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North Sydney Council
Bushland Rehabilitation Plans 2019-2029

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1.0 Introduction

The North Sydney Bushland Plan of Management (BPOM) provides an overarching plan for all bushland in the local government area that is either Council owned or Crown land managed by North Sydney Council. It applies to land managed as bushland and zoned E2 Environmental Conservation or RE1 Public Recreation under the *North Sydney Local Environmental Plan 2013*.

The Plan of Management, prepared under the requirements of the NSW *Local Government Act 1993*, outlines Council's core objectives, statutory obligations, relevant policies, general bushland characteristics, values and resources. Issues and threats are identified and a clear direction is outlined for planning, resource management and maintenance that provides a basis for assigning priorities in works programming and budgeting.

In early 2002, Bushland Rehabilitation Plans (BRPs) and Fauna Rehabilitation Plans (FRPs) for Middle Harbour and Port Jackson catchments were finalised under the North Sydney Bushland Plan of Management. Specific goals for each reserve were prepared by looking at individual issues within each of these areas and devising ways to limit the threats, conserve existing biodiversity, and rehabilitate degraded areas.

During 2017-19, BRPs for all bushland reserves were updated to reflect the gains that have been made in bushland condition since their original inception, as well as developments in bush regeneration practices that have evolved over the years. The revised plans combine fauna components that were previously contained in separate FRPs. They include a more comprehensive consideration of heritage values and reflect changes in legislation, policy, data, and community needs and desires.

Recent legislative and policy changes that have been considered in the preparation of the BRP include the NSW *Biodiversity Conservation Act 2016*; *Biosecurity Act 2015*; *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017*; *State Environmental Planning Policy (Coastal Management) 2018*; *Rural Fires Regulation 2013* and *NSW Invasive Species Plan 2015*. Environmental legislation and other relevant statutory instruments will continue to be amended and/or repealed during the life of these plans. Where required, changes in the statutory obligations of Council will be integrated into bushland management strategy/practice.

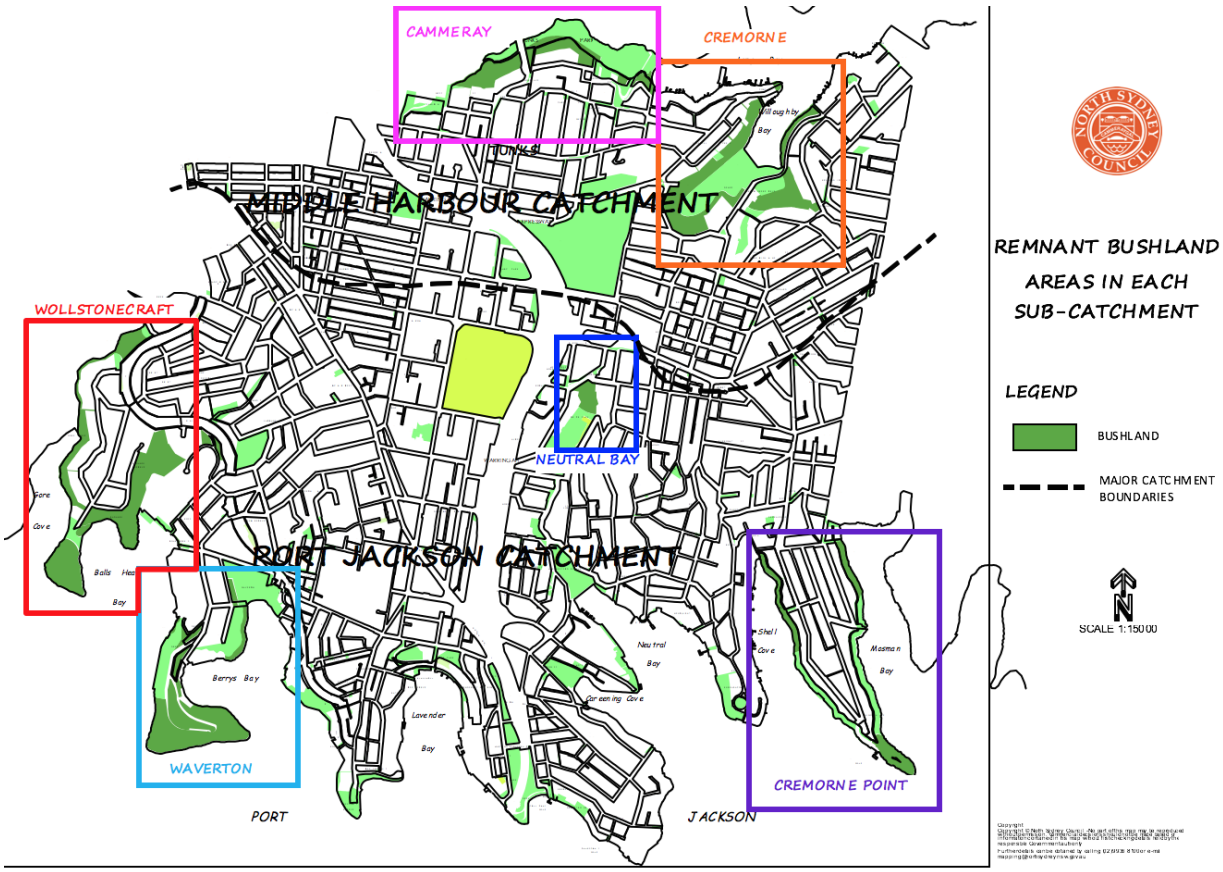
Eleven BRPs have been prepared that outline the characteristics and issues facing each individual bushland reserve (or reserve grouping) and propose practical actions to effectively manage them. These 11 plans have been developed for application over 10 years from 2019-2029. Preparation of the BRPs has been made possible due to funding through Council's Environmental Levy.

The reserves and their accompanying BRPs have been divided on a catchment basis into two groups, Port Jackson and Middle Harbour, as indicated in Table 1 and Map 1. In some cases, adjoining or nearby reserves have been grouped together in one rehabilitation plan. Management actions are also interrelated between bushland in the Cremorne, Cammeray, Waverton and Wollstonecraft remnants where vegetation connectivity is encouraged.

Table 1: Bushland Rehabilitation Plans based on catchments and remnant groups

Port Jackson Catchment	**Remnant Group**
Smoothey Park and Gore Cove Reserve BRP	Wollstonecraft remnants
Badangi Reserve BRP (including Walumetta Park & Sugar Works Reserve)	
Berry Island Reserve BRP	
Balls Head Reserve, Carradah Park, Waverton Park and Coal Loader Parklands BRP	Waverton remnants
Cremorne Point (Woolwarra-jeung) Reserve BRP	Cremorne Point remnant
Forsyth Park BRP	Neutral Bay remnant
Middle Harbour Catchment	
Brightmore Reserve BRP	Cremorne remnants
Primrose Park / Folly Point BRP	
Wonga Reserve / Tobruk Avenue Lookout BRP	
Tunks Park BRP	Cammeray remnants
Mortlock Reserve and Judith Ambler Reserve BRP	

Map 1. Location of bushland reserves and bushland remnant groups



1.1 The Aim, Role and Goals of Bushland Rehabilitation Plans

Remnant bushland in the North Sydney local government area has many values including ecological, genetic, cultural, historical, scientific, educational, archaeological, geological, recreational, scenic and visual. The BRPs aim to preserve, manage and rehabilitate bushland and its associated values in the face of climate change, increased use, and constant impacts from the surrounding urban environment.

The role of the BRPs is to:

- inform the public, bush regeneration contractors, volunteers and council staff about the principles and procedures that North Sydney Council has adopted to manage each reserve which complies with the North Sydney BPOM and best practice bush regeneration;
- contain a summary of each reserve's characteristics, values, threats and land use zoning;
- identify the level of degradation (condition) and resilience of bushland areas;
- identify past fire events, fire management access zones and planned ecological burns over the next 10 years;
- incorporate the latest research data and best practice developments in bush regeneration methodology to inform appropriate management responses and reflect adaptive management principles;
- acknowledge and adapt to changes in legislative / policy requirements;
- identify factors that require monitoring;
- identify hazards and risks and appropriate management responses;
- prioritise areas and issues needing attention and provide practical solutions; and
- plan and prioritise future capital works to inform resource requirements.

Bushland management goals have been developed for each bushland reserve that reflect those in the BPOM but can vary between reserves depending on their characteristics and challenges. Typical goals are listed below:

- maintain and enhance biodiversity and habitat for long term ecosystem resilience and function;
- conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve;
- strategically restore bushland (prioritise areas of highest resilience);
- enhance habitat connectivity;
- preserve genetic integrity of the vegetation community;
- manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality;
- conserve the natural landscape and heritage values;
- provide for sustainable and bushland-sensitive recreation needs of the community;
- prevent inappropriate use of public bushland; regulate activities that risk bushland values, and
- implement the strategic fire hazard reduction program and manage fuel to protect life, property and endemic biodiversity.

1.2 Approach and Methodology

1.2.1 Collaboration

The BRPs promote a collaborative and coordinated approach to the rehabilitation and management of bushland areas in North Sydney. They have been designed to inform and engage with residents, volunteers, contractors, council staff, the Aboriginal Heritage Office, infrastructure providers and

other stakeholders to obtain the best outcomes for the reserves and the community. Co-operation with catchment stakeholders is required in specific projects where bushland in the local government area connects with bushland in neighbouring Councils, for pest management such as fox control programs, fire management, or for the management of infrastructure such as sewerage pipes and stormwater infastructure.

1.2.2 Source Material

The plans comprise all relevant available information to inform suitable management responses. All plans are based on site inspections, consultation with council staff and stakeholders, legislation, policies, masterplans, previous bushland and fauna rehabilitation plans, topographic maps, aerial photos and baseline data on natural resources and reserve values.

The plans have largely been based on results from the North Sydney Council *Natural Area Survey* (NAS) conducted by Smith and Smith Ecological Consultants in 2010. This report identifies and maps the 12 native vegetation communities found within the local government area, some of which are endangered ecological communities. It also contains a list of all flora and fauna species typically found in each vegetation community, and identifies bushland condition, biodiversity 'hotpots' and wildlife corridors. Analysis and recommendations made in the *Natural Area Survey* regarding fire regimes, changed species composition, dieback, genetic viability of small isolated reserves and climate change were also taken into consideration when preparing the BRPs.

Other sources of data included Council, State and Federal government records, legislation and maps on relevant endangered ecological communities, threatened species, soil landscape, Aboriginal heritage, European heritage, climate change predictions, facilities provision, infrastructure, easements and land use zoning. Bushland rehabilitation contractor annual reports and specific flora and fauna studies focusing on (for example) micro bats or threatened plants were also used to identify values, threats and management responses.

1.2.3 The Bradley Method for Bushland Restoration and New Principles

Bush regeneration is a long-term process of staged rehabilitation. It aims to convert weed affected or otherwise degraded areas into healthier ecological communities to sustain endemic biodiversity, as well as reinstate and reinforce the natural regeneration processes.

Bushland restoration methods are constantly evolving, however, the three main principles of the Bradley Method developed in the 1960s and 70s still apply whereby over time, ecosystems can sustain themselves, regenerating naturally with little human intervention. The basic principles of the Bradley Method have been incorporated in the BRPs and are as follows:

1. To prioritise protection and rehabilitation of resilient bushland areas (described as 'core' bushland) before commencing rehabilitation in more degraded/peripheral areas. Core areas represent the most efficient and effective rehabilitation pathway due to their inherent high resilience where weeds, once removed, are mostly replaced naturally by regenerating native species. The valuable biodiversity contained in core areas will eventually spread into adjoining, more degraded areas, as part of the assisted restoration process.
2. To minimise the disturbance of natural conditions such as soil layers and vegetative cover, as disturbance encourages the establishment of weeds, causes soil erosion and diminishes resilience. Weeds are usually removed by hand with care not to harm any native seedlings. Exposed ground is covered with natural leaf litter (or mulch if necessary) to suppress weed growth and erosion control measures are implemented if needed. (Note that modern

techniques also recognise the need for appropriate ecological disturbance that triggers regeneration, such as fire or the strategic removal of mesic canopy).

3. To let the rate of regeneration of native plants determine the rate of weed removal. Avoid over clearing weeds as they thrive in disturbed areas and new infestations typically establish in bare soil with plenty of sunlight. Any areas cleared of weeds will require intensive follow up work to remove weed regrowth that is generally present in disturbed soils. Concentrate on smaller natural areas, and once weeds have been removed and natives have begun to re-establish, then move onto a new area within the reserve.

These three basic principles were developed with the aim of:

- preventing the deterioration of core areas known as primary conservation zones in the BRPs;
- improving the next best areas known as secondary conservation zones;
- holding the advantage gained; and
- cautiously moving into the worst areas which are known as the Conservation Buffer Zones which comprise degraded bush edges, weedy habitat zones, areas dominated by mesic plant species (which can include invasive natives that favour moister conditions) and exotic dominated areas.

Rehabilitation principles are now not only recognising bushland condition, composition and structure but also the workings of an ecosystem. For instance, a dense weedy area may have been targeted in the past for removal, but now it may be recognised as important habitat for small birds and reptiles and therefore necessary to maintain until suitable adjoining native vegetation can perform the same habitat function.

In the past, the presence of any endemic species in bushland was generally regarded as positive. Now it is recognised that certain disturbance-enabled endemic species may threaten habitat structure and function, lowering biodiversity and therefore require thinning or removal. Mesic species (for example) can change a dry sclerophyll forest into a moist, shady environment, altering its habitat structure and function. Similarly, fast-growing native grasses such as *Microlaena stipoides* can smother juvenile plants on the forest floor, inhibiting seed germination; species diversity and habitat complexity.

There is also a new focus on identifying and prioritising bushland areas of highest resilience. Bushland resilience is determined by the capacity of a site to recover from a disturbance event. For example, a weedy area that appears degraded may in fact have resilience if a sufficiently diverse bank of native seeds is present in the soil and can be triggered to germinate following a fire event or other ecologically appropriate disturbance. To determine resilience, impacts affecting bushland need to be defined as permanent or reversible. Changes are defined as reversible when it is possible to eliminate or at least reduce their negative consequences so that a return, or near return of original ecosystem features / functions is achievable. Permanent impacts that severely diminish (or eliminate) resilience include landfill sites, artificial stormwater drainage lines or the installation of services like sewer infrastructure in bushland.

Sections of bushland solely affected by reversible changes in ecological factors tend to have the best resilience and species diversity. In all cases, areas of high resilience take priority over areas of low resilience for rehabilitation works.

Different approaches to ecological restoration are needed, based on the level of degradation within a site. Natural regeneration and ecological burns are likely to be all that is needed in core areas. Assisted natural regeneration interventions are often needed for sites of intermediate degradation where natural regeneration is ineffective. This may involve planting locally sourced plant material to maintain

genetic integrity (in accordance with Flora Bank Guidelines) and to boost biodiversity. Whilst areas with high level degradation usually require reconstruction. Where restoration of the previous community is unfeasible due to permanent impacts, degraded areas can be transformed into an alternative locally occurring community better suited to the changed soil/site conditions. For instance, where stormwater has changed hydrological regimes making an area permanently moist and nutrient enriched, mesic species are more suitable. In all cases, managers are always encouraged to restore an area (as much as possible) back to its pre-existing ecosystem.

1.2.4 Monitoring and Review

On-going monitoring will be carried out throughout the life of the BRPs to obtain qualitative and quantitative data and to determine whether objectives are being achieved. An adaptive management approach will be taken whereby the feedback from monitoring will be assessed and proposed actions revised to obtain optimal outcomes.

Monitoring will play a crucial role in identifying and measuring the impact of climate change over time. Factors that will need to be monitored will include temperature and rainfall, frequency and severity of bushfire, extreme weather events, raised sea levels, foreshore erosion and impacts to Aboriginal middens as well as species survival rates and changes to the structure and function of bushland.

Monitoring will include:

- establishing photo points to monitor projects;
- creating and maintaining species lists (native and exotic) for each reserve
- recording uncommon flora and fauna species identified to inform risk of extinction in the reserves;
- monitoring sites to identify, report and manage early stages of weed outbreaks, disease/health impacts caused by external factors (e.g. termite over-abundance) or shifts in plant species assemblages likely to become detrimental to biodiversity;
- monitoring the changing conditions leading to the low population numbers of locally rare plant species;
- monitoring fauna occupation of natural and created habitat such as tree hollows and nest boxes;
- monitoring post fire flora regeneration in the ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species;
- monitoring feral or aggressive / territorial fauna, cats, unleashed dogs and illegal activity including tree vandalism, boat storage and encroachments;
- monitoring Aboriginal and non-Aboriginal heritage for any damage or maintenance requirements;
- monitoring erosion along creeklines, stormwater drainage lines and the foreshore;
- monitoring formal and informal tracks for erosion, maintenance requirements or closure;
- monitoring interpretative signage for vandalism or wear and tear; and
- recording unauthorised activities and the impact they have on bushland condition.

1.2.5 Mapping

The BRPs use 2 systems for mapping bushland condition and ecosystem function:

- bushland condition mapping for field work monitoring and progress focusing on native vegetation and weed impact; and

- ecological zone mapping for setting strategies and objectives for the BRP focusing on biodiversity, resilience and ecosystem functions.

Bushland Condition and Resilience Mapping

The bushland condition and resilience mapping is based on an adaptation of the traditional methodology used by the National Trust. Bushland condition is evaluated on percentage of native cover and a table complementing the maps shows detailed improvement through strata layers. This approach provides a more accurate record of progress made at specific sites.

The following lists the colour key used to map bushland condition:

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc.) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural recruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting Poor indicative resilience
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience – limited regeneration potential (1-2 species)
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed VENM* sandstone)

*Virgin Excavated Natural Material

Ecological zone mapping

Ecological zone mapping is based on changes in ecological factors, bushland resilience and level of biodiversity. Each reserve has been mapped into ecological zones to assist bushland managers and bush regeneration contractors to:

- set management objectives that address issues specific to each ecological zone;
- focus field work toward the overall aim of biodiversity protection; and
- measure improvement relative to the level of bushland degradation.

There are 3 zones defining ecological condition:

- Primary Conservation Zone – PCZ;
- Secondary Conservation Zone – SCZ; and
- Conservation Buffer Zone – CBZ.

Primary Conservation Zone – PCZ
Management aim: To protect biodiversity and ensure the long-term stability of ecosystem functions.

PCZ sites are composed of resilient sections of bushland where plant community remnants are not permanently affected by changes in ecological factors. PCZs harbour rich flora diversity, good samples of vegetation community remnants and provide critical habitat to threatened and declining flora and fauna species sensitive to permanent changes in ecological factors.

PCZs are the most important ecological asset remaining in North Sydney today. They are the backbone of biodiversity and provide the bulk of remaining suitable habitat for plant species and plant communities at risk of localised extinction.

Secondary Conservation Zone – SCZ
Management aim: To stabilise bushland remnant ecosystems, promote regeneration and provide buffer function to adjacent PCZ sites.

SCZ sites are composed of unstable remnants of original vegetation communities with some resilience interspaced with small sections of degraded vegetation affected by reversible changes in ecological factors. SCZs have lost or are in the process of losing some flora diversity and exotic plants tend to be persistent particularly through the ground layer. Original soil profiles are in fair condition and remain throughout the majority of SCZ sites.

SCZs play an important role in protecting biodiversity in North Sydney because:

- boundaries are usually shared with PCZ sites, providing a natural buffer to the bushland core;
- many SCZ sites have the potential to be regenerated to PCZ level;
- some species no longer visually present, may be stored in the soil seed bank; and
- areas where the original set of abiotic factors remain in-tact, may allow for the reintroduction of missing plant species known to belong to the vegetation community, thus increasing biodiversity.

Conservation Buffer Zone – CBZ
Management aim: to influence the ongoing ecological shift towards an outcome beneficial to biodiversity in North Sydney

CBZ sites are sections of the reserve permanently affected by changes in physical factors. Permanent changes in ecological factors occur when it is no longer realistic or possible to eliminate the causes that currently affect the ecology, or once altered, the bushland cannot be returned to its original state and species composition. Examples include the extensive dumping of fill material, quarrying or stormwater infrastructure. In such cases, the integrity of original vegetation communities is compromised and resilience is diminished whereby the re-introduction of lost species is not likely to be successful without improvement works aiming to re-establish a near return of the original set of ecological factors.

In typical CBZ sites, new vegetation communities composed of simple assemblage of remnant native, mesic and exotic species form as they adapt to a new set of abiotic factors.

CBZs are characterised by three subgroups based on their composition or ecological function within a particular bushland reserve:

1. Buffers: *covers degraded bush edges and bush edges restored into native buffers currently at maintenance level;*
2. Weedy habitat: a*reas dominated by exotic species recognised as valuable habitat for fauna species in decline in North Sydney such as small birds; and*
3. Mesic shift: *areas with limited history of ecological management, dominated by mesic and exotic species*.

CBZs have the potential to play an important role in protecting biodiversity in North Sydney because they provide us with:

- opportunities to influence the outcome of the ecological shift in progress. This can provide benefits to biodiversity without the constraint of protecting or rehabilitating the integrity of the original plant community;
- habitat for fauna reliant on vegetation structure as opposed to vegetation diversity alone;
- additional protection from erosion, weed sources, fragmentation and edge effects; and
- where stable and contained, CBZs are a lower priority for rehabilitation investment. This enables a more strategic and effective use of limited resources, to the betterment of biodiversity.

Photo Left: Dense weedy habitat in Forsyth Park, Neutral Bay 2017

Image by EConPlan

1.2.6 Role of Council's Nursery in Promoting Biodiversity and Genetic Viability

Due to the fragmented nature of bushland remnants in North Sydney LGA, populations of plant species in decline are susceptible to loss of genetic diversity. This causes additional strains on affected populations such as:

- increased inbreeding;
- reduced seed production leading to a declining seed bank, poor germination and reduced seedling vigour;
- increased vulnerability to pathogens such as *Phytophthora cinnamomi* and *Uredo rangelii* (Myrtle rust);
- reduced capacity to adapt to changing environmental conditions, such as long-term climate change; and
- compromised value as seed sources for revegetation and restoration projects.

Wildlife plays an important ecological function in maintaining genetic diversity. When bushland remnants can no longer provide suitable habitat for a range of wildlife, ecological functions are diminished or lost, creating a range of negative ecological feedbacks, one of which is the loss of floral genetic diversity leading to loss of genetic viability.

In North Sydney, isolated and underrepresented plant populations have reached a stage where ecological functions and biodiversity need to be assisted, through the propagation of selected species that do not originate from the reserves where they are to be planted. Seed or plant propagules (e.g. cuttings) are collected from adjoining reserves or from Council LGAs that share boundaries with North Sydney to avoid introducing genetic strains of the species that may be poorly adapted to local conditions or incompatible with local strains.

Acacia terminalis subspecies *terminalis* is the exception. This subspecies is listed as endangered under the Commonwealth *Environmental Planning and Biodiversity Conservation Act 1999* and the NSW *Biodiversity Conservation Act 2016* and occurs in some of North Sydney Council's reserves. It is important that no plantings of any *Acacia terminalis* subspecies occur near known natural populations as this may compromise their genetic integrity, causing interbreeding.

Council's nursery at the Coal Loader Centre for Sustainability provides an opportunity to have direct control over the provenance of seeds and plant material. The following table lists various strategies where the nursery will play an important role in maintaining healthy floral genetic viability.

Table 2: Role of Council's Nursery

ROLE OF COUNCIL'S NURSERY	
Management Strategies	Role of Nursery
Primary Conservation Zones Promote the regeneration of plant species categorized as rare, uncommon or in decline.	• Enhance genetic diversity of small isolated populations; • Ensure provenance is varied when reintroducing plant species now extinct at site level.
Secondary Conservation Zones Improve plant species diversity and integrity of vegetation strata through vegetation community remnants with low resilience.	• Propagation of uncommon species to enhance biodiversity; • Ensure selected species belong to the recipient vegetation community.
Conservation Buffer Zones Influence ongoing vegetation shift triggered by permanent changes in abiotic factors towards the formation of viable vegetation communities composed of a mix of native species that will support the conservation of biodiversity in North Sydney.	• Enhance genetic diversity of species categorised as rare, uncommon or in decline in North Sydney; • Ensure provenance is varied when reintroducing plant species now extinct at site level.
Mesic Shift Areas In primary and secondary conservation zones where controlled burns cannot be implemented, protect flora diversity and promote natural regeneration using techniques other than ecological burns.	• Propagation at the nursery of plant species at risk of localised extinction caused by lack of fire regime and strategically plant in suitable areas.
Fauna species reliant on bushland ecology Link permanent core fauna habitats and increase habitat range of small bird populations	• Propagation of plants species known to provide food or shelter for rare or declining wildlife (including small bird species; invertebrates; mammals and reptiles etc).

1.2.7 Fire Management

Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity. Strict legislation controls bushfire management including burning of bushland for ecological purposes. Bushfire can only be conducted in compliance with the *Rural Fires Act 1997* and the *Mosman North Sydney Willoughby Bushfire Risk Management Plan* (BFRMP).

A BFRMP is a strategic document that identifies community assets at risk and sets out a five-year program of coordinated multi-agency treatments to reduce the risk of bushfire to these assets. Treatments may include such things as hazard reduction burning, community education, fire trail

maintenance and establishing community fire units. Annual programs to implement the treatments identified in the BFRMP are undertaken by the relevant land managers and fire-fighting authorities.

The environmental objective of the BFRMP is to manage fuel to reduce the rate of spread and intensity of bush fires while minimising environmental/ecological impacts. Environmental assets with known minimum fire threshold (i.e. an ecologically required length of time in which fire remains absent) are assessed to determine if they are at risk of a bush fire within the 5-year life of the BFRMP using fire history and fire threshold data.

Knowledge of fire ecology and the implementation of appropriate fire regimes through bushland remnants are effective management tools to improve bushland health and protect biodiversity. Appropriate fire regimes through PCZ and SCZ combined with planned bush regeneration work schedules before and after fire aim to:

- trigger natural regeneration through senescing resilient bushland;
- halt the decline of fire dependent plant species;
- reinstate the natural processes of species succession;
- promote natural levels of species composition that make up stable, diverse and structurally complex vegetation communities;
- reduce the dominance of aggressive coloniser plant species over weaker uncommon native species; and
- reduce the prevalence of mesic native species that are a symptom of altered fire regimes.

Fire agencies such as NSW Fire and Rescue prioritise proposed hazard reduction burns based on asset exposure and overall threat category, combined with other management constraints including weather conditions and proximity to sensitive sites. The likelihood that adequate fire regimes can be implemented through all bushland remnants in North Sydney is very low. It is therefore important to:

- maintain land management zones adjoining private property and implement appropriate stabilisation techniques;
- identify and prioritise the management of areas which are most at risk of declining species diversity in the near future due to lack of fire;
- plan ecological burns to occur in a mosaic pattern across each reserve as this achieves variability in vegetation age class; species composition; structural complexity; habitat and fuel loads. This approach improves bushland function and biodiversity whilst also reducing risks to adjoining assets;
- explore the feasibility of integrating priority areas with the future planning and scheduling of hazard reduction burns; and
- provide alternative management solutions to minimise biodiversity loss for priority areas not likely to be burnt in the near future.

Maps indicating land management zones, reserve fire history and proposed future burns have been prepared for each BRP. Fire management strategies in the BRPs often incorporate the following methodology:

- strategically cull mesic species to increase light and reduce competition in the shrub layer (prioritised in Autumn and Winter before bird breeding and timed to enhance ground fuels in the area as required);
- reduce the seedbank of dominant natives to control the seeding cycle and improve post-burn regeneration success;
- increase the seed bank of uncommon/ rare species with brush matting techniques (collected from donor sites where seed removal will not affect biodiversity);

- design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds;
- implement post-fire monitoring and bushland rehabilitation strategies. This includes monitoring the regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time after the burn;
- maintain and improve Fire Management Access Zones (FMAZ) around the reserve periphery; and
- educate reserve neighbours about bushfire preparedness on their own property.

1.2.8 Mesic Shift Management

Mesic shift occurs through many sections of bushland remnants in North Sydney. Mesic shift is the progressive change that can occur in dry sclerophyll forest when endemic or non-endemic species typical of moister areas change the forest structure and function, which in-turn negatively impacts on biodiversity over time. The drivers of mesic shift include a long absence of fire; the introduction of nutrients and moisture from stormwater drains and seed spread by over-abundant wildlife (particularly birds). Where mesic species dominate, they create shade and increase soil moistness, reducing the opportunity for ecological burns. These conditions lead to the loss of less shade-tolerant native species and accelerates a breakdown of the soil seed bank.

Mesic shift through sections of Primary Conservation Zone (PCZ) and Secondary Conservation Zone (SCZ) is particularly detrimental to biodiversity in North Sydney as these areas harbor the most biodiversity. The rate of biodiversity loss will vary depending on the length of mesic shift exposure, species composition of the original vegetation community and presence of other abiotic factors (such as stormwater).

Mesic shift is one of many factors affecting permanently degraded areas such as Conservation Buffer Zones (CBZ). In some cases, however, mesic shift can be used as a valuable (though temporary) management tool for the implementation of specific management objectives. For example: mesic species may be retained or their assemblage modified, in order to retain complex habitat, particularly for small passerine bird species.

Mesic shift affected areas are separated into two groups according to the aim of their management strategies:

a) Mesics in Primary and Secondary Conservation Zones

Management Aim – To prioritise the management of areas at risk of flora diversity loss.

Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team:

- pile burn where appropriate;
- address stormwater drainage issues where feasible (e.g. construct sandstone-armoured artificial creeklines; install energy dissipation devices or gross pollutant traps etc.)
- strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding);
- reduce the seedbank of dominant natives and control the seeding cycle;
- lightly disturb mulch / organic matter to stimulate regeneration;
- increase seed bank of uncommon / rare species with brush matting techniques (collected from donor sites where seed removal will not affect biodiversity);

- propagate senescing plant species at risk of extinction in the reserve due to inadequate fire regime and plant tubestock in suitable locations.

b) Mesics in Conservation Buffer Zones

Management Aim – To identify and integrate beneficial ecological functions within management strategies for CBZ and the protection of fauna species reliant on bushland ecology.

In the short to medium-term, it may be necessary to retain (and contain) areas of dense weed, vines and mesic species in some reserves as these areas provide critical habitat for vulnerable native wildlife. In the longer-term, bush regenerators will aim to transition these areas to a self-maintaining fabricated vegetation community composed of native species adapted to current abiotic factors that support biodiversity and achieve habitat requirements.

1.2.9 Fauna Habitat Management

The diversity of fauna species has declined in the North Sydney LGA over the last 200 years, largely due to land clearing and loss of hollow bearing trees, urbanisation, the introduction of pets, feral animals and weeds, degradation of bushland remnants, a decline or localised loss of native plant species, changes to vegetation structure and function and bushland fragmentation. Bushland fragmentation poses the greatest management challenge to bushland managers today and results in:

- isolation of small fauna populations and limited resource availability;
- constrained population sustainability and barriers to fauna dispersal between remnants;
- reduction of genetic diversity within isolated fauna populations; and
- increased risk of localised loss of fauna populations from disturbances such as disease, predation, climate change and bushfire.

With appropriate management, remaining fauna species in the LGA may be able to bounce back within the limits of the carrying capacity of bushland remnants and wildlife corridors which link bushland remnants across the landscape.

The following fauna management strategies have been developed to improve biodiversity and resilience in the LGA and these are incorporated into the relevant BRPs:

- identify and co-ordinate the best methods to establish or embellish wildlife corridors linking bushland reserves. Where appropriate the BRPs include Council programs and plans to improve wildlife habitat and corridors on land that adjoin the reserves and encourage engagement with local land owners and residents. These include the Native Havens Program, Streets Alive Program, Habitat Stepping Stones Program; Responsible pet education programs and provisions found in the North Sydney Development Control Plan 2013 for developments located within 300m of Bushland;

Photo Left: Balls Head Reserve, Waverton: Dog Management signage 2018

Image by NSC

- integrate strategies to increase habitat values of selected fauna species in bush regeneration activities;
- identify and protect nesting, roosting and breeding sites of threatened, endangered or locally significant fauna and focus resources on threatened species and species known to be reliant on bushland ecology for survival such as small birds, microbats, *Ninox strenua* (Powerful Owl) and some reptile species. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened, endangered or locally significant species;
- where appropriate, install fauna nesting boxes and create hollows in suitable dead trees before they are de-limbed to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed;
- investigate financial opportunities to invest in habitat enhancement and work collaboratively with adjoining Councils and stakeholders;
- implement the successful regional fox baiting program that has resulted in the return of numerous species to North Sydney reserves after an absence of more than 50 years. This includes the return of the *Perameles nasuta* (Long-nosed bandicoot) and the *Menura novaehollandiae* (Superb Lyre-bird);
- monitor and control feral or aggressive/territorial fauna activity with appropriate measures e.g. trapping, community education programs, or camera observation;
- promote appropriate management of domestic pets and implement Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 in applicable reserves allowing for the exclusion of cats and cat trapping. Exclude dogs from all bushland reserves unless on a lead and under effective control. All bushland reserves are sign-posted as 'dog on-leash areas'. Currently, five bushland reserves are classified as Wildlife Protection Areas however this should be expanded to incorporate all North Sydney bushland reserves overtime;
- collect relevant data to inform management strategies to establish sustainable fauna habitat, and identify and establish effective corridors to increase habitat range. North Sydney constantly promotes the collection of fauna data in bushland remnants by periodically engaging consultants to undertake fauna surveys, encouraging volunteers and bush regenerators to record wildlife

sightings or collaborating with university or government based fauna study programs. All data collected is recorded in Council's Wildlife Watch database;

- minimise disturbance to wildlife during bush rehabilitation and ecological fire regimes. Avoid sensitive nesting periods and implement mosaic-pattern burns to achieve habitat variation within the reserve system and to promote ecological productivity;
- protect, maintain and restore quality fauna foraging habitat using a diverse mix of locally appropriate native species. Retain habitat features such as rock piles, hollow-bearing trees, natural debris, dead standing trees, forest litter, logs and branches;
- consider short term strategies to maintain fauna habitat provided by dense mesic, vine and weed species identified within some 'Conservation Buffer Zones' and contain their spread. In the longer term, aim to establish a self-maintaining fabricated vegetation system in these areas composed of native species adapted to the prevailing abiotic factors; protect biodiversity and enhance habitat;
- ensure best-practice design of any proposed sports field lighting adjoining bushland to reduce impacts on nocturnal fauna (e.g. endangered microbats) and educate adjoining residences regarding the impact of light pollution in bushland, where the need is identified.

Photo Left:
Powerful Owl hollow creation in crown-reduced dead tree. Primrose Park, Cremorne 2017.

Image by EConPlan

1.2.10Heritage Management

Many known and unidentified Aboriginal sites and non-Aboriginal historic sites and relics are conserved within North Sydney Council's bushland reserves as these areas are generally amongst the least disturbed by development.

All items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1979* and the *Heritage Act 1977*. These include places, objects and features of significance to Aboriginal people. Legislative reforms proposed in the draft *Aboriginal Cultural Heritage Bill 2018* will expand Aboriginal cultural heritage to include intangible aspects of cultural heritage, new governance arrangements for state and local Aboriginal bodies, new systems for mapping important locations and staged impact assessment pathways. Any new sites identified within the bushland reserves and changes to management requirements will be addressed in future amendments to the BRPs once this legislation is gazetted.

All known historic values listed on the NSW Government's *Aboriginal Heritage Information Management System* (AHIMS) database, the NSW *State Heritage Register* and the *North Sydney Local Environmental Plan 2013* have been included in the BRPs along with non-statutory classifications made by the National Trust of Australia.

Threats to historic values within North Sydney Council reserves include vandalism, intended or unintended disturbance, removal of vegetation from bushland restoration works, erosion and compaction caused by people walking on sites, weathering and decay, damage and instability from invasive root systems, fire and smoke damage, insensitive development activities and construction of bushland infrastructure such as walking tracks.

As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require investment in identifying values, specialist management and certain bush regeneration practices, monitoring and maintenance in consultation with relevant stakeholders.

The Aboriginal Heritage Office for the North Sydney area, the Metropolitan Local Aboriginal Lands Council and the New South Wales Office of Environment and Heritage are key stakeholders in relation to Aboriginal sites. Council's Heritage Officer, the Heritage Council of NSW, the Office of Environment and Heritage and interested heritage community groups are key stakeholders for non-Aboriginal heritage.

All relevant bushland rehabilitation plans incorporate the following strategies to identify, manage, protect and promote heritage values:

- all identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1979* and *Heritage Act 1977*;
- Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual;
- all bushland management staff attend Aboriginal Heritage Awareness training provided by the Aboriginal Heritage Office (AHO). Bush Regeneration contract site supervisors are informed of this training and encouraged to attend also;
- as all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance;

- bushland management staff are to consult with the AHO prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey;
- discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol; and
- organise an assessment of the heritage significance of unassessed items by qualified professionals, formulate recommendations and appropriate management measures.

1.2.11 Urban Impact Management "*Edge Effects*"

The limited size and narrowness of bushland remnants amplify their vulnerability to fragmentation and impacts from the surrounding urban environment. These impacts are collectively known as "edge effects".

All bushland remnants suffer weed invasion and other disturbance from adjoining roads, private properties, sports fields or parks. Areas particularly affected by weed incursions have been the creeklines, areas adjoining stormwater drains, and areas below or beside roads, gardens and lawn.

Various forms of infrastructure that supply sewerage, electricity, gas and telecommunication services to adjoining urban areas require easements and access for maintenance vehicles and machinery through bushland and restrict some areas from undergoing ecological burns.

Past dumping of industrial and domestic waste, garden clippings as well as quarry and fill works including from road and other construction, have significantly degraded some reserves, impacting soil stability, composition and structure, seedbank viability, natural hydrological flows and bushland resilience. Major soil disturbance limits (and in severe cases, negates) the process of assisted natural regeneration.

Stormwater and sewerage infrastructure are increasingly under stress as urban density increases in the catchment, causing pop-tops and broken pipes to occasionally over flow, increasing nutrification, soil erosion and moisture as well as polluting bushland and waterways. These impacts are also caused by runoff from hard surfaces and irrigation contaminated by garden fertiliser on adjoining properties which exacerbate weed growth, particularly along drainage lines, encourage pathogens such as *Phytophthora cinnamomi* (root rot) and permanently change soil conditions.

Several major stormwater pipes drain directly into bushland areas and form deep channels from the effects of erosion and high velocity storm-flows. They also result in considerable waste matter/litter being deposited in the bushland and receiving waters.

Other threats include encroachment from adjoining residences, periodic illegal clearing of bushland and tree vandalism, often motivated by a desire to enhance water views from private property.

Photo Left:
Badangi Reserve, Wollstonecraft: Sewerage overflow from a pop-top into creek below.

Image by EConPlan

Field work strategies to minimise the effects of permanent changes in ecological factors tend to require improvement works combined with rehabilitation of native bushland. In some situations, improvement works such as sandstone capping or armouring of eroded drainage lines followed by native revegetation can reverse some of the permanent factors that continue to degrade the natural environment. Improvement works are necessary and beneficial to the protection of original bushland remnants, however, they are costly and the end product will never replace the loss of the original vegetation communities. Where achievable, regeneration activities to assist with stabilisation of natural bushland ecosystems should remain the primary management strategy.

All relevant bushland rehabilitation plans encourage engagement with stakeholders that contribute to urban impacts and incorporate the following strategies to manage those impacts:

Hydrology

- Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater-tolerant natives, constructing stormwater reduction devices to reduce erosion, constructing bio-retention basins, sediment basins or wetlands to reduce levels of stormwater contaminants and nutrients from flowing into bushland and waterways.
- Investigate stormwater management measures and the possible installation of gross pollutant traps around significant pipe outlets to reduce the detrimental impacts from high velocity water, sediments and litter.

- Where creek banks are scouring, devise appropriate stabilisation techniques for bed and creek bank armouring such as gabion walls with local stone that complement the landscape.
- Identify problem-causing stormwater pipes exiting private property into bushland and address with the assistance of Council's Development Compliance Team.

Weed and Pathogen Incursions

- As residential properties adjoining bushland can contribute to weed spread, monitor and address invasive garden plants in accordance with the *Biosecurity Act 2015* and promote Council's Native Havens Program.
- Where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a long-term solution to stop herbaceous weeds / grass species spreading into reserves.
- Manage effects of garden escape weeds and residential stormwater along reserve boundaries through the installation of sediment fences; edging and mulch.
- Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Other Threats

- Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove gross pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
- Irresponsible pet ownership results in bushland degradation. Council seeks to address this impact though a combination of community education/engagement and compliance through the implementation of Wildlife Protection Area provisions. Council conducts strategic cat trapping within WPA's following extensive camera monitoring programs. Trapping may also be conducted in non-WPA declared bushland where predation of wildlife by cats is documented.
- Other damaging activities in bushland include incompatible commercial, sporting or recreational activities (e.g. orienteering; rock climbing; geo-caching; mountain biking; camping etc). Whilst these activities may be appropriate in some locations, they are not compatible or sustainable within North Sydney's small, fragmented and highly impacted bushland reserves.

Photo Left:
Dumping of garden refuse in bushland: Cremorne Reserve, Cremorne 2017.

Image by EConPlan

1.2.12Visitation Management

Population growth is increasing demand on North Sydney Council reserves as places for respite and recreation which can put pressure on bushland, causing vegetation damage and erosion, particularly along the track network as well as disturbance to habitat.

Other forms of disturbance by users include rubbish dumping, drug taking, vandalism and even camping as the homeless seek shelter. Off-leash dogs disturb fauna and remote-controlled drones have been found to disturb arboreal fauna. Illegal storage of dinghies in many of Council's foreshore reserves damages foreshore vegetation and causes erosion. Typically, illegal walking tracks are also created to access these areas which results in the trampling of bushland and further erosion. Bushland areas adjoining playgrounds and grassed picnic areas are often targeted by children to make cubby houses and informal tracks which damage vegetation. Special events such as New Year's Eve can also be very damaging to bushland along foreshore reserves as vegetation is trampled by high numbers of visitors wishing to see the fireworks displays from a limited number of vantage points.

With the increase in demand, more resources are required to maintain and improve recreation infrastructure such as walking tracks, seating, lookouts, signage and interpretation to cater for larger numbers, different users and the mobility impaired.

Activities in bushland reserves need to be managed to ensure that the reserves can be maintained in a healthy condition and their values protected. Some non-passive recreation activities including orienteering, rock climbing, geo-caching, camping and mountain biking cause substantial damage to native vegetation and soil stability and are therefore prohibited in North Sydney's bushland reserves. Dinghy and kayak storage is also prohibited within bushland reserves except where permissible in Council's Small Watercraft Storage Strategy 2018.

Interpretive signage along walking tracks is the main tool used to assist users with way-finding and can also be utilised to bring additional awareness of reserve values and threats. Some panels may describe special ecological features or functions, some may highlight a degraded area and the cause of degradation, some signs placed strategically may describe rehabilitation work currently being implemented or prohibited or damaging activities in the reserves aimed at changing behaviour. As technology advances, communication with recreation/education users and monitoring will evolve into more electronic modes.

All relevant bushland rehabilitation plans incorporate some of the following strategies to manage impacts from recreation uses:

- Close informal tracks to prevent damage to habitat, minimise erosion/sedimentation; impede feral animal movement through bushland and reduce weed spread.
- Implement a track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, widening and degrading track conditions.
- Use sedimentation fencing, rope fencing, wooden logs, coir logs, fallen timber, brush matting, sandstone blocks, beams and signage as a management tool for erosion and to define edges between the bushland, tracks and lawn interfaces.
- Restrict access to environmentally or culturally sensitive areas e.g. Aboriginal heritage sites.
- Assess the need for additional directional and / or interpretive signage.
- Regularly inspect fishing and illegal kayak storage locations and take appropriate action to discourage damage to reserve values.

- When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council.
- Do not permit any events to occur within the bushland unless impacts are determined to be minimal and manageable.
- Report all illegal drug and alcohol use locations and associated damage to Council's Ranger team. All affected areas are to be listed on Council's register for such sites and collaboration is required with Local Area Command (Police) to implement management strategies.
- Monitor and report unauthorised activities (e.g. unleashed dogs; orienteering events; rock climbing; geocaching; mountain biking; camping etc) and address impacts. This may include community education programs, penalty notices or camera observation.

1.2.13 Community Engagement

Community engagement is fundamental when managing bushland reserves as the community are the ultimate guardians and users of these assets.

Community engagement is important to:

- Encourage participation in programs such as Bushcare and citizen science where the community provide a valuable resource in bushland rehabilitation or scientific data gathering;
- Harness the success of habitat enhancement programs that extend outside of the reserves onto privately owned land;
- Increase public awareness about impacts that they may be contributing to and ways to minimise those impacts;
- Foster community stewardship, interaction and appreciation through education programs; and
- Increase public understanding of Council's aims, goals and actions regarding bushland management.

All relevant bushland rehabilitation plans incorporate the following strategies to foster community engagement:

- Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
- Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
- Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan. Plan replanting projects to coincide with National Tree Day.
- Promote appropriate management of domestic pets particularly in areas adjoining declared Wildlife Protection Areas.
- Regularly assess the need for additional directional and / or interpretive signage in reserves.

Section 2 – Bushland Rehabilitation Plans

2.1 Port Jackson Catchment

2.1.1 Badangi Reserve (incl. Walumetta Park, Sugar Works Reserve and Harry Howard Reserve) Bushland Rehabilitation Plan

2.1.2 Balls Head Reserve (incl. Carradah Park foreshore, Waverton Park and the Coal Loader Parklands foreshore) Bushland Rehabilitation Plan

2.1.3 Berry Island Reserve Bushland Rehabilitation Plan

2.1.4 Cremorne Reserve (Woolwarra-jeung) Bushland Rehabilitation Plan

2.1.5 Forsyth Park Bushland Rehabilitation Plan

2.1.6 Smoothey Park and Gore Cove Reserve Bushland Rehabilitation Plan

2.2 Middle Harbour Catchment

2.2.1 Brightmore Reserve Bushland Rehabilitation Plan

2.2.2 Mortlock Reserve and Judith Ambler Reserve Bushland Rehabilitation Plan

2.2.3 Primrose Park (incl. Folly Point) Bushland Rehabilitation Plan

2.2.4 Tunks Park (incl. Hamilton Reserve) Bushland Rehabilitation Plan

2.2.5 Wonga Reserve (incl. Tobruk Ave Lookout) Bushland Rehabilitation Plan

2.1.1 Badangi Reserve (incl. Walumetta Park, Sugar Works Reserve and Harry Howard Reserve) Bushland Rehabilitation Plan

Description

Size: Badangi Reserve 7.1 Ha; Walumetta Park 0.47 Ha; Sugar Works Reserve 0.09 Ha, Harry Howard Reserve 0.35 Ha.

Access: Badangi Reserve is accessed via Shirley Road; Tryon Road and Bridge End, Wollstonecraft. Walumetta Park is accessed via Gas Works Road and Walumetta Road, Wollstonecraft. Sugar Works Reserve is accessed via stairs from Horace Street and Ross Street, Waverton. Harry Howard is accessed via Meadow Lane and Newlands Lane, Wollstonecraft.

Ownership: Badangi Reserve is Crown Land under the management of North Sydney Council. Walumetta Park, Sugar Works Reserve and Harry Howard Reserve are owned by North Sydney Council.

