North Head Sanctuary, Manly

Ecological Management Review & Recommendations

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Abbreviations

Abbreviation	Description
AWC	Australian Wildlife Conservancy
BC Act	NSW *Biodiversity Conservation Act 2016*
ELA	Eco Logical Australia
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ESBS	Eastern Suburbs Banksia Scrub
NHS	North Head Sanctuary
NHSF	North Head Sanctuary Foundation
NPWS	National Parks and Wildlife Service
RF Act	NSW *Rural Fires Act 1997*
Harbour Trust	Sydney Harbour Federation Trust

Executive Summary

The Sydney Harbour Federation Trust ('Harbour Trust') commissioned this independent expert report to review ecological management of North Head Sanctuary land and provide recommendations for future management. North Head Sanctuary is a biodiverse area with important ecological values that the Harbour Trust has a statutory duty to protect. It features threatened flora and fauna species, populations and communities in an easily accessible coastal bushland location within Sydney. The natural environment of North Head attracts local and international visitors, and many people volunteer time to assist with its protection and enhancement.

As with much of Sydney's remnant bushland, there has been an overall decline in biodiversity and condition at North Head due to urbanisation. This decline has been slowed to some extent in recent years by actions that include revegetation using local provenance species, weed and pest control, fire and the reintroduction of three mammal species. However, increasing pressures such as climate change further threaten ecological values and ecosystem resilience.

Long-term integrated management of this important environmental asset is required. Recommendations for future management of North Head Sanctuary by the Harbour Trust have been developed in consultation with stakeholders and are as follows:

- Clarify roles and responsibilities, including development and implementation of a communication protocol
- Maintain the local provenance native plant nursery run by community volunteers
- Survey and map the distribution and condition of plant community types across North Head Sanctuary
- Prepare and implement a bushland management plan for North Head Sanctuary to sustain threatened flora and communities, including application of appropriate fire regimes
- Control pests (e.g., Rabbits, Black Rats, Foxes, Cats and Dogs) and diseases (e.g., Phytophthora) that threaten ecological values
- Monitor and manage threatened fauna, including the provision of supplementary habitat within North Head Sanctuary if needed
- Educate and engage the community
- Support and learn from research.

1. Introduction

North Head at Manly is a sandstone peninsula at the northern entrance to Sydney Harbour characterised by rich natural and cultural heritage. The Gayamagal people are the Traditional Owners and Custodians of the land. As indicated in Figure 1, North Head / Car-rang-gel comprises:

- North Head Sanctuary (NHS), managed by the Sydney Harbour Federation Trust ('Harbour Trust') since 2001; approximately 58 ha of the 74 ha NHS site is bushland
- Sydney Harbour National Park (156 ha National Park, 27 ha Quarantine Station), managed by NSW National Parks and Wildlife Services (NPWS)
- North Head Wastewater Treatment Plant, managed by Sydney Water
- The Australian Institute of Police Management.

This report has been commissioned by the Harbour Trust to review ecological management of NHS and provide recommendations to guide future management on Harbour Trust land. It identifies preferred and ecologically sustainable outcomes to be reflected in the masterplan for NHS. It also establishes the required scope for ecological services (studies and on-ground works) over the next five years.

This report has been prepared using information from brief site inspections in August 2022, desktop review and stakeholder consultation. The Harbour Trust, NPWS and current ecological service providers at NHS were consulted to understand the roles and the services they provide, and where there are gaps, overlaps or issues to be addressed. Representatives from the community volunteer organisation, North Head Sanctuary Foundation Inc. (NHSF), were also consulted for this study. We thank all participants for their contributions and insights.

Figure 1: North Head overview

2. Ecology

The purpose of this chapter is to analyse the current state of NHS's ecology, using existing data.

2.1. Ecological values

Ecological monitoring over several decades has revealed that NHS and the surrounding Sydney Harbour National Park (Figure 1) comprise an area of high ecological value. The bushland of North Head features threatened flora and fauna species, populations and communities.

2.1.1. Terrestrial habitat connectivity

Good habitat connectivity enhances the ecological carrying capacity of an area and is important for exchange of genetic material and fauna movement. North Head peninsula is effectively an ecological island due to the surrounding sea and harbour and its narrow link to the mainland. The adjacent suburb of Manly was mostly cleared for development in the 1840s, resulting in the habitat of North Head becoming even more isolated from other remnant bushland areas. Within North Head, bushland habitat is generally well connected in the National Park but fragmented around the Quarantine Station and NHS by cleared areas and infrastructure associated with buildings, roads, tracks and fences.

2.1.2. Habitat and vegetation types

North Head features a variety of habitats and vegetation communities. These were categorised in the 2003 ecological survey by GIS Environmental Consultants as:

- Shrubland
- Eastern Suburbs Banksia Scrub (ESBS)
- Woodland / forest
- Fern heath, rocky heath, heath
- Exotic grassland
- Hind dune, beach and rocky foreshore
- Wetland, creeklines and artificial water bodies
- Cliff face, boulder slope, sandstone caves, sandstone outcrops
- Stone walls, built structures, tunnels and fortifications

Similar categories were applied by Australian Wildlife Conservancy (AWC) in the 2021 map of 'vegetation classes' across North Head (Figure 2).

In 2016, OEH used desktop techniques to map the plant community types (PCTs) at North Head. PCTs are the master community-level typology used in NSW planning and assessment tools and vegetation mapping and management programs. The PCT classification is maintained in the NSW Government's BioNet Vegetation Classification application.

