Ecological Constraints Assessment

Former Manly Hospital

Report prepared by Narla Environmental Pty Ltd

for Development and Transactions, Property NSW, DPIE c/-COX Architecture

July 2020

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Report Certification

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Glossary

Acronym/ Term	Definition
asl	Above Sea Level
APZ	Asset Protection Zone: required to protect the proposed development from the effects of bushfire
BAM	Biodiversity Assessment Method
BDAR	Biodiversity Development Assessment Report
BC Act	Biodiversity Conservation Act 2016
BOS	Biodiversity Offset Scheme
BOM	Bureau of Meteorology
BV Map	Biodiversity Value Map
CEEC	Critically Endangered Ecological Community
DCP	Manly Development Control Plan 2013
Development	The use of land, and the subdivision of land, and the carrying out of a work, and the demolition of a building or work, and the erection of a building, and any other act, matter or thing referred to in section 26 that is controlled by an environmental planning instrument but does not include any development of a class or description prescribed by the regulations for the purposes of this definition (Environmental Planning and Assessment Act 1979)
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
ECA	Ecological Constraints Assessment
EEC	Endangered Ecological Community
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESD	Ecologically Sustainable Development
FFA	Flora and Fauna Assessment
ha	Hectare
km	Kilometre
KTP	Key Threatening Process (as listed in the BC Act)
LEP	Manly Local Environmental Plan 2013
LGA	Local Government Area
Locality	The area within a 10km radius of the Subject Site. The same meaning when describing a local population of a species or local occurrence of an ecological community
m	Metre
MNES	Mattes of National Environmental Significance
NPWS	NSW National Parks and Wildlife Services
NSW	New South Wales
OEH	Office of Environment and Heritage
PCT	Plant Community Type
Proposal	The development, activity or action proposed
SSD	State Significant Development. Assessed under division 4.7 of the EP&A Act 1979
SSI	State Significant Infrastructure

1. Introduction

1.1 Project Proposal

Narla Environmental Pty Ltd (Narla) was engaged by COX Architecture on behalf of Development and Transactions, Property NSW (the proponent) to prepare an Ecological Constraints Assessment (ECA) to determine the future development potential and ecological constraints of the Former Manly Hospital (hereafter collectively referred to as the 'Subject Site')(**Figure 1**) that is comprised of the following land parcels:

- Lot 2619/DP752038
- Lot 2727/DP752038
- Lot 2774/DP752038

The objectives of this Ecological Constraints Assessment were to assess all possible ecological constraints of the proposed activity to support a planning proposal and future site master planning to be undertaken for the Subject Site through the creation of a site-specific DCP, including to:

- Undertake background research to determine the likelihood for NSW and/or Commonwealth threatened biota to utilise or occur within the Subject Site during any point of their lifecycles;
- Establish the likelihood of occurrence of migratory species, threatened species, endangered populations and threatened ecological communities as listed under the BC Act and/or the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act);
- Identify and map the distribution of vegetation communities within the Subject Site and discuss patch size and condition;
- Detail any potential offset obligations in accordance with Stage 1 of the Biodiversity Assessment Method (BAM),
- Record presence and the extent of any priority weed infestations that require management by law;
- Determine ecological impacts or risks that may result due to any future works;
- Recommendation of any controls or additional actions to be taken to protect or improve environmental outcomes of the proposed works; and
- Recommend any controls or additional actions to be taken to protect or improve ecological / biodiversity values of the Subject Site.

Narla have produced this report in order to assess any potential impacts associated with the future use of the Subject Site and to recommend appropriate measures to mitigate any potential ecological impacts.

1.2 Site Description and Location

The Subject Site is located in the suburb of Manly which lies within the Northern Beaches Local Government Area (LGA). The site covers an area of approximately 4.66 ha and is currently zoned as 'SP2 – Infrastructure' and 'E2 – Environmental Conservation'. The Subject Site has been historically cleared and developed and currently contains a number of former hospital buildings and amenities within the site. The site is bounded by Darley Road to the north, the Health Infrastructure managed lot 2728 to the east and the Sydney Harbour National Park to the south.

1.2.1 Topography, Geology and Soils

The Subject Site is situated on a gentle south-west facing gradient. Elevation ranges between 72m above sea level (asl) in the north-east and 41m asl in the south-west of the site.

The Subject Site is mapped at the 1:100 000 scale as occurring on the transition between the North Head and Gymea Soil Landscapes (Chapman et al. 2009). Site investigation by Narla confirmed this pattern of geology and soils within the Subject Site.

Gymea Soil Landscape is typically characterised by undulating to rolling rises and low hills on Hawkesbury Sandstone. Local relief 20-80m, slopes 10-25%. Rock outcrop <25%. Broad convex crests, moderately inclined side-slopes with wide benches, localised rock outcrop on low broken scarps. The underlying geology reflects Hawkesbury Sandstone, which is a medium to coarse-grained quartz sandstone with minor shale and laminite lenses. Soils are generally shallow to moderately deep (30-100 cm) Yellow Earths and Earthy Sands on crests and inside of benches; shallow (<20 cm) Siliceous Sands on leading edges of benches; localised Gleyed Podzolic Soils and Yellow Podzolic Soils on shale lenses.

North Head Soil Landscape has been mapped to occur within the south-eastern corner of the Subject Site. This soil landscape is typically characteristic of elevated gently undulating dune fields of windblown sands on coastal headlands. Local relief <5m, slopes <15%. Rock outcrop is usually absent. Dunes and swales have often been reworked and may be difficult to distinguish. Drainage is mostly sub-surface. Soils are typically deep (>200 cm) Podzols overlying bedrock; buried Podzols; buried sandstone soils, occasional shallow (<50 cm) Siliceous Sands and Yellow Podzolic Soils on edge of this unit.

1.2.2 Hydrology

There are no mapped watercourses within the Subject Site. Stormwater runoff from the Subject Site flows south-east, eventually flowing into Collins Flat Beach, North Harbour.

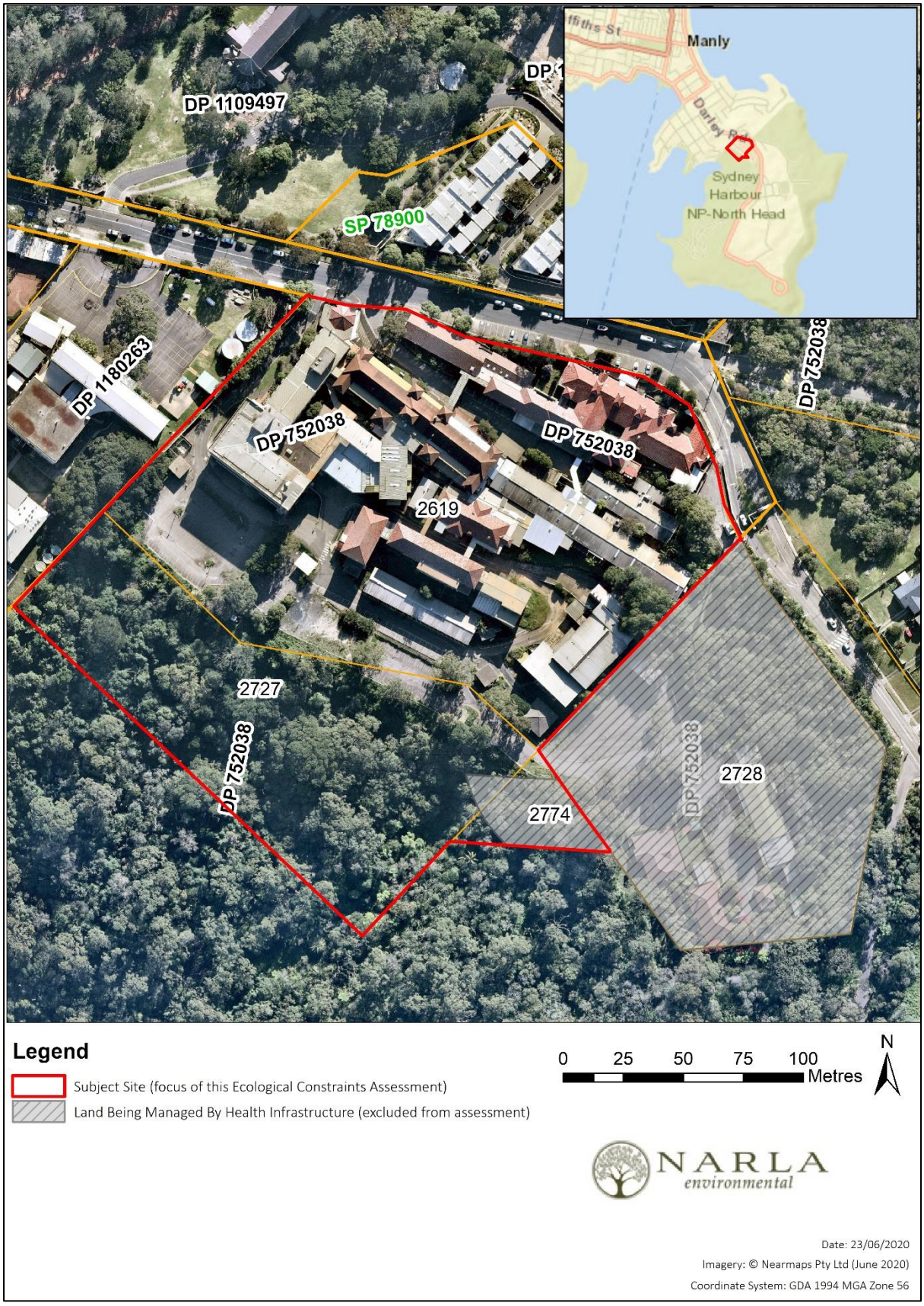

Figure 1. Location of the Subject Site

1.3 Biodiversity Assessment Pathway

The requirements of the BC Act 2016 and Biodiversity Conservation Regulation 2017 are mandatory for all future developments (DA) assessed pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) submitted in the Northern Beach Local Government Area.

The BC Act and its regulations stipulate clearing 'area threshold' values (**Table 1**) that determine whether a development is required to be assessed in accordance with the 'Biodiversity Offset Scheme' (BOS). Minimum entry thresholds for vegetation clearing depend on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan (LEP)), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP).

The current minimum lot size prescribed to the Subject Site is less than 1ha. To avoid triggering the Biodiversity Offset Scheme, the proponent must avoid the clearing/management of native vegetation in excess of 0.25 ha.

Table 1. Biodiversity Offset Scheme Entry Thresholds

Minimum lot size associated with the property	Threshold for clearing, above which the BAM and offsets scheme apply
Less than 1 ha	0.25 ha or more
1 ha to less than 40 ha	0.50 ha or more
40 ha to less than 1000 ha	1 ha or more
1000 ha or more	2 ha or more

Additionally, any future works conducted in mapped areas of 'High Biodiversity Value' (**Figure 2**) under the BC Act will automatically require the production of a Biodiversity Development Assessment Report (BDAR) and entry into the Biodiversity Offset Scheme.

1.3.1 Planning proposals and the Biodiversity Assessment Method

DPIE has provided the following guidance for all planning proposals where the Biodiversity Offset Scheme is likely to be triggered;

"if the planning proposal will facilitate future development at a particular site, and this development will result in biodiversity impacts that trigger the Biodiversity Offset Scheme, OEH recommends that biodiversity is assessed as part of the planning proposal using Stage 1 (as a minimum) of the Biodiversity Assessment Method. Application of the Biodiversity Assessment Method by an accredited person will identify the biodiversity values present on the site. Such information can be used and presented to inform decisions on avoiding and minimising potential biodiversity impacts within the site. It will also help to identify the biodiversity values that may require offsets for future development which can be considered in the plan making process. Implementation of Stage 1 of the Biodiversity Assessment Method will provide a solid foundation for the assessment of biodiversity impacts at the development application stage" (DPIE 2020).

As any future development within the site will likely exceed the BOS vegetation clearing threshold, this report has been prepared in accordance with Stage 1 of the BAM. Potential offset requirements associated with any future development within the site are outlined in **section 3.4**.

