conservation Society Australia ('the proponent') to prepare a Biodiversity Development Assessment Report (BDAR). The BDAR will accompany a State Significant Development (SSD) Application for the new Reptile and Amphibian Conservation Centre (RACC), located within Taronga Zoo at Bradleys Head Rd, Mosman NSW 2088 (Lot 22/DP843294). The BDAR will assess the biodiversity impacts of the proposed development in accordance with the requirements of the Biodiversity Conservation Act 2016 and Biodiversity Conservation Regulation 2017. The assessment has been completed in accordance with Appendix K of the BAM (DPIE 2020a).

The proposed development will involve the construction of a new RACC with associated ramps, forecourt area and animal exhibits. The proposed development includes the operational and the construction footprint (0.12ha), which is collectively referred to as the 'Subject Land'. The proposed development has been positioned to minimise impacts on native vegetation and habitat as much as possible. The majority of the of the proposed development is located within historically modified land, adjacent to man-made structures and consisting of predominately planted and landscaped vegetation.

The proposed development is expected to impact one (1) Plant Community Type (PCT) 1778: Smooth-barked Apple - Coast Banksia /Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney. The following ecosystem credits are required to be offset in order to mitigate the impacts upon biodiversity as a result of the proposed development:

- Two (2) ecosystem credits for PCT 1778.

The proposed development is also likely to impact upon vegetation that provides habitat (vegetation within 200m of wetland areas) for the Biodiversity Conservation Act (BC ACT) listed Vulnerable species *Myotis macropus* (Southern Myotis). As this species has been historically recorded within close proximity to the Subject Land, the following species credits are required to be offset in order to mitigate the impacts to this species:

- Two (2) species credits for *Myotis macropus* (Southern Myotis).

In order to avoid and minimise potential impacts of the proposal on local biodiversity values, a series of mitigation and management measures have been identified, which are to be implemented as part of any Construction Environmental Management Plan (CEMP) produced for the site. This includes assigning an experienced, suitably qualified and licenced wildlife expert to undertake a pre-clearing survey and to supervise the clearing of all vegetation in relation to the proposed development.

1. Introduction

1.1 Overview

Narla Environmental Pty Ltd (Narla) was commissioned by Taronga Conservation Society Australia ('the proponent') to prepare a BDAR. This BDAR will accompany an Environmental Impact Statement (EIS) as part of the Secretary's Environmental Assessment Requirements (SEARs) for the proposed development of a new RACC, located within Taronga Zoo at Bradleys Head Rd, Mosman NSW 2088 (Lot 22/DP843294; hereafter referred to as the 'Subject Property').

The RACC development is a SSD. Part 4, Division 4.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act) establishes the assessment framework for SSD's. The preparation of this BDAR is in response to Item 15 'Biodiversity' of the SEARs issued for the EIS by the NSW Department of Planning, Industry and Environment (DPIE 2021).

This BDAR has been prepared as a 'Streamlined assessment module- small area development that requires consent' as it does not exceed the area clearing threshold for small area developments as outlined in the Biodiversity Assessment Method (BAM; DPIE 2020a; **Table 1**). Narla have produced this report in accordance with the requirements of the Biodiversity Conservation Act 2016 and Biodiversity Conservation Regulation 2017. The assessment has been completed in accordance with Appendix K of the BAM (DPIE 2020a).

Table 1. Area limits for application of small area development threshold on land not shaded on the biodiversity value map. Dark border indicated clearing threshold relevant to this report.

Minimum lot size associated with the property	Maximum area clearing limit for application of the small area development module
Less than 1ha	≤1ha
Less than 40ha but not less than 1ha	≤2ha
Less than 1000ha but not less than 40ha	≤5ha
1000ha or more	≤10ha

1.2 The Proposed Development

The proposed development consists of the footprint of the proposed works, including demolition works, new enclosures and pedestrian access (footpaths) as well additional land that is required for proposed stockpiling. This area can also be used for temporary/ancillary construction facilities (**Figure 1**).

The Subject Land covers an area of approximately 0.12ha, which is largely comprised of planted vegetation that is subject to regular maintenance and historic clearing for the purpose of creating suitable animal enclosures and wetlands (**Figure 2**). The proposed works has been strategically located in a way that will minimise potential impacts on biodiversity where possible.

1.3 Site Location and Description

The Subject Property is situated within the suburb of Mosman in the Mosman Council Local Government Area (LGA), covering an area of approximately 28ha on land zoned as 'SP1 - Special Activities: Zoological Gardens'. The Subject Property is situated within the northern area of Bradleys Head, and is surrounded by Sydney Harbour National Park on the eastern and southern boundaries, and low density residential to the north (**Figure 3**).

1.4 Sources of Information Used

A thorough literature review was undertaken to gain an insight into the ecology and applicable legislation within the locality and the Mosman LGA. Relevant data and literature reviewed in preparation of this report included:

- Relevant State and Commonwealth Databases & Datasets:
 - NSW BioNet. The website of the Atlas of NSW Wildlife (DPIE 2021a);
 - NSW BioNet. Threatened Biodiversity Data Collection (DPIE 2021b);
 - NSW BioNet. Vegetation Classification System (DPIE 2021c); and
 - NSW Government Spatial Services: Six Maps Clip & Ship (NSW Government Spatial Services 2021)
- Vegetation and Soil Mapping:
 - The Native Vegetation of the Sydney Metropolitan Area and Vegetation Information System (VIS) 3.1 (OEH 2016)
 - Soil Landscapes of the Sydney 1:100 000 Sheet (Chapman and Murphy 2009).
- NSW State Guidelines:
 - Biodiversity Assessment Method (DPIE 2020a);
 - Guidance to assist a decision-maker to determine a serious and irreversible impact (DPIE 2019a);
 - Biodiversity Assessment Method Calculator Version 1.3.0.00 (DPIE 2021d);
 - Biodiversity Offsets and Agreement Management System (BOAMS);
 - Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method (DPIE 2020b); and
 - Threatened Species Survey and Assessment: Guidelines for developments and activities. Working Draft (DEC 2004)
- Council Documents:
 - Mosman Local Environmental Plan (LEP) 2013
 - Mosman Development Control Plan (DCP) 2013
 - Weeds Declared in the Greater Sydney Region (DPI 2021)

Preparation of this BDAR also involved the review of the following accompanying project documents:

- Planning Secretary's Environmental Assessment Requirements (SEARs; DPIE 2021); and
- Site Plan – Existing/Demolition (DWP 2021).

These sources were used to gain an understanding of the natural environment and ecology of the Subject Land and its surrounds. Searches using NSW Wildlife Atlas (BioNet) were conducted to identify current threatened flora and fauna records within and surrounding the Subject Land. These data were used to assist in establishing the presence or likelihood of any biodiversity values as occurring on, or adjacent to, the Subject Land, and helped inform our Ecologist on what to look for during the site assessment.

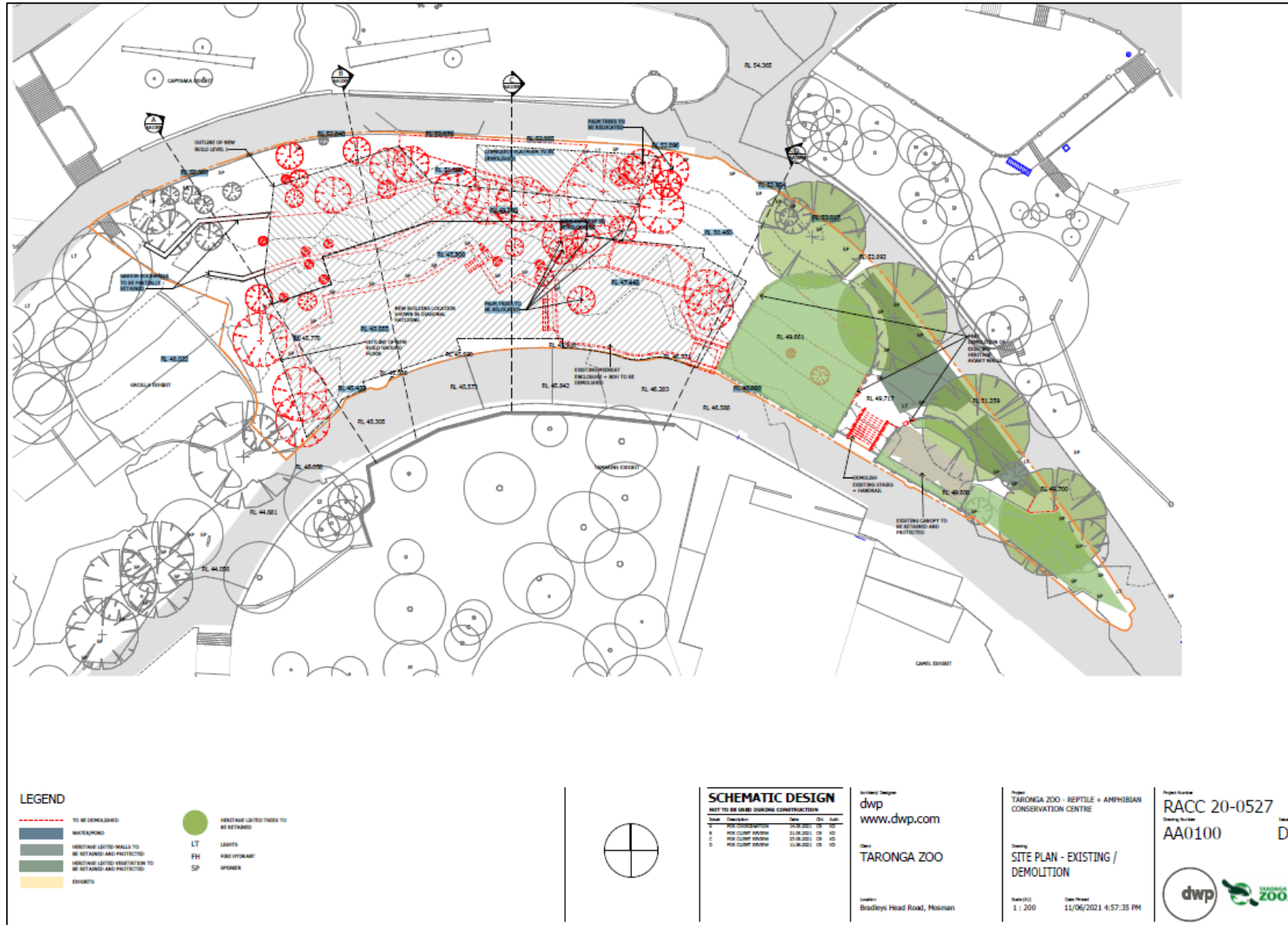


Figure 1. Proposed Site Plan – Existing/Demolition (DWP 2021).

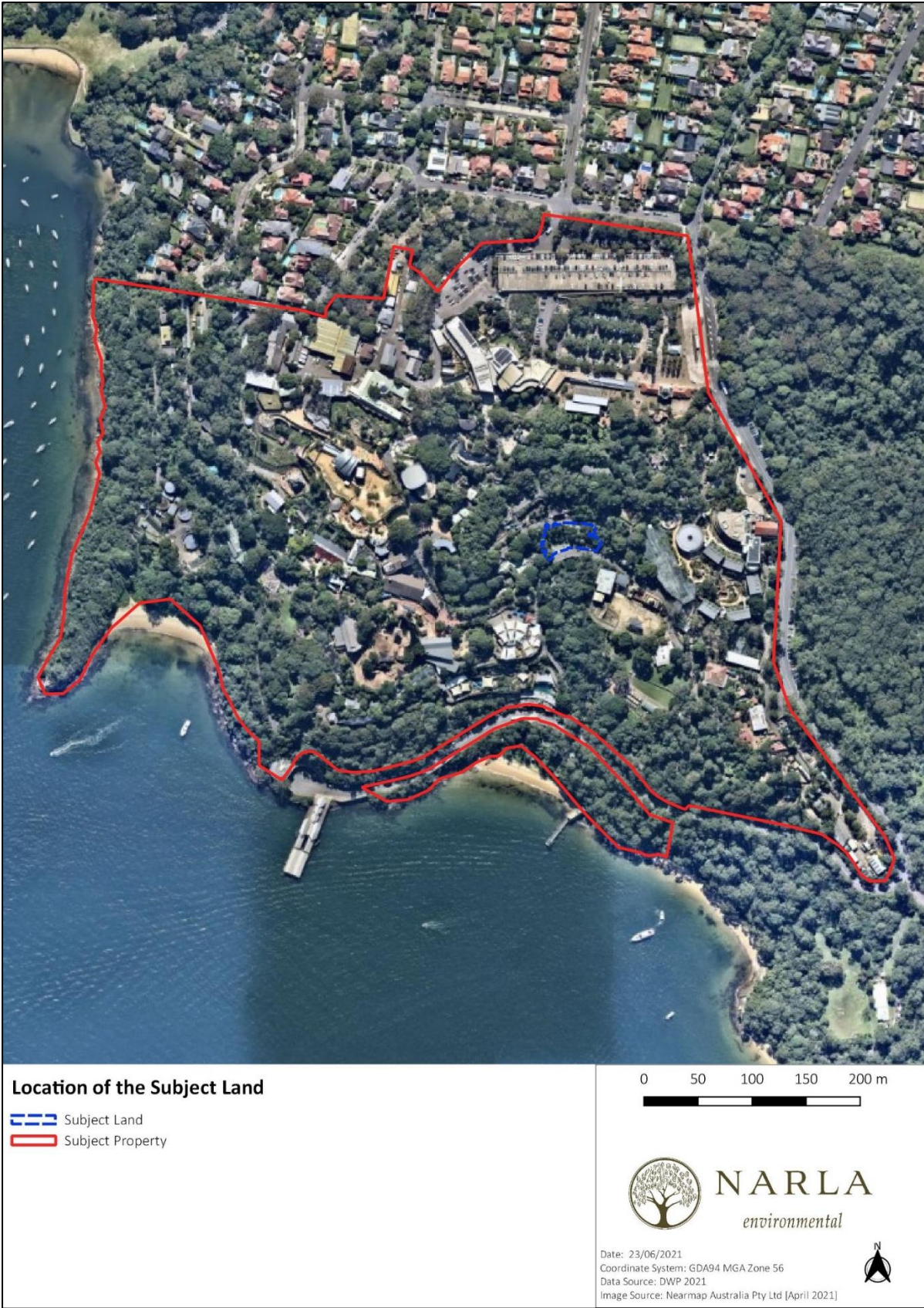


Figure 2. The location of the Subject Land within the Subject Property.