Figure 3 shows that NHS is dominated by PCT 664 Banksia Heath on aeoline sands of eastern Sydney suburbs, Sydney Basin Bioregion. This is an open to closed heath found on shallow to moderately deep sand mantles that are perched above some of Sydney's major sandstone headlands. It is recognised as part of the threatened ecological community Eastern Suburbs Banksia Scrub (refer to section 2.1.3).

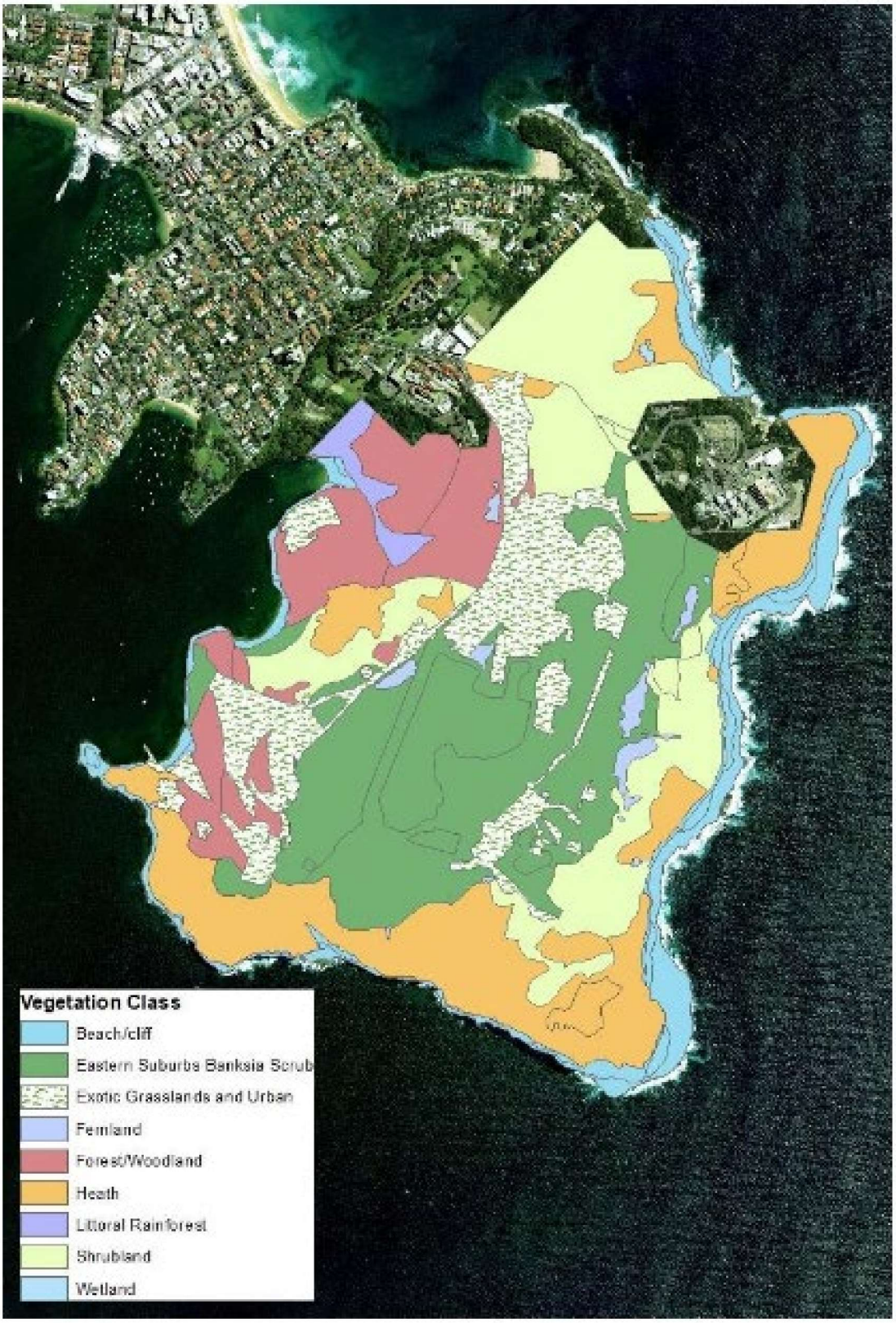

Figure 2: Vegetation classes across North Head (AWC 2021)

Figure 3: Plant community types (OEH 2016)

2.1.3. Threatened ecological communities

Eastern Suburbs Banksia Scrub (ESBS) is listed as a Critically Endangered Ecological Community under the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This community occurs on disjunct patches of nutrient poor aeolian (wind-blown) dune sand. It can regenerate naturally on cleared sand where the soil profile remains intact, however, the floristic composition and vegetation structure becomes simplified with a few species dominating after a more than 15 years without fire or similar disturbance (Perkins et al 2012).

Sydney Freshwater Wetlands in the Sydney Basin Bioregion is an Endangered Ecological Community under the BC Act that occurs within NHS as a hanging swamp created by a constructed berm (Peter Jensen, Harbour Trust, pers. comm.). This community is mapped in Figure 3 as PCT 1809 Crimson Bottlebrush – Banksia – Melaleuca/Baumea woody sedgeland in dune swales of the Sydney Basin.

2.1.4. Flora

A BioNet database search indicated approximately 300 flora species have been recorded at North Head. This includes the following threatened species:

- *Acacia terminalis* ssp. Eastern Sydney (Sunshine Wattle) – listed as endangered under the BC Act and EPBC Act
- *Eucalyptus camfieldii* (Camfield's Stringybark) – listed as vulnerable under the BC Act and EPBC Act
- *Persoonia hirsuta* (Hairy Geebung) – listed as endangered under the BC Act and EPBC Act
- *Pimelea curviflora* var. *curviflora* (Curved Rice-flower) – listed as vulnerable under the BC Act and EPBC Act.