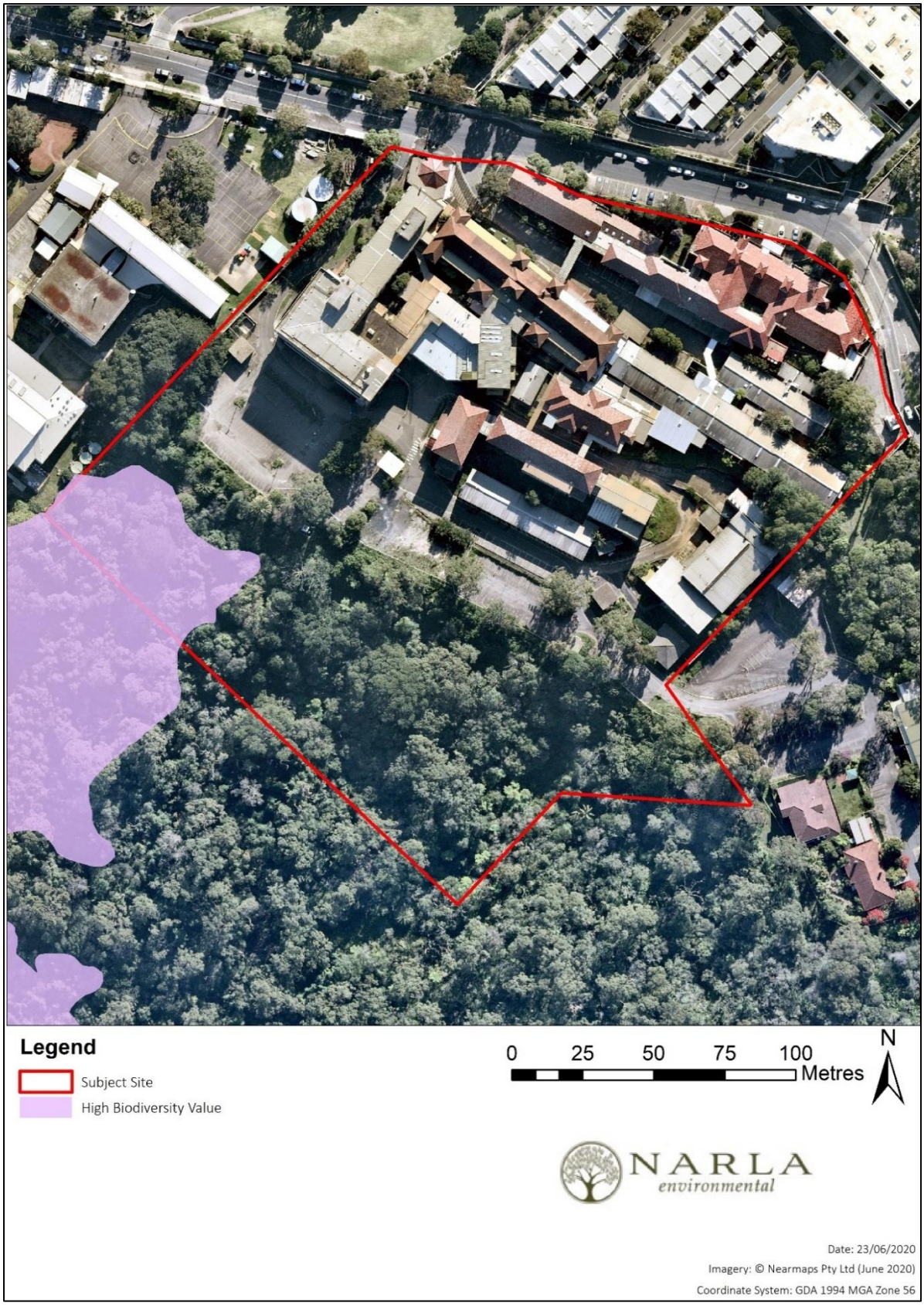

Figure 2. Biodiversity Values Mapping [Accessed 25/02/2020] (DPIE 2020)

1.4 Sources of Information Used

A thorough literature review of local information relevant to the locality and the Northern Beaches Local Government Area (LGA) was undertaken. Relevant literature that was reviewed in preparation of this report included:

- Relevant State and Commonwealth Databases
  - Protected Matters Search Tool (Commonwealth of Australia 2020)
  - NSW BioNet. The website of the Atlas of NSW Wildlife (DPIE 2020)
  - Atlas of Living Australia Spatial Portal (ALA 2020
- Soil Landscape Mapping
  - Soil landscapes of the Sydney 1:100,000 sheet (Chapman et al 2009)
- Vegetation Mapping
  - The Native Vegetation of the Sydney Metropolitan Area. Volume 1: Technical Report (OEH 2016b)
  - The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles (OEH 2016c)
- Council Documents
  - Manly Local Environmental Plan 2013
  - Manly Development Control Plan 2013
  - Priority weeds for the Greater Sydney (Northern Beaches Council) (DPI 2020)
- State and Federal Guidelines
  - Threatened Species Survey and Assessment: Guidelines for Developments and Activities. Working Draft. (DEC 2004)
  - NSW Guideline to Surveying Threatened Plants (OEH 2016a)
  - Guidelines for developments adjoining land managed by the Office of Environment and Heritage (OEH 2013)

Online databases and literature review were utilised to gain an understanding of the natural environment and ecology of the Subject Site and its surrounds to an area of approximately 10 km². This data was used to assist in establishing the presence or likelihood of any such ecological values as occurring on or adjacent the Subject Site and helped inform our Ecologist on what to look for during the site assessment.

1.5 Relevant Legislation and Policies

The following list of legislation and policies are addressed in this report.

Table 2. Relevant Legislation and Policies Addressed.

Legislation/ Policy	Relevant Ecological Feature on Site	Triggered	Action Required
Environmental Planning and Assessment Act 1979 (EP&A Act)	All features	Yes	This ecological assessment and all subsequent recommendations relevant to the planning process.
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	One (1) EPBC Act listed ecological communities were represented within the Subject Site: ▪ Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregion (Critically Endangered) Suitable habitat for several EPBC Act (Commonwealth) threatened fauna species is present.	Yes	A Biodiversity Development Assessment Report and entry into the Biodiversity Offset Scheme will be required to mitigate the potential impacts to all EPBC listed communities and threatened species found within the Subject Site. If it is deemed that a significant impact is likely to occur to any EPBC listed Communities or species then an EPBC referral will be required.
Biodiversity Conservation Act 2016 (BC Act)	One (1) BC Act listed ecological communities were represented within the Subject Site: ▪ Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregion (Endangered) In addition to the endangered ecological community found on site, two (2) BC Act listed threatened species were also found: ▪ *Perameles nasuta* North Head (Endangered Population) ▪ *Ninox strenua* (Vulnerable) Suitable habitat for several other BC Act (NSW) threatened fauna species is also present.	Yes	A Biodiversity Development Assessment Report and entry into the Biodiversity Offset Scheme will be required to mitigate the potential impacts to all native vegetation communities and threatened species found within the Subject Site.
Biosecurity Act 2015 (Bio Act)	The following Priority Weeds were identified on the site: ▪ *Anredera cordifolia* ▪ *Asparagus aethiopicus* ▪ *Asparagus plumosus* ▪ *Cestrum parqui* ▪ *Chrysanthemoides monilifera* ▪ *Lantana camara* ▪ *Olea europaea* subsp. *cuspidata*	Yes	Prohibition on dealings: *Must not be imported into the State or sold.* All priority weeds must be suppressed and eradicated from the Subject Site.
State Environmental Planning Policy (Koala Habitat Protection) 2019	This SEPP applies to land in the Northern Beaches LGA however, there is no land within the Subject Site that is identified on the Koala Development Application Map and therefore this SEPP does not apply.	No	None
State Environmental Planning Policy (Coastal Management) 2018)	Areas mapped as Littoral Rainforest and Proximity to Littoral Rainforest are present within the Subject Site.	Yes	The provisions of the Coastal Management SEPP relating to the development within 100m of mapped Littoral Rainforest are applicable to any future works within the Subject Site.

Legislation/ Policy	Relevant Ecological Feature on Site	Triggered	Action Required
Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005	The Subject Site is located within the "Foreshores and Waterways Area Boundary" to which this SREP applies.	Yes	Any future proposed development must take into account the objectives of the SREP as discussed in section 3.6.5.
National Parks and Wildlife Act 1974	The Subject Site is located on land that borders Sydney Harbour National Park.	Yes	An assessment will need to be included within any future development proposal against the guidelines for developments adjoining land managed by DPIE

1.6 Manly Local Environmental Plan

1.6.1 Zoning

The Subject Site is currently zoned as 'SP2 – Infrastructure' and 'E2 – Environmental Conservation'. The development must satisfy the zone objectives of the LEP, including:

Objectives of zone 'SP2 – Infrastructure':

- To provide for infrastructure and related uses;
- To prevent development that is not compatible with or that may detract from the provision of infrastructure; and
- To minimise loss of views to, from and within heritage items and minimising intrusion on the heritage landscape and visual curtilage of heritage items.

Objectives of zone 'E2 – Environmental Conservation':

- To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values; and
- To prevent development that could destroy, damage or otherwise have an adverse effect on those values.

1.6.2 Terrestrial Biodiversity

The Subject Site is identified as 'Biodiversity' on the Terrestrial Biodiversity Map (Northern Beaches Council 2013).

The objective of this clause is to maintain terrestrial biodiversity by:

- Protecting native fauna and flora;
- Protecting the ecological processes necessary for their continued existence; and
- Encouraging the conservation and recovery of native fauna and flora and their habitats.

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

Whether the development is likely to have:

- Any adverse impact on the condition, ecological value and significance of the fauna and flora on the land;
- Any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna;
- Any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land; and

- Any adverse impact on the habitat elements providing connectivity on the land.
- Any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

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

- The development is designed, sited and will be managed to avoid any significant adverse environmental impact;
- If that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact; and
- If that impact cannot be minimised—the development will be managed to mitigate that impact.

2. Methodology

2.1 Desktop Assessment and Literature Review

A thorough literature review of local information relevant to the ecology and natural environment of the locality and requirements of the Northern Beaches Council was undertaken. Online databases were utilised to obtain threatened species and biodiversity data recorded from or modelled within the Subject Site and their surrounds to 10km radius.

Searches utilising NSW Wildlife Atlas (BioNet) and the Commonwealth Protected Matters Search Tool were conducted to identify all current threatened and migratory flora and fauna records within a 10 km² search area centred on the Subject Site. This data was used to assist in establishing the presence or likelihood of any such ecological values as occurring on or adjacent to the Subject Site and helped inform our Ecologist on what to look for during the site assessment. The following documents were also reviewed as part of the preparation of this report:

- Manly Local Environmental Plan 2013;
- Manly Development Control Plan 2013;
- The Native Vegetation of the Sydney Metropolitan Area – Volume 1: Technical Report (OEH 2016b); and
- The Native Vegetation of the Sydney Metropolitan Area – Volume 2: Vegetation Community Profiles (OEH 2016c).

Soil landscape and geological mapping were examined to gain an understanding of the environment on the Subject Site and assist in determining whether any threatened flora or ecological communities may occur there (Chapman et al 2009).

2.2 Ecological Site Assessment

The following sections of this report detail the site assessment undertaken by Narla Environmental including the survey methods and the weather conditions experienced in the lead-up and during each assessment.

2.2.1 General Survey

An initial site assessment was undertaken by Narla Environmental Ecologists, Alexander Graham and Emily Benn on 16th and 17th February 2018. A further site assessment was carried out by Chris Moore and Polina Zadorojnaya on 19th February 2020 and again on the 18th June 2020.

During the site assessment, the following activities were undertaken:

- Identifying and recording the vegetation communities present on the Survey Area, with focus on identifying any Threatened Ecological Communities (TEC);
- Conducting the appropriate amount of Vegetation Integrity Survey Plots in accordance with Stage 1 of the BAM;
- Recording a detailed list of flora species encountered on the Survey Area, with a focus on threatened species, species diagnostic of threatened ecological communities and priority weeds;
- Recording opportunistic sightings of any fauna species seen or heard on or within the immediate surrounds of the Subject Site;
- Identifying and recording the locations of notable fauna habitat such as important nesting, roosting or foraging microhabitats;
- Targeting the habitat of any threatened and regionally significant fauna including:
    - Tree hollows (habitat for threatened large forest owls, parrots, cockatoos and arboreal mammals);
    - Caves and crevices (habitat for threatened reptiles, small mammals and microbats);
    - Termite mounds (habitat for threatened reptiles);

- Soaks (habitat for threatened frogs);
- Wetlands (habitat for threatened fish, frogs and water birds);
- Drainage lines (habitat for threatened fish and frogs);
- Fruiting trees (food for threatened frugivorous birds and mammals);
- Flowering trees (food for threatened nectivorous mammals and birds);
- Trees and shrubs supporting nest structures (habitat for threatened birds and arboreal mammals);
- Logs, bark and artificial debris (habitat for threatened frogs, reptiles and snails);
- Any other habitat features that may support fauna (particularly threatened) species; and
- Assessing the connectivity and quality of the vegetation within the Subject Site and surrounding area.

2.2.2 Weather Conditions Prior and During the General Survey

A summary of the prevailing weather conditions during the Subject Site surveys and the lead-up to the surveys are presented (**Table 3**). This data was collected from the nearest weather station 'Sydney Harbour' (BOM 2020). The consistent rainfall leading up to the most recent site visit made for ideal conditions for the survey of threatened flora and fauna.

Table 3. Weather Conditions Taken from the Nearest Weather Station (Sydney Harbour) Preceding and During the Field Survey (BOM 2020) (Survey dates in bold).

