Quarantine Station North Head

Flora and Fauna Assessment

prepared for

North Head Sydney Pty Ltd

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Executive Summary

The Quarantine Station (Q Station) is owned by the NSW Department of Planning Housing and Infrastructure (DPHI) and managed by the National Parks and Wildlife Service (NPWS).

The lease for the site is currently held by North Head Sydney Pty Ltd (NHS), which is for cultural tourism, accommodation, conferences, and function purposes until 2027, with an option to extend until 2050.

The current planning approval is due to lapse on 23 December 2024 and a new planning approval is being sought for the ongoing operation of Q Station beyond 2024, consistent with the current lease.

While there are no changes to current approved 'Key Site Activities' at Q Station, a range of amendments are proposed for the new planning approval. The proposed amendments aim to rationalise the requirements of the planning approval to provide a streamlined, contemporary and more workable approval for both NHS and NPWS. This would be achieved through the following:

- Deleting conditions fulfilled by the previous leaseholder and/or are no longer relevant to the ongoing operation of the site.
- Removing duplication of conditions.
- Updating conditions to reflect:
  - more recent management plans, titles and terminology,
  - contemporary environmental standards, guidelines and best practice, and
  - knowledge gained from the past decades of monitoring and data collection.

This Flora and Fauna Assessment (FFA) report has been prepared to support the Review of Environmental Factors for approval from NPWS (the consent authority) for the ongoing operation of Q Station (the facility).

The FFA describes the existing environment and the potential impacts upon native vegetation, threatened species, populations and ecological communities as relevant to the ongoing operation of the facility.

North Head's unusual history of development and management has left a legacy on the landscape. However, even the lawn areas within North Head provide important habitat for at least some species, such as long-nosed bandicoots which forage extensively in these grassed areas (NPWS 2012).

This is particularly relevant for the Q Station (QS) lease area, which contains a diverse native landscape surrounding and interspersed within the built environment.

However, the most significant fauna habitat in the study area is the outstanding biodiversity value area (AOBV) declared for the endangered little penguin *Eudyptula minor* population in the Manly Point area, which includes nesting and potential nesting areas within the QS lease area.

The AOBV areas includes foraging habitat which extends 50 metres out from the mean highwater mark and lies within North (Sydney) Harbour Aquatic Reserve.

Parts of this aquatic zone include seagrass beds that are likely to be important feeding areas, especially during the rearing of chicks when little penguins are known to seek food closer to their nests.

While the land below the mean highwater mark is not under the jurisdiction of NPWS (instead the NSW Maritime Authority of Transport NSW), Spring Cove (including the extent of AOBV Area A) has been included within the study area of this assessment.

Due to the location of the study area to the Tasman Sea and larger open water zones of Port Jackson, threatened species records returned in database searches have been filtered to exclude species that would never occur or are highly unlikely to occur in the study area, such as:

- Pelagic bird species (albatrosses, petrels);
- Marine mammals (dugongs, whales);
- Fin fish such sharks, and pelagic species (tuna)
- Migratory wader birds (i.e., that require intertidal mudflats, shallow wetlands etc for foraging)

As the proposal is located on a declared AOBV area, the requirement to prepare a species impact statement (SIS) is triggered.

While the main focus of the proposal's SIS (écologique, 2024) is the endangered little penguin population at Manly, other biodiversity values described in this FFA are also assessed in the SIS. These include the following:

- The endangered Long-nosed bandicoot (*Perameles nasuta*) population at North Head
- Threatened ecological community Eastern Suburbs Banksia Scrub
- *Posidonia australis* an endangered seagrass community
- *Eucalyptus camfieldii* Camfield's stringybark
- *Acacia terminalis* subsp. *terminalis* Sunshine wattle
- *Pseudophryne australis* Red-crowned toadlet
- *Cercartetus nanus* Eastern pygmy possum

The ongoing operation of Q Station does not introduce any new and adverse effects on the biodiversity values in the study area.

No clearing of vegetation is proposed. Potential clearing required for maintenance of Asset Protection Zones (APZs) will be subject to a separate approval process to be led by NPWS.

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Shortened form

AWC	Australian Wildlife Conservancy
BC Act	NSW *Biodiversity Conservation Act 2016*
BC Reg.	NSW *Biodiversity Conservation Regulation 2017*
Biosecurity Act	NSW *Biodiversity Security Act 2015*
CEEC	Critically Endangered Ecological Community
COPA	Conditions of Planning Approval
DACMP	Detailed Area Conservation Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPHI	NSW Department of Planning Housing and Infrastructure
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	Commonwealth *Environment Protection Biodiversity and Conservation Act 1999*
FM Act	NSW *Fisheries Management Act 1994*
IBRA	Interim Biogeographic Regionalisation of Australia
IMAMS	Integrated monitoring and adaptive management system
LEP	Local Environment Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NPWS	National Parks and Wildlife Services
PCT	Plant Community Type
REF	Review of Environmental Factors
SAII	Serious and Irreversible Impact
SEARs	Secretary's Environmental Assessment Requirements
SEPP	NSW State Environment Protection Policy
SIS	Species Impact Statement
SSD	State Significant Development
TEC	Threatened Ecological Community
TBDC	Threatened Biodiversity Data Collection

1. Introduction

1.1 Background

The Quarantine Station is owned by the NSW Department of Planning Housing and Infrastructure (DPHI) and managed under the National Parks and Wildlife Service (NPWS). DPHI is the parent organisation of NPWS and regulates matters relating to heritage, pollution, native vegetation, biodiversity and National Parks.

Planning approval (MP08_0041) was granted in 2003 for the 'North Head Quarantine Station Conservation and Adaptive re-use Proposal' with NPWS and Mawland as co-proponents. In 2006 the site was leased to Mawland for the readaptation and operation of a tourist facility "Q Station", accommodating conferences, weddings, tours and education programs and overnight stays. Mawland operated the facility and ran the day-to-day activities onsite up until 2022.

The lease for the site is currently held by North Head Sydney Pty Ltd (NHS). This lease was granted under Section 151A of the *National Parks and Wildlife Act 1974* (NPW Act).

The operation of the site is undertaken in accordance with the current planning approval, which was granted by the NSW Minister for the Environment on the 23 December 2003 and later modified in 2015 (following over ten years of operation).

The operation of the site is subject to a lease for cultural tourism, accommodation, conferences, and function purposes until 2027, with options to extend until 2050. However, the current planning approval is due to lapse on 23 December 2024.

NHS is currently seeking approval for the ongoing operation of Q Station from beyond 2024 until 2050 (the proposal).

The proposed activity seeks:

+ To obtain a new planning approval under Part 5 of the EP&A Act and Clause 171 of the EP&A Regulation for the ongoing operation of Q Station beyond 2024, consistent with the current lease.
+ Rationalise the requirements of the planning approval to provide a streamlined, contemporary and more workable approval for both NHS and NPWS.

There is no proposed change of use from the current approved 'Key Site Activities' as outlined in the current conditions of approval nor are any physical works proposed.

A range of physical works are likely to be required over the course of the lease period to ensure facilities are maintained at an appropriately high standard across time, and that the site's unique qualities and significance are protected. These works will be subject to separate planning approval.

A Masterplan, which is separate to and not part of this REF, has been prepared by Keylan Consulting to demonstrate the overall, long-term vision and framework for the site and the proposed future physical works.

1.2 Aim of Flora and Fauna Assessment

NPWS as the determining authority is required to consider the environmental impacts of the proposal in the context of Part 5 of the EP&A Act and Clause 171 of the EP&A Regulation. Accordingly, the REF is submitted to NPWS for consideration.

This Flora and Fauna Assessment (FFA) has been prepared on behalf of NHS as a supporting technical document to the REF. The FFA describes the existing environment and the potential impacts upon native vegetation, threatened species and threatened ecological communities as it pertains to the ongoing operation of the facility.

1.3 Methods

1.3.1 Overview

Q Station and its surrounding environment are well researched through a range of past flora and fauna assessments and ongoing monitoring programs. Ongoing monitoring programs are undertaken by NPWS for the little penguin, the long-nosed bandicoot, seagrass, the Eastern Suburbs Banksia Scrub and threatened flora species that occur in the QS leas area (i.e. *Acacia terminalis* subsp. *terminalis* and *Eucalyptus camfieldii*)

The North Head ecohealth reporting is undertaken by the Harbour Trust provides annual data collection and reporting, which includes the QS lease area. The scope of this FFA has therefore not included targeted flora or fauna surveys[1]. Instead relying on a comprehensive review of both historical and contemporary data and site-specific reporting, supplemented by a review of scientific literature (as relevant to the site's threatened species, communities and populations).

1.3.2 Desktop assessment

The following information sources have been used:

+ Spatial data
  - Nearmap Date20240225, Date20240312, Date20230620
  - Sydney-CONT-AHD_56_2m shapefile
  - SydneyMetroArea_v3_2016_E_4489 (OEH 2016)
  - SVTM_NSW_Extant_PCT_vC2_0_ M2_0_106 (DPE 2023)
  - Estuary Macrophytes (DECCW 2010)
  - Soil Landscapes of the Sydney 1:100,000 Sheet map, Ed. 4, (DECCW, Chapman et al., 2009)
+ Approvals and operational documents
  - Species Impact Statement - Adaptive Reuse Proposal (Gunninah 2001)
  - Environmental Impact Statement (Manidis Roberts 2003)
  - Joint Determination Report (2003) Clause 243 Report under Part 5 of the EP&A Act
  - Environmental Impact Assessment MP08_0041-Mod-3 (Linchpin, 2015)
  - Consolidated Consent as modified by MP08_0041-Mod-3 (DPE, 2018)
  - Quarantine Station North Head Management Plans:
    - Conservation Works Program (Paul Davies Pty Ltd, 2006)
    - Environmental Management Plan (DEC, 2005)
    - Integrated monitoring and adaptive management system (Mawland Construction, 2006)
    - Heritage Landscape Management Plan (Thompson Berrill Landscape Design Pty Ltd, 2006)
    - Integrated monitoring and adaptive management system (Mawland Construction 2006)
    - Infrastructure Control Plan - Part 1 (Mawland Construction Pty Ltd 2008)
    - Predator and Pest Management Plan (NPWS, 2008)
  - Audit compliance reports completed for 2006-2011 (Graham A Brown & Associates, 2011); 2011-2018 (SNC-Lavalin, 2018); and 2018-2021 (Wolfpeak, 2022)
  - NSW National Parks & Wildlife Service (2017-2022) Monitoring Report 2017-2022. Quarantine Station – Sydney Harbour NP Integrated Monitoring Program.

[1] Site inspections of the the long-nosed bandicoot habitat and little penguin were undertaken 19 October 2023, 27 November 2023,-8 February 2024.

- Biodiversity
  - An analysis of the May 2020 census of the North Head Long-nosed Bandicoot Population (Price & Banks 2021)
  - Scientific Committee Final Determinations (Commonwealth, NSW & Fisheries (as relevant)
  - Acacia terminalis subsp. terminalis (Sunshine Wattle) National Recovery Plan (DECCW 2010)
  - Eastern Suburbs Banksia Scrub Endangered Ecological Community Recovery Plan (DEC 2004)
  - Eucalyptus camfieldii Conservation Advice (Commonwealth of Australia 2008)
  - Flora of North Head (Skelton et al, 2003) prepared for the Sydney Harbour Federation Trust
  - Littoral Rainforest and Coastal Vine Thickets of Eastern Australia Conservation Advice (Commonwealth of Australia 2015)
  - Long-nosed Bandicoot Monitoring North Head, Manly (Price & Banks 2018)
  - Manly Little Penguin Sustainability Report prepared for DCCEEW-NPWS (O'Neill, 2024)
  - Status of the Endangered Population of Little Penguins Eudyptula minor at Manly (NPWS, 2007)
- Assessment guidelines
  - Commonwealth of Australia (2013) Matters of National Environmental Significance - Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999.
  - Commonwealth of Australia (2018) *Posidonia australis* Seagrass Meadows of the Manning-Hawkesbury Ecoregion
  - NSW Department of Primary Industries - Fisheries (2008) Threatened species assessment

1.3.2 Data assessment

Available data has been sourced from the following:

- Manly Little Penguin Recovery Program annual monitoring reports (NPWS, 2002/03-2023/24), provides quantity data on the following parameters:
  - breeding pairs
  - active burrows
  - eggs laid
  - fledglings
- North Head Ecohealth Reporting (Australian Wildlife Conservancy, 2020, 2021, 2022):
  - *Cercartetus nanus* (eastern pygmy possum)
  - *Perameles nasuta* (long-nosed bandicoot)
  - *Pseudophryne australis* (red-crowned toadlet)
- Seagrass Monitoring Program 2022/2023 (Marine Pollution Research Pty Ltd, 2023):
  - Posidonia australis, Zostera and Halophila species
  - Kelp and Sargassum beds
  - Syngnathid (e.g. seahorse, pipefish) habitat
- Long-nosed bandicoot mortality register
- Eastern Suburbs Banksia Scrub - floristic sampling within similar labelled 20 x 20 m quadrats at two locations in the QS lease area and photo point monitoring

2. Environmental Setting

2.1 Site description

2.1.1 Subject site

The site is defined as the 27.5 hectares (ha) within the boundaries of the Q Station. As shown in Figure 2-1 and Figure 2-2, the site is situated on the western side of North Head, on a natural amphitheatre of land centred on Quarantine Beach. The area is fringed by a continuous tract of bushland on the north, south and eastern sides, and by the harbour on the western side (NSW State Heritage Register, 2024).

Quarantine Beach is 200 m long, faces northwest into North Harbour, and is hemmed in by rocks at each end, together with a seawall and wharf at the southern end. Currently, formal access to the beach is via the visitor's centre at the main entrance (on foot or by shuttle bus), although many visitors come by boat, kayaks and paddle boards.

Vegetation within the bushland reflects North Head's sandstone geology but varies considerably with elevation, which descends from 76m AHD in the northeast and 50m AHD on the southeast down to 0m at Quarantine Beach (see Figure 1-1).

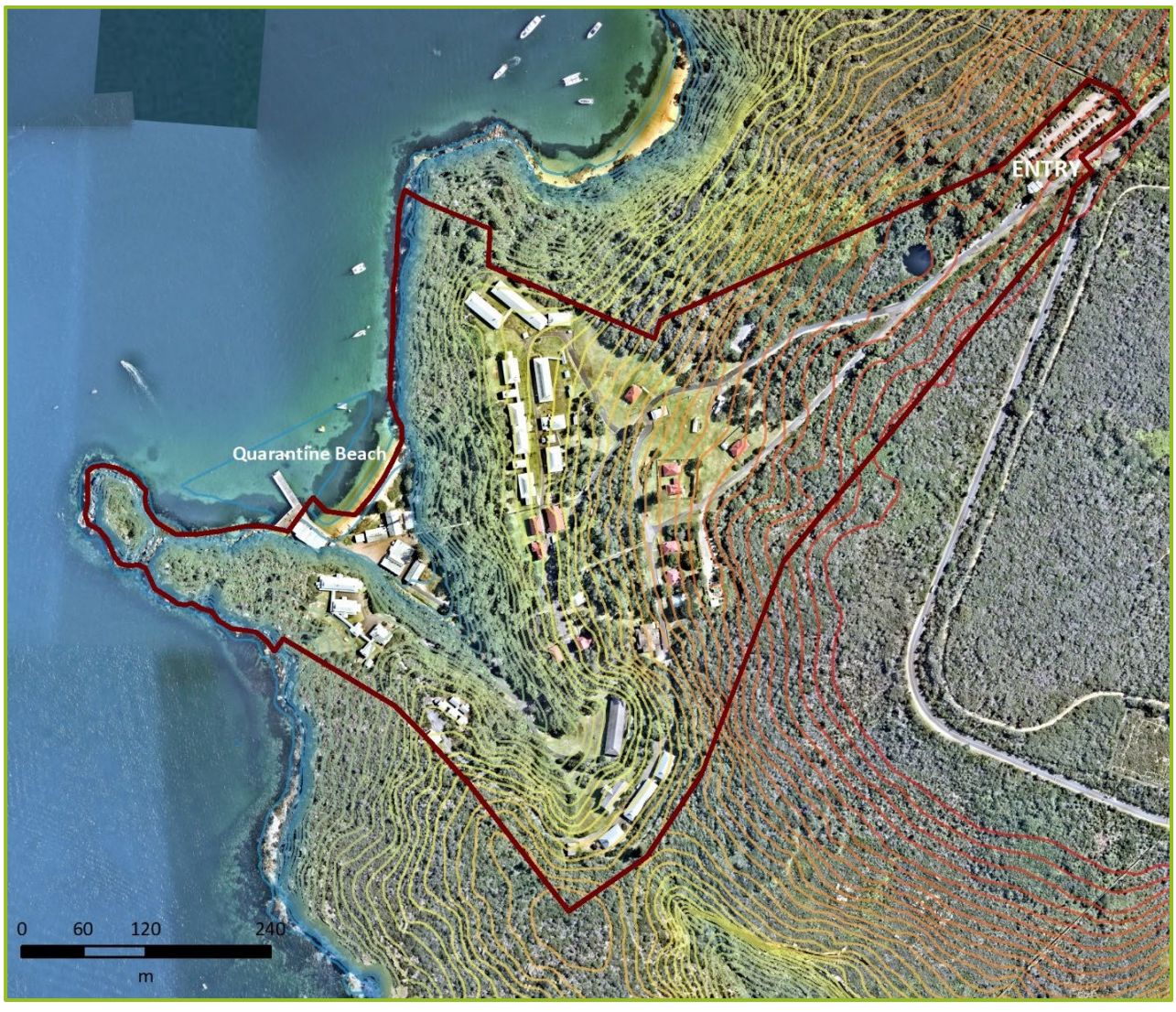

Figure 2-1. Subject site (Nearmap imagery 25/02/2024)

Figure 2-2. Subject site and surrounding land

2.1.2 Surrounding Land Uses (study area)

As shown in Figure 2-2, the Sydney Harbour National Park includes and extends to the north, south and east of Q Station and encircles the North Head Sanctuary and North Head Wastewater Treatment Plant.