2.1.5. Fauna

BioNet shows that 205 native fauna species have been recorded at North Head, including two fauna populations listed as endangered under the BC Act:

- Little Penguin (*Eudyptula minor*); areas of penguin habitat around Manly have also been declared 'critical habitat', now referred to as 'Areas of Outstanding Biodiversity Value' (AOBV), which includes a narrow band of aquatic and terrestrial habitat at Collins, Store and Quarantine beaches on the western edges of North Head
- North Head Long-nosed Bandicoot (*Perameles nasuta*).

Bionet records indicate that the following threatened species have been recorded at North Head, most of which are highly mobile:

- Barking Owl (*Ninox connivens*) – listed as vulnerable under the BC Act
- Bush Stone-curlew (*Burhinus grallarius*) – listed as endangered under the BC Act
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) – listed as vulnerable under the BC Act
- Grey-headed Flying-fox (*Pteropus poliocephalus*) (foraging habitat; no camps) – listed as vulnerable under the BC Act and EPBC Act
- Large-eared Pied Bat (Chalinolobus dwyeri) – listed as vulnerable under the BC Act and EPBC Act

- Large Bent-winged bat (*Miniopterus orianae oceanensis*) (formerly named the Eastern Bentwing-bat) – listed as vulnerable under the BC Act
- Little Lorikeet (Glossopsitta pusilla) – listed as vulnerable under the BC Act
- Powerful Owl (*Ninox strenua*) – listed as vulnerable under the BC Act
- Red-crowned Toadlet (*Pseudophryne australis*) – listed as vulnerable under the BC Act
- Southern Myotis (*Myotis macropus*) – listed as vulnerable under the BC Act
- Varied Sittella (*Daphoenositta chrysoptera*)– listed as vulnerable under the BC Act
- White-bellied Sea Eagle (*Haliaeetus leucogaster*) – listed as vulnerable under the BC Act
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) – listed as vulnerable under the BC Act.

The following marine or migratory species listed have been recorded at North Head:

- Arctic Jaeger (*Stercorarius parasiticus*) – listed as Migratory under the EPBC Act (International agreements with China, Japan, Korea)
- Black-browed Albatross (*Thalassarche melanophris*) – listed as Vulnerable under the BC and EPBC Acts
- Buller's Albatross (*Thalassarche bulleri*) - listed as Vulnerable under the EPBC Act
- Caspian Tern (*Hydroprogne caspia*) - listed as Migratory under the EPBC Act (International agreement with Japan)
- Common Greenshank (*Tringa nebularia*) – listed as Migratory under the EPBC Act (International agreements with China, Japan, Korea)
- Common Sandpiper (*Actitis hypoleucos*) – listed as Migratory under the EPBC Act (International agreements with China, Japan, Korea)
- Crested Tern (*Thalasseus bergii*) - listed as Migratory under the EPBC Act (International agreement with Japan)
- Fork-tailed Swift (*Apus pacificus*) – listed as Migratory under the EPBC Act (International agreements with China, Japan, Korea)
- Grey Plover (*Pluvialis squatarola*) – listed as Migratory under the EPBC Act (International agreements with China, Japan, Korea)
- Pied Oystercatcher (*Haematopus longirostris*) - listed as Endangered under the EPBC Act
- Pomarine Jaeger (*Stercorarius pomarinus*) - listed as Migratory under the EPBC Act (International agreements with China, Japan, Korea)
- Ruddy Turnstone (*Arenaria interpres*) - listed as Migratory under the EPBC Act (International agreements with China, Japan, Korea)
- Short-tailed Shearwater (*Ardenna tenuirostris*) - listed as Migratory under the EPBC Act (International agreements with China, Japan, Korea)
- Shy Albatross (*Thalassarche cauta*) - listed as Vulnerable under the BC and EPBC Acts
- Southern Giant Petrel (*Macronectes giganteus*) - listed as Endangered under the BC and EPBC Acts
- Streaked Shearwater (*Calonectris leucomelas*) - listed as Migratory under the EPBC Act (International agreements with China, Japan, Korea)
- Wandering Albatross (*Diomedea exulans*) - listed as Endangered under the BC and EPBC Acts
- Wedge-tailed Shearwater (*Ardenna pacifica*) - listed as Migratory under the EPBC Act (International agreement with Japan)

- White-throated Needletail (*Hirundapus caudacutus*) listed as Vulnerable and Migratory under the EPBC Act (International agreements with China, Japan, Korea).

The following three mammal species were recorded at North Head prior to the 2003 ecological study, but not recorded in 2003:

- Brown Antechinus (*Antechinus stuartii* ssp. *stuartii*)
- Bush Rat (*Rattus fuscipes* ssp. *assimilis*)
- Eastern Pygmy-possum (*Cercartetus nanus*) – listed as vulnerable under the BC Act

These three species were reintroduced to North Head (or their low populations bolstered) by AWC in phases since 2013. The reintroductions aimed to restore the ecological role of native small mammal species as pollinators on North Head, particularly in relation to Banksia species within ESBS. Banksia species rely on insect, bird and mammal species feeding on nectar to transfer pollen between flowers.

The AWC fauna reintroduction program has been successful as Bush Rats have become one of the most common and widespread native mammals on the headland, with a stable population since 2018. Abundance of the Eastern Pygmy-possum increased in 2021, continuing a trend since 2018, and occupancy and total captures of the Brown Antechinus also increased in 2021. These results suggest successful breeding and recruitment by these reintroduced species, but findings may be compounded by post-fire effects (AWC 2022).