Catchment: Port Jackson

Configuration / Connectivity: Badangi Reserve is broadly boot shaped where the widest section is located to the north and to the south, protruding into Balls Head Bay. It is bounded by the north shore railway line and medium to high density residential development to the north. A high density residential development on the old gas works site (Wondakiah) includes a private recreation area of tennis courts, grassed and planted areas that adjoin the eastern boundary. Oyster Cove, Balls Head Bay and Berry Island form the southern boundary and Shirley Road and Tryon Rd form the western boundary. To the west, Badangi Reserve forms part of a significant vegetated corridor with Berry Island Reserve, Gore Cove Reserve, and Smoothey Park in Wollstonecraft that connects with Greendale Park and Holloway Park in Greenwich. To the east it connects with native plantings on the Wondakiah estate. To the north east lies Walumetta Park which is narrow, abuts the railway line and is divided in two by Walumetta Drive. The Park is largely disconnected from Badangi Reserve due to residential development and roads. Although the railway line creates an obstacle to continuous connectivity, more bushland and parkland is located to the north east beyond the railway line in Harry Howard Reserve. Sugar Works Reserve comprises a very narrow pedestrian corridor of stairs off Horace Street and a walkway along Oyster Cove adjoining recreation, residential and military land uses.

Hydrology: All surface water drains to Balls Head Bay either directly or via a creekline that flows from the most north westerly point of Badangi Reserve. The lower sections of the creek have been channelled underground before discharge into Balls Head Bay. The creek carries urban runoff, sewage overflows and pollutants from the upper catchment. Stormwater dissipater drains have been created in some areas to control urban runoff entering bushland. Hydrology has been altered in Walumetta Park due to the railway line upslope.

Geology: Hawkesbury Sandstone of medium to coarse grained quartz sandstone with minor shale and laminate lenses and sandstone outcrops.

Soil landscape: Hawkesbury Sandstone Landscape consisting of shallow, poor sandy soils, highly erosive with low soil fertility. Localised Yellow and Red Podzolic Soils are associated with shale lenses. Siliceous Sands and secondary Yellow Earths are along the creekline. Some areas have been significantly disturbed, destroying the original soil profile including sections of the creekline, the ridgetop, areas below roads and the railway line due to fill from past construction and dumping and from past industrial activity.

Slope: Moderate to steep slopes.

Facilities / Infrastructure: The Badangi Reserve walking track circulates from Shirley Rd where it can link to the Gore Cove Track or the Berry Island Gadyan Track. Within Badangi Reserve the track is an easy grade 30-minute walk with interpretative signage. The exit point is via box stairs onto Bridge End to the north or at the south-eastern edge of the reserve along Oyster Cove foreshore towards Balls Head. Sydney Water infrastructure is located within Badangi Reserve along with a series of pop tops. The reserve includes culverts and small bridges along the track. The Horace Street stairs / walkway provide a strategic pedestrian link from Waverton to Wollstonecraft reserves and the foreshore.

Plant Community:

Badangi Reserve

- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species found along the foreshore.
- Forest Redgum Foreshore Forest – Open-forest dominated by Forest Red Gum (*Eucalyptus tereticornis*). It is a rare and unusual type of Turpentine – Ironbark Forest listed as endangered under the NSW and Commonwealth legislation. In North Sydney it only occurs on one site at Badangi Reserve on a small peninsula in Balls Head Bay.
- Disclimax Sandstone Scrub – an altered community of open to closed scrub, or a forest of mixed and variable composition due to disturbance and an absence of fire.
- Blackbutt Gully Forest – an open or tall open forest with Blackbutt (*Eucalypt pilularis)* as the dominant tree species.
- Sandstone Gallery Rainforest - Closed-forest dominated by Lilly Pilly (*Acmena smithii)*, Coachwood (*Ceratopetalum apetalum)* and Sweet Pittosporum (*Pittosporum undulatum)* on steep, sheltered slopes besides rocky creeklines on Hawkesbury Sandstone.
- Refer to Map 1 for the plant communities; Table 1 for common flora species and Table 2 for plant species of special conservation concern in Badangi Reserve.

Walumetta Park

- Native plantings and remnant trees.

Sugar Works Reserve

- Native plantings mixed with non-endemic species.

Harry Howard Reserve

- Remnant trees, native plantings mixed with non-endemic and exotic canopy plantings and lawn areas.

Wildlife Habitat:

- Badangi Reserve provides a diverse range of habitats including open and closed forest and scrub, a creek,

rocky outcrops, beach, mudflats, rocky foreshore and dense weed.
- The reserve forms a key component of the Waverton-to-Wollstonecraft habitat corridor. This green corridor links bushland in Gore Cove Reserve/Smoothey Park and Berry Island (Wollstonecraft) through small pockets of remnant/planted bushland in Walumetta Park and Sugar Works Reserve (Waverton) to the single largest area of remnant bushland in North Sydney – Balls Head Reserve (Waverton).
- The reserve is within range for many wildlife species that move between reserves such as the Common Brushtail (*Trichosurus vulpecula*) and Ringtail Possums (*Pseudocheirus peregrinus*), bats, woodland and water birds.
- Since the implementation of regionally coordinated fox baiting across northern Sydney in 2000, wildlife such as Brush Turkeys (*Alectura lathami*) have naturally re-colonised. Remnant small range species include skinks, lizards, geckoes, snakes and frogs.
- A wide range of birds have been recorded including the White-bellied Sea-Eagle (*Haliaeetus leucogaster)* which has been observed nesting in a canopy tree within Badangi Reserve.
- A dense weed thicket below Bridge End residential boundary provides important habitat for small birds such as robins, wrens, and satin bower-birds.
- Native Water Rats (*Hydromys chrysogaster*) have been recorded in Badangi Reserve, one of only two locations in North Sydney.
- The reserve lacks nesting hollows and roosting sites for birds and arboreal mammals due to the lack of mature native trees. Such creatures play an important role in the ecology of the vegetation communities, assisting in pollination, seed dispersal and germination.
- Refer to Table 2 for the fauna species of special conservation concern found in Badangi Reserve.

Condition and Resilience:
- Most areas of bushland are in good or fair condition. Residential or railway interface areas are still in the process of being rehabilitated following significant disturbance and have low resilience and condition. The size of the Badangi Reserve remnant, its diversity of vegetation communities and its connectivity to other bushland remnants gives it higher long-term resilience and viability.
- Council and the community have worked to transform the bushland over the last 20 years. Native plant species and vegetation community structure are successfully re-establishing through ongoing application of bush regeneration and ecological burning. Core areas have been expanded, native plantings have stabilised reserve edges whilst canopy trees and upper canopy has continued to slowly develop. For instance, a heathy area is transitioning to woodland in the north east of Badangi Reserve following an ecological burn.
- The narrow configuration of this bushland makes it vulnerable to weed invasion from adjoining residential development, the Creek, the railway line (for Walumetta Park) and the harmful effects of stormwater runoff.
- Disturbance from dumping of waste and building materials, land clearing and major infrastructure and industrial works (e.g. railway, gas works, stormwater and sewerage infrastructure) has changed soil structure, stability and composition in some areas, destroying or burying the original seed bank, which limits unassisted native plant regeneration.
- Some exposed sandstone outcrops demonstrate areas with high resilience and more intact soil structure further down slope.
- Native and exotic mesic and vine species require targeted and regular maintenance to manage colonisation / domination in areas of open forest and where elevated soil moisture and nutrient conditions have excluded fire for long periods.
- Contaminated water entering the creek negatively impacts stream ecology and biodiversity and high water velocity erodes the banks in Badangi Reserve.
- Log borders and fences have been installed along Tryon Road to prevent cars from parking along the bushland edge, reduce weed infiltration and inhibit foot access / trampling.
- Sections of Walumetta Park, Sugar Works Reserve and Harry Howard Reserve have been extensively replanted and are establishing well. Sugar Works Reserve and Harry Howard Reserve comprises trees that are not endemic but these areas do offer corridor potential as biodiversity increases over time.
- Bush regeneration activities are carried out by Council's Bushland Management Team, bush regeneration contractors (since 1997), the volunteer Badangi Reserve Bushcare Group formed in 1993 and (at times) community members involved in the Adopt-a-Plot program.
- Refer to Map 2 Condition of Bushland and Resilience (2018).

Zone / Classification:
- The bushland in Badangi Reserve and Walumetta Park is zoned E2 Environmental Conservation under *North Sydney LEP 2013.* It is classified public bushland in *SEPP No. 19 Bushland in Urban Areas (*and in the draft SEPP (*Environment)* that will supersede *SEPP 19).* Sugar Works Reserve and Harry Howard Reserve are partly zoned E2 and RE1 Public Recreation.
- The bushland is identified as a Coastal Environment Area and Coastal Use Area under *SEPP (Coastal Management*).

Statement of significance:
Historic Values
- The bushland is a legacy of past land management by the traditional Aboriginal custodians, the Cammeraygal, who originally occupied the area. Aboriginals used the creek as a fresh water source for many thousands of years. Shell middens are represented along the foreshore. Other signs of Aboriginal presence may exist but remain undiscovered. Places, objects and features of significance to Aboriginal people are protected under the NSW *National Parks and Wildlife Act 1974*.
- The reserve formed part of the original Berry / Wollstonecraft Estate, a free land grant made in 1821.
- Unlisted historic relics can be found within the reserve dating to the 1850's. These include old sandstone walls defining a road edge, pebbled paths, concrete slab remains and relics from the sugar refinery (circa 1850's), the Kerosene works (circa 1860's) and the old Gas Works from 1917-1983 that operated on the Oyster Cove foreshore.
- Badangi Reserve is listed as a heritage landscape on *North Sydney LEP 2013* Schedule 5 along with Gore Cove Reserve. Together they are listed as the "Wollstonecraft Foreshore Reserves".

Natural Values

- Badangi Reserve plays a significant role in maintaining biodiversity in the region and assists in conservation of species and habitat function.
- The reserve connects with other reserves along the foreshore and catchment to provide a significant wildlife corridor in an urbanised setting. The interlinked reserves include Smoothey Park, Gore Cove, Berry Island and Badangi Reserve that form the 'Wollstonecraft reserves', identified as a biodiversity hotspot as they contain 10 of the 12 vegetation communities known to occur in the local government area (Smith & Smith 2010).
- Forest Red-Gum Foreshore Forest community in Badangi Reserve is the "best naturally occurring population of the species (*Eucalyptus tereticornis*) on a headland reserve around Sydney Harbour" (D. Benson 1992). This community may represent a form of Sydney Turpentine-Ironbark Forest, which is listed as a critically endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* and as an endangered ecological community under the NSW *Biodiversity Conservation Act 2016* (*BC Act*).
- Angophora Foreshore Forest, Disclimax Sandstone Scrub and Blackbutt Gully Forest are threatened at a local level and Sandstone Gallery Rainforest is threatened at a regional level due to limited extent.
- Locally rare species include *Eucalyptus teretecornis*, *Pultenaea flexis, Cryptostylis erecta, Leionema dentatum, Epacris longifolia, Solanun vescum* and *Acianthus fornicatus*.
- The endangered *Acacia terminalis* subspecies *terminalis* listed under the Commonwealth *EPBC Act* and the NSW *BC Act* was recorded in Badangi Reserve in 2010 during the North Sydney Natural Area Survey by Smith and Smith. In 2017, two samples from the reserve, analysed by the NSW Herbarium, were confirmed to be the subspecies. Its occurrence could be more widespread in the reserve as it is known to occur in Angophora Foreshore Forest, Blackbutt Gully Forest, Disclimax Sandstone Scrub and Forest Redgum Foreshore Forest.
- Badangi Reserve is noted for the diverse fungi species that emerge after rain. It has the largest variety recorded in any North Sydney bushland reserve.
- Badangi Reserve has been declared a Wildlife Protection Area under the NSW *Companion Animals Act* 1998. The reserve provides habitat for a range of wildlife including threatened and declining fauna species. The threatened species below have either been recorded in the reserve or adjoining reserves and include the Powerful owl (*Ninox strenua*) (vulnerable under the *BC Act*); the Grey-headed flying-fox (*Pteropus poliocephalus*) (vulnerable under the *BC Act* and *EPBC Act)*; the Black Bittern (*Ixobrychus flavicollis*) (vulnerable under the *BC Act*), and White-bellied Sea-Eagle (*Haliaeetus leucogaster)* (vulnerable under the *BC Act*)
- Recorded bat species listed as vulnerable under the *BC Act* were the Eastern bentwing bat (*Miniopterus schreibersii oceanensis*) and the Southern myotis (*Myotis macropus*) of which there is a recorded concentration of activity in Oyster Cove due to nearby roost sites. The Eastern freetail bat (*Mormopterus norfolkensis*) listed as vulnerable under the *BC Act* has been recorded in nearby Smoothey Park and could occur within the reserve.

Recreation / Education Values

- Badangi Reserve, Walumetta Park, Sugar Works Reserve and Harry Howard Reserve provide a valuable educational, nature appreciation and bushwalking resource that is highly accessible due to the track network and proximity to Wollstonecraft and Waverton Stations. These bushland areas line the foreshore of Sydney Harbour which is an iconic natural and public asset of national significance.

Fire history:

- Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity in Badangi Reserve.
- Past burns have resulted in the successful germination of native endemic flora species, including the threatened species *Acacia terminalis* subsp. *terminalis.*
- Fire management access zones exist along all boundaries with private property.
- An arson-lit fire occurred in Badangi Reserve in 2010.
- Planned hazard reduction / ecological broad area burns are conducted from time to time. Refer to Map 3 Fire History and Future Managed Burns.

Threats:

- The limited size and narrowness of bushland remnants amplify vulnerability to fragmentation and edge/external effects from the surrounding urban environment.
- Impacts from adjoining residential properties that facilitate weeds include garden escapes and dumping of garden clippings into the bushland. A recurring problem of broken drainage pipes and terracotta sewerage pipes servicing adjoining residential development also increases moisture and nutrification. Runoff from hard surfaces and irrigation increase nutrient loads, moisture and erosion on the slopes below. Garden fertiliser also leaches into the bush increasing nutrients. Other threats include encroachment from adjoining residences due to ambiguous property boundaries, periodic illegal clearing and tree vandalism.
- Widespread fill over many decades, as well as past and more recent dumping, significantly compromises soil stability and structure, seedbank viability and bushland resilience. Bridge End, Walumetta Park and Harry Howard Reserve are particularly affected. The waste comprises a range of material including demolition, domestic and industrial waste, foreign soil and excavated material from adjoining sites.
- Stormwater pipes drain directly into the creek in Badangi Reserve and form deep channels and destabilise creek banks from the effects of erosion and high velocity outputs during high rainfall. They also result in considerable waste matter being deposited in the bushland.
- Degraded and deteriorating stream ecology due to pollutants in the catchment impact on biodiversity. The creek is a source of weed seed and increased nutrient pollution from the upper catchment.
- A Sydney Water sewerage main extends the length of Badangi Reserve. Periodically, pop-tops surcharge raw sewage that severely contaminates the creekline and pollutes the surrounding bushland with high nutrient loads and moisture, exacerbating weeds. The leaks also create unpleasant odours for visitors.
- Informal tracks in the critically endangered Forest Redgum Foreshore Forest are significantly damaging the ecological community.
- Native and exotic vines, mesic species and weeds are a serious threat to the stability of resilient cores and long-term viability of biodiversity. *Cissus antarctica* is a particular threat to the tree canopy in gully areas.

- Refer to Table 3 for plant species affecting biodiversity and stability of bushland assets.
- The adjoining railway corridor running between Walumetta Park and Harry Howard Reserve are a constant source of weed infiltration.
- Areas where bushland is bordered by lawn grass e.g. along Tryon Road verge are impacted by exotic grass encroachment. Cars have parked here in the past which has compacted the soil (logs now inhibit parking along the verge). No curb and gutter exists along this boundary allowing surface runoff from Tryon Road into the bushland.
- *Phytophthora cinnamomi* (root rot*)* affects the health of the bushland and is widespread in North Sydney.
- Hybridization is a significant threat to *Acacia terminalis* subsp. *terminalis* in these reserves.
- At times, foxes (*Vulpes vulpes*), domestic cats (*Felis cattus*) and off-leash dogs (*Canis lupus familiaris)* are observed in the reserve and along the foreshore. These animals predate, scare and disturb wildlife, pollute with their faeces and spread weed seed. Shorebirds are particularly impacted by dogs off lead.
- Some species of introduced, endemic or non-endemic birds are very territorial and compete for habitat, limiting species diversity.
- Native bats and birds can introduce new flora species and weeds that have the potential to change vegetation structure over time.
- Inappropriate weed removal can reduce fauna habitat with greater impacts on short range species and small birds.
- Artificial night lighting from adjoining development can also detrimentally affect nocturnal fauna.
- Increased drone usage is causing disturbance to fauna that occur in the canopy.
- Climate change is an ongoing threat. Anticipated impacts include increased threat of bushfire and extreme weather events. Raised sea levels are predicted to inundate shoreline vegetation, eroding the foreshore and destroying Aboriginal middens. Intensified storm events will result in higher volumes of of stormwater runoff which is likely to result in erosion to drainage lines and creeks. Increased temperatures are likely to affect biodiversity and ecosystems, favouring some species over others and changing the structure and function of the bushland. The rate of climate change may be faster than the rate of natural adaptation. Increased temperatures will harm sensitive fauna such as bats, impacting their important ecosystem function.
- Non-passive recreational activities (incl. orienteering; rock climbing; geo-caching, camping and mountain biking) cause substantial damage to native vegetation and soil stability. These activities are prohibited in North Sydney's bushland reserves.

Bushland Management Goals

a. Maintain and enhance biodiversity and habitat for long term ecosystem resilience and function
b. Conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve
c. Strategically restore bushland (prioritise areas of highest resilience)
d. Enhance habitat connectivity
e. Preserve genetic integrity of the vegetation community
f. Manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality
g. Conserve the natural landscape and heritage values
h. Provide for ecologically sustainable recreation needs of the community
i. Implement the strategic fire hazard reduction program and manage fuel loads to protect life, property and endemic biodiversity

Rehabilitation Principles and Procedures:

General

1. Bush regeneration is a long-term process of staged weed removal to ensure endemic biodiversity, native plant establishment and continued habitat for local wildlife. It relies on site assessments that identify values and how best to restore and enhance ecosystem function and structure. Routine site monitoring, evaluation of field strategies and periodic native flora and fauna surveys inform management priorities over time. Works normally proceed from bush in good condition with high resilience. Degraded areas are a lower priority but the weeds always require containment.

Planning, Evaluation and Review

2. The Bushland Management Team should regularly evaluate bushland rehabilitation plans and the success of field strategies to inform management priorities early.
3. Establish photo points to monitor projects.
4. In the bushland rehabilitation planning process, consider the potential impact of future infrastructure earthworks, or access requirements on bushland, habitats, green corridors or active rehabilitation sites.
5. The Bushland Management Team must approve all contractor project proposals before implementation.
6. All Work, Health and Safety requirements must be adhered to by Council staff, volunteers and contractors before, during and after site works.

Native Flora

7. Record uncommon flora species to determine risk of extinction in the reserve. (Use North Sydney flora survey record template).
8. Prioritise protection / rehabilitation in areas of highest resilience.
9. Buffer areas should protect biodiversity from disturbances caused by fragmentation and edge effects: (a) monitor to identify gaps in buffer vegetation and senescing / restored vegetation and organise replacement planting; (b) where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a medium/long term solution to stop herbaceous weeds and grasses from spreading into bushland; (c) control vines, noxious weeds and other plant species affecting stability of adjoining bushland.
10. When natural regeneration is ineffective, locally source all plant material for supplementary planting to maintain genetic integrity of native vegetation in accordance with Flora Bank Guidelines https://www.greeningaustralia.org.au/florabank. Only plant when natural regeneration is ineffective to boost biodiversity, with the aim to achieve 80% survival rates. Plant in stages, basing species selection on the target vegetation community/structure, successional stage, habitat requirements and physical constraints. This process involves collaboration from Council's nursery supervisor, bush regeneration team, Bushcare volunteers and bush regeneration contractors.
11. In areas lacking diversity and structure; direct seed, transplant and use appropriate tube stock to enhance existing plant communities. When planning a replanting site: (a) prepare a suitable plant list based on rehabilitation objectives and prevailing site condition; (b) allow time for seed collection and propagation (9-12 months ahead of planting); (c) identify where seed harvesting/cuttings will be gathered; (d) prepare area (e.g. reduce density of dominant species on ground layer or mesic species in shrub layer); (e) schedule planting for early Autumn during or after soaking rain.
12. Collect seed of suitable locally rare species from nearby bushland areas, propagate and plant in appropriate areas of the reserve to enhance biodiversity and ensure the long-term viability. For species that are difficult to propagate, explore other methods such as seed scarification / raking treatment / seedbank translocation etc.
13. Implement a canopy replacement program in areas where remnant canopy is absent, senescing or failing to regenerate or where non-endemic trees have been removed.
14. Do not encourage large canopy species on unstable areas or under electricity easements where they cannot be supported and may cause future hazards.
15. Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team: (a) pile burn where appropriate; (b) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (c) reduce seedbank of dominant natives - control seeding cycle; (d) lightly disturb mulch / organic matter to stimulate regeneration; (e) increase seed bank of uncommon/ rare species with brush matting techniques (collect from donor sites where seed removal will not affect biodiversity); (f) propagate senescing plant species at risk of extinction in the reserve (i.e. due to an inadequate fire regime) and plant tubestock in suitable locations.
16. When planting along bushland edges, select species in consideration of their potential to compliment views from residential or public viewing areas and design to enhance habitat / connectivity (e.g. for small birds).
17. Conserve and protect naturally regenerating / colonising canopy species providing they are in sustainable locations.

Weeds and Pathogens

18. Implement the *Biosecurity Act 2015* consistently and effectively, in accordance with bushland management objectives and processes.
19. Residential properties adjoining bushland can contribute to weed spread. Monitor and address invasive garden plants in accordance with the *Biosecurity Act 2015* and promote Council's Native Havens / Habitat Stepping Stones Programs.

20. Ongoing weed management should: (a) prioritise good bush areas; (b) target species threatening stability e.g. vines, woody or canopy weeds; (c) interrupt seed cycle of target species, especially annual and grass weeds; (d) prioritise areas where plant diversity is most affected by mesic shift and vines. (In consideration of fauna habitat needs, schedule works from Autumn through Winter before bird breeding season.)
21. Monitor sites to identify, report and manage early stages of weed outbreaks or shifts in plant species assemblages likely to become detrimental to biodiversity. Manage according to the issues they raise. Report other threats to ecosystem function.
22. All compost weed material is removed off site.
23. Retain weeds on highly erodible or dangerous slopes and use methods of weed suppression that will not create potential for soil erosion. Incorporate abseiling activities on cliff faces to remove weeds that are a constant weed seed source.
24. Strategically remove non-endemic or exotic trees that interfere with ecosystem function or structure. Assess for habitat potential before they are de-limbed.
25. Consider all potential impacts of herbicide and proximity to water when determining suitability for weed control.
26. Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Native Fauna and Habitat

27. Record wildlife sightings and observations in Council's Wildlife Watch database. Share this information with NSW BioNet and the Commonwealth's ALA.
28. Identify and protect nesting, roosting and breeding sites of threatened, vulnerable or locally significant fauna.
29. Minimise disturbance to wildlife, enhance habitat where needed and improve the condition/connectivity of wildlife corridors between adjoining reserves.
30. Protect, maintain and restore quality fauna foraging habitat using a diverse mix of endemic native species. Retain habitat features such as fallen and standing dead wood, rock piles, hollow-bearing trees, natural debris, dead standing trees, forest litter, logs and branches.
31. Short-term strategies to maintain fauna habitat provided by mesic and weed species may require retention yet containment of dense areas of weed, vines and mesic species. In the longer-term, aim to establish a self-maintaining fabricated vegetation community in these areas composed of native species adapted to changed site conditions (abiotic factors) that enhance biodiversity and habitat availability.
32. Before any unfavourable trees are de-limbed, assess for habitat potential e.g. tree hollows.
33. Where suitable, install fauna nesting boxes and create hollows in suitable dead trees to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed.
34. Investigate financial opportunities to invest in habitat enhancing research and developing methodologies.

Threatened species

35. Identify threatened or endangered, rare or locally rare species of flora and fauna. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs.
36. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened species.

Ecological Burns

37. Hazard reduction and ecological burns are based on a strategic burn program consistent with the Mosman North Sydney Willoughby Bushfire Risk Management Plan. Ecological burn regimes are to be in a mosaic pattern to improve bushland function and biodiversity. Areas of high bushfire risk or core ecological resilience are usually prioritised in the annual burn program.
38. Maintain land management zones where bush adjoins residences and implement site stabilisation measures.
39. Over the next 10 years, prioritise prescribed burns at sites at risk of diminishing flora diversity.
40. For pre-fire preparation: (a) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (b) reduce seedbank of dominant natives to control seeding cycle; (c) increase seed bank of uncommon/ rare species with brush matting (collect from donor sites where seed removal will not affect biodiversity).
41. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds.
42. Implement post-fire monitoring and bush rehabilitation strategies. Monitor regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time period post-burn.

Pests and Illegal Activity

43. Monitor and control feral or aggressive/territorial fauna activity, cats, unleashed dogs and illegal activity with appropriate measures e.g. trapping, community education programs, penalty notices or camera observation. If applicable, manage reserves in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 and relevant North Sydney Council policies.
44. Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
45. Monitor the impacts of drones and implement management measures if required.
46. Address instances of unauthorised activities in bushland incl. orienteering; rock climbing; geocaching; mountain biking; camping etc.

Tracks, Water and Erosion

47. Close informal tracks to prevent damage to habitat, impede feral animals and reduce weed spread.
48. Implement track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, track widening and degrading track conditions.
49. Assess the need for additional directional and / or interpretive signage.
50. Stabilise steep slopes, ephemeral flow lines and highly erosive areas using local native species, particularly ground covers, to re-establish appropriate vegetation community structure where natural regeneration is poor or absent. Install sedimentation fences, terracing, coir logs, matting or other appropriate measures where

needed to stabilise washout areas and improve access and safety.

51. Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater tolerant natives.

Aboriginal and non-Aboriginal Heritage

52. All identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1974* and *Heritage Act 1977*.
53. Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual.
54. As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance.
55. Bushland management staff consult with the Aboriginal Heritage Office or Council's heritage officer prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey.
56. Discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol.

Community

57. Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
58. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
59. Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan.
60. When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council

Reserve **Specific Rehabilitation Actions**

Priorities will be given to programs with long term benefit to the reserve or where natural assets are at greatest risk to avert irreversible deterioration or loss.

Flora and Weeds

1. Liaise with Council's Parks and Gardens Team to enhance vegetation along the Shirley Rd interface to improve wildlife corridor linkages to Berry Island and Gore Cove Reserve and to manage erosion from pedestrian traffic on the eastern Shirley Rd verge.
2. Collect locally rare plant species seed from adjoining remnants, parks and private properties.
3. Collaborate with Lane Cove Council to collect seed from rare or uncommon species in their reserves.
4. Increase flora species diversity along the creek to improve structure and function of the riparian corridor.
5. Retain some herbaceous weeds along the creekline to absorb high nutrient loads from stormwater and sewer overflows to act as a natural bio-filtration system.
6. Monitor the encroachment of *Cissus antarctica* in mid and upper canopy and control to avoid smothering and development of a monoculture. Establish containment lines in appropriate locations.
7. When undertaking planting along the residential boundary interface, select plant species in consideration of fire management.
8. Continue to liaise with Rail Corp to encourage rehabilitation of railway land.
9. Thin invasive bracken fern (*Pteridium esculentum)*, particularly in post-burn areas (e.g. below Tryon Ave) to facilitate native species germination and maximise diversity.
10. Maintain the sediment fence below the railway line in Walumetta Park to control weeds.

Fauna

11. Retain yet contain dense vines, mesic and exotic plants in the area below Bridge End for fauna habitat until suitable habitat in adjacent sections of the bushland is mature enough to ensure survival of vulnerable native species (e.g. small birds).
12. Continue to enhance wildlife corridors thrpugh adjoining reserves and investigate opportunities to promote habitat enhancement.
13. Promote responsible pet ownership in adjoining residential areas and enforce WPA requirements within Badangi Reserve (i.e. monitor for presence of cats and undertake trapping as required).
14. Conserve microbat habitat and utilise opportunities to add / augment nesting hollows
15. Continue to implement fox baiting in coordination with the Sydney North Vertebrate Pest Committee.
16. Undertake periodic monitoring for uncommon / threatened species including the Rakali (*Hydromys chrysogaster*); White-bellied Sea-eagle (*Haliaeetus leucogaster)* and microbats.

Tracks, Water and Erosion

17. Informal tracks in the critically endangered Forest Redgum Foreshore Forest are significantly damaging the ecological community and need to be closed or rationalised to reduce ongoing impacts.
18. Where creek banks are scouring, devise appropriate stabilisation techniques that complement the landscape.
19. Use slope stabilisation techniques such as mulching, sediment fencing, timber logs and sandstone capping as management tools for erosion, weed spread and to define the edge between bushland, road verge, lawn areas and the residential interface.
20. Maintain sandstone culverts below Tryon Ave ensuring they are in working order and not blocked. Repair or upgrade as required.
21. Liaise with Sydney Water to improve sewerage infrastructure and reduce pollutants entering Badangi Reserve and its creekline.
22. Assess the need for additional directional and / or interpretative signage.

Threatened Species

23. Work in collaboration with the Saving Our Species program managed by the NSW Office of Environment and Heritage and the NSW Herbarium to identify, monitor and protect *Acacia terminalis* subsp. *terminalis* in the reserves and contribute to the preparation of best practice guidelines for the species.
24. Preserve and enhance the habitat of threatened microbat species, Powerful Owl (*Ninox strenua*) and Grey-headed Flying fox (*Pteropus poliocephalus*).

Aboriginal and Historic Heritage

25. Assess the heritage significance of unrecorded items using qualified professionals. Formulate recommendations and appropriate management measures.

Illegal Activity

26. Regularly inspect fishing and illegal kayak storage locations and take appropriate action to discourage damage to Badangi Reserve and its values.
27. Dinghy and kayak storage is prohibited within the reserves except for where permissible in Council's Small Watercraft Storage Strategy.
28. Report all illegal drug and alcohol use locations and associated damage to Council's Ranger team. All affected areas are to be listed on Council's register for such sites and collaboration is required with the Police to implement management strategies.
29. Monitor and report unauthorised activities (e.g. unleashed dogs; orienteering events; rock climbing; geocaching; mountain biking; camping etc) and address impacts.

Ecological Burns

30. Refer to Map 3 Fire History and Future Managed Burns.
31. Manage ecological burns to preserve and encourage locally rare plant species.

Community

32. Plan replanting projects to coincide with National Tree Day e.g. along Horace Street stairs; the interface with Wondakiah estate and within Harry Howard Reserve.
33. Investigate the feasibility of creating a new Bushcare site near the interface with the Wondakiah estate and liaise with local residents.
34. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot program.
35. Develop a bushland neighbour information brochure to help raise awareness of edge effects and the ways local residents can improve their bushland footprint.

Capital Projects

36. Consider installing signage and barriers in areas where dinghies and kayaks are illegally stored to deter illegal activity.
37. Investigate the feasibility of creekline rehabilitation projects and prioritise according to levels of need in Badangi Reserve.
38. Implement a walking track upgrade project to reduce informal tracks; improve surface condition; minimise erosion and address safety concerns (e.g. foot bridge).
39. Enhance the Fire Management Access Zone at the rear of Walumetta Drive properties using bark blower technology and consider removal of inappropriate canopy and replacement with endemic species.

Map 1: Vegetation Communities (NAS 2010)

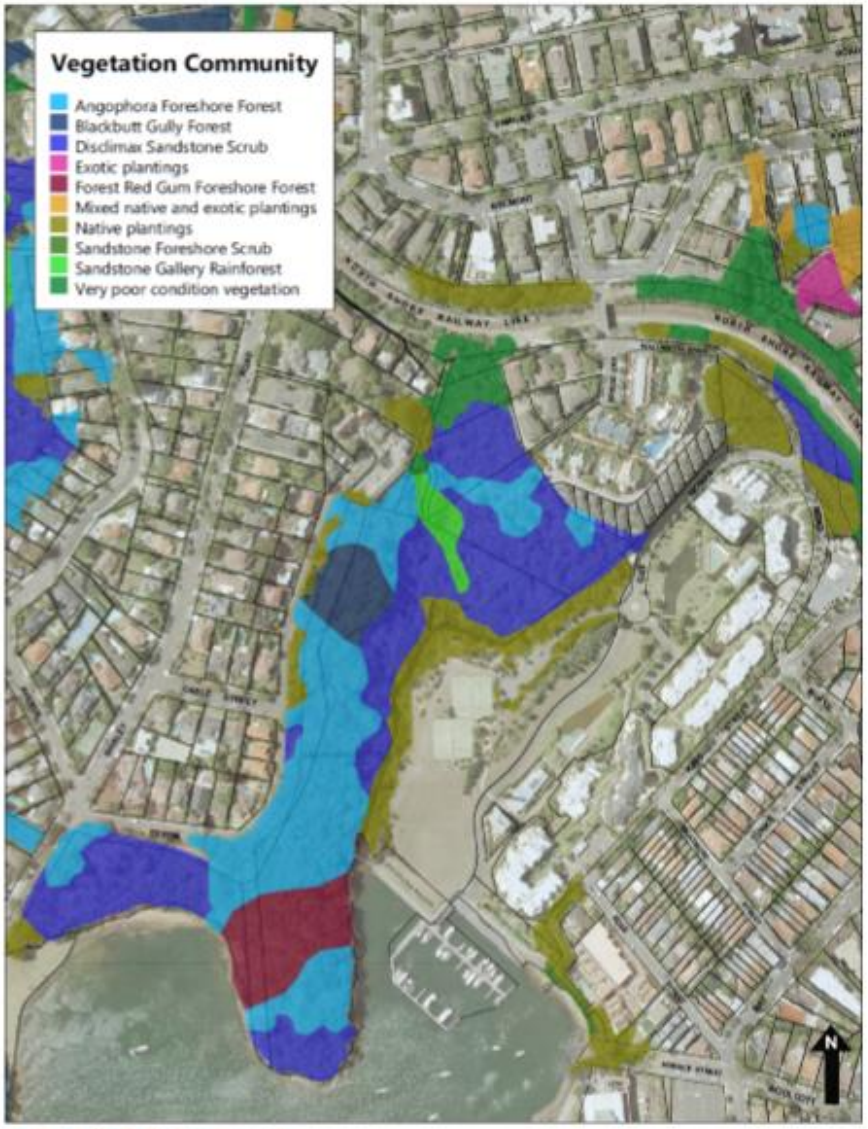


Table 1: Common species recorded in the W'craft remnants

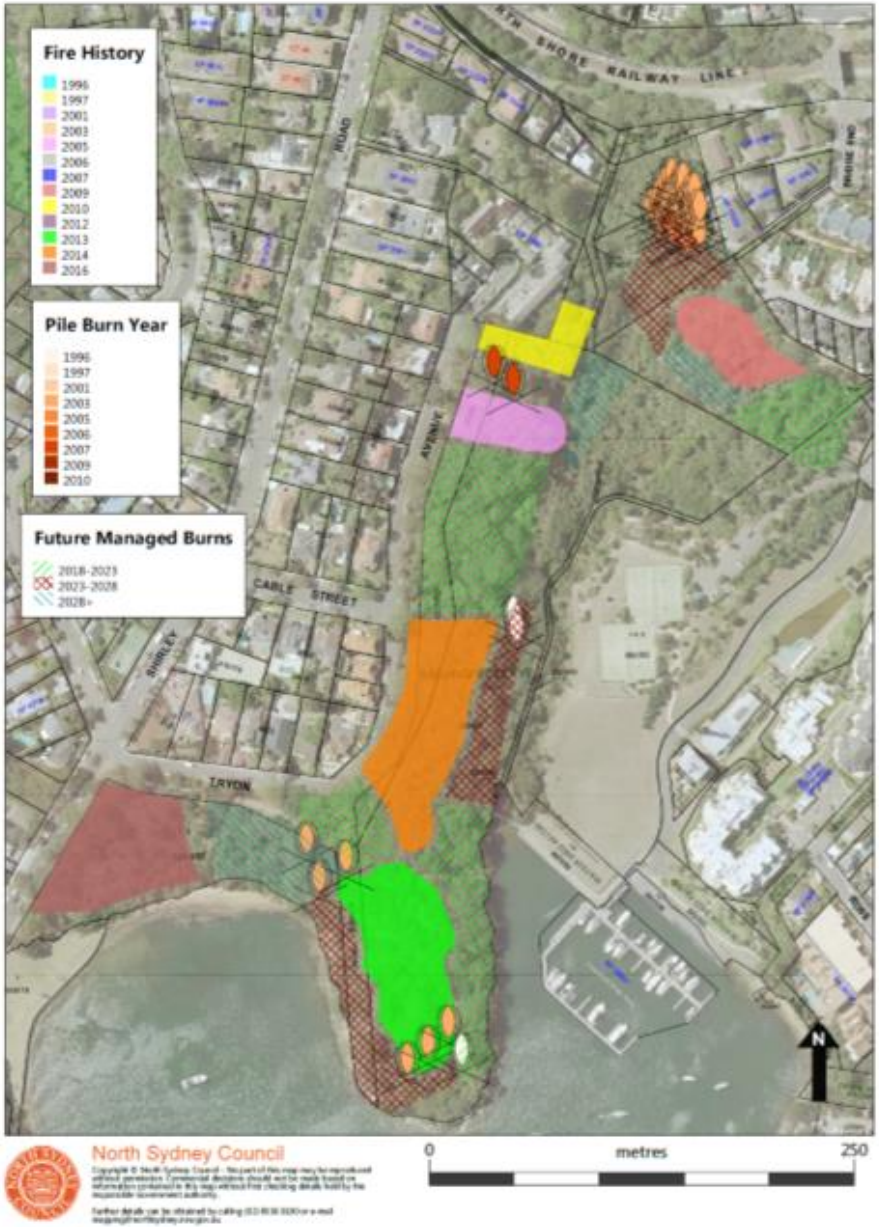
Scientific Name	Common Name	Vegetation Community
Acacia longifolia	Sydney Golden Wattle	BG; AF; RF; DS; FS
Acmena smithii	Lilly Pilly	AF; GR DS
Angophora costata	Sydney Red Gum	BG; AF; RF; DS; FS; SO
Banksia integrifolia	Coast Banksia	AF; DS; FS; SO
Calochlaena dubia	Common Ground Fern	BG; AF; GR; DS; FS
Dianella caerulea	Blue Flax Lily	BG; AF; RF; GR; DS; FS; SO
Dodonaea triquetra	Common Hop Bush	BG; AF; RF; GR; DS; FS; SO
Elaeocarpus reticulatus	Blueberry Ash	BG; AF; RF; GR; DS; FS
Entolasia stricta	Wiry Panic	BG; AF; RF; GR; DS; FS; SO
Eucalyptus pilularis	Blackbutt	BG; AF; GR; DS; SO
Eucalyptus resinifera	Red Mahogany	BG; AF; GR; DS
Eucalyptus tereticornis	Forest Red Gum	RF
Eustrephus latifolius	Wombat Berry	BG; AF; RF; GR; DS; FS; SO
Ficus rubiginosa	Port Jackson Fig	BG; AF; GR; DS; FS
Glochidion ferdinandi	Cheese Tree	BG; AF; RF; GR; DS; FS; SO
Leionema dentatum	Toothed Phebalium	BG; AF; RF; GR; DS; FS; SO
Lomandra longifolia	Spiny-headed Mat-rush	BG; AF; DS
Microlaena stipoides	Weeping Grass	BG; AF; RF; GR; DS; FS; SO
Notelaea longifolia	Large Mock-olive	BG; AF; RF; GR; DS; FS; SO
Pandorea pandorana	Wonga Wonga Vine	BG; AF; RF; GR; DS; FS; SO
Pittosporum undulatum	Pittosporum	BG; AF; RF; GR; DS; FS; SO
Poa affinis		BG; AF; RF; GR; DS; FS; SO
Pteridium esculentum	Bracken	BG; AF; RF; GR; DS; FS; SO
DS: Disclimax Sandstone Scrub	**SO: Estuarine Swamp-oak Fst**	**RF: Forest Red Gum Foreshore Fst**
AF: Angophora Foreshore Forest	**BG: Blackbutt Gully Forest**	**GR: Sandstone Gallery Rainforest**
FS: Sandstone Foreshore Scrub		

Map 2: Condition of Bushland and Resilience (2018)

Condition of Bushland and Resilience Key

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural recruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting Poor indicative resilience
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience – limited regeneration potential (1-2 species)
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed sandstone)

Map 3: Fire History & Future Managed Burns



North Sydney Council

Table 2: Species of Special Conservation Concern

COMMON NAME	SCIENTIFIC NAME	CAUSE OF DECLINE
Yellow Thornbill Brown Thornbill Eastern Spinebill Brown Goshawk Pacific Baza Yellow-tail Black Cockatoo Glossy Black Cockatoo Gould's Wattled Bat Black-faced Cuckooshrike Spangled Drongo Nankeen Kestrel Peregrin Falcon White-bellied Sea Eagle Water Rat Superb Fairly-wren Variegated Fairy-wren Common Bent-wing Bat Eastern Bent-wing Bat Eastern Free-tailed Bat Large-footed Myotis Boobook Owl Powerful Owl Australian Golden Whistler Spotted Pardolote Tree Martin Tawny Frogmouth Red-bellied Black Snake Eastern Whipbird Grey-headed Flying Fox Satin Bowerbird Roufus Fantail White-browed Scrubwren Weebill Australaisan Figbird Sacred Kingfisher Sooty Owl Silvereye	*Acanthiza nana* *Acanthiza pusilla* *Acanthorhynchus tenuirostris* *Accipiter fasciatus* *Aviceda subcristata* *Calyptorhynchus funereus* *Calyptorhynchus lathami* *Chalinolobus gouldi* *Coracina novaehollandiae* *Dicrurus bracteatus* *Falco cenchroides* *Falco peregrinus* *Haliaeetus leucogaster* *Hydromys chrysogaster* *Malurus cyaneus* *Malurus lamberti* *Miniopterus schreibersii* *Miniopterus schreibersii oceanensis* *Mormopterus ridei* *Myotis macropus* *Ninox novaeseelandiae* *Ninox strenua* *Pachycephala pectoralis* *Pardalotus punctatus* *Petrochelidon nigricans* *Podargus strigoides* *Pseudechis porphyriacus* *Psophodes olivaceus* *Pteropus poliocephalus* *Ptilonorhynchus violaceus* *Rhipidura rufifrons* *Sericornis frontalis* *Smicrornis brevirostris* *Sphecotheres vieillioti* *Todiramphus sanctus* *Tyto tenebricosa* *Zosterops lateralis*	- Reduction of Tall Eucalypt Forest in North Sydney; - Loss of habitat /Declining canopy cover - Reduction and degradation of bushland habitat in North Sydney; - Ecosystem degradation general loss of species diversity; Urban ecology expansion is beneficial to larger common birds; - Fragmented populations confined to small native bushland remnants are at risk of local extinction; - Lack of constant food source; - Predation from cats, dogs and urban predatory birds such as Currawongs and butcher birds. - Scarcity of natural breeding hollows - Altered stormwater system causing habitat loss; stormwater pollution; Sedimentation; Chytrid fungus; & Isolation of small populations.
Lilly Pilly Black She-Oak Flannel Leaf Peppermint Gum Forest Red Gum Gompholobium Toothed Phebalium Graceful Bush Pea Maytenus	*Acmena smithii* *Allocasuarina littoralis* *Astrotricha floccosa* *Eucalyptus piperita* *Eucalyptus tereticornis* *Gompholobium grandiflorum* *Lejoneme dentatum* *Pultenaea flexilis* *Maytenus silvestris*	- Altered fire regimes; - Ecosystem degradation; general loss of species diversity; - Fragmented populations confined to small bushland remnants; - Lack of connectivity between bushland limits pollination pathways and seed dispersal - Community use pressures - Stormwater pollution, erosion and sedimentation

Table 3: Plant species affecting biodiversity and stability of Bushland

Common Name	Botanic Name	Habit	Common Name	Botanic Name	Habit
African love grass	*Eragrostis curvula*	Grass/Ground layer	Purple top	*Verbena bonariensis*	Ground layer
Barbed wire grass	*Cymbopogon refractus*	Grass/Ground layer	Thick head	*Crassocephalum crepidioides*	Ground layer
Couch	*Cynodon dactylon*	Grass/Ground layer	Thistle sp	*Cirsium vulgare*	Ground layer
Crows foot grass	*Eleusine indica*	Grass/Ground layer	Trad	*Tradescantia fluminensis*	Ground layer
Ehrharta	*Ehrharta erecta*	Grass/Ground layer	Turkey rhubarb	*Acetosa sagittatus*	Ground layer
Foxtail grass	*Pennisetum alopecuroides*	Grass/Ground layer	Balloon vine	*Cardiospermum grandiflorum*	Climber
Kikuyu	*Pennisetum clandestinum*	Grass/Ground layer	Cape Ivy	*Delairea odorata*	Climber
Weeping grass	*Microlaena stipoides*	Grass/Ground layer	Honeysuckle	*Lonicera japonica*	Climber
Palm grass	*Setaria palmifolia*	Grass/Ground layer	Madeira vine	*Anredera cordifolia*	Climber
Parramatta grass	*Sporobolus indicus*	Grass/Ground layer	Morning glory coastal	*Ipomea cairica*	Climber
Paspalum	*Paspalum dilatatum*	Grass/Ground layer	Morning glory	*Ipomea indica*	Climber
Red natal grass	*Melinis repens*	Grass/Ground layer	Moth vine	*Araujia sericifolia*	Climber
Summer grass	*Digitaria sanguinalis*	Grass/Ground layer	Corky Passionfruit	*Passiflora suberosa*	Climber
Asthma weed	*Parietaria judaica*	Ground layer	Box Elder	*Acer negundo*	Canopy/Shrub
Asparagus fern	*Protasparagus aethiopicus*	Ground layer	African olive	*Olea europaea ssp. cuspidata*	Canopy/Shrub
Bidens	*Bidens pilosa*	Ground layer	Castor oil plant	*Ricinus communis*	Canopy/Shrub
Scurvy weed	*Commelina cyanea*	Ground layer	Camphor laurel	*Cinnamomum camphora*	Canopy/Shrub
Crofton	*Ageratina adenophora*	Ground layer	Cassia	*Senna pendula*	Canopy/Shrub
Fishbone fern	*Nephrolepis cordifolia*	Ground layer	Cheese Tree	*Glochidion ferdinandi*	Canopy/Shrub
Fleabane	*Conyza spp*	Ground layer	Coral Tree	*Erythrina sp*	Canopy/Shrub
Mist flower	*Ageratina riparia*	Ground layer	Lantana	*Lantana camara*	Canopy/Shrub
Montbretia	*Crocosmia X crocosmiiflora*	Ground layer	Ochna	*Ochna serrulata*	Canopy/Shrub
Mother of millions	*Bryophyllum delagoense*	Ground layer	Port Jackson Fig	*Ficus rubiginosa*	Canopy/Shrub
Mustard weed	*Brassica spp.*	Ground layer	Sweet Pittosporum	*Pittosporum undulatum*	Canopy/Shrub
Paddys lucerne	*Sida rhombifolia*	Ground layer	Small leaf Privet	*Ligustrum sinense*	Canopy/Shrub
Pampas lily of the valley	*Salpichroa organifolia*	Ground layer	Large leaf Privet	*Ligustrum lucidum*	Canopy/Shrub
Pareuvian lily	*Alstroemeria pulchella*	Ground layer	Wild tobacco	*Solanum mauritianum*	Canopy/Shrub

2.1.2 Balls Head Reserve (incl. Carradah Park foreshore, Waverton Park foreshore and Coal Loader Parklands foreshore) Bushland Rehabilitation Plan

Description

Size: Balls Head Reserve (including the Coal Loader foreshore remnant) is 12.5Ha; Waverton Park bushland (including the Carradah Park foreshore remnant) is 1Ha.