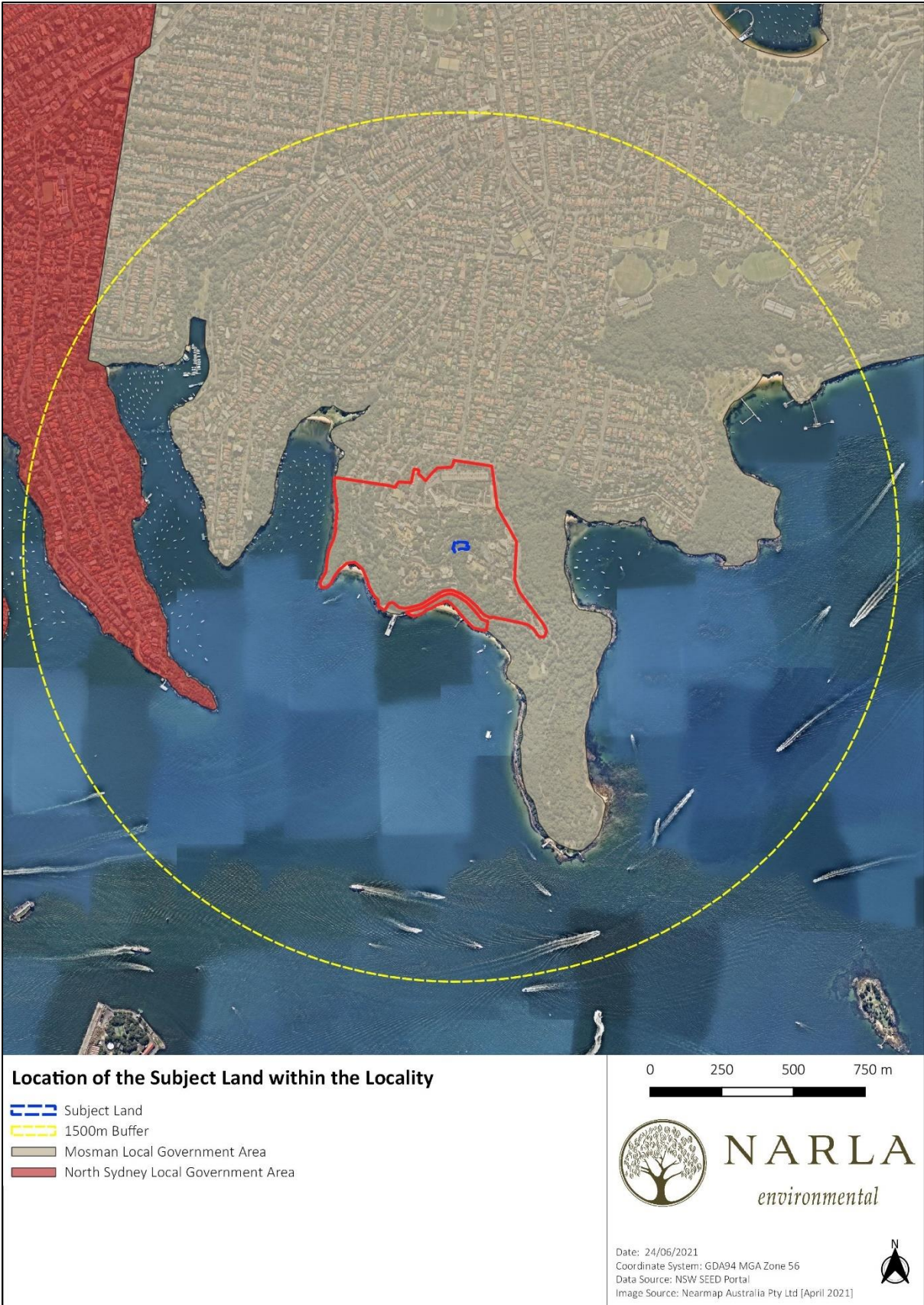


Figure 3. The location of the Subject Land within the locality.

1.5 Aim and Approach

This report has been prepared in accordance with the BAM (DPIE 2020a) and aims to:

- Describe the biodiversity values present within the Subject Land, including the extent of native vegetation, vegetation integrity and the presence of Threatened Ecological Communities (TECs);
- Determine the habitat suitability within the Subject Land for candidate threatened species;
- Prepare an impact assessment in regard to potential impacts of the proposed development on biodiversity values, including potential prescribed impacts and SALLs within the Subject Land;
- Discuss and recommend efforts to avoid and minimise impacts on biodiversity values; and
- Calculate the biodiversity credits (i.e., ecosystem credits and species credits) that measure potential impacts of the development on biodiversity values. This calculation will inform the decision maker as to the number and class of offset credits required to be purchased and retired as a result of the proposed development.

2. Landscape Context

2.1 IBRA Bioregion and Subregion

The Subject Land occurs within the 'Pittwater' Interim Biogeographic Regionalisation for Australia 7 (IBRA7) Subregion, which is part of the 'Sydney Basin' IBRA7 Bioregion (**Figure 4**).

2.2 Topography, Geology and Soils

The Subject Land is situated on steep terrain with an elevation ranging between 49m and 55m above sea level (Google Earth 2021). The Subject Land is mapped as occurring on the Gymea/Lambert and Hawkesbury Soil Landscapes. The Gymea/Lambert Soil Landscape is typically characterised by undulating to rolling rises and low hills on Hawkesbury Sandstone. The Gymea Soil Landscape occurs extensively throughout the Hornsby Plateau and along the foreshores of Sydney Harbour and the Parramatta and Georges Rivers. Examples include areas of Northbridge, Forestville, Drummoyne, Balmain, Arcadia and Berrilee. The underlying geology is typical of Hawkesbury Sandstone, which is a medium to coarse-grained quartz sandstone with minor shale and laminitic lenses. Soils are shallow to moderately deep (30-100cm) Yellow Earths and Earthy Sands on crests and inside of benches; shallow (Siliceous Sands on leading edges of benches; localised Gleyed Podzolic Soils and Yellow Podzolic Soils on shale lenses; shallow to moderately deep (<100cm) Siliceous Sands and Leached Sands along drainage lines (Chapman et al. 2009).

The Hawkesbury Soil Landscape is characterised by rugged, rolling to very steep hills on Hawkesbury Sandstone. This landscape features narrow crests and ridges, narrow incised valleys, steep side slopes with rocky benches, broken scarps and boulders. It contains mostly uncleared eucalypt open woodland (dry sclerophyll forest) and tall open-forest (wet sclerophyll forest).

2.3 Areas of Geological Significance and Soil Hazards

The Subject Land did not contain any areas of geological significance, such as karsts, caves, cliffs or crevices. The Subject Land was not mapped as occurring on Acid Sulfate Soils nor mapped as having risk/probability of exhibiting occurrence of acid sulfate soils.

2.4 Hydrology

No mapped watercourses are located within the Subject Land. Several 1st order watercourses occur within the 1500m buffer (**Figure 5**).

The Subject Land and the immediate surrounds (within the 1500m buffer) did not contain any areas of native vegetation identified as 'Coastal Wetlands' as per the State Environmental Planning Policy (Coastal Management) 2018. However, areas mapped as containing: Coastal Use Area and Coastal Environmental Area as per the SEPP were mapped within the Subject Land, and areas of Littoral Rainforest and Proximity to Littoral Rainforest occurring in the broader landscape (**Figure 6**); **Figure 7**).

2.5 Native Vegetation Cover and Connectivity

Native vegetation cover and connectivity have been assessed in accordance with Section 3.2 of the BAM (DPIE 2020a). The native vegetation cover will be used to assess the habitat suitability of the Subject Land for threatened species. Areas of connectivity will determine the extent of habitat that may facilitate the movement of threatened species across their range. A 1500m buffer around the boundary of the Subject Land was calculated to determine

the extent of native vegetation and habitat connectivity. Native vegetation covered approximately 130ha within the buffer circle (total land area = 361ha) and was assigned to the >30-70% class.

Areas of connectivity will determine the extent of habitat that may facilitate the movement of threatened species across their range. Areas of connectivity that may facilitate the movement of threatened species were evident within the 1500m surrounding the Subject Land (**Figure 8; Figure 9**) with the most significant areas being located to the south along the Sydney Harbour foreshore.

2.6 Areas of Outstanding Biodiversity Value

No Areas of Outstanding Biodiversity Value occur on the Subject Land or surrounding area.

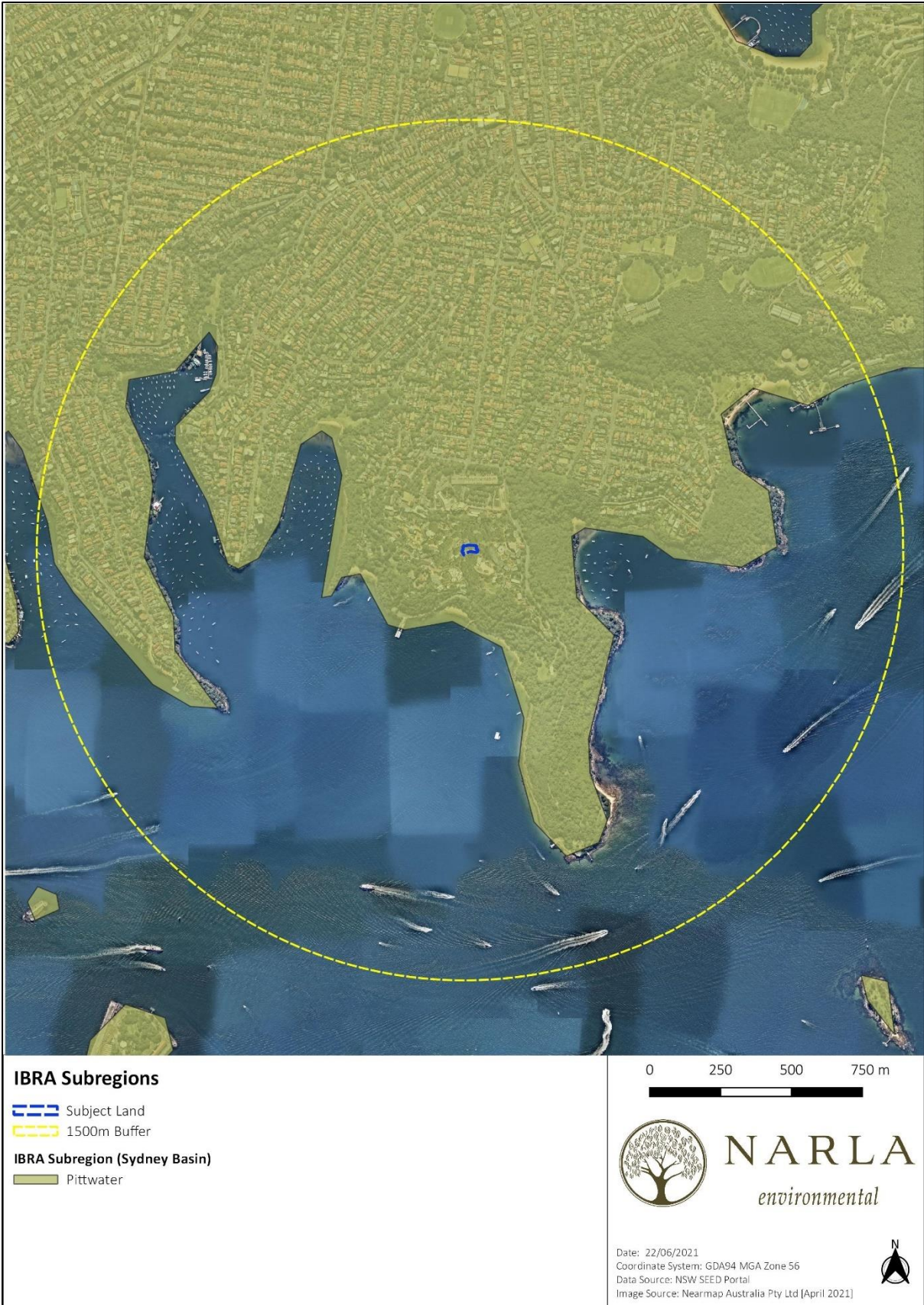


Figure 4. IBRA Bioregion and Subregion of the Subject Land, and within a 1500m buffer.