2.2. Threats

Threats to ecological values at NHS are tabulated below and ranked according to monitoring data and advice from stakeholders consulted for this report. Climate change causing drought, fire, extreme weather events etc will exacerbate many of these threats and decrease natural resilience.

Table 1: Summary of prioritised threats to ecological values at NHS

Threat	Description
Higher priority threats	
Inappropriate fire regime	Native vegetation communities have evolved to thrive under certain fire regimes (see Appendix 2 of Travers Bushfire & Ecology (2022)). Low fire frequency can result in changes to habitat (altered vegetation structure, low plant diversity, loss of species, senescent vegetation, invasion by rainforest plant species, invasion by exotic weeds, invasion and degradation of the soil seedbank). High frequency fire can result in result in the disruption of life cycle processes in plants and animals and loss of vegetation structure and species richness. Due to topography and wind conditions on North Head, hazard reduction burns appear difficult to keep within burn prescriptions of low to moderate intensity and within the burn areas across the headland. The high intensity hazard reduction burn that escaped control lines in October 2020 led to post fire weeds, increased rabbit population and access resulting in trampling of seedlings. It also resulted in an increased flora species diversity.
Fragmentation and encroachment	Small areas of bushland have greater 'edge effects' compared to larger intact bushland areas. High edge effects increase risk of weeds, disease (e.g., *Phytophthora cinnamomi*), trampling, erosion, unplanned fire, encroachment, dumping of garden refuse, soil and rubbish, stormwater and nutrient runoff and predation. Much of the bushland within NHS is already subject to fragmentation and encroachment. This could be exacerbated by clearing or modification of vegetation for bushfire asset protection zones, development (new buildings, roads or tracks) and unauthorised tracks. Walls and fences can impede fauna access.
Pest fauna species	Pest species are an ongoing problem at NHS. Pest fauna such as domesticated Dogs (*Canis familiaris*), feral or domesticated Cats (*Felis catus*), and the European Red Fox (*Vulpes vulpes*) attack or predate native fauna. Feral Rabbits (*Oryctolagus cuniculus*) and Black Rats (*Rattus rattus*) predate seeds and seedlings. Mosquito Fish (*Gambusia affinis*) predate tadpoles and native fish.
Lower priority threats	
Erosion and stormwater runoff	The soils of North Head are highly erodible, so easily eroded by wind, hikers, bikes, rabbits, vehicles and rain if vegetation is removed by clearing, tracks, roads, fire, etc. Stormwater runoff can result in excessive nutrients and sediments being deposited into naturally low-nutrient areas, favouring weed species, reducing water quality and smothering aquatic habitats.
Vehicle strikes	Vehicle traffic can injure or kill native fauna. This is currently being managed by signage and traffic calming devices throughout North Head but remains a concern.
Predation/ competition	Aggressive exotic and native bird species such as Common Myna (*Acridotheres tristis*), Common Starling (*Sturnus vulgaris*), Pied Currawong (*Strepera graculina*), and Noisy Miner (*Manorina melanocephala*) can predate native species.
Habitat removal	Bushrock and log removal are key threatening process that can result in habitat loss.

3. Ecological management to date

The purpose of this chapter is to review the Harbour Trust's management of NHS's ecology.

3.1. Sydney Harbour Federation Trust

The Harbour Trust is a statutory agency created by the Federal Government in accordance with the *Sydney Harbour Federation Trust Act 2001* to protect and conserve natural and built heritage on Commonwealth land around Sydney Harbour, including NHS. The Harbour Trust has permanent staff working at all its sites, including Rangers and an Environmental Officer. Historically the ecological services at NHS have been carried out for the Harbour Trust by:

- Harbour Trust contractor since 2009 – fauna reintroductions, research, surveys and monitoring
- Harbour Trust contractor since 2004 – bush regeneration services, botanical surveys, bushfire management, track and trail construction and maintenance
- Volunteer group NHSF working under a partnership agreement with the Harbour Trust since 2006 who propagate local provenance plants, carry out planting and weeding, assist with surveys, educational activities, etc. NHSF issues monthly newsletters.
- Harbour Trust contractor from 2004 to 2021 - feral animal control including rabbit shooting and RHDV releases
- NPWS – Fox 1080 baiting and shooting, Long-nosed Bandicoot monitoring across North Head land tenures, and North Head stakeholder group coordination
- Various ecological consultants 2003-2022 – flora and fauna surveys and research, including:
    - 2003 Fauna of North Head report, including maps and descriptions of vegetation communities, threatened flora and weed species
    - 2012 Research paper on Eastern Suburbs Banksia Scrub recovery
    - 2012 Heathland dieback and soil investigation
    - 2017 North Head ecological monitoring framework
    - 2022 Bushfire management plan
    - 2018-2022 Survey of *Acacia terminalis* Eastern Sydney
    - North Head post-fire recovery review and plan
    - North Head Ecohealth reports
    - 2021-23 North Head Sanctuary Fauna Restoration Program
    - Progress reports from contractors.

3.2. North Head stakeholder groups

There is a history of collaboration between stakeholders of North Head, including via two stakeholder working groups. The first group is led by the Harbour Trust and focused on activities within NHS. The second group includes representatives from all land tenures and interests across North Head and deals with broader planning matters. Stakeholders include:

- Sydney Harbour Federation Trust
- NPWS – facilitator of the broader North Head stakeholder group
- North Head Sanctuary Foundation (NHSF)

- Police
- Sydney Water
- Local Member of Parliament
- Quarantine Station
- International College of Management
- Australian Wildlife Conservancy (AWC).