Access: Balls Head Reserve is accessed via Balls Head Drive. Carradah Park is accessed via Larkin St and a walking track from Balls Head Road. The Coal Loader Parklands are accessed via Waterhen Drive, Balls Head Road and Balls Head Drive. Waverton Park is accessed via Woolcott St, Larkin Street and John Street, Waverton.

Ownership: Balls Head Reserve, Carradah Park, Waverton Park and the Coal Loader Parklands are Crown land under the care, control and management of Council.

Catchment: Port Jackson

Configuration / Connectivity: The bushland within Balls Head Reserve, Carradah Park and the Coal Loader Parklands are all located on the Waverton Peninsula, which is bordered on three sides by Sydney Harbour. The peninsula also supports other major land uses including the old Quarantine Depot, the former Balls Head Coal Loader, HMAS Waterhen (which comprises bushland), relic infrastructure from the former Caltex and BP industrial sites as well as water taxi and boat charter businesses along the foreshore. The bushland remnants are all interconnected, at times tentatively, due to their narrowness and the presence of roads or other physical separations. Balls Head Reserve comprises the largest bushland remnant, with the other fragments generally hugging the foreshore. The Commonwealth-owned bushland within HMAS Waterhen provides a small but important northern extension to the Waverton remnant.

Hydrology: All surface water drains to Port Jackson. No surface water drains onto Balls Head Reserve from the adjoining peninsula. Natural drainage on the peninsula has been altered due to industrial land uses and no original water courses or drainage lines exist.

Geology: Hawkesbury Sandstone of medium to coarse grained quartz sandstone with minor shale and laminate lenses and substantial sandstone outcrops.

Soil landscape: Hawkesbury Soil Landscape on Balls Head Reserve. Gymea Soil Landscape at Waverton Park. A mix of both soil landscapes at Carradah Park and the Coal Loader. Both soil landscapes are associated with Hawkesbury Sandstone and consist of shallow, poor sandy soils, which are highly erosive with low soil fertility. Localised Yellow and Red Podzolic Soils are associated with shale lenses. Areas below roads, the railway line and industrial or residential development are in parts disturbed with fill from past construction and dumping.

Slope: Moderate to steep slopes. Natural topography has been substantially modified in Carradah Park and the Coal Loader Parklands due to former cuttings, quarries and construction associated with their past industrial land-use.

Facilities / Infrastructure:
Balls Head Reserve comprises a network of walking tracks including boardwalks, stairs, interpretative signage, bench seats, picnic tables, potable water points, memorial bubbler, bike racks, toilet facilities, car parking, several stonework lookouts, depression-era shelters and historic flag pole sites. The walking tracks include: Angophora Walk, Midden Walk, Ballasters Track East, Harbour View Walk, Isabella Brierley and Coal Loader Link Track. Service infrastructure includes septic tanks/infiltration trench, water pipes, under and over ground power lines, electric BBQs, lighting and stormwater pipes.
Carradah Park includes walking tracks, stairs and interpretative signage detailing natural, cultural and industrial history of the park. Lookout platforms, seating, water fountain, water quality control ponds with associated wetland and frog habitat areas and former industrial infrastructure relating to its time as the BP bulk fuel storage site.
Waverton Park comprises walking tracks with interpretative signage. The adjoining parkland includes a bowling club and playing fields that include an off-leash dog exercise area.
The Coal Loader comprises walking tracks, parking, a sustainability centre, café, toilets, seating, water fountain, exhibition areas, Council offices, historic sites, grassed parkland, community gardens, SES, and a native plant nursery.

Plant Community:
Balls Head Reserve
- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species.
- Sandstone Foreshore Scrub – Open-scrub or closed scrub growing on steep sandstone slopes adjacent to the harbour, with extensive sandstone outcrops and cliffs. It is similar to Disclimax Sandstone Scrub, but appears to be a natural community.
- Kunzea scrub – open-scrub dominated by *Kunzea ambigua* (tick-bush), growing in the elevated centre of the headland with extensive flat stone outcrops on shallow soils. It may not reflect the original composition of the community due to disturbance.
- Disclimax Sandstone Scrub – an altered community of open to closed scrub, or a forest of mixed and variable composition due to disturbance and lack of fire.

Waverton Park/ Carradah Park/ Coal Loader Parklands
- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species found along the foreshore.
- Disclimax Sandstone Scrub – an altered community of open to closed scrub, or a forest of mixed and variable composition due to disturbance and lack of fire.
- Refer to Map 1 for the plant communities; Table 1 for common flora species and Table 2 for plant species of special conservation concern in Balls Head Reserve.

Wildlife Habitat:
- The Waverton peninsula reserves provide a diverse range of habitats including open forest, closed forest, scrub, intertidal mudflats adjoining Waverton Park Foreshore, and rocky outcrops.
- This network of reserves forms an important habitat corridor around the Waverton Peninsula that also tentatively links to nearby bushland areas in

Wollstonecraft via small bushland remnants (e.g. Sugar Works Reserve), native plantings (e.g. Walumetta Park) and core bushland (e.g. Badangi Reserve).
- The reserves are within range for many wildlife species that move between reserves such as the common Brushtail (*Trichosurus Vulpecula*) and Ringtail Possums (*Pseudocheirus peregrinus*), bats, woodland and water birds. Over the past 5-10 years, wildlife such as Brush Turkeys (*Alectura lathami*) have naturally re-colonised. Remnant small range species include skinks, lizards, geckoes, snakes and frogs.
- A wide range of birds have been recorded including sea birds, open and closed forest and scrub birds.
- The intertidal mudflats provide habitat for birds, bats, insects, mammals, crabs, molluscs and fish at different phases of the tide.
- The reserves lack nesting hollows and roosting sites for birds and arboreal mammals due to the lack of mature native trees. Such creatures play an important role in the ecology of the vegetation communities by assisting in pollination, seed dispersal and germination.
- Refer to Table 2 for the fauna species of special conservation concern found in the Waverton Peninsula reserves.

Condition and Resilience:
- Most of the bushland is in good or fair condition. The connectivity of the bushland to remnants increases its long-term resilience and viability.
- Bush regeneration activities in these reserves are carried out by Council's Bushland Management Team, bush regeneration contractors and the Balls Head Bushcare group. Council began bush regeneration at Balls Head Reserve in 1980 and the Bushcare group formed in 1987.
- Refer to Map 2 Condition of Bushland and Resilience (2018).

Balls Head Reserve
- Balls Head Reserve is generally in good condition with moderately low densities of herbaceous weeds occurring along track edges, roads, picnic or other open areas. Sporadic weeds occur throughout the native vegetation. The bushland has slowly regenerated since it was cleared of all trees by 1930. A tree planting program began in 1931 when some non-endemic species were planted. Some of these trees still exist amongst regenerated bushland.
- The vegetated area above the beach on the eastern side of Balls Head Reserve remains very poor.
- Some exposed sandstone outcrops demonstrate areas with higher resilience and more intact soil structure.
- Balls Head Reserve is not impacted by urban stormwater runoff from the upper catchment or associated weed seed spread, increased nutrients and moisture.

Coal Loader Parklands / Carradah Park Foreshore
- The bushland in the Coal Loader Parklands and Carradah Park foreshore is highly disturbed due to previous heavy industrial uses and quarrying / excavation activities.
- In Carradah Park, bushland is restricted to a narrow strip along the foreshore of Berry's Bay, where extensive planting of native species supplements the remnant bushland. The creation of this corridor is providing an important link between Balls Head Reserve and Waverton Park.
- The most accessible areas are successfully being restored and require regular weed control.
- Less accessible areas are dominated by woody weeds and invasive grasses (e.g. Fountain Grass).

Waverton Park
- Bushland of Waverton Park varies in health and condition due to past land uses from good and fair, to poor.
- Some areas are highly degraded and filled with loose boulders and bricks which has changed soil structure, stability and composition, destroying or burying the original seed bank, which limits unassisted native plant regeneration.
- In some locations, only a few mature native canopy trees remain.
- The majority of the park is at maintenance level with some areas displaying significant resilience where higher plant diversity and more stable, self-sustaining native vegetation communities occur.
- Infill planting is providing a good structure and diversity to the bushland.
- Native and exotic mesic and vine species require targeted and regular maintenance to manage colonisation / domination in areas of open forest and where elevated soil moisture and nutrient conditions have excluded fire for long periods.
- Some highly degraded weedy areas in the park are inaccessible and progress is limited. They tend to be on steep slopes that are too dangerous to work on without using rope access equipment. These areas are managed to contain weed spread and to provide dense weedy habitat for small birds and other fauna.
- Fern species stabilise steep, erosion prone areas near the Bowling Club.
- Along the eastern boundary of the park, residential properties and the railway corridor remain a constant source of weed seed, exotic vines and woody weeds.
- The long thin configuration of this bushland makes it vulnerable to edge effects and the harmful effects of stormwater runoff / infrastructure.

Zone / Classification:
- The bushland areas in the Waverton reserves are zoned E2 Environmental Conservation under the *North Sydney LEP 2013.* These areas are classified public bushland in *SEPP No. 19 Bushland in Urban Areas (*and in the draft SEPP (*Environment)* that will supersede *SEPP 19).*
- The subject area is identified as a Coastal Environment Area and Coastal Use Area under *SEPP (Coastal Management*).
- The Waverton Peninsula Strategic Masterplan (1999) includes strategies for the future development of the Coal Loader / Caltex and BP ex-industrial sites for public open space and working waterfront land uses. The masterplan is being progressively implemented in stages as funding permits. The ex BP site is now Carradah Park.

Statement of Significance:
The natural topography, remnant vegetation, Aboriginal heritage and phases of industrial development in the Waverton reserves combine to provide a rich, layered cultural landscape.

Historic Values
- The bushland in these reserves is a legacy of past land management by the traditional Aboriginal custodians, the Cammeraygal, who originally occupied the area. The Waverton reserves are rich in Aboriginal sites, some of which are connected to Dreamtime and the Dreaming. They include archaeological deposits, middens, shelters,

art sites, burials and rock engravings. Other signs of Aboriginal presence may exist but remain undiscovered. Places, objects and features of significance to Aboriginal people are protected under the NSW *National Parks and Wildlife Act 1974*.

- Balls Head was named after Henry Lidgbird Ball, Commander of the ship 'Supply' in the First Fleet of 1788. Carradah Park is named after Cammeraygal man Carradah, who befriended Lieutenant Ball.
- The Waverton reserves were included in the large Wollstonecraft Estate, a land grant to Edward Wollstonecraft in 1825.
- The land remained largely undeveloped at the beginning of the 20th century. The Quarantine Depot was established in Berry's Bay in 1912 which serviced boats operating to and from the Quarantine Station at North Head. In the early 1920's the land on the eastern side of the peninsula became a fuel storage depot (now Carradah Park) and the land on the west became a coal loading terminal (now the Coal Loader Parklands). Both operations ceased in the 1990s. In 1997 the State Government announced these former industrial sites would be preserved as public open space managed by North Sydney Council.
- Balls Head was declared a public park in 1926. Soon after, much of the cleared headland was replanted with native and non-native tree species some of which still exist today and are retained for their heritage value.
- Historic flagpole footings in Balls Head Reserve situated 300 feet above sea level, mark the location of flag poles that were used as a means of communication with Government House during early settlement. Sites primarily associated with mid-19th century shipping in Berry's Bay are found along the south-east foreshore of Balls Head Reserve.
- Other historic European industrial sites dating back to the 19th and early 20th century located north of the Quarantine Depot include the original stone store (house) / torpedo depot and ship repair yards. Some of the stone stores were used for shelter by homeless people during the Great Depression in the 1930's when shanty towns formed on the peninsula.
- Balls Head Reserve is listed as a heritage landscape on *North Sydney LEP 2013* Schedule 5 and listed items within the reserve include Uncle Tom's Cabin, relics of a ring bolt, ironscreen and windlass spindle as well as steps to a former harbour pool. The former Coal Loader, the BP site and the former quarantine depot are also listed as heritage items on the *North Sydney LEP 2013* Schedule 5.
- The Coal Loader is classified by the National Trust of Australia which is a non-statutory list.
- Waverton Park was dedicated to North Sydney Council by the Government in the 1940s for recreation and open space.

Natural Values

- Balls Head and the other Waverton reserves play a significant role in maintaining biodiversity in the region and assist in conservation of species and habitats.
- Balls Head Reserve connects with the other Waverton reserves along the Waverton Peninsula and foreshore to provide a significant wildlife corridor in an urbanised setting, close to the city centre.
- The marine waters bordering the reserves are part of a large Intertidal Protection Area for Sydney Harbour that aims to protect intertidal biodiversity and structure.
- Angophora Foreshore Forest, Disclimax Sandstone Scrub and Kunzea Scrub are threatened at a local level whilst Sandstone Foreshore Scrub is threatened at a regional level due to limited extent.
- Locally rare species include *Desmodium rhytidphyylum*, *Calochilus gracilimus* (Late Beard Orchid) and *Liparis reflexa* (Yellow Rock Orchid)
- The endangered *Acacia terminalis* subspecies *terminalis* listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (*EPBC Act)* and the NSW *Biodiversity Conservation Act* 2016 (*BC Act)* was recorded on Balls Head Reserve during the 2010 North Sydney Natural Area Survey by Smith and Smith and during the 2017 Office of Environment and Heritage survey undertaken to specifically identify the species. Two samples assessed by the NSW Herbarium in 2017 were confirmed as the subspecies and both were located on the eastern side of the reserve above Balls Head Drive. Occurrence of the subspecies could be more widespread in the reserve.
- Balls Head Reserve has been declared a Wildlife Protection Area under the NSW *Companion Animals Act* 1998.
- The reserve provides habitat for a range of wildlife including threatened and declining fauna species. The threatened species below have been recorded on Balls Head Reserve and may occur in adjoining reserves: Grey-headed Flying-fox (*Pteropus poliocephalus*) (vulnerable under the BC Act and *EPBC Act)*; Powerful Owl (*Ninox strenua*), Black Bittern (*Ixobrychus flavicollis*) and White-bellied Sea-Eagle (*Haliaeetus leucogaster)* all of which are listed as vulnerable under the *BC Act*.
- The Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), the Eastern Freetail Bat (*Mormopterus norfolkensis*) and the Southern Myotis (*Myotis macropus*) have been recorded at Balls Head Reserve, the Coal Loader and Balls Head Bay where there are known roosting sites. All of these bat species are listed as vulnerable under the *BC Act*.

Recreation / Education Values

- The Waverton Peninsula reserves provide a valuable educational, nature appreciation and bushwalking resource. They form part of Sydney Harbour which is an iconic natural and public asset of national significance. Balls Head Reserve is one of the most utilised recreation areas in North Sydney Local Government Area with magnificent views of Sydney Harbour and the city skyline. The Waverton reserves are an easy 10-minute walk from Waverton Station.

Fire History:

- Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity in the Waverton Peninsula Reserves.
- Past burns have resulted in the successful germination of native endemic flora species and the regeneration of previously unrecorded species.
- Fire Management Zones exist along boundaries with the Old Quarantine Station and Coal Loader Parkland.
- Planned hazard reduction / ecological broad area burns are conducted from time to time with the exception of areas that are logistically restricted from an ecological burn program. Refer to Map 3 Fire History and Future Managed Burns.

Threats:

- The limited size and narrowness of some Waverton Peninsula reserves amplifies their vulnerability to fragmentation and edge effects from the surrounding urban environment.

- Native and exotic vines, mesic species and weeds are a serious threat to the stability of resilient cores and long-term viability of biodiversity. Refer to Table 3 for plant species affecting biodiversity and stability of bushland assets.
- Illegal dumping of building rubble, tree mulch or residential waste occurs fairly regularly.
- Water pooling on rock engravings can accelerate their deterioration.
- *Phytophthora cinnamomi* (root rot*)* affects the health of the bushland and is widespread.
- At times, foxes (*Vulpes vulpes*), domestic cats (*Felis cattus*) and off-leash dogs (*Canis lupus familiaris)* are observed in the reserve and along the foreshore. These animals predate, scare and disturb wildlife, pollute with their faeces and spread weed seed. Shorebirds are particularly impacted by dogs off lead.
- Some introduced or endemic fauna are very territorial and compete for habitat, limiting species diversity.
- Native bats and birds can introduce new flora species and weeds that have the potential to change vegetation structure over time.
- Inappropriate weed removal can reduce fauna habitat with greater impacts on short range species and small birds.
- Increased drone usage is causing disturbance to fauna that occur in the canopy.
- Areas where bushland is bordered by lawn grass e.g. adjoining grassed picnic areas, are impacted by exotic grass encroachment.
- Homeless people have at times taken up residence in bushland areas, bringing in bulky items, tents, furniture, depositing litter and damaging vegetation.
- Climate change is an ongoing threat. Anticipated impacts include increased threat of bushfire and extreme weather events. Raised sea levels are predicted to inundate shoreline vegetation, eroding the foreshore and destroying Aboriginal middens*.* Increased temperatures are likely to affect biodiversity and ecosystems, favouring some species over others and changing the structure and function of the bushland. The rate of climate change may be faster than the rate of natural adaptation. Increased temperatures will harm sensitive fauna such as bats, impacting their important ecosystem function.

Balls Head Reserve

- Along Balls Head Drive, vehicles have been witnessed exceeding the speed limit which poses a threat to fauna and visitors.
- The high usage walking tracks on Balls Head Reserve are prone to erosion and require regular monitoring.
- Informal walking tracks in Balls Head Reserve from fishing, orienteering/geocaching and rock climbing activities result in trampled plants and erosion.
- Hard surface runoff such as from road surfaces contributes to increased moisture and erosion.
- Discarded fishing waste (hooks and line) along the rocky foreshore threatens wildlife such as water birds and turtles. Fishing can overharvest protected species.
- Periodically, illegal camp fires are made within the bushland. This results in habitat damage as branches and other natural combustible materials are burnt.
- Vandalism to historic sites and park infrastructure occurs from time to time along with drug taking, binge drinking and other anti-social/illegal activities.
- Illegal storage of dinghies and other small watercraft occurs from time to time along the rocky foreshore.
- Hybridization is a significant threat to the endangered *Acacia terminalis* subsp. *terminalis* that occurs in Balls Head Reserve.
- Occasionally, the toilet block-septic system in Balls Head Reserve fails, causing inundation of the walking track that runs below the infiltration trench. Increased moisture and nutrient levels in this area contribute to persistent weed growth that is difficult to manage.
- At times possums are dumped in Balls Head Reserve after being trapped in houses. This causes a territorial imbalance in the fauna population and usually results in the dumped animal dying.
- Rock climbing/abseiling; orienteering; geocaching; mountain biking; fishing and other active recreation activities damage sensitive bushland vegetation and result in the creation of informal tracks and erosion.
- Unauthorised commercial activities occur from time to time in the reserve. These are usually incompatible with the bushland setting and cause damage to vegetation/tracks or disturb wildlife.
- Balls Head is often selected by students as a study site for research purposes. Whilst this can have benefits for management, potential impacts such as off-track access and vegetation impacts need to be considered and assessed by Council.
- New Year's Eve, along with other large-scale harbour-focussed public events, cause widespread and intense damage to Balls Head Reserve's natural environment.

Waverton Park

- The off-leash dog exercise area in Waverton Park significantly increases the occurrence of off leash dogs within the bushland areas of this park.
- Residential properties adjoining the eastern side of Waverton Park can facilitate weeds from garden escapes and dumping of garden clippings into the bushland. A recurring problem of broken drainage pipes and terracotta sewerage pipes servicing adjoining residential properties increases moisture and nutrification. Runoff from hard surfaces, irrigation and pools increase nutrient loads, moisture and erosion on the slopes below. Garden fertiliser also leaches into the bush increasing nutrients. Other threats include encroachment from adjoining residences and periodic illegal vegetation clearing and tree vandalism.
- Areas contaminated by fill, as well as past and more recent dumping, significantly compromises soil stability and structure, seedbank viability and bushland resilience. The waste can comprise a range of material including demolition, domestic and industrial waste, foreign soil and excavated material from adjoining construction sites.
- In Waverton Park, sewerage can leak from concrete pop-top lids along the sewerage pipeline.
- Blockages to drainage lines also occur from time to time and the overflow leads to soil erosion, contributing to further weed infestations in otherwise healthy bushland. Some juvenile native trees have died due to the continuous influx of nutrients and high soil moisture levels from upper lawn areas.

Bushland Management Goals

a. Maintain and enhance biodiversity and habitat for long term ecosystem resilience and function
b. Conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve
c. Strategically restore bushland (prioritise areas of highest resilience)
d. Enhance habitat connectivity
e. Preserve genetic integrity of the vegetation community
f. Manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality
g. Conserve the natural landscape and heritage values
h. Provide for ecologically sustainable recreation needs of the community
j. Implement the strategic fire hazard reduction program and manage fuel loads to protect life, property and endemic biodiversity

Rehabilitation Principles and Procedures:
General

1. Bush regeneration is a long-term process of staged weed removal to ensure endemic biodiversity, native plant establishment and continued habitat for local wildlife. It relies on site assessments that identify values and how best to restore and enhance ecosystem function and structure. Routine site monitoring, evaluation of field strategies and periodic native flora and fauna surveys inform management priorities over time. Works normally proceed from bush in good condition with high resilience. Degraded areas are a lower priority but the weeds always require containment.

Planning, Evaluation and Review

2. The Bushland Management Team should regularly evaluate bushland rehabilitation plans and the success of field strategies to inform management priorities early.
3. Establish photo points to monitor projects.
4. In the bushland rehabilitation planning process, consider the potential impact of future infrastructure earthworks, or access requirements on bushland, habitats, green corridors or active rehabilitation sites.
5. The Bushland Management Team must approve all contractor project proposals before implementation.
6. All Work, Health and Safety requirements must be adhered to by Council staff, volunteers and contractors before, during and after site works.

Native Flora

7. Record uncommon flora species to determine risk of extinction in the reserve. (Use North Sydney flora survey record template).
8. Prioritise protection / rehabilitation in areas of highest resilience.
9. Buffer areas should protect biodiversity from disturbances caused by fragmentation and edge effects: (a) monitor to identify gaps in buffer vegetation and senescing / restored vegetation and organise replacement planting; (b) where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a medium/long term solution to stop herbaceous weeds and grasses from spreading into bushland; (c) control vines, noxious weeds and other plant species affecting stability of adjoining bushland.
10. When natural regeneration is ineffective, locally source all plant material for supplementary planting to maintain genetic integrity of native vegetation in accordance with Flora Bank Guidelines https://www.greeningaustralia.org.au/florabank. Only plant when natural regeneration is ineffective to boost biodiversity, with the aim to achieve 80% survival rates. Plant in stages, basing species selection on the target vegetation community/structure, successional stage, habitat requirements and physical constraints. This process involves collaboration from Council's nursery supervisor, bush regeneration team, Bushcare volunteers and bush regeneration contractors.
11. In areas lacking diversity and structure; direct seed, transplant and use appropriate tube stock to enhance existing plant communities. When planning a replanting site: (a) prepare a suitable plant list based on rehabilitation objectives and prevailing site condition; (b) allow time for seed collection and propagation (9-12 months ahead of planting); (c) identify where seed harvesting/cuttings will be gathered; (d) prepare area (e.g. reduce density of dominant species on ground layer or mesic species in shrub layer); (e) schedule planting for early Autumn during or after soaking rain.
12. Collect seed of suitable locally rare species from nearby bushland areas, propagate and plant in appropriate areas of the reserve to enhance biodiversity and ensure the long-term viability. For species that are difficult to propagate, explore other methods such as seed scarification / raking treatment / seedbank translocation etc.
13. Implement a canopy replacement program in areas where remnant canopy is absent, senescing or failing to regenerate or where non-endemic trees have been removed.
14. Do not encourage large canopy species on unstable areas or under electricity easements where they cannot be supported and may cause future hazards.
15. Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team: (a) pile burn where appropriate; (b) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (c) reduce seedbank of dominant natives - control seeding cycle; (d) lightly disturb mulch / organic matter to stimulate regeneration; (e) increase seed bank of uncommon/ rare species with brush matting techniques (collect from donor sites where seed removal will not affect biodiversity); (f) propagate senescing plant species at risk of extinction in the reserve (i.e. due to an inadequate fire regime) and plant tubestock in suitable locations.
16. When planting along bushland edges, select species in consideration of their potential to compliment views from residential or public viewing areas and design to enhance habitat / connectivity (e.g. for small birds).
17. Maintain existing formal viewlines within the reserve where appropriate.
18. Conserve and protect naturally regenerating / colonising canopy species providing they are in sustainable locations.

Weeds and Pathogens

19. Implement the *Biosecurity Act 2015* consistently and effectively, in accordance with bushland management objectives and processes.
20. Residential properties adjoining bushland can contribute to weed spread. Monitor and address invasive garden plants in accordance with the

Biosecurity Act 2015 and promote Council's Native Havens / Habitat Stepping Stones Programs.

21. Ongoing weed management should: (a) prioritise good bush areas; (b) target species threatening stability e.g. vines, woody or canopy weeds; (c) interrupt seed cycle of target species, especially annual and grass weeds; (d) prioritise areas where plant diversity is most affected by mesic shift and vines. (In consideration of fauna habitat needs, schedule works from Autumn through Winter before bird breeding season.)
22. Monitor sites to identify, report and manage early stages of weed outbreaks or shifts in plant species assemblages likely to become detrimental to biodiversity. Manage according to the issues they raise. Report other threats to ecosystem function.
23. All compost weed material is removed off site.
24. Retain weeds on highly erodible or dangerous slopes and use methods of weed suppression that will not create potential for soil erosion. Incorporate abseiling activities on cliff faces to remove weeds that are a constant weed seed source.
25. Strategically remove non-endemic or exotic trees that interfere with ecosystem function or structure. Assess for habitat potential before they are de-limbed.
26. Consider all potential impacts of herbicide and proximity to water when determining suitability for weed control.
27. Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Native Fauna and Habitat

28. Record wildlife sightings and observations in Council's Wildlife Watch database. Share this information with NSW BioNet and the Commonwealth's ALA.
29. Identify and protect nesting, roosting and breeding sites of threatened, vulnerable or locally significant fauna.
30. Minimise disturbance to wildlife, enhance habitat where needed and improve the condition/connectivity of wildlife corridors between adjoining reserves.
31. Protect, maintain and restore quality fauna foraging habitat using a diverse mix of endemic native species. Retain habitat features such as fallen and standing dead wood, rock piles, hollow-bearing trees, natural debris, dead standing trees, forest litter, logs and branches
32. Short-term strategies to maintain fauna habitat provided by mesic and weed species may require retention yet containment of dense areas of weed, vines and mesic species. In the longer-term, aim to establish a self-maintaining fabricated vegetation community in these areas composed of native species adapted to changed site conditions (abiotic factors) that enhance biodiversity and habitat availability.
33. Before any unfavourable trees are de-limbed, assess for habitat potential e.g. tree hollows.
34. Where suitable, install fauna nesting boxes and create hollows in suitable dead trees to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed.
35. Investigate financial opportunities to invest in habitat enhancing research and developing methodologies.

Threatened species

36. Identify threatened or endangered, rare or locally rare species of flora and fauna. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs.
37. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened species.

Ecological Burns

38. Hazard reduction and ecological burns are based on a strategic burn program consistent with the Mosman North Sydney Willoughby Bushfire Risk Management Plan. Ecological burn regimes are to be in a mosaic pattern to improve bushland function and biodiversity. Areas of high bushfire risk or core ecological resilience are usually prioritised in the annual burn program.
39. Maintain land management zones where bush adjoins residences and implement site stabilisation measures.
40. Over the next 10 years, prioritise prescribed burns at sites at risk of diminishing flora diversity.
41. For pre-fire preparation: (a) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (b) reduce seedbank of dominant natives to control seeding cycle; (c) increase seed bank of uncommon/ rare species with brush matting (collect from donor sites where seed removal will not affect biodiversity).
42. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds.
43. Implement post-fire monitoring and bush rehabilitation strategies. Monitor regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time period post-burn.

Pests and Illegal Activity

44. Monitor and control feral or aggressive/territorial fauna activity, cats, unleashed dogs and illegal activity with appropriate measures e.g. trapping, community education programs, penalty notices or camera observation. If applicable, manage reserves in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 and relevant North Sydney Council policies.
45. Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
46. Monitor the impacts of drones and implement management measures if required.
47. Address instances of unauthorised activities in bushland incl. orienteering; rock climbing; geocaching; mountain biking; camping etc.

Tracks, Water and Erosion

48. Close informal tracks to prevent damage to habitat, impede feral animals and reduce weed spread.
49. Implement track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, track widening and degrading track conditions.
50. Assess the need for additional directional and / or interpretive signage.
51. Stabilise steep slopes, ephemeral flow lines and highly erosive areas using local native species, particularly ground covers, to re-establish appropriate vegetation community structure where natural regeneration is

poor or absent. Install sedimentation fences, terracing, coir logs, matting or other appropriate measures where needed to stabilise washout areas and improve access and safety.

52. Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater tolerant natives.

Aboriginal and non-Aboriginal Heritage

53. All identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1974* and *Heritage Act 1977*.
54. Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual.
55. As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance.
56. Bushland management staff consult with the Aboriginal Heritage Office or Council's heritage officer prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey.
57. Discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol.

Community

58. Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
59. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
60. Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan.
61. When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council.

Reserve Specific Rehabilitation Actions

Priorities will be given to programs with long term benefit to these reserves or where natural assets are at greatest risk to avert irreversible deterioration or loss.

Flora

1. Monitor and control the seedlings of mature non-endemic trees on Balls Head Reserve that have been retained for their historic value, so they do not displace the native vegetation by becoming invasive. Allow the mature trees to naturally die out.
2. Maintain existing lookouts where appropriate by selectively pruning vegetation.
3. Monitor termite activity and implement management controls as necessary.
4. In Waverton Park conduct infill planting throughout dense areas of *Microlaena stipoides* to increase diversity and habitat.
5. In Waverton Park increase native vegetation along the oval edges with brush matting.
6. Monitor the changing conditions leading to the low population numbers of locally rare plant species (e.g. *Themeda triandra*) and implement actions to increase their occurrence / viability.
7. Collect seeds from rare and significant species in the Waverton reserves and store in the NSC seedbank.

Fauna

8. Retain (yet contain) dense vines, mesic and exotic plants in the weedy habitat zone north of the Old Quarantine Station for fauna habitat until suitable habitat in adjacent sections of the reserve are able to support sensitive fauna species (e.g. small birds).
9. Continue to implement wildlife corridor enhancement for all of the Waverton reserves.
10. Install shields on lights within the Waverton reserves to reduce impacts on nocturnal fauna. Monitor the impact of lighting on the new Coal Loader platform, particularly regarding impacts on microbat foraging. Investigate a transition to narrow-wavelength lights.
11. Participate in regionally coordinated vertebrate pest management programs (e.g. fox baiting).
12. Monitor populations of endemic (and non-endemic) fauna populations. Seek to address damaging imbalances where appropriate/feasible.
13. Investigate complimentary management of Open Space areas within Carradah Park with adjacent bushland in order to improve habitat availability whilst retaining the different functional uses of these areas.

Tracks, Water and Erosion

14. Use slope stabilisation techniques such as sedimentation fencing, wooden logs, mulch and sandstone capping as management tools for erosion, weed spread and to define the edge between bushland, road verge, lawn areas and the residential interface.
15. Assess walking track network in order to rationalise informal/redundant tracks, improve safety, enhance accessibility and directional signage, reduce adverse impacts and update interpretative information.
16. In Balls Head Reserve, actively discourage informal access to sensitive areas (e.g. cliff lines) and plan for large-scale public events in order to protect bushland.
17. In Waverton Park, install sediment fences below house boundaries (e.g. Commodore Crescent) to manage weed spread encroaching into regenerating remnant areas.

Threatened Species

18. Work in collaboration with the Saving Our Species program managed by the NSW Office of Environment and Heritage and the NSW Herbarium to identify, monitor and protect *Acacia terminalis* subsp. *terminalis* in the reserves and contribute to the preparation of best practice guidelines for the species.
19. Preserve and enhance the habitat (incl. roosts) of threatened microbat species, Powerful Owl (*Ninox strenua*), White-bellied Sea-eagle (*Haliaeetus leucogaster)* and Grey-headed Flying-fox (*Pteropus poliocephalus*).
20. Monitor the winter roosting patterns of Eastern Bent-wing Bats in Balls Head / Coal Loader Parkland and record in Council's Wildlife Watch database.
21. Evaluate lighting impacts on nocturnal fauna and liaise with adjoining land managers to effect improvements.

Aboriginal and Historic Heritage

22. Manage Aboriginal Sites on the Waverton peninsula in accordance with relevant site specific Aboriginal Site Management Strategies.
23. Any proposed Aboriginal site remediation, including the management of water pooling on rock engravings, must occur in consultation with the NSW Office of Environment and Heritage, the Aboriginal Heritage Office and the Metropolitan Local Aboriginal Land Council. The same procedure must be followed for any changes to interpretation or access.
24. Organise an assessment of the heritage significance of unassessed Aboriginal and non-Aboriginal heritage items within the reserves by qualified professionals, formulate recommendations and appropriate management measures in consultation with key stakeholders.

Illegal Activity

The Bushland Management Team and North Sydney Council Rangers will take appropriate action in relation to any prohibited activity occurring within Bushland Reserves,including but not limited to:

25. Regularly inspect popular fishing and illegal small watercraft storage locations and take action to discourage damage to the reserves and their values.
26. Dinghy and kayak storage is prohibited within the reserves except for where permissible in Council's Small Watercraft Storage Strategy.
27. Report all illegal drug and alcohol use locations and associated damage to Council's Ranger team. All affected areas are to be listed on Council's register for such sites and collaboration is required with the Harbourside Local Area Command (Police) to implement management strategies.
28. Dogs must be kept on a short lead in all bushland reserves.
29. Cats are prohibited in Balls Head Reserve as it is a Wildlife Protection Area.
30. Camping and the lighting of fires is prohibited in all Waverton Reserves.
31. Parking of vehicles overnight is prohibited in Balls Head Reserve, to limit the incidence of vandalism etc.
32. Commercial, organised and non-passive recreation activities that may cause damage or are inconsistent with the conservation values of Balls Head Reserve, are not permitted. Breaches will be referred for action.
33. Other illegal or anti-social activities reported in the reserves will be investigated and referred for action.

Ecological Burns

34. Refer to Map 3 Fire History and Future Managed Burns.

Community

35. Plan community and local school replanting projects to coincide with National Tree Day.
36. Assess the need for additional directional and / or interpretative signage in all reserves.
37. Seek opportunities to limit visitor numbers during large-scale public events such as New Year's Eve.

Capital Projects

38. Coordinate the redesign and update of visitor facilities, walking tracks and lookouts in Balls Head Reserve.
39. Replace the Balls Head Reserve septic tank with a more appropriate/sustainable waste disposal system.
40. Install boom-gates on the inbound and outbound lanes of Balls Head Drive (where the lanes split) in order to manage public access during severe fire danger.
41. Redesign Balls Head Drive (where the lanes split) to enable vehicle U-turns when boom-gates are in use.
42. To reduce the instances of night-time illegal/anti-social activity in Balls Head Reserve, consider limiting vehicle access to the reserve from sunset to sunrise.
43. Consider installing signage and barriers in areas where small watercraft are illegally stored.
44. Assess the need to install traffic calming devices along Balls Head Drive on the southern section of the road from the parking area and into the north-bound corner.
45. Upgrade and augment fauna awareness and appreciation signage along the Balls Head Reserve roadway and in picnic, parking and fishing areas. Inform the public about rules relating to relocating trapped animals such as possums, not feeding birds and the impacts of cats and dogs on wildlife.
46. In fishing locations, inform the public about the impacts of discarded fishing line/hooks on aquatic wildlife and waterbirds. Provide simple identification of protected aquatic species and maritime fishing rules.
47. Identify areas affected by hard-surface run-off and implement actions to mitigate impacts.

Map 1: Vegetation Communities (NAS 2010)

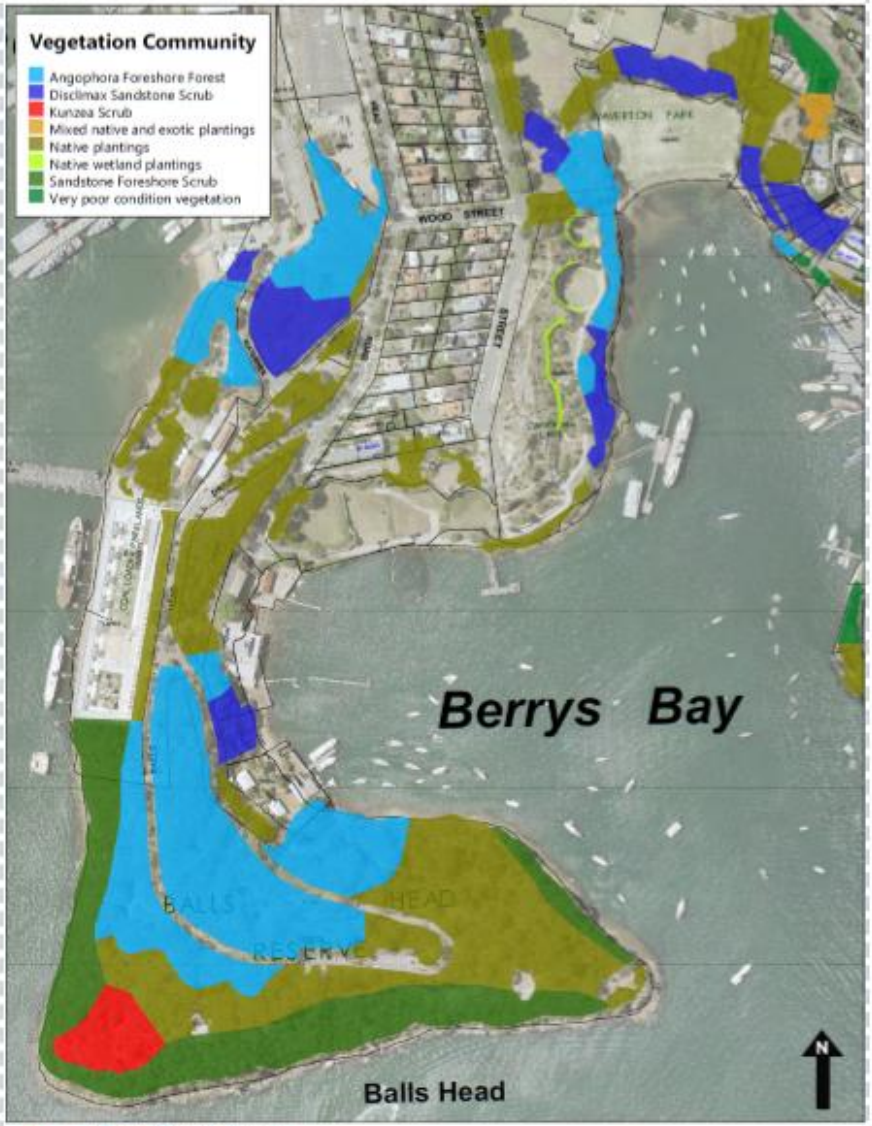


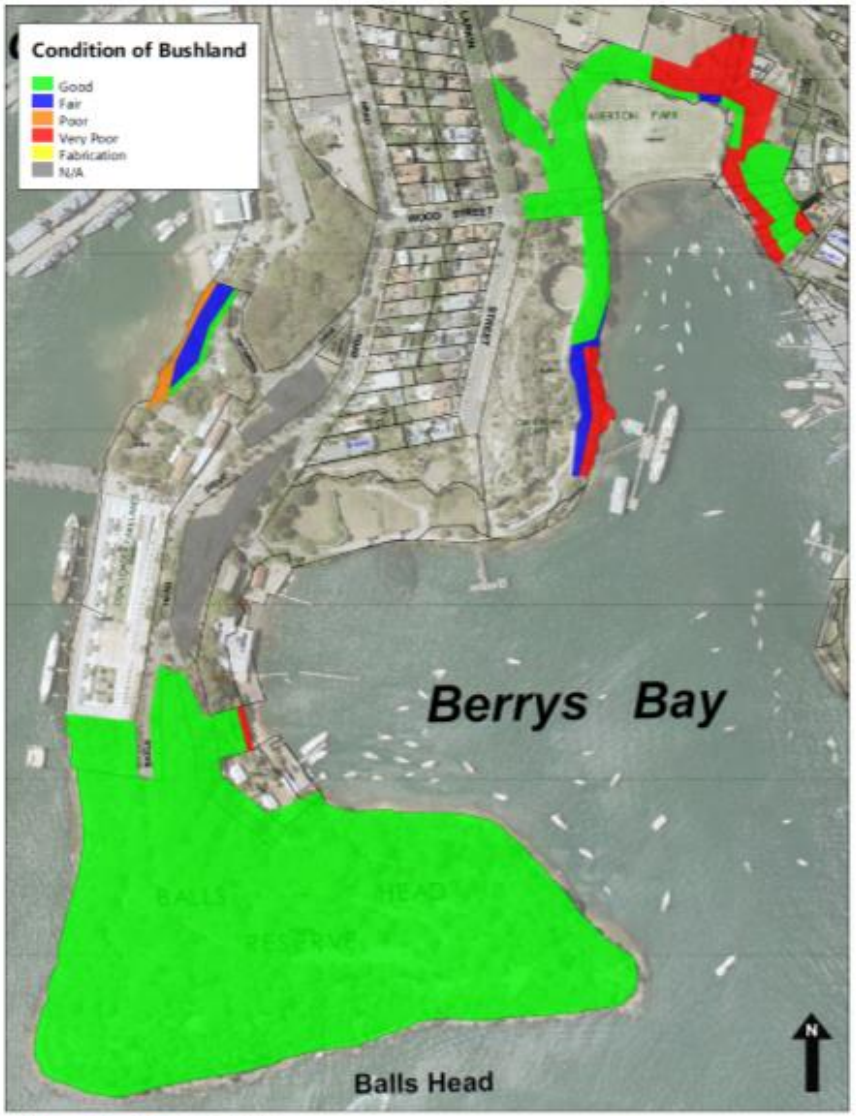
Table 1: Common species recorded in the Waverton remnants

Scientific name	Common name	Vegetation Community
Acacia longifolia	Sydney Golden Wattle	AF
Angophora costata	Sydney Red Gum	AF; DS
Banksia integrifolia	Coast Banksia	DS; FS
Calochlaena dubia	Common Ground Fern	AF; DS
Commelina cyanea	Scurvy Weed	AF
Dianella caerulea	Blue Flax Lily	AF
Dodonaea triquetra	Common Hop Bush	AF
Elaeocarpus reticulatus	Blueberry Ash	AF; DS; FS
Entolasia stricta	Wiry Panic	AF; DS; KS; FS
Eragrostis brownii	Brown's Lovegrass	KS
Eucalyptus resinifera	Red Mahogany	AF
Ficus rubiginosa	Port Jackson Fig	AF; DS
Glochidion ferdinandi	Cheese Tree	AF; DS; FS
Grevillea linearifolia	White Spider-flower	AF; KS
Hakea dactyloides	Broad-leaved Hakea	AF
Hydrocotyle peduncularis		FS
Kunzea ambigua	Tick Bush	KS
Leioneme dentatum	Toothed Phebalium	DS
Lomandra longifolia	Spiny-headed Mat-rush	AF; DS; KS; FS
Microlaena stipoides	Weeping Grass	AF; DS; KS; FS
Monotoca elliptica	Tree Broom-heath	FS
Notelaea longifolia	Large Mock-olive	AF; DS; FS
Oplismenus aemulus	Basket Grass	DS
Pittosporum revolutum	Rough-fruit Pittosporum	AF
Pittosporum undulatum	Pittosporum	AF; DS; FS
Platysace lanceolata	Native Parsnip	AF
Poa affinis		AF; DS; FS
Pteridium esculentum	Bracken	AF; DS
Smilax glyciphylla	Sweet Sarsaparilla	DS

AF = Angophora Foreshore Forest **FS = Sandstone Foreshore Scrub**

DS = Disclimax Sandstone Scrub **KS = Kunzea Scrub**

Map 2: Condition of Bushland and Resilience (2018)



Condition of Bushland and Resilience Key

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural recruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting Poor indicative resilience
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience – limited regeneration potential (1-2 species)
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed sandstone)