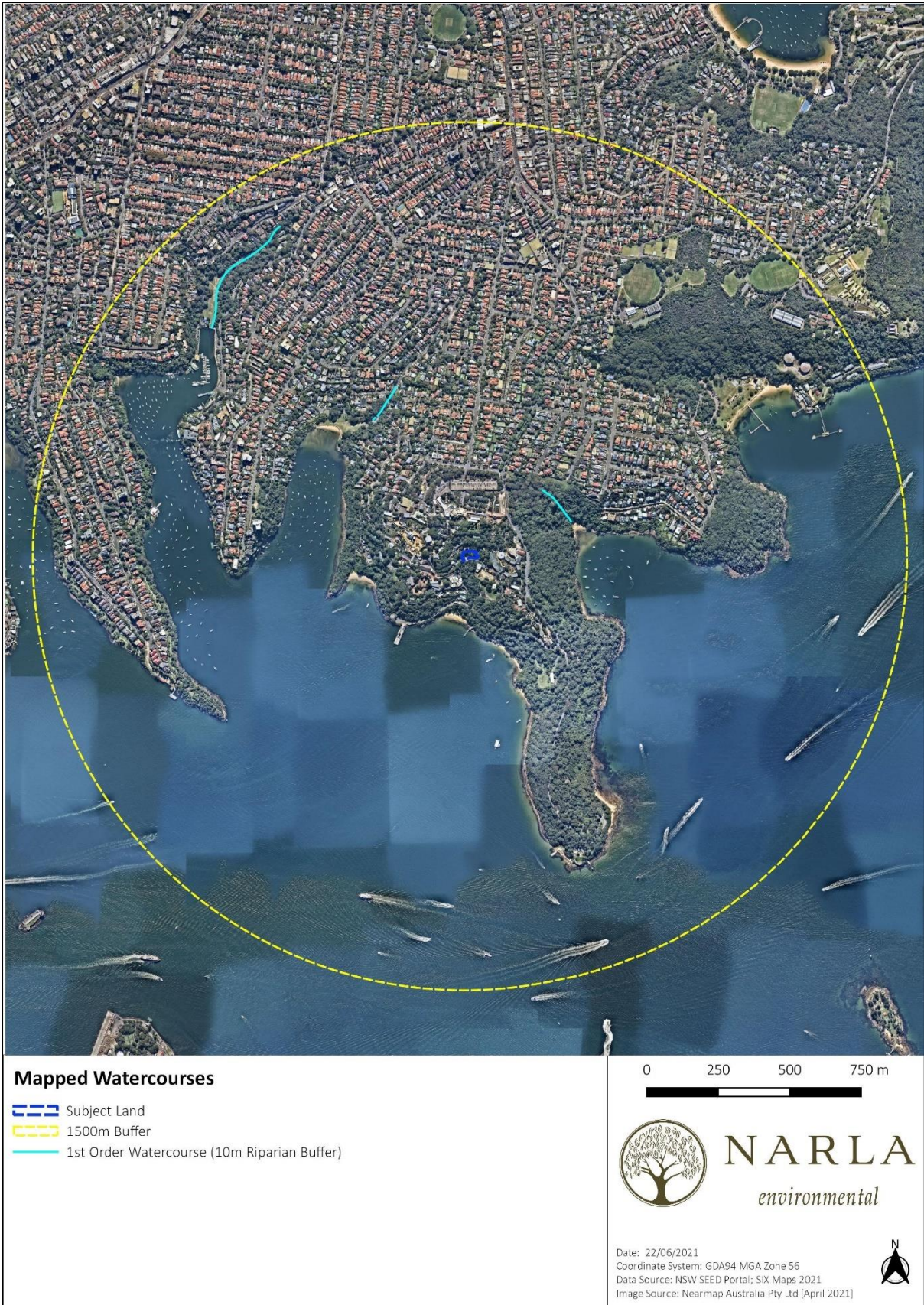


Figure 5. Rivers and streams (with associated riparian buffers) occurring within the 1500m buffer.

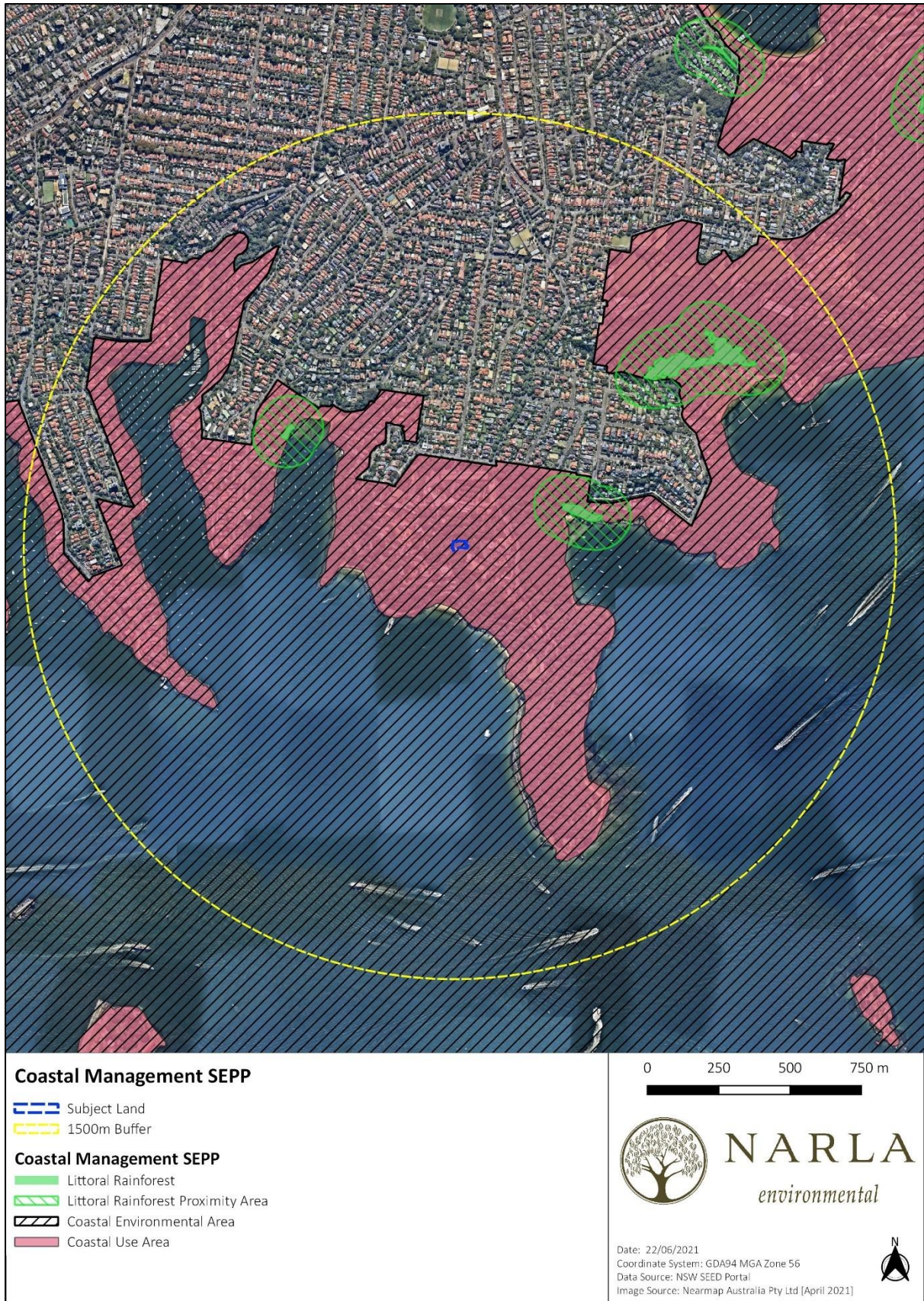


Figure 6. Areas mapped under the Coastal Management SEPP in relation to the Subject Land and general locality.



Figure 7. Areas mapped under the Coastal Management SEPP within the Subject Land.

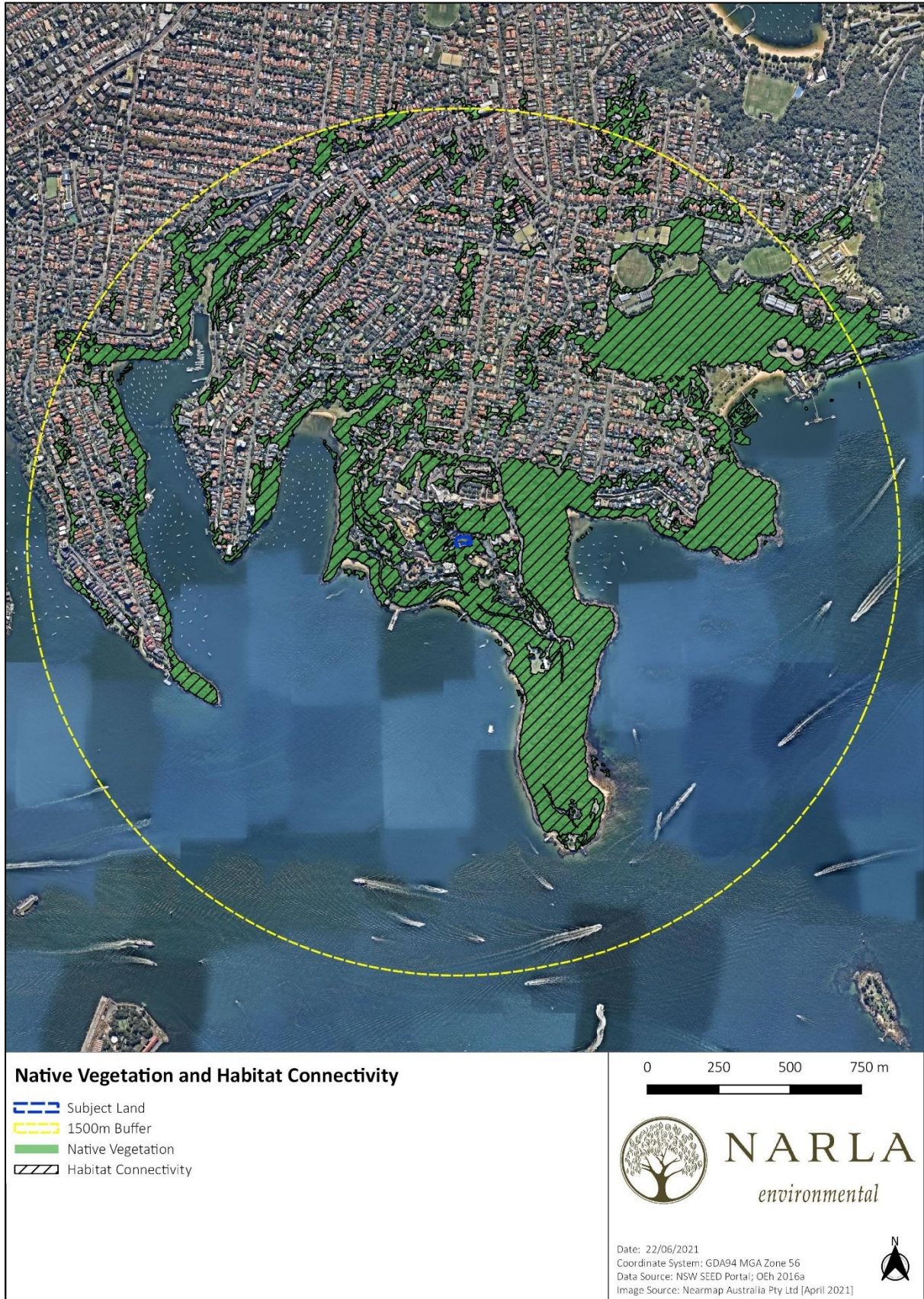


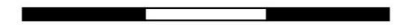
Figure 8. The extent of native vegetation and habitat connectivity within the 1500m buffer.



Native Vegetation and Habitat Connectivity - Subject Land

-  Subject Land
-  Native Vegetation Cover
-  Habitat Connectivity

0 5 10 15 m



NARLA
environmental

Date: 23/06/2021
 Coordinate System: GDA94 MGA Zone 56
 Data Source: NSW SEED Portal; OEH 2016a
 Image Source: Nearmap Australia Pty Ltd [April 2020]



Figure 9. The extent of native vegetation and habitat connectivity within the Subject Land.

3. Native Vegetation

3.1 Plant Community Types (PCTs) Identified within the Subject Land

3.1.1 Historically Mapped Vegetation

The Native Vegetation of the Sydney Metropolitan Area (OEH 2016a; OEH 2016b) indicated the presence of one (1) vegetation type within the Subject Land:

- Weeds and Exotics

No native PCTs were historically mapped within the Subject Land. However, in the broader Subject Property and immediately adjacent surrounding areas the following PCT was historically mapped:

- PCT 1778 - Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney

3.1.2 Plant Community Type Selection Process

Historically, the Subject Land has undergone development and the majority (if not all) of vegetation within the Subject Land has been altered through historic landscaping, however it is representative of a single locally-indigenous PCT Flora species assemblage, structure and landscape interpretation data collected from the site assessment were compared against all potentially occurring PCTs in order to determine the most likely candidates that occur within the Subject Land. Selection was undertaken using information and databases provided in the BioNet Vegetation Classification System (DPIE 2021c).

A single PCT was assigned to vegetation within the Subject Land as the assessment is a streamlined assessment, in which only the dominating PCT is assigned to vegetation. Best-fit PCT selection for the vegetation was undertaken using information and databases provided in the BioNet Vegetation Classification System (DPIE 2020c). The following selection criteria were used in the PCT Filter Tool to develop the PCT shortlist:

- IBRA Bioregion: Sydney Basin
- IBRA Subregion: Pittwater
- Dominant Species: *Acacia decurrens* and *Banksia integrifolia*

This process delivered a selection of sixteen (16) PCT's that occur within the Pittwater IBRA Subregion (and Sydney Basin Bioregion) that had one or more (out of two) of the observed dominant species (i.e., the highest potential of occurring within the Subject Land). The geographical distribution and landscape position of each shortlisted PCT was then compared against the location and landscape of the Subject Land, resulting in one (1) candidate PCTs (**Table 2**). The steps taken to justify the candidate PCT within the Subject Land are detailed in **Table 3**.

Table 2. Output from the PCT Filter Tool (DPIE 2021c) and subsequent shortlisting of candidate PCTs. Green shading indicates the PCTs from the output that occur within the distribution of the Subject Land.