Landowners/managers of North Head have unique statutory responsibilities and governance frameworks, operating under the various plans and programs for the site, some of which are outlined in section 3.4. This has generally worked well but all stakeholders acknowledge there have been some challenges (gaps and overlaps) regarding roles and responsibilities for ecological management, including instances of poor communication and decision making.

3.3. Researcher and community involvement

Community volunteers and researchers contribute enormous value to the ecological health and understanding of North Head. This reduces management costs and enhances its profile and attractiveness to the broader community. Volunteer activities include:

- Seed collection in accordance with relevant permits
- Plant propagation at the on-site nursery
- Restoration, revegetation, weed removal and/or gardening at selected sites
- Environmental education e.g., Bandicoot Heaven, guided wildflower walks
- Citizen science environmental monitoring i.e., Echidna recording
- Visitor services and tours.

3.4. Management plans and programs

3.4.1. 2011 NHS Management Plan

The 2011 NHS Management Plan sits within the Comprehensive Plan for Sydney Harbour Federation Trust. The vision in the 2011 Plan states 'The natural environment forms the heart and soul of the sanctuary concept and will be one of the main reasons for visitors to come to North Head.' The Plan includes the following objectives relevant to ecology:

- Protect, maintain and enhance where appropriate, the prominence of the relatively intact and rare ecosystems of the North Head Sanctuary including its flora, fauna, biodiversity and geodiversity
- Protect, conserve and interpret the natural values of the precinct
- Protect adjacent bushland from the spread of *Phytophthora cinnamomi*
- Apply the principles of ecologically sustainable development.

The 2011 Plan established the following conservation policies as required by EPBC Regulations, 10.01C, Schedule 5A(h)(i-xii) and 10.03B, Schedule 7A(h)(i-xii) relevant to the natural environment:

- 'Communities of Eastern Suburb Banksia Scrub are maintained or improved.

  - Ensure all tenants and lessees are made aware of the presence of the endangered ESBS and the separate legislative requirements of endangered ecological communities.
  - Recommendations of the Eastern Suburbs Banksia Scrub Endangered Ecological Community Recovery Plan (DECC, 2004) be followed in relation to ongoing management of the ESBS.
  - ESBS should only be removed in order to keep accessways, drains and culverts clear, to maintain reasonable space around buildings, military structures and places to recover important vistas and maintain important spaces that were part of the original layout and to create protective asset protection zones.
  - Investigate the possibility of controlled burns to enable the completion of the investigation into the Aboriginal occupation of North Head and recovery of the ESBS community.
  - Investigate regeneration of ESBS in areas previously disturbed.

- Populations of the North Head Long-nosed Bandicoot (*Perameles nasuta*) are maintained or improved.

  - Ensure all tenants and lessees are made aware of the presence of the endangered North Head Long-nosed Bandicoot and the separate legislative requirements of endangered ecological communities.
  - Recommendations of the Draft Recovery Plan for the endangered North Head Long-nosed Bandicoot (*Perameles nasuta*) population are followed in relation to ongoing management of Bandicoot populations.
  - Re-plant and mulch selected areas of open space in the North Head Sanctuary with vegetation of local provenance to improve Bandicoot recovery.

- Manage, conserve and enhance the natural environment.

  - Remove dominant *Leptospermum laevigatum* (Coastal Tea-Tree) and invasive species where this will improve the integrity of the ESBS.
  - Ensure any removal of vegetation does not lead to soil erosion, wind exposure, a loss of amenity or introduction of weed species.
  - Reduce or improve the quality of runoff from North Head Sanctuary to the Sydney Harbour National Park by installing pollutant traps and upgrading services infrastructure.
  - Remove vegetation from around the Battery, Battery Observation Post and the Command Post / Close Defence Battery Observation Post to reinstate WWII conditions of clear views along the coast. Vegetation should remain clear of 1930s brick buildings.
  - Investigate the potential to harness stormwater and rainwater for irrigation and toilet-flushing purposes.

- Control the spread of *Phytophthora cinnamom*i at the precinct.

  - Ensure all tenants, lessees and visitors are aware of and adopt the Trust's PC management strategy.'

The overarching design objectives for the NHS in the 2011 Plan were to:

- 'Open up the former military base to public access and make it more inviting

- Create a sense of arrival at each precinct befitting its character and its role within the proposed sanctuary
- Link up the precincts to the surrounding lands through a network of pathways that connect with the main access points to the headland and its main features
- Provide landscape improvements to the degraded peripheral areas of each precinct to improve conditions for flora and fauna as well as the appearance and sense of arrival to each precinct'.

The 2011 Plan aimed to achieve the outcome that 'Public access to the Sanctuary will be provided and managed in accordance with requirements for conservation of flora and fauna habitats'.

The Plan also highlighted the importance of integrated management, where 'Integrated management means having regard for the whole, considering the consequences of individual actions on the overall headland, considering relationships, (social, economic and environmental) and identifying opportunities for actions to be mutually supporting rather than conflicting'. It recognised that 'each existing agency to still function as independent corporate entities maintaining their normal business operations, whilst co-operating in areas in which they can contribute to the protection and enhancement of North Head'.

3.4.2. 2021 NHS Draft Concept

A draft concept was prepared for the NHS in 2021 and the community provided strong feedback supporting protection of the natural environment (KJA 2021). The 2021 NHS draft concept includes the following 'consultation insights' about community values and aspirations on 'rejuvenating and protecting the natural environment':

- A need for protection and conservation of flora and fauna, ecology and wildlife
- Promoting appreciation of nature and importance of well-being in the great outdoors
- Continuing to value the beauty of the natural environment.

Specific measures in the concept that relate to ecological management at NHS include:

- An environmental education centre and accessible pathway through native gardens in the North Fort Precinct
- Protection and regeneration of the environment in the Artillery Barracks Precinct.