In 1984, ownership of the Q Station was transferred from the Commonwealth to the State Government and it was reserved as part of Sydney Harbour National Park. The North Head Sanctuary has been retained by the Commonwealth and is managed by the Sydney Harbour Federation Trust (or Harbour Trust).

Other land uses proximal to the Q Station include Stores Beach, the Australian Institute of Police Management (AIPM), Collins Beach, the former Manly Hospital site, St Paul's Catholic College, Little Manly Point and Little Manly Beach (see Figure 2-2).

Q Station is accessed via an internal road that connects to the North Head Scenic Drive. Prior to Q Station the scenic drive provides access to the AIPM, Collins Beach and the Barracks Precinct of the North Head Sanctuary. Beyond Q Station the scenic drive provides further access to the North Head Sanctuary and the scenic lookouts within the Sydney Harbour National Park (see Figure 2-2).

For the purposes of this assessment, the study includes the areas of Sydney Harbour National Park to the north south and east of Q Station and Spring Cove and Little Manly Cove (and associated headlands or points).

2.2 Landscape

The diversity, abundance and distribution of the vegetation, and in turn fauna habitat, that occurs on North Head is a result of the topography, geology, soil landscapes, hydrology, salt spray, fire history and anthropogenic disturbance.

2.2.1 Geology

North Head was formed 90 million years ago during the Late Cretaceous Period. Following rifting of the Tasman Sea and uplift of the Hornsby Plateau, stream erosion began to cut into the plateau surface. This erosion excavated the valley system now flooded by Sydney Harbour and left behind the ridges and plateau remnants forming the high ground and headlands around the harbour. There have been at least eight sea level changes over the past 700,000 years, and as a result of these changes in sea level, North Head has on various occasions formed a mesa, an island and a tied island. The main valleys of North Head are the landward extensions of these ancient valleys in the bed of Sydney Harbour. The largest valley extends from Manly Hospital to Collins Beach and is the landward extension of the palaeovalley in Spring Cove.

Above the 60metre contour, North Head is a plateau with a central north-south trending ridge of Pleistocene-aged dune sands up to 30 metres thick. These sands are a significant aquifer; wetlands are developed where the sand deposits are shallow and where sand chokes valleys on the western side and springs rise at the boundary between the sands and the Hawkesbury Sandstone.

Sydney Harbour is made up of mostly sandstone and shale formed during the Triassic period (about 220 million years ago). These formations were later raised to their present heights by earth movements, starting in the Jurassic period, (200 million years ago). During this time great cracks formed and molten lava rose up through the rocks to form volcanic vents, these then cooled and hardened to form dykes of basalt. Remains of basalt dykes occur at North Head.

Along some parts of the harbour there are some low-lying areas of sand that has been deposited by water (alluvium) running between hills of sandstone. Particularly high areas such as North Head, were once islands now joined to the mainland by sand spits such as the Corso area of Manly.

North Head is formed from Triassic units of the Sydney Basin sequence intruded by dykes of probable Jurassic age. North Head is an outlying remnant of the Hornsby Plateau from which it has become isolated due to erosion. It is in fact a tied island, connected to the mainland only by the sand spit (tombolo) on which Manly village is now located (Skelton et al., 2003).

Wind deposited sand dunes made up of white quartz sand cover much of the central section of North Head, generally above the 80m contour and beyond the subject site. Two basaltic dykes have been identified at North Head, a larger one running between the cliffs west of Old Man's Hat and the southern face of Cannae Point and a smaller one exposed in the cliff south of Blue Fish Point. Both dykes strike approximately NW-SE (Osborne & Osborne 1999).

2.2.2 Soil landscape

Mapping of the 1:100 000 map sheet (Chapman and Murphy 1989) identifies three soil landscapes within the subject site: Lambert; Gymea; and North Head. As shown in Figure 2-3 most of the subject site overlies the Lambert soil landscape, with the vegetated slopes leading to and including QS Beach overlying Gymea soil landscape, and land at higher elevation surrounding the entrance road overlying the North Head soil landscape.

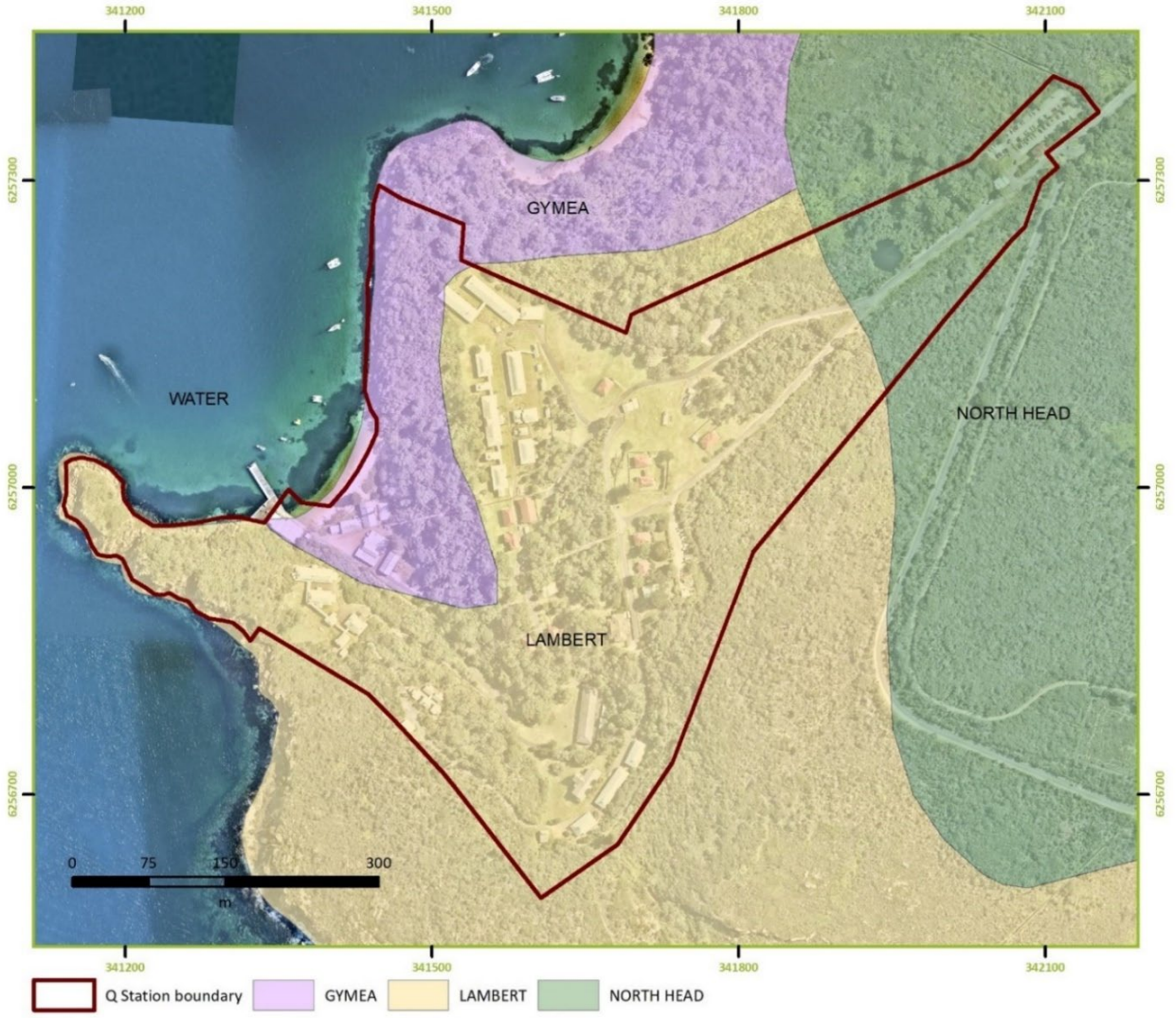

Figure 2-3. Soil landscapes

Table 2-1 summarises key characteristics of each soil landscape, which influence the plant communities present and, in turn, the habitat provided for local fauna and visiting fauna species.

Table 2-1. Soil landscapes

Soil type	Landscape	Vegetation
Lambert (erosional process)	Geology: Hawkesbury Sandstone - medium to coarse-grained quartz sandstone with minor shale and laminite lenses. Topography: Undulating to rolling low hills. Local relief 20–120 m and slopes <20%. Broad convex crests and plateau surfaces. Gently to moderately inclined side slopes, often associated with small hanging valleys.	Predominantly uncleared open-heathlands, closed-heathlands and scrublands, with patches of low eucalypt woodland. The heathlands and scrublands are often exposed to strong winds. Shallow, poorly drained soils fluctuate between being saturated or dry. Isolated lines and patches of trees are occasionally associated with joint crevices. *Allocasuarina distyla* and/or *Banksia ericifolia* are usually dominant.

Soil type	Landscape	Vegetation
	Characteristic sandstone bedrock that outcrops as wide benches (10–100 m), with broken scarps 1–4 m high. Small, poorly drained seepage areas are common.	Other shrubs such as *Hakea teretifolia* may be locally dominant in areas subject to seepage or prolonged saturation. Associated shrubs include various *Grevillea* spp., *Konza* spp., *Pultenaea* spp., *Leptospermum* spp. and *Epacris* spp.
Gymea (erosional process)	Geology: Hawkesbury Sandstone, which is a medium to coarse-grained quartz sandstone with minor shale and laminite lenses. Topography: Undulating to rolling low hills with local relief 20–80 m and slopes of 10–25%. Sideslopes with narrow to wide outcropping sandstone rock benches (10–100 m), often forming broken scarps of <5 m.	Low, dry sclerophyll open woodland dominates ridges and upper slopes. Common species include red bloodwood, yellow bloodwood, scribbly gum, brown stringybark and old man banksia. On the more sheltered slopes, black ash, Sydney peppermint and smooth-barked apple are common tree species. The dry sclerophyll understorey consists of shrubs from the families Epacridaceae, Myrtaceae, Fabaceae and Proteaceae.
North Head (aeolian process)	Geology: Elevated, undulating to rolling rises of aeolian reworked dune fields. Topography: Local relief to 5 m; slopes 5–15%. Rock outcrop is usually absent. Dunes and swales have often been reworked and may be difficult to distinguish. Drainage is mostly sub-surface.	Mostly cleared heathland and scrub. Common species include Sydney golden wattle, prickly Moses, coastal tea tree, native rosemary , and coastal heath. Occasionally eucalypt woodland is located in less exposed areas. These areas are usually dominated by old man banksia, smooth-barked apple and Sydney peppermint.

2.3 Hydrology

Availability of water is a major factor influencing the distribution of many plant species on North Head. There are no rivers, lakes, lagoons or other major water features on the headland. Due to the sand dunes, clay patches and less permeable layers of sandstone, there are many springs that seep out on the cliff face on the eastern side and occasional wet patches on the western side, including the subject site (Skelton et al., 2003).

Prior to colonial occupation, a large water catchment covered a significant portion in the centre of North Head and depressions in the sites topography combined with the landscape's hydrological systems created hanging swamps. This hydrology was altered for the construction and operation of the quarantine facility with water that fell within the catchment redirected to two reservoirs. From the 1930s, many of the military buildings and installations were located within the catchment and the earthworks that were required to develop adversely affected the hydrological systems of the landscape (Cox Architecture, 2024).

Current day, stormwater is conveyed through the subject site through concrete pipe drains and concrete side entry pits, which were constructed across the site, during different periods. Larger streets have sub surface concrete storm water drains and pit systems (Mawland Construction Pty Ltd. 2008, Thompson Berrill Landscape Design Pty Ltd, 2006)

The current condition of stormwater control mechanisms varies in quality and state of repair. Extensive work was carried out to divert storm water from entering the sewer system which was an on-going

problem due to original poor design. Most down pipes and open culverts are now diverted away from the sewer drains. All stormwater that isn't absorbed by the ground drains to QS Beach enters Sydney Harbour from a 600mm diameter concrete pipe located above the high tide mark at the south end of the beach (Mawland Construction Pty Ltd. 2008).

Areas of surface erosion lacking formalised stormwater measures as identified in the Heritage Landscape Management Plan for Q Station (Thompson Berrill Landscape Design Pty Ltd, 2006) have been progressively stabilised.

As shown in Figure 2-4 a large proportion of stormwater runoff is generated upslope and beyond the subject site boundary and Q Stations' operational control. Except for the North Head Scenic Drive, the external catchment area comprises bushland.

Figure 2-4. Subject site catchment and stormwater runoff (source: Manidis Roberts, 2001)

2.4 Fire History

Heath and scrub vegetation has evolved with fire over many thousands of years to the extent that they require fire to trigger reproduction. For many of the native plants, fire stimulates flowering and seed dispersal, germination of the soil stored seed bank, or regrowth from epicormic buds and lignotubers (depending on the species and its tolerance to fire).

The absence of fire for the last 30 years has favoured dominance of senescent *Leptospermum laevigatum* (tea tree scrub) whose tall thick canopy suppresses regeneration of the diverse range of groundcover and shrub species (Cox Architects, February 2024).

This is supported by Skelton et al., (2003) who detail the known fire history of North Head and conclude that the past fire frequency was leading to a loss of biodiversity in the heath and coastal scrub communities with local extinctions of species likely to be occurring. This evidenced by much of the heath, scrub, woodland and forest communities becoming dominated by species that are favoured by an absence of fire, such as: *Pittosporum undulatum, Melaleuca armillaris, Leptospermum laevigatum*, and the exotic and native weeds *Cinnamomum camphora* and *Tristania confertus (*synonym for *Lophostemon confertus)* respectively.

The Fire Management Plan for Sydney Harbour & Botany Bay (La Perouse Precinct) National Parks (DEC, 2004) has mapped the Bushfire Potential Behaviour for the site, which is summarised as follows:

- High Bushfire Behaviour Potential areas include:
  - Coastal Heathland to the south western portion of the site (i.e. behind Isolation);
  - the Heathland immediately east of Third-Class Precinct and north of Second Cemetery;
  - the Coastal Woodland escarpment between Wharf Precinct and First and Second Class, and
  - a small path of overstorey vegetation on the escarpment in front of Isolation.
- Moderate Bushfire Behaviour Potential areas include:
  - Coastal Heathland immediately to the south and east of Third-Class Precinct (with an area of low potential in the vicinity of The Old Mans Hat walking track);
  - the ESBS vegetation to the east of the entire site;
  - the woodland to the northern side of Quarantine Station Entry Road;
  - the Broad-leaved Paperbark gully land associated woodland on the northern boundary of Second Class and Administration; and
  - the escarpment vegetation in front of Isolation extending around to Third Class.

The mown grass areas within the Quarantine Station are identified as having negligible fire risk potential.

NPWS are responsible for implementing the Fire Management Plan (DEC, 2004) and vegetation management in the site is required to be consistent with this.

Potential impacts on threatened species, populations and communities that may result from fuel load reduction or fire hazard reduction burns are not within the scope of this assessment.

Bushfire hazard reduction practices are the responsibility of the NPWS and are assessed separately from the continued operations proposal.

2.5 Vegetation

2.5.1 Overview

The headland's naturally isolated remnant bushland has been conserved largely by virtue of its historical land uses and soil landscapes. As identified in Section 2.2, most soil types have a low to poor capacity for urban development. The types of land uses that transpired historically (the Quarantine Station, defence site, military training base, nature reserve and National Park) have supported the retention of extensive tracts of remnant native vegetation.

The native vegetation communities at North Head have been reported by a substantial amount of literature. Gunninah (2001) and Skelton et al., (2003) describe over 35 studies relating to North Head and adjacent areas that provide data from 1980 through to 2003.

With the exception of ongoing monitoring of the Eastern Suburbs Banksia Scrub community, limited data and reporting have been produced since this time.

The Plan of Management for Sydney Harbour National Park (NPWS 2012) describes North Head as containing a more expansive area of bushland than any other precinct in the National Park, which includes the following:

- Approximately 460 species of plants, within the different vegetation communities, and
- A mosaic of vegetation communities including Sydney Harbour's most extensive area of heath and scrub vegetation, including:
  - coastal rock-plate heath,
  - coastal sandstone plateau heath,
  - coastal sandstone ridge-top woodland,
  - coastal sandstone gully forest,
  - littoral thicket and a small patch of temperate littoral rainforest, and
  - the largest remaining example of the endangered Eastern Suburbs Banksia Scrub (ESBS) community.