Plant Community Type (PCT)	Subject Land within known distribution/landscape position?	No. of Matches	<i>Acacia decurrens</i>	<i>Banksia integrifolia</i>
PCT 659: Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin Bioregion and South East Corner Bioregion	The Subject Land does not occur on deep coastal sands on the	1	-	x

Plant Community Type (PCT)	Subject Land within known distribution/landscape position?	No. of Matches	<i>Acacia decurrens</i>	<i>Banksia integrifolia</i>
	Central and South Coasts.			
PCT 771: Coast Banksia - Coast Tea-tree low moist forest on coastal sands and headlands, Sydney Basin Bioregion and South East Corner Bioregion	No. This PCT occurs on coastal foredunes and beach ridges near the open ocean.	1	-	x
PCT 772: Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion	No. The Subject Land is located on Hawkesbury Sandstone, with an underlying geology of medium to coarse-grained quartz sandstone with minor shale and laminite lenses. This PCT occurs on coastal sand mass frontal dunes and beach ridges along the eastern coastline of New South Wales	1	-	x
PCT 774: Coast Banksia scrub on sand in the Elderslie area, Sydney Basin Bioregion	No. The Subject Land is not located in the Camden-Elderslie area	2	x	x
PCT 898: Kangaroo Grass sod tussock grassland of coastal areas of the Sydney Basin Bioregion and South East Corner Bioregion	No. The Subject Land is located on sandstone soils. PCT 898 occurs on clay soils on exposed headlands,	1	-	x
PCT 910: Lilly Pilly littoral rainforest of the southern Sydney Basin Bioregion and South East Corner Bioregion	No. The Subject Land is located on sandstone soils. PCT 910 is situated on shale-influenced soils.	1	-	x
PCT 1236: Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion	No. PCT 1236 occurs along estuarine flats on the central and south coasts of New South Wales	1	-	x
PCT 1536: Tuckeroo - Lilly Pilly - Coast Banksia littoral rainforest	No. PCT 1536 occurs on near coastal areas on coastal lowlands of	1	-	x

Plant Community Type (PCT)	Subject Land within known distribution/landscape position?	No. of Matches	<i>Acacia decurrens</i>	<i>Banksia integrifolia</i>
	the lower North coast and Central Coast.			
PCT 1653: Coast Tea Tree - Coast Banksia - <i>Ficinia nodosa</i> low open shrubland on coastal foredunes	No. PCT 1653 is confined to low sandstone hills and dunes along the coast from Terrigal to Seal Rocks.	1	-	x
PCT 1697: Kangaroo Grass - Coastal Rosemary grassland on coastal headlands	No. PCT 1697 is confined to exposed coastal headlands from Wamberal north to Wallis Lake.	1	-	x
PCT 1775: Smooth-barked Apple - Old-man Banksia - Red Bloodwood open forest on Pleistocene sand dunes around Sydney and the Central Coast	No. PCT 1775 is found on the large sand dunes.	1	-	x
PCT 1778: Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	Yes	1	-	x
PCT 1793: Smooth-barked Apple - Bangalay / Tuckeroo - Cheese Tree open forest on coastal sands of the Sydney basin	No. This PCT is found on flat, low-lying coastal marine sand deposits of the coastal zones with an elevation that rarely exceeds 10 metres above sea level.	1	-	x
PCT 1809: Crimson Bottlebrush - Banksia - Melaleuca / <i>Baumea</i> woody sedgeland in dune swales of the Sydney basin	No. This PCT is restricted to dune swales associated with coastal sandplains or headland dune systems	1	-	x
PCT 1817: Banksia - Tea-tree - She-oak / Spiny-headed Mat-rush - Kangaroo Grass heath on clay soils on headlands around Sydney and the Central Coast	No. PCT 1817 is associated with Narrabeen sandstone and shales. The Subject Land occurs on Hawkesbury Sandstone.	1	-	x
PCT 1912: Smooth-barked Apple - Yellow Bloodwood - Grey Gum open forest on	No. PCT 1912 occurs on the steep	1	-	x

Plant Community Type (PCT)	Subject Land within known distribution/landscape position?	No. of Matches	<i>Acacia decurrens</i>	<i>Banksia integrifolia</i>
sandstone slopes along the Hawkesbury River	sandstone slopes that overlook the Hawkesbury River and its tributaries.			

Table 3. PCT Selection Criteria. Green indicates the selected PCT.

Candidate PCT	Characteristics (DPIE 2021c)	Justification
PCT 1778: Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	Landscape position/ geology	<p>Narla have assigned this PCT to the vegetation within the Subject Land as it fits with the landscape profile and comprises a number of diagnostic species.</p> <p>The Subject Land is situated on sheltered sandstone slopes along the foreshores of Sydney's major waterways (Sydney Harbour) and coastal escarpments. The underlying geology is Hawksbury Sandstone.</p> <p>The majority of the Subject Land is situated at an elevation of approximately 50m above sea level, which is approximately 5m above the elevation of PCT 1778. However, this PCT has been historically mapped as occurring within Sydney Harbour National Park, which is directly adjacent the Subject Land across Bradleys Head Road.</p> <p>Mean annual rainfall recorded at the closest weather station (Sydney Botanic Gardens; which is approximately 4.5km from Mosman) is 1229 mm</p> <p>Furthermore, PCT 1778 is described as having a canopy that contains localised patches of coast banksia (<i>Banksia integrifolia</i>) which was identified within the Subject Land. This PCT also contained the most diagnostic floristic species identified within the Subject Land.</p>
	Occurs on sheltered sandstone slopes along the foreshores of Sydney's major waterways and coastal escarpments, within 10 km of the coastline. It is restricted to sandstone soils derived from either Hawkesbury or Narrabeen geology.	
	The distribution is coastal and requires a combination of low elevation (between two and 45 metres above sea level) and mean annual rainfall that exceeds 1100 millimetres per annum.	
	Characteristic canopy	
	<i>Banksia integrifolia</i> and <i>Eucalyptus botryoides</i> .	
	Characteristic mid-storey/ shrub	
<i>Glochidion ferdinandi</i> , <i>Pittosporum undulatum</i> , <i>Allocasuarina littoralis</i> , <i>Breynia oblongifolia</i> , <i>Notelaea longifolia</i> , <i>Dodonaea triquetra</i> , <i>Elaeocarpus reticulatus</i> , <i>Polyscias sambucifolia</i> and <i>Acacia longifolia</i> .		
Characteristic ground layer		
<i>Dianella caerulea</i> , <i>Pteridium esculentum</i> , <i>Lomandra longifolia</i> , <i>Entolasia stricta</i> , <i>Imperata cylindrica</i> , <i>Microlaena stipoides</i> var. <i>stipoides</i> , <i>Poa affinis</i> , <i>Themeda australis</i> and <i>Xanthorrhoea arborea</i> .		

3.1.3 Final PCT and Vegetation Zone Selection

Field surveys conducted by Narla confirmed that one (1) PCT was identified within the Subject Land:

- PCT 1778: Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney

One (1) vegetation zone was identified within the Subject Land:

- Zone 1: PCT 1778 Moderate Condition.

This vegetation zone is detailed in **Table 4**, and displayed in **Figure 10**.

Table 4. Vegetation zones identified within the Subject Land.

PCT 1778: Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	
Vegetation class	Sydney Coastal Dry Sclerophyll Forests
Total area within Subject Land	0.09ha
Condition Class	Moderate Condition
Field survey effort	A site assessment was conducted by experienced Narla Ecologist Sarah Cardenzana on the 13 th January 2021. One (1) BAM plot was established.
Description of vegetation within the Subject Land	
Vegetation within this zone consisted of a mixture of planted locally indigenous and non-locally indigenous native species, with moderate levels of weed infestation. Native canopy species located in the BAM Plot included <i>Banksia integrifolia</i> , <i>Acacia decurrens</i> , and <i>Corymbia maculata</i> . Native mid-storey species included <i>Acacia implexa</i> , <i>Hakea salicifolia</i> , <i>Xylomelum pyriforme</i> , <i>Acacia floribunda</i> , <i>Indigofera australis</i> and <i>Polyscias sambucifolia</i> . Native groundcover species included <i>Microlaena stipoides</i> , <i>Oplismenus aemulus</i> , <i>Themeda triandra</i> , <i>Poa labillardierei</i> var. <i>labillardierei</i> and <i>Carex appressa</i> . (Plate 1).	
Description in the VIS (DPIE 2021c)	
Coastal Sandstone Foreshores Forest is found on sheltered sandstone slopes along the foreshores of Sydney's major waterways and coastal escarpments. It is an open forest with a moist shrub layer and a ground cover of ferns, rushes and grasses. The flora of this community has a maritime influence given its exposure to prevailing sea breezes. The canopy can be dominated by pure stands of smooth-barked apple (<i>Angophora costata</i>), though more regularly this is found in combination with other tree species. Localised patches of bangalay (<i>Eucalyptus botryoides</i>) and coast banksia (<i>Banksia integrifolia</i>) occur closest to the coast, whereas Sydney peppermint (<i>Eucalyptus piperita</i>) and blackbutt (<i>Eucalyptus pilularis</i>) prefer more protected locations and in the case of the latter some minor shale enrichment in the soil. A prominent layer of hardy mesic small trees and shrubs is present. These include sweet pittosporum (<i>Pittosporum undulatum</i>), cheese tree (<i>Glochidion ferdinandi</i>) and blueberry ash (<i>Elaeocarpus reticulatus</i>). In the suburban environment the proliferation of these species in the understorey at long unburnt sites has generated considerable debate, particularly as there appears to be strong correlation between time since fire and their density (Rose and Fairweather 1997). It also appears that these species are more common in these littoral zones than in other sheltered sandstone forests situated further away from the coast.	
This forest is restricted to sandstone soils derived from either Hawkesbury or Narrabeen geology. The distribution is coastal and requires a combination of low elevation (between two and 45 metres above sea level) and mean annual rainfall that exceeds 1100 millimetres per annum. It is noticeable that most sites are exposed to salt-laden winds. Samples are situated up to 10 kilometres from the coastline, but still in close proximity to major waterways.	

PCT 1778: Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney

<p>Structure of vegetation</p>	<p>All stratum (canopy, shrub and groundcover) were present within this zone. Vegetation was relatively dense with moderate levels of weed infestation.</p> <p>Native vegetation within the BAM plot was comprised of trees (24.5%), shrubs (11.3% cover), as well as groundcovers (21.7%). Litter cover (44.2% cover) was approximately 20% lower than benchmark for this community. The vegetation zone contained only small tree stem sizes; no large trees (>30cm DBH) were recorded. No hollow bearing trees were recorded in the VIS Plot.</p>
<p>Scientific Reference from VIS (DPIE 2021c)</p>	<p>OEH (2016) The Native Vegetation of the Sydney Metropolitan Area NSW Office of Environment and Heritage Sydney.</p>
<p>TEC Status (BC Act 2016 and EPBC Act 1999)</p>	<p>Not listed</p>
<p>Estimate of percent cleared value of PCT in the major catchment area</p>	<p>90%</p>



Plate 1. Representative photo of PCT 1778 (Vegetation Zone 1) in the Subject Land.



Figure 10. Narla field validated vegetation mapping and location of BAM plots within the Subject Land.

3.2 Assessing Patch Size

As defined by the BAM, a patch is an area of native vegetation that occurs on the Subject Land and includes native vegetation that has a gap of less than 100m from the next area of native vegetation (or ≤ 30 m for non-woody ecosystems). A patch may extend onto adjoining land. For each vegetation zone, the assessor must determine the patch size in hectares and assign it to one of the following classes:

- <5ha
- 5–<25ha
- 25–<100ha
- ≥ 100 ha.

The patch size class is used to assess habitat suitability on the Subject Land for threatened species. The assessor may assign more than one patch size class to the vegetation zone if both of the following apply:

- A vegetation zone comprises two or more discontinuous areas of native vegetation, and
- The areas of discontinuous native vegetation have more than one patch size class.

As areas outside of the Subject Property were not assessed as part of the scope of this assessment, the vegetation zones identified within the Subject Land were separated into the following categories to allow for aerial mapping of patch size within the broader area (**Figure 11**):

- Woody Ecosystems:
 - Zone 1: PCT 1778.

Table 5. Patch size classes of each PCT and associated vegetation zones.

Plant Community Type	Category	Vegetation Zone	Patch Size Class
PCT 1778	Woody Ecosystems	Zone 1	>100ha

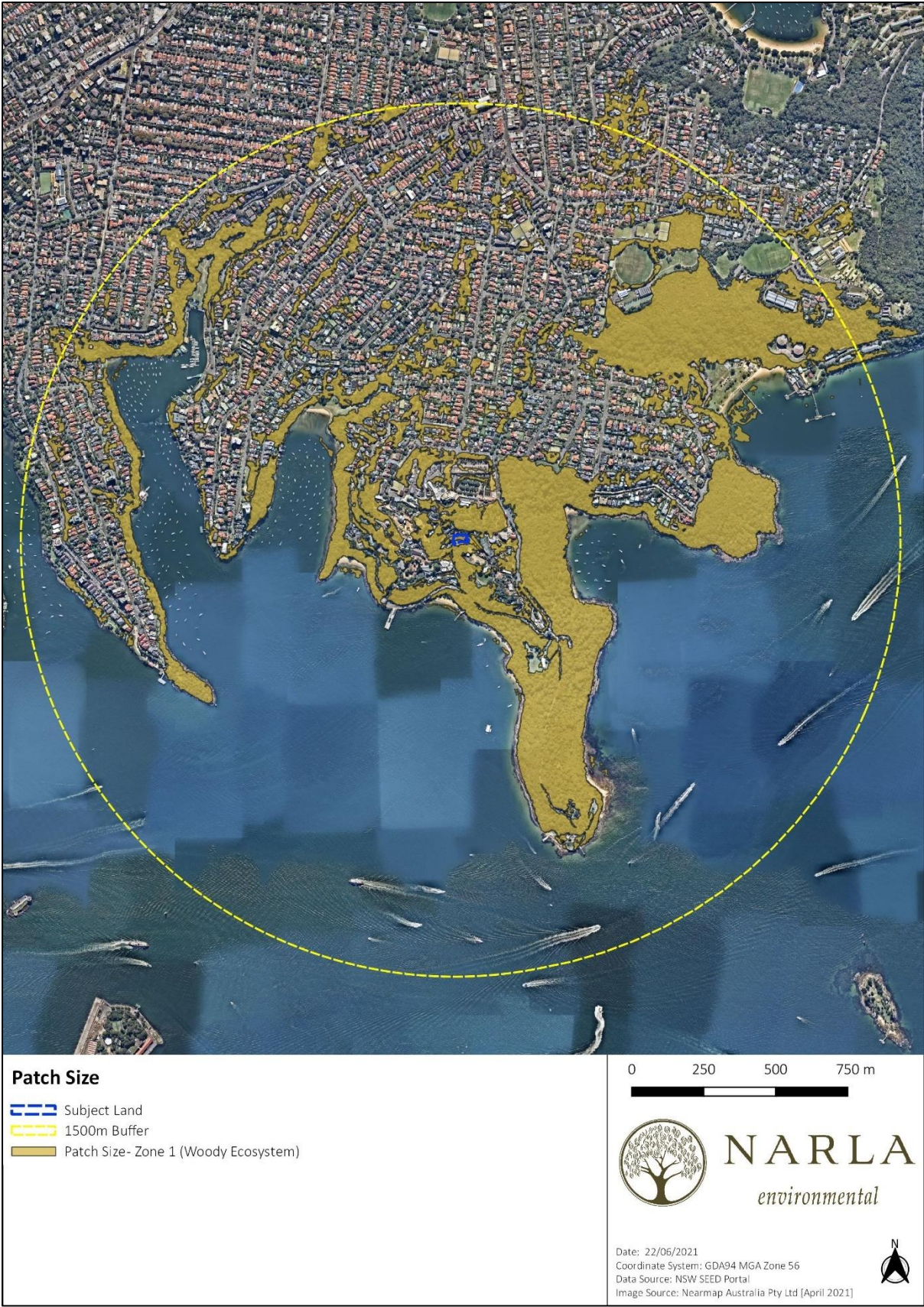


Figure 11. Patch size identified within the Subject Land.