3.4.3. Saving our Species program

The NSW Government's Saving our Species program aims to increase the number of threatened species that are secure in the wild in New South Wales for 100 years and control the key threats facing our threatened plants and animals. Conservation actions have been identified by the NSW Government to sustain three priority species and sites at North Head

- Eastern Suburbs Banksia Scrub
- *Eucalyptus camfieldii*
- *Acacia terminalis* Eastern Sydney

Of these three priorities for North Head, the Saving our Species website indicates that only ESBS is covered by the program within NHS despite records of *E. camfieldii* and *A. terminalis* also being within NHS. Threat mitigation actions for ESBS nominated under the Saving our Species program are

summarised in Table 2. A Saving our Species conservation project is being developed by DPE for Long-nosed Bandicoot but it is not yet clear if this will cover NHS.

Table 2: Saving our Species actions - Eastern Suburbs Banksia Scrub

Threat name	Objective	Methodology type
Hydrological disturbance	Maintain suitable drainage / hydrological regime	Alter drainage characteristics
Inappropriate fire regime	Maintain appropriate fire regime for the species/community	Promote disturbance (burn/mechanical)
Feral browsers	Reduce the impacts of grazing	Rabbit control and monitoring pest/weed threat
Weeds	Ensure that non-target effects of weed control are minimised; reduce and maintain weed densities at low levels	Site-based weed control and monitoring pest/weed threat

3.4.4. Fire management plan

A Bushfire Management Plan for NHS (Travers Bushfire & Ecology 2022) was commissioned by the Harbour Trust to meet the requirements of Section 63(2) of the NSW *Rural Fires Act 1997* 'to prevent the occurrence of bushfires on the land that they manage, and to minimise the danger of the spread of bushfires on, or from, that land'. The plan identifies 'bushfire protection strategies to be undertaken by the Harbour Trust in a manner that recognises the site's ecological and environmental values and places this in the context of the need to protect life and property from wildfire'. Appendix 2 of the Bushfire Management Plan sets requirements for fire management regimes to sustain ecosystems at North Head.

North Head is within the jurisdiction of the Northern Beaches Bushfire Management Committee, facilitated by the Rural Fire Service (RFS). Objectives of the 2017-2022 Bush Fire Risk Management Plan include to 'manage fuel to reduce the rate of spread and intensity of bush fires, while minimising environmental/ecological impacts'. An updated Bush Fire Risk Management Plan is scheduled to be released in 2023.

A North Head Bushfire Recovery Advisory Group was established by the Harbour Trust and co-chaired with NPWS to support and coordinate fire recovery efforts following the escaped hazard reduction burn in October 2020. The program's initial focus was on providing artificial habitat (Figure 4), monitoring of fauna populations and increasing the level of weed control and pest animal control as the vegetation regenerated (Figure 5).

Figure 4: Supplementary habitat installed in NHS post-fire

Figure 5: Vegetation in NHS recovering post-fire

4. Ecological objectives and outcomes

The purpose of this chapter is to identify preferred and sustainable ecological outcomes for NHS.

Table 3 identifies the ecological management objectives and outcomes to be achieved at NHS. Ideally, these should be adopted by all North Head stakeholders to provide a consistent framework for operational management and strategic planning. It will be difficult to achieve these outcomes, and statutory obligations to protect biodiversity, if they only apply to NHS.

Table 3: Ecological management objectives and outcomes for NHS

Objective	Desired outcomes	Comment
Maintain or improve biodiversity	Maintain or increase the number of native flora and fauna species, populations and communities at NHS No loss of threatened species, populations or communities from NHS	Further threat mitigation must be targeted to holistically manage all species and avoid further local extinction of ground-dwelling species at NHS. Restoring habitat and addressing threats is considered a higher priority than replacement of existing species with further reintroductions, to ensure existing reintroductions are successful and there are no unintended consequences in the small bushland remnant. It is recommended that additional attention be given over the next five years to populations of threatened frog species that appear to have been declining.
Maintain or improve ecological connectivity	No reduction or further fragmentation of the total bushland area at NHS Regenerate/revegetate suitable cleared areas Improve condition of degraded bushland	Well-connected bushland in good condition will be more resilient to climate change and other potential impacts.
Implement appropriate ecological fire regimes - Appendix 2 of the Bushfire Management Plan (Travers 2022)	Improve condition and diversity of native vegetation at NHS	Undertake detailed planning of ecological burns, consistent with fire ecology and innovative burning practices. Undertake pre- and post-fire monitoring to ensure fire regimes are optimal for the ecosystems to be supported; update requirements for burns if there is good evidence to support the change
Support and grow community engagement consistent with the other ecological objectives	Maintain local provenance nursery to support revegetation within NHS	Community volunteers add value by operating a native plant nursery, educating the community, and participating in ecological monitoring (citizen science) and on-ground activities (e.g., revegetation, weed removal). Consider additional programs for Indigenous cultural activities, and targeting bike riders, walkers and heritage visitors.

5. Future management

The purpose of this chapter is to:

- **Recommend future management measures for the Harbour Trust to deliver ecological outcomes, both into the long term, and also within the next five years.**
- **Inform the Harbour Trust's future engagement of various service providers to deliver those outcomes (which may include the provision of bush regeneration, fauna species reintroductions, feral animal control, flora and fauna surveys, and ecological research, monitoring and evaluation).**
- **Inform the Harbour Trust's co-ordination with adjoining land managers.**

5.1. Clarify roles and responsibilities

As a minimum, the Harbour Trust should have one full-time equivalent Environmental Officer dedicated to planning and coordinating ecological management at NHS. It is further recommended that an Indigenous Ranger be recruited by the Harbour Trust, if possible, to assist the Environmental Officer with operations and stakeholder liaison. Specialist contractors and consultants will need to be engaged for selected tasks, under supervision by the Harbour Trust or other independent representatives.