The coastal sandstone heaths and scrub form dense vegetation thickets up to 2 metres high on shallow stony soils on Hawkesbury Sandstone. The heath is dominated by sclerophyllous vegetation such as heath banksia *Banksia ericifolia*, coastal banksia *B. integrifolia*, red bloodwood *Corymbia gummifera*, smooth-barked apple *Angophora costata*, various heath species, and tea-tree *Leptospermum laevigatum*.

Common ESBS species include *B. ericifolia, B. serrata, Eriostemon australasius, Leptospermum laevigatum, Monotoca elliptica, Pteridium esculentum, Ricinicarpos pinifolius* and *Xanthorrhoea resinifera*.

The coastal sandstone gully forest with smooth-barked apple *Angophora costata*, grey gum *E. punctata* and forest red gum *E. tereticornis* is found on more sheltered slopes and near creeklines such as on the western side of North Head.

Coastal sandstone ridgetop woodland with smooth-barked apple and bangalay *E. botryoides* is found in more exposed sandstone slopes.

2.5.2 Vegetation mapping

The most recent available vegetation mapping is the NSW State Vegetation Type Map (SVTM) - SVTM_NSW_Extant_PCT_vC2_0_M2_0 (DPE, 2023). Plant community types (PCTs) mapped in the SVTM have been updated following a systematic ecological review of the (Eastern NSW PCT Classification version 1.1), which decommissioned PCTs shown in earlier (such as the Native Vegetation of the Sydney Metropolitan Area - Version 3_1 VIS_ID 4489: OEH, 2016).

The SVTM (DPE 2023) shows eight (8) PCTs are located within the subject site (see Figure 2-7). Table 2-2 lists each PCT and whether listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and / or the Commonwealth *Environment Protection* and *Biodiversity Conservation Act 1999* (EPBC Act).

Table 2-2. Plant community types (PCTs) within the subject site

PCT ID	PCT name	Status	
		BC Act	EPBC Act
3040	Sydney Coastal Foreshores Gully Rainforest	Not listed	CE
3546	Coastal Sands Littoral Scrub-Forest	E	CE
3594	Sydney Coastal Sandstone Foreshores Forest	Not listed	Not listed
3805	Southern Sandplain Heath	CE	CE
3806	Sydney Coastal Sand Mantle Heath	CE	CE
3811	Sydney Coastal Headland Cliff Scrub	Not listed	Not listed
3812	Sydney Coastal Sandstone Headland Heath	Not listed	Not listed
3922	Sydney Coastal Sand Swamp Scrub	E	Not listed

Key **E** = Endangered **CE** = Critically Endangered

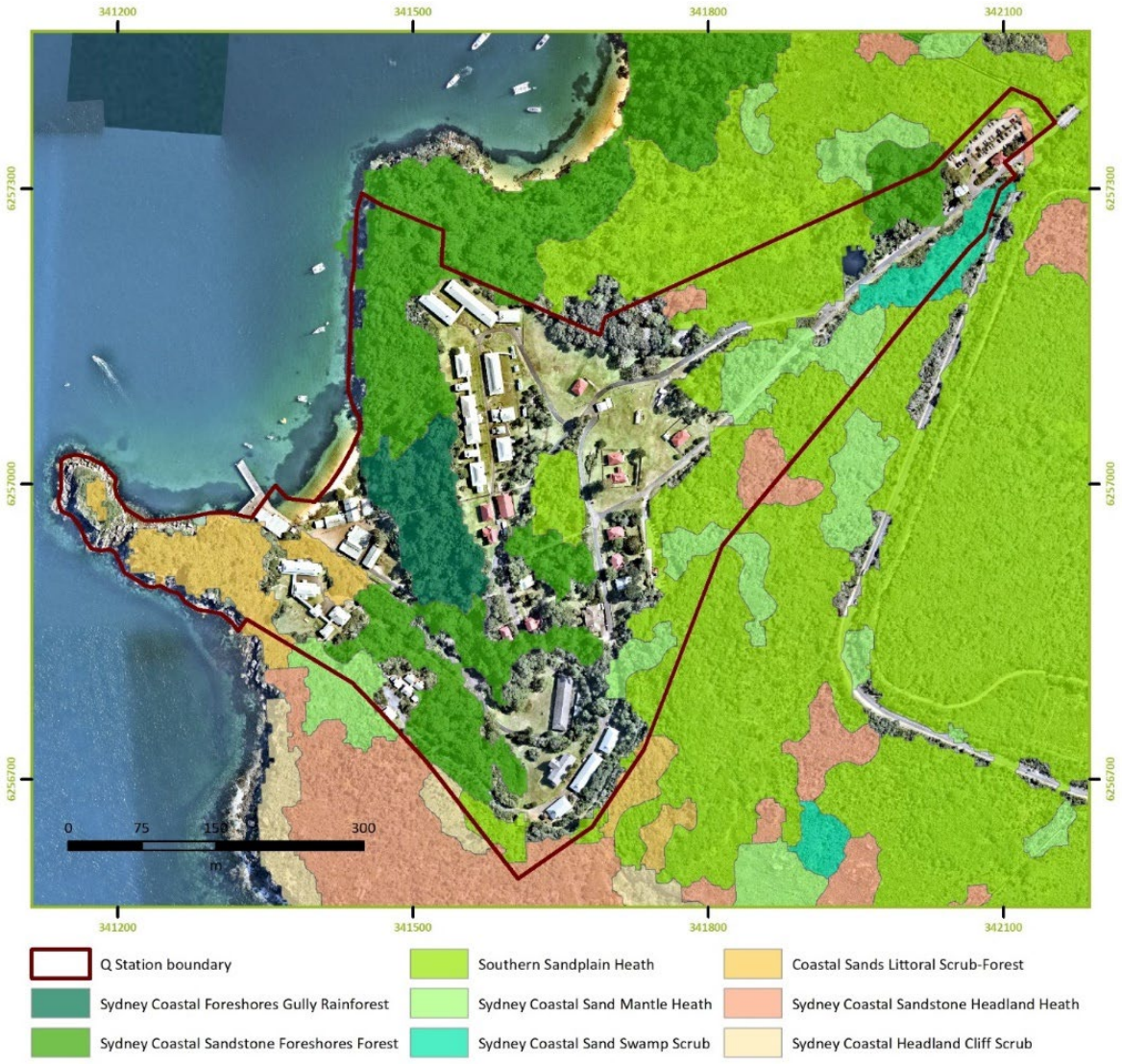

Figure 2-5. SVTM (DPE 2022) mapped PCTs

Field validation of available vegetation mapping was beyond the scope of this assessment. The proposal does not involve any clearing of native vegetation or changed uses that would result in indirect impacts not already considered in existing approval conditions.

Desktop aerial photographic interpretation using 2024 high resolution aerial photography has identified that the boundaries of mapped PCTs do not necessarily align with the current extent of native vegetation in the subject site.

Diagrams illustrating the extent of native vegetation used in various reports reviewed for this assessment also varied considerably. However, this might be due to changes in growth / habit of vegetation over time. As indicated by Skelton et al., (2003) and Cox Architects (2024) the absence of fire over time has promoted the growth of a taller and thicker canopy compared to a more diverse range of shrub and groundcover species.

On-site validation of mapped PCT boundaries and verification of DPE (2023) PCT allocations would be beneficial in terms of filling knowledge gaps and guiding ongoing management of remnant vegetation, threatened species habitat and ecological / hazard reduction fire regimes.

2.6 Fauna habitat

North Head's unusual history of development and management has left a legacy on the landscape. However, even the lawn areas within North Head provide important habitat for at least some species, such as long-nosed bandicoots which forage extensively in these grassed areas (NPWS 2012).

This is particularly relevant for the QS lease area, which contains a diverse native landscape surrounding and interspersed within the built environment. Due to the location, geology and topography, there is a diverse range of habitat features present within the QS lease area (see Table 2-3).

Table 2-3. Habitat features present within the QS lease area

Habitat component	Site values
Coarse woody debris	Potential in more timbered areas below ridgelines
Rock outcrops and bush rock	Present throughout
Caves, crevices and overhangs	Crevices and overhangs present along the south and western peripheries of the site
Culverts, bridges, mine shafts, or abandoned structures	Absent, but many buildings and manmade structures present throughout that may provide threatened microbat habitat
Nectar/lerp-bearing trees	Many nectar-bearing trees are present: *Eucalyptus botryoides, Corymbia gummifera, Angophora costata, Melaleuca quinquenervia*
Nectar-bearing shrubs	Many nectar-bearing shrubs are present: *Banksia, Callistemon, Melaleuca species, Kunzea ambigua, Leptospermum* spp.
Large stick nests	No large stick nests suitable for threatened raptorial birds of prey have been previously observed but a number of raptor species have been recorded visiting or using the wider study area.
Sap and gum sources	Native sap and gum source trees are present: *Eucalyptus botryoides, Corymbia gummifera, Angophora costata*.
She-oak fruit (Glossy Black Cockatoo feed)	*Casuarina glauca* and *Allocasuarina distyla* are present
Seed-bearing trees and shrubs	Seed-bearing trees such as *Eucalyptus* and *Allocasuarina* species may provide foraging habitat for threatened avian species.

Habitat component	Site values
Soft-fruit-bearing trees	Fruit-bearing trees are present: *Pittosporum undulatum* (Sweet Pittosporum), and *Elaeocarpus reticulatus* (Blueberry Ash), *Ficus* spp. Fig trees.
Dense shrubbery and leaf litter	Widespread
Tree hollows	Present, but not inventoried
Decorticating bark	Present
Wetlands, soaks and streams	Present
Open water bodies	Present (reservoir)
Estuary, beach, rocky foreshore	Present

In addition to the habitat features listed in Table 2-3, the Wharf Precinct contains beach and tidal habitat and the QS Wharf extends into subtidal habitat which contains macroalgae (Kelp and Sargassum) and seagrass bed.

However, the most significant fauna habitat in the study area is the outstanding biodiversity value area[2] (AOBV) declared for the endangered little penguin *Eudyptula minor* population in the Manly Point area, which includes nesting and potential nesting areas within the QS lease area.

AOBVs are special areas with irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. The relevant legislative provisions for AOBVs are Part 3 of the BC Act and BC Reg.

As shown in Figure 2-8, the little penguin's critical habitat is in two AOBV areas:

+ Area A starts from west of Collins Beach and extends to the northern side of Cannae Point. It includes Collins, Store and QS Beaches to the northern side of Cannae Point.

  The terrestrial boundary of the critical habitat in Sydney Harbour National Park includes ridgetop areas where penguins currently nest or could potentially nest.

+ Area B starts at 11A Oyama Avenue and extends around Manly Point to 26 Addison Road. The land side of the critical habitat includes the area from the mean high watermark, up the rocky foreshore slope to the beginning of the ridgetop in residential areas.

+ The rocky foreshore upslope to the boundary of formed residential backyards is included as critical habitat, but formed backyards and residential areas are not included.

The AOBV areas includes foraging habitat which extends 50 metres out from the mean highwater mark and lies within North (Sydney) Harbour Aquatic Reserve.

Parts of this aquatic zone include seagrass beds that are likely to be important feeding areas, especially during the rearing of chicks when little penguins are known to seek food closer to their nests.

Relevant to the QS lease area is that part of Area A that extents from Cannae Point to Rance Point as shown in Figure 2-9.

While the land below the mean highwater mark is not under the jurisdiction of NPWS (instead the NSW Maritime Authority of Transport NSW), Spring Cove (including the extent of AOBV Area A) has been included within the study area of this assessment.

[2] Formerly known as declared critical habitat under the repealed *Threatened Species Conservation Act 1995*

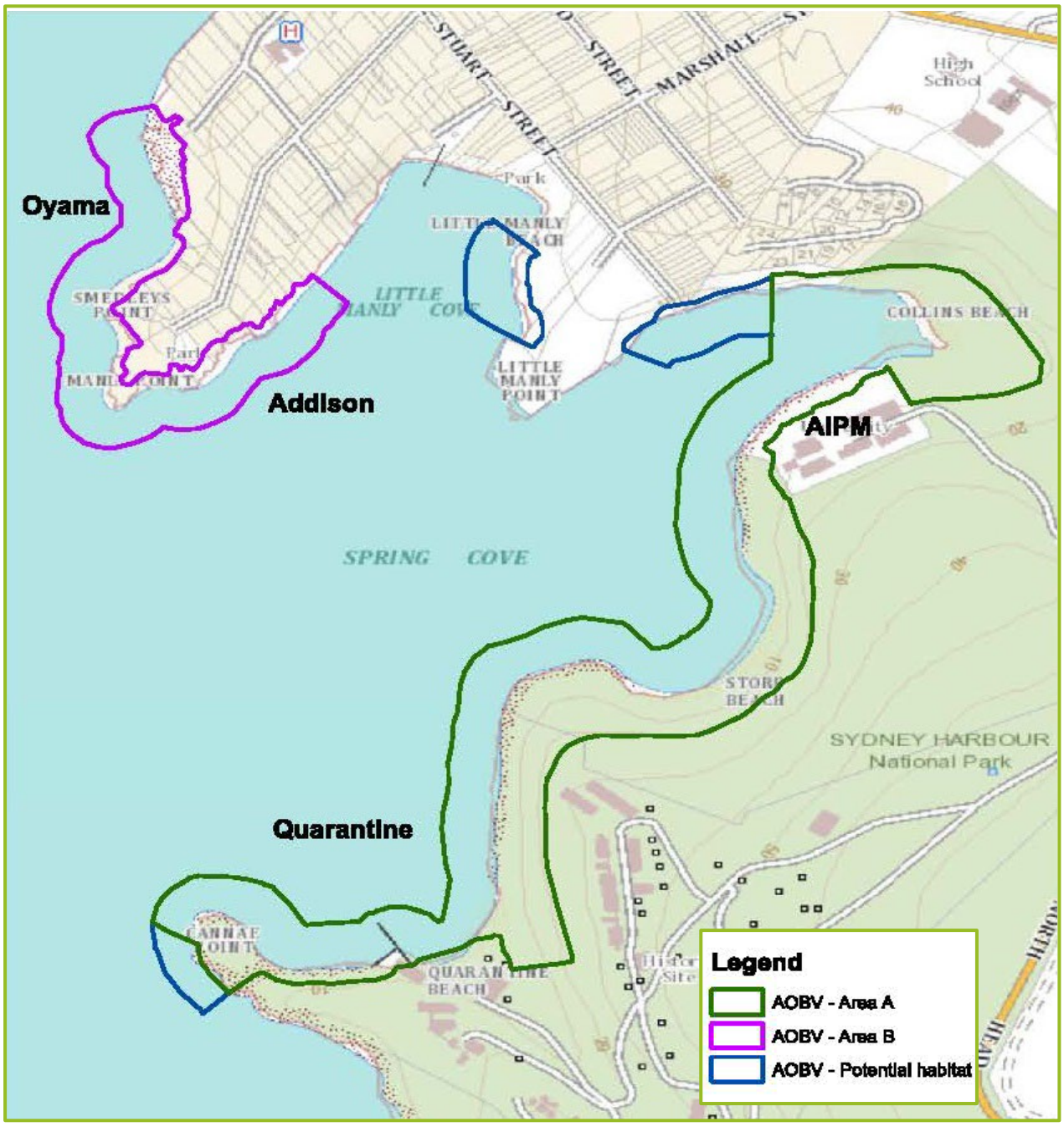

Figure 2-6. Little penguin critical habitat

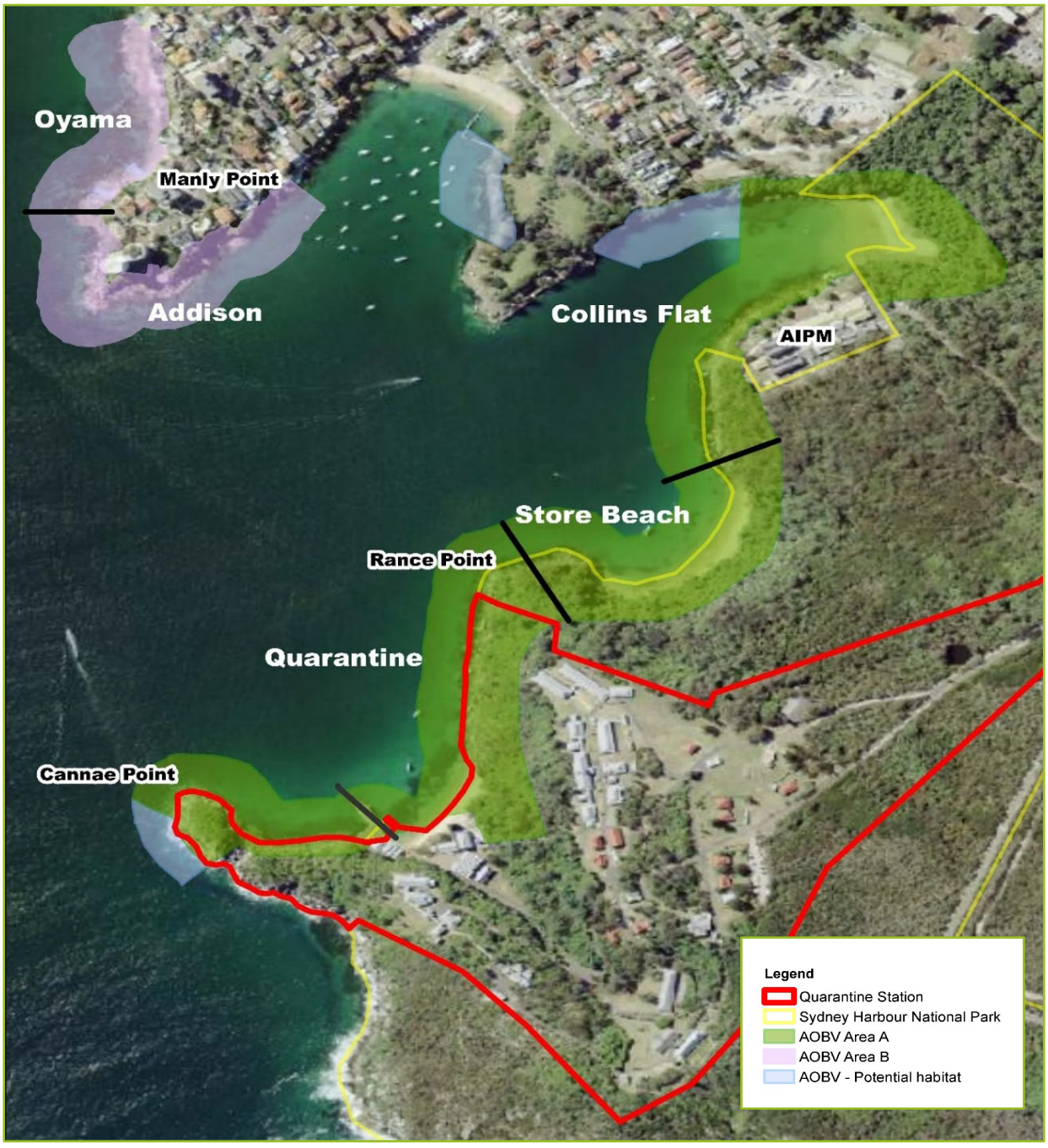

Figure 2-7. Map of breeding areas (Source: Figure 1 2024 Manly Little Penguin Sustainability Report 12/06/2024)

2.7 Threatened species

The review of data from the BioNet threatened species database collection (TBDC), the Commonwealth's Protected Matters Report and literature review, has generated a list of threatened species, populations and communities that are considered in this assessment.