3.3 Vegetation Integrity Survey (VIS) Plots

One (1) BAM VIS Plot was established within the Subject Land. Plot data gathered for each attribute used to assess the function of the Subject Land vegetation is detailed in **Appendix A**. Vegetation Integrity (VI) Scores represented by existing vegetation within the vegetation zone are detailed in **Table 6**.

3.3.1 Determining future vegetation integrity scores

Most projects will result in complete clearing of vegetation and threatened species habitat within the development footprint. In this scenario, the assessor must assess the proposed future value of each of the VI attributes as zero in the BAMC (DPIE 2020a).

The Subject Land will be exposed to full clearing as a result of the proposed development (**Figure 12**):

- Vegetation Zone 1: PCT 1778:
 - Management Zone 1: Total Impact – this area is defined by the construction and operational footprints, and will require the removal of all vegetation to allow for the proposed development.

All areas outside of the above management zone consist of exotic lawn vegetation and existing hardstand and have therefore not been assigned to a management zone.



Figure 12. Management zones within the Subject Land.

Table 6. Vegetation integrity scores for each identified zone.

PCT	Management Zone	Area (ha)	Survey Effort	Composition Condition Score	Structure Condition Score	Function Condition Score	VI Score	Future VI Score	Change in VI Score	Total VI Loss	Hollow bearing trees
PCT 1778 - Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	Total Impact	0.09	1 x 1000m ² (20m x 50m) VIS Plot	46.1	41.5	42.1	17.8	43.2	-43.2	-43.2	0

4. Threatened Species

4.1 Candidate Ecosystem Credit Species

Ecosystem credit species associated with the Subject Land are listed below in **Table 7**. No species predicted by the BAM calculator as potential ecosystem credits were excluded from the assessment due to habitat constraints.

Table 7. Candidate ecosystem credits predicted to occur within the Subject Land.

Scientific Name	BC Act Status	Excluded from Assessment	Reason for Exclusion from Assessment
<i>Anthochaera phrygia</i> Regent Honeyeater (Foraging)	Critically Endangered	No	-
<i>Artamus cyanopterus cyanopterus</i> Dusky Woodswallow	Vulnerable	No	-
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo (Foraging)	Vulnerable	No	-
<i>Daphoenositta chrysoptera</i> Varied Sittella	Vulnerable	No	-
<i>Dasyurus maculatus</i> Spotted-tailed Quoll	Vulnerable	No	-
<i>Glossopsitta pusilla</i> Little Lorikeet	Vulnerable	No	-
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle (Foraging)	Vulnerable	No	-
<i>Hieraetus morphnoides</i> Little Eagle (Foraging)	Vulnerable	No	-
<i>Hirundapus caudacutus</i> White-throated Needletail	Vulnerable	No	-
<i>Hoplocephalus bungaroides</i> Broad-headed Snake (foraging)	Endangered	No	-
<i>Lathamus discolor</i> Swift Parrot (Foraging)	Endangered	No	-
<i>Lophoictinia isura</i> Square-tailed Kite (Foraging)	Vulnerable	No	-
<i>Micronomus norfolkensis</i> Eastern Coastal Free-tailed Bat	Vulnerable	No	-
<i>Miniopterus australis</i> Little Bent-winged Bat (Foraging)	Vulnerable	No	-
<i>Miniopterus orianae oceanensis</i> Large Bent-winged bat (Foraging)	Vulnerable	No	-
<i>Ninox connivens</i> Barking Owl (Foraging)	Vulnerable	No	-
<i>Ninox strenua</i> Powerful Owl (Foraging)	Vulnerable	No	-
<i>Pandion cristatus</i> Eastern Osprey (Foraging)	Vulnerable	No	-

Scientific Name	BC Act Status	Excluded from Assessment	Reason for Exclusion from Assessment
<i>Phascolarctos cinereus</i> Koala (Foraging)	Vulnerable	No	-
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (Foraging)	Vulnerable	No	-
<i>Tyto novaehollandiae</i> Masked Owl (Foraging)	Vulnerable	No	-
<i>Varanus rosenbergi</i> Rosenberg's Goanna	Vulnerable	No	-

4.2 Historically Recorded Threatened Fauna


The following threatened species credit species have been historically recorded within the broader Subject Property however outside the Subject Land (**Figure 13**):

- *Pteropus poliocephalus* (Grey-headed Flying Fox);
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat);
- *Myotis macropus* (Southern Myotis); and
- *Petaurus norfolcensis* (Squirrel Glider).

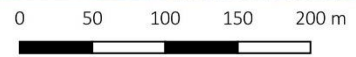
Each species is therefore required to have their specific habitat requirements assessed in this assessment regardless of whether or not the species is considered an SAI. If suitable habitat is identified within the Subject Land, these species are required to be assumed present or be surveyed to rule out their presence in accordance with section 5.2 of the BAM (DPIE 2020a).



Historically Recorded Species Credit Species

-  Subject Land
-  Subject Property
-  Southern Myotis (Narla 2020)

- BioNet (DPIE 2021)**
-  Grey-headed Flying-fox
 -  Large Bent-winged Bat
 -  Southern Myotis
 -  Squirrel Glider



NARLA
environmental

Date: 23/06/2021
 Coordinate System: GDA94 MGA Zone 56
 Data Source: BioNet (DPIE 2021b)
 Image Source: Nearmap Australia Pty Ltd [April 2021]



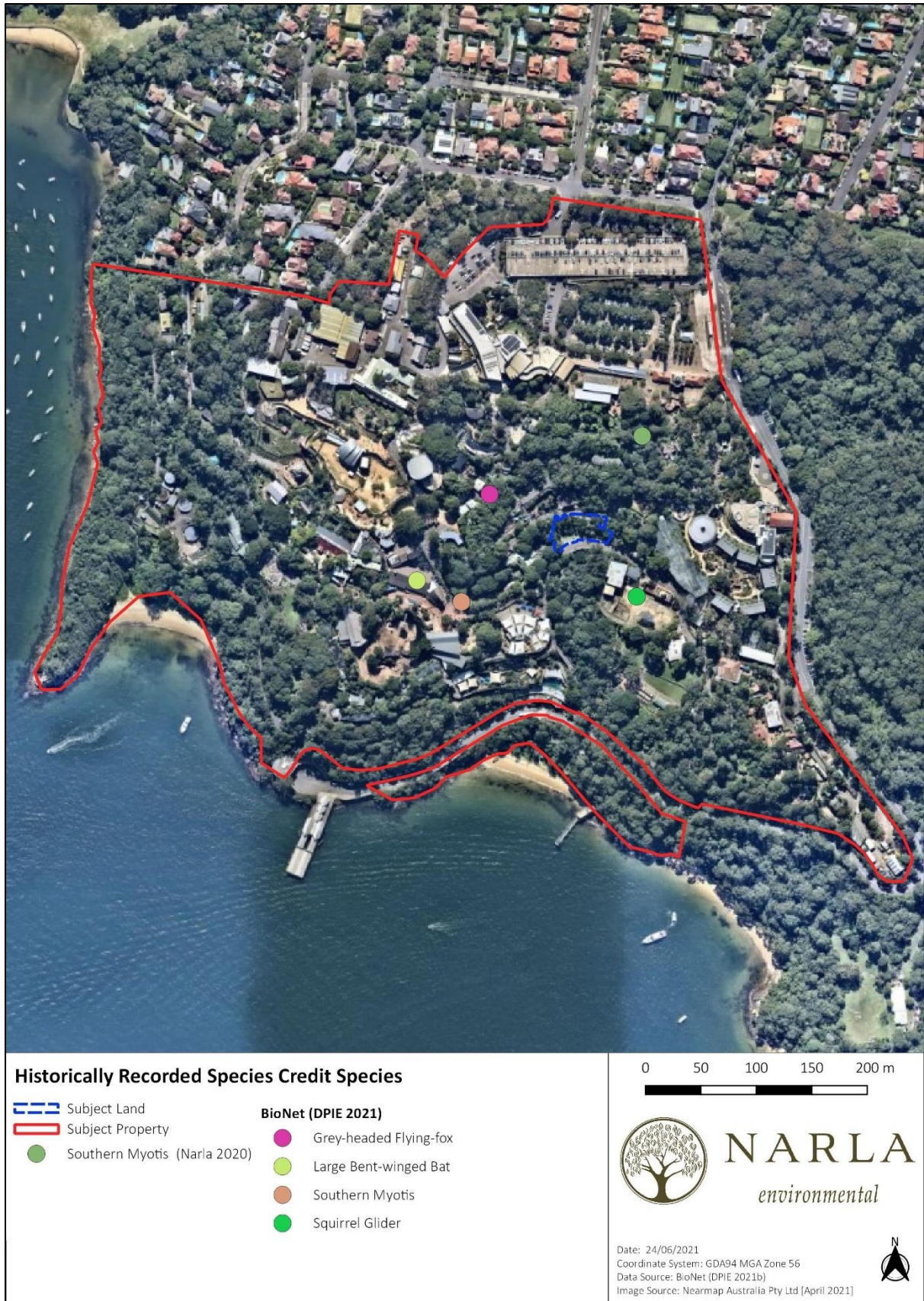


Figure 13. Historically recorded species credit species within the Subject Property.

4.3 Candidate Species Credit Species Summary

This section provides a summary of the candidate species credit fauna and flora species for the Subject Land derived from BAMC (DPIE 2021d). A summary of the targeted survey effort applied to each species is provided along with the results of the survey effort, specifically whether or not the species credit needs to be offset through retiring of Biodiversity Offset Credits (**Table 8; Table 9**).

As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAll species or those threatened species incidentally located where suitable habitat was present.

Table 8. Candidate fauna credit species predicted to occur within the Subject Land.

Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
<i>Anthochaera phrygia</i> Regent Honeyeater (Breeding)	This Subject Land is not located within any mapped areas of important habitat for this species. Therefore, it has been excluded from the assessment.	No	NA	Very High - 3	No
<i>Callocephalon fimbriatum</i> - endangered population Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	As per Appendix C of the BAM (OEH 2020a), the Streamlined Assessment Module only requires surveying for SAll species. This species is not an SAll species and was therefore excluded from the assessment.	No	NA	High – 2	No
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo (Breeding)	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAll species. This species is not an SAll species and was therefore excluded from the assessment.	No	NA	High -2	No
<i>Cercartetus nanus</i> Eastern Pygmy-possum	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAll species. This species is not an SAll species and was therefore excluded from the assessment.	No	NA	High - 2	No
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	This species is known to occur within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels. Such geological features were not observed within or adjacent to the Subject Land. Potential foraging habitat	No	NA	Very High - 3	No

Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
	occurs within the Subject Land, however, as foraging habitat is not considered an SAIL it has not been assessed in this BDAR.				
<i>Eudyptula minor</i> - endangered population Little Penguin in the Manly Point Area (being the area on and near the shoreline from Cannae Point generally northward to the point near the intersection of Stuart Street and Oyama Cove Avenue, and extending 100 metres offshore from that shoreline)	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	High - 2	No
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle (Breeding)	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	High - 2	No
<i>Heleioporus australiacus</i> Giant Burrowing Frog	As per Appendix C of the BAM (OEH 2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	Moderate - 1.5	No
<i>Hieraaetus morphnoides</i> Little Eagle (Breeding)	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	High - 2	No
<i>Hoplocephalus bungaroides</i> Broad-headed Snake (Breeding)	This species is known to breed in areas containing rocky areas including escarpments and outcrops. Such geological features were not observed within or adjacent to the Subject Land. Bush rock was however present in small quantities offering sub-optimal breeding habitat. The Subject Land occurs on	No	NA	Very High - 3	No

Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
	highly modified and fragmented planted vegetation amidst areas of hardstand. No BioNet records of this species occur within a 10km radius of the Subject Land. As such, this species was excluded from the assessment.				
<i>Lathamus discolor</i> Swift Parrot (Breeding)	No, the Subject Land is not included on the map of important areas for Swift Parrot.	No	NA	Very High - 3	No
<i>Lophoictinia isura</i> Square-tailed Kite (Breeding)	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	Moderate - 1.5	No
<i>Meridolum maryae</i> Maroubra Woodland Snail	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	High - 2	No
<i>Miniopterus australis</i> Little Bent-winged Bat (Breeding)	This species is known to breed in caves, tunnels, mines and culverts. As such habitat constraints are not present within the Subject Land, this species was excluded from the assessment.	No	NA	Very High - 3	No
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat (Breeding)	This species is known to breed in caves, tunnels, mines and culverts. This species has been historically recorded within the broader Taronga Zoo, however as there is no breeding habitat (caves, tunnels, mines and culverts) present within the Subject Land, this species was able to be excluded from the assessment.	No	NA	Very High - 3	No
<i>Myotis macropus</i> Southern Myotis	This species has been historically recorded with the broader Taronga Zoo (Narla 2020). As the Subject Land is located within 200m of suitable habitat for this species. This species is required to be assumed present and offset accordingly.	No	Yes (Assumed Present)	High - 2	Yes

Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
<i>Ninox connivens</i> Barking Owl (Breeding)	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	High - 2	No
<i>Ninox strenua</i> Powerful Owl (Breeding)	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	High - 2	No
<i>Pandion cristatus</i> Eastern Osprey (Breeding)	As per Appendix C of the BAM (DPIE2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	Moderate - 1.5	No
<i>Perameles nasuta</i> - endangered population Long-nosed Bandicoot, North Head	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	High - 2	No
<i>Petaurus norfolcensis</i> Squirrel Glider	One (1) historic record of the species is located within the broader Taronga Zoo, however outside the Subject Land. This species prefers vegetation with large old trees with hollows (DPIE 2021c), such habitat was not present within the Subject Land. Therefore, this species has been excluded from the assessment.	No	NA	High - 2	No
<i>Phascolarctos cinereus</i> Koala (Breeding)	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	High - 2	No
<i>Phascolarctos cinereus</i> - endangered population Koala in the Pittwater Local Government Area	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAIL species. This species is not an SAIL species and was therefore excluded from the assessment.	No	NA	High - 2	No

Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
<i>Pseudophryne australis</i> Red-crowned Toadlet	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAll species. This species is not an SAll species and was therefore excluded from the assessment.	No	NA	Moderate - 1.5	No
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (Breeding)	One (1) historic records of this species occur in the broader Taronga Zoo however, no camps were present within the Subject Land. Therefore, this species has been excluded from the assessment.	NA	NA	High - 2	No
<i>Tyto novaehollandiae</i> Masked Owl (Breeding)	As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAll species. This species is not an SAll species and was therefore excluded from the assessment.	No	NA	High - 2	No

Table 9. Candidate Flora Credit Species predicted to occur within the Subject Land.