Date	Day	Minimum Temp. °C	Maximum Temp. °C	Rainfall (mm)
08/02/2018	Thursday	21.9	26.9	0
09/02/2018	Friday	22.1	25.8	0
10/02/2018	Saturday	21.8	28.3	0
12/02/2018	Monday	22.2	25.6	0
13/02/2018	Tuesday	23.0	26.0	0
14/02/2018	Wednesday	23.6	28.9	0
15/02/2018	**Thursday**	**21.8**	**24.9**	**0**
16/02/2018	**Friday**	**21.4**	**27.2**	**0**
13/02/2020	Thursday	20.9	27.5	14.8
14/02/2020	Friday	21.1	25.5	0
15/02/2020	Saturday	18.5	26.3	0
16/02/2020	Monday	20.1	25.0	1.2
17/02/2020	Tuesday	20.2	24.8	1.2
18/02/2020	Wednesday	20.8	31.8	0.4
19/02/2020	**Thursday**	**20.3**	**30.4**	**13.0**
12/06/2020	Thursday	14.3	17.5	0
13/06/2020	Friday	14.3	19.8	5.4
14/06/2020	Saturday	15.1	21.5	9.6
15/06/2020	Monday	10.5	19.6	0
16/06/2020	Tuesday	12.5	20.4	0
17/06/2020	Wednesday	13.7	18.1	0
18/06/2020	**Thursday**	**14.4**	**19.1**	**2.4**

2.3 Vegetation Community Assessment

An initial desktop assessment using aerial imagery, geological mapping, soil-landscape mapping and topographic mapping, in addition to existing vegetation mapping (OEH 2016b; OEH 2016c) was used to stratify the Subject Site into distinct stratigraphic units.

The following document was consulted during the assessment to assist identification of the historically mapped vegetation communities present within the Subject Site:

- The Native Vegetation of the Sydney Metropolitan Area – Volume 1: Technical Report (OEH 2016b); and
- The Native Vegetation of the Sydney Metropolitan Area – Volume 2: Vegetation Community Profiles (OEH 2016c).

The determinations of each vegetation community were based on desktop and field analysis of the geomorphology and geology of the Survey Area, in addition to a quantitative analysis of the positive 'diagnostic' flora species (OEH 2016b; OEH 2016c) identified in each discrete vegetation patch within the Subject Site.

2.4 Preliminary Targeted Threatened Flora and Fungi Surveys

Preliminary targeted surveys were undertaken within the Subject Site to identify locations of any threatened flora or fungi species known or predicted to occur within the locality. Narla Environmental undertook targeted surveys for all threatened flora with potential to occur, with effort focused on all flora listed in **Table 4.**

Targeted surveys were undertaken in accordance with the 'NSW Guide to Surveying Threatened Plants (OEH 2016a) with maximum effort directed toward sampling areas with suitable habitat. The preliminary survey was restricted to the time of the Site Assessments and may not have coincided with the DPIE required survey timetable for certain species.

Any tentative threatened species found were photographed and specimens were taken for identification utilising formal keys. Where necessary, this involved the use of a microscope. Any confirmed or plausible specimens identified were GPS tagged for future reference. Where identification of plausible specimens could not be made with absolute confidence by Narla Ecologists, specimens were collected and sent to the National Herbarium for expert identification.

Table 4. Optimal Survey Periods for the Threatened Flora and Fungi Species Targeted (DPIE 2020).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acacia terminalis subsp. terminalis (Sunshine Wattle)		√				√						
Allocasuarina portuensis (Nielsen Park She-oak)		√				√						
Asterolasia elegans (White-flowered Wax Plant)		√				√						
Callistemon linearifolius (Netted Bottle Brush)		√				√						
Camarophyllopsis kearneyi		√				√						
Chamaesyce psammogeton (Sand Spurge)		√				√						

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cryptostylis hunteriana (Leafless Tongue Orchid)		√				√						
Darwinia biflora (Mountain Double Bell)		√				√						
Epacris purpurascens var. purpurascens		√				√						
Eucalyptus camfieldii (Camfield's Stringybark)		√				√						
Genoplesium baueri (Bauer's Midge Orchid)		√				√						
Grammitis stenophylla (Narrow-leaf Finger Fern)		√				√						
Grevillea caleyi (Caley's Grevillia)		√				√						
Hygrocybe anomala var. ianthinomarginata		√				√						
Hygrocybe aurantipes		√				√						
Hygrocybe austropratensis		√				√						
Hygrocybe collucera		√				√						
Hygrocybe griseoramosa		√				√						
Hygrocybe lanecovensis		√				√						
Hygrocybe reesiae		√				√						
Hygrocybe rubronivea		√				√						
Lasiopetalum joyceae (Joyce's Lasiopetalum)		√				√						
Melaleuca deanei (Deane's paper Bark)		√				√						
Melaleuca biconvexa (Biconvex Paperbark)		√				√						
Microtis angusii (Angus's Onion Orchid)		√				√						

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pimelea curviflora var. curviflora		√				√						
Rhodamnia rubescens (Scrub Turpentine)		√				√						
Rhodomyrtus psidioides (Native Guava)		√				√						
Syzygium paniculatum (Magenta Lilly Pilly)		√				√						
Tetratheca glandulosa (Glandular Pink bell)		√				√						
KEY	Survey Period						Time of Survey = √					

2.5 Preliminary targeted Fauna Surveys

With the considerable possibility that a suite of threatened animals could occur within the Subject Site, Narla Environmental performed preliminary specialised surveys to target such animals, as summarised in **Table 5**. These targeted surveys were undertaken during the same period as general fauna surveys during 16th February 2018 and 6th March 2018.

Table 5. Summary of Threatened Species Target Survey Techniques Utilised.

Species	Primary Technique	Secondary Technique
Eastern Pygmy-possum	Automated wildlife cameras aimed at potential foraging habitat	Habitat assessment – presence or absence of potential foraging resources
Grey-headed Flying Fox	Habitat assessment - presence or absence of potential foraging resources	Scat/pellet searches
Squirrel Glider	Automated wildlife cameras aimed at potential foraging habitat	Habitat assessment – presence or absence of potential foraging resources
Long-nosed Bandicoot	Automated wildlife cameras aimed at potential foraging habitat	Habitat assessment – presence or absence of potential foraging resources
All locally occurring Vulnerable Microbats	Automated, passive ultrasonic bat recording device aimed at potential fly-ways	Habitat assessment - presence or absence of tree hollows or deep rock crevices

Species	Primary Technique	Secondary Technique
Powerful Owl	Habitat assessment – breeding, roost and nesting	-

2.5.1 Automated Wildlife Cameras

A total of five (5) automated wildlife cameras were deployed across the Subject Site for a total of eighteen (18) nights, from 16th February 2018 to 6th March 2018. Cameras were installed within two different habitat areas depending on target species.

Three (3) cameras were set on tree trunks at ground level, to target ground-dwelling species such as the Long-Nosed Bandicoot. These cameras were aimed at lures (mixed peanut butter, honey and oat bait). Two (2) cameras were installed facing *Banksia ericifolia* flowers sprayed with a mixture of honey and water to attract Eastern Pygmy-possum and Squirrel Glider.

2.5.1 Microbat Acoustic Monitors

One bat acoustic monitor (Song Meter SM4 Bat) was installed within habitat most likely to be utilised by microbats. The SM4 was directed at a flyway within sandstone outcropping that contained several small crevices. The unit was deployed within the field for a total of eighteen (18) nights from 16th February 2018 to 6th March 2018. Analysis of the collected data was undertaken by bat acoustics specialist Peter Knock (2018).

2.5.2 Opportunistic Sightings and Analysis of Scats, Tracks and Traces

During all site visits throughout the project, opportunistic fauna observations including sightings, scats, tracks, characteristic scrapes on trees, burrows and bones were collected. These were identified within the site, and/or used as focus areas to position additional targeted survey techniques to determine species presence.

2.5.3 Weather Conditions During Targeted Fauna Survey efforts

Weather conditions recorded at the nearest weather station (Sydney Harbour) during the time the wildlife cameras and acoustic monitors were deployed is provided in **Table 6** (BOM 2018). The minimal rainfall whilst the cameras and monitors were deployed, made for ideal conditions as targeted species would be expected to be foraging at night time as opposed to sheltering from adverse weather.

Table 6. Weather Conditions in Sydney Harbour Preceding and During the Wildlife Camera Deployment Periods (Deployment and retrieval days are in bold).

Date	Day	Minimum Temp. °C	Maximum Temp. °C	Rainfall (mm)
16/02/2018	**Friday**	**21.4**	**27.2**	**0**
17/02/2018	Saturday	22.4	24.4	0
18/02/2018	Sunday	22.2	25.1	0
19/02/2018	Monday	23.4	26.2	0
20/02/2018	Tuesday	20.9	21.8	0
21/02/2018	Wednesday	18.4	23.4	0
22/02/2018	Thursday	19.0	23.7	0
23/02/2018	Friday	21.1	24.3	0

Date	Day	Minimum Temp. °C	Maximum Temp. °C	Rainfall (mm)
24/02/2018	Saturday	21.5	25.4	0
25/02/2018	Sunday	22.7	22.8	0
26/02/2018	Monday	17.7	22.0	46.2
27/02/2018	Tuesday	17.6	23.0	3.6
28/02/2018	Wednesday	17.5	26.0	0
01/03/2018	Thursday	20.3	23.7	0
02/03/2018	Friday	19.5	23.4	0
03/03/2018	Saturday	20.1	25.0	0
04/03/2018	Sunday	21.6	23.1	0
05/03/2018	Monday	21.2	23.3	0
06/03/2018	**Tuesday**	**18.8**	**22.7**	**8.4**

2.6 Study Limitations

The timing of the survey may not have coincided with emergence times of some species of flora and fauna, such as seasonally flowering herbs and orchids, seasonal migratory fauna or nocturnal fauna. No targeted fauna survey was undertaken during this assessment as these items were outside the scope of works.

3. Results and Discussion

Following desktop analysis and site assessment, Narla were satisfied that the future development within the Subject Site could be achieved with minimal ecological impact, subject to following the recommendations within this report. Significant development constraints are confined to areas of the CEEC Littoral Rainforest.

3.1 Vegetation Communities within the Subject Site

3.1.1 Historical Vegetation Mapping

Office of Environment and Heritage NSW (OEH 2016a; 2016b) Native Vegetation of the Sydney Metropolitan Area mapping indicates the presence of two (2) PCTs represented within the Subject Site:

- S_DSF06 Coastal Sandstone Foreshore Forest (PCT 1778: Smooth-barked Apple - Coast Banksia / Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney); and
- S_RF07 Coastal Escarpment Littoral Rainforest (PCT 1833: Lilly Pilly - Cabbage Tree Palm littoral rainforest on escarpment slopes and gullies of the Sydney basin).

3.1.2 Field-validated Vegetation Mapping

Vegetation within the Subject Site was in low-moderate condition with large areas of dense weed infestations. Field surveys conducted by Narla Environmental Ecologists confirmed the presence of the two (2) historically mapped PCTs within the Subject Site (**Figure 3**), including:

- PCT 1833: Lilly Pilly – Cabbage Tree Palm littoral rainforest on escarpment slopes and gullies of the Sydney Basin; and
- PCT 1778: Smooth-Barked Apple – Coast Banksia/Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney.

Details of the vegetation, including a floristic and structural description are presented in **Table 7**.

Table 7. Description of Vegetation Communities Found Within the Subject Site.

PCT 1833: Lilly Pilly – Cabbage Tree Palm littoral rainforest on escarpment slopes and gullies of the Sydney Basin	
	
Vegetation Formation / Keith Class	Rainforest / Littoral Rainforest
Condition of PCT	<u>Low</u> Exotic vegetation was dominant through this PCT
Extent within Subject Site (approximate)	0.2 ha
Description in Subject Site	
The littoral rainforest located within the Subject Site was in Low condition, with only select remnant species such as *Glochidion ferdinandi, Pittosporum undulatum* and *Breynia oblongifolia* present. The area was dominated by exotic vegetation and had experienced sections of historic clearing.	