Map 3: Fire History & Future Managed Burns

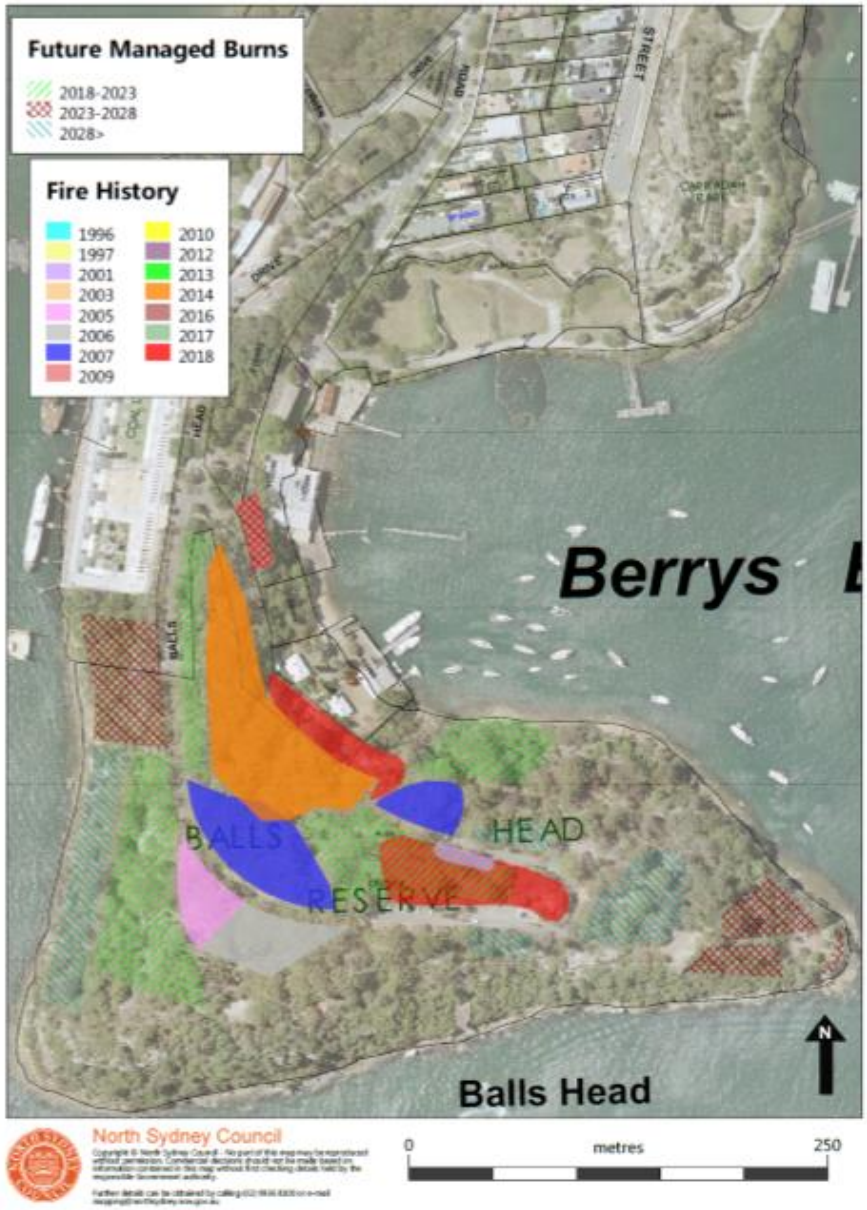


Table 2: Species of Special Conservation Concern

COMMON NAME	SCIENTIFIC NAME	CAUSE OF DECLINE
Eastern Spinebill	*Acanthorhynchus tenuirostris*	- Reduction of Tall Eucalypt Forest in North Sydney; - Loss of habitat /Declining canopy cover - Reduction and degradation of bush-land habitat in North Sydney; - Ecosystem degradation general loss of species diversity; Urban ecology expansion is beneficial to larger common birds; - Fragmented populations confined to small native bushland remnants are at risk of local extinction; - Lack of constant food source; - Predation from cats, dogs and urban predatory birds such as Currawongs and butcher birds. - Scarcity of natural breeding hollows - Altered stormwater system causing habitat loss; stormwater pollution; Sedimentation; Chytrid fungus; & Isolation of small populations.
Brown Goshawk	*Accipiter fasciatus*	
Brown Antechinus	*Antechinus stuartii*	
Pacific Baza	*Aviceda subcristata*	
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	
Yellow-tail Black Cockatoo	*Calyptorhynchus funereus*	
Gould's Wattled Bat	*Chalinolobus gouldii*	
Black-faced Cuckooshrike	*Coracina novaehollandiae*	
Common Tree Snake	*Dendrelaphis punctulatus*	
Black-shouldered Kite	*Elanus axillaris*	
Nankeen Kestrel	*Falco cenchroides*	
Peregrin Falcon	*Falco peregrinus*	
Buff-banded Rail	*Gallirallus philippensis*	
White-bellied Sea Eagle	*Haliaeetus leucogaster*	
Whistling Kite	*Haliastur sphenurus*	
Superb Fairly-wren	*Malurus cyaneus*	
Variegated Fairy-wren	*Malurus lamberti*	
Common Bent-wing Bat	*Miniopterus schreibersii*	
Eastern Bent-wing Bat	*Miniopterus schreibersii oceanensis*	
Boobook Owl	*Ninox novaeseelandiae*	
Powerful Owl	*Ninox strenua*	
Spotted Pardolote	*Pardalotus punctatus*	
Tree Martin	*Petrochelidon nigricans*	
Tawny Frogmouth	*Podargus strigoides*	
Red-bellied Black Snake	*Pseudechis porphyriacus*	
Grey-headed Flying Fox	*Pteropus poliocephalus*	
Roufus Fantail	*Rhipidura rufifrons*	
White-browed Scrubwren	*Sericornis frontalis*	
Forest Kingfisher	*Todiramphus macleayii*	
Sacred Kingfisher	*Todiramphus sanctus*	
Silvereye	*Zosterops lateralis*	
Lilly Pilly	*Acmena smithii*	- Altered fire regimes; - Ecosystem degradation; general loss of species diversity; - Fragmented populations confined to small bushland remnants are at risk of local extinction; - Lack of connectivity between bush-land limits pollination pathways and seed dispersal - Community use pressures - Stormwater pollution, erosion and sedimentation
Black She-Oak	*Allocasuarina littoralis*	
Coastal Banksia	*Banksia integrifolia*	
Red Bloodwood	*Corymbia gummifera*	
Bangalay	*Eucalyptus botryoides*	
Peppermint Gum	*Eucalyptus piperita*	
Broad-leaved Hakea	*Hakea dactyloides*	
Tree Broom Heath	*Monotoca elliptica*	
Smooth Geebung	*Persoonia levis*	
Narrow-leaved Geebung	*Persoonia linearis*	
Pomaderris	*Pommaderris intermedia*	
Kangaroo Grass	*Themeda triandra (Blue form)*	

Table 3: Plant species affecting biodiversity and stability of Bushland

Common Name	Botanic Name	Habit	Common Name	Botanic Name	Habit
African love grass	*Eragrostis curvula*	Grass/Ground layer	Purple top	*Verbena bonariensis*	Ground layer
Barbed wire grass	*Cymbopogon refractus*	Grass/Ground layer	Thick head	*Crassocephalum crepidioides*	Ground layer
Couch	*Cynodon dactylon*	Grass/Ground layer	Thistle sp	*Cirsium vulgare*	Ground layer
Crows foot grass	*Eleusine indica*	Grass/Ground layer	Trad	*Tradescantia fluminensis*	Ground layer
Ehrharta	*Ehrharta erecta*	Grass/Ground layer	Turkey rhubarb	*Acetosa sagittatus*	Ground layer
Foxtail grass	*Pennisetum alopecuroides*	Grass/Ground layer	Balloon vine	*Cardiospermum grandiflorum*	Climber
Kikuyu	*Pennisetum clandestinum*	Grass/Ground layer	Cape Ivy	*Delairea odorata*	Climber
Weeping grass	*Microlaena stipoides*	Grass/Ground layer	Honeysuckle	*Lonicera japonica*	Climber
Palm grass	*Setaria palmifolia*	Grass/Ground layer	Madeira vine	*Anredera cordifolia*	Climber
Parramatta grass	*Sporobolus indicus*	Grass/Ground layer	Morning glory coastal	*Ipomea cairica*	Climber
Paspalum	*Paspalum dilatatum*	Grass/Ground layer	Morning glory	*Ipomea indica*	Climber
Red natal grass	*Melinis repens*	Grass/Ground layer	Moth vine	*Araujia sericifolia*	Climber
Summer grass	*Digitaria sanguinalis*	Grass/Ground layer	Corky Passionfruit	*Passiflora suberosa*	Climber
Asthma weed	*Parietaria judaica*	Ground layer	Box Elder	*Acer negundo*	Canopy/Shrub
Asparagus fern	*Protasparagus aethiopicus*	Ground layer	African olive	*Olea europaea ssp. cuspidata*	Canopy/Shrub
Bidens	*Bidens pilosa*	Ground layer	Castor oil plant	*Ricinus communis*	Canopy/Shrub
Scurvy weed	*Commelina cyanea*	Ground layer	Camphor laurel	*Cinnamomum camphora*	Canopy/Shrub
Crofton	*Ageratina adenophora*	Ground layer	Cassia	*Senna pendula*	Canopy/Shrub
Fishbone fern	*Nephrolepis cordifolia*	Ground layer	Cheese Tree	*Glochidion ferdinandi*	Canopy/Shrub
Fleabane	*Conyza spp*	Ground layer	Coral Tree	*Erythrina sp*	Canopy/Shrub
Mist flower	*Ageratina riparia*	Ground layer	Lantana	*Lantana camara*	Canopy/Shrub
Montbretia	*Crocosmia X crocosmiiflora*	Ground layer	Ochna	*Ochna serrulata*	Canopy/Shrub
Mother of millions	*Bryophyllum delagoense*	Ground layer	Port Jackson Fig	*Ficus rubiginosa*	Canopy/Shrub
Mustard weed	*Brassica spp.*	Ground layer	Sweet Pittosporum	*Pittosporum undulatum*	Canopy/Shrub
Paddys lucerne	*Sida rhombifolia*	Ground layer	Small leaf Privet	*Ligustrum sinense*	Canopy/Shrub
Pampas lily of the valley	*Salpichroa organifolia*	Ground layer	Large leaf Privet	*Ligustrum lucidum*	Canopy/Shrub
Pareuvian lily	*Alstroemeria pulchella*	Ground layer	Wild tobacco	*Solanum mauritianum*	Canopy/Shrub

2.1.3 Berry Island Reserve Bushland Rehabilitation Plan

Description

Size: 3.76 hectares

Access: Shirley Rd, Wollstonecraft.

Ownership: Crown land under Council management.

Catchment: Port Jackson

Configuration / Connectivity: Berry Island Reserve is broadly triangular in shape bordered by the marine environment of Sydney Harbour to the south, west and east where it is surrounded by the waters of Gore Bay and Balls Head Bay. It was originally a peninsula connected to the mainland by a sandy isthmus to the north. Berry Island forms part of a vegetated corridor with Gore Cove Reserve and Smoothey Park to the north west and Badangi Reserve to the north east.

Hydrology: All surface runoff drains to Port Jackson (Sydney Harbour). No creeks or ponds exist on the Island and it is unaffected by urban runoff.

Geology: Hawkesbury Sandstone of medium to coarse grained quartz sandstone with minor shale and laminate lenses and sandstone outcrops.

Soil Landscape: Hawkesbury Soil Landscape consisting of shallow, poor sandy soils, which are highly erosive with low soil fertility. Soils are particularly shallow in the interior. Localised Yellow and Red Podzolic Soils are associated with shale lenses.

Slope: Moderate to steep slopes.

Facilities / Infrastructure: The Gadyan Track (a 0.7km loop) circumnavigates the edge of the Island. It includes interpretative signage, a lookout, a boardwalk and viewing area of Aboriginal rock engravings. The track links with the Gore Cove Track to the north west and the Badangi Track to the north east. The bushland adjoins a recreation area to the north which includes a children's playground, toilets, BBQs and a grassed picnic area with a sea wall and fencing. Two formal tracks lead to the foreshore on the eastern side of the Island. On the western side a boat shed is located along the foreshore just south of the children's playground.

Plant Community:

- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species found along the foreshore and up to 1 km away.
- Kunzea scrub – open-scrub dominated by *Kunzea ambigua* (tick-bush), growing in the elevated centre of the Island with extensive flat stone outcrops on shallow soils. It may not reflect the original composition of the community due to historical disturbance (WW2 search light) / altered fire regime.
- Sandstone Foreshore Scrub – Open-scrub or closed scrub growing on steep sandstone slopes adjacent to the harbour, with extensive sandstone outcrops and cliffs. It is similar to Disclimax Sandstone Scrub, but appears to be a naturally occurring community.
- Refer to Map 1 for the plant communities; Table 1 for common flora species and Table 2 for plant species of special conservation concern in Berry Island Reserve.

Wildlife Habitat:

- Berry Island provides a diverse range of habitat including open forest and scrub, rocky outcrops and intertidal areas of shallow rock pools, sandy beaches and seagrass.
- The Island is part of an important habitat link to nearby bushland areas in Badangi Reserve, Gore Cove and Smoothey Park in Wollstonecraft, and Greendale Park and Holloway Park in Greenwich.
- The intertidal rocky foreshore provides habitat for birds, microbats, insects, mammals, crabs, molluscs and fish at different phases of the tide.
- The reserve is within range for many wildlife species that move between reserves such as the Common Brushtail (*Trichosurus Vulpecula*) and Ringtail possums (*Pseudocheirus peregrinus*), Grey-headed Flying-fox (*Pteropus poliocephalus*), microbats, woodland and sea birds. Since the implementation of regionally coordinated fox baiting around 2000, wildlife such as Brush Turkeys (*Alectura lathami*) have naturally re-colonised. Remnant small range species include skinks, lizards, geckoes, snakes and frogs. Goulds Wattled Bat and the Eastern Bent-wing Bat have been recorded in the reserve.
- The reserve lacks nesting hollows and roosting sites for birds and arboreal mammals due to the lack of mature native trees. Such creatures play an important role in the ecology of the vegetation communities, assisting in pollination, seed dispersal and germination.
- Refer to Table 2 for the fauna species of special conservation concern in Berry Island Reserve.

Condition and Resilience:

- Most of the bushland is in good condition as it is isolated from houses, roads and drainage lines. These factors along with the shape and size of the remnant gives it high long-term resilience and viability. The reserve now requires less maintenance however weed incursions still need to be monitored within the bushland and along walking tracks.
- Since 1980 bush regeneration has transformed the bushland. Native vegetation species are successfully re-establishing through ongoing application of bush regeneration and ecological burning. Core areas have been expanded and native plantings have stabilised bushland edges.
- Native and exotic mesic and vine species require targeted and regular maintenance to manage colonisation / domination in areas of open forest and where fire has been excluded for long periods.
- Since 1998, revegetation along the western side of the grassed picnic area has progressed to improve a wildlife corridor link between Berry Island and Gore Cove Reserve. A vegetated link between the island and Badangi Reserve is limited on the eastern side due to the need to preserve views of the Harbour from the grassed picnic area.
- Efforts are made to keep walkers to the track with temporary fencing and signage. The grassed picnic area / bushland interface is also clearly designated with stone or log edging and mulch.
- Bush regeneration activities are carried out by Council's Bushland Management Team.
- Refer to Map 2 Condition of Bushland and Resilience.

Zone / Classification:

- The bushland is zoned E2 Environmental Conservation under *North Sydney LEP 2013* and is classified public bushland in *SEPP No. 19 Bushland in Urban Areas (*and in the draft SEPP (*Environment)* that will supersede *SEPP 19.*

- A small section of grassland along the reclaimed grassed parkland on the western side has been revegetated to bushland and is zoned RE1 Public Recreation. The island is identified as a Coastal Environment Area and Coastal Use Area under *SEPP (Coastal Management*).

Statement of Significance:
Historic Values
- The bushland is not only an example of past vegetation communities along the Sydney Harbour foreshore but also a legacy of past land management by the traditional Aboriginal custodians, the Cammeraygal, who originally occupied the area. Aboriginals frequented the Island and fine examples of sites and relics can be found including shell middens, axe grinding grooves, engravings and a watering hole. Other signs of Aboriginal presence may exist but remain undiscovered. Places, objects and features of significance to Aboriginal people are protected under the NSW *National Parks and Wildlife Act 1974*.
- Berry Island is an important site for Aboriginal people. It is one of few significant sites in close proximity to the City where Aboriginal cultural heritage is conserved in a natural setting.
- Berry Island formed part of a land grant to Edward Wollstonecraft in 1825. It was acquired by the Berry Estate who by arrangement with the Government, dedicated the island as a nature reserve for public recreation in 1926. Around this time stone was quarried and shell (possibly middens) dug up to make building lime. A stone causeway was built in the 1880s to aid passage during high tide across the isthmus.
- Berry Island forms part of Sydney Harbour which is an outstanding natural and public asset of national significance. The island is a cultural landscape that is historically rare state-wide based on State Heritage Register criteria. Currently the NSW Office of Environment and Heritage is seeking to list the island on the State Heritage Register under the *Heritage Act* for cultural and natural values.
- Berry Island is listed as a heritage landscape in the *North Sydney LEP 2013* Schedule 5 as a landscape heritage item and as part of the "Wollstonecraft Foreshore Reserves" group that includes Badangi Reserve and Gore Cove Reserve.
- Unlisted heritage items are scattered throughout the reserve including stone walls and stairs.

Natural Values
- Berry Island plays a significant role in maintaining biodiversity in the region and assists in conservation of species and habitat function.
- Berry Island is amongst the 'Wollstonecraft reserves' (Smoothey Park, Gore Cove and Badangi reserves) which have been identified as a biodiversity hotspot. This reserve group contains 10 of the 12 vegetation communities known to occur in the local government area (Smith & Smith 2010).
- Angophora Foreshore Forest and Kunzea Scrub are threatened at a local level whilst Sandstone Foreshore Scrub is threatened at a regional level.
- Locally rare flora species include *Acacia longissimi*, *Banksia oblongifolia*, *Eucalyptus paniculata* (Grey Ironbark), *Trachymene incisa*, *Lomandra micrantha* and *Juncus kraussii* (Sea Rush).
- The endangered *Acacia terminalis* subspecies *terminalis* listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* and the NSW *Biodiversity Conservation Act 2016 (BC Act)* occurs in Angophora Foreshore Forest and Sandstone Foreshore Scrub within the reserve.
- The Island forms an important part of the Waverton to Wollstonecraft wildlife corridor, which in-turn links to adjoining bushland in the Lane Cove Council area.
- The reserve provides habitat for a range of wildlife including threatened and declining fauna species. The threatened species below have been recorded in Wollstonecraft and may occur in the reserve: Grey-headed Flying-fox (*Pteropus poliocephalus*) (vulnerable under the BC Act and *EPBC Act)*; Powerful Owl (*Ninox strenua*); Black Bittern (*Ixobrychus flavicollis*) and White-bellied Sea-eagle (*Haliaeetus leucogaster)* all of which are listed as vulnerable under the *BC Act*.
- The Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), listed as vulnerable under the *BC Act* has been recorded at the island. Other recorded bat species in adjoining reserves that are listed as vulnerable under the *BC Act* and which could occur on the island were the Eastern Freetail Bat (*Mormopterus norfolkensis*) and the Southern Myotis (*Myotis macropus*).

Recreation / Education Values
- The reserve is a valuable educational, nature appreciation and bushwalking resource that showcases Aboriginal heritage on iconic Sydney Harbour and is highly accessible due to its loop track and proximity to Wollstonecraft Station. It is also valued as a destination for family outings centred around the adjoining children's playground and grassed picnic area.

Fire History:
- Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity on the island.
- Past burns have resulted in the successful germination of native endemic flora species.
- Planned hazard reduction / ecological broad area burns are conducted from time to time. Refer to Map 3 Fire History and Future Managed Burns.

Threats:
- The limited size of the reserve amplifies vulnerability to fragmentation and edge effects from the surrounding urban environment and limits genetic integrity.
- Native and exotic vines, mesic species and weeds are a serious threat to the stability of resilient cores and long-term viability of biodiversity. Refer to Table 3 for plant species affecting biodiversity and stability of bushland assets.
- Native bats and birds can transport new flora species and weeds into the reserve that have the potential to change its structure over time.
- Areas where bushland is bordered by lawn grass e.g adjoining the grassed picnic area are impacted by exotic grass encroachment.
- Significant visitation to the reserve puts pressure on the track network causing erosion and track widening which is exacerbated during heavy rain. Erosion down slope impacts vegetation and foreshore water quality.
- Informal tracks down steep slopes from the Gadyan Track to the foreshore area facilitates trampling, erosion and weed spread.
- Fishermen who use the foreshore areas leave rubbish including hooks and fishing line and can over harvest protected species. Fallen timber is occasionally removed from bushland and used for lighting fires on the foreshore at night.
- Some areas have been significantly damaged due to trampling and soil compaction during events such as the regular jazz band site in the centre/ north of the island. This area is now lacking understorey plants which hold the soil

together, causing a loss of top soil. Since July 2017 the jazz concert picnics have ceased to be held in the reserve and the area is undergoing rehabilitation.

- Children make tracks and cubbyhouses in the recreated bushland close to the playground and grassed picnic area causing erosion and trampling of the bush. Visitors also trample around rock overhangs and cliff faces.
- Increased drone usage is causing disturbance to fauna that occur in the canopy.
- From time to time, illegal boat storage occurs along the foreshore, damaging vegetation.
- At times, foxes (*Vulpes vulpes*), domestic cats (*Felis cattus*) and off-leash dogs (*Canis lupus familiaris)* are observed in the reserve and along the foreshore. These animals predate, scare and disturb wildlife, pollute with their faeces and spread weed seed. Shorebirds are particularly impacted by dogs off lead.
- Some species of introduced or endemic fauna are very territorial and compete for habitat, limiting species diversity.
- Hybridization, inundation by native competitors, particularly vines and lack of fire pose a significant threat to *Acacia terminalis* subsp. *terminalis*.
- *Phytophthora cinnamomi* (root rot*)* affects the health of the bushland and is widespread in North Sydney.
- Climate change is an ongoing threat. Anticipated impacts include increased threat of bushfire and extreme weather events. Raised sea levels are predicted to inundate shoreline vegetation, eroding the foreshore and destroying Aboriginal middens. Increased temperatures are likely to affect biodiversity and ecosystems, favouring some species over others and changing the structure and function of the bushland. The rate of climate change may be faster than the rate of natural adaptation. Increased temperatures will harm sensitive fauna such as bats, impacting their important ecosystem function.
- Non-passive recreational activities (incl. orienteering; rock climbing; geo-caching, camping and mountain biking) cause substantial damage to native vegetation and soil stability. These activities are prohibited in North Sydney's bushland reserves.

Bushland Management Goals

a. Maintain and enhance biodiversity and habitat for long term ecosystem resilience and function
b. Conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve
c. Strategically restore bushland (prioritise areas of highest resilience)
d. Enhance habitat connectivity
e. Preserve genetic integrity of the vegetation community
f. Manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality
g. Conserve the natural landscape and heritage values
h. Provide for ecologically sustainable recreation needs of the community
i. Implement the strategic fire hazard reduction program and manage fuel loads to protect life, property and endemic biodiversity.

Rehabilitation Principles and Procedures:

General

1. Bush regeneration is a long-term process of staged weed removal to ensure endemic biodiversity, native plant establishment and continued habitat for local wildlife. It relies on site assessments that identify values and how best to restore and enhance ecosystem function and structure. Routine site monitoring, evaluation of field strategies and periodic native flora and fauna surveys inform management priorities over time. Works normally proceed from bush in good condition with high resilience. Degraded areas are a lower priority but the weeds always require containment.

Planning, Evaluation and Review

2. The Bushland Management Team should regularly evaluate bushland rehabilitation plans and the success of field strategies to inform management priorities early.
3. Establish photo points to monitor projects.
4. In the bushland rehabilitation planning process, consider the potential impact of future infrastructure earthworks, or access requirements on bushland, habitats, green corridors or active rehabilitation sites.
5. The Bushland Management Team must approve all contractor project proposals before implementation.
6. All Work, Health and Safety requirements must be adhered to by Council staff, volunteers and contractors before, during and after site works.

Native Flora

7. Record uncommon flora species to determine risk of extinction in the reserve. (Use North Sydney flora survey record template).
8. Prioritise protection / rehabilitation in areas of highest resilience.
9. Buffer areas should protect biodiversity from disturbances caused by fragmentation and edge effects: (a) monitor to identify gaps in buffer vegetation and senescing / restored vegetation and organise replacement planting; (b) where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a medium/long term solution to stop herbaceous weeds and grasses from spreading into bushland; (c) control vines, noxious weeds and other plant species affecting stability of adjoining bushland.
10. When natural regeneration is ineffective, locally source all plant material for supplementary planting to maintain genetic integrity of native vegetation in accordance with Flora Bank Guidelines https://www.greeningaustralia.org.au/florabank. Only plant when natural regeneration is ineffective to boost biodiversity, with the aim to achieve 80% survival rates. Plant in stages, basing species selection on the target vegetation community/structure, successional stage, habitat requirements and physical constraints. This process involves collaboration from Council's nursery supervisor, bush regeneration team, Bushcare volunteers and bush regeneration contractors.
11. In areas lacking diversity and structure; direct seed, transplant and use appropriate tube stock to enhance existing plant communities. When planning a replanting site: (a) prepare a suitable plant list based on rehabilitation objectives and prevailing site condition; (b) allow time for seed collection and propagation (9-12 months ahead of planting); (c) identify where seed harvesting/cuttings will be gathered; (d) prepare area (e.g. reduce density of dominant species on ground layer or mesic species in shrub layer); (e) schedule planting for early Autumn during or after soaking rain.
12. Collect seed of suitable locally rare species from nearby bushland areas, propagate and plant in appropriate areas of the reserve to enhance biodiversity and ensure the long-term viability. For species that are difficult to propagate, explore other methods such as seed scarification / raking treatment / seedbank translocation etc.
13. Implement a canopy replacement program in areas where remnant canopy is absent, senescing or failing to regenerate or where non-endemic trees have been removed.
14. Do not encourage large canopy species on unstable areas or under electricity easements where they cannot be supported and may cause future hazards.
15. Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team: (a) pile burn where appropriate; (b) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (c) reduce seedbank of dominant natives - control seeding cycle; (d) lightly disturb mulch / organic matter to stimulate regeneration; (e) increase seed bank of uncommon/ rare species with brush matting techniques (collect from donor sites where seed removal will not affect biodiversity); (f) propagate senescing plant species at risk of extinction in the reserve (i.e. due to an inadequate fire regime) and plant tubestock in suitable locations.
16. When planting along bushland edges, select species in consideration of their potential to compliment views from residential or public viewing areas and design to enhance habitat / connectivity (e.g. for small birds).
17. Conserve and protect naturally regenerating / colonising canopy species providing they are in sustainable locations.

Weeds and Pathogens

18. Implement the *Biosecurity Act 2015* consistently and effectively, in accordance with bushland management objectives and processes.
19. Residential properties adjoining bushland can contribute to weed spread. Monitor and address invasive garden plants in accordance with the *Biosecurity Act 2015* and promote Council's Native Havens / Habitat Stepping Stones Programs.
20. Ongoing weed management should: (a) prioritise good bush areas; (b) target species threatening stability e.g. vines, woody or canopy weeds; (c) interrupt seed cycle of target species, especially annual and grass weeds; (d)

prioritise areas where plant diversity is most affected by mesic shift and vines. (In consideration of fauna habitat needs, schedule works from Autumn through Winter before bird breeding season.)

21. Monitor sites to identify, report and manage early stages of weed outbreaks or shifts in plant species assemblages likely to become detrimental to biodiversity. Manage according to the issues they raise. Report other threats to ecosystem function.
22. All compost weed material is removed off site.
23. Retain weeds on highly erodible or dangerous slopes and use methods of weed suppression that will not create potential for soil erosion. Incorporate abseiling activities on cliff faces to remove weeds that are a constant weed seed source.
24. Strategically remove non-endemic or exotic trees that interfere with ecosystem function or structure. Assess for habitat potential before they are de-limbed.
25. Consider all potential impacts of herbicide and proximity to water when determining suitability for weed control.
26. Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Native Fauna and Habitat

27. Record wildlife sightings and observations in Council's Wildlife Watch database. Share this information with NSW BioNet and the Commonwealth's ALA.
28. Identify and protect nesting, roosting and breeding sites of threatened, vulnerable or locally significant fauna.
29. Minimise disturbance to wildlife, enhance habitat where needed and improve the condition/connectivity of wildlife corridors between adjoining reserves.
30. Protect, maintain and restore quality fauna foraging habitat using a diverse mix of endemic native species. Retain habitat features such as fallen and standing dead wood, rock piles, hollow-bearing trees, natural debris, dead standing trees, forest litter, logs and branches.
31. Short-term strategies to maintain fauna habitat provided by mesic and weed species may require retention yet containment of dense areas of weed, vines and mesic species. In the longer-term, aim to establish a self-maintaining fabricated vegetation community in these areas composed of native species adapted to changed site conditions (abiotic factors) that enhance biodiversity and habitat availability.
32. Before any unfavourable trees are de-limbed, assess for habitat potential e.g. tree hollows.
33. Where suitable, install fauna nesting boxes and create hollows in suitable dead trees to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed.
34. Investigate financial opportunities to invest in habitat enhancing research and developing methodologies.

Threatened species

35. Identify threatened or endangered, rare or locally rare species of flora and fauna. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs.
36. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened species.

Ecological Burns

37. Hazard reduction and ecological burns are based on a strategic burn program consistent with the Mosman North Sydney Willoughby Bushfire Risk Management Plan. Ecological burn regimes are to be in a mosaic pattern to improve bushland function and biodiversity. Areas of high bushfire risk or core ecological resilience are usually prioritised in the annual burn program.
38. Maintain land management zones where bush adjoins residences and implement site stabilisation measures.
39. Over the next 10 years, prioritise prescribed burns at sites at risk of diminishing flora diversity.
40. For pre-fire preparation: (a) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (b) reduce seedbank of dominant natives to control seeding cycle; (c) increase seed bank of uncommon/ rare species with brush matting (collect from donor sites where seed removal will not affect biodiversity).
41. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds.
42. Implement post-fire monitoring and bush rehabilitation strategies. Monitor regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time period post-burn.

Pests and Illegal Activity

43. Monitor and control feral or aggressive/territorial fauna activity, cats, unleashed dogs and illegal activity with appropriate measures e.g. trapping, community education programs, penalty notices or camera observation. If applicable, manage reserves in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 and relevant North Sydney Council policies.
44. Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
45. Monitor the impacts of drones and implement management measures if required.
46. Address instances of unauthorised activities in bushland incl. orienteering; rock climbing; geocaching; mountain biking; camping etc.

Tracks, Water and Erosion

47. Close informal tracks to prevent damage to habitat; impede feral animals and reduce weed spread.
48. Implement track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, track widening and degrading track conditions.
49. Assess the need for additional directional and / or interpretive signage.
50. Stabilise steep slopes, ephemeral flow lines and highly erosive areas using local native species, particularly ground covers, to re-establish appropriate vegetation community structure where natural regeneration is poor or absent. Install sedimentation fences, terracing, coir logs, matting or other appropriate measures where needed to stabilise washout areas and improve access and safety.
51. Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater tolerant natives.

Aboriginal and non-Aboriginal Heritage

52. All identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1974* and *Heritage Act 1977*.
53. Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual.
54. As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance.
55. Bushland management staff consult with the Aboriginal Heritage Office or Council's heritage officer prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey.
56. Discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol.

Community

57. Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
58. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
59. Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan.
60. When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council.

Reserve Specific Rehabilitation Actions

Priorities will be given to programs with long term benefit to the reserve or where natural assets are at greatest risk to avert irreversible deterioration or species loss.

Flora and Threatened Species

1. Work in collaboration with the Saving Our Species program managed by the NSW Office of Environment and Heritage and the NSW Herbarium to identify, monitor and protect *Acacia terminalis* subsp. *terminalis* and contribute to the preparation of best practice guidelines for the species.
2. Continue to expand and improve buffer plantings adjoining the grassed picnic area.
3. Monitor previous Boneseed (*Chrysanthemoides monilifera* subsp*. monilifera*) locations for regrowth.
4. Monitor termite activity and implement management controls as necessary.

Fauna

5. Make investigations into the possible sighting of the Broad-headed snake (*Hoplocephalus bungaroides*) in 1997 and undertake an assessment if warranted.
6. Promote appropriate management of domestic pets as the reserve adjoins declared Wildlife Protection Areas in Gove Cove Reserve and Badangi Reserve.
7. Investigate zoning Berry Island as a 'Wildlife Protection Area' under the *Companion Animals Act, 1998.*
8. Conserve microbat habitat and utilise opportunities to add / augment nesting hollows.

Tracks, Water and Erosion

9. Use sedimentation fencing, rope fencing, wooden logs, coir logs, fallen timber, brush matting, sandstone blocks and signage as a management tool for erosion and to define edges between the bushland, tracks and lawn interfaces.
10. Rationalise informal tracks and restrict access to environmentally or culturally sensitive areas (e.g. western foreshore below engraving; old central track).
11. Do not permit any events to occur within the bushland zone unless impacts are determined to be minimal and manageable.

Heritage

12. Assist the NSW Office of Environment and Heritage preparing documentation to support the listing of Berry Island on the State Heritage Register.

Illegal Activity

13. Regularly inspect popular fishing and illegal kayak storage locations and take appropriate action to discourage damage to the reserve and its values.
14. Dinghy and kayak storage is prohibited with the reserve except for where permissible in Council's Small Watercraft Storage Strategy.
15. Report all illegal drug and alcohol use locations and associated damage to Council's Ranger team. All affected areas are to be listed on Council's register for such sites and collaboration is required with the Police to implement management strategies.
16. Monitor and report unauthorised activities (e.g. unleashed dogs; orienteering events; rock climbing; geocaching; mountain biking; camping etc) and address impacts.

Ecological Burns

17. Refer to Map 3 Fire History and Future Managed Burns.

Community

18. Plan replanting projects to coincide with National Tree Day.
19. Engage with local residents to promote bushland-friendly practices and encourage participation in Bushcare Programs

Capital Projects

20. Assess the heritage significance of unassessed items within the park and prepare appropriate management measures.
21. Prepare a landscape plan (in conjunction with Council Parks and Gardens and in consultation with residents and users) for the grassed picnic area that includes enhancing vegetation / wildlife corridor linkages to the Gore Cove Reserve and Badangi Reserve.
22. Upgrade the Gadyan Track including installing boardwalks, edging, stairs / ramps and seating to improve accessibility and safety. Upgrades will also manage erosion, trampling of the bush and protection of Aboriginal cultural sites.
23. Investigate enhancing signage to improve educational opportunities and reduce impacts on natural and cultural values e.g. signage about fauna habitat and the impacts of dogs as well as signage indicating that dinghy storage is illegal along the foreshore.
24. Consider installing barriers in areas where dinghies and kayaks are illegally stored to deter the illegal activity.

Map 1: Vegetation Communities (NAS 2010)

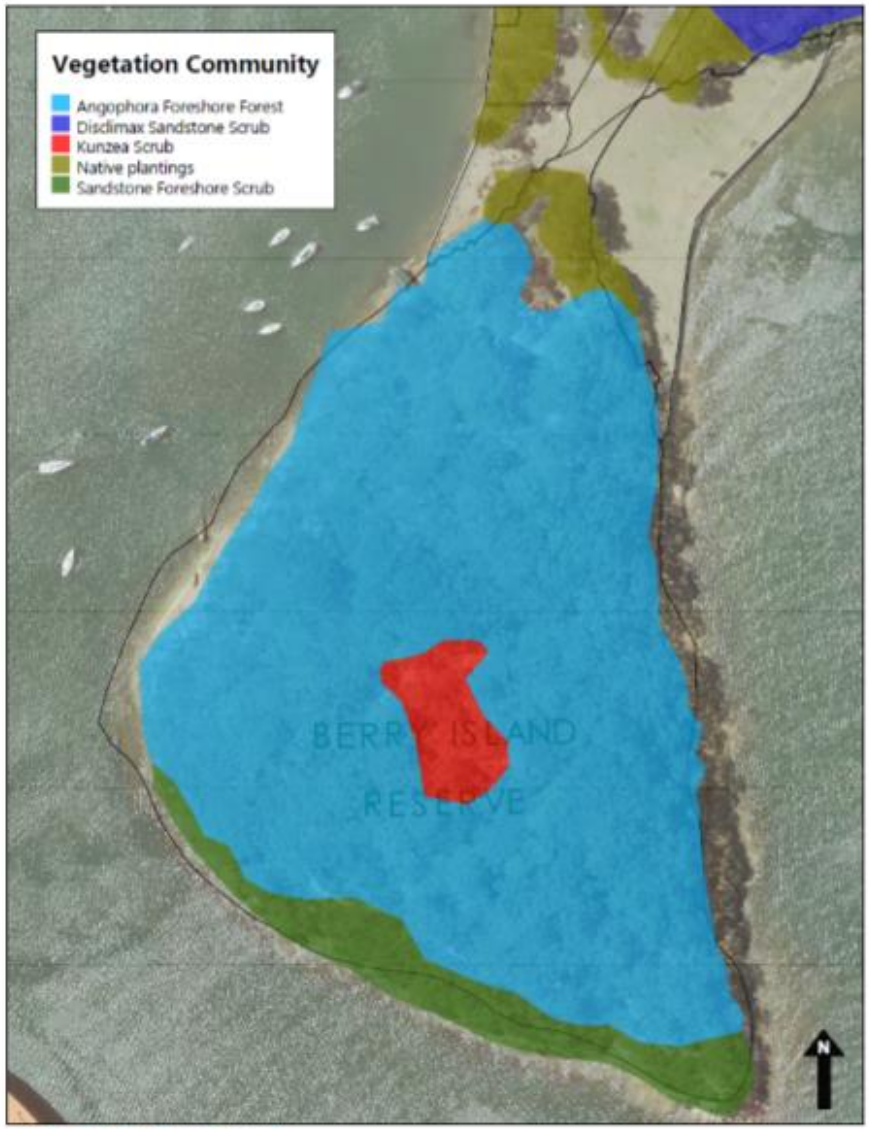
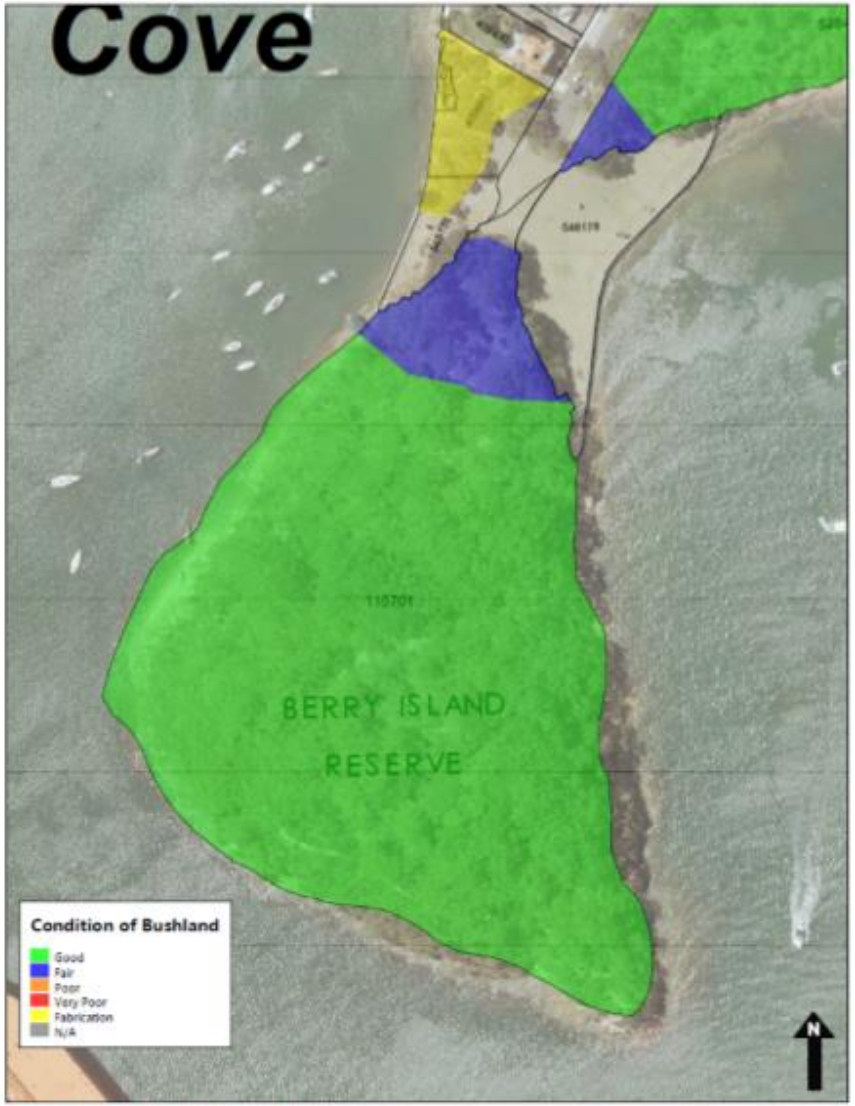


Table 1: Common species recorded in Berry Island Reserve

Scientific name	Common name	Vegetation communities
Allocasuarina littoralis	Black She-oak	AF; DS; FS; KS
Angophora costata	Sydney Red Gum	AF; DS; FS; KS
Banksia integrifolia	Coast Banksia	AF; DS; FS; KS
Banksia serrata	Old Man Banksia	AF; DS; FS; KS
Breynia oblongifolia	Coffee Bush	AF; DS; FS; KS
Calochlaena dubia	Common Ground Fern	AF; DS; FS
Commelina cyanea	Scurvy Weed	AF; DS; FS; KS
Crowea saligna		AF; DS; FS
Dianella caerulea	Blue Flax Lily	AF; DS; FS; KS
Dianella revoluta	Spreading Flax Lily	AF; DS; FS; KS
Echinopogon caespitosus	Tufted Hedgehog Grass	AF; DS; FS; KS
Elaeocarpus reticulatus	Blueberry Ash	AF; DS; FS; KS
Entolasia stricta	Wiry Panic	AF; DS; FS; KS
Epacris longiflora	Fuchsia Heath	AF; DS; FS
Eragrostis brownii	Brown's Lovegrass	AF; KS
Eucalyptus piperita	Sydney Peppermint	AF; DS
Ficus rubiginosa	Port Jackson Fig	AF; DS; FS; KS
Glochidion ferdinandi	Cheese Tree	AF; DS; FS; KS
Grevillea linearifolia	White Spider-flower	AF; DS; FS; KS
Hibbertia dentata	Twining Guinea Flower	AF; DS; FS
Kunzea ambigua	Tick Bush	AF; DS; FS; KS
Lomandra longifolia	Spiny-headed Mat-rush	AF; DS; FS; KS
Microlaena stipoides	Weeping Grass	AF; DS; FS; KS
Monotoca elliptica	Tree Broom-heath	AF; DS; FS; KS
Notelaea longifolia	Large Mock-olive	AF; DS; FS; KS
Oplismenus aemulus	Basket Grass	AF; DS; FS; KS
Pandorea pandorana	Wonga Wonga Vine	AF; DS; FS; KS
Paspalidium distans		AF; DS; KS
Pittosporum revolutum	Rough-fruit Pittosporum	AF; DS; KS
Pittosporum undulatum	Pittosporum	AF; DS; FS; KS
Poa affinis		AF; DS; FS; KS
Pteridium esculentum	Bracken	AF; DS; FS; KS
Smilax glyciphylla	Sweet Sarsaparilla	AF; DS; FS
Stephania japonica	Stephania	AF; DS; FS
Zieria smithii	Sandfly Zieria	AF; DS; KS

AF: Angophora Foreshore Forest **DS: Disclimax Sandstone Scrub**
FS: Sandstone Foreshore Scrub **KS: Kunzea Scrub**

Map 2: Condition of Bushland and Resilience (2018)



North Sydney Council

Condition of Bushland and Resilience Key

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural recruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience – limited regeneration
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed sandstone)

Map 3: Fire History & Future Managed Burns

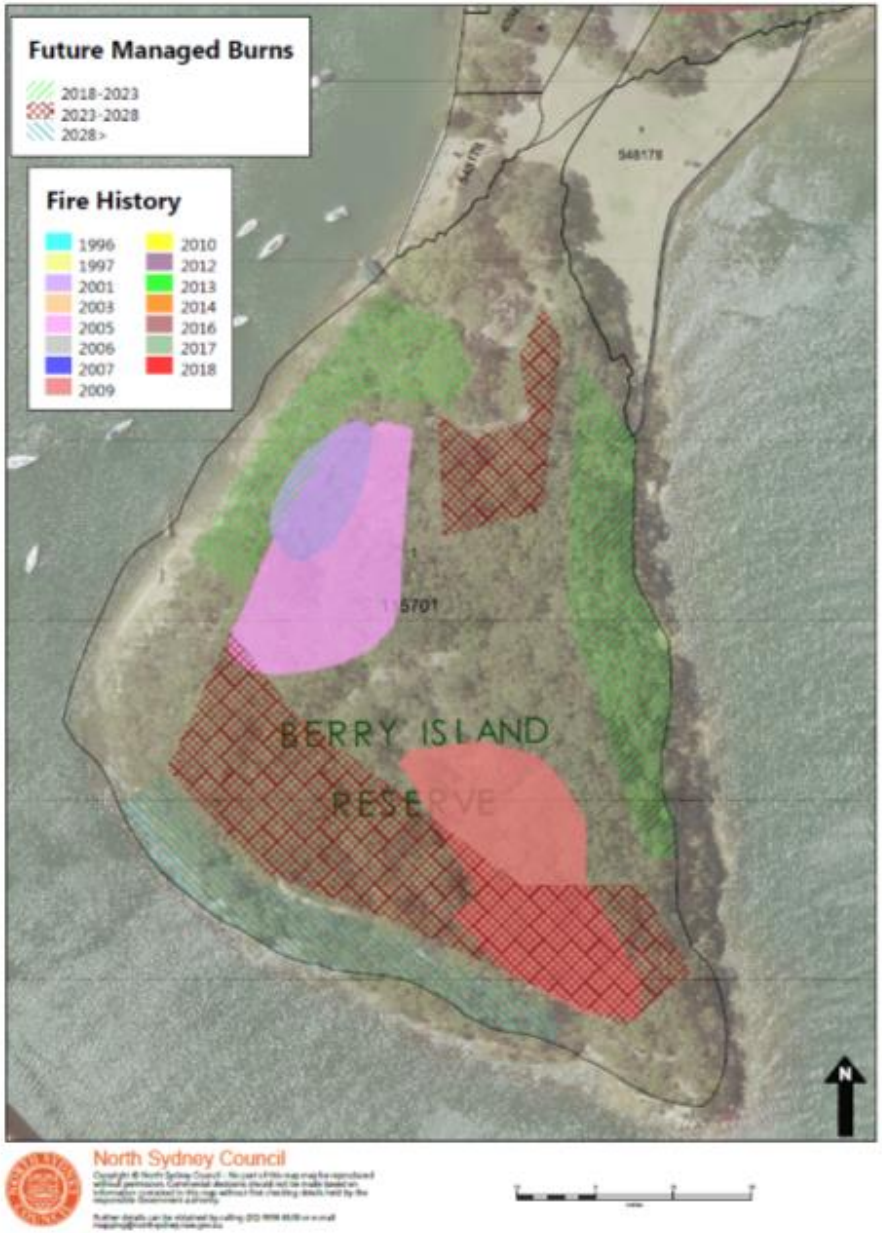


Table 2: Species of Special Conservation Concern

COMMON NAME	SCIENTIFIC NAME	CAUSE OF DECLINE
King Parrot Chestnut Teal Pacific Black Duck Australian Darter Little Wattlebird Goulds Wattled Bat Plumed Whistleing Duck White-faced Heron Eastern Koel Little Penguin Eastern Water Skink Bar-sided Skink White-bellied Sea Eagle Eastern Water Dragon Little Pied Cormorant Eastern Bent-wing Bat Powerful Owl Black Cormorant Little Black Cormorant Australian Pied Cormorant Crimson Rosella Eastern Rosella Tawny Frogmouth Ring-tail Possum White-browed Scrubwren Little Tern Greater Crested Tern Blue-tongue Lizard Sacred Kingfisher	*Alisterus scapularis* *Anas castanea* *Anas superciliosa* *Anhinga novaehollandia* *Anthochaera chrysoptera* *Chalinolobus gouldii* *Dendrocygna arcuata* *Egretta novaehollandiae* *Eudynamys orientalis* *Eudyptula minor* *Eulamprus quoxii* *Eulamprus tenuis* *Haliaeetus leucogaster* *Intellagama lesueurii* *Microcarbo melanoleucos* *M.schreibersii oceanensis* *Ninox strenua* *Phalacrocorax carbo* *Phalacrocorax sulcirostris* *Phalacrocorax varius* *Platycercus elegans* *Platycercus eximius* *Podargus strigoides* *Pseudocheirus peregrinus* *Sericornis frontalis* *Sternula albifrons* *Thalasseus bergii* *Tiliqua scincoides* *Todiramphus sanctus*	- Reduction of Tall Eucalypt Forest in North Sydney; - Loss of habitat /Declining canopy cover - Reduction and degradation of bushland habitat in North Sydney; - Ecosystem degradation general loss of species diversity; Urban ecology expansion is beneficial to larger common birds; - Fragmented populations confined to small native bushland remnants are at risk of local extinction; - Lack of constant food source; - Predation from cats, dogs and urban predatory birds such as Currawongs and butcher birds. - Scarcity of natural breeding hollows - Altered stormwater system causing habitat loss; stormwater pollution; Sedimentation; Chytrid fungus; & Isolation of small populations.
Sunshine Wattle Red Bloodwood Native Fuscia Cherry Ballart Boobialla Golden Geebung Trachymene	*Acacia terminalis ssp. terminalis* *Corymbia gummifera* *Epacris ericoides* *Exocarpus cupressiformis* *Myoporum boninense ssp. australe* *Persoonia laurina* *Trachymene incisa*	- Altered fire regimes; - Ecosystem degradation; general loss of species diversity; - Fragmented populations confined to small bushland remnants; - Lack of connectivity between bushland limits pollination pathways and seed dispersal - Community use pressures - Stormwater pollution, erosion and sedimentation

Table 3: Plant species affecting biodiversity and stability of Bushland

Common Name	Botanic Name	Habit	Common Name	Botanic Name	Habit
African love grass	*Eragrostis curvula*	Grass/Ground layer	Purple top	*Verbena bonariensis*	Ground layer
Barbed wire grass	*Cymbopogon refractus*	Grass/Ground layer	Thick head	*Crassocephalum crepidioides*	Ground layer
Couch	*Cynodon dactylon*	Grass/Ground layer	Thistle sp	*Cirsium vulgare*	Ground layer
Crows foot grass	*Eleusine indica*	Grass/Ground layer	Trad	*Tradescantia fluminensis*	Ground layer
Ehrharta	*Ehrharta erecta*	Grass/Ground layer	Turkey rhubarb	*Acetosa sagittatus*	Ground layer
Foxtail grass	*Pennisetum alopecuroides*	Grass/Ground layer	Balloon vine	*Cardiospermum grandiflorum*	Climber
Kikuyu	*Pennisetum clandestinum*	Grass/Ground layer	Cape Ivy	*Delairea odorata*	Climber
Weeping grass	*Microlaena stipoides*	Grass/Ground layer	Honeysuckle	*Lonicera japonica*	Climber
Palm grass	*Setaria palmifolia*	Grass/Ground layer	Madeira vine	*Anredera cordifolia*	Climber
Parramatta grass	*Sporobolus indicus*	Grass/Ground layer	Morning glory coastal	*Ipomea cairica*	Climber
Paspalum	*Paspalum dilatatum*	Grass/Ground layer	Morning glory	*Ipomea indica*	Climber
Red natal grass	*Melinis repens*	Grass/Ground layer	Moth vine	*Araujia sericifolia*	Climber
Summer grass	*Digitaria sanguinalis*	Grass/Ground layer	Corky Passionfruit	*Passiflora suberosa*	Climber
Asthma weed	*Parietaria judaica*	Ground layer	Box Elder	*Acer negundo*	Canopy/Shrub
Asparagus fern	*Protasparagus aethiopicus*	Ground layer	African olive	*Olea europaea ssp. cuspidata*	Canopy/Shrub
Bidens	*Bidens pilosa*	Ground layer	Castor oil plant	*Ricinus communis*	Canopy/Shrub
Scurvy weed	*Commelina cyanea*	Ground layer	Camphor laurel	*Cinnamomum camphora*	Canopy/Shrub
Crofton	*Ageratina adenophora*	Ground layer	Cassia	*Senna pendula*	Canopy/Shrub
Fishbone fern	*Nephrolepis cordifolia*	Ground layer	Cheese Tree	*Glochidion ferdinandi*	Canopy/Shrub
Fleabane	*Conyza spp*	Ground layer	Coral Tree	*Erythrina sp*	Canopy/Shrub
Mist flower	*Ageratina riparia*	Ground layer	Lantana	*Lantana camara*	Canopy/Shrub
Montbretia	*Crocosmia X crocosmiiflora*	Ground layer	Ochna	*Ochna serrulata*	Canopy/Shrub
Mother of millions	*Bryophyllum delagoense*	Ground layer	Port Jackson Fig	*Ficus rubiginosa*	Canopy/Shrub
Mustard weed	*Brassica spp.*	Ground layer	Sweet Pittosporum	*Pittosporum undulatum*	Canopy/Shrub
Paddys lucerne	*Sida rhombifolia*	Ground layer	Small leaf Privet	*Ligustrum sinense*	Canopy/Shrub
Pampas lily of the valley	*Salpichroa organifolia*	Ground layer	Large leaf Privet	*Ligustrum lucidum*	Canopy/Shrub
Pareuvian lily	*Alstroemeria pulchella*	Ground layer	Wild tobacco	*Solanum mauritianum*	Canopy/Shrub

2.1.4 Cremorne Reserve (Woolwarra-jeung) Bushland Rehabilitation Plan

Description

Size: Cremorne Reserve 4.2 Ha

Access: Cremorne Reserve is accessed via Bogota Avenue, Milson Rd, Cremorne Road, Kareela Rd, Hodgson Avenue and Bromley Avenue, Cremorne Point.