Scientific Name	Included in Assessment?	Targeted Survey conducted?	Present within Subject Land?	Biodiversity Risk Weighting	Biodiversity Offset Credits Required?
<i>Allocasuarina portuensis</i> Nielsen Park She-oak	As the Subject Land is located to the east of Gladesville and within 5km of the Sydney Harbour foreshore it is within the geographic distribution for this species. Therefore, the species was included in the assessment.	Yes	No	Very High – 3	No
<i>Leptospermum deanei</i> Leptospermum deanei	As per Appendix C of the BAM (OEH 2020a), the Streamlined Assessment Module only requires surveying for SAll species. This species is not an SAll species and was therefore excluded from the assessment.	No	NA	High - 2	No
<i>Melaleuca biconvexa</i> Biconvex Paperbark	As per Appendix C of the BAM (OEH 2020a), the Streamlined Assessment Module only requires surveying for SAll species. This species is not an SAll species and was therefore excluded from the assessment.	No	NA	High – 2	No

4.4 Targeted Species Credit Surveys

4.4.1 Fauna Species Credit Survey

A total of twenty-three (23) threatened fauna species were identified within the BAMC (DPIE 2021d) as having the potential to occur within the Subject Land. None of the listed Candidate Species Credit Species were surveyed for due to one of the following reasons:

- Species are considered unlikely to occur and no further assessment is required for that species if it is determined that no habitat constraints are present on the entire Subject Land for the threatened species (as per Section 5.2.2 of the BAM, DPIE 2020a);
- As per Appendix C of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAll species. Therefore, all non-SAll species were excluded from the assessment.

4.4.1.1 Assumed Present Fauna

One species, *Myotis macropus* (Southern Myotis), has been historically recorded within the broader Taronga Zoo, with the Subject Land containing known habitat (vegetation within 200m from waterbodies) for this species. Therefore, this species is required to be assumed present and offset accordingly.

4.4.2 Flora Species Credit Survey

A total of three (3) threatened flora species were identified within the BAMC (DPIE 2021d) as having the potential to occur within the Subject Land. Two (2) of these species; *Leptospermum deanei* and *Melaleuca biconvexa* were not surveyed for due to the following:

- As per Appendix c of the BAM (DPIE 2020a), the Streamlined Assessment Module only requires surveying for SAll species. Therefore, all non-SAll species were excluded from the assessment.

One (1) species; *Allocasuarina portuensis*, was surveyed for within the Subject Land. The targeted surveys were undertaken for these species in accordance with the 'Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method' (DPIE 2020e; **Figure 15**). The species was not located.

Candidate Fauna Species	Survey Period (BAMC)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Allocasuarina portuensis</i> Nielsen Park She-oak	✓											
Key	✓ = Surveyed					= Optimum Survey Period						

4.5 Species Polygons

A species polygon was created for one (1) species credit species assumed present within the Subject Land (**Figure 14**):

- Myotis macropus* (Southern Myotis) – Species polygon comprises of all associated PCTs (OEH 2018 within 200m of a waterbody).

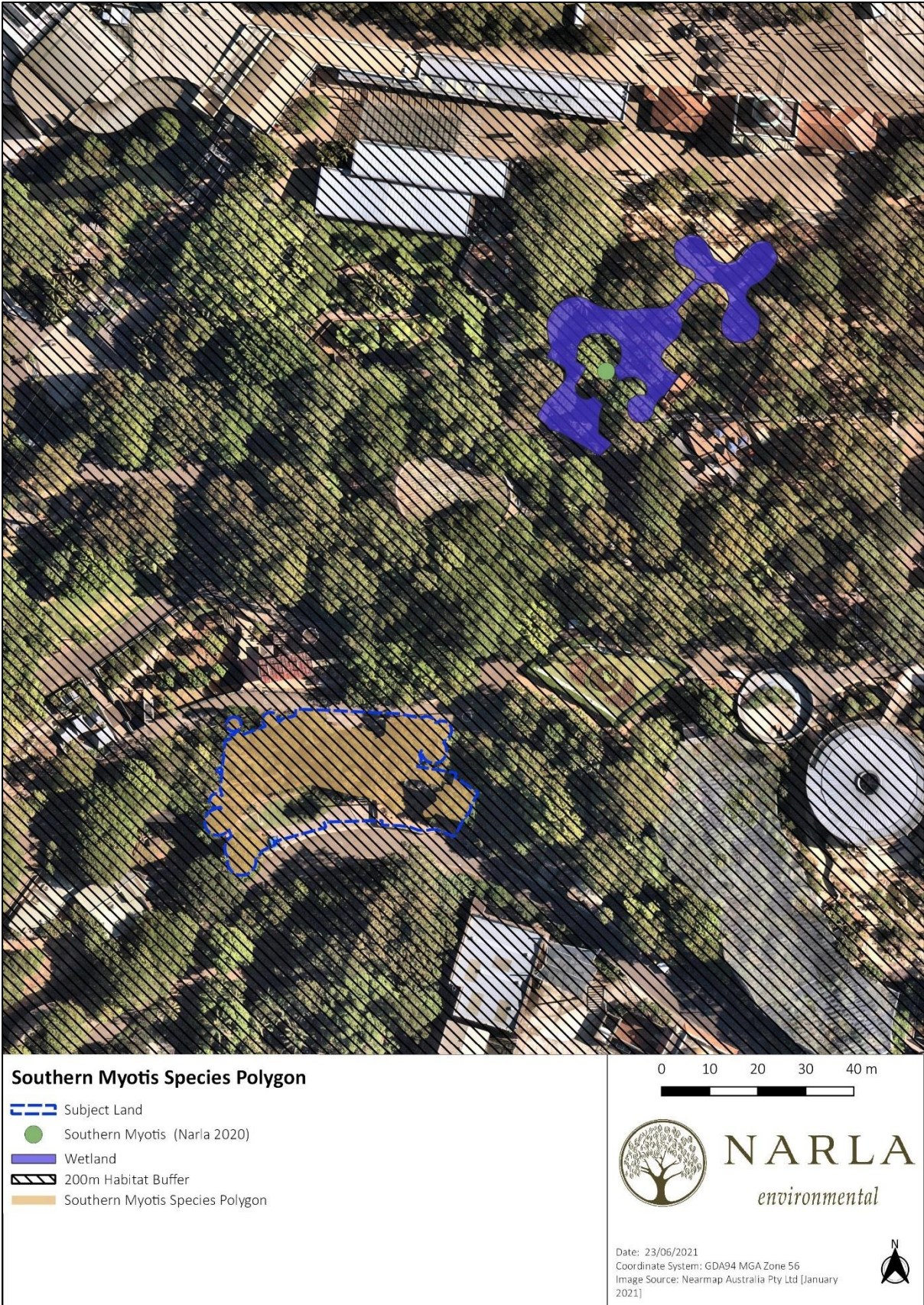


Figure 14. Southern Myotis species polygon.



Figure 15. Targeted survey effort for species credit species within the Subject Land.

5. Prescribed Impacts

Certain projects may have impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. For many of these impacts, the biodiversity values may be difficult to quantify, replace or offset, making avoiding and minimising impacts critical. Prescribed biodiversity impacts require an assessment of the impacts of the subdivision on the habitat of threatened species or ecological communities. This is discussed in **Table 10**.

Table 10. Prescribed and uncertain impacts associated with the proposed development.

Will there be impacts on any of the following?	Yes/No	If Yes, Address all of the assessment questions from section 6 of the BAM
<p>Habitat of threatened entities including:</p> <ul style="list-style-type: none"> ▪ karst, caves, crevices, cliffs, rocks and other geological features of significance, or ▪ human-made structures, or ▪ non-native vegetation 	<p>Yes</p>	<p>There are no karsts, caves, crevices, cliffs, rocks and other features of geological significance on or near the Subject Land.</p> <p>The Subject Land contains a human-made Meerkat enclosure, that will be demolished as part of the development. A number of threatened microbat species may utilise the indoor sections of this enclosure for roosting and breeding, including:</p> <ul style="list-style-type: none"> ▪ <i>Falsistrellus tasmaniensis</i> (Eastern False Pipistrelle); ▪ <i>Micronomus norfolkensis</i> (Eastern Coastal Free-tailed Bat); ▪ <i>Miniopterus australis</i> (Little Bent-winged Bat); ▪ <i>Miniopterus orianae oceanensis</i> (Large Bent-winged bat); ▪ <i>Myotis macropus</i> (Southern Myotis); ▪ <i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail-bat); and ▪ <i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat). <p>Non-native vegetation was present within the Subject Land; however, it only exists in the form of herbaceous weeds, landscape plants and exotic grasses, the removal of which is not expected to impact any threatened species.</p>

Will there be impacts on any of the following?	Yes/No	If Yes, Address all of the assessment questions from section 6 of the BAM
On areas connecting threatened species habitat, such as movement corridors	No	It is unlikely the proposed development will interrupt connectivity for any threatened species, as areas of habitat connectivity will continue to exist in vegetated areas surrounding the Subject Land.
That affect water quality, water bodies and hydrological processes that sustain threatened entities (including from subsidence or upsidence from underground mining)	No	It is also not expected that the removal of vegetation within the Subject Land will impact upon any groundwater processes or hydrological processes within the surrounding landscape.
On threatened and protected animals from turbine strikes from a wind farm	No	No wind farms are associated with the proposed development.
On threatened species or fauna that are part of a TEC from vehicle strikes.	No	The Subject Land has the potential to support threatened species. However, due to the nature of the proposed development, it is highly unlikely that vehicle strikes will be an issue given the slow speed requirements of vehicles within the property.

6. Avoid and Minimise Impacts

6.1 Impact Mitigation and Minimisation Measures

This section details the measures to be implemented before, during and post construction to avoid and minimise the impacts of the project (Table 11).

Table 11. Mitigation and minimisation of impacts associated with the proposed development.

Action	Outcome	Timing	Responsibility
Avoid and Minimise Impact - Project Location and Design	<p>The development has been strategically positioned to minimise impacts on native vegetation and habitat as much as possible. The proponent has located the proposed works within historically modified areas that currently consists of planted native vegetation, exotic lawn and existing hardstand.</p> <p>Any temporary structures required for construction works should be located within hardstand and cleared areas that have minimal biodiversity values. This will avoid unnecessary impacts on native vegetation and habitat elsewhere within the Subject Property.</p>	Pre-construction phase	Proponent
Preparation of a Construction Environmental Management Plan (CEMP)	<p>A CEMP may be required for the construction phase of the project, and will be prepared prior to issue of the Construction Certificate. The CEMP would include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures, including the procedures outlined below. The proposed mitigation measures would include environmental safeguards for protection of neighbouring properties and nearby waterways in accordance with relevant policy documentation and Government guidelines. In order to address the potential impacts of the proposal on biodiversity, the mitigation and management measures outlined within this table would be implemented as part of the CEMP for the site.</p>	Pre-construction phase	Proponent Construction Contractor

Action	Outcome	Timing	Responsibility
Tree Protections	<p>Australian Standard 4970 (2009) Protection of Trees on Development Sites (AS-4970) outlines that a Tree Protection Zone (TPZ) is the principal means of protecting trees on construction sites. It is an area isolated from construction disturbance so that the tree remains viable. Ideally, works should be avoided within the TPZ.</p> <p>A Minor Encroachment is less than 10% of the TPZ and is outside the SRZ. A Minor Encroachment is considered acceptable by AS-4970 when it is compensated for elsewhere and contiguous within the TPZ.</p> <p>A Major Encroachment is greater than 10% of the TPZ or inside the SRZ. Major Encroachments generally require root investigations undertaken by non-destructive methods or the use of tree sensitive construction methods.</p>	Pre-construction phase	Proponent Arborist
Assigning a Project Ecologist for vegetation clearing	<p>Prior to construction, the applicant should commission the services of a qualified and experienced Ecologist Consultant (minimum 3 years' experience) with a minimum tertiary degree in Science, Conservation, Biology, Ecology, Natural Resource Management, Environmental Science or Environmental Management. The Ecologist must be licensed with a current Department of Primary Industries Animal Research Authority permit and New South Wales Scientific License issued under the BC Act. The Ecologist will be commissioned to:</p> <ul style="list-style-type: none"> ▪ Undertake an extensive pre-clearing survey, delineating habitat-bearing trees and shrubs to be retained/removed; ▪ Conduct microbat survey of indoor sections of the meerkat enclosure, prior to demolition; and ▪ Supervise the clearance of trees and shrubs (native and exotic) in order to capture, treat and/or relocate any displaced fauna. 	Prior to and during vegetation clearance works	Proponent Project Ecologist
Relocation of woody debris	Any woody debris (fallen trees and logs) within the Subject Land are to be relocated to areas of native vegetation elsewhere with the Zoo.	Construction phase	Project Ecologist Proponent Bush regeneration contractor

Action	Outcome	Timing	Responsibility
Erosion and Sedimentation	Appropriate erosion and sediment control must be erected and maintained at all times during construction in order to avoid the potential of incurring indirect impacts on biodiversity values. As a minimum, such measures should comply with the relevant industry guidelines such as 'the Blue Book' (Landcom 2004).	Construction phase	Proponent Construction Contractor
Erection of temporary fencing	Temporary fencing should be erected around retained native vegetation that may incur indirect impacts on biodiversity values due to the construction works.	Construction phase	Proponent Construction Contractor
Storage and Stockpiling (Soil and Materials)	Allocate all storage, stockpile and laydown sites away from any native vegetation that is planned to be retained. Avoid importing any soil from outside the site as this can introduce weeds and pathogens to the site in order to avoid the potential of incurring indirect impacts on biodiversity values.	Construction phase	Construction Contractors
Stormwater	Potential impacts relating to stormwater and runoff will be managed during construction and operation phases. The CEMP will guide stormwater management during the construction phase of development.	Post-construction phase	Proponent Construction Contractors/ Architect

7. Assessment of Impacts

7.1 Direct Impacts

7.1.1 Full Clearing

The proposed development will result in impacts to the following vegetation:

- 0.09ha of vegetation representative of PCT 1778.