PCT 1833: Lilly Pilly – Cabbage Tree Palm littoral rainforest on escarpment slopes and gullies of the Sydney Basin		
Description from OEH (2016b)		
Coastal Escarpment Littoral Rainforest is found on protected escarpment slopes and gullies along the New South Wales coast. It prefers clay soils that derive either from shale layers in sandstone bedrock or from down-slope enrichment from shale capping above. Unlike other rainforests in the Sydney area, it can occur some distance from the sea in protected situations at the foot slopes of major scarps or in deep, protected harbour gullies. Inland sites are all exposed to maritime influences arising from low-lying harbour-side positions or from strong sea breezes that blow across the coastal plain. Depending on the degree of exposure the rainforest canopy may be tall or wind-sheared and at some sites may have a sparse cover of emergent eucalypts. The floristic composition of this rainforest reflects both littoral and warm temperate influences. Lilly Pilly (*Acmena smithii*), cabbage tree palm (*Livistona australis*), sweet pittosporum (*Pittosporum undulatum*), scentless rosewood (*Synoum glandulosum*) and cheese tree (*Glochidion ferdinandi*) are the most frequently recorded trees although a wide variety of other rainforest species are encountered less consistently. Coachwood (*Ceratopetalum apetalum*), a tree species commonly recorded in sandstone warm temperate rainforests, is infrequently recorded here. The ground is a cover of ferns, broken only by fallen trees and rock outcrops. A diversity of vines and climbers are present between the upper canopy and the forest floor. The community is found up to four kilometres from the coastline but only where mean annual rainfall exceeds 1200 millimetres and elevation is less than 140 metres above sea level.		
Justification of PCT Assignment	Characteristic Flora Species	A total of five (5) species were characteristic of this PCT. Species included *Pittosporum undulatum, Glochidion ferdinandi, Breynia oblongifolia, Homalanthus populifolius* and *Oplismenus imbecilis.*
	Geography and Other	The community is present on sheltered slopes of the lower Hacking River, the Sydney eastern suburbs escarpment, the Warringah escarpment and Pittwater peninsula. It occurs between Newcastle and Batemans Bay in the Sydney Basin Bioregion.
Scientific Reference from VIS (DPIE 2019)		OEH (2013) The Native Vegetation of the Sydney Metropolitan Area Version 2.0 NSW Office of Environment and Heritage Sydney
TEC Status (Biodiversity Conservation Act 2016)		The extent of this PCT on the Subject Site forms part of the Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community.
Estimate of Percent Cleared Value of PCT		68%

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 Formation / Keith Class	Dry Sclerophyll Forests (Shrubby sub-formation) / Sydney Coastal Dry Sclerophyll Forests
Condition of PCT	<u>Low-Moderate</u> Exotic vegetation was dominant through this PCT with a few emergent native species present
Extent within Subject Site (approximate)	1.6 ha
Description in Subject Site	
The vegetation present was primarily composed of high-density exotic weeds with scattered natives including *Angophora costata, Eucalyptus botryoides*, Banksia Integrifolia and *Glochidion ferdinandi*. The understory is comprised of *Pteridium esculentum, Gleichenia dicarpa* and mixed exotic weeds.	

<table>
<tr><th colspan="3">PCT 1778: Smooth-Barked Apple – Coast Banksia/Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney</th></tr>
<tr><th colspan="3">Description from OEH (2016b)</th></tr>
<tr><td colspan="3">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 (Angophora costata), though more regularly this is found in combination with other tree species. Localised patches of bangalay (Eucalyptus botryoides) and coast banksia (Banksia integrifolia) occur closest to the coast, whereas Sydney peppermint (Eucalyptus piperita) and blackbutt (Eucalyptus pilularis) 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 (Pittosporum undulatum), cheese tree (Glochidion ferdinandi) and blueberry ash (Elaeocarpus reticulatus). 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.</td></tr>
<tr><td rowspan="3">Justification of PCT Assignment</td><td rowspan="2">Characteristic Flora Species</td><td>The Subject Site contained two (2) characteristic canopy species of PCT 1778 including Banksia integrifolia and Eucalyptus botryoides.</td></tr>
<tr><td>A total of 10 species were characteristic of this PCT including: Angophora Costata, Eucalyptus Botryoides, Banksia integrifolia Allocasuarina littoralis, Acacia longifolia, Dianella caerulea, Dodonaea triquetra, Glochidion ferdinandi, Lomandra longifolia, and Pittosporum undulatum.</td></tr>
<tr><td>Geography and Other</td><td>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. The Subject Site is located on Hawkesbury</td></tr>
<tr><td colspan="2">Scientific Reference from VIS (DPIE 2019)</td><td>OEH (2013) The Native Vegetation of the Sydney Metropolitan Area Version 2.0 NSW Office of Environment and Heritage Sydney</td></tr>
<tr><td colspan="2">TEC Status (Biodiversity Conservation Act 2016)</td><td>There are currently no TECs associated with PCT 1778.</td></tr>
<tr><td colspan="2">Estimate of Percent Cleared Value of PCT</td><td>90%</td></tr>
</table>

Urban Exotic/Native	
	
Condition of Vegetation on Subject Site	<u>NA</u> The community present within the Subject Site was comprised of a mixture of exotic and native vegetation, historic planted within garden beds surrounding the existing infrastructure.
Extent within Subject Site (approximate)	0.3 ha

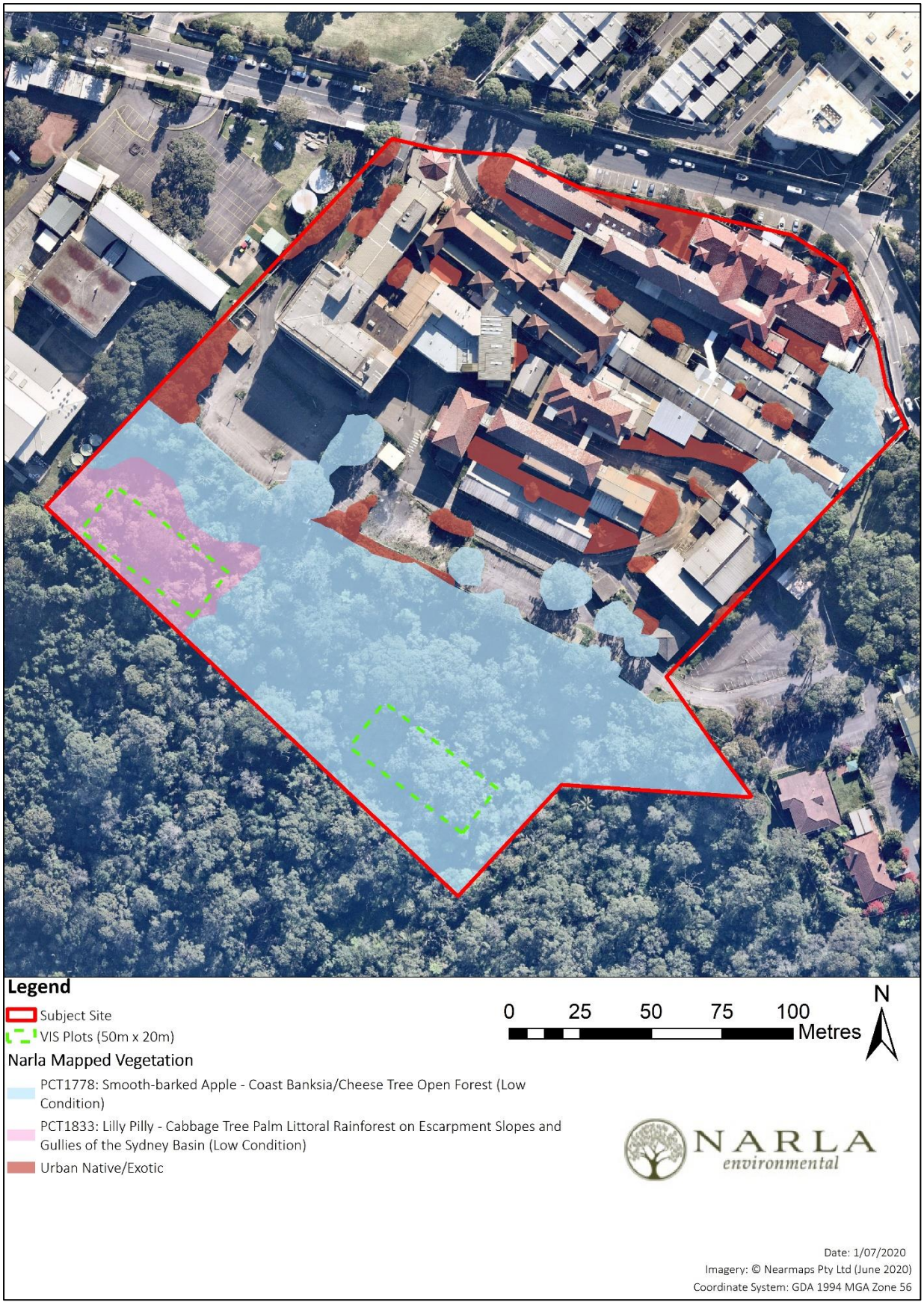

Figure 3. Narla Field-validated Vegetation Communities

3.2 Threatened Flora

Desktop analysis revealed a range of threatened flora as occurring or having the potential to occur on or within a 10km search area of the Subject Site. Searches were undertaken throughout the Subject Site for potentially occurring threatened flora (**Table 4**).

Two (2) BC and EPBC listed threatened flora species were identified during the assessment within the adjoining lot being managed by Health Infrastructure (Lot 2728) outside of the Subject Site:

- *Acacia terminalis* subsp. *terminalis* (Sunshine Wattle) (**Photo Plate 1; Figure 4**); and
- *Syzygium paniculatum* (Magenta Lilly Pilly) (**Photo Plate 2; Figure 4**).

Photo Plate 1. *Acacia terminalis subsp. terminalis* recorded within the adjoining lot.

Photo Plate 2. *Syzygium paniculatum* recorded within the adjoining lot.

3.3 Threatened Fauna

The desktop analysis and site habitat assessment revealed a suite of threatened fauna species had potential to utilise habitat within the Subject Site during part of their lifecycles. *Ninox strenua* (Powerful Owl) was confirmed within the Subject Site (**Photo Plate 3; Figure 4**). A breeding pair were observed roosting within the south-west of the Subject Site, approximately 20m south from a carpark, in a *Ficus rubiginosa* (Port Jackson Fig) covered with a dense infestation of *Anredera cordifolia* (Madeira vine), that provided ample shelter and refuge during daylight hours.

Photo Plate 3. Powerful Owl Recorded Within Subject Site.

Perameles nasuta (Long-nosed Bandicoot) were also recorded throughout the Subject Site **(Photo Plate 4; Figure 4**). This species is listed under the BC Act as an Endangered Population in North Head.

Photo Plate 4. Long-Nosed Bandicoot Recorded Within Subject Site.

Figure 4. Threatened species located within and around the Subject Site.

3.3.1 Threatened Fauna Habitat

A suite of foraging habitat, including fruit and flower-bearing trees may provide valuable foraging habitat for locally resident and nomadic fauna, including:

- *Pteropus poliocephalus* (Grey-headed Flying Fox);
- *Petaurus norfolcensis* (Squirrel Glider);
- *Lathamus discolor* (Swift Parrot) and *Glossopsitta pusilla* (Little Lorikeet) which may feed on the flowering *Eucalyptus robusta* and *Eucalyptus botryoides*; and
- *Calyptorhynchus lathami* (Glossy Black-Cockatoo) due to the presence of *Casuarina glauca* and *Allocasuarina littoralis* trees within the Subject Site.

3.3.2 Microchiropteran Bats

The Subject Site may be utilised by a number of threatened insectivorous microchiropteran bats given the presence of hollow-bearing trees and/or stags (dead tree) and rock crevice habitat within the Subject Site, likelihood of occurrence is considered low however due to the small amount of habitat available within the Subject Site. Despite this, the Subject Site may provide suitable habitat for threatened hollow-roosting and cave dwelling microchiropteran bats including:

- *Mormopterus norfolkensis* (Eastern Freetail-bat);
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat);
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle);
- *Chalinolobus dwyeri* (Large-eared Pied Bat);
- *Miniopterus australis* (Little Bentwing-bat);
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat)
- *Myotis macropus* (Southern Myotis); and
- *Scoteanax rueppellii* (Greater Broad-nosed Bat).

3.3.3 Birds

Small-medium sized mammals and birds within the Subject Site may attract foraging predatory birds including:

- *Ninox connivens* (Barking Owl);
- *Tyto novaehollandiae* (Masked Owl);
- *Ninox strenua* (Powerful Owl) (confirmed on-site);
- *Lophoictinia isura* (Square-tailed Kite);
- *Haliaeetus leucogaster* (White-bellied Sea Eagle), and
- *Hieraaetus morphnoides* (Little Eagle).

3.4 Potential Offset Requirement Associated with Future Use of the Subject Site

3.4.1 Vegetation Integrity Survey (VIS) Plots

Two (2) BAM VIS Plots were undertaken to assess the determine the integrity score of the vegetation within the Subject Site. Plot data gathered for each attribute used to assess the vegetation function within the Subject Land is detailed in **Appendix C.** Vegetation Integrity (VI) scores represented by existing vegetation is detailed in **Table 8.**

Table 8. Vegetation integrity scores for each identified PCT and potential future offset requirements.

PCT	Area (ha)	Survey Effort	Composition Condition Score	Structure Condition Score	Function Condition Score	VI Score	Cost Per Credit (excl gst; only accurate of 26/06/2020)
PCT 1778: Smooth-Barked Apple – Coast Banksia/Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney	1.6 ha	One 1000m (20x50m) VIS plot	24.6	31.4	93.7	41.7	$13,762.61
PCT 1833: Lilly Pilly – Cabbage Tree Palm littoral rainforest on escarpment slopes and gullies of the Sydney Basin	0.2 ha	One 1000m (20x50m) VIS plot	4.7	9	66.1	14.1	$9,386.68

Note: Price per credit is only accurate at the time of calculation (26/06/2020) prices are subject to change. This price only accounts for 1 credit for each candidate PCT, the exact number of credits required to be offset can only be calculated during an official impact assessment where the exact area of impact is known as the amount credits are generated by the condition of the PCT as well as the area of impact. In a future Biodiversity Development Assessment Report, it is likely that more than 1 credit will be generated and required to be offset.