Appendix A provides a summary of all entities returned in database searches, their habitat requirements and likelihood of occurring within the study area.

2.7.1 Threatened flora species

Table 2-4 lists threatened flora species recorded in the search area (i.e., a 10km radius from the site) and the likelihood of occurrence within the subject site.

Two species are known to occur within the QS lease area, two species have been recorded at North Head and habitat for a further five species is considered to potentially occur.

Table 2-4. Threatened flora species records

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence
Acacia bynoeana Bynoe's wattle	E	V	Potential habitat, although absence of detection historically and lack of records in study area suggests a low likelihood.
Acacia terminalis subsp. terminalis Sunshine wattle	E	E	**Present**
Allocasuarina portuensis Nielsen Park she-oak	E	E	Unlikely, the species originally naturally occurred at South Head existing species have been planted.
Asterolasia buxifolia	E		Unlikely, habitat absent
Callistemon linearifolius Netted bottle brush	V,3		Unlikely, habitat absent
Chamaesyce psammogeton Sand spurge	E		Potential habitat
Epacris purpurascens var. purpurascens	V		Unlikely, habitat absent
Eucalyptus camfieldii Camfield's stringybark	V	V	**Present**
Eucalyptus nicholii Narrow-leaved black peppermint	V	V	Unlikely, restricted distribution that does not include the study area
Grammitis stenophylla Narrow-leafed finger fern			Unlikely, habitat absent
Grevillea caleyi Caley's grevillea	E	CE	Unlikely, restricted distribution that does not include the study area
Hibbertia superans	E		Unlikely, restricted distribution that does not include the study area
Macadamia integrifolia Macadamia nut		V	Not known to occur naturally in the wild in NSW.

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence
Melaleuca biconvexa Biconvex paperbark	V	V	Unlikely, habitat absent and not known from the locality
Microtis angusii Angus's onion orchid	E	E	Unlikely, habitat absent
Persoonia hirsuta Hairy geebung	E	E	Present in study area
Pimelea curviflora var. curviflora	V	V	Present in study area
Prasophyllum fuscum Slaty leek orchid	E	V	Potential habitat
Prostanthera marifolia Seaforth mintbush	E	CE	Unlikely, restricted distribution that does not include the study area
Rhodamnia rubescens Scrub turpentine	E	CE	Unlikely, habitat absent
Senecio spathulatus Coast groundsel	E		Potential habitat
Syzygium paniculatum Magenta lilly pilly	E	V	Potential habitat
Tetratheca glandulosa	V		Unlikely, habitat absent
Tetratheca juncea Black-eyed susan	V	V	Unlikely, habitat absent
Triplarina imbricata Creek triplarina	E	E	Unlikely, habitat absent

2.7.1.1 *Acacia terminalis subsp. terminalis* Sunshine wattle

Sunshine wattle occurs in 53 sites of which only four sites occur on private land (two owned by St. Patricks College proximal to the subject site) and 15 sites where the species occur within Sydney Harbour National Park and are zoned as National Park (including North Head) (DECCW, 2010).

Within the QS lease area, Sunshine wattle occurs in scattered locations across the site. Based on TBDC records, there is approximately 188 specimens, which includes approximately 100 seedlings planted under the Saving Our Species program.

2.7.1.2 *Eucalyptus camfieldii Camfield's stringybark*

Camfield's Stringybark was originally known from as far south as Bulli Pass (near Wollongong) and as far north as Gosford. In NSW, this species is now known only from a very few small stands confined mainly to the national parks north and south of Sydney. Populations are known at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park (EPBC Act SPRAT).

Camfield's Stringybark occurs as three individual specimens located within the QS lease area (see Figure 2-8). The total number of individual specimens reported from North Head, based on TBDC records is 53 and over the species entire range is approximately 5,200.

The 3 specimens in the QS lease area were reported to be in good health in the Q Station Monitoring Report 2017-2022 (NPWS).

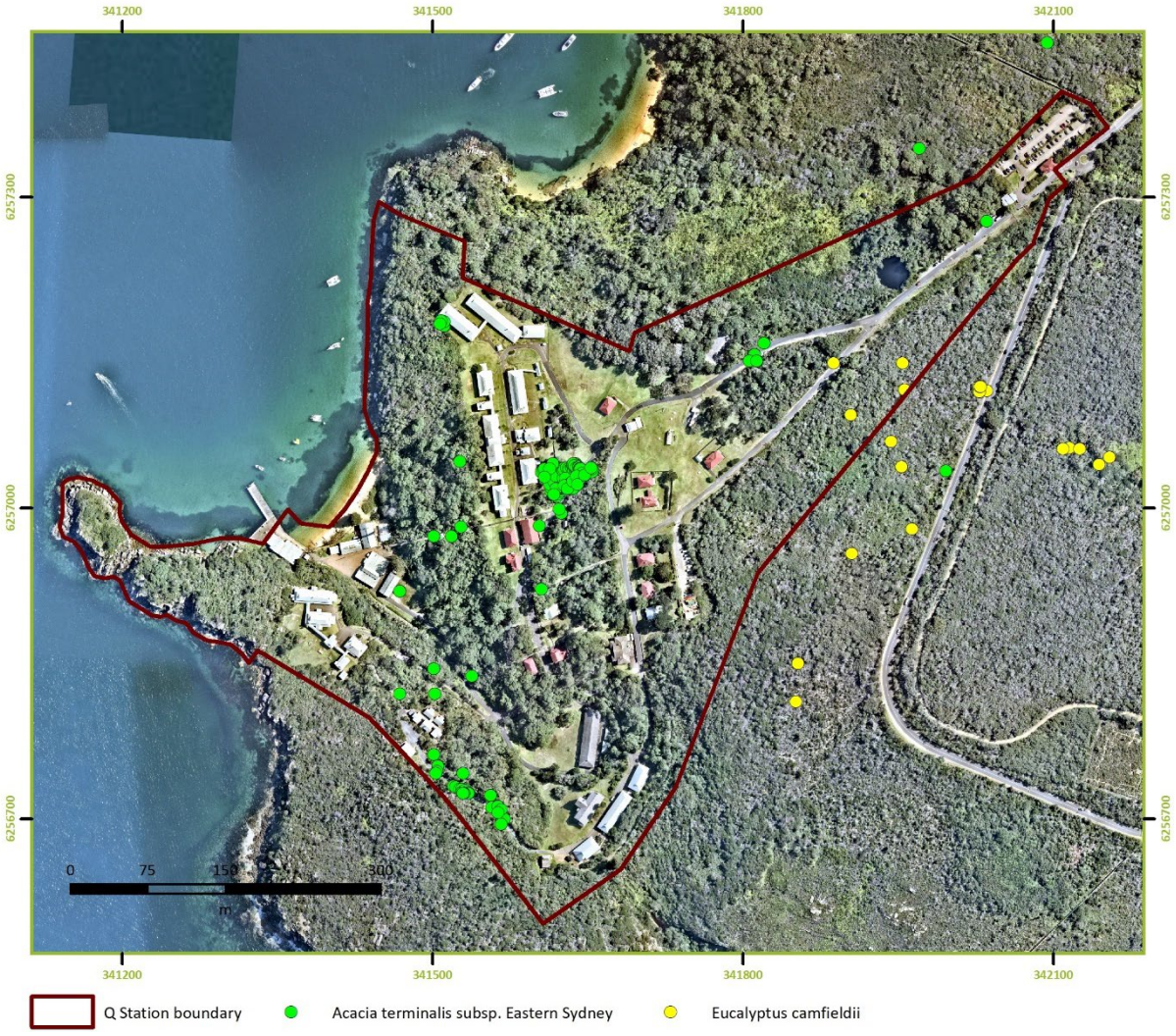

Figure 2-8. Threatened flora species in the QS lease area

2.7.2 Threatened fauna species

Table 2-5 lists threatened fauna species recorded in the search area (i.e., a 10km radius from the site) and the likelihood of occurrence within the subject site.

Eleven species are known to occur within the QS lease area, seven species have been recorded at North Head and habitat for a further five species are considered to potentially occur.

Table 2-5. Threatened fauna species records

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence
Amphibia			
Pseudophryne australis Red-crowned toadlet	V		**Present**
Aves			
Anthochaera phrygia Regent honeyeater	CE	CE	Site not located in important areas mapped for this species.
Burhinus grallarius Bush stone-curlew	E		Habitat present, recorded at North Head in 2019, will not be affected by the proposal
Climacteris picumnus victoriae Brown treecreeper (eastern subspecies)	V	V	Unlikely, habitat absent
Eudyptula minor Little Penguin in the Manly Point Area	E		**Present**
Glossopsitta pusilla Little lorikeet	V		Marginal habitat present, will not be affected by the proposal
Haematopus fuliginosus Sooty oystercatcher	E		Habitat in study area, will not be affected by the proposal
Haematopus longirostris Pied oystercatcher	V		Habitat in study area, will not be affected by the proposal
Haliaeetus leucogaster White-bellied sea-eagle	V		Present in study area (foraging)
Hieraaetus morphnoides little eagle	V		Present in study area (foraging)
Hirundapus caudacutus White-throated needletail		V	Present in study area (foraging)
Lathamus discolor Swift parrot	E	CE	Site not located in important areas mapped for this species.
Lophoictinia isura Square-tailed kite	V		Unlikely, habitat absent
Ninox connivens Barking owl	V		Unlikely, habitat absent
Ninox strenua Powerful owl	V		Present in study area (foraging) - will not be affected by the proposal
Pandion cristatus Eastern osprey	V		Present in study area (foraging) - will not be affected by the proposal

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence
Petroica boodang Scarlet robin	V		Unlikely, habitat absent
Ptilinopus regina Rose-crowned fruit-dove	V		Vagrant
Ptilinopus superbus Superb Fruit-Dove	V		Vagrant
Mammalia			
Cercartetus nanus Eastern pygmy-possum	V		**Present**
Isoodon obesulus obesulus Southern brown bandicoot [eastern]	E	E	Potential habitat, although absence of detection historically and lack of records in study area suggests a low likelihood.
Perameles nasuta Long-nosed bandicoot, North Head	E		**Present**
Mammalia - bats			
Chalinolobus dwyeri Large-eared pied bat	V	E	Present in study area - will not be affected by the proposal Multiple echolocation recordings between 2021-2023 at several locations across North Head closest to site at Stores Beach
Falsistrellus tasmaniensis Eastern false pipistrelle	V		Habitat present - will not be affected by the proposal
Miniopterus australis Little bent-winged bat	V		Present - will not be affected by the proposal
Miniopterus orianae oceanensis Large bent-winged bat	V		Present - will not be affected by the proposal
Myotis macropus Southern myotis	V		Present in study area One record from Store Beach 9 years ago (2015) there is no riparian habitat or suitable foraging resources for the species
Pteropus poliocephalus Grey-headed flying-fox	V	V	Present - will not be affected by the proposal Ubiquitous species
Saccolaimus flaviventris Yellow-bellied sheathtail-bat	V		Present - will not be affected by the proposal
Scoteanax rueppellii Greater broad-nosed bat	V		Present - will not be affected by the proposal
Reptile			
Varanus rosenbergi Rosenberg's goanna	V		Unlikely, habitat absent

2.7.2.1 Pseudophryne australis red-crowned toadlet

Red-crowned toadlets usually live in the vicinity of permanently moist soaks or areas of dense ground vegetation or leaf litter along or near head-water stream beds. Potential habitat within the QS lease area would be present on moist sandstone benches or at the base of rock outcrops. Figure 2-9 shows the habitat areas that Gunninah (2001) suggested may provide habitat for the species and the location of records sourced from the TBDC (in Table 2-5).

It should be noted that both records shown within the QS lease area are unlikely to represent the actual location where the species has been heard calling. One is from 1996 and reported as located within the gutter of the car park at the Ranger headquarters and where exposed rock shelves were covered in parts by *Gleichenia* sp., (coral fern).

The second record from within the QS lease area is from March 2023, and the record to the east of the subject site is from June 2023. All records were 'heard' calls of the species.

The AWC surveys for the species at three locations within the northeast area of North Head and where hanging swamps have been maintained. These areas are relatively distanced from the subject site and may have been affected by the 2020 hazard reduction burns (that broke containment lines), as the species has not been recorded during biannual surveys following the fire (although its presence was heard incidentally during 2022 surveys).

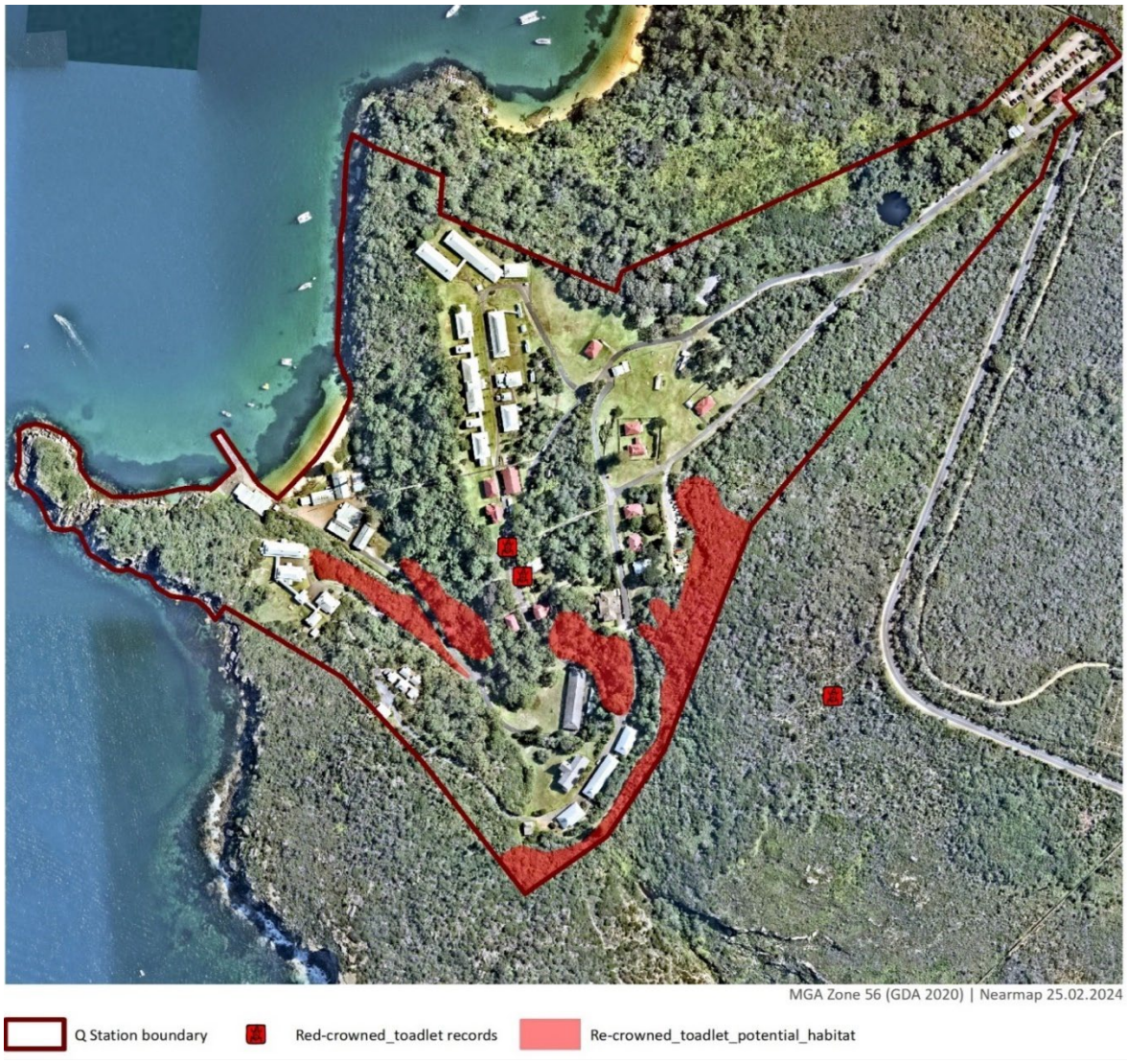

Figure 2-9. Potential red-crowned toadlet habitat

2.7.2.2 *Cercartetus nanus* eastern pygmy possum

The TBDC describes the eastern pygmy possum as occurring in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred.