Roles and responsibilities for ecological management at NHS and North Head more broadly are generally well understood by people who have been working or volunteering in the area over a long period. However, gaps and overlaps in existing roles and responsibilities have led to instances of poor decisions or inefficiencies, and this risk could be increased if there are changes to long-term personnel at the Harbour Trust or in other stakeholder organisations. Clearly defined roles, responsibilities and communication protocols will support improved ecological management at NHS.

Roles and responsibilities for ecological management and activities that could affect the natural environment of NHS should be clearly articulated in brief written form to Harbour Trust staff and other North Head stakeholders, including contractors. This document would summarise key points from position descriptions, contracted scopes of work and delegations of authority. It would need to be updated and reissued whenever there are changes to personnel or their roles or responsibilities. It would cover:

- Current contact details for all key personnel and alternative personnel involved in ecological management at NHS, and obligations for notification if personnel change.
- Responsibilities for engaging with media and communications with external parties regarding ecological management, including community environmental engagement and education.
- Requirements for maintaining records of all survey, research and on-ground activities relevant to ecological management at NHS. This should include updating shared spatial datasets via BioNet, SEED or similar.
- Schedules and purpose of routine meetings between stakeholders. For example, annual plant nursery planning meeting, quarterly stakeholder group meetings.
- Types of activities that others need to be informed of in advance e.g.:
    - Vegetation clearing or trimming, so seed can be collected

- Prescribed burns, so nest boxes and other habitat can be checked and relocated if needed

Other North Head stakeholders should be encouraged, via existing stakeholder group meetings, to provide their own roles and responsibilities summary document that can be shared with the Harbour Trust to enhance communication and decision-making by all parties.

5.2. Maintain community native plant nursery

The native plant nursery is an important, low-cost resource to sustain bushland ecosystems and native gardens at NHS because seed is collected locally for plant propagation and revegetation on-site. The seed collection and nursery are managed by NHSF volunteers under permit. Any proposed changes to the nursery location or infrastructure by the Harbour Trust should be made in consultation with the NHSF volunteers.

It is recommended that an annual nursery plan be developed and updated each quarter by the Harbour Trust in consultation with the NHSF nursery manager and NPWS. This will determine types and approximate quantities of required plant stock for revegetation activities. Categorisation of the stock (e.g., ESBS groundcover) by nursery volunteers will assist to identify and supply suitable plants if there are changes to requirements.

5.3. Survey and map plant community types

Existing vegetation types and condition across NHS need to be surveyed and mapped to provide a robust basis for decision-making and enable tracking of changes over time. The field survey methods should include vegetation validation through random meander and stratified systematic survey of vegetation zones using up-to-date techniques such as plots and transects (i.e., Biodiversity Assessment Method 2020) and classification of vegetation communities into Eastern Coast PCTs 2022, and Keith formations and classes. It should utilise techniques such as parallel transects outlined in recent survey guides such as the NSW Department of Planning, Industry and Environment 2020 'Surveying threatened plants and their habitats'.

A qualified and experienced Botanist should be engaged for the comprehensive vegetation survey task. The mapping will provide a scientifically robust baseline to inform management actions and be repeated every five years to determine if the ecological objectives and outcomes (section 4) are being met. The survey should include weed / condition mapping, and mapping of vegetation affected by diseases such as Phytophthora. It should identify locations of threatened flora species and populations.

Results of the vegetation survey should be captured in an open spatial database such as Bionet and presented to stakeholders on a GIS map (e.g., via SEED, Avenza). The map can be updated by the Harbour Trust or its contractors in future as conditions change and used as a basis for the Harbour Trust and others involved in NHS management to plan and track actions (see sections 5.4 to 5.9 below).

5.4. Prepare and implement bushland management plan

5.4.1. Prepare bushland management plan

The vegetation survey (section 5.3) will provide the baseline for development of the bushland management plan for NHS. This should be prepared by a Restoration Ecologist in consultation with key stakeholders. The bushland management plan should include a map of ecological management zones,

each with specific objectives and actions, consistent with the broad objectives and outcomes in section 4 of this report. Management zones will include requirements for:

- Ecological burns in accordance with Appendix 2 of the Bushfire Management Plan and other available information (e.g., post-fire monitoring of *Acacia terminalis* subsp. Eastern Sydney)
- Bushfire Asset Protection Zone and Strategic Fire Advantage Zone works, including chainsaw work (no climbing) and slashing in accordance with Bushfire Management Plan
- Erosion control and stormwater management relevant to bushland areas
- Weed control including bush regeneration (primary, secondary and maintenance weeding, manual, mechanical and chemical methods - including backpack and volume application)
- Bush track vegetation management (manual and mechanical methods)
- Line of site vegetation trimming
- Waste management (removal of weed propagules and managing weed compost piles)
- Revegetation complementary to the work of volunteers and advanced ordering of local provenance plant stock from the nursery – refer to section 5.2. Revegetation should be designed to improve habitat condition and connectivity where suitable conditions exist.
- Threatened flora monitoring using survey methods outlined in section 5.3.

The bushland management plan and associated maps should be in a format that can easily be updated each year as the outcomes of monitoring and implementation become available.

5.4.2. Implement the bushland management plan

Bush regeneration contractors must have expertise, qualifications and experience in bushland restoration, preferably with ESBS. Qualifications include minimum of Certificate III Conservation and Land Management and suitable experience or be accredited by Australian Association of Bush Regenerators.