3.4.2 Candidate Species Credit Species Summary

This section provides a summary of the candidate species credit fauna and flora species for the Subject Site derived from BAMC (DPIE 2019b). All species identified within **Table 9** that are deemed likely to occur within the Subject Site will require assessment and targeted survey in accordance with the DPIE assessment guidelines for any future development in which the Biodiversity Offset Scheme is triggered.

Table 9. BAMC generated candidate Species Credit species and their targeted survey requirements.

Scientific Name	Include in Future Assessment?	Targeted Survey requirements	DPIE approved Survey Period	Biodiversity Risk Weighting	Cost Per Credit (excl gst; only accurate of 26/06/2020)
Allocasuarina portuensis Nielsen Park She-Oak	Yes. The Subject Site is located east of the Gladesville Bridge and within 5km of the Sydney Harbour foreshore which is the geographical range for this species.	Field survey in accordance with DPIEs Surveying threatened plants and their habitats guidelines (DPIE 2020)	All Year	Very High - 3	$744.06
Anthochaera phrygia Regent Honeyeater (Breeding)	No. There are no mapped areas of important Regent Honeyeater habitat located within the Subject Site. Therefore, this species will not require future assessmen.t	NA	NA	NA	NA
Callocephalon fimbriatum – endangered population Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	No. The Subject Site is not located within either the Hornsby or Ku-ring-gai Local Government Area and therefore, this endangered population does not require assessment.	NA	NA	NA	NA
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	Yes. This species is known to breed in Eucalypt trees with hollows greater than 15cm diameter (DPIE 2020e. As such	On site survey, for breeding pairs during breeding season.	April - August	High – 2	$680.71

Scientific Name	Include in Future Assessment?	Targeted Survey requirements	DPIE approved Survey Period	Biodiversity Risk Weighting	Cost Per Credit (excl gst; only accurate of 26/06/2020)
	habitat was located within the Subject Site, this species will require assessment.				
Camarophyllopsis kearneyi	Yes. This Subject Site is located within 500m of a waterbody and within 500m of semi wet areas, therefore this species will require assessment.	Survey seven (7) days after at least 40mm rain over a 2week period (DPIE 2020).	May - June	Very High - 3	$312.38
Cercartetus nanus Eastern Pygmy-possum	Yes. Due to the presence of hollow bearing trees within the Subject Site in conjunction with suitable foraging habitat this species will require assessment.	Baited wildlife cameras for a minimum of seven (7) nights and two (2) nights spotlighting	Oct - March	High - 2	$935.14
Chalinolobus dwyeri Large-eared Pied Bat	Yes. The known habitat for this species is any area within 2km of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices or within 2kms of old mines or tunnels. As such habitat is located within 2km of the Subject Land, this species will require assessment.	Four (4) harp traps over a minimum of four (4) nights, and four (4) acoustic detection devices over a minimum of four (4) nights (OEH 2018).	Nov - January	Very High - 3	$1,075.65
Eudyptula minor – endangered population Little Penguin in the Manly Point Area	Yes. The Subject Site is located within the proximity of the Manly Point Area and therefore, will require assessment.	Baited wildlife cameras for a minimum of seven (7) nights and two (2) nights spotlighting.	June - Feb	High - 2	$2,403.79
Grammitis stenophylla Narrow-leaf Finger Fern	Yes. This species is known to inhabit moist places, usually near streams, on rocks or in trees in rainforest and moist eucalypt	Field survey in accordance with DPIEs Surveying threatened	All Year	High - 2	$660.94

Scientific Name	Include in Future Assessment?	Targeted Survey requirements	DPIE approved Survey Period	Biodiversity Risk Weighting	Cost Per Credit (excl gst; only accurate of 26/06/2020)
	forest. As such habitat exists within the Subject Site this species will require assessment.	plants and their habitats guidelines (DPIE 2020)			
Haliaeetus leucogaster White-bellied Sea-Eagle (Breeding)	This species requires living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines. As such habitat was present within the Subject Site, this species will require assessment.	Site walkover checking for large stick nests during breeding season.	July - Dec	High – 2	$312.38
Heleioporus australiacus Giant Burrowing Frog	Yes. This species is found in found in heath, woodland and open dry sclerophyll forest on a variety of soil types. As such habitat was located within the Subject Site this species will require assessment.	Site transects and call play back over two (2) nights following heavy rain (OEH 2009)	Sep - May	Moderate – 1.5	$935.14
Hieraaetus morphnoides Little Eagle (Breeding)	Yes. This species required living or dead large old trees to nest in. As such habitat was found within the Subject Site this species will require assessment.	Site walkover checking for large stick nests during breeding season.	Aug - Oct	Moderate – 1.5	$680.71
Hoplocephalus bungaroides Broad-headed Snake (Breeding)	Yes. This species requires rocky areas including escarpments, outcrops and pogodas within the Sydney Sandstone geologies. As such habitat was found within the Subject Site this species will require assessment.	Two (2) nights of nocturnal surveys focusing on microhabitats (rocks and crevices)	Aug - Sep	Very High – 3	$8,263.15
Hygrocybe anomala var. ianthinomarginata	Yes. This Subject Site is located within 500m of a waterbody and within 500m of semi wet areas, therefore this species will require assessment.	Survey seven (7) days after at least 40mm rain over a 2week period (DPIE 2020).	May - June	Very High – 3	$138.09

Scientific Name	Include in Future Assessment?	Targeted Survey requirements	DPIE approved Survey Period	Biodiversity Risk Weighting	Cost Per Credit (excl gst; only accurate of 26/06/2020)
Hygrocybe aurantipes	Yes. This Subject Site is located within 500m of a waterbody and within 500m of semi wet areas, therefore this species will require assessment.	Survey seven (7) days after at least 40mm rain over a 2week period (DPIE 2020).	May - June	Very High – 3	$138.09
Hygrocybe austropratensis	Yes. This Subject Site is located within 500m of a waterbody and within 500m of semi wet areas, therefore this species will require assessment.	Survey seven (7) days after at least 40mm rain over a 2week period (DPIE 2020).	May - June	Very High – 3	$312.38
Hygrocybe collucera	Yes. This Subject Site is located within 500m of a waterbody and within 500m of semi wet areas, therefore this species will require assessment.	Survey seven (7) days after at least 40mm rain over a 2week period (DPIE 2020).	June	Very High – 3	$312.38
Hygrocybe griseoramosa	Yes. This Subject Site is located within 500m of a waterbody and within 500m of semi wet areas, therefore this species will require assessment.	Survey seven (7) days after at least 40mm rain over a 2week period (DPIE 2020).	May - June	Very High – 3	$312.38
Hygrocybe lanecovensis	Yes. This Subject Site is located within 500m of a waterbody and within 500m of semi wet areas, therefore this species will require assessment.	Survey seven (7) days after at least 40mm rain over a 2week period (DPIE 2020).	May - June	Very High – 3	$312.38
Hygrocybe reesiae	Yes. This Subject Site is located within 500m of a waterbody and within 500m of semi wet areas, therefore this species will require assessment.	Survey seven (7) days after at least 40mm rain over a 2week period (DPIE 2020).	May - June	Very High – 3	$138.09

Scientific Name	Include in Future Assessment?	Targeted Survey requirements	DPIE approved Survey Period	Biodiversity Risk Weighting	Cost Per Credit (excl gst; only accurate of 26/06/2020)
Hygrocybe rubronivea	Yes. This Subject Site is located within 500m of a waterbody and within 500m of semi wet areas, therefore this species will require assessment.	Survey seven (7) days after at least 40mm rain over a 2week period (DPIE 2020).	May - June	Very High – 3	$138.09
Lathamus discolour Swift Parrot (Breeding)	Yes. Correspondence is required with DPIE to confirm there are no important areas of Swift Parrot habitat within the Subject Site. Until then it will require assessment.	Correspond with DPIE about whether any areas of important Swift Parrot habitat occur within the Subject Site	-	Very High - 3	$935.14
Leptospermum deanei	No. As no waterbodies exist within the Subject Site and the site is not located within 100m of freshwater or estuarine stream, which is a habitat constraint for this species, this species will not require assessment.	NA	NA	NA	NA
Lophoictinia isura Square-tailed Kite (Breeding)	Yes. As the Subject Site contained potential nest trees, this species will require assessment.	Site walkover checking for large stick nests during breeding season.	Sep - Jan	Moderate - 1.5	$680.71
Melaleuca Biconvexa Biconvex Paperbark	Yes. Grows in damp places, often near streams or low-lying areas. As such habitat exists within the Subject Site, this species will require assessment.	Field survey in accordance with DPIEs Surveying threatened plants and their habitats guidelines (DPIE 2020)	All year	High - 2	$196.19

Scientific Name	Include in Future Assessment?	Targeted Survey requirements	DPIE approved Survey Period	Biodiversity Risk Weighting	Cost Per Credit (excl gst; only accurate of 26/06/2020)
Miniopterus australis Little Bent-winged Bat (Breeding)	Yes. This species is known to breed in caves, tunnels, mines and culverts. As such habitat was present within the Subject Site, this species will require assessment.	Four (4) nights of two (2) harp traps placed close to the exits of caves (OEH 2018)	Dec - February	Very High - 3	$680.71
Miniopterus orianae oceanensis Large Bent-winged Bat (Breeding)	Yes. This species is known to breed in caves, tunnels, mines and culverts. As such habitat was present within the Subject Site, this species will require assessment.	Four (4) nights of two (2) harp traps placed close to the exits of caves (OEH 2018)	Dec - February	Very High - 3	$1,075.65
Mixophyes iteratus Giant Barred Frog	No. This species is known to breed within 50m of semi-permanent and permanent drainage lines. As such habitat was not present within the Subject Site this species will not require assessment	NA	NA	NA	NA
Myotis macropus Southern Myotis	Yes. As the Subject Site contains hollow bearing trees and occurs within 200m of a riparian zone, this species will require assessment.	Four (4) harp traps over a minimum of four (4) nights, and four (4) acoustic detection devices over a minimum of four (4) nights (OEH 2018).	Oct – March	High – 2	$1,075.65
Ninox connivens Barking Owl (Breeding)	Yes. This species is known to breed in living or dead trees with hollows greater than 20cm diameter and greater than 4m above the ground (DPIE 2020e). As such habitat was present within the Subject Site, this species will require assessment.	Minimum of five (5) nights of spotlighting and call playback (DEC 2004).	May - Dec	High - 2	$312.38

Scientific Name	Include in Future Assessment?	Targeted Survey requirements	DPIE approved Survey Period	Biodiversity Risk Weighting	Cost Per Credit (excl gst; only accurate of 26/06/2020)
Ninox strenua Powerful Owl (Breeding) (**Found within the Subject Site**)	This species has been found within the Subject Site with suitable breeding habitat. If a future development is entered into the BOS it will be required to purchase offset credits for this species.	NA	NA	High - 2	$680.71
Pandion cristatus Eastern Osprey	Yes. As the Subject Site contained potential nest trees, this species will require assessment.	Site walkover checking for large stick nests during breeding season.	Apr - Nov	Moderate – 1.5	$196.19
Perameles nasuta – endangered population Long-nosed Bandicoot, North Head (**Found within the Subject Site**)	This species has been found within the Subject Site. If a future development is entered into the BOS it will be required to purchase offset credits for this species.	NA	NA	High - 2	$935.14
Petaurus norfolcensis Squirrel Glider	Yes. This species is known to feed on *Acacia spp.* and nest in the hollows of Eucalypts. As such habitat was located in the Subject Site this species will require assessment.	Baited wildlife cameras for a minimum of seven (7) nights and two (2) nights spotlighting	All year	High - 2	$935.14
Petaurus norfolcensis – endangered population	No. The Subject Site is not located within the Barrenjoey Peninsula and therefore this endangered population would not require assessmen.t	NA	NA	NA	NA