The species feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. It shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, ringtail possum dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks.

Since 2016, 43 eastern pygmy-possums have been translocated to North Head (2016 = 8, 2017 = 10, 2018 = 7, 2019 = 6, 2020 = 3 and 2022 = 9). In 2022, individual eastern pygmy-possums were captured in 27 out of 101 nest boxes (total occupancy = 27%), with a mean occupancy per survey of 8.4% (±3.8). This metric almost doubled from 2021 to 2022. The location of occupied nest boxes showed some variation in 2022 compared to previous years, with 20 boxes occupied for the first time. This suggests that eastern pygmy-possum are beginning to expand from initial release areas, thereby satisfying key success criteria associated with their reintroduction (AWC 2022).

Figure 2-10 shows nest box occupation across North Head.

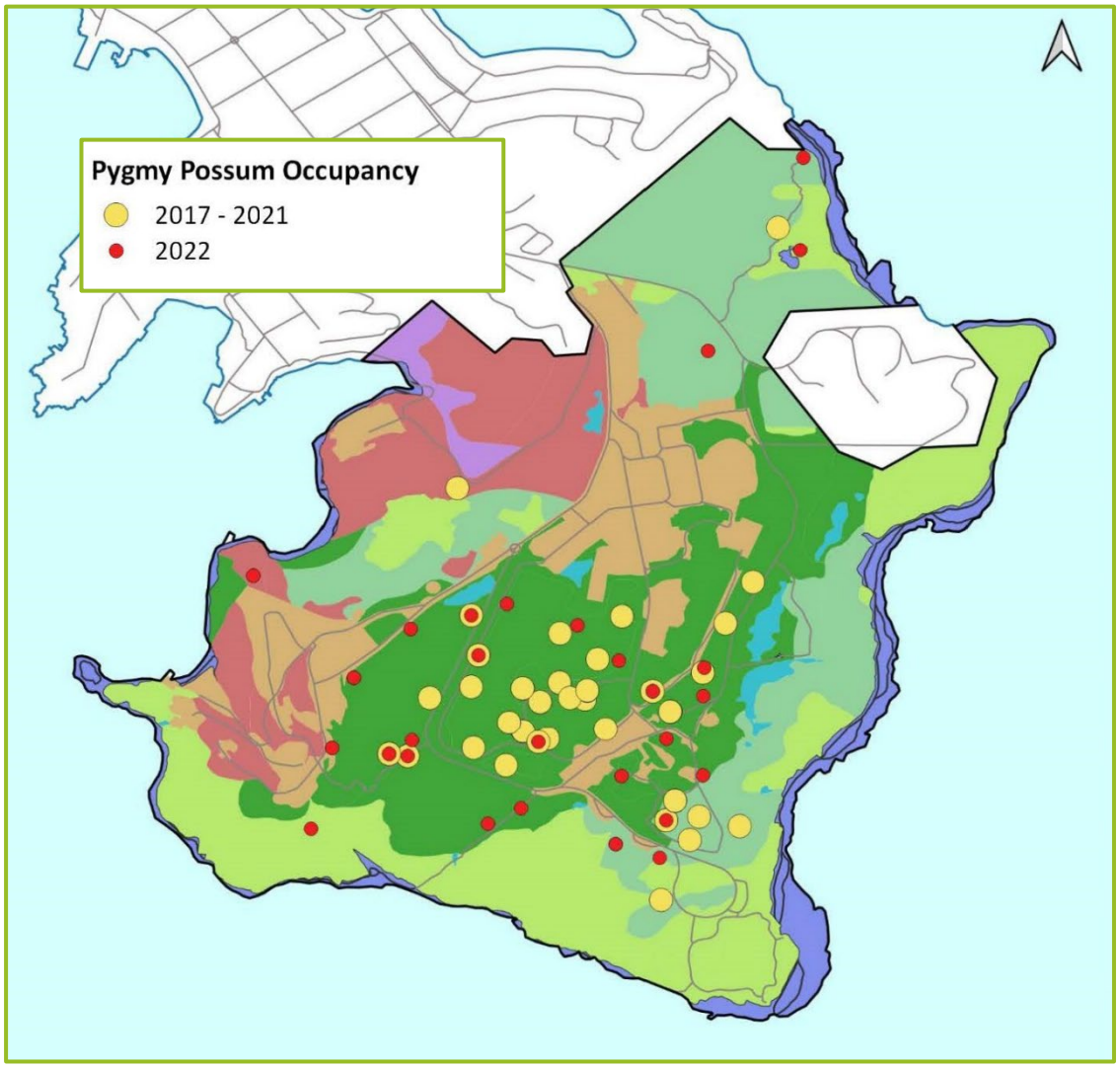

Figure 2-10. Eastern pygmy possum occupancy at North Head (source: AWC 2022)

2.8 Threatened ecological communities

Five (5) PCTs mapped within the QS lease area are related to threatened ecological communities (TECs) listed under the BC Act and/or the EPBC Act (see Figure 2-10

Table 2-6. Threatened ecological communities (TECs) within the subject site

PCT name (PCT ID)	Status
Sydney Coastal Foreshores Gully Rainforest (PCT 3040)	Relates to the Commonwealth Littoral Rainforest and Coastal Vine Thickets of Eastern Australia TEC where it occurs within 2 km of coastline or on an offshore island or adjacent to a large body of saltwater subject to maritime influence and satisfies condition thresholds as per Section 4 of the Listing Advice.
Coastal Sands Littoral Scrub-Forest (PCT 3546)	PCT 3546 relates to the following: + NSW Bangalay Sand Forest TEC when it occurs on marine sand as per paragraph 2 of the Final Determination and within the Sydney Basin or South East Corner bioregions (IBRA Version 4.0) as per paragraph 1. + Commonwealth Littoral Rainforest and Coastal Vine Thickets of Eastern Australia TEC where it occurs within 2 km of coastline or on an offshore island or adjacent to a large body of saltwater subject to maritime influence and satisfies condition thresholds as per Section 4 of the Listing Advice.
Southern Sandplain Heath (PCT 3805)	Both PCT 3805 and 3806 relates to the following: + NSW Eastern Suburbs Banksia Scrub TEC. + Commonwealth Eastern Suburbs Banksia Scrub TEC where it occurs in Sydney Basin Bioregion between the Hawkesbury River and Stanwell Park as per Section 2.1 of the Conservation Advice. It must also satisfy the minimum condition thresholds set out in Section 2.3 of the Advice, relating to patch size and numbers of native species.
Sydney Coastal Sand Mantle Heath (PCT 3806)	
Sydney Coastal Sand Swamp Scrub (PCT 3922)	Relates to the NSW Sydney Freshwater Wetlands TEC.

Figure 2-11. Indicative TECs in the subject site

2.8.1 Commonwealth Littoral Rainforest and Coastal Vine Thickets

The NSW Bionet Vegetation Classification (VC) database indicates that both Sydney Coastal Foreshores Gully Rainforest (PCT 3040) and Coastal Sands Littoral Scrub-Forest (PCT 3546) are related to the Commonwealth EPBC Act listed Littoral Rainforest and Coastal Vine Thickets critically endangered community.

The Conservation Advice approved by the Delegate of the Minister on 12 November 2015 describes the community as a complex of rainforest and coastal vine thickets on the east coast of Australia influenced by its proximity to the sea. The canopy, which protects less tolerant species and propagules in the understorey from salt laden winds, can range from patchy to closed and may include emergents as well as dead trees due to ongoing natural disturbance.

In NSW, the community Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions is listed as endangered, but PCTs 3040 and 3546 are not identified as being related to this TEC in the TBDC.

The EPBC Act listed Littoral Rainforest and Coastal Vine Thickets of Eastern Australia TEC comprises those patches that the key diagnostic characteristics and the condition thresholds presented in Table 2-7 and which represent the minimum level for patches to be included in EPBC listed community.

Table 2-7. Littoral Rainforest & Coastal Vine Thickets of Eastern Australia - key diagnostic characteristics & condition thresholds

Diagnostic & condition threshold	Relevance
Key diagnostic characteristics	
The ecological community occurs in the following IBRA bioregions: Cape York Peninsula, Wet Tropics, Central Mackay Coast, South Eastern Queensland, NSW North Coast, Sydney Basin and South East Corner.	**Meets threshold:** occurs in the Sydney Basin
Patches of the ecological community occur within two kilometres of the east coast, including offshore islands, or adjacent to a large body of salt water, such as an estuary, where they are subject to maritime influence.	**Meets threshold:** the subject site occurs within two kilometres of the east coast and adjacent to a large body of salt water subject to maritime influence.
The structure of the ecological community typically is a closed canopy of trees that can be interspersed with canopy gaps that are common in exposed situations or with storm events.	**Not verified[#]:** PCT 3040 is described as a mid-high to tall, closed rainforest with occasional sclerophyll emergents, or a tall to very tall sclerophyll open forest with a mid-high sub-canopy of mesophyllous small trees and shrubs. **Considered unlikely to meet threshold:** PCT 3546 within the subject site does not exist as a canopy of trees and is not considered further.
Usually, several vegetation strata are present. However, where there is extreme exposure to salt laden winds, these strata may merge into a height continuum rather than occurring as distinct vegetation layers. The canopy forms a mosaic due to canopy regeneration, typically in the form of basal coppice following canopy decapitation due to prevailing salt laden winds and storm events. Wind sheared canopy can be present on the frontal section leading to closed secondary canopies. Emergents may be present, for example, species from the genera *Araucaria* (northern bioregions only), *Banksia* or *Eucalyptus*. The ground stratum of the vegetation typically is very sparse.	**Not verified or applicable:** Several vegetation strata are present. The community is relatively protected from extreme exposure to salt laden winds and canopy regeneration following canopy decapitation is not evident. Emergents of *Banksia* and *Eucalyptus* genera are present. PCT 3040 is reported as common on slopes above harbour foreshores with the proximity to maritime influences leading to some floristic characteristics shared with rainforests within the littoral zone elsewhere in the Sydney region.
Condition thresholds	
Small patches can be resilient and viable, but the minimum size of a patch needs to be 0.1 ha	**Meets threshold:** patch greater than 0.1 ha, i.e. PCT 3040 in the subject site (ignoring other adjacent vegetation patches) has a patch size of approx. 1.8ha.
The cover of transformer weed species (as identified in Attachment A) is 70% or less	**Meets threshold:** identified transformer weeds for this TEC are listed below and all are known to occur in

Diagnostic & condition threshold	Relevance
Transformer weeds are highly invasive taxa with the potential to seriously alter the structure and function of the ecological community. This threshold recognises the relative resilience and recoverability of the ecological community to invasion by weed species	the study area. The cover of transformer weeds, while not verified, is anticipated to be 70% or less. + *Asparagus aethiopicus, Chrysanthemoides monilifera, Delairea odorata, Ehrharta erecta, Lantana camara, Senna pendula, Tradescantia albiflora*
The patch must have: + at least 25% of the native plant species diversity characteristic of this ecological community in that bioregion (Attachment A); OR + at least 30% canopy cover of one rainforest canopy (either tree or shrub) species (Attachment A, excluding Banksia and Eucalyptus species that may be part of the ecological community).	**Not verified:** Species in Attachment A excluding Banksia and Eucalyptus species include: **Trees** + *Acmena smithii, Acronychia oblongifolia, Cupaniopsis anacardioides, Diospyros pentamera, Elaeodendron australe, Glochidion ferdinandi, Guioa semiglauca, Livistona australis, Pittosporum undulatum, Podocarpus elatus, Myrsine howittiana, Sarcomelicope simplicifolia, Synoum glandulosum* **Shrubs** + *Breynia oblongifolia, Notelaea longifolia, Pittosporum revolutum, Syzygium paniculatum*

2.8.2 Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions

The NSW Bionet Vegetation Classification (VC) database relates PCT 3546 to the TEC Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions (Bangalay Sand Forest) when it occurs on marine sand as per paragraph 2 of the Final Determination and within the Sydney Basin or South East Corner bioregions (IBRA Version 4.0) as per paragraph 1.

Paragraph 1 of the determination describes Bangalay Sand Forest typically as a dense to open tree canopy, approximately 5-20 m tall, depending on exposure and disturbance history. The most common tree species include *Eucalyptus botryoides* and *Leptospermum laevigatum*, while *E. pilularis* and *Acmena smithii* may occur in more sheltered situations.

The open shrub stratum may be dominated by sclerophyllous species, such as *Banksia integrifolia*, *L. laevigatum* and *Monotoca elliptica*, or mesophyllous, species, such as *Breynia oblongifolia* and *Pittosporum undulatum*, or a combination of both. Shrubs may vary in height from one to ten metres tall. The groundcover varies from open to dense and may be sparse where the tree canopy is dense or where there is a thick litter of leaves and branches.

Mapped PCT 3546 within the QS lease area is located on the exposed western harbour side overlying the Lambert soil landscape (which comprise shallow, poorly drained soils) (see Figure 2-10). PCT 3546 at this location appears to comprise a heath or open scrub community with occasional trees and lacks a dense or open tree canopy as described in its listing.

Consequently, it is considered unlikely that PCT 3546 within the QS lease area is commensurate with the NSW listed TEC.

2.8.3 Eastern Suburbs Banksia Scrub

Eastern Suburbs Banksia Scrub (ESBS) is a sclerophyllous heath/scrub community that occurs on disjunct patches of nutrient poor, aeolian dune sand and may contain small patches of woodland, low forest or limited wetter areas, depending on site topography and hydrology.

The VC database indicates that PCTs 3805 and 3806 relate to the NSW and Commonwealth listed ESBS. Within the QS lease area mapped PCTs 3805 and 3806 extend over 7.03 ha, which comprises:

+ 6.20 ha of PCT 3805 in 3 x patches (0.13 ha, 0.19 ha and 0.51 ha), and
+ 0.83 ha of PCT 3806 in 8 x patches (0.05 ha, 0.09 ha, 0.11 ha, 0.15 ha, 0.40 ha, 0.45 ha, 0.58 ha and 1.61 ha)

There are no thresholds for the NSW listed ESBS, however, for the community to be considered as the Commonwealth TEC, it must satisfy the minimum condition thresholds set out in the Commonwealth Conservation Advice for the community (see Table 2-8).

Table 2-8. Eastern Suburbs Banksia Scrub - key diagnostic characteristics & condition thresholds

Diagnostic & condition threshold	Relevance
Key diagnostic characteristics	
Occurs in Sydney Basin Bioregion within 10 km of the coast, between the Hawkesbury River estuary in the north and Stanwell Park in the south. Within this area, the ecological community typically occurs on headlands, sandplains or dunes near the coast, but not on dunes comprised primarily of sand of recent marine origin.	**Meets threshold:** occurs in the Sydney Basin within an appropriate environment.
The ecological community occurs on low nutrient sands, of primarily Quaternary age, and commonly of wind-blown origin. These sands are often podsolised, showing contrasting horizons. These soils are underlain by sandstone. The depth to this sandstone layer varies: small areas of sandstone may outcrop but typically outcrops are.	**Meets threshold:** occurs on low nutrient sands underlain by sandstone
The structure and floristics of the ecological community vary in response to landscape position, soil depth and drainage as well as disturbance, in particular fire history and soil disturbance. Typically, the ecological community occurs in a predominantly sclerophyllous heath, shrubland or scrub. Some trees and localised wetter patches may be present.	**Meets threshold:** occurs in a predominantly sclerophyllous heath, shrubland or scrub.
No species are known to be present at all sites but species most commonly associated with the ecological community are shrubs such as: *Acacia longifolia*, *A. suaveolens*, *Allocasuarina distyla*, *Banksia aemula*, *B. serrata*, *Isopogon anemonifolius*, *Kunzea ambigua*, *Lambertia formosa*, *Leptospermum laevigatum*, *Leucopogon ericoides*, *Melaleuca nodosa*, *Monotoca elliptica*, *Persoonia lanceolata*, *Philotheca salsolifolia, Pimelea linifolia*, *Ricinocarpos pinifolius*, *Styphelia viridis*, *Woollsia pungens* and a range of native peas.	**Meets threshold:** occurs in a predominantly sclerophyllous heath, shrubland or scrub. The listed most commonly associated species are reported from the subject site PCTs and surrounding study area.