Ownership: Crown land

Catchment: Port Jackson

Configuration / Connectivity: Cremorne Reserve comprises a very long and narrow foreshore reserve fringing both sides of a peninsula bounded by Sydney Harbour on the foreshore side and residential development. Robertsons Point at the tip of the peninsula forms the largest remnant in this reserve that is connected to vegetation along the foreshore of the peninsula to Reid Park in Mosman. Shell Cove abuts the reserve to the west and Mosman Bay to the east.

Hydrology: All surface water drains to Sydney Harbour directly off the narrow peninsula. No creek lines exist within the reserve. Hydrology has been extensively altered whereby the reserve receives surface flow and stormwater from the adjoining residential development up slope.

Geology: Hawkesbury Sandstone of medium to coarse grained quartz sandstone with minor shale and laminate lenses and sandstone outcrops.

Soil landscape: Hawkesbury Sandstone Landscape consisting of shallow, poor sandy soils, highly erosive with low soil fertility. Localised Yellow and Red Podzolic Soils are associated with shale lenses. Some areas have been significantly disturbed, destroying the original soil profile due to fill from past construction works up slope.

Slope: Moderate to steep slopes.

Facilities / Infrastructure: A 3 km circuit walk with interpretative signage extends from Cremorne Point Wharf to Cremorne Reserve and Robertons Point Lookout which provide beautiful views of Mosman Bay, Sydney Harbour and the city skyline. Robertsons Point Lighthouse still operates and is located at the very tip of Robertsons Point. MacCallum Seawater Swimming Pool is located on the western side of the peninsula. An amenities block, bubblers, benches, children's playground, night lighting and picnic areas are located at Robertsons Point which is supplied by electricity, water and sewerage infrastructure. Benches are also located at intervals along the circuit walk. A bin for dog waste and bags is provided at the Bogota Avenue and Robertson Point end of the reserve. Within the reserve, there is extensive stormwater and sewerage infrastructure that services the adjoining residential development e.g. sewerage pipes are located below the sections of the circuit walk.

Plant Community:
The areas of Cremorne Reserve zoned E2 Environmental Conservation comprise the following plant communities:
- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species found along the foreshore.
- Disclimax Sandstone Scrub – an altered community of open to closed scrub, or a forest of mixed and variable composition due to disturbance and lack of fire.
- Mixed native and exotic plantings, formal lawns and gardens.
- Refer to Map 1 for the plant communities; Table 1 for common flora species and Table 2 for plant species of special conservation concern in Cremorne Reserve

Wildlife Habitat:
- Cremorne Reserve provides a diverse range of habitat including open forest and open and closed scrub, rocky outcrops and foreshore, and dense weed.
- The reserve is part of an important habitat link to nearby bushland areas that are situated along the foreshore of Sydney Harbor and its tributaries, in particular Reid Park in Mosman.
- The reserve is within range for many wildlife species that move between reserves such as the Common Brushtail (*Trichosurus Vulpecula*) and Ringtail possums (*Pseudocheirus peregrinus*), bats, woodland and water birds (some of which are migratory).
- A smaller range of birds have been recorded than in larger reserves of the LGA due to the fragmentation and narrowness of Cremorne Point bushland.
- Dense weed thickets, of which there is very little now, provide important habitat for small birds such as wrens.
- Larger birds are more common to this reserve due to the altered state of bushland structure/diversity and its interconnectedness with open space lawn areas.
- Although larger birds may freely move between other areas by using the scattered canopy of residential and street trees, fauna using the midstorey and understorey for habitat and shelter (including skinks, lizards, geckoes, snakes and frogs) are significantly limited from moving freely to other bushland areas of considerable size.
- Over the past 5-10 years, wildlife such as the Brush Turkeys (*Alectura lathami*) and the Eastern Water Dragons have naturally re-colonised.
- The reserve lacks nesting hollows and roosting sites for birds and arboreal mammals due to the lack of mature native trees. Such creatures play an important role in the ecology of the vegetation communities, assisting in pollination, seed dispersal and germination.
- Little penguins (*Eudyptula minor*) from the endangered population at Manly Point (listed under the NSW *Biodiversity Conservation Act 2016)* are occasionally seen feeding in Mosman Bay on the eastern side of Cremorne Reserve. A Leopard seal (*Hydrurga leptonyx*) and Southern elephant seal (*Mirounga leonina*) have also been seen from time to time.
- Refer to Table 2 for the fauna species of special conservation concern found in Cremorne Reserve.

Condition and Resilience:
- The bushland of Cremorne Reserve has low long-term resilience and viability as the bushland area is so limited, narrow, fragmented and degraded making it vulnerable to weed invasion and the deteriorating effects of stormwater runoff. The bushland with highest resilience is at Robertsons Point as it is not affected by stormwater from residential areas and is the most in-tact remnant in the reserve.

- The reserve contains large areas of lawn that invades adjoining bushland to varying degrees. Lawn areas are generally upslope of bushland which aids their spread.
- Various historic plantings including but not limited to Canary Island Date Palms (*Phoenix canariensis*), Brush Box (*Lophostemon confertus*) and Coral Tree (*Erythrina x sykesii*) occur along the foreshore and inhibit the regeneration due to shading, bulk and competition for soil moisture.
- The impacts of fill as well as stormwater and occasional sewerage pipe leaks have a significant impact on soil structure, nutrient levels and moisture, limiting unassisted native plant regeneration.
- Some exposed sandstone outcrops and cliffs demonstrate areas with high resilience and more intact soil structure further down slope.
- Native and exotic mesic and vine species require targeted and regular maintenance to manage colonisation / domination in areas of open forest and where elevated soil moisture and nutrient conditions have excluded fire for long periods.
- Council and the community have worked to transform the bushland over the last 20 years. Native plant species and vegetation community structure are successfully re-establishing through ongoing application of bush regeneration, replanting and ecological burning. The limited core areas are slowly expanding, native plantings are stabilising reserve edges, whilst endemic middle and upper canopy trees are continuing to slowly evolve.
- Bush regeneration activities are carried out by Council's Bushland Management Team, bush regeneration contractors (since 1997), the volunteer Cremorne Point Bushcare Group (since 1993) and community members involved in the Adopt-a-Plot program.
- Refer to Map 2 Condition of Bushland and Resilience.

Zone / Classification:
- The bushland in Cremorne Reserve is zoned E2 Environmental Conservation under the *North Sydney LEP 2013.* It is classified public bushland in *SEPP No. 19 Bushland in Urban Areas (*and in the draft SEPP (*Environment)* that will supersede *SEPP 19).*
- The areas zoned E2 comprise three separate parcels of land, one at Robertons Point and the other two on either side of the peninsula in the northern sections. These parcels of land are interlinked with land zoned RE1 Public Recreation.
- The reserve is identified as a Coastal Environment Area and Coastal Use Area under *SEPP (Coastal Management*).

Statement of significance:
Historic Values
- The bushland in this Reserve is a legacy of past land management by the traditional Aboriginal custodians, the Cammeraygal people, who originally occupied the area. The original inhabitants called Cremorne Point Woolwarra-jeung at the time of European settlement. Shell middens and rock engravings are represented along the foreshore. Other signs of Aboriginal presence may exist but remain undiscovered. Places, objects and features of significance to Aboriginal people are protected under the NSW *National Parks and Wildlife Act 1974*.
- In 1823, 86 acres including Cremorne Point were granted to a Scottish watchmaker, James Robertson. In the mid 1850's a section of Cremorne Point was turned into an amusement park called Cremorne Gardens. After six years, the gardens closed and in 1891 the land was sold for housing with the exception of land 100 feet above high water mark which was declared a public reserve in 1905. Cremorne Reserve is the most substantial example in North Sydney of the State-imposed 100-foot reservation that applied from 1828 and the court action/Parliamentary inquiry in the 1890's that led to the rules' implementation.
- Robertson's Point Lighthouse was constructed in 1910 and is still operational.
- Unlisted historic relics can be found within the reserve.
- Cremorne Reserve and Robertsons Point are listed as a heritage landscape on the *North Sydney LEP 2013*.

Natural Values
- Cremorne Reserve plays a significant role in maintaining biodiversity in the region and assists in conservation of species and habitat function.
- The reserve connects with other reserves along the foreshore (Reid Park Mosman) to provide a significant wildlife corridor in a highly urbanised setting.
- Angophora Foreshore Forest and Disclimax Sandstone Scrub are threatened at a local level due to their limited extent.
- Locally rare species including *Eucalyptus haemastoma* and *Grevillea speciosa* occur in the Reserve.
- The reserve provides habitat for a range of wildlife including threatened and declining fauna species. The following species listed as vulnerable under the BC Act have been recorded in the reserve: Powerful owl (*Ninox strenua*); the Grey-headed flying-fox (*Pteropus poliocephalus*) (also listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act)*; the Glossy black Cockatoo (*Calyptorhynchus lathami*), and White-bellied Sea-eagle (*Haliaeetus leucogaster),* the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) and the Southern Myotis (*Myotis macropus*). The Eastern Freetail Bat (*Mormopterus norfolkensis*) listed as vulnerable under the *BC Act* has been recorded in other foreshore reserves and could occur in Cremorne Reserve.
- The endangered *Acacia terminalis* subspecies *terminalis* listed under the Commonwealth *EPBC Act* and the NSW *BC Act* could occur within the reserve as it is known to occur in Angophora Foreshore Forest, and Disclimax Sandstone Scrub.

Recreation / Education Values
- Cremorne Reserve is a high-profile reserve that provides a valuable educational, nature appreciation and bushwalking destination that is highly accessible due to the track network and proximity to ferry, bus and car transport options. The bushland that lines the public foreshore of Sydney Harbour is an iconic natural asset of national significance.
- Cremorne Reserve is a significant tourist attraction, the reserve is regularly used by large groups, attracting both international and local visitors.

Fire History:
- Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity in Cremorne Reserve.
- Past pile burns have resulted in limited germination of native endemic flora species.

- Planned hazard reduction / ecological broad area burns may be conducted from time to time. Refer to Map 3 Fire History and Future Managed Burns.

Threats:

- The small size and narrow shape of Cremorne Reserve amplifies its vulnerability to fragmentation and edge effects. There are 125 residential properties adjoining the reserve, many of which are apartments.
- Impacts from adjoining residential properties that facilitate weeds include garden escapes and dumping of garden clippings into the bushland. Sewage leaks from private connections and Sydney Water mains pollute the reserve. Unauthorised/historic private stormwater outlets increase moisture and nutrification, limiting capacity for unassisted natural regeneration. Runoff from hard surfaces and irrigation increase nutrient loads, moisture and erosion on the slopes below. Garden fertiliser also leaches into the bush increasing nutrients.
- Due to the high value the community places on views, it can be very difficult to establish tree canopy in some areas due to resistance. Some residents resort to tree and vegetation vandalism to create or maintain views.
- Visitor impacts include trampling of bushland next to the children's playground at Robertsons Point, along designated walking tracks and within bushland where informal tracks have been created to access the foreshore for views or illegal storage of watercraft. Bushland trampling destroys the vegetation and exacerbates soil erosion. Trampling of bushland is widespread during New Year's Eve celebrations.
- Extensive fill-dumping over many decades from adjoining development and infrastructure significantly compromises soil stability and structure, seedbank viability and bushland resilience.
- Native and exotic vines, mesic species and weeds are a serious threat to the stability of resilient cores and long-term viability of biodiversity. Fire has been excluded from some areas of the reserve for a long time favouring mesic species. (Refer to Table 3 for plant species affecting biodiversity and stability of bushland assets).
- There is a lack of endemic canopy trees in the reserve. Various historic plantings including Canary Island date palms (*Phoenix canariensis*) and Coral tree (*Erythrina x sykerii*) extend along the foreshore and inhibit the regeneration of endemic bushland species.
- Areas where bushland is bordered by lawn grass are impacted by exotic grass encroachment.
- *Phytophthora cinnamomi* (root rot*)* affects the health of the bushland and is widespread.
- At times, foxes (*Vulpes vulpes*), domestic cats (*Felis cattus*) and off-leash dogs (*Canis lupus familiaris)* are observed in the reserve and along the foreshore. These animals predate or scare wildlife, pollute with their faeces and spread weed seed. Foreshore birds are particularly impacted by dogs off lead.
- Some species of introduced, endemic or non-endemic birds are very territorial and complete for habitat, limiting species diversity.
- Native bats and birds can introduce new flora species and weeds that have the potential to change vegetation structure over time.
- Inappropriate weed removal can reduce fauna habitat with greater impacts on short range species and small birds.
- Artificial night lighting from adjoining residences can detrimentally affect nocturnal fauna, especially some microbat species.
- Increased drone usage is causing disturbance to fauna that occur in the canopy.
- Climate change is an ongoing threat. Anticipated impacts include increased threat of bushfire and extreme weather events. Raised sea levels are predicted to inundate shoreline vegetation, eroding the foreshore and destroying Aboriginal middens. Intensified storm events will result in higher volumes of of stormwater runoff which is likely to result in erosion to drainage lines. Increased temperatures are likely to affect biodiversity and ecosystems, favouring some species over others and changing the structure and function of the bushland. The rate of climate change may be faster than the rate of natural adaptation. Increased temperatures will harm sensitive fauna such as bats, impacting their important ecosystem function.
- Non-passive recreational activities (incl. orienteering; rock climbing; geo-caching; camping and mountain biking) cause substantial damage to native vegetation and soil stability. These activities are prohibited in North Sydney's bushland reserves.

Bushland Management Goals

a. Maintain and enhance biodiversity and habitat for long term ecosystem resilience and function
b. Conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve
c. Strategically restore bushland (prioritise areas of highest resilience)
d. Enhance habitat connectivity
e. Preserve genetic integrity of the vegetation community
f. Manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality
g. Conserve the natural landscape and heritage values
h. Provide for ecologically sustainable recreation needs of the community
i. Implement the strategic fire hazard reduction program and manage fuel loads to protect life, property and endemic biodiversity

Rehabilitation Principles and Procedures:
General

1. Bush regeneration is a long-term process of staged weed removal to ensure endemic biodiversity, native plant establishment and continued habitat for local wildlife. It relies on site assessments that identify values and how best to restore and enhance ecosystem function and structure. Routine site monitoring, evaluation of field strategies and periodic native flora and fauna surveys inform management priorities over time. Works normally proceed from bush in good condition with high resilience. Degraded areas are a lower priority but the weeds always require containment.

Planning, Evaluation and Review

2. The Bushland Management Team should regularly evaluate bushland rehabilitation plans and the success of field strategies to inform management priorities early.
3. Establish photo points to monitor projects.
4. In the bushland rehabilitation planning process, consider the potential impact of future infrastructure earthworks, or access requirements on bushland, habitats, green corridors or active rehabilitation sites.
5. The Bushland Management Team must approve all contractor project proposals before implementation.
6. All Work, Health and Safety requirements must be adhered to by Council staff, volunteers and contractors before, during and after site works.

Native Flora

7. Record uncommon flora species to determine risk of extinction in the reserve. (Use North Sydney flora survey record template).
8. Prioritise protection / rehabilitation in areas of highest resilience.
9. Buffer areas should protect biodiversity from disturbances caused by fragmentation and edge effects: (a) monitor to identify gaps in buffer vegetation and senescing / restored vegetation and organise replacement planting; (b) where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a medium/long term solution to stop herbaceous weeds and grasses from spreading into bushland; (c) control vines, noxious weeds and other plant species affecting stability of adjoining bushland.
10. When natural regeneration is ineffective, locally source all plant material for supplementary planting to maintain genetic integrity of native vegetation in accordance with Flora Bank Guidelines https://www.greeningaustralia.org.au/florabank. Only plant when natural regeneration is ineffective to boost biodiversity, with the aim to achieve 80% survival rates. Plant in stages, basing species selection on the target vegetation community/structure, successional stage, habitat requirements and physical constraints. This process involves collaboration from Council's nursery supervisor, bush regeneration team, Bushcare volunteers and bush regeneration contractors.
11. In areas lacking diversity and structure; direct seed, transplant and use appropriate tube stock to enhance existing plant communities. When planning a replanting site: (a) prepare a suitable plant list based on rehabilitation objectives and prevailing site condition; (b) allow time for seed collection and propagation (9-12 months ahead of planting); (c) identify where seed harvesting/cuttings will be gathered; (d) prepare area (e.g. reduce density of dominant species on ground layer or mesic species in shrub layer); (e) schedule planting for early Autumn during or after soaking rain.
12. Collect seed of suitable locally rare species from nearby bushland areas, propagate and plant in appropriate areas of the reserve to enhance biodiversity and ensure the long-term viability. For species that are difficult to propagate, explore other methods such as seed scarification / raking treatment / seedbank translocation etc.
13. Implement a canopy replacement program in areas where remnant canopy is absent, senescing or failing to regenerate or where non-endemic trees have been removed.
14. Do not encourage large canopy species on unstable areas or under electricity easements where they cannot be supported and may cause future hazards.
15. Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team: (a) pile burn where appropriate; (b) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (c) reduce seedbank of dominant natives - control seeding cycle; (d) lightly disturb mulch / organic matter to stimulate regeneration; (e) increase seed bank of uncommon/ rare species with brush matting techniques (collect from donor sites where seed removal will not affect biodiversity); (f) propagate senescing plant species at risk of extinction in the reserve (i.e. due to an inadequate fire regime) and plant tubestock in suitable locations.
16. When planting along bushland edges, select species in consideration of their potential to compliment views from residential or public viewing areas and design to enhance habitat / connectivity (e.g. for small birds).
17. Conserve and protect naturally regenerating / colonising canopy species providing they are in sustainable locations.

Weeds and Pathogens

18. Implement the *Biosecurity Act 2015* consistently and effectively, in accordance with bushland management objectives and processes.
19. Residential properties adjoining bushland can contribute to weed spread. Monitor and address invasive garden plants in accordance with the

Biosecurity Act 2015 and promote Council's Native Havens / Habitat Stepping Stones Programs.

20. Ongoing weed management should: (a) prioritise good bush areas; (b) target species threatening stability e.g. vines, woody or canopy weeds; (c) interrupt seed cycle of target species, especially annual and grass weeds; (d) prioritise areas where plant diversity is most affected by mesic shift and vines. (In consideration of fauna habitat needs, schedule works from Autumn through Winter before bird breeding season.)
21. Monitor sites to identify, report and manage early stages of weed outbreaks or shifts in plant species assemblages likely to become detrimental to biodiversity. Manage according to the issues they raise. Report other threats to ecosystem function.
22. All compost weed material is removed off site.
23. Retain weeds on highly erodible or dangerous slopes and use methods of weed suppression that will not create potential for soil erosion. Incorporate abseiling activities on cliff faces to remove weeds that are a constant weed seed source.
24. Strategically remove non-endemic or exotic trees that interfere with ecosystem function or structure. Assess for habitat potential before they are de-limbed.
25. Consider all potential impacts of herbicide and proximity to water when determining suitability for weed control.
26. Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Native Fauna and Habitat

27. Record wildlife sightings and observations in Council's Wildlife Watch database. Share this information with NSW BioNet and the Commonwealth's ALA.
28. Identify and protect nesting, roosting and breeding sites of threatened, vulnerable or locally significant fauna.
29. Minimise disturbance to wildlife, enhance habitat where needed and improve the condition/connectivity of wildlife corridors between adjoining reserves.
30. Protect, maintain and restore quality fauna foraging habitat using a diverse mix of endemic native species. Retain habitat features such as fallen and standing dead wood, rock piles, hollow-bearing trees, natural debris, dead standing trees, forest litter, logs and branches.
31. Short-term strategies to maintain fauna habitat provided by mesic and weed species may require retention yet containment of dense areas of weed, vines and mesic species. In the longer-term, aim to establish a self-maintaining fabricated vegetation community in these areas composed of native species adapted to changed site conditions (abiotic factors) that enhance biodiversity and habitat availability.
32. Before any unfavourable trees are de-limbed, assess for habitat potential e.g. tree hollows.
33. Where suitable, install fauna nesting boxes and create hollows in suitable dead trees to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed.
34. Investigate financial opportunities to invest in habitat enhancing research and developing methodologies.

Threatened species

35. Identify threatened or endangered, rare or locally rare species of flora and fauna. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs.
36. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened species.

Ecological Burns

37. Hazard reduction and ecological burns are based on a strategic burn program consistent with the Mosman North Sydney Willoughby Bushfire Risk Management Plan. Ecological burn regimes are to be in a mosaic pattern to improve bushland function and biodiversity. Areas of high bushfire risk or core ecological resilience are usually prioritised in the annual burn program.
38. Maintain land management zones where bush adjoins residences and implement site stabilisation measures.
39. Over the next 10 years, prioritise prescribed burns at sites at risk of diminishing flora diversity.
40. For pre-fire preparation: (a) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (b) reduce seedbank of dominant natives to control seeding cycle; (c) increase seed bank of uncommon/ rare species with brush matting (collect from donor sites where seed removal will not affect biodiversity).
41. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds.
42. Implement post-fire monitoring and bush rehabilitation strategies. Monitor regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time period post-burn.

Pests and Illegal Activity

43. Monitor and control feral or aggressive/territorial fauna activity, cats, unleashed dogs and illegal activity with appropriate measures e.g. trapping, community education programs, penalty notices or camera observation. If applicable, manage reserves in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 and relevant North Sydney Council policies.
44. Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
45. Monitor the impacts of drones and implement management measures if required.
46. Address instances of unauthorised activities in bushland incl. orienteering; rock climbing; geocaching; mountain biking; camping etc.

Tracks, Water and Erosion

47. Close informal tracks to prevent damage to habitat, impede feral animals and reduce weed spread.
48. Implement track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, track widening and degrading track conditions.
49. Assess the need for additional directional and / or interpretive signage.
50. Stabilise steep slopes, ephemeral flow lines and highly erosive areas using local native species, particularly ground covers, to re-establish appropriate vegetation community structure where natural regeneration is

poor or absent. Install sedimentation fences, terracing, coir logs, matting or other appropriate measures where needed to stabilise washout areas and improve access and safety.

51. Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater tolerant natives.

Aboriginal and non-Aboriginal Heritage

52. All identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1974* and *Heritage Act 1977*.
53. Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual.
54. As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance.
55. Bushland management staff consult with the Aboriginal Heritage Office or Council's heritage officer prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey.
56. Discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol.

Community

57. Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
58. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
59. Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan.
60. When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council.

Reserve Specific Rehabilitation Actions

Priorities will be given to programs with long term benefit to the reserve or where natural assets are at greatest risk to avert irreversible deterioration or loss.

Flora and Weeds

1. When undertaking planting along the residential boundary interface, select plant species in consideration of present views.
2. Areas within Cremorne Reserve that contain remnant patches of bushland, not zoned E2 Environmental Conservation, are excluded by the scope of this rehabilitation plan. However, in cooperation with Councils Parks & Gardens Section, some of these areas may be managed as bushland in accordance with the same principles and procedures.
3. Encourage the presence of *Eucalyptus botryoides*, *E. resinifera, Allocasuarina distyla, Banksia integrifolia, Kunzea ambigua* and *Grevillea speciosa* within the reserve.
4. Collect seed of locally rare species for the North Sydney Seed Bank and propagate when required. Plant in regenerating areas to increase population size and ensure long-term viability.
5. Collect seeds from remnant *Eucalyptus botryoides (*and other endemic canopy species) from urban areas on the Cremorne peninsula for the North Sydney Seed Bank and propagate when required. Also use for direct seeding within the reserve. Develop a register of seed source trees.
6. Undertake an assessment to prioritise which trees need to be removed. Plant suitable native canopy trees near trees to be removed. Ensure sapling are established before removing unsuitable trees. Sympathetically thin tree canopy or lower branches of trees to be removed in the interim, to ensure sufficient sunlight for endemic saplings to establish.
7. Retain exotic trees in degraded sections where they will be difficult to replace with endemic canopy trees.
8. Monitor new fig saplings and remove where appropriate to maintain and improve potential for endemic biodiversity or to avoid damage to infrastructure and retaining walls.
9. Where appropriate, create a border between lawn and bushland e.g. with logs, coir logs or siltation fencing. Gradually reinstate bushland up to these edges.
10. Plant wet areas with suitable understorey species to soak up hard surface runoff and in areas prone to sewerage / grey water leaks.
11. To maintain and improve potential for endemic biodiversity and overall bushland condition, prevent the re-establishment of exotic canopy by actively targeting regrowth and juvenile trees (e.g. Coral Trees (*Erythrina x sykerii*), Phoenix Palms (*Phoenix canariensis*) and Camphor Laurel (*Cinnamomum camphora*)
12. Investigate complimentary management of Open Space areas within Cremorne Reserve with adjoining bushland in order to improve habitat availability and connectivity whilst retaining the different functional uses of these areas.

Fauna

13. Continue to enhance wildlife corridors and investigate financial opportunities to promote habitat enhancement.
14. Protect vital habitat for small birds by retaining some patches of dense weed growth (incl. *Lantana camara*) along the foreshore and seek to replace it with suitable endemic species over time.
15. Where possible, work with the Cremorne Reserve Parks and Gardens Team to consider wildlife impacts when planning the removal of dense weeds and the potential impact this may have on habitat connectivity between bushland areas.

Tracks, Water and Erosion

16. Rationalise unauthorised/informal tracks at Robertsons Point to help limit erosion, prevent trampling of sensitive vegetation and ensure community safety.
17. Utilise rope fencing, brush matting and signage to discourage use of new and existing informal tracks that lead to the foreshore at Robertsons Point.
18. Investigate ways to reduce the damage to bushland caused by New Year's Eve celebrations including signage, fencing, obstacles and surveillance.
19. Address the impacts of new and existing stormwater pipes along the boundary with private properties
20. Encourage the removal/cessation of use of private pathways that link residential properties with the Cremorne Point Pathway.

Threatened Species

21. Work in collaboration with the Saving Our Species program managed by the NSW Office of Environment and Heritage and the NSW Herbarium to identify, monitor and protect *Acacia terminalis* subsp. *terminalis* in the reserve and contribute to the preparation of best practice guidelines for the species.
22. Preserve and enhance the habitat of threatened microbat species, Powerful Owl (*Ninox strenua*) and the Grey-headed flying-fox (*Pteropus poliocephalus*).

Aboriginal and Historic Heritage

23. Organise an assessment of the heritage significance of unassessed items including old non-endemic canopy trees by qualified professionals. Formulate recommendations and appropriate management measures. Any recommendations regarding non-endemic canopy trees would need to consider the potential for hazards, invasiveness and impacts on bushland values.
24. Protect known sites of Aboriginal heritage significance in Cremorne Reserve.

Pests and Illegal Activity

25. Regularly inspect fishing and illegal small watercraft storage locations and take appropriate action to discourage damage to the reserve and its values.
26. Dinghy and kayak storage is prohibited within the reserve except for where permissible in Council's Small Watercraft Storage Strategy.
27. Consider installing signage and barriers in areas where dinghies and kayaks are illegally stored to deter illegal activity.
28. Report all illegal drug and alcohol use locations and associated damage to Council's Ranger Team. All affected areas are to be listed on Council's register for such sites and collaboration is required with the Police to implement management strategies.
29. Monitor termite activity that is threatening *Eucalyptus botryoides* canopy trees at Robertsons Point and implement management controls as necessary.
30. Monitor and report unleashed dogs.

31. Tree vandalism in this reserve has occurred previously. Monitor tree canopy health and investigate suspected vandalism. Educate and engage reserve neighbours through the Native Havens Program.

Ecological Burns

32. Refer to Map 3 Fire History and Future Managed Burns.
33. Manage ecological burns to preserve and encourage locally rare plant species.
34. Identify potential locations where pile burning may be used to test resilience.

Community

35. Consider opportunities to adjust Bushcare site boundaries in order to improve accessibility and encourage greater community participation.
36. Carry out appropriate community consultation regarding tree work, tree removals and tree replanting.
37. Develop a bushland neighbour information brochure to help raise awareness of edge effects and the ways local residents can improve their bushland footprint.

Capital Projects

38. Assess the need for upgrades to directional and / or interpretative signage and implement as needed.
39. Extend hardwood fencing along the bushland edge at Robertsons Point to protect it from illegal track creation and damage during New Year's Eve celebrations.
40. Commence stabilising and revegetation work along the Milson Rd foreshore – where accessible.
41. Assess safety fencing in Bushland areas and replace as required.

Map 1: Vegetation Communities (NAS 2010)

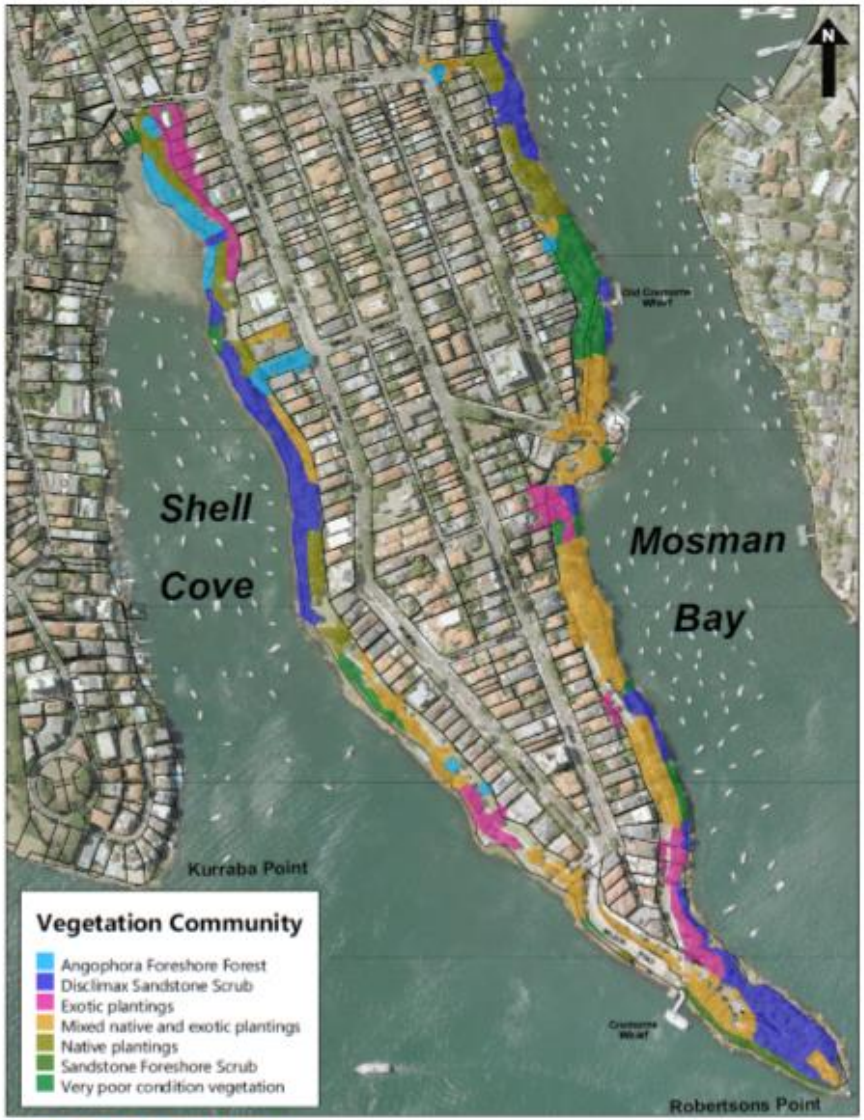


Table 1: Common species recorded in Cremorne Reserve

Scientific Name	Common name	Vegetation Community
Acacia longifolia	Sydney Golden Wattle	AF
Angophora costata	Sydney Red Gum	AF; DS
Banksia integrifolia	Coast Banksia	DS; FS
Calochlaena dubia	Common Ground Fern	AF; DS
Commelina cyanea	Scurvy Weed	AF
Dianella caerulea	Blue Flax Lily	AF
Dodonaea triquetra	Common Hop Bush	AF
Elaeocarpus reticulatus	Blueberry Ash	AF; DS; FS
Entolasia stricta	Wiry Panic	AF; DS; FS
Ficus rubiginosa	Port Jackson Fig	AF; DS
Glochidion ferdinandi	Cheese Tree	AF; DS; FS
Grevillea linearifolia	White Spider-flower	AF
Hakea dactyloides	Broad-leaved Hakea	AF
Hydrocotyle peduncularis	Native Pennywort	FS
Lomandra longifolia	Spiny-headed Mat-rush	AF; DS; FS
Microlaena stipoides	Weeping Grass	AF; DS; FS
Monotoca elliptica	Tree Broom-heath	FS
Notelaea longifolia	Large Mock-olive	AF; DS; FS
Oplismenus aemulus	Basket Grass	DS
Pittosporum revolutum	Rough-fruit Pittosporum	AF
Pittosporum undulatum	Pittosporum	AF; DS; FS
Pteridium esculentum	Bracken	AF; DS
Smilax glyciphylla	Sweet Sarsaparilla	DS

AF: Angophora Foreshore Forest **FS: Sandstone Foreshore Scrub**

DS: Disclimax Sandstone Scrub

Map 2: Condition of Bushland and Resilience (2018)

Condition of Bushland and Resilience Key

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural recruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting Poor indicative resilience
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience – limited regeneration potential (1-2 species)
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed sandstone)

Map 3: Fire History & Future Managed Burns

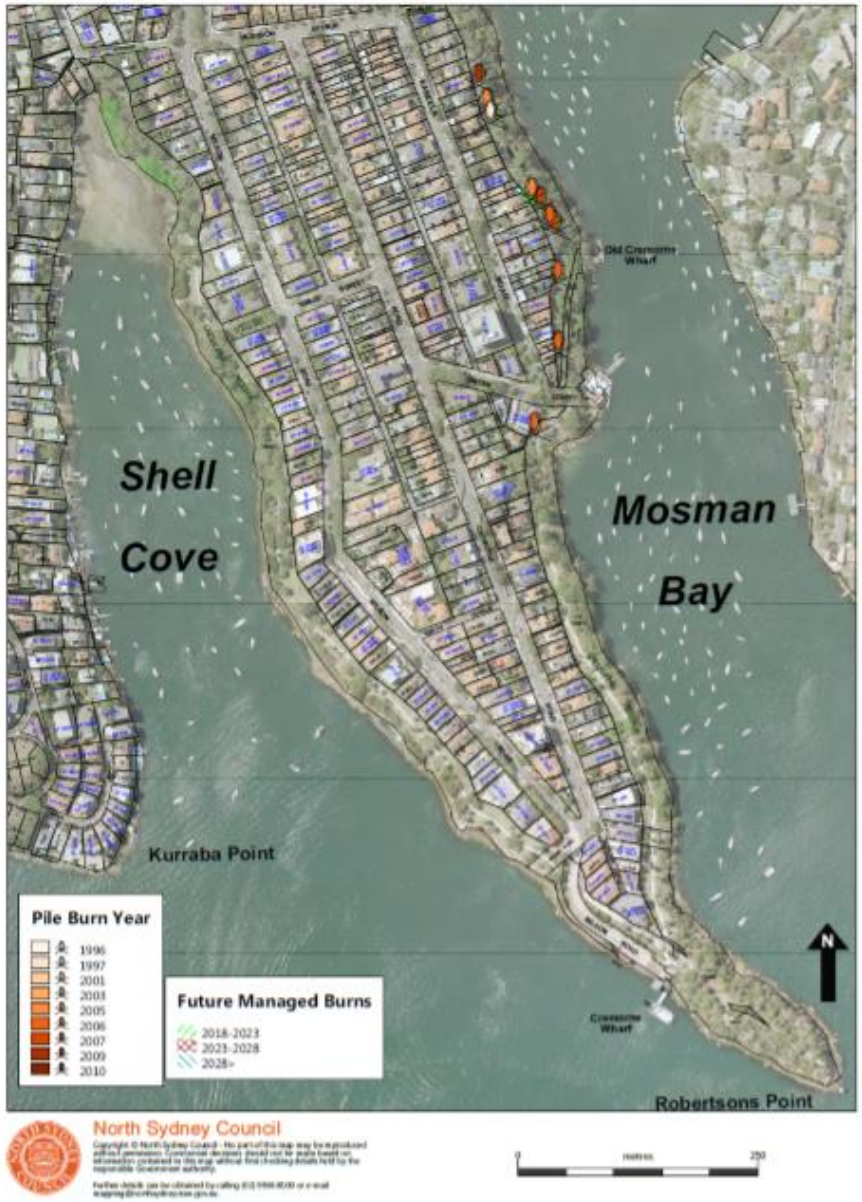


Table 2: Species of Special Conservation Concern

COMMON NAME	SCIENTIFIC NAME	CAUSE OF DECLINE
Yellow Thornbill King Parrot Pacific Baza Brush Cuckoo Golden-crowned Snake Yellow-tail Black Cockatoo Gould's Wattled Bat Black-faced Cuckooshrike Common Tree Snake White-bellied Sea Eagle Whistling Kite Superb Fairly-wren Variegated Fairy-wren Common Bent-wing Bat Eastern Bent-wing Bat Eastern Free-tailed Bat Large-footed Myotis Boobook Owl Powerful Owl Crimson Rosella Eastern Rosella Tawny Frogmouth Eastern Whipbird Grey-headed Flying Fox White-browed Scrubwren Forest Kingfisher Sacred Kingfisher	*Acanthiza pusilla* *Alisterus scapularis* *Aviceda subcristata* *Cacomantis variolosus* *Cacophis squamulosus* *Calyptorhynchus funereus* *Chalinolobus gouldii* *Coracina novaehollandiae* *Dendrelaphis punctulatus* *Haliaeetus leucogaster* *Haliastur sphenurus* *Malurus cyaneus* *Malurus lamberti* *Miniopterus schreibersii* *Miniopterus schreibersii oceanensis* *Mormopterus ridei* *Myotis macropus* *Ninox novaeseelandiae* *Ninox strenua* *Platycercus elegans* *Platycercus eximius* *Podargus strigoides* *Psophodes olivaceus* *Pteropus poliocephalus* *Sericornis frontalis* *Todiramphus macleayii* *Todiramphus sanctus*	- Reduction of Tall Eucalypt Forest in North Sydney; - Loss of habitat /Declining canopy cover - Reduction and degradation of bushland habitat in North Sydney; - Ecosystem degradation general loss of species diversity; Urban ecology expansion is beneficial to larger common birds; - Fragmented populations confined to small native bushland remnants are at risk of local extinction; - Lack of constant food source; - Predation from cats, dogs and urban predatory birds such as Currawongs and butcher birds. - Scarcity of natural breeding hollows - Altered stormwater system causing habitat loss; stormwater pollution; Sedimentation; Chytrid fungus; & Isolation of small populations.
Sydney Red Gum Red Blood Wood Bangalay Red Mahogany Tree Broom-Heath Native Parsnip Bush Pea Coastal Rosemary Snow Wreath	*Angophora costata* *Corymbia gummifera* *Eucalyptus botryoides* *Eucalyptus resnifera* *Monotoca elliptica* *Platysace lanceolata* *Pultenaea daphnoides* *Westringia fruticosa* *Woollsia pungens*	- Altered fire regimes; - Ecosystem degradation; general loss of species diversity; - Fragmented populations confined to small bushland remnants; - Lack of connectivity between bushland limits pollination pathways and seed dispersal - Community use pressures - Stormwater pollution, erosion and sedimentation

Table 3: Plant species affecting biodiversity and stability of Bushland

Common Name	Botanic Name	Habit	Common Name	Botanic Name	Habit
African love grass	*Eragrostis curvula*	Grass/Ground layer	Purple top	*Verbena bonariensis*	Ground layer
Barbed wire grass	*Cymbopogon refractus*	Grass/Ground layer	Thick head	*Crassocephalum crepidioides*	Ground layer
Couch	*Cynodon dactylon*	Grass/Ground layer	Thistle sp	*Cirsium vulgare*	Ground layer
Crows foot grass	*Eleusine indica*	Grass/Ground layer	Trad	*Tradescantia fluminensis*	Ground layer
Ehrharta	*Ehrharta erecta*	Grass/Ground layer	Turkey rhubarb	*Acetosa sagittatus*	Ground layer
Foxtail grass	*Pennisetum alopecuroides*	Grass/Ground layer	Balloon vine	*Cardiospermum grandiflorum*	Climber
Kikuyu	*Pennisetum clandestinum*	Grass/Ground layer	Cape Ivy	*Delairea odorata*	Climber
Weeping grass	*Microlaena stipoides*	Grass/Ground layer	Honeysuckle	*Lonicera japonica*	Climber
Palm grass	*Setaria palmifolia*	Grass/Ground layer	Madeira vine	*Anredera cordifolia*	Climber
Parramatta grass	*Sporobolus indicus*	Grass/Ground layer	Morning glory coastal	*Ipomea cairica*	Climber
Paspalum	*Paspalum dilatatum*	Grass/Ground layer	Morning glory	*Ipomea indica*	Climber
Red natal grass	*Melinis repens*	Grass/Ground layer	Moth vine	*Araujia sericifolia*	Climber
Summer grass	*Digitaria sanguinalis*	Grass/Ground layer	Corky Passionfruit	*Passiflora suberosa*	Climber
Asthma weed	*Parietaria judaica*	Ground layer	Box Elder	*Acer negundo*	Canopy/Shrub
Asparagus fern	*Protasparagus aethiopicus*	Ground layer	African olive	*Olea europaea ssp. cuspidata*	Canopy/Shrub
Bidens	*Bidens pilosa*	Ground layer	Castor oil plant	*Ricinus communis*	Canopy/Shrub
Scurvy weed	*Commelina cyanea*	Ground layer	Camphor laurel	*Cinnamomum camphora*	Canopy/Shrub
Crofton	*Ageratina adenophora*	Ground layer	Cassia	*Senna pendula*	Canopy/Shrub
Fishbone fern	*Nephrolepis cordifolia*	Ground layer	Cheese Tree	*Glochidion ferdinandi*	Canopy/Shrub
Fleabane	*Conyza spp*	Ground layer	Coral Tree	*Erythrina sp*	Canopy/Shrub
Mist flower	*Ageratina riparia*	Ground layer	Lantana	*Lantana camara*	Canopy/Shrub
Montbretia	*Crocosmia X crocosmiiflora*	Ground layer	Ochna	*Ochna serrulata*	Canopy/Shrub
Mother of millions	*Bryophyllum delagoense*	Ground layer	Port Jackson Fig	*Ficus rubiginosa*	Canopy/Shrub
Mustard weed	*Brassica spp.*	Ground layer	Sweet Pittosporum	*Pittosporum undulatum*	Canopy/Shrub
Paddys lucerne	*Sida rhombifolia*	Ground layer	Small leaf Privet	*Ligustrum sinense*	Canopy/Shrub
Pampas lily of the valley	*Salpichroa organifolia*	Ground layer	Large leaf Privet	*Ligustrum lucidum*	Canopy/Shrub
Pareuvian lily	*Alstroemeria pulchella*	Ground layer	Wild tobacco	*Solanum mauritianum*	Canopy/Shrub

2.1.5 Forsyth Park Bushland Rehabilitation Plan

Description

Size: Forsyth Park 1.05 Ha

Access: Forsyth Park bushland areas are accessed via Bent Street, Montpelier Street and Yeo Street, Neutral Bay.