Scientific Name	Include in Future Assessment?	Targeted Survey requirements	DPIE approved Survey Period	Biodiversity Risk Weighting	Cost Per Credit (excl gst; only accurate of 26/06/2020)
Squirrel Glider on Barrenjoey Peninsula north of Bushrangers Hill					
Phascolarctos cinereus Koala (Breeding)	Yes. Due to the presence of feed trees on site (*Angophora costata* and *Eucalyptus botryoides*) this species will require assessment.	Koala scat searches in conjunction with 2 consecutive nights of spotlighting.	All year	High - 2	$935.14
Phascolarctos cinereus – endangered population Koala in the Pittwater Local Government Area	No. Th Subject Site is not located within the former Pittwater Local Government Area. Therefore, this endangered population does not require assessment.	NA	NA	NA	NA
Pseudophryne australis Red-crowned Toadlet	Yes. This species is known to inhabit forests on Hawkesbury Sandstone amongst dense vegetation or leaf litter. As such habitat is present within the Subject Site, this species will require assessment.	Site transects and call play back over two (2) nights following heavy rain (OEH 2009)	All year	Moderate – 1.5	$680.71
Pteropus poliocephalus Grey-headed Flying-fox (Breeding)	No. This species is known to breed within breeding camps. As such habitat constraints are not present within the Subject Site, this species does not require assessment.	NA	NA	NA	NA
Rhodamnia rubescens Scrub Turpentine	Yes. This species is found in rainforests and wet sclerophyll forests. As such habitat is present within the Subject Site, this species will require assessment.	Field survey in accordance with DPIEs Surveying threatened plants and their	All year	Very High - 3	$5,982.49

Scientific Name	Include in Future Assessment?	Targeted Survey requirements	DPIE approved Survey Period	Biodiversity Risk Weighting	Cost Per Credit (excl gst; only accurate of 26/06/2020)
		habitats guidelines (DPIE 2020)			
Rhodomyrtus psidioides Native Guava	Yes. This species is found in rainforests and wet sclerophyll forests. As such habitat is present within the Subject Site, this species will require assessment.	Field survey in accordance with DPIEs Surveying threatened plants and their habitats guidelines (DPIE 2020)	All year	Very High - 3	No price currently available.
Tyto novaehollandiae Masked Owl (Breeding)	Yes. This species is known to breed in living or dead trees with hollows greater than 20cm diameter (DPIE 2020e). As such habitat area present within the Subject Site, this species will require assessment.	Minimum of eight (8) nights of spotlighting and call playback (DEC 2004).	May - Aug	High - 2	$680.71

Note: Price per credit is only accurate at the time of calculation (26/06/2020) prices are subject to change. This price only accounts for 1 credit for each candidate species, as the exact number of credits can only be calculated following an official impact assessment where the exact area of impact is known. In the event that one of these species are discovered in a future Biodiversity Development Assessment report, it is likely that more than 1 credit will be generated and required to be offset.

3.5 Priority and Environmental Weeds

Six (6) Priority Weed species, as listed under the *Biosecurity Act 2015* within the Northern Beaches Local Government Area (LGA), were identified within the Subject Site:

- Anredera cordifolia (Madeira Vine);
- *Asparagus aethiopicus* (Ground Asparagus);
- *Asparagus plumosus* (Climbing Asparagus Fern);
- *Chrysanthemoides monilifera* (Bitou Bush);
- *Lantana camara* (Lantana); and
- *Olea europaea subsp. cuspidate* (African Olive).

Priority weeds must be managed in accordance with the Biosecurity Act 2015.

3.6 Other State and Federal Conservation Matters

3.6.1 Areas of Outstanding Biodiversity Values – Little Penguin Critical Habitat

Critical *Eudyptula minor* (Little Penguin) Habitat, which is declared as an 'Area of Outstanding Biodiversity Value' under the Biodiversity Conservation Act 2016 (BC Act), is located approximately 200m to the south of the Subject Site (**Figure 6**). It is an offence to:

- Remove or prune any vegetation in Little Penguin habitat or critical habitat (including weeds and planted vegetation);
- Build or carry out landscaping within this area; and
- Dump grass/garden clippings or rubbish.

It deemed unlikely that the proposed planning proposal will have any impact upon the Little Penguin Critical Habitat.

3.6.2 Section 3.25 of the Environmental Planning and Assessment Act – Special consultation procedures concerning threatened species

- In this section, the relevant authority means—
  - In the case of a proposed SEPP—the Planning Secretary, or
  - (b) in the case of a proposed LEP—the relevant planning authority.
- Before an environmental planning instrument is made, the relevant authority must consult with the Chief Executive of the Office of Environment and Heritage if, in the opinion of the relevant authority, critical habitat or threatened species, populations or ecological communities, or their habitats, will or may be adversely affected by the proposed instrument.
- For the purposes of the consultation, the relevant authority is to provide such information about the proposed instrument as would assist in understanding its effect (including information of the kind prescribed by the regulations).
- The consultation in relation to a proposed local environmental plan is to commence after a decision under section 3.34 (Gateway determination) that the matter should proceed, unless the regulations otherwise provide.
- The Chief Executive of the Office of Environment and Heritage may comment to the relevant authority on the proposed instrument within the following period after the consultation commences—
  - the period agreed between the Chief Executive and the relevant authority,
  - in the absence of any such agreement, the period of 21 days or such other period as is prescribed by the regulations.
- The consultation required by this section is completed when the relevant authority has considered any comments so made.

- In this section, a reference to the Chief Executive of the Office of Environment and Heritage includes, in the application of this section to fish and marine vegetation, a reference to the Secretary of the Department of Industry, Skills and Regional Development

It is deemed unlikely that the proposed planning proposal will result in an adverse impact upon any threatened species, populations or communities. The planning proposal will aim to utilise the already developed sections within the site, with the only likely impacts on biodiversity being the establishment of an Asset Protection Zone, which will be mostly achieved through the removal of exotic vegetation, this will be guided by a site-specific Vegetation Management Plan (Narla 2020). Therefore, it is not deemed necessary that any consultation is required with the Chief Executive of the Office of Environment and Heritage.

3.6.3 Other Matters of National Environmental Significance

Littoral Rainforest is listed as a Matter of National Environmental Significance (MNES) under the EPBC Act 1999.

Any potential 'Significant Impact' on this community would require an EPBC referral. A significant impact is deemed unlikely to occur to any of the MNES as they are all proposed for retention.

3.6.4 SEPP (Coastal Management) 2018

Areas of 'Littoral Rainforest' as well as 'Proximity to Littoral Rainforest' under SEPP (Coastal Management) 2018 have been mapped within the Subject Site (Figure 6).

By containing 'Littoral Rainforest' and 'Proximity to Littoral Rainforest', the Subject Site is subject to both development requirements. The following may be carried out on land identified as "Littoral Rainforest" on the *Littoral Rainforests Area Map* only with development consent:

- The clearing of native vegetation;
- The harm of marine vegetation;
- The carrying out of any of the following:
    - Earthworks
    - Constructing a levee
    - Draining the land
    - Environmental protection works; or
    - Any other development.

Development for which consent is required, other than development for the purpose of environmental protection works, is declared to be designated development for the purposes of the Act.

Consent authority must not grant consent for development unless the consent authority is satisfied that sufficient measures have been, or will be, taken to protect, and where possible enhance, the biophysical, hydrological and ecological integrity of the coastal wetland.

Development consent must not be granted to development on land identified as "Proximity Area for Littoral Rainforest" unless the consent authority is satisfied that the proposed development will not significantly impact on:

- The biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest; or
- The quantity and quality of surface and groundwater flow to and from the adjacent coastal wetland or littoral rainforest.

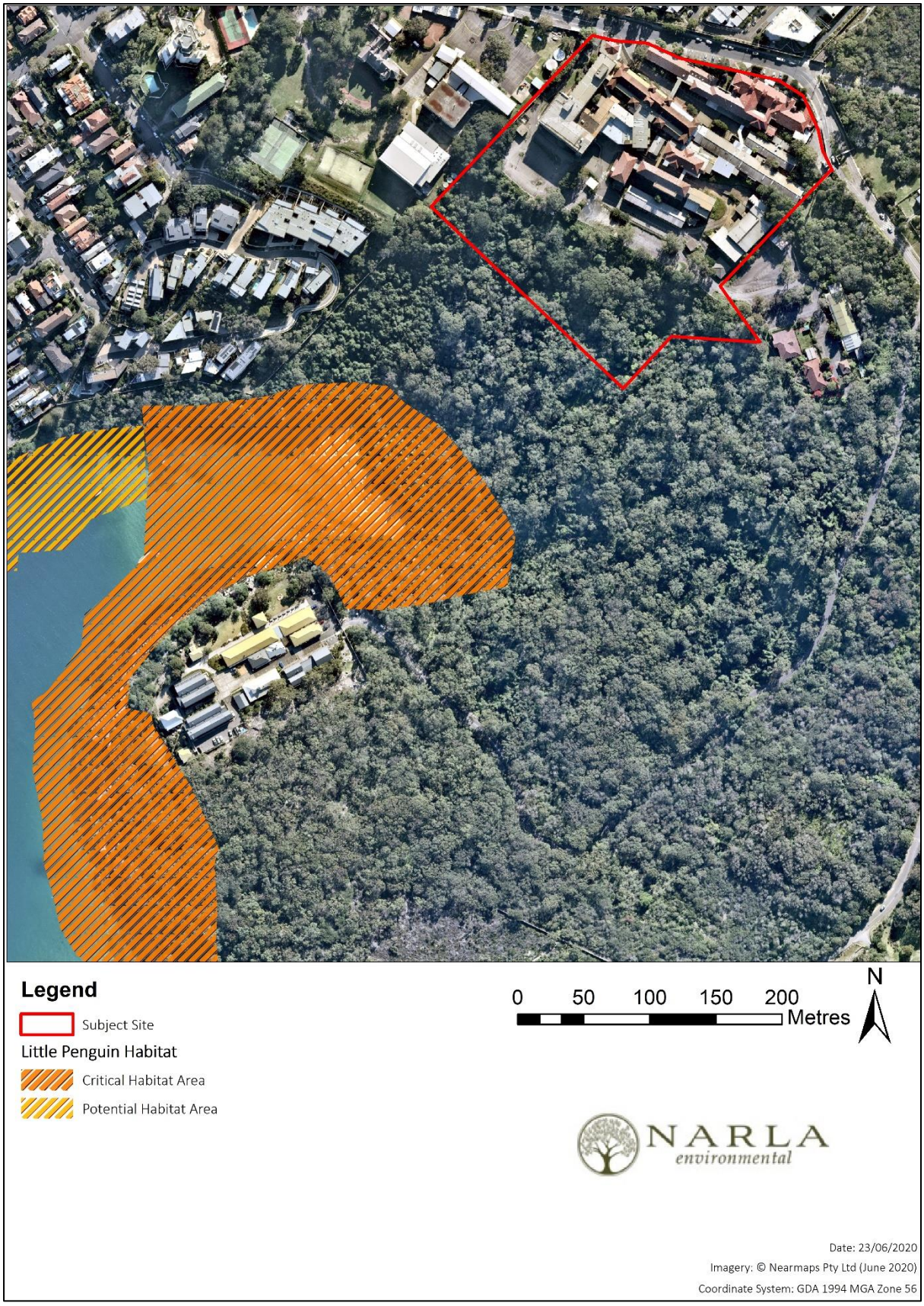

Figure 5. Proximity of the Subject Site to Critical Little Penguin Habitat.

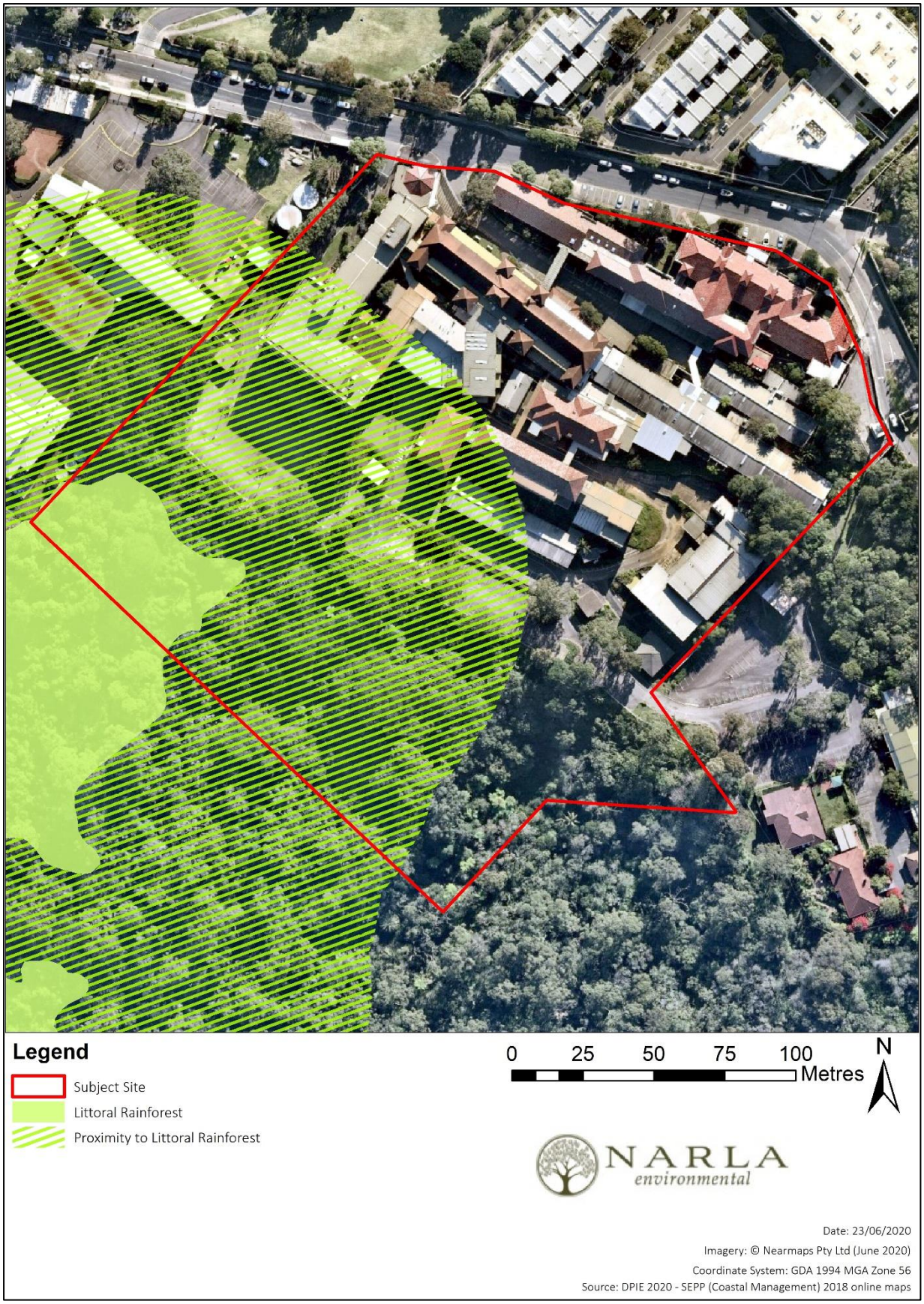

Figure 6. Mapped Littoral Rainforest and Proximity to Littoral Rainforest on the Subject Site.