Diagnostic & condition threshold	Relevance
Condition thresholds	
Minimum patch size 0.05 ha AND	**Meets threshold:** occurs in patches greater than 0.05 ha.
No more than 70% perennial weed cover (mean cover estimated across strata present e.g. ground layer, shrub layer)	**Meets threshold:** no more than 70% perennial weed cover present in patches

2.8.3 NSW Sydney Freshwater Wetlands

The VC database indicates that Sydney Coastal Sand Swamp Scrub (PCT 3922) relates to the NSW Sydney Freshwater Wetlands TEC. This TEC is described as a complex of vegetation types largely restricted to freshwater swamps in coastal areas, which may vary considerably due to fluctuating water levels and seasonality. Areas of open water may occur where drainage conditions have been altered and there may also be patches of emergent trees and shrubs.

Characteristic vegetation in the final determination to list the TEC includes: *Eleocharis sphacelata, Machaerina juncea, M. rubiginosa, M. articulata, Gahnia sieberiana, Ludwigia peploides* subsp. *montevidensis* and *Persicaria species*.

There may be considerable areas of open water particularly where drainage conditions have been altered. There may be patches of emergent trees such as *Melaleuca quinquenervia* and shrubs (including *Leptospermum juniperinum, Banksia robur, Callistemon citrinus, Melaleuca nodosa, Viminaria juncea*).

Within the subject site, mapped PCT 3922 covers approximately 0.86 ha (three patches <0.2 ha, <0.1 ha, 0.58 ha, see Figure 2-10).

Species within these areas contain consistent with the TEC include: *Gahnia clarkei* and *Gahnia sieberiana*, *Gleichenia dicarpa, Pteridium esculentum, Melaleuca nodosa, Lomandra longifolia* and *Imperata cylindrica*.

2.9 Aquatic zone

As described in Section 2.6, the AOBV areas extend 50 metres out from the mean highwater mark. This aquatic zone includes intertidal rocky foreshore areas and subtidal environment macroalgae and seagrass, and the various estuarine / marine fauna that utilise these areas.

Due to the location of the study area to the Tasman Sea and larger open water zones of Port Jackson, threatened species records returned in database searches have been filtered to exclude species that would never occur or are highly unlikely to occur in the study area, such as:

- Pelagic bird species (albatrosses, petrels);
- Marine mammals (dugongs, whales);
- Fin fish such sharks, and pelagic species (tuna)
- Migratory wader birds (i.e., that require intertidal mudflats, shallow wetlands etc for foraging)

Table 2-9 identifies threatened species that do occur, or have the potential to occur, in the aquatic zone that could be indirectly impacted by the facility's operation.

Table 2-9. Aquatic threatened species

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence
Avifauna			
Haematopus fuliginosus Sooty oystercatcher	V		Potential foraging habitat on exposed sand, rocks at low tide, rocky shelves, exposed reefs with rock pools. Surveys conducted by Marine Pollution Research(2023) discounted suitable habitat for the species.
Haematopus longirostris Pied oystercatcher	E		
Flora	FM Act*		
Posidonia australis in Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie	E		Present
Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion		E	Seagrass meadows in study area do not meet the meet diagnostic thresholds[3] to be considered under the EPBC Act (< 50% cover of *P.australis* present in seagrass beds)
Finfish	FM Act*		
Epinephelus daemelii Black rockcod	V	V	Surveys conducted by Marine Pollution Research(2023) discounted suitable habitat for the species.
Hippocampus whitei White's Seahorse	E	E	Surveys conducted by Marine Pollution Research(2023) discounted suitable habitat for the species.
Marine mammals			
Arctocephalus forsteri New Zealand fur-seal	V		Potential to infrequently use rocky foreshore as haul out resting sites. Will not be affected by the proposal.
Arctocephalus pusillus doriferus Australian fur-seal	V		
Marine reptiles			
Caretta caretta Loggerhead turtle	E	E	Potential to occur in study area (Spring Cove & Little Manly Cove). Multiple records from search area, including Manly Cove and Middle Harbour for the green turtle. Will not be affected by the proposal.
Chelonia mydas Green turtle	V	V	
Dermochelys coriacea Leatherback turtle	E	E	
Eretmochelys imbricata Hawksbill turtle		V	

* NSW *Fisheries Management Act 1994*

[3] Based on surveys conducted by Marine Pollution Research (2023) and resultant mapping produced

2.10 Endangered populations

2.10.1 Endangered little penguin Eudyptula minor population in Manly

As discussed in Section 2.6, an area of AOBV for Manly's little penguins is located within the QS lease area.

The breeding success of Manly's little penguins is monitored annually with all accessible, known burrows and nests inspected fortnightly between July and January. A little penguin expert contracted by NPWS monitors the number of: active nests; breeding pairs; eggs laid and fledglings.

The most recent monitoring report for the 2023-2024 season identifies that there are still far fewer penguins coming ashore to breed than in the years prior to the 2015 fox predation. The level of breeding declined over a number of years after the incursion but over the last few years, numbers appear to have reached a plateau, albeit at a much lower number.

In the years 2006 to 2014, breeding pairs were regularly in the range from 50 to 70 pairs, and active nests from 84 to 107. In the last five years, numbers of breeding pairs have ranged only from the low this year of 19, to 35 pairs. It is considered likely now that the roughly 20 to 30 breeding pairs experienced over the last few years are the new normal base.

As the proposed ongoing operation of the facility is located in an area of AOBV, the requirement to prepare an SIS is triggered and Manly's little penguins are the main focus of the proposal's SIS (écologique, 2024).

2.10.2 Endangered long-nosed bandicoot (Perameles nasuta) population on North Head

The endangered population of long-nosed Bandicoots (hereafter referred to simply as bandicoots) on North Head has been systematically monitored since 2002 (Price & Banks, 2021). Monitoring and management forms part of the work program of the North Head Long-nosed bandicoot Recovery Team. NPWS and other stakeholders such as Australian Wildlife Conservancy monitor the population cross the headland.

This includes monitoring bandicoot numbers, health, and breeding success and how they are responding to threats, such as habitat loss, predation by dogs and foxes, inbreeding and disease.

Monitoring of the long-nosed bandicoot population on North Head undertaken by the Australian Wildlife Conservancy (AWC) is a component of the Ecological Health Monitoring Program (Ecohealth) for the Harbour Trust, which has been conducted since 2017– and includes the Q Station on behalf of NPWS. Previous monitoring programs reported by Price & Banks (2021) have been undertaken biannually from 2002.

This monitoring program comprises 47 transects with 6 cage traps each for 5 nights repeated annually at the locations shown in Figure 2-9.

Previous monitoring programs reported by Price & Banks (2021) have been undertaken biannually from 2002.

In 2022, 123 bandicoots were trapped (captured) a total of 239 times across 47 transects. Population modelling resulted in an estimated population size of 193 (±17) individuals. This was the second highest population estimate since 2004, lower only than 2021.

Numbers of bandicoots on the headland remain relatively high compared to historical data.

The sex ratio of individuals captured in 2022 was even for the first time since 2016. In 2017-2021 the sex ratio was female biased.

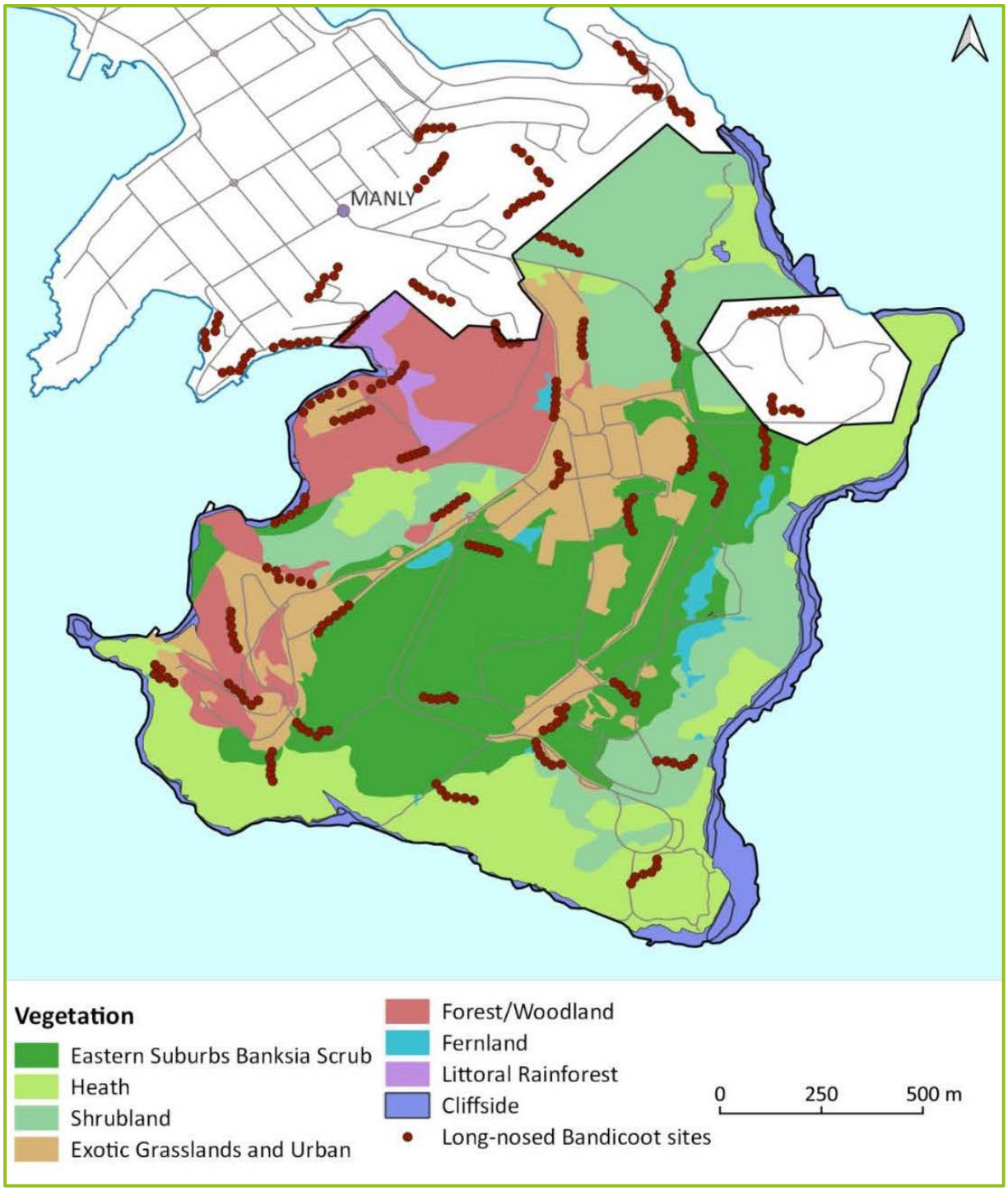

Figure 2-12. Location of bandicoot monitoring sites (from AWC EcoHealth reporting)

Table 2-10 provides a summary of bandicoots trapped (captured) and number of individuals from the North Head headland with Q Station reported separately. Figure 2-11 illustrates the number of individuals from the headland and the subject site from 2017 to 2022.

Figure 2-12 illustrates various areas of bandicoot habitat within the QS lease area including that discussed in the EIS (Manidis and Roberts 2003) and SIS (Gunninah 2001) for the Adaptation and Reuse Major Project application; and includes an area investigated by camera trap to the northeast and west of building 24 (undertaken by écologique in late 2023).

Table 2-10. Long-nosed bandicoot monitoring 2017- 2023

Location & type	May 2017	May 2018	Nov 2018	May 2020	Nov 2020	May 2021	May 2022	May 2023
QS captured	21	53	8	32.	Approx 10	Approx 69	Approx 62	
QS individuals	15	16	5	16	Approx 8	Approx 41	Approx 29	
Whole of headland (North Head) captured	83	265	104	207	Approx 47	Approx 338	257	363
Whole of headland (North Head) individuals	60	114	55	109	29	Approx 107	Approx 80	114

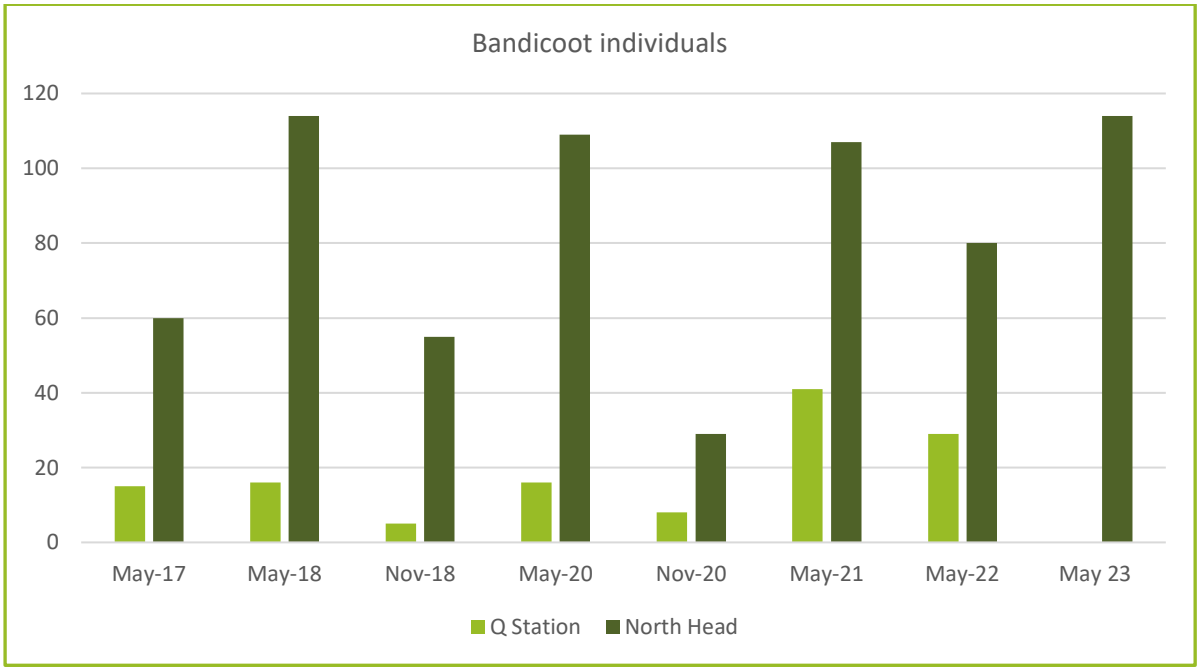

Figure 2-13. Individual bandicoots found during monitoring at Q Station and at North Head headland 2017-2022/23

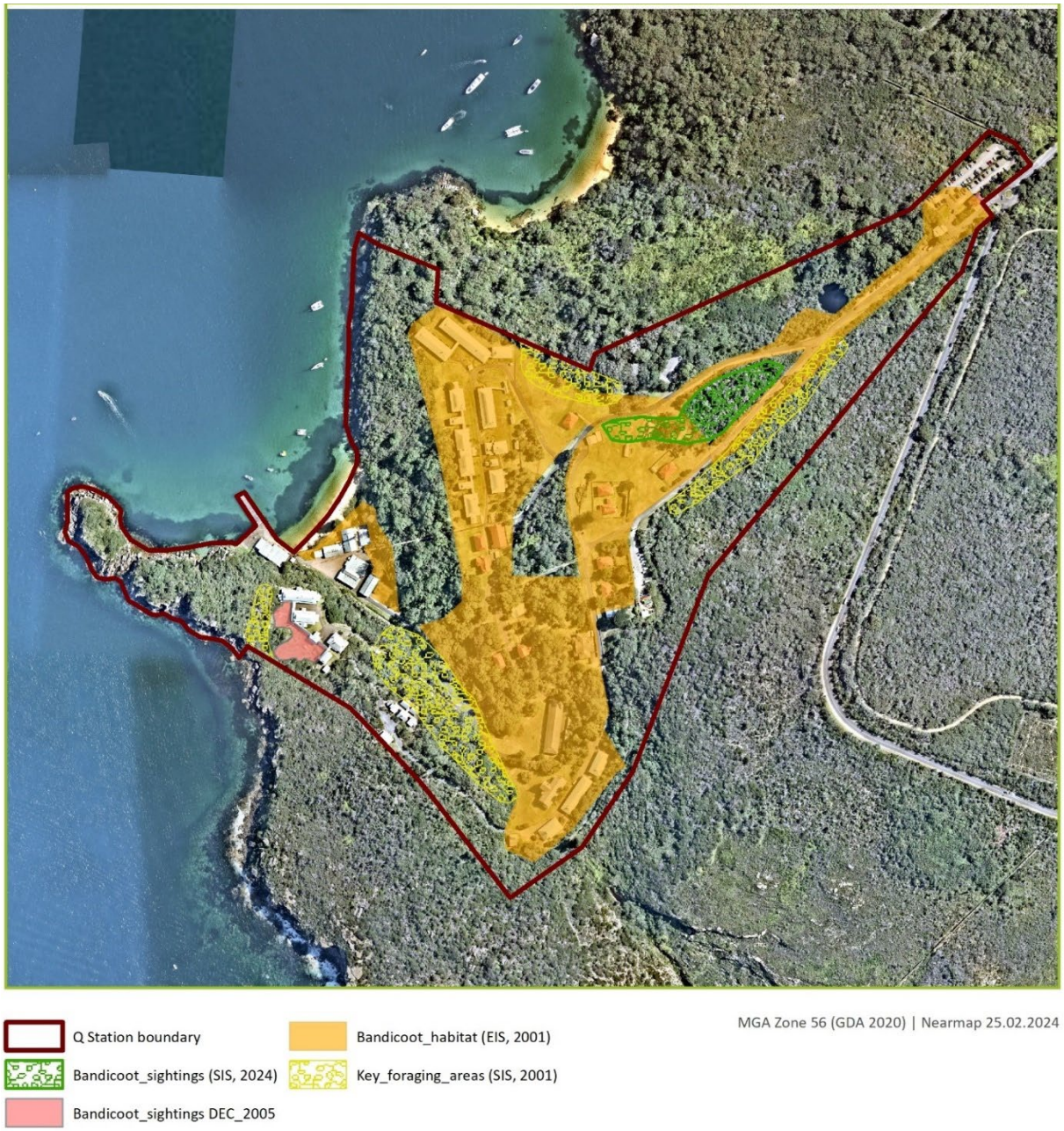

Figure 2-14. Bandicoot habitat areas

3. The Proposal

3.1 Overview

As detailed in Section 1.1, operation of the facility is undertaken in accordance with the current planning approval. The proposed ongoing operation does not seek to change any of the current approved 'Key Site Activities' nor are any physical works proposed.