Ownership: North Sydney Council

Catchment: Port Jackson via Neutral Bay

Configuration / Connectivity: Forsyth Park bushland comprises a fragmented and isolated triangular shaped patch of bushland at the north of Forsyth Park playground, playing fields and community centre. It is bounded by residential development, Bent St and Yeo St to the west, north and east. This patch of bushland is located in a highly urbanised environment and lacks connectivity to other parcels of bushland.

Hydrology: Hydrology has been extensively altered. The reserve receives surface flow and stormwater from the residential development up slope, to an unnamed tributary that extends from the north of the site at the intersection of Bent and Yeo Streets to the south of the bushland patch. The tributary is then piped below the playing fields. All surface water drains to Port Jackson via Neutral Bay.

Geology: Hawkesbury Sandstone of medium-to-coarse grain with minor shale/laminate lenses. Visible outcrops.

Soil landscape: Hawkesbury Sandstone Landscape consisting of shallow, poor sandy soils, highly erosive with low soil fertility. Localised Yellow and Red Podzolic Soils are associated with shale lenses. Some areas have been significantly disturbed, destroying the original soil profile due to rock cuttings as well as fill from past construction works up slope and dumping of waste.

Slope: Moderate to steep slopes forming a gully.

Facilities / Infrastructure: A walking track extends from Montpelier St and the active recreation areas, community garden and playground, upslope to Bent Street. The Bent Street end of the track comprises stairs. The boundary of the bushland to Bent Street and Yeo Street is delineated with ordinance fencing and a concrete footpath. Bollards are located at the service entry to Forsyth Park off Montpellier Street. A short, informal walking track extends from this service entry into the bushland upslope. Extensive stormwater and sewerage infrastructure is located within the park that services the adjoining residential areas.

Plant Community:
The areas of Forsyth Park zoned E2 Environmental Conservation comprise the following plant communities:
- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species.
- Disclimax Sandstone Scrub – an altered community of open to closed scrub, or a forest of mixed and variable composition due to disturbance and lack of fire.
- Refer to Map 1 for the plant communities; Table 1 for common flora species and Table 2 for plant species of special conservation concern in Forsyth Park.

Wildlife Habitat:
- Forsyth Park provides a diverse range of habitat including open and closed forest and scrub, rocky outcrops and dense weed.
- The park has limited potential to form part of a habitat corridor as it is isolated amongst urban development.
- The reserve is within range for many wildlife species that move through the leafy urban environment such as the Common Brushtail (*Trichosurus vulpecula*) and Ringtail Possums (*Pseudocheirus peregrinus*), bats, and woodland birds (some of which are migratory).
- Dense weed thickets particularly along the eastern side provide important habitat for small birds such as robins and wrens.
- Larger birds are common in this park due to the altered state of bushland structure/species diversity and the proximity to large areas of open space.
- Although larger birds may freely move between other areas by using the scattered canopy of residential and street trees, fauna using mid and lower levels of vegetation for habitat and shelter are more restricted. Such fauna includes skinks, lizards, geckoes, snakes and frogs.
- Over the past 5-10 years, wildlife such as the Brush Turkey (*Alectura lathami*) have naturally re-colonised.
- The park lacks nesting hollows and roosting sites for birds and arboreal mammals due to the lack of mature native trees. Such creatures play an important role in the ecology of the vegetation communities, assisting in pollination, seed dispersal and germination.
- Refer to Table 2 for the fauna species of special conservation concern found in Forsyth Park.

Condition and Resilience:
- The fragmented bushland of Forsyth Park covers a small area and generally lacks flora diversity, canopy structure particularly in the upper gully and is degraded due to stormwater, fill, infrastructure works and significant weed encroachment. These factors lower its long-term resilience and viability. The eastern boundary is in particularly poor condition and is inundated (in parts) by invasive vines that extend over the canopy. The open forest in the middle to west side of the park is in better condition with higher resilience due to less fill, weed and stormwater impacts.
- The impacts of fill and stormwater along with occasional sewerage pipe leaks along the eastern and western boundary have a significant impact on soil structure, nutrient levels and moisture, limiting the capacity for unassisted natural regeneration and diminishing creek water quality in an already degraded riparian corridor.
- Some exposed sandstone outcrops demonstrate areas with higher resilience and more intact soil structure.
- Native and exotic mesic and vine species require targeted and regular maintenance, to manage colonisation and where elevated soil moisture and nutrient conditions have excluded fire for long periods. The thick vines along the eastern side of the gully extend over the canopy creating dense fauna habitat to the detriment of flora diversity and forest structure.
- Council and the community have worked to transform the bushland over the last 20 years. Native plant species and vegetation community structure are successfully re-establishing through ongoing application of bush regeneration, replanting and ecological burning. The

limited core areas are slowly expanding, whilst endemic middle and upper canopy trees are continuing to slowly evolve.
- Bush regeneration activities are carried out by Council's Bushland Management Team, bush regeneration contractors (since 1996) and the volunteer Forsyth Park Bushcare Group (since 1996).
- Refer to Map 2 Condition of Bushland and Resilience.

Zone / Classification:
- The bushland in Forsyth Park is zoned E2 Environmental Conservation under the *North Sydney LEP 2013.* It is classified public bushland in *SEPP No. 19 Bushland in Urban Areas (*and in the draft SEPP (*Environment)* that will supersede *SEPP 19).*

Statement of significance:
Historic Values
- The bushland is a legacy of past land management of the traditional Aboriginal custodians, the Cammeraygal, who originally occupied the area and used it for many thousands of years. Places, objects and features of significance to Aboriginal people are protected under the NSW *National Parks and Wildlife Act 1974*.
- Forsyth Park was named after Alderman R.C. Forsyth, Mayor of North Sydney from 1934-1935.
- North Sydney Council acquired the park in 1931 when the land was covered in scrub and proceeded to tunnel the creek through concrete pipes to create the playing fields.
- The two former oil tanks just south of the bushland remnant were used in World War II for defence purposes.

Natural Values
- Forsyth Park plays a role in maintaining biodiversity in the region and assists in conservation of species and habitat function.
- Angophora Foreshore Forest and Disclimax Sandstone Scrub are threatened at a local level due to their limited extent in North Sydney.
- Locally rare species include *Bauera rubioides* (River Rose) and *Allocasuarina torulosa*. Although regionally rare, planted *Austrostipa ramosissima* present in the bushland is becoming weedy and requires control.
- The reserve provides habitat for a range of wildlife including threatened and declining fauna species. The Grey-headed flying-fox (*Pteropus poliocephalus*) (vulnerable under the NSW *Biodiversity Conservation Act* 2016 (*BC Act*) and *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* has been recorded in the park and the Powerful Owl (*Ninox strenua*) (vulnerable under the *BC Act*) is highly likely to forage and temporarily roost in the reserve.
- Recorded bat species listed as vulnerable under the *BC Act* include the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) and the Eastern Freetail Bat (*Mormopterus norfolkensis*).
- The endangered *Acacia terminalis* subspecies *terminalis* listed under the Commonwealth *EPBC Act* and the NSW *BC Act* could occur within the park as it is known to occur in Angophora Foreshore Forest and Disclimax Sandstone Scrub.

Recreation / Education Values
- Forsyth Park bushland provides a valuable educational, nature appreciation and bushwalking resource that is highly accessible to local residents and users of the playground/active recreation areas of the park.

Fire History:
- Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity in this bushland remnant.
- Past pile burns have resulted in the successful germination of native endemic flora species.
- Planned hazard reduction / ecological broad area burns are conducted from time to time. Refer to Map 3 Fire History and Future Managed Burns.

Threats:
- The limited size of this remnant amplifies its vulnerability to fragmentation and edge effects from the surrounding urban environment/private properties.
- Impacts from adjoining residential properties that facilitate weeds include garden escapes and dumping of garden clippings into the bushland. A recurring problem of broken drainage pipes and terracotta sewerage pipes servicing adjoining residences, as well as overflowing Sydney Water pop tops, increases moisture and nutrification. This limits capacity for unassisted natural regeneration. Runoff from hard surfaces upslope, irrigation and garden fertiliser use results in increased nutrient loads, moisture and erosion on the slopes below. Other threats include illegal encroachment from adjoining residences.
- The creekline was once entirely contained within a large pipeline throughout the bushland remnant, extending below the playing fields. The pipeline was disturbed in the north of the reserve two decades ago, allowing stormwater to spill over into the lower sections of the natural gully of Forsyth Park bushland. Although the water supply is important to fauna, the high nutrient and moisture conditions exacerbate weed invasion and intense storm-flows exacerbate erosion.
- Visitor impacts include trampling of bushland to create informal tracks which destroys the vegetation and cause soil erosion. Litter is dumped along the track and accumulates in 'day camp areas' where alcohol and drugs are consumed in secluded locations. From time to time, chairs and lounges are brought into the day camps which further damages vegetation.
- Widespread fill over many decades from general dumping, the construction of adjoining properties and infrastructure etc has significantly compromised soil stability and structure, seedbank viability and bushland resilience. The composition of the fill includes rubbish, asbestos and broken glass that not only looks aesthetically unattractive in a bushland setting but also poses hazards for bush regenerators and park visitors.
- Native and exotic vines, mesic species and weeds are a serious threat to the stability of resilient cores and the long-term viability of biodiversity. Fire has been excluded from some areas of the reserve for many decades, allowing mesic species to thrive. (Refer to Table 3 for plant species affecting biodiversity and stability of bushland assets).
- There is a lack of endemic canopy trees, particularly along the creekline and gully slope to the east.
- Areas where bushland is bordered by turf lawns are impacted by exotic grass encroachment.
- *Phytophthora cinnamomi* (root rot*)* affects the health of the bushland and is widespread.
- At times, foxes (*Vulpes vulpes*), domestic cats (*Felis cattus*) and off-leash dogs (*Canis lupus familiaris)* are observed in the reserve and along the foreshore. These

animals predate, scare and disturb wildlife, pollute with their faeces and spread weed seed.
- Some species of introduced, endemic or non-endemic birds are very territorial and compete for habitat, limiting species diversity.
- Native bats and birds can introduce new flora species and weeds that have the potential to change vegetation structure over time.
- Inappropriate weed removal can reduce fauna habitat with greater impacts on short range species and small birds.
- Artificial night lighting from adjoining development can also detrimentally affect nocturnal fauna.
- Increased drone usage is causing disturbance to fauna that occur in the canopy.
- Climate change is an ongoing threat. Anticipated impacts include increased threat of bushfire and extreme weather events. Intensified storm events will result in higher volumes of of stormwater runoff which is likely to result in erosion to drainage lines and creeks. Increased temperatures are likely to affect biodiversity and ecosystems, favouring some species over others and changing the structure and function of the bushland. The rate of climate change may be faster than the rate of natural adaptation. Increased temperatures will harm sensitive fauna such as bats, impacting their important ecosystem function.
- Non-passive recreational activities (incl. orienteering; rock climbing; geo-caching, camping and mountain biking) cause substantial damage to native vegetation and soil stability. These activities are prohibited in North Sydney's bushland reserves.

Bushland Management Goals

a. Maintain and enhance biodiversity and habitat for long term ecosystem resilience and function
b. Conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve
c. Strategically restore bushland (prioritise areas of highest resilience)
d. Enhance habitat connectivity
e. Preserve genetic integrity of the vegetation community
f. Manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality
g. Conserve the natural landscape and heritage values
h. Provide for ecologically sustainable recreation needs of the community
i. Implement the strategic fire hazard reduction program and manage fuel loads to protect life, property and endemic biodiversity.

Rehabilitation Principles and Procedures:

General

1. Bush regeneration is a long-term process of staged weed removal to ensure endemic biodiversity, native plant establishment and continued habitat for local wildlife. It relies on site assessments that identify values and how best to restore and enhance ecosystem function and structure. Routine site monitoring, evaluation of field strategies and periodic native flora and fauna surveys inform management priorities over time. Works normally proceed from bush in good condition with high resilience. Degraded areas are a lower priority but the weeds always require containment.

Planning, Evaluation and Review

2. The Bushland Management Team should regularly evaluate bushland rehabilitation plans and the success of field strategies to inform management priorities early.
3. Establish photo points to monitor projects.
4. In the bushland rehabilitation planning process, consider the potential impact of future infrastructure earthworks, or access requirements on bushland, habitats, green corridors or active rehabilitation sites.
5. The Bushland Management Team must approve all contractor project proposals before implementation.
6. All Work, Health and Safety requirements must be adhered to by Council staff, volunteers and contractors before, during and after site works.

Native Flora

7. Record uncommon flora species to determine risk of extinction in the reserve. (Use North Sydney flora survey record template).
8. Prioritise protection / rehabilitation in areas of highest resilience.
9. Buffer areas should protect biodiversity from disturbances caused by fragmentation and edge effects: (a) monitor to identify gaps in buffer vegetation and senescing / restored vegetation and organise replacement planting; (b) where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a medium/long term solution to stop herbaceous weeds and grasses from spreading into bushland; (c) control vines, noxious weeds and other plant species affecting stability of adjoining bushland.
10. When natural regeneration is ineffective, locally source all plant material for supplementary planting to maintain genetic integrity of native vegetation in accordance with Flora Bank Guidelines https://www.greeningaustralia.org.au/florabank. Only plant when natural regeneration is ineffective to boost biodiversity, with the aim to achieve 80% survival rates. Plant in stages, basing species selection on the target vegetation community/structure, successional stage, habitat requirements and physical constraints. This process involves collaboration from Council's nursery supervisor, bush regeneration team, Bushcare volunteers and bush regeneration contractors.
11. In areas lacking diversity and structure; direct seed, transplant and use appropriate tube stock to enhance existing plant communities. When planning a replanting site: (a) prepare a suitable plant list based on rehabilitation objectives and prevailing site condition; (b) allow time for seed collection and propagation (9-12 months ahead of planting); (c) identify where seed harvesting/cuttings will be gathered; (d) prepare area (e.g. reduce density of dominant species on ground layer or mesic species in shrub layer); (e) schedule planting for early Autumn during or after soaking rain.
12. Collect seed of suitable locally rare species from nearby bushland areas, propagate and plant in appropriate areas of the reserve to enhance biodiversity and ensure the long-term viability. For species that are difficult to propagate, explore other methods such as seed scarification / raking treatment / seedbank translocation etc.
13. Implement a canopy replacement program in areas where remnant canopy is absent, senescing or failing to regenerate or where non-endemic trees have been removed.
14. Do not encourage large canopy species on unstable areas or under electricity easements where they cannot be supported and may cause future hazards.
15. Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team: (a) pile burn where appropriate; (b) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (c) reduce seedbank of dominant natives - control seeding cycle; (d) lightly disturb mulch / organic matter to stimulate regeneration; (e) increase seed bank of uncommon/ rare species with brush matting techniques (collect from donor sites where seed removal will not affect biodiversity); (f) propagate senescing plant species at risk of extinction in the reserve (i.e. due to an inadequate fire regime) and plant tubestock in suitable locations.
16. When planting along bushland edges, select species in consideration of their potential to compliment views from residential or public viewing areas and design to enhance habitat / connectivity (e.g. for small birds).
17. Conserve and protect naturally regenerating / colonising canopy species providing they are in sustainable locations.

Weeds and Pathogens

18. Implement the *Biosecurity Act 2015* consistently and effectively, in accordance with bushland management objectives and processes.
19. Residential properties adjoining bushland can contribute to weed spread. Monitor and address invasive garden plants in accordance with the *Biosecurity Act 2015* and promote Council's Native Havens / Habitat Stepping Stones Programs.

20. Ongoing weed management should: (a) prioritise good bush areas; (b) target species threatening stability e.g. vines, woody or canopy weeds; (c) interrupt seed cycle of target species, especially annual and grass weeds; (d) prioritise areas where plant diversity is most affected by mesic shift and vines. (In consideration of fauna habitat needs, schedule works from Autumn through Winter before bird breeding season.)
21. Monitor sites to identify, report and manage early stages of weed outbreaks or shifts in plant species assemblages likely to become detrimental to biodiversity. Manage according to the issues they raise. Report other threats to ecosystem function.
22. All compost weed material is removed off site.
23. Retain weeds on highly erodible or dangerous slopes and use methods of weed suppression that will not create potential for soil erosion. Incorporate abseiling activities on cliff faces to remove weeds that are a constant weed seed source.
24. Strategically remove non-endemic or exotic trees that interfere with ecosystem function or structure. Assess for habitat potential before they are de-limbed.
25. Consider all potential impacts of herbicide and proximity to water when determining suitability for weed control.
26. Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Native Fauna and Habitat

27. Record wildlife sightings and observations in Council's Wildlife Watch database. Share this information with NSW BioNet and the Commonwealth's ALA.
28. Identify and protect nesting, roosting and breeding sites of threatened, vulnerable or locally significant fauna.
29. Minimise disturbance to wildlife, enhance habitat where needed and improve the condition/connectivity of wildlife corridors between adjoining reserves.
30. Protect, maintain and restore quality fauna foraging habitat using a diverse mix of endemic native species. Retain habitat features such as fallen and standing dead wood, rock piles, hollow-bearing trees, natural debris, dead standing trees, forest litter, logs and branches.
31. Short-term strategies to maintain fauna habitat provided by mesic and weed species may require retention yet containment of dense areas of weed, vines and mesic species. In the longer-term, aim to establish a self-maintaining fabricated vegetation community in these areas composed of native species adapted to changed site conditions (abiotic factors) that enhance biodiversity and habitat availability.
32. Before any unfavourable trees are de-limbed, assess for habitat potential e.g. tree hollows.
33. Where suitable, install fauna nesting boxes and create hollows in suitable dead trees to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed.
34. Investigate financial opportunities to invest in habitat enhancing research and developing methodologies.

Threatened species

35. Identify threatened or endangered, rare or locally rare species of flora and fauna. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs.
36. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened species.

Ecological Burns

37. Hazard reduction and ecological burns are based on a strategic burn program consistent with the Mosman North Sydney Willoughby Bushfire Risk Management Plan. Ecological burn regimes are to be in a mosaic pattern to improve bushland function and biodiversity. Areas of high bushfire risk or core ecological resilience are usually prioritised in the annual burn program.
38. Maintain land management zones where bush adjoins residences and implement site stabilisation measures.
39. Over the next 10 years, prioritise prescribed burns at sites at risk of diminishing flora diversity.
40. For pre-fire preparation: (a) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (b) reduce seedbank of dominant natives to control seeding cycle; (c) increase seed bank of uncommon/ rare species with brush matting (collect from donor sites where seed removal will not affect biodiversity).
41. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds.
42. Implement post-fire monitoring and bush rehabilitation strategies. Monitor regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time period post-burn.

Pests and Illegal Activity

43. Monitor and control feral or aggressive/territorial fauna activity, cats, unleashed dogs and illegal activity with appropriate measures e.g. trapping, community education programs, penalty notices or camera observation. If applicable, manage reserves in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 and relevant North Sydney Council policies.
44. Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
45. Monitor the impacts of drones and implement management measures if required.
46. Address instances of unauthorised activities in bushland incl. orienteering; rock climbing; geocaching; mountain biking; camping etc.

Tracks, Water and Erosion

47. Close informal tracks to prevent damage to habitat, impede feral animals and reduce weed spread.
48. Implement track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, track widening and degrading track conditions.
49. Assess the need for additional directional and / or interpretive signage.
50. Stabilise steep slopes, ephemeral flow lines and highly erosive areas using local native species, particularly ground covers, to re-establish appropriate vegetation community structure where natural regeneration is poor or absent. Install sedimentation fences, terracing, coir logs, matting or other appropriate measures where

needed to stabilise washout areas and improve access and safety.

51. Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater tolerant natives.

Aboriginal and non-Aboriginal Heritage

52. All identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1974* and *Heritage Act 1977*.
53. Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual.
54. As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance.
55. Bushland management staff consult with the Aboriginal Heritage Office or Council's heritage officer prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey.
56. Discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol.

Community

57. Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
58. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
59. Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan.
60. When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council.

Reserve Specific Rehabilitation Actions

Priorities will be given to programs with long term benefit to the park or where natural assets are at greatest risk to avert irreversible deterioration or loss.

Flora and Weeds

1. Encourage the presence of locally rare *Bauera rubioides*, *Phebalium squamulosum* and *Allocasuarina torulosa*. Collect seed for the North Sydney Seed Bank and propagate when required. Plant in regenerating areas to increase population size and ensure long-term viability.
2. Plant unnaturally wet areas (caused by urban runoff) with suitable understorey species to increase diversity and limit weed colonisation.
3. Plant endemic canopy species particularly along the creekline and the eastern gully slope to shade the area, limit weed inundation, improve resilience and reinstate the essence of an open and closed forest.
4. Increase flora species diversity along the creek to improve structure and function of the riparian corridor.
5. Maintain and improve the *Kunzea ambigua* dominated scrub located above the cliff near the northern park boundary. This area contains diverse endemic flora.
6. Rehabilitate bushland at Montpelier Street end of the park which is a constant source of weed seed.
7. Monitor the encroachment of vines on the eastern gully slope and establish containment lines.
8. Work with Council's Parks & Gardens Section to replace weedy areas adjoining Lower Bent Street with local native buffer/habitat plantings.

Fauna

9. Continue to enhance wildlife corridors and investigate financial/operational opportunities to promote habitat enhancement and connectivity.
10. Retain yet contain dense vines, mesic and exotic plants in the dense weed habitat zone on the eastern gully slope for fauna habitat until suitable habitat in adjacent sections of the bushland are mature enough to ensure survival of small bird species.

Tracks, Water and Erosion

11. Consider using stone refuse from the site to stabilise the eastern gully slope and create areas for planting.
12. Install sedimentation fencing and edge stabilisation management structures (e.g. timber sleepers, coir logs etc) along the edge of private property boundaries and near stormwater drains where needed.
13. Liaise with Sydney Water to improve their infrastructure to reduce pollutants in the park.

Threatened Species

14. Work in collaboration with the Saving Our Species program managed by the NSW Office of Environment and Heritage and the NSW Herbarium to identify, monitor and protect *Acacia terminalis* subsp. *terminalis* if present in the park and contribute to the preparation of best practice guidelines for the species.
15. Preserve and enhance the habitat of threatened microbat species, Powerful Owl (*Ninox strenua*) and Grey-headed Flying-fox (*Pteropus poliocephalus*).

Aboriginal and Historic Heritage

16. Organise an assessment of the heritage significance of unassessed items within the park by qualified professionals, formulate recommendations and appropriate management measures.

Pests and Illegal Activity

17. Report all illegal drug and alcohol use locations and associated damage to Council's Ranger team. All affected areas are to be listed on Council's register for such sites and collaboration is required with the Police to implement management strategies.
18. Monitor for illegal encroachments and the development of unauthorised tracks. Address as identified.

Ecological Burns

19. Manage ecological burns to preserve and encourage locally rare plant species.
20. Refer to Map 3 Fire History and Future Managed Burns.

Community

21. Engage local residents in Bushcare Programs (e.g. Bushcare; Adopt-a-Plot; Native Havens; Wildlife Watch; Bush friendly neighbour program).
22. Liaise with the Community Gardeners to prevent dumping of green waste on the bushland edge and mitigate the potential for garden plants spreading.
23. Carry out appropriate community consultation regarding tree work, tree removals and tree replanting.
24. Develop a bushland neighbour information brochure to help raise awareness of edge effects and the ways local residents can improve their bushland footprint.

Capital Projects

25. Assess the need for directional and / or interpretative signage and implement as needed.
26. Monitor condition of the bushland walking track and schedule upgrade works as required.
27. Consider installation of handrails in strategic locations to reduce formation of unauthorised walking tracks and limit access to known locations of anti-social activity.
28. Install edging in areas that adjoin mown turf to delineate boundaries and minimise spread of exotic grass/herbaceous weeds in to bushland.

Map 1: Vegetation Communities (NAS 2010)

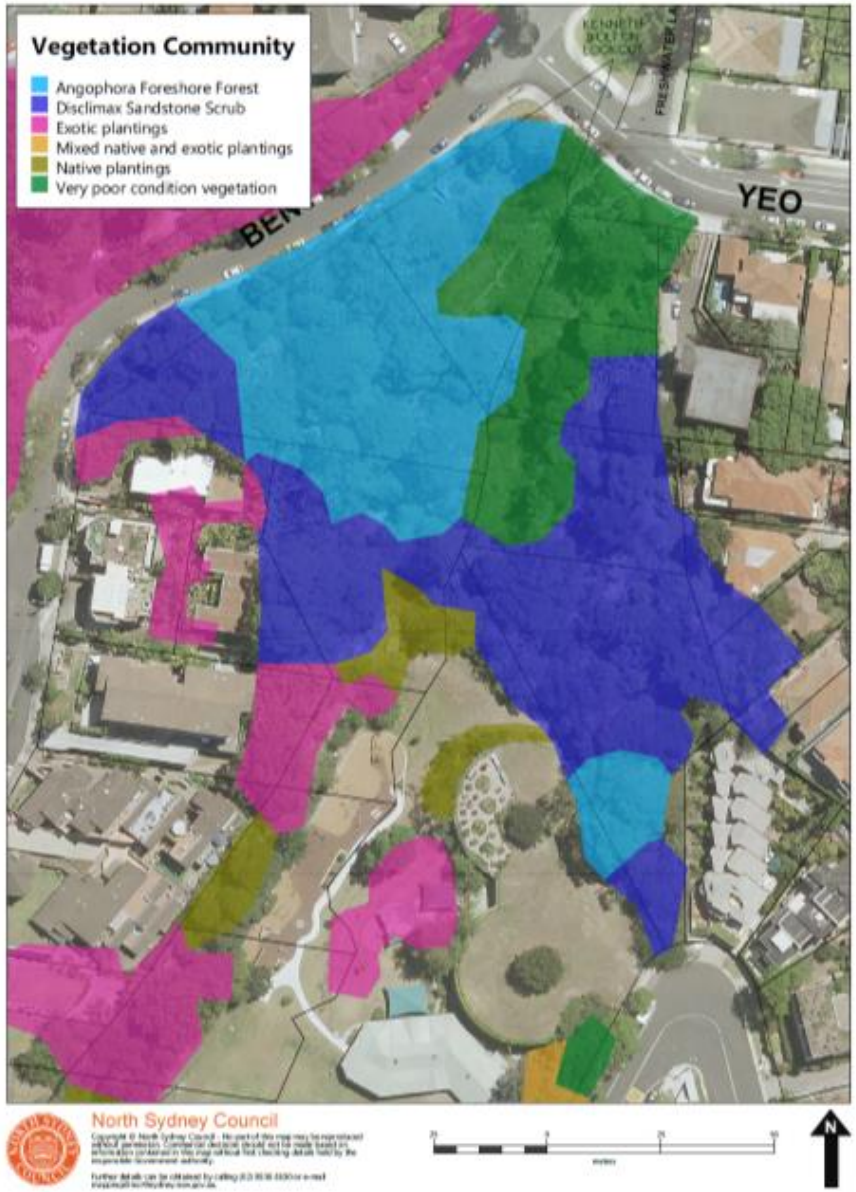
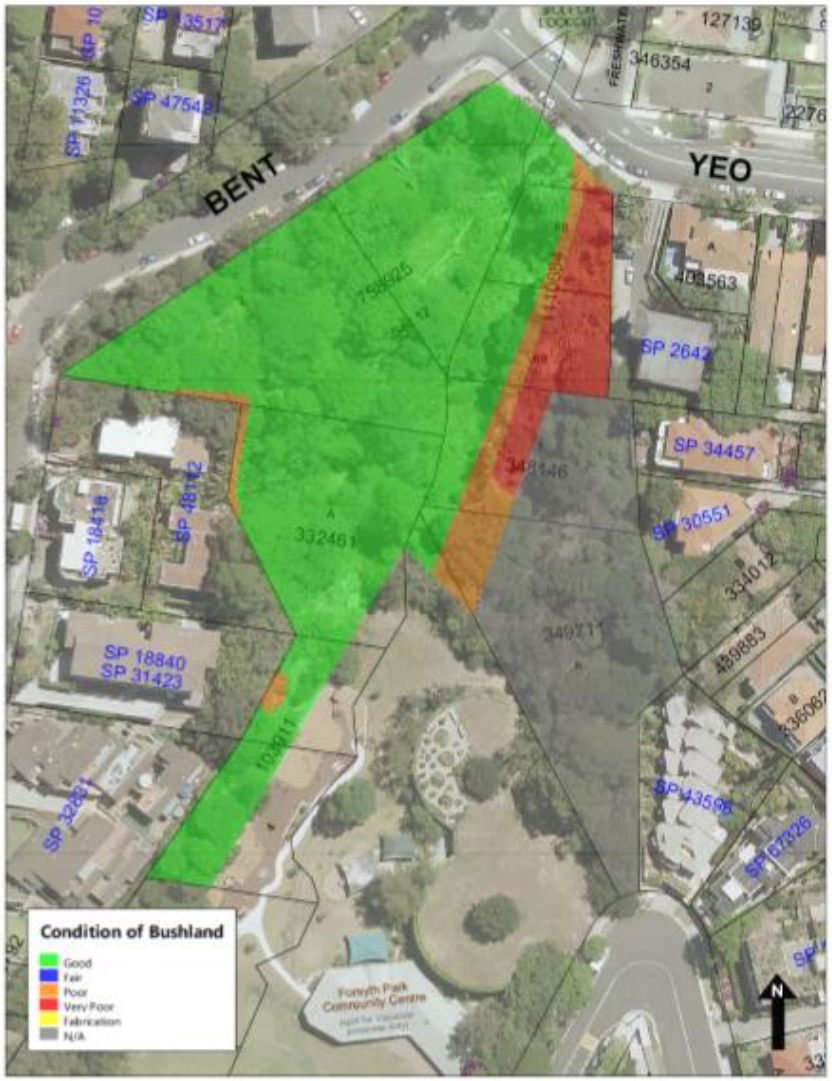


Table 1: Common species recorded in Forsyth Park

Scientific Name	Common Name	Vegetation Community
Angophora costata	Sydney Red Gum	AF; DS
Callicoma serratifolia	Black Wattle	DS
Calochlaena dubia	Common Ground Fern	AF; DS
Dianella caerulea	Blue Flax Lily	AF
Elaeocarpus reticulatus	Blueberry Ash	AF; DS
Entolasia stricta	Wiry Panic	AF; DS
Ficus rubiginosa	Port Jackson Fig	AF; DS
Glochidion ferdinandi	Cheese Tree	AF; DS
Hypolepis muelleri	Harsh Ground Fern	AF
Lomandra longifolia	Spiny-headed Mat-rush	AF;DS
Microlaena stipoides	Weeping Grass	AF; DS
Oplismenus aemulus	Basket Grass	DS
Polyscias sambucifolia	Elderberry Panax	AF
Pteridium esculentum	Bracken	AF; DS
Smilax glyciphylla	Sweet Sarsaparilla	DS
AF: Angophora Foreshore Forest		
DS: Disclimax Sandstone Scrub		

Map 2: Condition of Bushland and Resilience (2018)



Condition of Bushland and Resilience Key

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural recruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting Poor indicative resilience
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience – limited regeneration potential (1-2 species)
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed sandstone)

Map 3: Fire History & Future Managed Burns

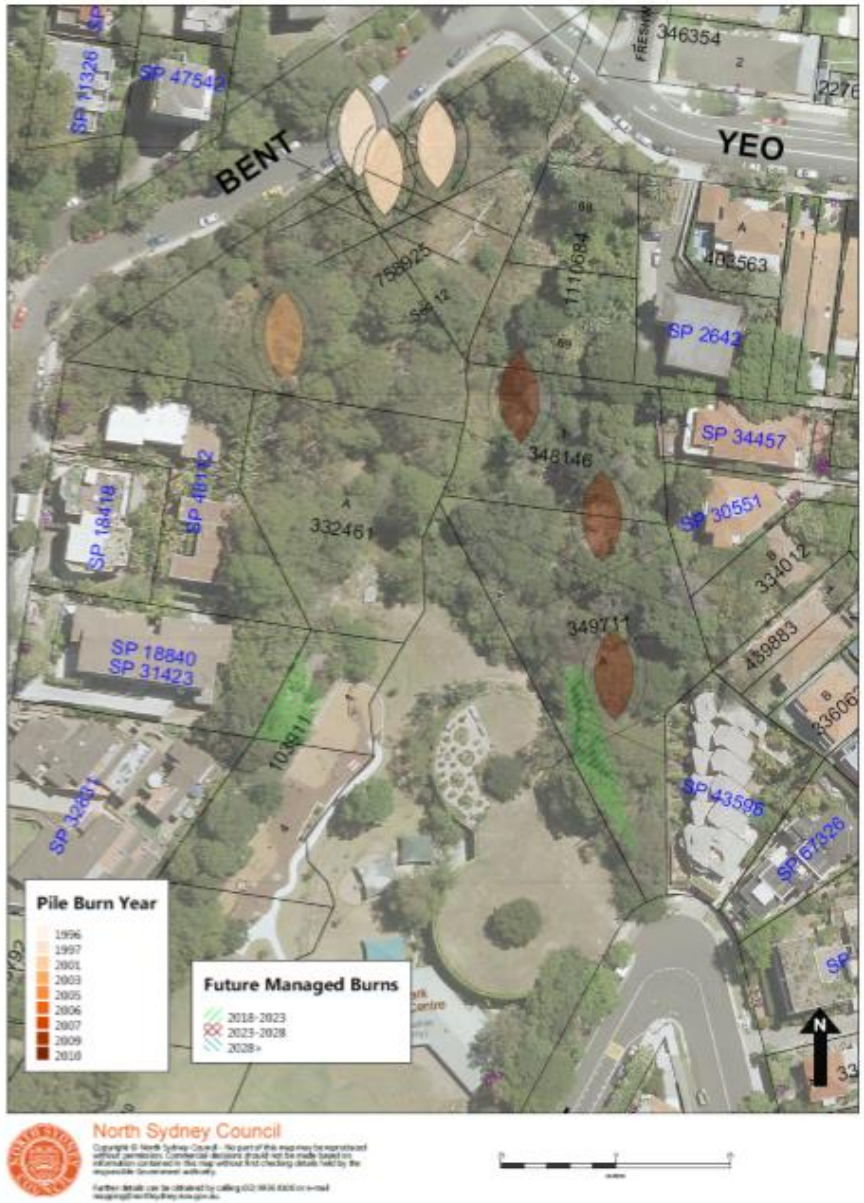


Table 2: Species of Special Conservation Concern

COMMON NAME	SCIENTIFIC NAME	CAUSE OF DECLINE
Australian Brush Turkey Australian Magpie Australian Raven Bar-sided Skink Blue-banded Bee Butterfly Cabbage White Butterfly Channel-billed Cuckoo Common Crow Butterfly Crested Pigeon Crimson Rosella Eastern Bent-wing Bat Eastern Whipbird Gould's Wattled Bat Grey Butcherbird Grey-headed Flying-fox King Parrot Laughing Kookaburra Masked Lapwing Musk Lorikeet Noisy Minor Pied Currawong Powerful Owl Rainbow Lorikeet Southern Weasel Skink Sulpher-crested Cockatoo Tawny Frogmouth Welcome Swallow White-browed Scrubwren White-faced Heron Willie Wagtail Yellow-tailed Black Cockatoo	*Alectura lathami* *Cracticus tibicen* *Corvus coronoides* *Eulamprus tenuis* *Amegilla sp* *Crune synopla* *Piens rapae* *Scythrops novaehollandiae* *Euploea core* *Ocyphaps lophotes* *Platycercus elegans* *Miniopterus schreibersii oceanensis* *Psophodes olivaceus* *Chalinolobus gouldi* *Cracticus torquatus* *Pteropus poliocephalus* *Alisterus scapularis* *Dacelo novaeguineae* *Vanellus miles* *Glossopsitta concinna* *Manorina melanocephala* *Strepera graculina* *Ninox strenua* *Trichoglossus haematodus* *Saproscincus mustelinus* *Cacatua galerita* *Podargus strigoides* *Hirundo neoxena* *Sericornis frontalis* *Egretta novaehollandiae* *Rhipidura leucophrys* *Calyptorhynchus funereus*	- Reduction of Tall Eucalypt Forest in North Sydney; - Loss of habitat /Declining canopy cover - Reduction and degradation of bushland habitat in North Sydney; - Ecosystem degradation general loss of species diversity; Urban ecology expansion is beneficial to larger common birds; - Fragmented populations confined to small native bushland remnants are at risk of local extinction; - Lack of constant food source; - Predation from cats, dogs and urban predatory birds such as Currawongs and butcher birds. - Scarcity of natural breeding hollows - Altered stormwater system causing habitat loss; stormwater pollution; Sedimentation; Chytrid fungus; & Isolation of small populations.
Prickly Moses Leionema Black Wattle Handsome Flat-Pea Tick Bush Bangalay Red Bloodwood Forest She-Oak	*Acacia ulicifolia* *Leionema dentatum* *Callicoma serratifolia* *Platylobium formosum* *Kunzea ambigua* *Eucalyptus botryoides* *Corymbia gummifera* *Allocasuarina torulosa*	- Altered fire regimes; - Ecosystem degradation; general loss of species diversity; - Fragmented populations confined to small bushland remnants; - Lack of connectivity between bushland limits pollination pathways and seed dispersal - Community use pressures - Stormwater pollution, erosion and sedimentation

Table 3: Plant species affecting biodiversity and stability of Bushland

Common Name	Botanic Name	Habit	Common Name	Botanic Name	Habit
African love grass	*Eragrostis curvula*	Grass/Ground layer	Purple top	*Verbena bonariensis*	Ground layer
Barbed wire grass	*Cymbopogon refractus*	Grass/Ground layer	Thick head	*Crassocephalum crepidioides*	Ground layer
Couch	*Cynodon dactylon*	Grass/Ground layer	Thistle sp	*Cirsium vulgare*	Ground layer
Crows foot grass	*Eleusine indica*	Grass/Ground layer	Trad	*Tradescantia fluminensis*	Ground layer
Ehrharta	*Ehrharta erecta*	Grass/Ground layer	Turkey rhubarb	*Acetosa sagittatus*	Ground layer
Foxtail grass	*Pennisetum alopecuroides*	Grass/Ground layer	Balloon vine	*Cardiospermum grandiflorum*	Climber
Kikuyu	*Pennisetum clandestinum*	Grass/Ground layer	Cape Ivy	*Delairea odorata*	Climber
Weeping grass	*Microlaena stipoides*	Grass/Ground layer	Honeysuckle	*Lonicera japonica*	Climber
Palm grass	*Setaria palmifolia*	Grass/Ground layer	Madeira vine	*Anredera cordifolia*	Climber
Parramatta grass	*Sporobolus indicus*	Grass/Ground layer	Morning glory coastal	*Ipomea cairica*	Climber
Paspalum	*Paspalum dilatatum*	Grass/Ground layer	Morning glory	*Ipomea indica*	Climber
Red natal grass	*Melinis repens*	Grass/Ground layer	Moth vine	*Araujia sericifolia*	Climber
Summer grass	*Digitaria sanguinalis*	Grass/Ground layer	Corky Passionfruit	*Passiflora suberosa*	Climber
Asthma weed	*Parietaria judaica*	Ground layer	Box Elder	*Acer negundo*	Canopy/Shrub
Asparagus fern	*Protasparagus aethiopicus*	Ground layer	African olive	*Olea europaea ssp. cuspidata*	Canopy/Shrub
Bidens	*Bidens pilosa*	Ground layer	Castor oil plant	*Ricinus communis*	Canopy/Shrub
Scurvy weed	*Commelina cyanea*	Ground layer	Camphor laurel	*Cinnamomum camphora*	Canopy/Shrub
Crofton	*Ageratina adenophora*	Ground layer	Cassia	*Senna pendula*	Canopy/Shrub
Fishbone fern	*Nephrolepis cordifolia*	Ground layer	Cheese Tree	*Glochidion ferdinandi*	Canopy/Shrub
Fleabane	*Conyza spp*	Ground layer	Coral Tree	*Erythrina sp*	Canopy/Shrub
Mist flower	*Ageratina riparia*	Ground layer	Lantana	*Lantana camara*	Canopy/Shrub
Montbretia	*Crocosmia X crocosmiiflora*	Ground layer	Ochna	*Ochna serrulata*	Canopy/Shrub
Mother of millions	*Bryophyllum delagoense*	Ground layer	Port Jackson Fig	*Ficus rubiginosa*	Canopy/Shrub
Mustard weed	*Brassica spp.*	Ground layer	Sweet Pittosporum	*Pittosporum undulatum*	Canopy/Shrub
Paddys lucerne	*Sida rhombifolia*	Ground layer	Small leaf Privet	*Ligustrum sinense*	Canopy/Shrub
Pampas lily of the valley	*Salpichroa organifolia*	Ground layer	Large leaf Privet	*Ligustrum lucidum*	Canopy/Shrub
Pareuvian lily	*Alstroemeria pulchella*	Ground layer	Wild tobacco	*Solanum mauritianum*	Canopy/Shrub

2.1.6 Gore Cove Reserve and Smoothey Park Bushland Rehabilitation Plan

Description

Size: Gore Cove Reserve and Smoothey Park 4.3 Ha

Access: Smoothey Park is accessed via Russell Street and Milray Avenue. Gore Cove Reserve is accessed via Shirley Road, Wollstonecraft. The reserve can also be accessed via tracks in Lane Cove LGA from Vista Street, Glenview Street and Saint Giles Avenue, Greenwich.

Ownership: Gore Cove Reserve is crown land managed by North Sydney Council. Smoothey Park is Council owned.

Catchment: Port Jackson

Configuration / Connectivity: Smoothey Park is bounded by the north shore railway line to the east, Russell St to the north, Milray Ave and residential development to the south and Berry Creek and Greendale Park located in Lane Cove Council area to the west. Gore Cove consists of a narrow corridor of bushland bounded by Berry Creek and Gore Cove to the west, Smoothey Park to the north, residential development along the eastern boundary and the NSW Government's Fisheries Office to the south (soon to become another land use). It forms part of a vegetated corridor with Badangi Reserve and Berry Island Reserve in Wollstonecraft and Greendale Park and Holloway Park in Greenwich.

Hydrology: All surface water drains to Berry Creek and into Gore Cove. Stormwater enters Berry Creek via a large-diameter stormwater pipe at the northern end of Smoothey Park. This pipe contributes substantial urban runoff, waste water and pollutants from the upper catchment.

Geology: Hawkesbury Sandstone of medium to coarse grained quartz sandstone with minor shale and laminate lenses and sandstone outcrops.

Soil Landscape: Hawkesbury Soil Landscape except for the most northern area of Smoothey Park which is the Gymea Soil Landscape. Both soils are associated with Hawkesbury Sandstone and are shallow, poor sandy soils, highly erosive with low soil fertility. Localised Yellow and Red Podzolic Soils are associated with shale lenses. Siliceous Sands and secondary Yellow Earths are along the creekline. The area below roads, the railway line and residences are in parts disturbed with fill from past construction and dumping.

Slope: Moderate to steep slopes.
Facilities / Infrastructure: The Gore Cove Track, which includes interpretive signage, links Smoothey, Greendale and Holloway Parks to Berry Island and Badangi Reserve via Gore Cove Reserve. Within Smoothey Park, an asphalt pathway connects Russell St to Wollstonecraft Railway Station and another major pathway links the station to the Greenwich residential area via the high-level pedestrian bridge. Both paths are heavily used by commuters. A low-level pedestrian bridge also crosses Berry Creek and forms part of the Gore Cove walking track. Bench seats are located at intervals along the asphalt pathway. Limited dinghy storage (for registered and authorised vessels) is provided on the foreshore at the southern end of Gove Cove Reserve. A public hall, currently housing a Men's Shed, is located between the railway line and the bushland in Smoothey Park. The building is accessed via an asphalt road from Russell St. A small informal car park is located beside the hall. Service infrastructure includes a high pressure gas main, sewerage pipes, under and over ground power lines, stormwater pipes and potable water supply pipes.

Plant Community:
Smoothey Park
- Blackbutt Gully Forest – an open or tall open forest with *Eucalypt pilularis* as the dominant tree species.
- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species.

Gore Cove Reserve
- Estuarine Mangrove Forest – A low closed forest of *Avicennia marina* (Grey Mangrove) growing on intertidal mudflats at the mouth of Berry Creek.
- Estuarine Swamp Oak Forest – An open forest dominated by *Casuarina glauca* that grows beside the intertidal zone
- Estuarine Saltmarsh - a herb land of *Sarcocornia quinqueflora* and *Suaeda australis* on intertidal mudflats.
- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species found along the foreshore.
- Sandstone Gallery Rainforest – Closed-forest dominated by *Acmena smithii*, *Ceratopetalum apetalum* and *Pittosporum undulatum* on steep, sheltered slopes besides rock creeklines on Hawkesbury Sandstone.
- Disclimax Sandstone Scrub – an altered community of open to closed scrub, or a forest of mixed and variable composition due to disturbance and lack of fire.
- Refer to Map 1 for the plant communities; Table 1 for common flora species and Table 2 for plant species of special conservation concern in Gore Cove Reserve and Smoothey Park.

Wildlife Habitat:
- Smoothey Park and Gore Cove Reserve provide a diverse range of habitats including open and closed forest, a creek, intertidal mudflats, open to closed scrub and rocky outcrops.
- The park and reserve are part of an important habitat link to nearby bushland areas in Badangi Reserve and Berry Island. They also link with other parks within the Berry Creek catchment including Greendale Park and Holloway Park in Greenwich and Newlands Park in St Leonards.
- The reserve is within range for many wildlife species that move between reserves such as the Common Brushtail (*Trichosurus Vulpecula*) and Ringtail Possum (*Pseudocheirus peregrinus*), bats, woodland, rainforest and sea birds. Over the past 5-10 years, wildlife such as Brush Turkeys (*Alectura lathami*) have naturally re-colonised. Remnant small range species include skinks, lizards, geckoes, snakes and frogs.
- The intertidal mudflats provide habitat for waterbirds, bats, insects, mammals, crabs, molluscs and fish at different phases of the tide.
- The reserve lacks nesting hollows and roosting sites for birds and arboreal mammals due to the lack of mature native trees. Such creatures play an important role in the

ecology of the vegetation communities, assisting in pollination, seed dispersal and germination.
- Refer to Table 2 for the fauna species of special conservation concern found in Smoothey Park and Gore Cove Reserve.