Contractors who are responsible for mowing lawns and trimming landscaped gardens do not need to be bush regenerators and must avoid working in bushland areas.

Bush regeneration contractors need to prepare monthly progress statements and annual reports outlining work performed, updates to the vegetation condition mapping and considerations for the following month or year. Progress monitoring and reporting should address the ecological objectives and outcomes in section 4 and be used to update the bushland management plan for the following year (see section 5.4.1).

The type and locations of volunteer activities by the NHSF should be clearly defined and complementary to the work of bush regeneration contractors. The NHSF should submit quarterly activity statements to the Harbour Trust.

5.4.3. Implement appropriate fire regimes

Ecological burns are required to sustain healthy bushland at NHS. Fire management requirements for native vegetation communities are set out in Appendix 2 of the Bushfire Management Plan by Travers (2022). Opportunities for cultural burns by the Indigenous community should also be investigated in consultation with the Northern Beaches Bush Fire Risk Management Committee.

Vegetation should be monitored pre- and post-fire to ensure long-term objectives are being met. Monitoring data should be used to update the vegetation mapping and inform future bushland management responses.

5.5. Control pests

The peninsula geography of North Head means that pest animal control can be effective and have ecological benefits if it is well coordinated across landholdings. The Harbour Trust should collaborate with the stakeholder working group to develop and implement an integrated annual pest control plan for North Head. The plan will specify responsibilities, timeframes, target species, locations and control methods to be implemented on NHS land and other parts of North Head. Records of pests observed from incidental sightings, including from the community, and through formal survey should be captured in a shared spatial database/map (e.g., Feral Scan app) available to key stakeholders and used to inform control activities. Spatial data of control activities and monitoring (e.g., locations where cameras are installed or bait set) should also be recorded to inform planning of future control activities.

5.6. Control disease

Diseases such as Phytophthora have been recorded at North Head and can have a devastating effect on native species. Prevention is far more cost-effective than treatment, so it is important to educate staff, contractors, volunteers and the community about how to minimise the risk and spread of diseases. Available resources to inform development of educational material and standard work procedures at North Head for all stakeholders include:

- Arrive Clean, Leave Clean (Department of the Environment 2015)
- Threat Abatement Plan for *Phytophthora cinnamomi* (OEH 2002)
- Threat Abatement Plan for disease in natural ecosystems caused by *Phytophthora cinnamomi* (DEE 2018)

5.7. Monitor and manage threatened fauna

Comprehensive fauna monitoring has been undertaken at North Head. This has included supporting the reintroduction of three mammal species. Further reintroductions are not recommended at this stage.

Future fauna monitoring within NHS should be consistent with government survey guidelines, including:

- Animals Ethics (Animal Research Review Panel Guideline 1.0 2020) Wildlife surveys | Animal Ethics Infolink
- Survey Guidelines for Australia's Threatened Birds – Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment, Water, Heritage and the Arts 2010a)
- Survey Guidelines for Australia's Threatened Frogs – Guidelines for detecting frogs listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment, Water, Heritage and the Arts 2010b)
- Survey Guidelines for Australia's Threatened Mammals – Guidelines for detecting mammals listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment, Water, Heritage and the Arts 2011)

Short-term fluctuations in fauna survey results are to be expected. However, if NHS fauna monitoring reveals a long-term trend inconsistent with the objectives and outcomes in section 4, additional targeted action should be taken (e.g., install supplementary nest boxes or other habitat features for target species).

5.8. Educate and engage the community

There is already a high level of community engagement at North Head through the NHSF and other groups. There could be further opportunities to engage with the community (e.g., schools) through environmental education (e.g., ecological monitoring and bush tucker programs). Administrative barriers to achieving this should be reduced as there are many potential benefits from community engagement. Improved educational facilities within NHS buildings would also help to attract volunteers and participants to environmental education programs.

5.9. Support and learn from research

The ecological values and accessibility of NHS make it a popular site for research, especially studies associated with the reintroduction of species. Research can provide important insights to ecological management regimes and should continue to be encouraged (e.g., by providing work space, information and letters of support for research grant applications). Protocols for sharing knowledge should be part of agreements for any research undertaken at NHS.

5.10. Timing and cost estimates

Indicative costs and timing for each task are presented in Table 4. Additional costs would be incurred for (minimum) two full-time equivalent Harbour Trust staff, as described in section 5.1. It is also recommended that a contingency fund be allocated in cased there is a need to rapidly respond to unexpected events such as vandalism or bushfire.

Table 4: Timing and cost estimates for future ecological management of NHS by the Harbour Trust

Section	Task	Timing	Cost estimate in addition to salaries for NHS staff
5.1	Clarify roles and responsibilities	Year 1 - establish communication protocols	Nil
5.2	Maintain nursery	Ongoing	$5K pa for materials
5.3	Survey and map vegetation	Year 1 - Q1	$30K consultant
5.4.1	Prepare bushland management plan	Year 1 – Q2	$10K consultant
5.4.2	Implement bushland management plan	Ongoing	$100K pa contractor (includes annual update to bushland management plan)
5.4.3	Implement fire regimes	Ongoing	$10K pa contractor
5.5	Prepare and implement annual integrated pest control plan	Ongoing	$10K pa contractor for NHS land
5.6	Control disease	Year 1 educational material plus ongoing controls and tests, if needed	$5K pa
5.7	Monitor and manage threatened fauna	Ongoing	$20K pa consultant Excludes costs for additional or replacement nest boxes or habitat, if required
5.8	Educate and engage the community	Ongoing	Costs for materials recovered in fees for activities
5.9	Research	Opportunistic	Nil

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