3.6.5 Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

Any future development will abide by the environmental objectives of the Sydney Regional Environmental Plan (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 planting.

3.6.5.1 Foreshores and Waterway Areas

The Subject Site is located within Department of Planning and Environment Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 Foreshores and Waterways Area Map. The planning principles for the land within the Foreshores and Waterways Area are as follows:

- Development should protect, maintain and enhance the natural assets and unique environmental qualities of Sydney Harbour and its islands and foreshores;
- Public access to and along the foreshore should be increased, maintained and improved, while minimising its impact on watercourses, wetlands, riparian lands and remnant vegetation;
- Access to and from the waterways should be increased, maintained and improved for public recreational purposes (such as swimming, fishing and boating), while minimising its impact on watercourses, wetlands, riparian lands and remnant vegetation;
- Development along the foreshore and waterways should maintain, protect and enhance the unique visual qualities of Sydney Harbour and its islands and foreshores;
- Adequate provision should be made for the retention of foreshore land to meet existing and future demand for working harbour uses;
- Public access along foreshore land should be provided on land used for industrial or commercial maritime purposes where such access does not interfere with the use of the land for those purposes;
- The use of foreshore land adjacent to land used for industrial or commercial maritime purposes should be compatible with those purposes;
- Water-based public transport (such as ferries) should be encouraged to link with land-based public transport (such as buses and trains) at appropriate public spaces along the waterfront; and
- The provision and use of public boating facilities along the waterfront should be encouraged.

3.6.6 National Parks and Wildlife Act 1974

Due to the Subject Site sharing a border with the Sydney Harbour National Park, direct and indirect impacts of and future use of the site will need to managed in accordance with the Guidelines for developments adjoining land managed by the Office of Environment and Heritage (OEH 2013). The following considerations will need to be addressed in any future impact assessment for the Subject Site:

- Erosion and sediment control:
  - To prevent erosion and the movement of sediment onto OEH land, and ensure no detrimental change to hydrological regimes;
- Stormwater runoff:
  - Nutrient levels are minimised, and stormwater flow regimes and patterns mimic natural levels before it reaches OEH land;
- Wastewater:
  - The are no adverse impacts on OEH land due to water from adjacent development;
- Management implications relating to pests, weeds and edge effects:
  - Adjoining development does not:
    - Lead to increased impacts from invasive species (weeds and pests) domestic pets and stock.
    - Facilitate unmanaged visitation, including informal tracks, resulting in negative impacts on cultural or natural heritage values;
    - Lead to impacts associated with changes to the nature of the vegetation surrounding the reserve;
    - Impede OEH access for management purposes, including inappropriate fencing.
- Fire and the location of asset protection zones:
  - All asset protection measures are within the development area, there is no expectation for OEH to change its fire management regime for the land it manages;
- Boundary encroachments and access through OEH land:
  - No pre-construction, construction or post construction activity occurs on land managed by OEH. Any access that does occur must be legally authorised and comply with park management objectives;
- Visual, odour, noise, vibration, air quality and amenity impacts:
  - There is no reduction of amenity on OEH land due to adjacent development; and
- Threats to ecological connectivity and groundwater dependant ecosystems:
  - Native vegetation and other flora and fauna habitats that provide a linkage, buffer, home range or refuge role on land that is adjacent to reserves are maintained and enhanced.
  - Groundwater dependent ecosystems in OEH land are protected.

3.7 Bushfire Prone Land

The Subject Site is located within a designated bush fire-prone area. Any proposed development will require a Bushfire Assessment Report. The Asset Protection Zone (APZ) should be created to avoid impacts to areas mapped as Littoral Rainforest (PCT 1833) within the Subject Site. Exotic vegetation should be prioritised for removal to create APZ's in order to minimise any potential impacts to native fauna.

3.8 Preparation of a Vegetation Management Plan

A Vegetation Management Plan (Narla 2020) has been created in conjunction with this ECA Report to guide the management and rehabilitation of all vegetation across the Subject Site.

3.9 Biodiversity Constraints Mapping

Narla has mapped the Subject Site into three levels of 'Biodiversity Development Constraints'. The interpretation of each zone is detailed in **Table 10.**

The map was produced using information gathered from both desktop assessment of existing/historical mapping and data obtained from fieldwork undertaken by Narla Ecologists. It is to be used as a guide only and a strong degree of caution must be expressed when interpreting it. No one should rely on or make financial decisions based on this mapping. This map is presented in **Figure 7**.

Table 10. Key to Constraints Map.

Zone	Description
Low Constraints Area - Yellow	This zone is deemed to have high potential for future development with accompaniment of the appropriate environmental assessments and implementation of appropriate restrictions and guidelines. This zone encompasses: ▪ Historically cleared lands and existing infrastructure; ▪ Vegetation mapped as 'Urban Exotic/Native'; and ▪ Isolated native trees representative of PCT 1778: Smooth-Barked Apple – Coast Banksia/Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney, that now only exists as isolated carpark vegetation and provides minimal habitat value.
Moderate Constraints Area - Orange	This zone is deemed to have a moderate potential for future development as long as it is accompanied by the appropriate Ecological Impact Assessment. This zone encompasses: ▪ Vegetated areas mapped as 'Proximity to Littoral Rainforest' under SEPP (Coastal Wetlands) 2018; and ▪ Intact Vegetation mapped as 'PCT 1778: Smooth-Barked Apple – Coast Banksia/Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney'.
High Constraints Area - Red	This zone is deemed to have a low potential for future development without significant lot consolidation, zoning review, or severely restricted development plans. This zone encompasses: ▪ Lands mapped as 'Littoral Rainforest' under SEPP (Coastal Wetlands) 2018; ▪ Lands identified as having high biodiversity values within State Biodiversity Values Mapping; and ▪ Vegetation mapped as 'PCT 1833: Lilly Pilly – Cabbage Tree Palm littoral rainforest on escarpment slopes and gullies of the Sydney Basin' that is representative of Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

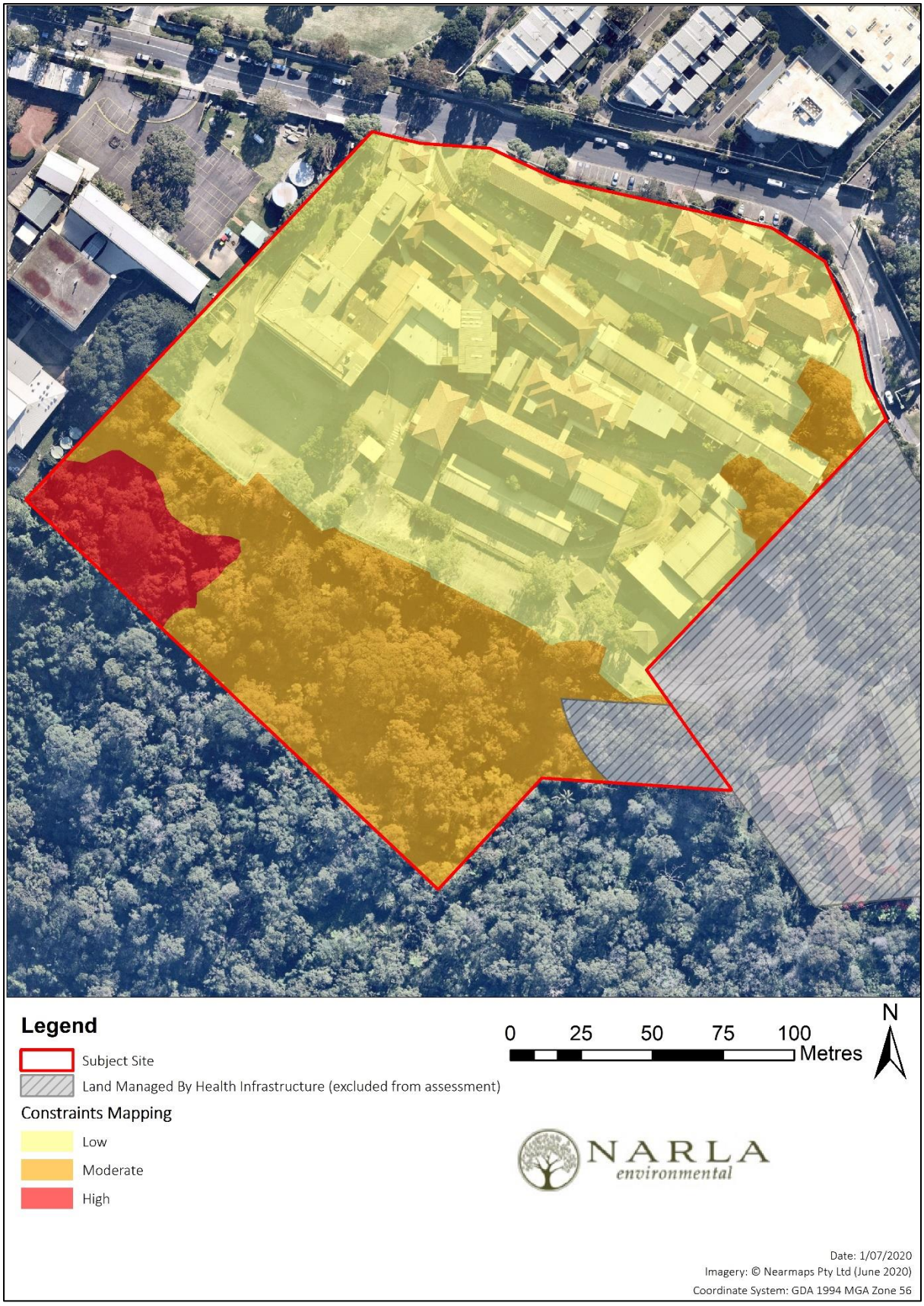

Figure 7. Ecological Constraints Mapping.

4. Conclusion

Considering all biodiversity constraints detailed within this report, it is considered feasible that development within the Subject Site can be achieved if the development avoids areas mapped as 'High Constraint'. It is deemed likely that due to the densely vegetated southern portion of the Subject Site, and its location within bush fire prone land that a Biodiversity Development Assessment Report and entry into the Biodiversity Offset Scheme will be required for any future use of the Subject Site.

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6. Appendices

Appendix A. Flora Species Identified within and surrounding the Subject Site.
Appendix B. Fauna Species Identified During Survey of Subject Site.
Appendix C. VIS Plot Data Sheets.

Appendix A. Flora Species Identified within and surrounding the Subject Site.