The development has been strategically positioned to minimise impacts on native vegetation and habitat as much as possible. The proponent has located the proposed works within historically modified areas that currently consists of planted native vegetation, exotic lawn and existing hardstand.

7.2 Prescribed Impacts

As there is potential for the Subject Land to contain habitat for a number of threatened microbat species in the form of human-made structures, an assessment of this prescribed impact must be undertaken in accordance with Section 8.3 of the BAM (DPIE 2020b). This is discussed in **Table 12**.

Table 12. Prescribed and uncertain impacts associated with the proposed development.

Prescribed Impact	Nature, Extent and Duration	Threatened Species and Their Habitat Likely to be Impacted	Consequences of the Impacts on Threatened Entities
Habitat of threatened entities: <ul style="list-style-type: none"> human-made structures. 	<p>There is the potential that threatened microbat species use human-made structures (in particular, roof cavities) within the Subject Land for roosting and potentially breeding. The demolition of these structures has the potential to temporarily displace any occurring individuals. These species are highly mobile and there is ample suitable roosting/breeding habitat nearby. It is therefore likely that this prescribed impact will have a low impact of short duration</p> <p>To manage these impacts, a pre-clearing survey for microbats in the roof space of the building is recommended prior to demolition. If any individuals are found to be present, they are to be captured and relocated (during demolition works) into surrounding bushland after sunset.</p>	<ul style="list-style-type: none"> <i>Falsistrellus tasmaniensis</i> (Eastern False Pipistrelle); <i>Micronomus norfolkensis</i> (Eastern Coastal Free-tailed Bat); <i>Miniopterus australis</i> (Little Bent-winged Bat); <i>Miniopterus orianae oceanensis</i> (Large Bent-winged bat); <i>Myotis macropus</i> (Southern Myotis); <i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail-bat); and <i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat). 	<p>While the demolition of potential roost/breeding sites may temporarily displace local populations of threatened microbats, these species are highly mobile with large areas of habitat continuing to exist in the broader locality, which would provide alternative roost/breeding sites. As such, any impacts would be considered minor and temporary.</p>

7.3 Indirect Impacts

Indirect impacts occur when the proposal or activities relating to the construction or operation of the proposal affect native vegetation, threatened ecological communities and threatened species habitat beyond the Subject Land. Impacts may also result from changes to land-use patterns, such as an increase in vehicular access and human activity on native vegetation, threatened ecological communities and threatened species habitat. The indirect impacts of this proposed development are outlined in **Table 13**.

Table 13. Indirect impacts associated with the proposed development.

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the native vegetation, threatened species, threatened ecological communities and their habitats.
(a) inadvertent impacts on adjacent habitat or vegetation	There is the potential for minor impacts to vegetation directly adjacent to the Subject Land as a result of the proposed development. However, the vegetation adjacent to the Subject Land is already highly disturbed, comprising numerous exotic species and subject to considerable, ongoing human disturbance. It is therefore likely that the proposed works will result in negligible/low inadvertent impacts during or post construction.	One PCT (PCT1778- not a TEC) occurs within the Subject Land. <i>Myotis macropus</i> (Southern Myotis) assumed present within the Subject Land. There is potential that additional threatened species may occur within the surrounding area. Foraging habitat for threatened species may be inadvertently impacted.	While changes to vegetation condition may have a low and localised impact to PCT 1778, threatened species and their habitats, this is not expected to impact on their bioregional persistence. In addition, exclusion fencing, pre-clearing surveys and clearing supervision has been proposed to reduce the risk of indirect impacts to any native vegetation and potentially occurring threatened species adjacent to the Subject Land.

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the native vegetation, threatened species, threatened ecological communities and their habitats.
(b) reduced viability of adjacent habitat due to edge effects	Due to the highly modified nature of the vegetation adjacent to the Subject Land, as well as the already existing presence of exotic vegetation. It is unlikely that the proposed development will result in a reduction in the viability of adjacent habitat due to edge effects.	<p><i>Myotis macropus</i> (Southern Myotis) assumed present within the Subject Land.</p> <p>There is also potential that threatened species use habitat adjacent to the Subject Land. Such species may be impacted by edge effect leading to a reduced viability in habitat.</p>	While edge effects may have a localised impact to PCT 1778 and threatened species, this is not expected to impact on their bioregional persistence, considering the areas of habitat connectivity surrounding the Subject Land.
(c) reduced viability of adjacent habitat due to noise, dust or light spill	<p>An increase in noise is to be expected during construction, which may impact on species roosting or foraging in habitat adjacent to the site. It is not expected that construction would occur throughout the night, and as such would not impact on nocturnal species that may utilise adjacent habitat, or diurnal species that roost in adjacent habitat. Post-construction it is expected that noise levels will return to current levels, as the site will be used in a similar manner (i.e., as a zoological park).</p> <p>The construction may increase dust in adjacent habitat. Dust can impact on a plants ability to photosynthesise and may increase plant mortality in the adjacent vegetation. It is</p>	<p><i>Myotis macropus</i> (Southern Myotis) assumed present within the Subject Land.</p> <p>There is potential that threatened species use habitat adjacent to the Subject Land. These species may be impacted by an increase in noise within the Subject Land.</p>	While the proposed development may have a localised impact to threatened species, this is not expected to impact on their bioregional persistence, considering large areas of habitat connectivity allowing their movement away from impacted areas.

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the native vegetation, threatened species, threatened ecological communities and their habitats.
	<p>however not expected that this would have such an impact to decrease the viability of adjacent habitat.</p> <p>It is expected that the construction would occur during normal working hours, and as such light spill is not expected to affect adjacent habitat.</p>		
(d) transport of weeds and pathogens from the site to adjacent vegetation	<p>As previously discussed, the proposed construction may lead to an increase in weed infiltration into adjacent habitat due to enhanced edge effects. It is however not expected that weeds will be transported via human or vehicular traffic into surrounding areas during construction. Temporary fencing will be erected around retained native vegetation to avoid such indirect impacts occurring during construction.</p>	<p>One PCT (PCT 1778) was identified within the Subject Land.</p> <p>There is also potential that threatened species use habitat adjacent to the Subject Land. The PCT and threatened species may be impacted by weed and pathogen transportation leading to a reduced viability in habitat.</p>	<p>While weeds and pathogens may have a localised impact to PCTs and threatened species, this is not expected to impact on their bioregional persistence, considering the large habitat connectivity within the surrounding areas.</p>
(e) increased risk of starvation, exposure and loss of shade or shelter	<p>It is highly unlikely that any threatened fauna would be exposed to increased risks from starvation, exposure, and loss of shade and shelter as a result of the proposed development given the small area of vegetation being removed. No habitat is to be removed beyond the Subject Land, although</p>	N/A	N/A

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the native vegetation, threatened species, threatened ecological communities and their habitats.
	<p>disturbances from other indirect impacts may deem such habitats unsuitable for certain species. However, due to the areas of habitat connectivity adjoining the Subject Land, it is unlikely that this localised impact will be significant as such habitats will continue to provide food resources and shelter for fauna species.</p>		
(f) loss of breeding habitats	<p>No breeding habitat features (e.g., hollows, nests caves) were identified immediately adjacent to the Subject Land. It is therefore considered unlikely that the proposed works would result in a loss of breeding habitats.</p>	NA	NA
(g) trampling of threatened flora species	<p>Although no threatened flora species have been historically recorded directly adjacent to the Subject Land, there is still the potential for such species to exist in these areas, as these areas were not extensively surveyed. In order to prevent the trampling of threatened flora species that could potentially occur within adjacent habitat, such habitats will be delineated with temporary fencing to avoid such impacts occurring during construction. It is not expected that such areas would be accessible post-construction.</p>	<p>There is the potential that threatened flora species occupy habitat adjacent to the Subject Land. Potential threatened species may be impacted by accidental trampling.</p>	<p>While the proposed development may result in a localised increase in the potential of threatened flora being trampled. This is however not considered a high risk and not expected to impact on their bioregional persistence, considering exclusion fencing has been suggested around all vegetation to be retained</p>

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the native vegetation, threatened species, threatened ecological communities and their habitats.
(h) inhibition of nitrogen fixation and increased soil salinity	It is unlikely that the inhibition of nitrogen fixation will affect vegetation adjacent to the Subject Land. Increased soil salinity may result due to clearing of vegetation leading to the rising of the water table. However, clearing will be limited to the Subject Land and as such is not expected to affect vegetation directly adjacent to the Subject Land.	N/A	N/A
(i) fertiliser drift	This issue is not likely to affect the vegetation surrounding the Subject Land. Although fertiliser may be used in landscaped vegetation, no fertiliser drift is expected to impact on adjacent vegetation.	N/A	N/A
(j) rubbish dumping	<p>Large scale rubbish dumping is not considered to be an issue in vegetation adjacent to the Subject Land as it is regularly maintained by Zoo staff.</p> <p>The minor dumping/littering of food resources may provide a food source for fauna, including threatened species. However, this may also encourage invasive species into such habitats.</p>	<p><i>Myotis macropus</i> (Southern Myotis) assumed present within the Subject Land.</p> <p>There is potential that threatened fauna species use habitat adjacent to the Subject Land. Such species may be impacted by the dumping of rubbish, particularly food resources. This may result in both positive (food source) and</p>	<p>This impact is expected to be localised and will not have an overall impact on the bioregional persistence of the threatened species.</p>

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the native vegetation, threatened species, threatened ecological communities and their habitats.
		negative impacts (increase in predators) to such species.	
(k) wood collection	Wood collection is not considered to be an issue within the vegetation adjacent to the Subject Land. No wood collection is associated with the proposed development.	N/A	N/A
(l) bush rock removal and disturbance	No bush rock is proposed for removal within the vegetation adjacent to the Subject Land as a result of the Proposed Development.	N/A	N/A
(m) increase in predatory species populations	It is unlikely that introduced predators have access to the Subject Land as the proposed development is situated within Taronga Zoo Sydney which is surrounded by fencing. The zoo is also known to conduct predatory species trapping and monitoring through the use of wildlife cameras.	N/A	N/A
(n) increase in pest animal populations	There is potential that pest animal populations already inhabit areas surrounding the Subject Land (particularly smaller	N/A	N/A

Indirect Impact	Nature, extent and duration	TEC's/PCTs and/or Threatened Species and their habitat likely to be impacted	Consequences of the impacts for the bioregional persistence of the native vegetation, threatened species, threatened ecological communities and their habitats.
	species which may fit through the chain-link fence). The proposed development is not likely to increase this potential risk.		
(o) increased risk of fire	The vegetation immediately adjacent to the Subject Land is not identified by Mosman Council as occurring within bushfire prone land. It is not expected that the proposed development will alter the bushfire risk of vegetation surrounding the Subject Land.	N/A	N/A
(p) disturbance to specialist breeding and foraging habitat, e.g., beach nesting for shorebirds.	No specialist breeding and foraging habitat was identified adjacent to the Subject Land. It is therefore not expected that the proposed development will disturb any specialist breeding and foraging habitat.	N/A	N/A

8. Thresholds for Assessing and Offsetting

8.1 Impacts on Native Vegetation

The following native vegetation within the Subject Land is proposed to be impacted as a result of the proposed development:

- 0.09ha representative of PCT 1788.

The purchase and retirement of Biodiversity Offset Credits will be required for the following native vegetation within the Subject Land (**Figure 16**):

- 0.09ha within Zone 1, representative of PCT 1778.

8.2 Impacts on Threatened Species

The following threatened species has been assumed present within the Subject Land and will require the purchase and retirement of Biodiversity Offset Credits:

- *Myotis macropus* (Southern Myotis).

8.3 Serious and Irreversible Impacts (SAIL's)

No ecological communities or threatened species at risk of Serious and Irreversible Impacts were identified within or likely to utilise the Subject Land.



Figure 16. Impacts on native vegetation and offset requirements.

9. Biodiversity Offset Credit Requirements

The preferred approach to offset the residual impacts of the proposal is to purchase and retire the appropriate species credits from registered Biodiversity Stewardship Sites that comply with the trading rules of the NSW BOS in accordance with the 'like for like' report generated by the BAM calculator. If such credits are unavailable, credits would be sourced in accordance with the 'variation report' generated by the BAMC.

A payment to the Biodiversity Conservation Trust (BCT) would be considered as a contingency option if a suitable number and type of biodiversity credits cannot be secured.

Estimated costs to purchase these credits, or alternatively, to allocate offset funds directly into the NSW BCT are available in the NSW Biodiversity Offsets Payment Calculator (DPIE 2021g).

9.1 Offset Requirement for Ecosystem Credits

A total of two (2) ecosystem credits are required to offset the biodiversity impacts of the proposed development (Table 14).

Table 14. Ecosystem credits required to offset the proposed development.

PCT	BC Act Status	Zone	Total Area (ha)	Ecosystem Credits Required
PCT: 1778 Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	NA	Zone 1	0.09	2
Total Ecosystem Credits				2

9.2 Offset Requirement for Species Credits

One (1) candidate species credit that has been 'assumed present' will require offsetting through the retiring of biodiversity offset species credits under the BOS as a result of the proposed development (Table 15).