While the current Key Site Activities allowed at Q Station will remain unchanged, a range of amendments are proposed which include:

+ Deletion of obsolete conditions (i.e., previously fulfilled by Mawland during the establishment of the facility and that which are no longer applicable)
+ Update conditions to reflect more recent management plans, titles and terminology

The proposed modifications are not considered to result in any new and adverse effects on the biodiversity values in the study area. A detailed description of the proposed modifications is provided in the proposal's REF and supporting species impact statement (SIS).

3.2 Current Site Operations

Table 3-1 provides an outline of the site operations that occur on a regular basis and Figure 3-1 illustrates the locations of buildings and operational areas referenced.

Table 3-1. Current site operations

Operation
Visitor access
There are 2 car parks at Q Station: + CP1 at reception/entrance with 120 spaces for all visitors and hotel guests + CP5 within the site with 56 spaces for Q Station vehicles, staff and guests For most arriving visitors parking is in CP1. Access into the site is then either walking or use of the Q Station shuttle bus. There is a boom gate at reception (A26), to manage vehicle access into the site. Staff are permitted to drive on site to access CP5 for staff parking and drive Q Station vehicles as necessary to their position. Contractors are permitted to drive on site when necessary. Guests staying in cottages can drive and park in designated parking areas adjacent to their cottage. If a driver is permitted to drive on site (i.e. staff, contractor or cottage guest) a site induction must be completed prior to entering. The Q Station shuttle provides a free transport in and out of Manly. This is timetabled and details are found on the Q Station website. Arrival to the site via ferry is not currently possible. Groups are encouraged to visit Q Station via private coach or bus. Small buses up to 22 seats with private groups attending a Q Station event or tour are permitted to drive into the site where the group has limited mobility. These small buses are escorted by a Q Station shuttle into the site.

Operation

Visitor management

Site capacity

The current capacity limit for the site has been set by the current CoPA to be optimally 315pax with a maximum of 600 pax at any one time. This includes staff and guests.

Two community open days are held each year. On each day a program of free tours, talks and activities is available for the community to book and attend.

The QSCCC meets at Q Station 4 time a year. It consists of an independent chair, representatives from NHS, NPWS and local community stakeholder groups.

Visitor Centre and Museum

Building A14-17 within Wharf precinct houses a free Quarantine Exhibition, Tours Desk, café and public toilets. The Tours desk is staffed 10am-4pm every day for visitor information & enquiries , assistance and tour booking. The café is open from 8am every day serving coffee, light meals and snacks.

Tours

The current tours on offer at Q Station can be divided into history, ghost and education programs. All education, public and private tour information can be found on the Q Station website. Bookings for public tours can be made through the website. Changes to specific tour schedules and content are based on demand and seasonality, however in general the tours run as follows:

Quarantine Wander History Tour – 11am daily

Disease and Burial History Tour – after dark

Ghostly Encounters Tour – 2.5 hours Wednesdays

Ghost trackers Family Tour – 2 hours Friday & Saturday

Paranormal Investigation – 3.5 hours Thursday evening

Private tours for in house conferences and other external social or corporate groups are also available. Booking requests managed individually. The site held 19000 tour guests in 2023.

Education programs

The site holds educational programs for primary and secondary students. These programs involve exploring the natural and built environment, handling artefacts, following paths of migration on large maps, experiencing past technologies, interacting with primary sources, playing games and hearing stories.

The Environment and Cultural Centre (A9 & A11) is also used as part of educational programs offered at the site. Groups are able to stay in the hotel accommodation. Buildings commonly used are P21, P22 or P23 or cottages, however this depends on the numbers, gender, staff to student ratio and other requirements of the school.

Conferences, functions and events

Q Station hosts a range of conferences, functions and events over the year, with the potential of up to 45% of total revenue being generated in this way. The follow 11 buildings are available for meetings and functions: P3, P7, P10, P12, P15, P16, P27, A2 & H1A.

A6:

The Boilerhouse Kitchen and Bar is a restaurant which operates out of building A6. Operating hours are outlined below:

Operation

Opening Times

Mon: Closed
Tues: Closed
Weds: 4:00pm – 9pm
Thurs: 4:00pm – 9pm
Fri: 4:00pm – 9pm
Sat: 12pm – 9pm
Sun: 12pm – 5pm

Lunch

12pm – 3pm Saturday and Sunday

Dinner

5:30pm – 9pm Wednesday to Saturday

The Engine Room bar at the beachside end of A6 offers a casual dining option for lunch, dinner or refreshments. Opening hours are as follows:

Friday 4pm-9pm

Saturday & Sunday 11am -5:30pm

The kitchen for the Boiler house and Engine Room bar is located within A6.

P12 & P13

A restaurant is located in building P12. Food preparation is conducted in neighbouring building P13.

This restaurant/food prep provided buffet breakfast for guests every morning from 7am.

A14 & A17

A café (known as the 'Wharf Café') is located inside A14-17 and forms part of the Visitor Centre complex in the Wharf precinct.

Opening hours are Sunday-Tuesday 8am-5pm and Wednesday-Saturday 8am-4pm.

Food preparation for this café is completed in P13 and then delivered to the café each day.

A20

A kitchen is located within A20. This kitchen is used on demand only for events and functions.

Q Station vehicles are used to transport food to all locations outside of immediate venues.

Staff

There are currently 140 staff employed at the site. This includes a mix of permanent full time and part or casual roles.

Environmental

Maintenance/conservation

+ Specific maintenance tasks on site are logged through the in-house Protel system.
+ Daily report tasks are attended to by the maintenance team in the first instance.
+ Specialised trades e.g. electrical, plumbing services are contracted when appropriate.
+ Regular use and inspection of buildings and infrastructure also informs ongoing maintenance requirements such as painting of buildings, drain clearing, road potholes.
+ Repairs to buildings and infrastructure are carried out in line with CWP guidelines.
+ Mown areas are subject to ongoing grass cutting, weeding and other gardening tasks are predominately carried out in the immediate garden beds adjacent to buildings or on the periphery of the mown areas.
+ Pest control.

3.3 Consideration of alternatives

Given the current planning approval expires in December this year, there is no alternative to the proposed activity, other than a 'do nothing' option.

Under a 'do nothing' option, the operations at the site would cease after 23 December 2024. This would prevent the site from operating for cultural tourism purposes, despite the current lease enabling this until 2050.

It would also mean an end to current public access to and operations on the site which have been made possible by the significant investment that has been undertaken in conserving the site's heritage and other improvements to the site since the original planning approval. This would also prevent the ability for the site's culture and heritage to be understood and interpreted by the public.

With specific relevance to the site's biodiversity values, a 'do nothing' option would ensure a lack of financial security for the ongoing conservation of the facility's biodiversity values and an increasing demand on public (NPWS) finances.

Figure 3-1. Location of precincts and operations

4. Impact Assessment

4.1 Threatened ecological communities

The ongoing operation of Q Station is not anticipated to directly impact on any of the TECs mapped within the subject site. No clearing of vegetation is proposed. Potential clearing required for maintenance of Asset Protection Zones(APZs) will be subject to a separate approval process to be led by NPWS.

The risk of the Q Station's continued operation is also not anticipated to indirectly impact on any TECs, above that which already exists (i.e., edge effects, inadvertent introduction of disease or pathogens such as Phytophora, which is already known to occur at North Head).

Various surveys and mapping of vegetation within the QS lease area generally agree on the PCTs present within the subject site but vary in the extent of some PCTs. This is particularly relevant with recent State Vegetation Type Mapping (DPE, 2023), which substantially increases the extent of the Eastern Suburbs Banksia Scrub TEC over that identified in earlier mapping versions and other floristic surveys undertaken at North Head (such as the Harbour Trust eco health monitoring).

Due to the uncertainties in the extent, composition and condition of native vegetation within the QS lease area, the TECs discussed in Section 2.8 are assessed further in the proposal's SIS (écologique, 2024).

4.2 Threatened populations

4.2.1 The endangered population of Little Penguins Eudyptula minor at Manly

Continuing poor monitoring results overall show that the Manly little penguin breeding population has reduced considerably. The population has not been able to recover from the extensive losses to the breeding population from a catastrophic fox predation incident during the pre-breeding season of June 2015.

The current low level of the population means there is little buffer against other impacts such as changes in oceanic conditions, which could impact individual breeding seasons or the long-term population.

Monitoring has not indicated that the past operation of Q Station has been a causal factor in population decline of breeding population, despite the absence of breeding proximal to the Boilerhouse Restaurant building and outdoor eating area on QS Beach.

There are a number of data deficient areas from which potential or suspected threats cannot be conclusively linked to impacts on the little penguin in the study area. Instead, we are reliant on anecdotal or qualitative observations, and scientific research that is largely generated from interstate populations.

The endangered population of Little Penguins Eudyptula minor at Manly is assessed in further detail in the proposal's SIS (écologique, 2024).

4.2.1 The endangered population of Long-nosed bandicoots at North Head

Currently, the main impact on long-nosed bandicoots at North Head, including the QS lease area, is fatalities by vehicle strike.

Road mortalities have been monitored by way of incidental records, including by the public and register maintained by the AWC and NPWS. Mortalities reported from locations across both NPWS and the Harbour Trust tenure (i.e., across the entire headland) have been as follows:

+ Seven mortalities in 2022 with June and October the highest number of vehicle strike mortalities (n = 2 for each).
+ Six mortalities in 2021 with September the highest number of vehicle strike mortalities (n = 2). The remainder of mortalities (n = 2) occurred in April and August.

+ Seven mortalities in 2020 with March the highest number of vehicle strike mortalities (n = 3). The remainder of mortalities (n = 4) occurred in April, August, November and December.

Mortalities have not exceeded the minimum Trigger level 2 (in accordance with existing operational consent) and NPWS are satisfied that the current mortality monitoring program and triggers are appropriate.

Based on available data and compliance reporting, the ongoing operation of the facility is considered unlikely to adversely affect the population.

Notwithstanding, the long-nosed bandicoot population at North Head, has been included and is discussed in further detail in the proposals SIS (écologique, 2024).

4.3 Threatened species

4.3.1 Fisheries Management Act 1994

4.3.1.1 Posidonia australis

NHS commissioned Marine Pollution Research (2023) to undertake baseline data collection and prepare an updated seagrass monitoring program, which was approved by NSW Fisheries in July 2023).

Marine Pollution Research (MPR) provide a synopsis of past seagrass monitoring programs and conducted a seagrass and aquatic ecological survey in Spring Cove (adjacent to QS Beach) in January and February 2023. The following was concluded:

"*whilst previous ferry and other longer term vessel activity associated with Quarantine Station wharf usage have contributed to localised seagrass loss via propeller wash disturbance of sea-beds that have led to destabilised seabed sediments, plus fragmentation and loss of seagrass offshore out from the wharf head, seagrass in Spring Cove/Quarantine Bay has been in a long-term decline due the effects of waves and boat/ferry wash originating from activities further afield and from more direct impact from vessel anchoring into seagrass beds, notwithstanding the provision of No Anchoring buoys*."

A long-term decline in core *Posidonia australis* beds is also noted in comparison to core inshore mixed Zostera and Halophila beds, whilst carrying the scars of previous disturbance, which have been able to re-grow into previous areas of seagrass loss in deeper water.

Posidonia australis within the estuaries of Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie is an endangered population under the *Fisheries Management Act 1994* (FM Act). These populations are under threat due to historical and current intensity of urbanisation and associated disturbance, including:

+ Direct physical disturbance from dredging and reclamation activities, as well as damage from anchors, boat propellers and boat moorings (which can harm seagrass by scouring as the mooring chain is dragged across the sea bed by the moored vessel).
+ Increased sediment entering waterways which can smother seagrass and block the light available for photosynthesis.
+ Eutrophication (nutrient increase, especially of nitrogen and phosphorus) resulting in an increase in epiphytes which grow on the leaves, reducing the photosynthetic capacity of Posidonia australis.
+ Indirect disturbance from altered tidal and wave regimes (associated with major dredging and foreshore reclamation) and stormwater discharges changing water quality and salinity levels.
+ The construction of foreshore structures such as pontoons, jetties and berthing areas which cause direct loss and shading that inhibits the growth of seagrass.
+ Potential impacts from invasive species which may have consequences for *Posidonia australis* that is already stressed due to other disturbances.

The aquatic zone will not be directly impacted by the ongoing operation of the facility as no works are proposed in this zone, and water vessel transport is not currently in operation.

Existing controls include Maritime regulations of watercraft speed limits and no-anchoring zones in Spring Cove (along with QS Wharf berthing protocols that were previously designed to minimise disturbance and further impacts on seagrasses including *Posidonia australis*).

The potential for indirect impacts (that are within the operation control of the facility) relate to activities that have the potential to decrease water quality. There have been no reports of stormwater impacts caused from the past operation of the facility.

Stormwater management is currently undertaken in accordance with the endorsed Infrastructure Control Plan Part 1, 2008 and Erosion and sedimentation control plan, 2005.

Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion is an endangered community under the EPBC Act. The *P. australis* at QS Beach do not currently meet the diagnostic and condition thresholds to be considered the endangered community under the EPBC Act.

The endangered *Posidonia australis* is assessed in further detail in the proposal's SIS (écologique, 2024).

4.3.1.2 Hippocampus whitei White's seahorse

White's Seahorse was listed as endangered under the FM Act in July 2019 and therefore has not been considered previously in assessments, COPAs or monitoring programs associated with the facility.

Surveys undertaken in January and February 2023 by MPR found that for the most part, the sub-tidal reefs in the study area form a single kelp bed zone, and while quite dense are most likely too shallow to support Whites seahorse - and none were located during specific searches.

The wharf piles do not provide sufficient complexity of shelter for seahorses and as the piles are generally located close to shallow rock habitat or over bare sand, they are considered unsuitable for White's seahorse colonisation, and this was confirmed by specific searches that yielded no sightings (MPR 2023). Notwithstanding MPR have recommended that, consideration of White's seahorse presence will continue during ongoing surveys.

4.3.2 Threatened terrestrial flora species

4.3.2.1 Acacia terminalis subsp. terminalis Sunshine Wattle

The Q Station Monitoring Report 2018-2019 – updated (SNC-Lavalin, 2022) identified unauthorised vegetation clearing, which was addressed through 'vegetation identification and clearing' refresher training provided to landscape contractors approximately every three months via toolbox talks, which commenced in mid-2018.

Despite the refresher training included the identification of Sunshine Wattle (SNC-Lavalin, 2022), the Q Station Monitoring Report 2017-2022 (NPWS) identified the following impacts on the species:

+ Previous QS management cleared one plant in 2019. NPWS investigated and the implemented action was to provide further education to the lessee's staff and contractors.
+ In 2021 Asset Protection Zone (APZ) maintenance impacted on several plants.

As part of the subsequent investigation and treatment NPWS worked with the Saving Our Species program to remediate the area and plant approximately 100 new seedlings through a community planting initiative incorporating a Back to Country event.

Since this time, the new QS management (from 2022) are actively working to protect Sunshine Wattle and have participated in flagging all plants to assist with ongoing site management (NPWS 2017-2022).