Name	Status	Canopy	Midstory	Groundcover
Acacia elata		x		
Acacia linifolia			x	
Acacia floribunda		x		
Acacia longifolia			x	
Acacia terminalis subsp. terminalis	Endangered		x	
Adiantum aethiopicum				x
*Agapanthus praecox**				x
*Ageratina adenophora**				x
Allocasuarina littoralis			x	
Angophora costata		x		
*Anredera cordifolia**	Priority			x
*Araujia sericifera**				x
*Araucaria heterophylla**		x		
Archontophoenix cunninghamiana		x		
*Aristea ecklonii **				x
*Arundo donax**				x
*Asparagus aethiopicus**	Priority			x
*Asparagus plumosus**	Priority			x
Asplenium australasicum			x	
Banksia integrifolia		x		
Billardiera scandens				x
Blechnum indicum				x
Brachychiton acerifolius		x		
Callistemon citrinus			x	
Callicoma serratifolia			x	
Calochlaena dubia				x
Cassytha pubescens				x
Casuarina glauca			x	
*Celtis sinensis**			x	
Centella asiatica				x
Ceratopetalum apetalum			x	
*Cestrum parqui**	Priority			x
*Chlorophytum comosum**				x
*Chrysanthemoides monilifera**	Priority		x	
*Cirsium vulgare**				x
Cissus hypoglauca				x
Clematis aristata				x
*Conyza bonariensis **				x
Commelina cyanea				x
*Cortaderia selloana**				x
Corymbia gummfiera		x		
Cupaniopsis anacardioides		x		
Cyathea australis		x		
Cyathea cooperi			x	
Cymbopogon refractus				x

Name	Status	Canopy	Midstory	Groundcover
Cyperus eragrostis				x
*Cyperus involucratus**				x
Dianella caerulea				x
Dodonaea triquetra			x	
Doodia aspera				x
*Ehrharta erecta**				x
Elaeocarpus reticulatus			x	
Elaeocarpus reticulatus			x	
Epacris longiflora				x
*Erythrina crista-galli**		x		
Eucalyptus robusta		x		
Eucalyptus botryoides		x		
*Euphorbia peplus**				x
Eustrephus latifolius				x
Ficus macrophylla		x		
Ficus rubiginosa		x		
Gahnia sieberiana			x	
*Gamochaeta calviceps**				x
Geitonoplesium cymosum				x
Gleichenia dicarpa				x
Glochidion ferdinandi		x		
*Hamelia patens**				x
Hardenbergia violacea				x
*Hedychium gardnerianum**				x
Hibbertia aspera				x
Histiopteris incisa				x
Homalanthus populifolius			x	
Imperata cylindrica				x
*Ipomea indica**				x
Kunzea ambigua			x	
*Lagunaria patersonii**		x		
*Lantana camara**	Priority		x	
*Ligustrum lucidum**			x	
*Ligustrum sinense**			x	
Livistonia australis			x	
Lomandra longifolia				x
*Lonicera japonica**				x
Lophostemon confertus		x		
*Modiola caroliniana**				x
Melaleuca nodosa			x	
Melaleuca quinquinervia		x		
Melia azedarach				x
Monotoca elliptica			x	
*Monstera deliciosa**			x	
*Morus sp.**		x		
Myrsine variabilis			x	

Name	Status	Canopy	Midstory	Groundcover
*Nephrolepis cordifolia**				x
*Nerium oleander**			x	
Notolea venosa			x	
*Ochna serrulata**			x	
*Olea europaea subsp. cuspidata**	Priority		x	
Oplismenus aemulus				x
Oxalis perennans				x
Ozothamnus diosmifolius			x	
Pandorea pandorana				x
*Paspalum dilatatum**				x
Parsonsia straminea				x
*Paspalum urvillei**				x
*Persicaria decipiens**				x
*Pennisetum clandestinum**				x
*Phoenix canariensis**		x		
*Pinus radiata**		x		
Pittosporum revolutum			x	
Pittosporum undulatum			x	
Platycerium sp.			x	
*Plumeria sp. **			x	
Psilotum nudum				x
Pteridium esculentum				x
*Rhaphiolepis indica**			x	
*Ricinus communis**			x	
*Senna pendula**			x	
Smilax glyciphylla				x
*Stenocarpus sinuatus**			x	
Stephania japonica				x
*Strelitzia nicolai**			x	
Synoum glandulosum			x	
Syzygium paniculatum	Endangered		x	
*Tetrapanax papyrifer **			x	
*Tradescantia fluminensis**				x
Xanthorrhoea sp.			x	
*Verbena bonariensis**				x

** Denotes exotic species*

Appendix B. Fauna Species Identified During Survey of Subject Site.

Class	Scientific Name	Common Name	Status
Aves	*Acanthiza nana*	Yellow Thornbill	Protected – BC Act
Aves	*Acanthorhynchus tenuirostris*	Eastern Spinebill	Protected – BC Act
Aves	*Alectura lathami*	Australian Brush-turkey	Protected – BC Act
Aves	*Anthochaera chrysoptera*	Little Wattlebird	Protected – BC Act
Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	Protected – BC Act
Aves	*Corvus coronoides*	Australian Raven	Protected – BC Act
Aves	*Cracticus tibicen*	Australian Magpie	Protected – BC Act
Aves	*Cracticus torquatus*	Grey Butcherbird	Protected – BC Act
Aves	*Dacelo novaeguineae*	Laughing Kookaburra	Protected – BC Act
Aves	*Falco peregrinus*	Peregrine Falcon	Protected – BC Act
Aves	*Hirundo neoxena*	Welcome Swallow	Protected – BC Act
Aves	*Manorina melanocephala*	Noisy Miner	Protected – BC Act
Aves	*Meliphaga lewinii*	Lewin's Honeyeater	Protected – BC Act
Aves	*Myiagra rubecula*	Leaden Flycatcher	Protected – BC Act
Aves	*Ninox strenua*	Powerful Owl	Vulnerable – BC Act
Aves	*Ocyphaps lophotes*	Crested Pigeon	Protected – BC Act
Aves	*Pardalotus punctatus*	Spotted Pardalote	Protected – BC Act
Aves	*Psophodes olivaceus*	Eastern Whipbird	Protected – BC Act
Aves	*Pycnonotus jocosus*	Red-Whiskered Bulbul	Exotic; Not-protected
Aves	*Rhipidura albiscapa*	Grey Fantail	Protected – BC Act
Aves	*Scythrops novaehollandiae*	Channel-billed Cuckoo	Protected – BC Act
Aves	*Sericornis frontalis*	White-browed Scrubwren	Protected – BC Act
Aves	*Strepera graculina*	Pied Currawong	Protected – BC Act
Aves	*Trichoglossus haematodus*	Rainbow Lorikeet	Protected – BC Act
Aves	*Zosterops lateralis*	Silvereye	Protected – BC Act
Mammalia	*Oryctolagus cuniculus*	European Rabbit	Exotic; Not-protected
Mammalia	*Perameles nasuta*	Long-Nosed Bandicoot	Endangered Population – BC Act
Mammalia	*Rattus fuscipes*	Bush Rat	Protected – BC Act
Mammalia	*Rattus rattus*	Black Rat	Exotic; Not-protected
Mammalia	*Tachyglossus aculeatus*	Short-beaked Echidna	Protected – BC Act
Mammalia	*Trichosurus vulpecula*	Common Brush-tailed Possum	Protected – BC Act
Reptilia	*Cryptoblepharus pulcher*	Delicate Snake-eyed Skink	Protected – BC Act
Reptilia	*Eulamprus quoyii*	Eastern Water Skink	Protected – BC Act
Reptilia	*Intellagama lesueurii*	Eastern Water Dragon	Protected – BC Act

Appendix C. VIS Plot Data Sheets.

BAM Site – Field Survey Form					
Date:	18th June 2020	**Plot ID:**	Plot 1	**Photo #:**	-
Zone:	56	**Plot Dimensions:**	50m x 20m	**Easting:**	342043.59 m E
Datum:	GDA94	**Middle bearing from 0m:**	119	**Northing:**	6257916.24 m S
PCT:	PCT 1778: Smooth-Barked Apple – Coast Banksia/Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney				

Growth Form	Scientific Name	Cover	Abundance
Tree (TG)	Glochidion ferdinandi	25	N/A
Other (OG)	Cyathea cooperi	6	N/A
High Threat Exotic	Lantana camara	6	N/A
High Threat Exotic	Ligustrum sinense	8	N/A
Fern (EG)	Nephrolepis cordifolia	7	N/A
High Threat Exotic	Lonicera japonica	5	100
Fern (EG)	Pteridium esculentum	25	N/A
High Threat Exotic	Ageratina adenophora	1	15
High Threat Exotic	Senna pendula	1	10
Shrub (SG)	Callicoma serratifolia	3	5
High Threat Exotic	Ochna serrulata	1	10
High Threat Exotic	Ligustrum lucidum	2	10
High Threat Exotic	Ipomoea indica	0.5	6
Shrub (SG)	Elaeocarpus reticulatus	1	3
Other (OG)	Stephania japonica	0.2	3
Other (OG)	Eustrephus latifolius	0.4	5

BAM Site – Field Survey Form			
Tree (TG)	Angophora costata	4	1
Other (OG)	Smilax glyciphylla	0.2	4
Shrub (SG)	Pittosporum undulatum	0.5	3
High Threat Exotic	Olea europaea	1	1
Other (OG)	Morinda jasminoides	0.1	1
Tree (TG)	Notelaea longifolia	0.2	2
Tree (TG)	Eucalyptus botryoides	0.1	1
High Threat Exotic	Asparagus aethiopicus	0.4	10
Tree (TG)	Brachychiton acerifolius	0.5	1
Exotic	Hedychium gardnerianum	1	10
Tree (TG)	Ficus rubiginosa	0.2	1
Grass & grasslike (GG)	Gahnia spp.	10	N/A
Fern (EG)	Gleichenia dicarpa	1	10

DBH	# Tree Stems Count	# Hollow Bearing Trees
80+cm	4	4
50-79cm	0	0
30-49cm	Present	1
20-29cm	Present	0
10-19cm	Present	0
5-9cm	Present	0
<5cm	Present	0
Length of Logs (m)	26	

BAM Attribute (1x1m)	Litter Cover (%)
1 (5m)	85
2 (15m)	95
3 (25m)	100
4 (35m)	100

BAM Site – Field Survey Form	
5 (45m)	100
Average	96

Growth Form	Composition Data (count of native cover)	Structure Data (sum of cover)
Tree	6	30
Shrub	3	4.5
Grass	1	10
Forb	0	0
Fern	3	33
Other	5	6.9
High Threat Exotics	10	25.9

BAM Site – Field Survey Form					
Date:	18th June 2020	Plot ID:	Plot 2	Photo #:	-
Zone:	56	Plot Dimensions:	50m x 20m	Easting:	341950.27 m E
Datum:	GDA94	Middle bearing from 0m:	105	Northing:	6257993.67 m S
PCT:	PCT 1833: Lilly Pilly – Cabbage Tree Palm littoral rainforest on escarpment slopes and gullies of the Sydney Basin				

Growth Form	Scientific Name	Cover	Abundance
High Threat Exotic	Asparagus aethiopicus	40	N/A
High Threat Exotic	Ligustrum sinense	2	10
Tree (TG)	Brachychiton acerifolius	2	1
High Threat Exotic	Lantana camara	0.5	3
High Threat Exotic	Ehrharta erecta	30	N/A
High Threat Exotic	Anredera cordifolia	10	N/A

BAM Site – Field Survey Form			
High Threat Exotic	Phoenix canariensis	0.2	1
High Threat Exotic	Ipomoea indica	0.5	10
Exotic	Strelitzia nicolai	1	1
Shrub (SG)	Pittosporum undulatum	0.5	2
High Threat Exotic	Tradescantia fluminensis	6	N/A
High Threat Exotic	Olea europaea	7	N/A
Exotic	Rhaphiolepis indica	0.5	1
High Threat Exotic	Araujia sericifera	0.2	4
Tree (TG)	Glochidion ferdinandi	15	N/A
High Threat Exotic	Ligustrum lucidum	0.5	4
Grass & grasslike (GG)	Oplismenus aemulus	6	N/A
Other (OG)	Stephania japonica	1	7
Exotic	Euphorbia peplus	0.6	20
High Threat Exotic	Senna pendula	0.6	4
Exotic	Solanum nigrum	0.5	10
High Threat Exotic	Cestrum parqui	2	6
Exotic	Conyza bonariensis	0.1	3
High Threat Exotic	Ochna serrulata	0.5	2
Forb (FG)	Sigesbeckia orientalis subsp. orientalis	0.3	4
High Threat Exotic	Cyperus eragrostis	0.2	5
High Threat Exotic	Ricinus communis	1	5
High Threat Exotic	Paspalum dilatatum	2	10

BAM Site – Field Survey Form			
High Threat Exotic	Ageratina adenophora	5	20

DBH	# Tree Stems Count	# Hollow Bearing Trees
80+cm	0	0
50-79cm	2	1
30-49cm	Present	0
20-29cm	Present	0
10-19cm	Present	0
5-9cm	Present	0
<5cm	Present	0
Length of Logs (m)	25	

BAM Attribute (1x1m)	Litter Cover (%)
1 (5m)	70
2 (15m)	95
3 (25m)	100
4 (35m)	95
5 (45m)	65
Average	**85**

Growth Form	Composition Data (count of native cover)	Structure Data (sum of cover)
Tree	2	17
Shrub	1	05
Grass	1	6
Forb	1	0.3
Fern	0	0
Other	1	1
High Threat Exotics	18	108.2

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