Condition and Resilience:
- Most of the bushland is in good-to-fair condition. The size and connectivity of these remnants to other bushland, provides high long-term resilience/viability.
- Council and the community have worked to transform the bushland over the last 20 years, reducing the mosaic effect of lawn and bushland in Smoothey Park, as well as the spread of weeds throughout. Native plants are successfully re-colonising through ongoing application of bush regeneration and ecological burning. Core areas have been expanded and native plantings have stabilised park edges. The lower gully is degraded; however, improvements are being made due to planting niche species and natural recruitment.
- The long, thin configuration of this bushland makes it highly vulnerable to edge effects from adjoining residential properties, Berry Creek, the railway line and the harmful effects of urban stormwater runoff.
- Disturbance from dumping of soil, waste and building materials from the back of residential properties and major infrastructure works (railway, stormwater and sewerage infrastructure) has changed soil structure, stability and composition in some areas, destroying or burying the original seed bank. This limits the process of unassisted natural regeneration. The creekline has been significantly impacted by stormwater impacts.
- Some exposed sandstone outcrops demonstrate areas with higher resilience and more in-tact soil structure further down slope.
- Removal of native vegetation to create lawn areas in Smoothey Park was undertaken without major soil disturbance or the use of fill. As the original soil profile remains, it responds well to the removal of mowing which has triggered relatively diverse regeneration.
- Dense middle story vegetation is lacking in the lower gully, which takes decades to develop due to low light levels. It also lacks upper canopy in areas affected by dense weed or historical logging.
- Native and exotic mesic and vine species require targeted and regular maintenance to manage colonisation/domination in areas of open forest and where elevated soil moisture and nutrient conditions excluded fire for long periods (excluding lower gully).
- Contaminated water entering Berry Creek negatively impacts stream ecology and biodiversity. In 2015, a small bio-retention system was installed in the north east of Smoothey Park. This system enhances habitat and improves the quality of runoff from Russell Street.
- Bush regeneration activities are carried out by Council's Bushland Management Team, bush regeneration contractors (since 1997), the volunteer Smoothey Park Bushcare Group formed in 1994 and community members involved in the Adopt-a-Plot program.
- Refer to Map 2 Condition of Bushland and Resilience.

Zone / Classification:
- The bushland is zoned E2 Environmental Conservation under the *North Sydney LEP 2013.* It is classified public bushland in *SEPP No. 19 Bushland in Urban Areas (*and in the draft SEPP (*Environment)* that will supersede *SEPP 19).*
- The park and reserve are identified as a Coastal Environment Area and Coastal Use Area under *SEPP (Coastal Management*) and parts are identified as Coastal Wetland or Proximity Area for Coastal Wetland.

Statement of Significance:
Historic Values
- The bushland is a legacy of past land management by the traditional Aboriginal custodians, the Cammeraygal, who originally occupied the area. Aboriginals frequented the valley and used Berry Creek as a fresh water source for many thousands of years. Shell middens are represented in the reserve. Other signs of Aboriginal life may be present but remain undiscovered. Places, objects and features of significance to Aboriginal people are protected under the NSW *National Parks and Wildlife Act 1974*.
- Smoothey Park was named after Mr S Smoothey who was an Alderman of North Sydney Council from 1911 to 1920. Gore Cove Reserve was named after Provost Marshall William Gore who was granted land in the area in 1806. Smoothey Park and Gore Cove formed part of the original Berry/Wollstonecraft Estate of 1821.
- Gore Cove Reserve forms part of Sydney Harbour, which is an outstanding natural and public asset of national significance. Gore Cove Reserve (along with Badangi Reserve) is listed as a heritage landscape under the *North Sydney LEP 2013* Schedule 5. Together they are listed as the "Wollstonecraft Foreshore Reserves".
- Unlisted heritage items are scattered throughout the bushland including dry cut stone walls, masonry walls, a rock-cut chamber and various rectangular cuts in the bedrock of Berry Creek. These are possibly associated with early Water Board activities in the 1920's or for another local industrial purpose.

Natural Values
- Smoothey Park and Gore Cove Reserve play a significant role in maintaining biodiversity in the region and assist in the conservation of species, habitats and ecological functions.
- Berry Creek is the longest and most in-tact natural creekline remaining in North Sydney and the wetland at the mouth of Berry Creek is the most significant in the local government area.
- The marine waters bordering the bushland of Gore Cove are part of a large Intertidal Protection Area for Sydney Harbour that aims to protect intertidal biodiversity and structure.
- Both reserves have been declared Wildlife Protection Areas under the NSW *Companion Animals Act* 1998.
- They also form part of the 'Wollstonecraft reserves', which have been identified as a biodiversity hotspot under Council's Natural Area Survey 2010. These Reserves contain 10 of the 12 vegetation communities known to occur in the North Sydney LGA.
- Both reserves connect with other bushland along the foreshore and catchment of Berry Creek, providing a significant wildlife corridor in an urbanised setting.
- Estuarine Swamp Oak Forest (otherwise known as Swamp Oak Forest on Coastal Floodplains) and Coastal Saltmarsh are listed as endangered ecological communities (EEC) under the NSW *Biodiversity Conservation Act 2016* (*BC Act*).
- Small colonies of Coastal Saltmarsh have been recorded on intertidal mudflats in Gore Cove. Saltmarsh is listed as a threatened ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*.

- Locally rare species include Flannel Flower (*Actinotus helinotus*), Scribbly Gum (*Eucalyptus racemosa*), *Dendrobium linguiforme,* Red Bloodwood *(Corymbia gummifera)*, Myrtle Wattle (*Acacia myrtifolia*) and Corkwood (*Endiandra sieberi*).
- The endangered *Acacia terminalis* subspecies *terminalis* listed under the Commonwealth *EPBC Act* and the NSW *BC Act* occurs in both reserves. Samples were confirmed by the NSW Herbarium in 2017. Its occurrence could be more widespread as it is known to occur in Angophora Foreshore Forest, Blackbutt Gully Forest and Disclimax Sandstone Scrub.
- Both reserves provide habitat for a range of wildlife including threatened and declining fauna species such as: Grey-headed flying-fox (*Pteropus poliocephalus*) (listed as vulnerable under the BC Act and *EPBC Act 1999)*; Powerful owl (*Ninox strenua*); Black Bittern (*Ixobrychus flavicollis*) and the White-bellied Sea-Eagle (*Haliaeetus leucogaster)* (all listed as vulnerable under the *BC Act*).
- Recorded bat species listed as vulnerable under the *BC Act* include the Eastern Freetail Bat (*Mormopterus norfolkensis*), the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) and the Southern Myotis (*Myotis macropus*).
- Migratory birds recorded in the reserves include the Common Sandpiper (*Actitis hypoleucos*), Rufus fantail (*Rhipidura rufifrons*) and Black-faced Monarch (*Monarcha melanopsis*).

Recreation / Education Values

- The park is a valuable educational, nature appreciation and bushwalking resource that is highly accessible due to its track network and proximity to Wollstonecraft Station. Gore Cove Reserve forms part of Sydney Harbour which is an outstanding natural and public asset of national significance.

Fire History:

- Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity in these reserves.
- Past burns have resulted in the successful germination of native endemic flora species and the regeneration of previously unrecorded species.
- Fire Management Zones exist along all boundaries with private property and park infrastructure.
- Planned hazard reduction / ecological broad area burns are conducted from time to time with the exception of very narrow inaccessible parts of Gove Cove Reserve that are logistically restricted from an ecological burn program. Refer to Map 3 Fire History and Future Managed Burns.

Threats:

- The limited size and narrowness of these reserves amplifies their vulnerability to fragmentation and edge effects from the surrounding urban environment. Impacts from adjoining residential properties that facilitate weeds include garden escapes and dumping of garden clippings into bushland. A recurring problem of broken drainage pipes and terracotta sewerage pipes servicing adjoining residential properties also increases moisture and nutrification. Runoff from hard surfaces, irrigation and pools increase nutrient loads, moisture and erosion on the slopes below. Garden fertiliser also leaches into bushland, increasing soil nutrients. Other threats include encroachment from adjoining residences and periodic illegal clearing and tree vandalism.
- Widespread fill over many decades, as well as past and more recent dumping, significantly compromises soil stability and structure, seedbank viability and bushland resilience. The waste comprises a range of material including demolition, domestic and industrial waste, foreign soil and excavated material from adjoining construction sites.
- Visitor impacts include creation of informal tracks, graffiti on rock faces and illegal storage of small watercraft along the foreshore of Gore Cove.
- *Phytophthora cinnamomi* (root rot*)* affects the health of the bushland and is widespread.
- Hybridization is a significant threat to the endangered *Acacia terminalis* subsp. *terminalis*.
- In heavy rainfall periods, effluent leaks from concrete pop-top lids along the sewerage pipeline. The flow of water down the creek also reaches a high velocity causing erosion along the banks, undercutting the roots of established trees and causing them to fail.
- Degraded and deteriorating stream ecology is also due to pollutants and nutrients in the upper catchment that incorporates parts of Crows Nest and St Leonards. Berry Creek presents a constant source of weed seed.
- Above ground or just below ground infrastructure associated with adjoining residential development such as plastic stormwater pipes, causes hazards and restricts the ability for bushland managers to burn in these areas. This issue is exacerbated by unclear property boundaries at the bushland interface.
- Native and exotic vines, mesic species (excluding the lower gully) and weeds are a serious threat to the stability of resilient cores and long-term viability of biodiversity. Refer to Table 3 for plant species affecting biodiversity and stability of bushland assets.
- Native bats and birds can transport new flora species and weeds into the bushland that have the potential to change its structure over time.
- At times, foxes (*Vulpes vulpes*), domestic cats (*Felis cattus*) and off-leash dogs (*Canis lupus familiaris)* are observed in the reserve and along the foreshore. These animals predate, scare and disturb wildlife, pollute with their faeces and spread weed seed. Shorebirds are particularly impacted by dogs off lead.
- Some introduced or endemic fauna are very territorial and complete for habitat, limiting species diversity.
- Inappropriate weed removal can reduce fauna habitat with greater impacts on short range species (e.g. small birds).
- Increased drone usage is causing disturbance to fauna that occur in the canopy.
- Parts of Smoothey Park's bushland are bordered by lawn grass. This causes exotic grass encroachment.
- At the bushland residential interface, the choice of plants in fire management areas can impact on bushland. Plants chosen are often native but not endemic and can be invasive and cross pollinate if not sourced locally.
- Climate change is an ongoing threat. Anticipated impacts include increased threat of bushfire and extreme weather events. Raised sea levels are predicted to inundate shoreline vegetation, eroding the foreshore and destroying Aboriginal middens. Intensified storm events will result in higher volumes of of stormwater runoff which is likely to result in erosion to drainage lines and creeks. Increased temperatures are likely to affect biodiversity and ecosystems, favouring some species over others and changing the structure and function of the bushland. The rate of climate change

may be faster than the rate of natural adaptation. Increased temperatures will harm sensitive fauna such as bats, impacting their important ecosystem function.
- Native vegetation around the Men's Shed suffers trampling and refuse dumping.
- Non-passive recreational activities (incl. orienteering; rock climbing; geo-caching, camping and mountain biking) cause substantial damage to native vegetation and soil stability. These activities are prohibited in North Sydney's bushland reserves.

Bushland Management Goals

a. Maintain and enhance biodiversity and habitat for long term ecosystem resilience and function
b. Conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve
c. Strategically restore bushland (prioritise areas of highest resilience)
d. Enhance habitat connectivity
e. Preserve genetic integrity of the vegetation community
f. Manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality
g. Conserve the natural landscape and heritage values
h. Provide for ecologically sustainable recreation needs of the community
k. Implement the strategic fire hazard reduction program and manage fuel loads to protect life, property and endemic biodiversity

Rehabilitation Principles and Procedures:
General

1. Bush regeneration is a long-term process of staged weed removal to ensure endemic biodiversity, native plant establishment and continued habitat for local wildlife. It relies on site assessments that identify values and how best to restore and enhance ecosystem function and structure. Routine site monitoring, evaluation of field strategies and periodic native flora and fauna surveys inform management priorities over time. Works normally proceed from bush in good condition with high resilience. Degraded areas are a lower priority but the weeds always require containment.

Planning, Evaluation and Review

2. The Bushland Management Team should regularly evaluate bushland rehabilitation plans and the success of field strategies to inform management priorities early.
3. Establish photo points to monitor projects.
4. In the bushland rehabilitation planning process, consider the potential impact of future infrastructure earthworks, or access requirements on bushland, habitats, green corridors or active rehabilitation sites.
5. The Bushland Management Team must approve all contractor project proposals before implementation.
6. All Work, Health and Safety requirements must be adhered to by Council staff, volunteers and contractors before, during and after site works.

Native Flora

7. Record uncommon flora species to determine risk of extinction in the reserve. (Use North Sydney flora survey record template).
8. Prioritise protection / rehabilitation in areas of highest resilience.
9. Buffer areas should protect biodiversity from disturbances caused by fragmentation and edge effects: (a) monitor to identify gaps in buffer vegetation and senescing / restored vegetation and organise replacement planting; (b) where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a medium/long term solution to stop herbaceous weeds and grasses from spreading into bushland; (c) control vines, noxious weeds and other plant species affecting stability of adjoining bushland.
10. When natural regeneration is ineffective, locally source all plant material for supplementary planting to maintain genetic integrity of native vegetation in accordance with Flora Bank Guidelines https://www.greeningaustralia.org.au/florabank. Only plant when natural regeneration is ineffective to boost biodiversity, with the aim to achieve 80% survival rates. Plant in stages, basing species selection on the target vegetation community/structure, successional stage, habitat requirements and physical constraints. This process involves collaboration from Council's nursery supervisor, bush regeneration team, Bushcare volunteers and bush regeneration contractors.
11. In areas lacking diversity and structure; direct seed, transplant and use appropriate tube stock to enhance existing plant communities. When planning a replanting site: (a) prepare a suitable plant list based on rehabilitation objectives and prevailing site condition; (b) allow time for seed collection and propagation (9-12 months ahead of planting); (c) identify where seed harvesting/cuttings will be gathered; (d) prepare area (e.g. reduce density of dominant species on ground layer or mesic species in shrub layer); (e) schedule planting for early Autumn during or after soaking rain.
12. Collect seed of suitable locally rare species from nearby bushland areas, propagate and plant in appropriate areas of the reserve to enhance biodiversity and ensure the long-term viability. For species that are difficult to propagate, explore other methods such as seed scarification / raking treatment / seedbank translocation etc.
13. Implement a canopy replacement program in areas where remnant canopy is absent, senescing or failing to regenerate or where non-endemic trees have been removed.
14. Do not encourage large canopy species on unstable areas or under electricity easements where they cannot be supported and may cause future hazards.
15. Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team: (a) pile burn where appropriate; (b) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (c) reduce seedbank of dominant natives - control seeding cycle; (d) lightly disturb mulch / organic matter to stimulate regeneration; (e) increase seed bank of uncommon/ rare species with brush matting techniques (collect from donor sites where seed removal will not affect biodiversity); (f) propagate senescing plant species at risk of extinction in the reserve (i.e. due to an inadequate fire regime) and plant tubestock in suitable locations.
16. When planting along bushland edges, select species in consideration of their potential to compliment views from residential or public viewing areas and design to enhance habitat / connectivity (e.g. for small birds).
17. Conserve and protect naturally regenerating / colonising canopy species providing they are in sustainable locations.

Weeds and Pathogens

18. Implement the *Biosecurity Act 2015* consistently and effectively, in accordance with bushland management objectives and processes.
19. Residential properties adjoining bushland can contribute to weed spread. Monitor and address invasive garden plants in accordance with the *Biosecurity Act 2015* and promote Council's Native Havens / Habitat Stepping Stones Programs.

20. Ongoing weed management should: (a) prioritise good bush areas; (b) target species threatening stability e.g. vines, woody or canopy weeds; (c) interrupt seed cycle of target species, especially annual and grass weeds; (d) prioritise areas where plant diversity is most affected by mesic shift and vines. (In consideration of fauna habitat needs, schedule works from Autumn through Winter before bird breeding season.)
21. Monitor sites to identify, report and manage early stages of weed outbreaks or shifts in plant species assemblages likely to become detrimental to biodiversity. Manage according to the issues they raise. Report other threats to ecosystem function.
22. All compost weed material is removed off site.
23. Retain weeds on highly erodible or dangerous slopes and use methods of weed suppression that will not create potential for soil erosion. Incorporate abseiling activities on cliff faces to remove weeds that are a constant weed seed source.
24. Strategically remove non-endemic or exotic trees that interfere with ecosystem function or structure. Assess for habitat potential before they are de-limbed.
25. Consider all potential impacts of herbicide and proximity to water when determining suitability for weed control.
26. Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Native Fauna and Habitat

27. Record wildlife sightings and observations in Council's Wildlife Watch database. Share this information with NSW BioNet and the Commonwealth's ALA.
28. Identify and protect nesting, roosting and breeding sites of threatened, vulnerable or locally significant fauna.
29. Minimise disturbance to wildlife, enhance habitat where needed and improve the condition/connectivity of wildlife corridors between adjoining reserves.
30. Protect, maintain and restore quality fauna foraging habitat using a diverse mix of endemic native species. Retain habitat features such as fallen and standing dead wood, rock piles, hollow-bearing trees, natural debris, dead standing trees, forest litter, logs and branches.
31. Short-term strategies to maintain fauna habitat provided by mesic and weed species may require retention yet containment of dense areas of weed, vines and mesic species. In the longer-term, aim to establish a self-maintaining fabricated vegetation community in these areas composed of native species adapted to changed site conditions (abiotic factors) that enhance biodiversity and habitat availability.
32. Before any unfavourable trees are de-limbed, assess for habitat potential e.g. tree hollows.
33. Where suitable, install fauna nesting boxes and create hollows in suitable dead trees to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed.
34. Investigate financial opportunities to invest in habitat enhancing research and developing methodologies.

Threatened species

35. Identify threatened or endangered, rare or locally rare species of flora and fauna. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs.
36. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened species.

Ecological Burns

37. Hazard reduction and ecological burns are based on a strategic burn program consistent with the Mosman North Sydney Willoughby Bushfire Risk Management Plan. Ecological burn regimes are to be in a mosaic pattern to improve bushland function and biodiversity. Areas of high bushfire risk or core ecological resilience are usually prioritised in the annual burn program.
38. Maintain land management zones where bush adjoins residences and implement site stabilisation measures.
39. Over the next 10 years, prioritise prescribed burns at sites at risk of diminishing flora diversity.
40. For pre-fire preparation: (a) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (b) reduce seedbank of dominant natives to control seeding cycle; (c) increase seed bank of uncommon/ rare species with brush matting (collect from donor sites where seed removal will not affect biodiversity).
41. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds.
42. Implement post-fire monitoring and bush rehabilitation strategies. Monitor regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time period post-burn.

Pests and Illegal Activity

43. Monitor and control feral or aggressive/territorial fauna activity, cats, unleashed dogs and illegal activity with appropriate measures e.g. trapping, community education programs, penalty notices or camera observation. If applicable, manage reserves in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 and relevant North Sydney Council policies.
44. Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
45. Monitor the impacts of drones and implement management measures if required.
46. Address instances of unauthorised activities in bushland incl. orienteering; rock climbing; geocaching; mountain biking; camping etc.

Tracks, Water and Erosion

47. Close informal tracks to prevent damage to habitat, impede feral animals and reduce weed spread.
48. Implement track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, track widening and degrading track conditions.
49. Assess the need for additional directional and / or interpretive signage.
50. Stabilise steep slopes, ephemeral flow lines and highly erosive areas using local native species, particularly ground covers, to re-establish appropriate vegetation community structure where natural regeneration is poor or absent. Install sedimentation fences, terracing, coir logs, matting or other appropriate measures where

needed to stabilise washout areas and improve access and safety.

51. Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater tolerant natives.

Aboriginal and non-Aboriginal Heritage

52. All identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1974* and *Heritage Act 1977*.
53. Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual.
54. As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance.
55. Bushland management staff consult with the Aboriginal Heritage Office or Council's heritage officer prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey.
56. Discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol.

Community

57. Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
58. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
59. Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan.
60. When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council

Reserve Specific Rehabilitation Actions

Priorities will be given to programs with long term benefit to the reserves or where natural assets are at greatest risk to avert irreversible deterioration or loss.

Flora

1. Increase species diversity in the gully to improve structure and function of the riparian corridor and encourage/maintain a transition of mesic species between open forest and the gully.
2. Enhance vegetation at the end of the Gore Cove Track /Shirley Rd interface to improve wildlife corridor linkages to Berry Island and Badangi Reserve.
3. Manage the interface of the bushland with parkland areas to ensure it is sympathetic to the desired landscape character.
4. Collaborate with Lane Cove Council to source suitable seed or tube stock from adjoining bushland to increase plant diversity and to share information to improve overall biodiversity outcomes.
5. Undertake bush regeneration and vegetation management activities in a sensitive manner that considers potential benefits/impacts on fauna – particularly the resident breeding Powerful Owl (*Ninox strenua*) pair.

Fauna

6. Where appropriate (based on impacts, risks and hazards), retain fallen timber in gullies and creeks to create aquatic habitat and refuges.
7. Design night lighting to reduce impacts on nocturnal fauna e.g. bats and educate adjoining residences backing onto the park to not direct lighting into bushland.
8. In conjunction with Lane Cove Council (a) improve wildlife corridor links including to Badangi Reserve and Berry Island, (b) apply consistent fauna conservation measures across the entire bushland remnant, (c) investigate financial opportunities to invest in habitat enhancement.

Tracks, Water and Erosion

9. Stabilise steep slopes, the creek bank and highly erodible areas using local native species to re-establish appropriate vegetation community structure, especially where natural regeneration is poor/absent.
10. Where creek banks are scouring, devise appropriate stabilisation techniques (e.g. gabions, coir logs etc) that complement the landscape and heritage items.
11. Use slope stabilisation techniques such as mulching, sediment fencing, timber logs and sandstone capping as management tools for erosion; weed spread and to define the edge between bushland; road verge; lawn areas and the residential interface.
12. Manage bushland vegetation adjoining commuter paths (Smoothey Park) to maintain sight lines and create a sense of security for pedestrians.
13. Monitor and prevent the creation of illegal private encroachments and informal pathways from residential property boundaries into bushland or to the foreshore.

Threatened Species

14. Work in collaboration with the Saving Our Species program managed by the NSW Office of Environment and Heritage and the NSW Herbarium to identify, monitor and protect *Acacia terminalis* subsp. *terminalis* in the reserves and contribute to the preparation of best practice guidelines for the species.
15. Preserve and enhance the habitat of threatened microbat species, Powerful Owl (*Ninox strenua*) and Grey-headed Flying fox (*Pteropus poliocephalus*).
16. Monitor the resident Powerful Owl breeding pair and consider potential impacts of any physical/capital/fire management activities planned for the reserve.

Aboriginal and Historic Heritage

17. Organise an assessment of the heritage significance of unassessed items within the reserves by qualified professionals, formulate recommendations and appropriate management measures.

Illegal Activity

18. Regularly inspect popular fishing locations or small watercraft storage locations to discourage inappropriate and damaging behaviour.
19. Dinghy and kayak storage is prohibited within the reserves except for where permissible in Council's draft Small Watercraft Storage Strategy.
20. Report all illegal drug and alcohol use locations and associated damage to Council's Ranger team. All affected areas are to be listed on Council's register for such sites and collaboration is required with the Police to implement management strategies.
21. Monitor and report unauthorised activities (e.g. unleashed dogs; orienteering events; rock climbing; geocaching; mountain biking; camping etc) and address impacts.
22. Gore Cove Reserve suffers from periodic tree vandalism and the creation of private encroachments. Monitor for future instances and implement regulatory action to address breaches of legislation / policy.

Ecological Burns

23. Refer to Map 3 Fire History and Future Managed Burns.

Community

24. Plan habitat/connectivity enhancement projects to coincide with National Tree Day community plantings.
25. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot program.
26. Develop a bushland neighbour information brochure to help raise awareness of edge effects and the ways local residents can improve their bushland footprint.

Capital Projects

27. Monitor small watercraft storage in Gore Cove and install signage/barriers to deter illegal storage in non-permitted areas.
28. Carry out improvements at the designated dinghy storage area in Gove Cove to increase capacity and minimise damage to the fragile foreshore.
29. Following an assessment and consultation with the Bushcare group, neighbours, track users and Sydney Water, upgrade the Gove Cove track to improve safety accessibility, directional and interpretative signage.
30. Continue to liaise with Rail Corp and encourage weed management of railway land south of the Men's Shed.
31. Consider the installation of a footbridge across Berry Creek to connect the North Sydney and Lane Cove Council sites of the walking track.

Map 1: Vegetation Communities (NAS 2010)

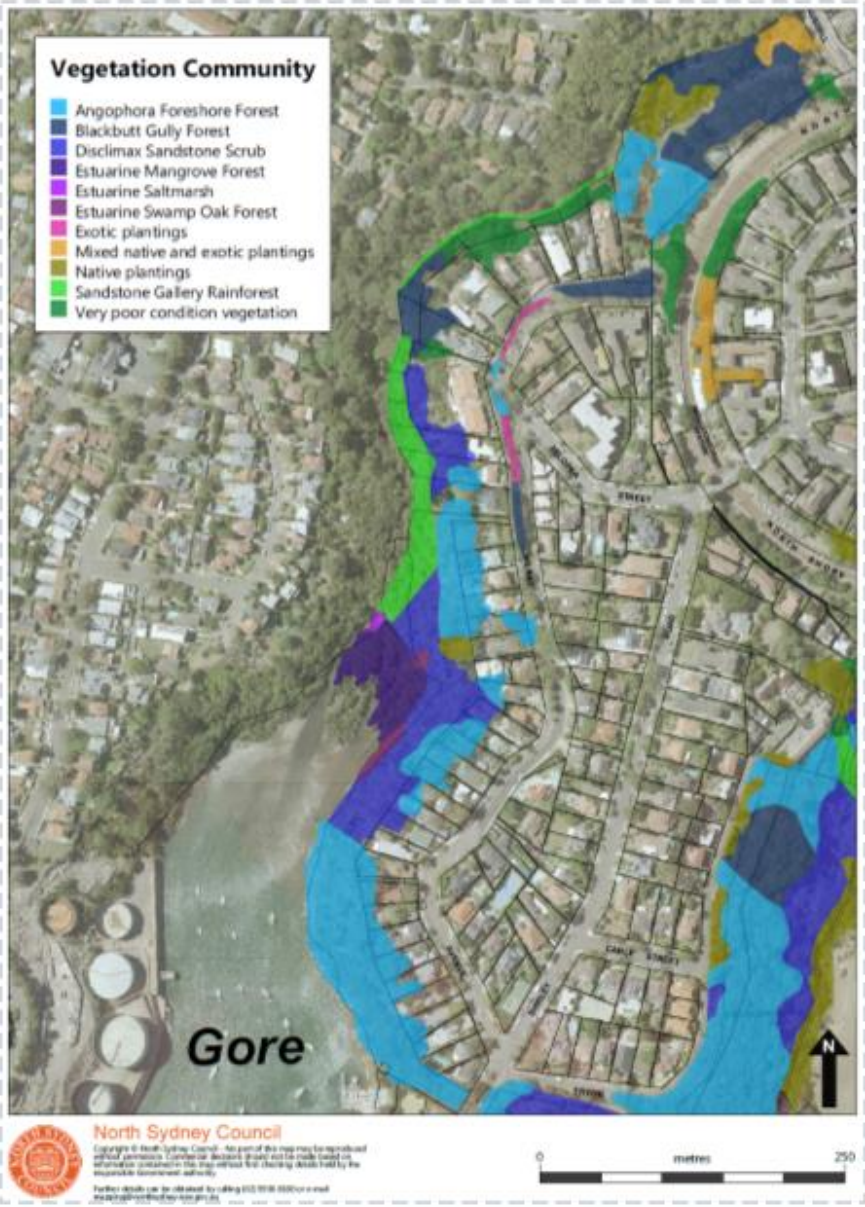


Table 1: Common species recorded in Gore Cove/Smoothey Pk

Scientific Name	Common Name	Vegetation Community
Acmena smithii	Lilly Pilly	GR
Allocasuarina littoralis	Black She-oak	BG; AF; DS
Angophora costata	Sydney Red Gum	BG; AF; DS
Avicennia marina	Grey Mangrove	SO; EM
Casuarina glauca	Swamp Oak	SO
Ceratopetalum apetalum	Coachwood	GR
Dodonaea triquetra	Common Hop Bush	BG; AF
Elaeocarpus reticulatus	Blueberry Ash	BG; AF; DS
Entolasia stricta	Wiry Panic	BG; AF; DS
Eucalyptus pilularis	Blackbutt	BG
Eucalyptus resinifera	Red Mahogany	BG; AF; GR
Glochidion ferdinandi	Cheese Tree	BG; AF; DS; SO
Lomandra longifolia	Spiny-headed Mat-rush	BG; AF; DS
Microlaena stipoides	Weeping Grass	BG; AF; DS; SO
Notelaea longifolia	Large Mock-olive	AF; DS
Pittosporum undulatum	Pittosporum	BG; AF; GR; DS
Platysace lanceolata	Native Parsnip	BG; AF
Polyscias sambucifolia	Elderberry Panax	BG
Smilax glyciphylla	Sweet Sarsaparilla	DS

DS: Disclimax Sandstone Scrub SO: Estuarine Swamp-oak Fst BG: Blackbutt Gully Forest

AF: Angophora Foreshore Fst EM: Estuarine Mangrove Fst GR: Sandstone Gallery Rainfst

Map 2: Condition of Bushland and Resilience (2018)

Condition of Bushland and Resilience Key

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural recruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting Poor indicative resilience
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience – limited regeneration potential (1-2 species)
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed sandstone)

Map 3: Fire History & Future Managed Burns

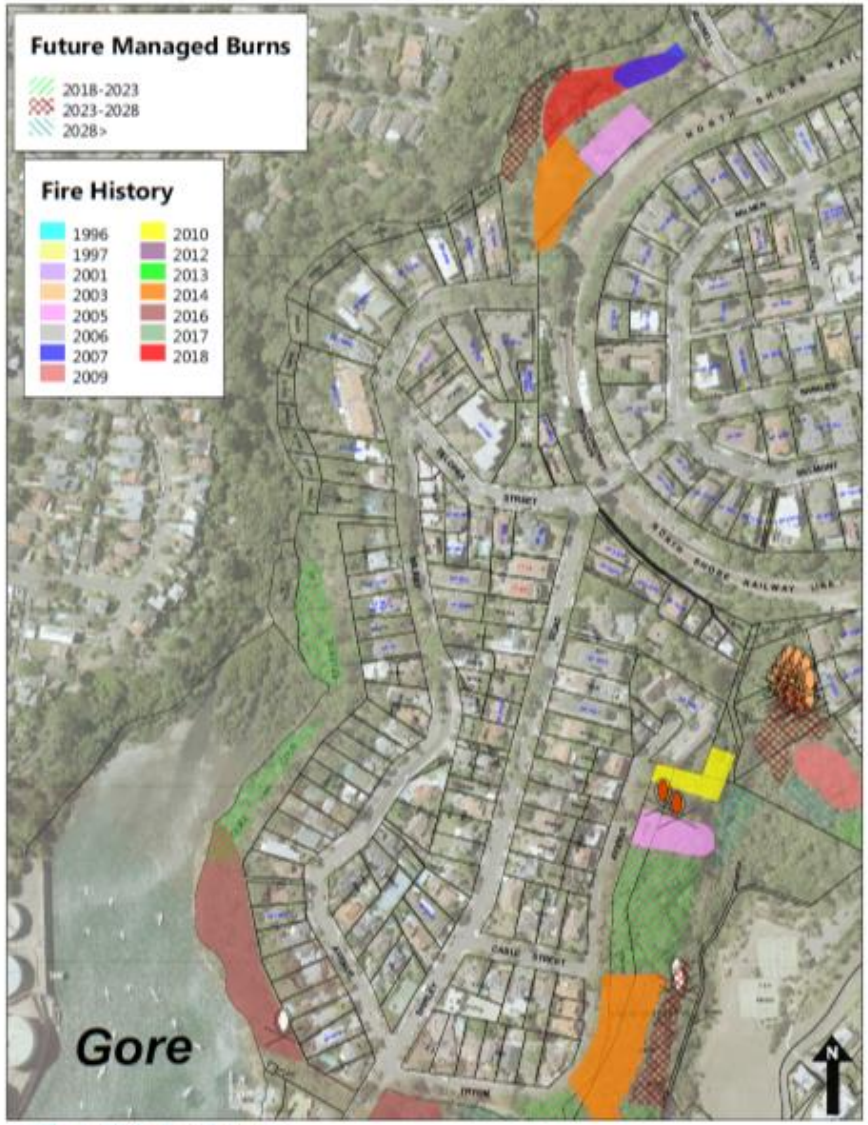


Table 2: Species of Special Conservation Concern

COMMON NAME	SCIENTIFIC NAME	CAUSE OF DECLINE
Yellow Thornbill Brown Thornbill Eastern Spinebill Brown Goshawk Pacific Baza Yellow-tail Black Cockatoo Glossy Black Cockatoo Gould's Wattled Bat Black-faced Cuckooshrike Spangled Drongo Nankeen Kestrel Peregrin Falcon White-bellied Sea Eagle Superb Fairy-wren Variegated Fairy-wren Common Bent-wing Bat Eastern Bent-wing Bat Eastern Free-tailed Bat Large-footed Mystis Boobook Owl Powerful Owl Australian Golden Whistler Spotted Pardolote Tree Martin Tawny Frogmouth Red-bellied Black Snake Eastern Whipbird Grey-headed Flying Fox Satin Bowerbird Roufus Fantail White-browed Scrubwren Weebill Australasian Figbird Sacred Kingfisher Sooty Owl Silvereye	*Acanthiza nana* *Acanthiza pusilla* *Acanthorhynchus tenuirostris* *Accipiter fasciatus* *Aviceda subcristata* *Calyptorhynchus funereus* *Calyptorhynchus lathami* *Chalinolobus gouldii* *Coracina novaehollandiae* *Dicrurus bracteatus* *Falco cenchroides* *Falco peregrinus* *Haliaeetus leucogaster* *Malurus cyaneus* *Malurus lamberti* *Miniopterus schreibersii* *Miniopterus schreibersii oceanensis* *Mormopterus ridei* *Myotis macropus* *Ninox novaeseelandiae* *Ninox strenua* *Pachycephala pectoralis* *Pardalotus punctatus* *Petrochelidon nigricans* *Podargus strigoides* *Pseudechis porphyriacus* *Psophodes olivaceus* *Pteropus poliocephalus* *Ptilonorhynchus violaceus* *Rhipidura rufifrons* *Sericornis frontalis* *Smicrornis brevirostris* *Sphecotheres viellioti* *Todiramphus sanctus* *Tyto tenebricosa* *Zosterops lateralis*	- Reduction of Tall Eucalypt Forest in North Sydney; - Loss of habitat/Declining canopy cover - Reduction and degradation of bushland habitat in North Sydney; - Ecosystem degradation general loss of species diversity; Urban ecology expansion is beneficial to larger common birds; - Fragmented populations confined to small native bushland remnants are at risk of local extinction; - Lack of constant food source; - Predation from cats, dogs and urban predatory birds such as Currawongs and butcher birds. - Scarcity of natural breeding hollows - Altered stormwater system causing habitat loss; stormwater pollution; Sedimentation; Chytrid fungus; & Isolation of small populations.
Sunshine Wattle Old Man Banksia Corkwood Native Fuschia Peppermint Gum Scribbly Gum Blood Root Micranthum Smooth Geebung Sydney Turpentine Broadleaf Grass Tree	*Acacia terminalis subsp. terminalis* *Banksia serrata* *Endiandra sieberi* *Epacris longiflora (White form)* *Eucalyptus piperita* *Eucalyptus racemose* *Haemodorum planifolium* *Micranthum ericoides* *Persoonia levis* *Syncarpia glomulifera* *Xanthorrhoea arborea*	- Altered fire regimes; - Ecosystem degradation; general loss of species diversity; - Fragmented populations confined to small bushland remnants; - Lack of connectivity between bushland limits pollination pathways and seed dispersal - Community use pressures - Stormwater pollution, erosion and sedimentation

Table 3: Plant species affecting biodiversity and stability of Bushland

Common Name	Botanic Name	Habit	Common Name	Botanic Name	Habit
African love grass	*Eragrostis curvula*	Grass/Ground layer	Purple top	*Verbena bonariensis*	Ground layer
Barbed wire grass	*Cymbopogon refractus*	Grass/Ground layer	Thick head	*Crassocephalum crepidioides*	Ground layer
Couch	*Cynodon dactylon*	Grass/Ground layer	Thistle sp	*Cirsium vulgare*	Ground layer
Crows foot grass	*Eleusine indica*	Grass/Ground layer	Trad	*Tradescantia fluminensis*	Ground layer
Ehrharta	*Ehrharta erecta*	Grass/Ground layer	Turkey rhubarb	*Acetosa sagittatus*	Ground layer
Foxtail grass	*Pennisetum alopecuroides*	Grass/Ground layer	Balloon vine	*Cardiospermum grandiflorum*	Climber
Kikuyu	*Pennisetum clandestinum*	Grass/Ground layer	Cape Ivy	*Delairea odorata*	Climber
Weeping grass	*Microlaena stipoides*	Grass/Ground layer	Honeysuckle	*Lonicera japonica*	Climber
Palm grass	*Setaria palmifolia*	Grass/Ground layer	Madeira vine	*Anredera cordifolia*	Climber
Parramatta grass	*Sporobolus indicus*	Grass/Ground layer	Morning glory coastal	*Ipomea cairica*	Climber
Paspalum	*Paspalum dilatatum*	Grass/Ground layer	Morning glory	*Ipomea indica*	Climber
Red natal grass	*Melinis repens*	Grass/Ground layer	Moth vine	*Araujia sericifolia*	Climber
Summer grass	*Digitaria sanguinalis*	Grass/Ground layer	Corky Passionfruit	*Passiflora suberosa*	Climber
Asthma weed	*Parietaria judaica*	Ground layer	Box Elder	*Acer negundo*	Canopy/Shrub
Asparagus fern	*Protasparagus aethiopicus*	Ground layer	African olive	*Olea europaea ssp. cuspidata*	Canopy/Shrub
Bidens	*Bidens pilosa*	Ground layer	Castor oil plant	*Ricinus communis*	Canopy/Shrub
Scurvy weed	*Commelina cyanea*	Ground layer	Camphor laurel	*Cinnamomum camphora*	Canopy/Shrub
Crofton	*Ageratina adenophora*	Ground layer	Cassia	*Senna pendula*	Canopy/Shrub
Fishbone fern	*Nephrolepis cordifolia*	Ground layer	Cheese Tree	*Glochidion ferdinandi*	Canopy/Shrub
Fleabane	*Conyza spp*	Ground layer	Coral Tree	*Erythrina sp*	Canopy/Shrub
Mist flower	*Ageratina riparia*	Ground layer	Lantana	*Lantana camara*	Canopy/Shrub
Montbretia	*Crocosmia X crocosmiiflora*	Ground layer	Ochna	*Ochna serrulata*	Canopy/Shrub
Mother of millions	*Bryophyllum delagoense*	Ground layer	Port Jackson Fig	*Ficus rubiginosa*	Canopy/Shrub
Mustard weed	*Brassica spp.*	Ground layer	Sweet Pittosporum	*Pittosporum undulatum*	Canopy/Shrub
Paddys lucerne	*Sida rhombifolia*	Ground layer	Small leaf Privet	*Ligustrum sinense*	Canopy/Shrub
Pampas lily of the valley	*Salpichroa organifolia*	Ground layer	Large leaf Privet	*Ligustrum lucidum*	Canopy/Shrub
Pareuvian lily	*Alstroemeria pulchella*	Ground layer	Wild tobacco	*Solanum mauritianum*	Canopy/Shrub

2.2.1 Brightmore Reserve Bushland Rehabilitation Plan

Description

Size: Brightmore Reserve 2.4 Ha

Access: Young St, Little Wonga Road, Little Young St, Brightmore St, Tobruk Ave, Bennelong St, Grasmere St;

Ownership: Crown Land.

Catchment: Middle Harbour

Configuration / Connectivity: Brightmore Reserve is triangular in shape and is bordered by Young St to the north / north-west, Little Young St and residences to the south, and Little Wonga Rd and residences to the east / north-east. The bushland forms part of a larger semi-connected remnant incorporating Primrose Park and Wonga Road Reserve to form a U shape remnant surrounding Willoughby Bay. These three reserves are known as "the Cremorne Remnants".

Hydrology: All water drains to Willoughby Bay. Brightmore Reserve has an altered hydrology due to the filling of a shallow bay in the 1940's and the piping of a natural watercourse in the north of the reserve to construct sewerage infrastructure and the grassed playing area. A waterfall would have once flowed down the centre of the reserve near the intersection of Tobruk Ave and Brightmore St. This water is now channelled through a stormwater drain below the surface. A short natural creek system remains in the western end of the reserve, below Little Young St. Stormwater outlets and a sewerage pipeline with pop tops and a vent stack are located behind residences along Tobruk Ave as well as in the creekline below Little Young St. Runoff from adjoining residences also enters the bushland through surface flow or via pipes.

Geology: Hawkesbury Sandstone of medium to coarse grained quartz sandstone with minor shale and laminate lenses and sandstone outcrops.

Soil Landscape: Hawkesbury Soil Landscape consisting of shallow, poor sandy soils, highly erosive with low soil fertility. Localised Yellow and Red Podzolic Soils are associated with shale lenses. Some areas are disturbed with fill from past dumping or construction of sewerage and stormwater infrastructure.

Slope: Moderate to steep slopes towards the grassed playing area in the north of the reserve.

Facilities / Infrastructure: Facilities include a fully fenced playground, picnic area, children's learner cycle track and toilets. Two walking tracks link to Primrose Park. The main track (with stairs) starts at Brightmore St and ends at the grassed playing area adjoining Young St. The second track is an old bitumen sealed access way which starts from Little Young St, traverses behind the rear of residential properties off Bennelong Rd and joins up with the main walking track. Major sewerage infrastructure is located below the grassed playing area and is operational by Sydney Water from time to time.

Plant Community:

- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species found along the foreshore.
- Blackbutt Gully Forest – an open or tall open forest with *Eucalypt pilularis* as the dominant tree species.
- Disclimax Sandstone Scrub – an altered community of open to closed scrub, or a forest of mixed and variable composition due to disturbance and an absence of fire.
- Sandstone Gallery Rainforest - Closed-forest dominated by *Acmena smithii*, *Ceratopetalum apetalum* and *Pittosporum undulatum* on steep, sheltered slopes besides rock creeklines on Hawkesbury Sandstone.
- Refer to Map 1 for the plant communities; Table 1 for common flora species and Table 2 for plant species of special conservation concern in Brightmore Reserve

Wildlife Habitat:

- Brightmore Reserve provides a range of habitat including open forest and scrub, a creekline, drainage areas and rocky outcrops.
- Despite limited connectivity of vegetation with larger areas of bushland, the reserve is within range for many wildlife species that move between reserves such as the Common Brushtail (*Trichosurus Vulpecula*) and Ringtail possums (*Pseudocheirus peregrinus*), microbats, woodland and sea birds. Remnant small range species include skinks, lizards, geckoes, snakes and frogs.
- The reserve lacks nesting hollows and roosting sites for birds and arboreal mammals due to the absence of mature native trees. Such creatures play an important role in the ecology of vegetation communities, assisting in pollination, seed dispersal and germination processes.
- Stormwater infrastructure in the reserve provides significant microbat roost and possibly breeding habitat.
- The reserve forms an important habitat link to Wonga Reserve and Primrose Park. Improved wildlife corridor linkages have been made with Primrose Park bushland over the last 15 years. These continue to be augmented by vegetating appropriate lawn areas adjoining bushland with local flora. Other works include under-planting existing trees with native midstorey/understorey species and providing an interconnecting canopy over Young St. for arboreal mammals and small bird species.
- Refer to Table 2 for the fauna species of special conservation concern found in Brightmore Reserve.

Condition and Resilience:

- The bushland is generally in good or fair condition and has increased resilience due to its close proximity to bushland in the adjoining Cremorne remnants. Areas in poor or very poor condition are located along the residential / bushland interface, the grassed parkland / bushland interface and the creekline. Areas in poor condition are also associated with sewer infrastructure works that has disturbed a stretch of land where a waterfall would have once flowed down the centre of the reserve near the intersection of Tobruk Ave and Brightmore St.
- The narrow strip of bushland is fragmented and resilience has been compromised by decades of dumping waste and fill (particularly in the south-east corner). Major stormwater and sewerage infrastructure works have also altered the hydrology, soil profile, stability and ecology, and have destroyed or buried the original seed bank limiting the application of assisted natural regeneration in some areas.
- Stormwater and garden escapes have destroyed or buried the original seed bank, spread weeds, increased

nutrient levels and changed soil structure, stability and composition. Areas particularly affected by weed incursions have been the creeklines, areas adjoining stormwater drains, and areas below roads and gardens. Major soil disturbance limits unassisted native plant regeneration.
- Native and exotic mesic and vine species require targeted and regular maintenance to manage colonisation / domination in areas of open forest and where elevated soil moisture and nutrient conditions have excluded fire for long periods.
- Bush regeneration activities are carried out by Council's Bushland Management Team, bush regeneration contractors and the volunteer Brightmore Reserve Bushcare Group.
- Refer to Map 2 Condition of Bushland and Resilience.

Zone / Classification:
- The bushland is zoned E2 Environmental Conservation under *North Sydney LEP 2013.* It is classified public bushland in *SEPP No. 19 Bushland in Urban Areas (*and in the draft SEPP (*Environment)* that will supersede *SEPP 19.*)
- The reserve is identified as a Coastal Environment Area and Coastal Use Area under *SEPP (Coastal Management*).

Statement of Significance:
Historic Values
- The bushland in this reserve is a legacy of past land management by the traditional Aboriginal custodians, the Cammeraygal people, who originally occupied the area. Known Aboriginal sites are located within the reserve. Other signs of Aboriginal presence may exist but remain undiscovered. Places, objects and features of significance to Aboriginal people are protected under the NSW *National Parks and Wildlife Act 1974*.
- The reserve was named after Lieutenant Brightmore.

Natural Values
- Brightmore Reserve plays a significant role in maintaining biodiversity in the region and assists in conservation of species and habitat function.
- Blackbutt Gully Forest and Angophora Foreshore Forest are threatened at a local level. Sandstone Gallery Rainforest is threatened at a regional level due to its limited extent.
- The endangered *Acacia terminalis* subspecies *terminalis* listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* and the NSW *Biodiversity Conservation Act 2016 (BC Act)* has been recorded in the Cremorne remnants and could occur in Brightmore Reserve.
- The reserve contains the locally rare *Leionema dentatum, Persoonia levis, Persoonia laurina, Persoonia pinifolia*, *Calystegia marginata, Corymbia gummifera, Pyrrosia rupestris, Themeda australis* and *Xanthorrhoea arborea.*
- The bushland forms part of an important habitat corridor along the foreshore to Wonga Reserve and Primrose Park which together are known to provide habitat for 87 fauna species and a high number of bird species due to diversity of habitat in a highly-urbanised environment.
- The reserve provides habitat for threatened and declining fauna species including the Powerful owl (*Ninox strenua*) (listed as vulnerable in NSW under the *BC Act*) and the Grey-headed flying-fox (*Pteropus poliocephalus*) (listed as vulnerable under the *BC Act* and the *EPBC Act*).
- Stormwater infrastructure in the reserve provides significant roost sites for the Eastern bentwing bat (*Miniopterus schreibersii oceanensis*) (listed as vulnerable in NSW under the *BC Act*) and may also be used for mating in autumn.
- Other species recorded in the Cremorne reserves are the Little bentwing bat (*Miniopterus australis*), Eastern freetail bat (*Mormopterus norfolkensis*) and Southern myotis (*Myotis macropus*) (all listed as vulnerable in NSW under the *BC Act*).