Table 15. Species credits required to offset the proposed development.

Species	BC Act Status	Zone	Total Area (ha)	Species Credits Required
<i>Myotis macropus</i> Southern Myotis	Vulnerable	Zone 1	0.09	2
Subtotal			2	

10. Other Relevant Legislation and Planning Policies

10.1 Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

The proposed development will abide by the environmental objectives of the Sydney Regional Environmental Plan (Sydney Harbour Catchment) (2005) which are to:

- Ensure that the catchment, foreshores, waterways and islands of Sydney Harbour are recognised, protected, enhanced and maintained:
 - As an outstanding natural asset, and
 - As a public asset of national and heritage significance, for existing and future generations
- Ensure a healthy, sustainable environment on land and water;
- Achieve a high quality and ecologically sustainable urban environment
- Ensure a prosperous working harbour and an effective transport corridor;
- Encourage a culturally rich and vibrant place for people;
- Ensure accessibility to and along Sydney Harbour and its foreshores;
- Ensure the protection, maintenance and rehabilitation of watercourse, wetlands, riparian lands, remnant vegetation and ecological connectivity; and
- Provide a consolidated, simplified and updated legislative framework for future planning.

The Subject Land is located within the Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 Foreshores and Waterways Area Map. Division 2 Section 21 'Biodiversity, ecology and environment protection' identifies a number of matters to be taken into consideration in relation to biodiversity, ecology and environment protection, including:

- Development should have a neutral or beneficial effect on the quality of water entering the waterways;
- Development should protect and enhance terrestrial and aquatic species, populations and ecological communities and, in particular, should avoid physical damage and shading of aquatic vegetation (such as seagrass, saltmarsh and algal and mangrove communities);
- Development should promote ecological connectivity between neighbouring areas of aquatic vegetation (such as seagrass, saltmarsh and algal and mangrove communities);
- Development should avoid indirect impacts on aquatic vegetation (such as changes to flow, current and wave action and changes to water quality) as a result of increased access;
- Development should protect and reinstate natural intertidal foreshore areas, natural landforms and native vegetation;
- Development should retain, rehabilitate and restore riparian land;
- Development on land adjoining wetlands should maintain and enhance the ecological integrity of the wetlands and, where possible, should provide a vegetative buffer to protect the wetlands;
- The cumulative environmental impact of development; and
- Whether sediments in the waterway adjacent to the development are contaminated, and what means will minimise their disturbance.

10.2 State Environmental Planning Policy (Koala Habitat Protection) 2021

This SEPP seeks to address the declining status of koalas in NSW through better conservation and management of koala habitat as part of the planning and assessment process. The overarching aim of the SEPP is to "... encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to support a permanent free-living population over their present range and reverse the current trend of koala population decline" (DPIE 2020b). This SEPP applies to local government areas that are listed in Schedule 1 'Local government areas' of the SEPP. As Mosman LGA is not included in Schedule 1, this SEPP does not apply to the Subject Land.

10.3 State Environmental Planning Policy No 19—Bushland in Urban Areas

SEPP 19 – Bushland in Urban Areas applies to the areas and parts of areas specified in Schedule 1 of the SEPP that adjoin bushland zoned or reserved for public open space purposes. As the Subject Land does not adjoin land zoned or reserved for public open space, this SEPP does not apply to the proposed development.

10.4 State Environmental Planning Policy (Coastal Management) 2018

State Environmental Planning Policy (Coastal Management) 2018 applies to land within the coastal zone. The coastal zone means the area of land comprised of the following coastal management areas:

- the coastal wetlands and littoral rainforests area;
- the coastal vulnerability area;
- the coastal environment area; or
- the coastal use area.

The Subject Land is located within the SEPP's 'coastal environment area' and 'Coastal Use Area', however, this clause does not apply to land within the Foreshores and Waterways Area within the meaning of Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005. As such, this SEPP is not triggered by the proposed development.

11. References

Australian Government Department of the Environment and Energy (2018) Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Subregions)

Australian Standard 4970 (2009) Protection of Trees on Development Sites

Biodiversity Conservation Act (2016) <https://legislation.nsw.gov.au/#/view/act/2016/63/full>

Biodiversity Conservation Regulation (2017) <https://www.legislation.nsw.gov.au/#/view/regulation/2017/432>

Chapman GA, Murphy CL, Tille PJ, Atkinson G and Morse RJ, (2009) Ed. 4, Soil Landscapes of the Sydney 1:100,000 Sheet map, Department of Environment, Climate Change and Water, Sydney

Department of Environmental Conservation (DEC) (2004) Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft), New South Wales Department of Environment and Conservation, Hurstville, NSW.

Department of Planning, Industry and Environment (DPIE) (2019a) Guidance to assist a decision-maker to determine a serious and irreversible impact <https://www.environment.nsw.gov.au/-media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/guidance-decision-makers-determine-serious-irreversible-impact-190511.pdf>

Department of Planning, Industry and Environment (DPIE) (2020a) Biodiversity Assessment Methodology

Department of Planning, Industry and Environment (DPIE) (2020b) Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method

Department of Planning, Industry and Environment (DPIE) (2021a) NSW BioNet. The website of the Atlas of NSW Wildlife <http://www.bionet.nsw.gov.au/>

Department of Planning, Industry and Environment (DPIE) (2021b) NSW BioNet. Threatened Biodiversity Data Collection

Department of Planning, Industry and Environment (DPIE) (2021c) NSW BioNet. Vegetation Classification System

Department of Planning, Industry and Environment (DPIE) (2021d) Biodiversity Assessment Method Calculator Version 1.3.0.00

Department of Planning, Industry and Environment (DPIE) (2021e) Biodiversity Offset Payment Calculator Version 2.0 <https://www.lmbc.nsw.gov.au/offsetpaycalc>

Department of Planning, Industry and Environment (DPIE) (2020h) Soil Landscapes <http://espade.environment.nsw.gov.au>

Dwp (2021) Taronga Zoo – Reptile and Amphibian Conservation Centre Site Plan – Existing/Demolition.

Google Earth (2021) Taronga Zoo, Mosman.

Landcom (2004) Managing Urban Stormwater: Soils and Construction 'The Blue Book', Volume 1, Fourth Edition, New South Wales Government, ISBN 0-9752030-3-7

Mitchell, P.B (2002) NSW Ecosystems Study: Background and Methodology (Unpublished).

Mosman Council (2012) Mosman Local Environment Plan

Mosman Council (2012) Mosman Open Space and Infrastructure Development Control Plan

Naylor, S.D., Chapman, G.A., Atkinson, G., Murphy, C.L., Tulau, M.J., Flewin, T.C., Milford, H.B., Morand, D.T. (1998), *Guidelines for the Use of Acid Sulfate Soil Risk Maps*, 2nd ed., Department of Land and Water Conservation, Sydney.

Nearmap Australia Pty Ltd (2021) Taronga Zoo, Bradleys Head Road, Mosman. Accessed January, April and May 2021.

NSW Government Spatial Services (2021) Six Maps Clip & Ship <https://maps.six.nsw.gov.au/clipnship.html>

Office of Environment and Heritage (OEH) (2016a) The Native Vegetation of the Sydney Metropolitan Area. Volume 1: Technical Report. Version 2.0, Department of Premier and Cabinet, Sydney.

Office of Environment and Heritage (OEH) (2016b) The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles. Version 3.0, Department of Premier and Cabinet, Sydney.

Office of Environment and Heritage (OEH) (2017) Biodiversity Conservation Regulation 2017: Ancillary rules: Reasonable steps to seek like-for-like biodiversity credits for the purpose of applying the variation rules

PlantNET (2021) The NSW Plant Information Network System, Royal Botanic Gardens and Domain Trust, Sydney. <http://plantnet.rbgsyd.nsw.gov.au>

Robinson, L. (2003) 'Field Guide to the Native Plants of Sydney', Third Edition, Kangaroo Press

12. Appendices

Appendix A. BAM Site - Field Survey Forma (copied directly from Electronic Data Sheet).

Appendix B. BAMC Generated Biodiversity Credit Report.

Appendix A. BAM Site - Field Survey Forma (copied directly from Electronic Data Sheet).

BAM Site – Field Survey Form					
Date:	13.01.21	Plot ID:	plot 1	Photo #:	0
Zone:	56H	Plot Dimensions:	50m x 20m	Easting:	337353.71 m E
Datum:	94	Middle bearing from 0m:	77	Northing:	6253782.51 m S
PCT:	Zone 1: PCT 1778				
Growth Form	Scientific Name		Cover	Abundance	
Fern (EG)	<i>Pteridium esculentum</i>		0.1	1	
Forb (FG)	<i>Commelina cyanea</i>		2	100	
Forb (FG)	<i>Dianella caerulea</i>		0.2	15	
Forb (FG)	<i>Dichondra repens</i>		0.2	50	
Forb (FG)	<i>Sigesbeckia orientalis subsp. orientalis</i>		0.1	1	
Grass & grasslike (GG)	<i>Imperata cylindrica</i>		20	N/A	
Grass & grasslike (GG)	<i>Cymbopogon refractus</i>		1	10	
Grass & grasslike (GG)	<i>Microlaena stipoides</i>		0.2	30	
Grass & grasslike (GG)	<i>Poa labillardierei var. labillardierei</i>		0.2	4	
Grass & grasslike (GG)	<i>Oplismenus aemulus</i>		0.1	20	
Grass & grasslike (GG)	<i>Themeda triandra</i>		0.1	10	
Grass & grasslike (GG)	<i>Carex appressa</i>		0.1	1	
High Threat Exotic	<i>Bidens pilosa</i>		1	50	
High Threat Exotic	<i>Ehrharta erecta</i>		0.5	20	
High Threat Exotic	<i>Cyperus eragrostis</i>		0.1	1	
Other (OG)	<i>Pandorea pandorana</i>		1	5	
Other (OG)	<i>Passiflora herbertiana</i>		0.5	1	
Other (OG)	<i>Cayratia clematidea</i>		0.2	1	
Shrub (SG)	<i>Acacia floribunda</i>		5	5	
Shrub (SG)	<i>Hakea salicifolia</i>		3	5	
Shrub (SG)	<i>Acacia implexa</i>		2	5	
Shrub (SG)	<i>Indigofera australis</i>		0.5	1	
Shrub (SG)	<i>Polyscias sambucifolia</i>		0.5	2	
Shrub (SG)	<i>Solanum aviculare</i>		0.2	1	
Shrub (SG)	<i>Xylomelum pyriforme</i>		0.1	1	
Tree (TG)	<i>Banksia integrifolia</i>		15	N/A	
Tree (TG)	<i>Harpullia pendula</i>		5	1	
Tree (TG)	<i>Acacia decurrens</i>		4	2	
Tree (TG)	<i>Corymbia maculata</i>		0.5	1	
Exotic	<i>Hypoestes aristata</i>		10		
Exotic	<i>Cymbalaria muralis subsp. muralis</i>		2	100	
Exotic	<i>Plumbago auriculata</i>		1	1	
Exotic	<i>Sida rhombifolia</i>		1	30	
Exotic	<i>Conyza sumatrensis</i>		0.5	20	
Exotic	<i>Lactuca serriola</i>		0.2	10	
Exotic	<i>Cirsium vulgare</i>		0.2	10	
Exotic	<i>Euphorbia peplus</i>		0.1	20	
Exotic	<i>Cyperus involucratus</i>		0.1	2	

Exotic	<i>Solanum nigrum</i>	0.1	15
Exotic	<i>Aster subulatus</i>	0.1	1
Exotic	<i>Phyllanthus tenellus</i>	0.1	1
Exotic	<i>Lysimachia arvensis</i>	0.1	10
Exotic	<i>Modiola caroliniana</i>	0.1	1
DBH	# Tree Stems Count	# Hollow Bearing Trees	
80+cm	0	0	
50-79cm	0	0	
30-49cm	0	0	
20-29cm	Present	0	
10-19cm	Present	0	
5-9cm	Present	0	
<5cm	Present	0	
Length of Logs (m)		0	
BAM Attribute (1x1m)	Litter Cover (%)		
1 (5m)	100		
2 (15m)	5		
3 (25m)	15		
4 (35m)	1		
5 (45m)	100		
Average	44.2		
Growth Form	Composition Data	Structure Data	
	(Count of Native Cover)	(Sum of Cover)	
Tree	4	24.5	
Shrub	7	11.3	
Grass	7	21.7	
Forb	4	2.5	
Fern	1	0.1	
Other	3	1.7	
High Threat Exotics	3	1.6	



BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00025619/BAAS21006/21/00025622	Taronga RACC	10/06/2021
Assessor Name	Assessor Number	BAM Data version *
Jack Tatler	BAAS21006	45
Proponent Names	Report Created	BAM Case Status
Taronga Zoo	05/07/2021	Finalised
Assessment Revision	Assessment Type	Date Finalised
0	Major Projects	05/07/2021

* 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.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

PCTs With Customized Benchmarks

Assessment Id	Proposal Name
00025619/BAAS21006/21/00025622	Taronga RACC

BAM Biodiversity Credit Report (Like for like)

PCT

No Changes

Predicted Threatened Species Not On Site

Name

No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1778-Coastal sandstone foreshores forest	Not a TEC	0.1	0	2	2

1778-Coastal sandstone foreshores forest	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1778	Sydney Coastal Dry Sclerophyll Forests > =90%	1778_Classname1	No	2	Pittwater, Cumberland, Sydney Cataract, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Myotis macropus / Southern Myotis	1778_Classname1	0.1	2.00

Credit Retirement Options

Like-for-like credit retirement options

Myotis macropus / Southern Myotis	Spp	IBRA subregion
	Myotis macropus / Southern Myotis	Any in NSW



NARLA
environmental

Eastern Sydney Office

Unit 2, 6-7/8 Apollo Street
Warriewood
NSW 2102

Western Sydney Office

7 Twentyfifth Avenue
West Hoxton
NSW 2171

Hunter Valley Office

10/103 Glenwood Drive
Thornton
NSW 2322

www.narla.com.au

Ph: 02 9986 1295