Given the nature of past impacts to the species, the ongoing conservation of the species (within the subject site) should be subject to more stringent controls.

The Sunshine wattle is assessed in further detail in the proposal's SIS (écologique, 2024).

4.3.2.2 Eucalyptus camfieldii Camfield's Stringybark

The Q Station Monitoring Report 2017-2022 (NPWS) identifies that the number of Camfield's Stringybark within the QS lease area was within the acceptable range (3 and above) in 2019, 2020, 2021 and 2022, with all three specimens in good health.

The only activities proposed in the vicinity of this species are vehicle and pedestrian movements, which have been in effect since 2006.

Future prescribed hazard reduction burns have the potential to impact on the species. Hazard reduction burns in 2020 occurred in Camfield' stringybark habitat areas.

Potential clearing for fuel reduction to maintain asset protect zones (APZs) will be subject to a separate approvals process led by NPWS.

The proposed ongoing operation of the facility is not anticipated to directly, or indirectly, impact on this species, providing visitor management and staff training is managed accordingly.

4.3.3 Threatened terrestrial fauna species

4.3.3.1 Pseudophryne australis red-crowned toadlet

There are no existing consent conditions that relate to the red-crowned toadlet. This is due to the SIS prepared for the original 2003 approval (Gunninah, 2001) concluding that:

+ The subject site does not provide optimal habitat for the species.
+ No potential (theoretical) habitat for the red-crowned toadlet areas would be affected.
+ The potential opportunistic use of artificial drains on the subject site cannot be regarded as critical for the species.
+ The proposal incorporates measures designed specifically to prevent contaminated runoff (Manidis Roberts EIS, 2001).
+ Consequently, the red-crowned toadlet is not considered an "affected species" with respect to the proposed activity.

As the species was considered unlikely to be present in 2001, there has not been any monitoring for the species within the subject site. Consequently, an assessment of the facility's past operation as a guide to assessing impacts on the proposed ongoing assessment is not possible.

Notwithstanding, the ongoing operation of the facility is considered unlikely to adversely affect the red-crowned toadlet. Potential habitat for the species (as mapped by Gunninah in 2001 and shown in Figure 2-9) will not be subject to any changes in operational activities.

Key impacts on potential habitat for this species would be altered hydrology and activities that decrease water quality. The subject site's hydrology will remain unchanged as will any activities that have the risk to impact on water quality.

Notwithstanding, the species is considered further in the proposal's SIS (écologique, 2024).

4.3.3.2 Cercartetus nanus eastern pygmy possum

The eastern pygmy possum was initially considered unlikely to be adversely affected by the proposed ongoing operation of the facility. This is largely due to the species having been introduced to the environment after operation of the facility had commenced. The pygmy possums introduced to nest boxes within or close to the subject site are anticipated to have adapted to any potential indirect impacts (e.g., light, noise) from the facility's operation.

However, during the preparation of this SIS a mother and young were killed in a vehicle strike within the QS lease area on the Entrance Road.

Consequently, the eastern pygmy possum has been included in the proposal's SIS (écologique, 2024) for further assessment.

5. Mitigation Measures

An assessment of the facility's operation, current site wide plans and additional measures recommended – as relevant to biodiversity - are summarised below in Table 5-1 and locations referenced are illustrated in Figure 3-1. All site wide plans are discussed in the proposal's REF.

Table 5-1. Operations assessment summary table

Operation / Impact	Management and mitigation measures	
	Site wide plans	**Mitigation measures**
Visitor management	**Endorsed**: + Visitor Management Plan, March 2005. **Draft**: Refer to the Environment and Heritage Site Wide Management 2023: + Appendix 10 Access Strategy Sub Plan (draft).	**Existing**: + A prohibition on the bringing of pets into the proposed lease area; + Education of visitors to the site by the use of signage and brochure material to indicate the environmental values of the site and its sensitivity and significance and encourage visitors to dispose of waste appropriately and not feed any of the fauna within the Quarantine Station; and + A prohibition on the feeding of all wildlife
Visitor access & management: + Wildlife mortalities from vehicle strikes	**Endorsed**: + Visitor Management Plan, March 2005. + Infrastructure Control Plan Part 1, 2008. **Draft**: Refer to the Environment and Heritage Site Wide Management 2023: + Appendix 10 Access Strategy Sub Plan (draft). + Appendix 6 Infrastructure Control Sub Plan (draft).	**Existing**: + Staff using vehicles undergo induction/training + Controls on vehicle movements, including: ○ the provision of a shuttle bus, associated with restrictions on private car access through the site; and ○ encouragement of the use of public transport + Existing mortality register included in monitoring program

Operation / Impact	Management and mitigation measures	
	Site wide plans	Mitigation measures
		+ Road signage pertaining to the little bandicoot and vehicle strike risk **Additional / recommended**: + Threatened species monitoring program Mortality register for long-nosed bandicoot to be updated to include eastern pygmy possum. + Consult with tertiary institutes to initiate trials of new and advancing technology designed to mitigate wildlife vehicle collisions (refer to SIS, écologique 2024).
Food preparation, conferences, functions and events + Noise pollution + Light spill + Waste	**Endorsed**: + Visitor Management Plan, March 2005. + Noise Management Plan, 2005. + Waste Management Plan, 2005. + Predator and Pest Animal Plan, 2008. + Infrastructure Control Plan Part 1, 2008. **Draft**: Refer to the Environment and Heritage Site Wide Management 2023: + Appendix 6 Infrastructure Control Sub Plan (draft). + Appendix 9 Predator and Pest Control Sub Plan (draft). + Appendix 10 Access Strategy Sub Plan (draft). + Appendix 12 Noise Management Plan (draft). + Appendix 13 Waste Management Plan (draft).	**Existing**: + Operational controls on noise generation and lighting design **Additional / recommended**: + Ensure mitigation of light spill impacts are updated to use the most recent advancements and guidelines (refer to SIS, écologique 2024). + It is recommended that lighting design for outdoor visitor infrastructure and buildings in the Wharf Precinct be reviewed and where applicable revised with consideration to the National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds January 2020 Version 1.0. (refer to SIS, écologique 2024). + Additional noise monitoring and sound reduction measures are recommended to fill existing knowledge gaps and provide additional

Operation / Impact	Management and mitigation measures	
	Site wide plans	Mitigation measures
		protection to little penguin habitat (refer to SIS, écologique 2024).
Staff and training	**Endorsed**: + Visitor Management Plan, March 2005. + Noise Management Plan, 2005. + Infrastructure Control Plan Part 1, 2008. + Predator and Pest Animal Plan, 2008. **Draft**: Refer to the Environment and Heritage Site Wide Management 2023: + Appendix 10 Access Strategy Sub Plan (draft). + Appendix 12 Noise Management Plan (draft).	**Existing**: + At the beginning of employment all staff must complete an induction training session and driver induction if driving on site. + Maintenance staff are to undertake regular induction and training in relation to threatened species habitat and their location.
Maintenance	**Endorsed:** + Heritage Landscape Management Plan 2005 + Infrastructure Control Plan Part 1, 2008. + Predator and Pest Animal Plan, 2008. + Erosion and sedimentation control plan, 2005. **Draft:** Refer to the Environment and Heritage Site Wide Management 2023: + Appendix 18 Outdoor Visitor Infrastructure Sub Plan (draft). + Appendix 6 Infrastructure Control Sub Plan (draft). + Appendix 9 Predator and Pest Control Sub Plan (draft). + Appendix 11 Erosion and Sedimentation Control Sub Plan (draft).	**Existing**: + Grassed areas on the site must be kept in good condition. No fertilisers or chemicals should be applied to open grassed areas, except where this is essential to the repair and stabilisation of existing eroded areas + Weeding and other gardening tasks are predominately carried out in the immediate garden beds adjacent to buildings or on the periphery of the mown areas. + Regular use and inspection of buildings and infrastructure also informs ongoing maintenance requirements such as painting of buildings, drain clearing, road potholes.
	Endorsed: + Infrastructure Control Plan Part 1, 2008.	**Existing**:

Operation / Impact	Management and mitigation measures	
	Site wide plans	**Mitigation measures**
	+ Predator and Pest Animal Plan, 2008. + Erosion and sedimentation control plan, 2005. **Draft:** Refer to the Environment and Heritage Site Wide Management 2023: + Appendix 18 Outdoor Visitor Infrastructure Sub Plan (draft). + Appendix 6 Infrastructure Control Sub Plan (draft). + Appendix 9 Predator and Pest Control Sub Plan (draft). + Appendix 11 Erosion and Sedimentation Control Sub Plan (draft).	+ Both species are monitored annually by NPWS with performance targets identified as follows: ○ Camfield's stringybark: 3 and above ○ Sunshine wattle: 12 and above + Best practice requirements have been integrated into induction programs for landscape maintenance personnel
Conservation – TECs and threatened flora species	**Endorsed:** + Infrastructure Control Plan Part 1, 2008. + Predator and Pest Animal Plan, 2008. + Erosion and sedimentation control plan, 2005. **Draft:** Refer to the Environment and Heritage Site Wide Management 2023: + Appendix 18 Outdoor Visitor Infrastructure Sub Plan (draft). + Appendix 6 Infrastructure Control Sub Plan (draft). + Appendix 9 Predator and Pest Control Sub Plan (draft). + Appendix 11 Erosion and Sedimentation Control Sub Plan (draft).	**Existing**: + Both threatened flora species are monitored annually by NPWS with performance targets identified as follows: ○ Camfield's stringybark: 3 and above ○ Sunshine wattle: 12 and above + Best practice requirements have been integrated into induction programs for landscape maintenance personnel **Additional / recommended** + Updated site specific PCT mapping and condition assessment, including weed mapping
Conservation – threatened fauna	**Endorsed:** + Noise Management Plan, 2005. + Infrastructure Control Plan Part 1, 2008.	**Additional / recommended**: + Sound reduction barriers are recommended to provide additional protection to the little penguin breeding habitat adjacent to the

Operation / Impact	Management and mitigation measures	
	Site wide plans	**Mitigation measures**
	+ Predator and Pest Animal Plan, 2008. + Erosion and sedimentation control plan, 2005. **Draft:** Refer to the Environment and Heritage Site Wide Management 2023: + Appendix 12 Noise Management Plan (draft). + Appendix 18 Outdoor Visitor Infrastructure Sub Plan (draft). + Appendix 6 Infrastructure Control Sub Plan (draft). + Appendix 9 Predator and Pest Control Sub Plan (draft). + Appendix 11 Erosion and Sedimentation Control Sub Plan (draft).	Boilerhouse Restaurant (refer to SIS, écologique 2024). + Review and upgraded fencing to little penguin habitat at northern end of QS Beach (refer to SIS, écologique 2024). + Habitat enhancement and artificial nest installations to be undertaken in consultation with specialists (refer to SIS, écologique 2024).

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Appendix A. Habitat summary tables

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence	Habitat
Amphibia				
Pseudophryne australis Red-crowned toadlet	V		Present	Usually live in the vicinity of permanently moist soaks or areas of dense ground vegetation or leaf litter along or near head-water stream beds. Potential habitat within the QS lease area would be present on moist sandstone benches or at the base of rock outcrops
Aves				
Anthochaera phrygia Regent honeyeater	CE	CE	Site not located in important areas mapped for this species.	
Burhinus grallarius Bush stone-curlew	E		Habitat limited, potential to occur as recorded from North Head in 2019 - will not be affected by the proposal	A conspicuous loud eerie wailing "wee-loo" call, mostly heard at night. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber.
Climacteris picumnus victoriae Brown treecreeper (eastern subspecies)	V	V	Unlikely, habitat absent	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey
Eudyptula minor Little Penguin in the Manly Point Area	E		Present	Critical habitat (AOBV) present
Glossopsitta pusilla Little lorikeet	V		Marginal habitat present, will not be affected by the proposal	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Nest sites are often used repeatedly for decades, suggesting that preferred sites are limited.
Haematopus fuliginosus Sooty oystercatcher	E		Potential habitat in AOBV areas, will not be affected by the proposal	Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels.
Haematopus longirostris Pied oystercatcher	V		Potential habitat in AOBV areas, will not be affected by the proposal	Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish.

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence	Habitat
Haliaeetus leucogaster White-bellied sea-eagle	V		Present in study area (foraging), will not be affected by the proposal	Species would feed mainly from ocean (on fish) but also on land (waterbirds, reptiles, mammals and carrion). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Ongoing operation of the facility would not impact on habitat for the species, which is less dominant type of vegetation in subject site.
Hieraaetus morphnoides little eagle	V		Present in study area (foraging), will not be affected by the proposal	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used
Hirundapus caudacutus White-throated needletail		V	Present in study area (foraging), will not be affected by the proposal	Migratory and usually seen in eastern Australia from October to April. Most often seen in eastern Australia before storms, low pressure troughs and approaching cold fronts and occasionally bushfire. These conditions are often used by insects to swarm (eg termites and ants) or tend to lift insects away from the surface which favours sighting of White-throated Needletails as they feed. More common in coastal areas, less so inland.
Lathamus discolor Swift parrot	E	CE	Site not located in important areas mapped for this species.	
Lophoictinia isura Square-tailed kite	V		Unlikely, habitat absent	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Appears to occupy large hunting ranges of more than 100 square km. Nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence	Habitat
Ninox connivens Barking owl	V		Unlikely, habitat absent	Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats.Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species. During nesting season, the male perches in a nearby tree overlooking the hollow entrance. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Common Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits.
Ninox strenua Powerful owl	V		Several records (1999 to 2020) from AIPM, Collins Beach. Potential foraging habitat - will not be affected by the proposal	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine Syncarpia glomulifera, Black She-oak Allocasuarina littoralis, Blackwood Acacia melanoxylon, Rough-barked Apple Angophora floribunda, Cherry Ballart Exocarpus cupressiformis and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. Flying-foxes are important prey in some areas; birds comprise about 10-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 ha can support a pair when prey are dense. Where hollow trees and prey have been depleted, the owls need up to 4000 ha. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence	Habitat
Pandion cristatus Eastern osprey	V		Present in study area (foraging) - will not be affected by the proposal	The Eastern Osprey is a large, water-dependent bird of prey, distinctive in flight and when perched. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea. Incubation of 2-3 eggs, usually by the female, is about 40 days. Female remains with young almost until they fly, usually after about nine weeks in the nest.
Petroica boodang Scarlet robin	V		Unlikely, habitat absent	Lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. Primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees.
Ptilinopus regina Rose-crowned fruit-dove	V		Vagrant	Occurs on the coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. They are shy pigeons, not easy to see amongst the foliage, and are more often heard than seen. They feed entirely on fruit from vines, shrubs, large trees and palms, and are thought to be locally nomadic as they follow the ripening of fruits. Some populations are migratory in response to food availability - numbers in north-east NSW increase during spring and summer then decline in April or May.

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence	Habitat
Ptilinopus superbus Superb Fruit-Dove	V		Vagrant	Occurs principally from north-eastern in Queensland to north-eastern NSW. It is much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic. There are records of single birds flying into lighted windows and lighthouses, indicating that birds travel at night. At least some of the population, particularly young birds, moves south through Sydney, especially in autumn.
Mammalia				
Cercartetus nanus Eastern pygmy-possum	V		Present	Occurs in a broad range of habitats from rainforest through sclerophyll forest and woodland to heath, but in most areas woodlands and heath appear to be preferred. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. It shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, ringtail possum dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks.
Isoodon obesulus obesulus Southern brown bandicoot [eastern]	E	E	Potential habitat. Absence of detection historically and lack of records in study area suggests a low likelihood, particularly given annual trapping efforts.	They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils.
Perameles nasuta Long-nosed bandicoot, North Head	E		Present	Essentially a solitary animal that occupies a variety of habitats on North Head.

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence	Habitat
Mammalia - bats				
Chalinolobus dwyeri Large-eared pied bat	V	E	Present in study area - will not be affected by the proposal. Multiple echolocation recordings between 2021-2023 at several locations across North Head closest to site at Stores Beach	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy.
Falsistrellus tasmaniensis Eastern false pipistrelle	V		Habitat present - will not be affected by the proposal	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter.
Miniopterus australis Little bent-winged bat	V		Present - will not be affected by the proposal	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.
Miniopterus orianae oceanensis Large bent-winged bat	V		Present - will not be affected by the proposal	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. Hunt in forested areas, catching moths and other flying insects above the tree tops.
Myotis macropus Southern myotis	V		Present in study area. One record from Store Beach 9 years ago (2015) there is no riparian habitat or suitable foraging resources for the species	Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, wharves, bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence	Habitat
Pteropus poliocephalus Grey-headed flying-fox	V	V	Present - will not be affected by the proposal Ubiquitous species	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.
Saccolaimus flaviventris Yellow-bellied sheathtail-bat	V		Present - will not be affected by the proposal	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.
Scoteanax rueppellii Greater broad-nosed bat	V		Present - will not be affected by the proposal	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.

Scientific name	BC Act	EPBC Act	Likelihood of Occurrence	Habitat
Vespadelus troughtoni Eastern cave bat	V			Very little is known about the biology of this uncommon species. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.
Reptile				
Varanus rosenbergi Rosenberg's goanna	V		Unlikely, habitat absent	Occurs in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component.