Recreation / Education Values
- The reserve is a valuable educational, nature appreciation and bushwalking resource. It is also valued as a destination for family outings centred around the adjoining children's playground and grassed picnic area.

Fire History:
- Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity in Brightmore Reserve.
- Past burns have resulted in the successful germination of native endemic flora species.
- Fire management access zones exist along all boundaries with private property and reserve structures.
- Planned hazard reduction / ecological broad area burns are conducted from time to time. Refer to Map 3 Fire History and Future Managed Burns.

Threats:
- The limited size and narrowness of the reserve amplifies vulnerability to fragmentation and "edge effects" from the surrounding urban environment. Impacts from adjoining residential properties that facilitate weeds include garden escapes and dumping of garden clippings into the bushland. A recurring problem of broken drainage pipes and old terracotta sewerage pipes servicing adjoining residential properties also increases moisture and nutrification. Runoff from hard surfaces, irrigation and pools increase nutrient loads, moisture and erosion on the slopes below. Garden fertiliser also leaches into the bush increasing nutrients. Other threats include encroachment from adjoining residences due to ambiguous property boundaries, periodic illegal clearing of bushland and tree vandalism.
- Widespread fill over many decades, as well as past and more recent dumping, significantly compromises soil stability and structure, seedbank viability and bushland resilience. The waste comprises a range of material including building rubble, domestic and industrial waste and foreign soil.
- *Phytophthora cinnamomi* (root rot*)* affects the health of the bushland and is widespread in North Sydney.
- In heavy rainfall periods, sewage leaks from concrete pop-top lids along the sewerage pipeline.
- Where bushland areas are bordered by lawn, or where invasive exotic or native grasses such as *Ehrharta erecta*, Weeping grass (*Microlaena stipoides)* or Basket grass *(Oplismenus aemulus*) are present, constant management is required to prevent these species outcompeting and compromising native regeneration and diversity.
- Native and exotic vines, mesic species and weeds are a serious threat to the stability of resilient cores and long term viability of biodiversity. Refer to Table 3 for plant species affecting biodiversity and stability of bushland assets.

- At times, foxes (*Vulpes vulpes*), domestic cats (*Felis cattus*) and off-leash dogs (*Canis lupus familiaris)* are observed in the reserve and along the foreshore. These animals predate, scare and disturb wildlife, pollute with their faeces and spread weed seed. Shorebirds are particularly impacted by dogs off lead.
- Native bats and birds can transport new plant species and weeds into the reserve that have the potential to change its structure over time.
- Some species of introduced or endemic fauna are very territorial and compete for habitat, limiting species diversity.
- Periodically, Sulphur-crested cockatoos congregate in large numbers within the bushland and over trim the canopy.
- Inappropriate weed removal can reduce fauna habitat with greater impacts on short range species and small birds.
- Visitor impacts include graffiti and trampling around rock overhangs and cliff faces, informal track creation, soil compaction and soil erosion. Recreation activities such as rock climbing, mountain biking and orienteering can disturb bushland and damage tracks. Children also make tracks and cubbyhouses in the bushland close to the playground causing erosion and trampling the bush. Increased drone usage may be causing disturbance to fauna that occur in the canopy.
- Climate change is an ongoing threat. Anticipated impacts include increased threat of bushfire and extreme weather events. Intensified storm events will result in higher volumes of of stormwater runoff which is likely to result in erosion to drainage lines and creeks. Increased temperatures are likely to affect biodiversity and ecosystems, favouring some species over others and changing the structure and function of the bushland. The rate of climate change may be faster than the rate of natural adaptation. Increased temperatures will harm sensitive fauna such as bats, impacting their important ecosystem function.
- Non-passive recreational activities (incl. orienteering; rock climbing; geo-caching, camping and mountain biking) cause substantial damage to native vegetation and soil stability. These activities are prohibited in North Sydney's bushland reserves.

Bushland Management Goals

a. Maintain and enhance biodiversity and habitat for long term ecosystem resilience and function
b. Conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve
c. Strategically restore bushland (prioritise areas of highest resilience)
d. Enhance habitat connectivity
e. Preserve genetic integrity of the vegetation community
f. Manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality
g. Conserve the natural landscape and heritage values
h. Provide for ecologically sustainable recreation needs of the community
i. Implement the strategic fire hazard reduction program and manage fuel loads to protect life, property and endemic biodiversity

Rehabilitation Principles and Procedures:
General

1. Bush regeneration is a long-term process of staged weed removal to ensure endemic biodiversity, native plant establishment and continued habitat for local wildlife. It relies on site assessments that identify values and how best to restore and enhance ecosystem function and structure. Routine site monitoring, evaluation of field strategies and periodic native flora and fauna surveys inform management priorities over time. Works normally proceed from bush in good condition with high resilience. Degraded areas are a lower priority but the weeds always require containment.

Planning, Evaluation and Review

2. The Bushland Management Team should regularly evaluate bushland rehabilitation plans and the success of field strategies to inform management priorities early.
3. Establish photo points to monitor projects.
4. In the bushland rehabilitation planning process, consider the potential impact of future infrastructure earthworks, or access requirements on bushland, habitats, green corridors or active rehabilitation sites.
5. The Bushland Management Team must approve all contractor project proposals before implementation.
6. All Work, Health and Safety requirements must be adhered to by Council staff, volunteers and contractors before, during and after site works.

Native Flora

7. Record uncommon flora species to determine risk of extinction in the reserve. (Use North Sydney flora survey record template).
8. Prioritise protection / rehabilitation in areas of highest resilience.
9. Buffer areas should protect biodiversity from disturbances caused by fragmentation and edge effects: (a) monitor to identify gaps in buffer vegetation and senescing / restored vegetation and organise replacement planting; (b) where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a medium/long term solution to stop herbaceous weeds and grasses from spreading into bushland; (c) control vines, noxious weeds and other plant species affecting stability of adjoining bushland.
10. When natural regeneration is ineffective, locally source all plant material for supplementary planting to maintain genetic integrity of native vegetation in accordance with Flora Bank Guidelines https://www.greeningaustralia.org.au/florabank. Only plant when natural regeneration is ineffective to boost biodiversity, with the aim to achieve 80% survival rates. Plant in stages, basing species selection on the target vegetation community/structure, successional stage, habitat requirements and physical constraints. This process involves collaboration from Council's nursery supervisor, bush regeneration team, Bushcare volunteers and bush regeneration contractors.
11. In areas lacking diversity and structure; direct seed, transplant and use appropriate tube stock to enhance existing plant communities. When planning a replanting site: (a) prepare a suitable plant list based on rehabilitation objectives and prevailing site condition; (b) allow time for seed collection and propagation (9-12 months ahead of planting); (c) identify where seed harvesting/cuttings will be gathered; (d) prepare area (e.g. reduce density of dominant species on ground layer or mesic species in shrub layer); (e) schedule planting for early Autumn during or after soaking rain.
12. Collect seed of suitable locally rare species from nearby bushland areas, propagate and plant in appropriate areas of the reserve to enhance biodiversity and ensure the long-term viability. For species that are difficult to propagate, explore other methods such as seed scarification / raking treatment / seedbank translocation etc.
13. Implement a canopy replacement program in areas where remnant canopy is absent, senescing or failing to regenerate or where non-endemic trees have been removed.
14. Do not encourage large canopy species on unstable areas or under electricity easements where they cannot be supported and may cause future hazards.
15. Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team: (a) pile burn where appropriate; (b) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (c) reduce seedbank of dominant natives - control seeding cycle; (d) lightly disturb mulch / organic matter to stimulate regeneration; (e) increase seed bank of uncommon/ rare species with brush matting techniques (collect from donor sites where seed removal will not affect biodiversity); (f) propagate senescing plant species at risk of extinction in the reserve (i.e. due to an inadequate fire regime) and plant tubestock in suitable locations.
16. When planting along bushland edges, select species in consideration of their potential to compliment views from residential or public viewing areas and design to enhance habitat / connectivity (e.g. for small birds).
17. Conserve and protect naturally regenerating / colonising canopy species providing they are in sustainable locations.

Weeds and Pathogens

18. Implement the *Biosecurity Act 2015* consistently and effectively, in accordance with bushland management objectives and processes.
19. Residential properties adjoining bushland can contribute to weed spread. Monitor and address invasive garden plants in accordance with the

Biosecurity Act 2015 and promote Council's Native Havens / Habitat Stepping Stones Programs.

20. Ongoing weed management should: (a) prioritise good bush areas; (b) target species threatening stability e.g. vines, woody or canopy weeds; (c) interrupt seed cycle of target species, especially annual and grass weeds; (d) prioritise areas where plant diversity is most affected by mesic shift and vines. (In consideration of fauna habitat needs, schedule works from Autumn through Winter before bird breeding season.)
21. Monitor sites to identify, report and manage early stages of weed outbreaks or shifts in plant species assemblages likely to become detrimental to biodiversity. Manage according to the issues they raise. Report other threats to ecosystem function.
22. All compost weed material is removed off site.
23. Retain weeds on highly erodible or dangerous slopes and use methods of weed suppression that will not create potential for soil erosion. Incorporate abseiling activities on cliff faces to remove weeds that are a constant weed seed source.
24. Strategically remove non-endemic or exotic trees that interfere with ecosystem function or structure. Assess for habitat potential before they are de-limbed.
25. Consider all potential impacts of herbicide and proximity to water when determining suitability for weed control.
26. Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Native Fauna and Habitat

27. Record wildlife sightings and observations in Council's Wildlife Watch database. Share this information with NSW BioNet and the Commonwealth's ALA.
28. Identify and protect nesting, roosting and breeding sites of threatened, vulnerable or locally significant fauna.
29. Minimise disturbance to wildlife, enhance habitat where needed and improve the condition/connectivity of wildlife corridors between adjoining reserves.
30. Protect, maintain and restore quality fauna foraging habitat using a diverse mix of endemic native species. Retain habitat features such as fallen and standing dead wood, rock piles, hollow-bearing trees, natural debris, dead standing trees, forest litter, logs and branches.
31. Short-term strategies to maintain fauna habitat provided by mesic and weed species may require retention yet containment of dense areas of weed, vines and mesic species. In the longer-term, aim to establish a self-maintaining fabricated vegetation community in these areas composed of native species adapted to changed site conditions (abiotic factors) that enhance biodiversity and habitat availability.
32. Before any unfavourable trees are de-limbed, assess for habitat potential e.g. tree hollows.
33. Where suitable, install fauna nesting boxes and create hollows in suitable dead trees to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed.
34. Investigate financial opportunities to invest in habitat enhancing research and developing methodologies.

Threatened species

35. Identify threatened or endangered, rare or locally rare species of flora and fauna. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs.
36. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened species.

Ecological Burns

37. Hazard reduction and ecological burns are based on a strategic burn program consistent with the Mosman North Sydney Willoughby Bushfire Risk Management Plan. Ecological burn regimes are to be in a mosaic pattern to improve bushland function and biodiversity. Areas of high bushfire risk or core ecological resilience are usually prioritised in the annual burn program.
38. Maintain land management zones where bush adjoins residences and implement site stabilisation measures.
39. Over the next 10 years, prioritise prescribed burns at sites at risk of diminishing flora diversity.
40. For pre-fire preparation: (a) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (b) reduce seedbank of dominant natives to control seeding cycle; (c) increase seed bank of uncommon/ rare species with brush matting (collect from donor sites where seed removal will not affect biodiversity).
41. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds.
42. Implement post-fire monitoring and bush rehabilitation strategies. Monitor regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time period post-burn.

Pests and Illegal Activity

43. Monitor and control feral or aggressive/territorial fauna activity, cats, unleashed dogs and illegal activity with appropriate measures e.g. trapping, community education programs, penalty notices or camera observation. If applicable, manage reserves in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 and relevant North Sydney Council policies.
44. Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
45. Monitor the impacts of drones and implement management measures if required.
46. Address instances of unauthorised activities in bushland incl. orienteering; rock climbing; geocaching; mountain biking; camping etc.

Tracks, Water and Erosion

47. Close informal tracks to prevent damage to habitat; impede feral animals and reduce weed spread.
48. Implement track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, track widening and degrading track conditions.
49. Assess the need for additional directional and / or interpretive signage.
50. Stabilise steep slopes, ephemeral flow lines and highly erosive areas using local native species, particularly ground covers, to re-establish appropriate vegetation community structure where natural regeneration is

poor or absent. Install sedimentation fences, terracing, coir logs, matting or other appropriate measures where needed to stabilise washout areas and improve access and safety.

51. Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater tolerant natives.

Aboriginal and non-Aboriginal Heritage

52. All identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1974* and *Heritage Act 1977*.
53. Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual.
54. As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance.
55. Bushland management staff consult with the Aboriginal Heritage Office or Council's heritage officer prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey.
56. Discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol.

Community

57. Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
58. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
59. Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan.
60. When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council.

Reserve Specific Rehabilitation Actions

Priorities will be given to programs with long term benefit to the reserve or where natural assets are at greatest risk to avert irreversible deterioration or loss.

Flora

1. Collect seed of locally rare species from nearby bushland areas, propagate and plant in appropriate areas in the reserve to increase the population size and ensure the long-term viability. For species that are difficult to propagate e.g. *Leionema dentatum,* explore other methods such as seed scarification/raking/fire.
2. Monitor and suppress the weed *Salpichroa organifolia*
3. Strengthen buffer edge plantings along the park edge; access road and private property boundaries.
4. Collaborate with Council's Open Space Team to expand and improve green corridor connections with Wonga Road Reserve and Primrose Park.
5. Contain mesic natives to drainage lines; plant species suited to altered soil conditions to improve diversity.

Fauna

6. Retain yet contain dense vines, mesic and exotic plants in the dense weed habitat zone (e.g. at the most eastern side of the reserve) for short term fauna habitat until suitable habitat in adjacent sections of the bushland are mature enough to ensure survival of small bird species.
7. Inhibit access to microbat roost sites and adjoining habitat areas. Maintain flight paths and ensure favourable conditions for microbat roosting. Aim to schedule any mandatory infrastructure works to the drains during times when bats would not be roosting.
8. Protect, maintain and restore quality bat foraging habitat (e.g. areas with high moisture), using a diverse mix of locally appropriate native species.
9. In conjunction with Open Space Management staff, improve wildlife corridors to bushland in Wonga Reserve and Primrose Park.
10. Promote appropriate management of domestic pets as the reserve adjoins a Wildlife Protection Area (Primrose Park).
11. Investigate zoning Brightmore Reserve as a 'Wildlife Protection Area' under the *Companion Animals Act, 1998.*

Threatened Species

12. If *Acacia terminalis* subsp. *terminalis* is found to occur in the reserve, work in collaboration with the Saving Our Species program managed by the NSW Office of Environment and Heritage and the NSW Herbarium to identify, monitor and protect *Acacia terminalis* subsp. *terminalis* and contribute to the preparation of best practice guidelines for the species.
13. Preserve and enhance the habitat of threatened microbat species, Powerful Owl (*Ninox strenua*) and Grey-headed Flying fox (*Pteropus poliocephalus*)

Illegal Activity

14. Illegal encroachments, breaches of Development Consents and construction of unauthorised paths leading from private property into the reserve will be referred to Council's Compliance Team for action.
15. Report all illegal drug and alcohol use locations and associated damage to Council's Ranger team. All affected areas are to be listed on Council's register for such sites and collaboration is required with the Police to implement management strategies

Tracks, Water and Erosion

16. Where the two walking tracks meet, stabilise this high moisture area with moisture tolerant native species.
17. Discourage children from making tracks and cubbyhouses in the bushland close to the playground with appropriate planting, signage and fencing.
18. Define the edge between the bushland, tracks, lawn and the residential interface by using natural log borders, with or without spray edges such as along the southern residential bushland interface.

Ecological Burns

19. Refer to Map 3 Fire History and Future Managed Burns.
20. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species e.g. *Leionema dentatum* or *Banksia serrata*.

Community

21. Plan replanting projects to coincide with National Tree Day.
22. Promote reserve neighbour involvement in Native Havens Program.
23. Promote community involvement in Bushcare.

Capital Projects

24. Assess the walking track network for upgrade requirements and undertake works based on priority and feasibility e.g. the old access track behind Bennelong Rd.
25. Update interpretive and directional signage.
26. Undertake stormwater improvement works below Brightmore St and Little Young St.
27. Assess slope stabilisation needs and undertake works where feasible.
28. Investigate the feasibility and prioritise creekline rehabilitation projects according to levels of need.
29. Investigate construction of a path linking Wonga Road with the Brightmore Reserve bushland track to complete this connection.

Map 1: Vegetation Communities (NAS 2010)

Table 1: Common species recorded in Brightmore Reserve

Scientific name	Common name	Vegetation communities
Acacia longifolia	Sydney Golden Wattle	BG; AF; DS
Allocasuarina littoralis	Black She-oak	BG; AF; DS
Angophora costata	Sydney Red Gum	BG; AF; DS
Banksia integrifolia	Coast Banksia	AF; DS
Calochlaena dubia	Common Ground Fern	BG; AF; DS
Ceratopetalum apetalum	Coachwood	AF; GR
Commelina cyanea	Scurvy Weed	BG; AF; GR; DS
Dianella caerulea	Blue Flax Lily	BG; AF; GR; DS
Dodonaea triquetra	Common Hop Bush	BG; AF; GR; DS
Elaeocarpus reticulatus	Blueberry Ash	BG; AF; GR; DS
Entolasia stricta	Wiry Panic	BG; AF; GR; DS
Eucalyptus pilularis	Blackbutt	BG; AF; GR; DS
Ficus rubiginosa	Port Jackson Fig	BG; AF; GR; DS
Glochidion ferdinandi	Cheese Tree	BG; AF; GR; DS
Grevillea linearifolia	White Spider-flower	BG; AF; DS
Hakea dactyloides	Broad-leaved Hakea	BG; AF; DS
Hibbertia dentata	Twining Guinea Flower	BG; AF; GR; DS
Leionema dentatum	Toothed Phebalium	BG; AF; DS
Lomandra longifolia	Spiny-headed Mat-rush	BG; AF; GR; DS
Microlaena stipoides	Weeping Grass	BG; AF; GR; DS
Notelaea longifolia	Large Mock-olive	BG; AF; GR; DS
Oplismenus aemulus	Basket Grass	BG; AF; GR; DS
Pittosporum undulatum	Pittosporum	BG; AF; GR; DS
Poa affinis		BG; AF; GR; DS
Polyscias sambucifolia	Elderberry Panax	BG; AF; DS
Pteridium esculentum	Bracken	BG; AF; DS
Schoenus melanostachys	Black Bog-rush	BG; AF
Smilax glyciphylla	Sweet Sarsaparilla	BG; AF; GR; DS
Syncarpia glomulifera	Turpentine	BG; AF

AF: Angophora Foreshore Forest **BG: Blackbutt Gully Forest**
DS: Disclimax Sandstone Scrub **GR: Sandstone Gallery Rainforest**

Map 2: Condition of Bushland and Resilience (2018)

Condition of Bushland and Resilience Key

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural recruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting Poor indicative resilience
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience – limited regeneration potential (1-2 species)
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed sandstone)

Map 3: Fire History & Future Managed Burns

Table 2: Species of Special Conservation Concern

COMMON NAME	SCIENTIFIC NAME	CAUSE OF DECLINE
Yellow Thornbill King Parrot Pacific Baza Brush Cuckoo Golden-crowned Snake Yellow-tail Black Cockatoo Gould's Wattled Bat Black-faced Cuckooshrike Common Tree Snake White-bellied Sea Eagle Whistling Kite Superb Fairly-wren Varigated Fairy-wren Common Bent-wing Bat Eastern Bent-wing Bat Eastern Free-tailed Bat Large-footed Myotis Boobook Owl Powerful Owl Crimson Rosella Eastern Rosella Tawny Frogmouth Eastern Whipbird Grey-headed Flying Fox White-browed Scrubwren Forest Kingfisher Sacred Kingfisher	*Acanthiza pusilla* *Alisterus scapularis* *Aviceda subcristata* *Cacomantis variolosus* *Cacophis squamulosus* *Calyptorhynchus funereus* *Chalinolobus gouldii* *Coracina novaehollandiae* *Dendrelaphis punctulatus* *Haliaeetus leucogaster* *Haliastur sphenurus* *Malurus cyaneus* *Malurus lamberti* *Miniopterus schreibersii* *M. schreibersii oceanensis* *Mormopterus ridei* *Myotis macropus* *Ninox novaeseelandiae* *Ninox strenua* *Platycercus elegans* *Platycercus eximius* *Podargus strigoides* *Psophodes olivaceus* *Pteropus poliocephalus* *Sericornis frontalis* *Todiramphus macleayii* *Todiramphus sanctus*	- Reduction of Tall Eucalypt Forest in North Sydney; - Loss of habitat /Declining canopy cover - Reduction and degradation of bushland habitat in North Sydney; - Ecosystem degradation general loss of species diversity; Urban ecology expansion is beneficial to larger common birds; - Fragmented populations confined to small native bushland remnants are at risk of local extinction; - Lack of constant food source; - Predation from cats, dogs and urban predatory birds such as Currawongs and butcher birds. - Scarcity of natural breeding hollows - Altered stormwater system causing habitat loss; stormwater pollution; Sedimentation; Chytrid fungus; & Isolation of small populations.
Coachwood Red Bloodwood Broad-leaved Hakea Rusty Petals Narrow-leaved Geebung Forked Comb Fern Yellow Rush-lily	*Ceratopetalum apetalum* *Corymbia gummifera* *Hakea dactyloides* *Lasiopetalum ferrugineum* *Leoneme dentatum* *Persoonia linearis* *Schizaea bifida* *Triconyne elatior*	- Altered fire regimes; - Ecosystem degradation; general loss of species diversity; - Fragmented populations confined to small bushland remnants; - Lack of connectivity between bushland limits pollination pathways and seed dispersal - Community use pressures - Stormwater pollution, erosion and sedimentation

Table 3: Plant species affecting biodiversity and stability of Bushland

Common Name	Botanic Name	Habit	Common Name	Botanic Name	Habit
African love grass	*Eragrostis curvula*	Grass/Ground layer	Purple top	*Verbena bonariensis*	Ground layer
Barbed wire grass	*Cymbopogon refractus*	Grass/Ground layer	Thick head	*Crassocephalum crepidioides*	Ground layer
Couch	*Cynodon dactylon*	Grass/Ground layer	Thistle sp	*Cirsium vulgare*	Ground layer
Crows foot grass	*Eleusine indica*	Grass/Ground layer	Trad	*Tradescantia fluminensis*	Ground layer
Ehrharta	*Ehrharta erecta*	Grass/Ground layer	Turkey rhubarb	*Acetosa sagittatus*	Ground layer
Foxtail grass	*Pennisetum alopecuroides*	Grass/Ground layer	Balloon vine	*Cardiospermum grandiflorum*	Climber
Kikuyu	*Pennisetum clandestinum*	Grass/Ground layer	Cape Ivy	*Delairea odorata*	Climber
Weeping grass	*Microlaena stipoides*	Grass/Ground layer	Honeysuckle	*Lonicera japonica*	Climber
Palm grass	*Setaria palmifolia*	Grass/Ground layer	Madeira vine	*Anredera cordifolia*	Climber
Parramatta grass	*Sporobolus indicus*	Grass/Ground layer	Morning glory coastal	*Ipomea cairica*	Climber
Paspalum	*Paspalum dilatatum*	Grass/Ground layer	Morning glory	*Ipomea indica*	Climber
Red natal grass	*Melinis repens*	Grass/Ground layer	Moth vine	*Araujia sericifolia*	Climber
Summer grass	*Digitaria sanguinalis*	Grass/Ground layer	Corky Passionfruit	*Passiflora suberosa*	Climber
Asthma weed	*Parietaria judaica*	Ground layer	Box Elder	*Acer negundo*	Canopy/Shrub
Asparagus fern	*Protasparagus aethiopicus*	Ground layer	African olive	*Olea europaea ssp. cuspidata*	Canopy/Shrub
Bidens	*Bidens pilosa*	Ground layer	Castor oil plant	*Ricinus communis*	Canopy/Shrub
Scurvy weed	*Commelina cyanea*	Ground layer	Camphor laurel	*Cinnamomum camphora*	Canopy/Shrub
Crofton	*Ageratina adenophora*	Ground layer	Cassia	*Senna pendula*	Canopy/Shrub
Fishbone fern	*Nephrolepis cordifolia*	Ground layer	Cheese Tree	*Glochidion ferdinandi*	Canopy/Shrub
Fleabane	*Conyza spp*	Ground layer	Coral Tree	*Erythrina sp*	Canopy/Shrub
Mist flower	*Ageratina riparia*	Ground layer	Lantana	*Lantana camara*	Canopy/Shrub
Montbretia	*Crocosmia X crocosmiiflora*	Ground layer	Ochna	*Ochna serrulata*	Canopy/Shrub
Mother of millions	*Bryophyllum delagoense*	Ground layer	Port Jackson Fig	*Ficus rubiginosa*	Canopy/Shrub
Mustard weed	*Brassica spp.*	Ground layer	Sweet Pittosporum	*Pittosporum undulatum*	Canopy/Shrub
Paddys lucerne	*Sida rhombifolia*	Ground layer	Small leaf Privet	*Ligustrum sinense*	Canopy/Shrub
Pampas lily of the valley	*Salpichroa organifolia*	Ground layer	Large leaf Privet	*Ligustrum lucidum*	Canopy/Shrub
Pareuvian lily	*Alstroemeria pulchella*	Ground layer	Wild tobacco	*Solanum mauritianum*	Canopy/Shrub

2.2.2 Mortlock Reserve and Judith Ambler Reserve Bushland Rehabilitation Plan

Description

Size: Mortlock Reserve 0.5 Ha; Judith Ambler Reserve 0.25 Ha

Access: Mortlock Reserve is accessed via Vernon Street and Brothers Avenue, Cammeray. Judith Ambler Reserve is accessed via Currawang Street and Vernon Street, Cammeray.

Ownership: North Sydney Council.

Catchment: Middle Harbour

Configuration / Connectivity: Mortlock Reserve is irregular in shape. It comprises a long and very narrow section in the south west between Vernon St and Brothers Ave and widens out towards the foreshore of Long Bay and boundary to Tunks Park. It is bounded by Tunks Park foreshore picnic area and carpark as well as Long Bay to the north, a private residence to the east, Vernon Street to the south and Brothers Ave to the west. The bushland forms part of a larger semi-connected remnant incorporating Tunks Park and Judith Ambler Reserve in Cammeray, Monro Park in Flat Rock Gully and Northbridge Golf Course on the northern side of Long Bay. Judith Ambler Reserve is triangular in shape and is bounded by Vernon St to the north-east, Currawang St to the west and two residences and grassed open space to the south east.

Hydrology: All surface water drains to Long Bay. In Mortlock Reserve a former stormwater channel along the eastern boundary of the reserve was converted to an open concrete drainage line with rock inserts to slow water flow several decades ago. The current drain carries water from the residential areas of Cammeray and does not interfere with bushland quality as moisture is well confined within it. Other urban runoff originates directly from the Vernon Street roadway as no gutter exists along the boundary of the reserve to manage surface water flow. In Judith Ambler Reserve no ephemeral creeks exist within the bushland area of the reserve. All surface flow from Currawang St is managed via gutters and drains that do not impact the reserve. A drain capturing surface flow from Currawang St and Pine St East is located at the interface of the bushland, grassed area, Pine St and Currawang St to the south-east of the reserve. Major stormwater infrastructure is situated beneath the adjacent grassed area within an easement.

Geology: Hawkesbury Sandstone of medium to coarse grained quartz sandstone with minor shale and laminate lenses and sandstone outcrops.

Soil Landscape: Hawkesbury Soil Landscape consisting of shallow, poor sandy soils, highly erosive with low soil fertility. Localised Yellow and Red Podzolic Soils are associated with shale lenses. The area in Mortlock Reserve below Vernon St and the area in Judith Ambler Reserve below Currawang St are disturbed due to fill from past road construction and dumping.

Slope: Mortlock Reserve has moderate to steep slopes from Vernon St towards Long Bay and Brothers Avenue with steep rocky cliff edges in some foreshore areas adjacent to Long Bay. Judith Ambler Reserve has steep slopes from Currawang St to Vernon St and the eastern side of the reserve forms a natural gully.

Facilities / Infrastructure: In Mortlock Reserve sewerage pop tops are located just below Vernon St and no formal tracks or recreation facilities are provided. In Judith Ambler Reserve sewerage pop tops are located just below Currawang St. A formal track links Currawang St with Vernon St and Tunks Park. No recreation facilities exist within this reserve.

Plant Community:
Mortlock Reserve
- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species found along the foreshore.
- Disclimax Sandstone Scrub – an altered community of open to closed scrub, or a forest of mixed and variable composition due to disturbance and an absence of fire.

Judith Ambler Reserve
- Largely native plantings including Blue Gums (*Eucalyptus saligna*) and some bushland remnants forming dry sclerophyll forest. The two remaining remnant canopy trees are a mature Blackbutt (*Eucalyptus pilularis*) and Sydney Peppermint (*E. piperita*).
- Refer to Map 1 for the plant communities; Table 1 for common flora species and Table 2 for plant species of special conservation concern in Mortlock and Judith Ambler Reserves.

Wildlife Habitat:
- Mortlock Reserve is dominated by dry sclerophyll forest and woodland type habitat. It contains rocky foreshore, drainage areas, and rocky outcrops. Judith Ambler Reserve is also dominated by derived dry sclerophyll forest and woodland. It is open and not high quality but can still provide useful habitat particularly for foraging and roosting.
- The reserves form an important habitat link to the larger bushland reserves in Tunks Park to the west and Northbridge Golf Course to the north and east and the aquatic habitat of Long Bay. Judith Ambler Reserve also links two wildlife corridors from upslope residential areas in Cammeray to Tunks Park (Tiley St and Pine St/Arkland St Reserve).
- The reserves form part of the Tunks Park remnant bushland 'biodiversity hotspot' identified by Smith and Smith in their 2008 bird survey commissioned by Council. This hotspot is North Sydney's most important habitat for small birds, which have dramatically declined since 1970. Locally significant small insectivorous birds such as the Eastern Yellow Robin (*Eopsaltria australis*), Superb Blue Fairy-Wren (*Malurus cyaneus*) and Silvereye (*Zosterops lateralis*) are known to inhabit Mortlock Reserve and are indicators of the health and habitat provided by bushland. A total of 43 avian species have been recorded in the reserve.
- The reserves are within range for many wildlife species that move between bushland remnants such as the Common Brushtail (*Trichosurus Vulpecula*) and Ringtail possums (*Pseudocheirus peregrinus*), microbats, woodland and water birds. Since the implementation of regionally coordinated fox baiting around 2000, wildlife such as Brush Turkeys (*Alectura lathami*) and Long-

nosed Bandicoots (*Perameles* nasuta) have naturally re-colonised. Remnant small range species include skinks, lizards, geckoes, snakes and frogs.
- The intertidal rocky foreshore adjoining Mortlock Reserve provides habitat for birds, bats, insects, mammals, crabs, molluscs and fish at different phases of the tide.
- The reserves lack nesting hollows and roosting sites for birds and arboreal mammals due to the lack of mature native trees. Such creatures play an important role in the ecology of vegetation communities, assisting in pollination, seed dispersal and germination.
- Refer to Table 2 for the fauna species of special conservation concern found in Mortlock and Judith Ambler Reserves.

Condition and Resilience:
Mortlock Reserve
- The narrow strip of fragmented bushland is in good to fair condition. Proximity to larger bushland areas increases its long-term resilience.
- Resilience has been significantly compromised by fill and dumped waste along Vernon St. This has destroyed or buried the original seed bank, limiting unassisted native plant regeneration and creating some unstable areas.
- Some areas with exposed sandstone outcrops demonstrate high resilience and more intact soil structure further down slope.
- Tree death in the top half of the reserve just below Vernon Street has resulted in sparse upper canopy cover.
- Some open areas are dominated by Weeping grass (*Microlaena stipoides),* inhibiting plant diversity and regeneration.
- The reserve is lacking dense middle story vegetation
- 'Hard surface' runoff from impervious surfaces such as Vernon St, stormwater, garden escapes and dumped garden clippings have spread weeds, increased nutrient and moisture levels and changed soil structure, stability and composition.
- Milk Thistle (*Sonchus oleraceus*), Ehrharta (*Ehrharta erecta*), Summer Grass (*Digitaria sanguinalis*), Cobblers Pegs (*Bidens pilosa*) and Fleabane (*Conyza sp*.) are commonly found along the edges of the roadway where surface flow from the road drains directly into the reserve.
- Native and exotic mesic and vine species require targeted and regular maintenance to manage colonisation / domination in areas of open forest and where elevated soil moisture and nutrient conditions have excluded fire for long periods.
- Mixed native and exotic plantings occur along the eastern boundary and native plantings occur along the northern boundary to the grassed area adjoining Tunks Park picnic area and car park and along portions of the narrow steep slope between Vernon St and Brothers Ave.
- No formal walking tracks exist through the reserve, which limits impacts from visitors and dogs, maximising the 'core conservation' area.
- Bush regeneration activities are carried out by Council's Bushland Management Team, bush regeneration contractors and the volunteer Mortlock Reserve Bushcare Group which formed in 1995.

Judith Ambler Reserve
- The small, narrow strip of bushland is fragmented and resilience has been significantly compromised by road fill along Currawang St. This has destroyed or buried the original seed bank, limiting unassisted native plant regeneration and creating some unstable areas. The condition of this remnant is generally fair.
- Some exposed sandstone outcrops demonstrate areas with high resilience and more intact soil structure further down slope in the north of the site.
- The bushland comprises a mature Blackbutt (*Eucalyptus pilularis*) and a Sydney Peppermint (*E. piperita*). Native plantings including Blue Gums (*Eucalyptus saligna*) that contribute to the canopy structure but do not belong in this vegetation community.
- Other non-endemic and exotic species have been planted in the eastern gully e.g. *Jacaranda sp*. and throughout the reserve and are progressively being removed.
- Since the bushland team has managed the reserve over the last 10 years, weeds have been removed and a burn in 2009 indicated some resilience with the successful germination of native endemic flora species including Hop Bush (*Dodonaea triquetra)*, acacias and native grasses.
- No water cuts through the reserve and no powerlines impact on tree canopy, increasing resilience.
- The reserve lacks dense middle story vegetation.
- A dead-end bitumen track was removed in 2010 as it served no purpose. Pedestrian traffic is now redirected back onto the main pathway and the area is being regenerated.
- Significant erosion occurs along the steep edges of the reserve that abut Vernon St where it is difficult to establish vegetation and maintain soil stability (the embankment was excavated to construct the road).
- Bush regeneration activities are carried out by Council's Bushland Management Team and the volunteer Mortlock Reserve Bushcare Group.
- Refer to Map 2 Condition of Bushland and Resilience.

Zone / Classification:
- The bushland is zoned E2 Environmental Conservation under *North Sydney LEP 2013.* It is classified public bushland in *SEPP No. 19 Bushland in Urban Areas (*and in the draft SEPP (*Environment)* that will supersede *SEPP 19.*)
- Mortlock Reserve is identified as a Coastal Environment Area and Coastal Use Area under *SEPP (Coastal Management*).

Statement of Significance:
Historic Values
- The bushland in these reserves is a legacy of past land management by the traditional Aboriginal custodians, the Cammeraygal people, who originally occupied the area. An Aboriginal midden exists along the foreshore in Mortlock Reserve. Other signs of Aboriginal presence may exist but remain undiscovered. Places, objects and features of significance to Aboriginal people are protected under the NSW *National Parks and Wildlife Act 1974*.
- In 1999, Mortlock Reserve was named after Bryce Mortlock, a local resident since the 1950s who was a pioneer bush regenerator. Along with his family, they weeded the bush and protected the trees from unnecessary culling. Judith Ambler Reserve was named after a passionate and concerned protector of the natural environment.

Natural Values

- The reserves play a significant role in maintaining biodiversity in the region and assist in conservation of species and habitat function.
- The bushland forms part of an important habitat corridor along the foreshore to Long Bay and Flat Rock Creek, which provides diversity of habitat in a highly-urbanised environment.
- Adjoining Tunks Park and Flat Rock Gully have been declared Wildlife Protection Areas under the NSW *Companion Animals Act* 1998 by Willoughby and North Sydney Councils.
- Angophora Foreshore Forest is threatened at a local level due to its limited extent.
- Mortlock Reserve contains the locally rare *Pultenaea flexilis.*
- The reserves and adjoining bushland areas provide habitat for threatened and declining fauna species including the Powerful Owl (*Ninox strenua*) (vulnerable in NSW under the *Biodiversity Conservation Act 2016*), the Grey-headed Flying-Fox (*Pteropus poliocephalus*) (vulnerable in NSW and federally under the *Environment Protection and Biodiversity Conservation Act 1999*, the Black Bittern (*Ixobrychus flavicollis*), White-bellied Sea-Eagle (*Haliaeetus leucogaster)* and Square Tailed Kite (*Lophoictinia isura)* all listed as vulnerable in NSW.
- In the North Sydney Microbat Survey 2013-14, Mortlock Reserve, Tunks Park and its weir had the highest diversity of bats (6) recorded in the North Sydney area. Bat species listed as vulnerable in NSW and recorded at Mortlock Reserve were the Eastern Freetail Bat (*Mormopterus norfolkensis*) and the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*). The Southern Myotis (*Myotis 113acropus*) and Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) were surveyed at Tunks Park weir and are also listed as vulnerable in NSW.

Fire History:

- Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity.
- Past burns have resulted in the successful germination of native endemic flora species including Hop Bush (*Dodonaea triquetra)*, *Entolasia marginata*, Fringed Wattle *(Acacia fimbriata*), Bleeding Heart (*Omalanthus populifolius*) and White Spider Flower (*Grevillea linearifolia*).
- Fire Management Access Zones exist along the eastern boundary of Mortlock Reserve, adjoining private property.
- Planned hazard reduction / ecological broad area burns are conducted from time to time. Refer to Map 3 Fire History and Future Managed Burns.

Threats:

- The limited size and narrowness of the reserves amplifies vulnerability to fragmentation and edge effects from the surrounding urban environment and limits genetic diversity.
- The ambiguous boundary on the eastern side of both reserves requires management to control garden escapes and encroachment. From time to time, dumping of garden clippings into bushland occurs off Vernon St and Currawang St which can damage native plantings and trigger weed infestations.
- In Mortlock Reserve, runoff from Vernon Street increases nutrient loads, moisture and erosion on the slopes below.
- Mortlock Reserve and Judith Ambler Reserve have an allocated road reserve that extends into the bushland. Future road works may result in the clearing of bushland within these areas
- Periodic illegal clearing and tree poisoning occurs along Vernon St for water views.
- Widespread fill over many decades off Vernon St and Currawang St, as well as past dumping, significantly compromises soil stability and structure, seedbank viability and bushland resilience along these reserve boundaries. The waste comprises a range of material including road fill, building rubble, domestic and industrial waste and foreign soil. The steep slopes opposite the Tunks Park children's playground, and at the most northern part of Judith Ambler Reserve, are particularly compromised, erodible and unstable, making it difficult to replant and support large canopy trees.
- *Phytophthora cinnamomi* (root rot*)* affects the health of the bushland and is widespread in North Sydney.
- In heavy rainfall periods, sewerage leaks from concrete pop-top lids along the sewerage pipeline below Vernon St and Currawang St.
- Where bushland areas are bordered by lawn, or where invasive exotic or native grasses such as *Ehrharta erecta*, Weeping Grass (*Microlaena stipoides)* or Basket Grass *(Oplismenus aemulus*) are present, constant management is required to prevent these species outcompeting and compromising native regeneration and diversity.
- In Mortlock Reserve native and exotic vines, mesic species and weeds are a serious threat to the stability of resilient cores and biodiversity in the long-term. Refer to Table 3 for plant species affecting biodiversity and stability of bushland assets in both reserves.
- Native bats and birds can transport new flora species and weeds into the reserve that have the potential to change its structure over time.
- At times, foxes (*Vulpes vulpes*), domestic cats (*Felis cattus*) and off-leash dogs (*Canis lupus familiaris)* are observed in the reserve and along the foreshore. These animals predate, scare and disturb wildlife, pollute with their faeces and spread weed seed. Shorebirds are particularly impacted by dogs off lead.
- Some species of introduced or endemic fauna are very territorial and complete for habitat, limiting species diversity.
- Inappropriate weed removal can reduce fauna habitat with greater impacts on short range species and small birds.
- In Mortlock Reserve no formal tracks exist yet visitor impacts include cubby building, informal track creation between Vernon St and Tunks Park, along the foreshore and to rocky outcrops and caves, resulting in soil compaction, erosion and trampling of vegetation.
- Increased drone usage may cause disturbance to fauna that occur in the canopy.
- In Mortlock Reserve past kayak and dinghy storage along the foreshore has compacted soil and damaged vegetation and an Aboriginal midden.
- In Judith Ambler Reserve Blue Gums (*Eucalyptus saligna*) create significant leaf litter that can crush and smother regenerating species and ground covers. The need to maintain sight lines from the adjoining roads for traffic safety also poses some constraints on revegetation options and bushland structure.
- Climate change is an ongoing threat. Anticipated impacts include increased threat of bushfire and extreme weather events. Raised sea levels are

predicted to inundate shoreline vegetation, eroding the foreshore and destroying Aboriginal middens. Intensified storm events will result in higher volumes of of stormwater runoff which is likely to result in erosion to drainage lines and creeks. Increased temperatures are likely to affect biodiversity and ecosystems, favouring some species over others and changing the structure and function of the bushland. The rate of climate change may be faster than the rate of natural adaptation. Increased temperatures will harm sensitive fauna such as bats, impacting their important ecosystem function.

- Non-passive recreational activities (incl. orienteering; rock climbing; geo-caching, camping and mountain biking) cause substantial damage to native vegetation and soil stability. These activities are prohibited in North Sydney's bushland reserves.

Bushland Management Goals

a. Maintain and enhance biodiversity and habitat for long term ecosystem resilience and function
b. Conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve
c. Strategically restore bushland (prioritise areas of highest resilience)
d. Enhance habitat connectivity
e. Preserve genetic integrity of the vegetation community
f. Manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality
g. Conserve the natural landscape and heritage values
h. Provide for ecologically sustainable recreation needs of the community
i. Implement the strategic fire hazard reduction program and manage fuel loads to protect life, property and endemic biodiversity

Rehabilitation Principles and Procedures:
General

1. Bush regeneration is a long-term process of staged weed removal to ensure endemic biodiversity, native plant establishment and continued habitat for local wildlife. It relies on site assessments that identify values and how best to restore and enhance ecosystem function and structure. Routine site monitoring, evaluation of field strategies and periodic native flora and fauna surveys inform management priorities over time. Works normally proceed from bush in good condition with high resilience. Degraded areas are a lower priority but the weeds always require containment.

Planning, Evaluation and Review

2. The Bushland Management Team should regularly evaluate bushland rehabilitation plans and the success of field strategies to inform management priorities early.
3. Establish photo points to monitor projects.
4. In the bushland rehabilitation planning process, consider the potential impact of future infrastructure earthworks, or access requirements on bushland, habitats, green corridors or active rehabilitation sites.
5. The Bushland Management Team must approve all contractor project proposals before implementation.
6. All Work, Health and Safety requirements must be adhered to by Council staff, volunteers and contractors before, during and after site works.

Native Flora

7. Record uncommon flora species to determine risk of extinction in the reserve. (Use North Sydney flora survey record template).
8. Prioritise protection / rehabilitation in areas of highest resilience.
9. Buffer areas should protect biodiversity from disturbances caused by fragmentation and edge effects: (a) monitor to identify gaps in buffer vegetation and senescing / restored vegetation and organise replacement planting; (b) where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a medium/long term solution to stop herbaceous weeds and grasses from spreading into bushland; (c) control vines, noxious weeds and other plant species affecting stability of adjoining bushland.
10. When natural regeneration is ineffective, locally source all plant material for supplementary planting to maintain genetic integrity of native vegetation in accordance with Flora Bank Guidelines https://www.greeningaustralia.org.au/florabank. Only plant when natural regeneration is ineffective to boost biodiversity, with the aim to achieve 80% survival rates. Plant in stages, basing species selection on the target vegetation community/structure, successional stage, habitat requirements and physical constraints. This process involves collaboration from Council's nursery supervisor, bush regeneration team, Bushcare volunteers and bush regeneration contractors.
11. In areas lacking diversity and structure; direct seed, transplant and use appropriate tube stock to enhance existing plant communities. When planning a replanting site: (a) prepare a suitable plant list based on rehabilitation objectives and prevailing site condition; (b) allow time for seed collection and propagation (9-12 months ahead of planting); (c) identify where seed harvesting/cuttings will be gathered; (d) prepare area (e.g. reduce density of dominant species on ground layer or mesic species in shrub layer); (e) schedule planting for early Autumn during or after soaking rain.
12. Collect seed of suitable locally rare species from nearby bushland areas, propagate and plant in appropriate areas of the reserve to enhance biodiversity and ensure the long-term viability. For species that are difficult to propagate, explore other methods such as seed scarification / raking treatment / seedbank translocation etc.
13. Implement a canopy replacement program in areas where remnant canopy is absent, senescing or failing to regenerate or where non-endemic trees have been removed.
14. Do not encourage large canopy species on unstable areas or under electricity easements where they cannot be supported and may cause future hazards.
15. Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team: (a) pile burn where appropriate; (b) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (c) reduce seedbank of dominant natives - control seeding cycle; (d) lightly disturb mulch / organic matter to stimulate regeneration; (e) increase seed bank of uncommon/ rare species with brush matting techniques (collect from donor sites where seed removal will not affect biodiversity); (f) propagate senescing plant species at risk of extinction in the reserve (i.e. due to an inadequate fire regime) and plant tubestock in suitable locations.
16. When planting along bushland edges, select species in consideration of their potential to compliment views from residential or public viewing areas and design to enhance habitat / connectivity (e.g. for small birds).
17. Conserve and protect naturally regenerating / colonising canopy species providing they are in sustainable locations.

Weeds and Pathogens

18. Implement the *Biosecurity Act 2015* consistently and effectively, in accordance with bushland management objectives and processes.
19. Residential properties adjoining bushland can contribute to weed spread. Monitor and address invasive garden plants in accordance with the

Biosecurity Act 2015 and promote Council's Native Havens / Habitat Stepping Stones Programs.

20. Ongoing weed management should: (a) prioritise good bush areas; (b) target species threatening stability e.g. vines, woody or canopy weeds; (c) interrupt seed cycle of target species, especially annual and grass weeds; (d) prioritise areas where plant diversity is most affected by mesic shift and vines. (In consideration of fauna habitat needs, schedule works from Autumn through Winter before bird breeding season.)
21. Monitor sites to identify, report and manage early stages of weed outbreaks or shifts in plant species assemblages likely to become detrimental to biodiversity. Manage according to the issues they raise. Report other threats to ecosystem function.
22. All compost weed material is removed off site.
23. Retain weeds on highly erodible or dangerous slopes and use methods of weed suppression that will not create potential for soil erosion. Incorporate abseiling activities on cliff faces to remove weeds that are a constant weed seed source.
24. Strategically remove non-endemic or exotic trees that interfere with ecosystem function or structure. Assess for habitat potential before they are de-limbed.
25. Consider all potential impacts of herbicide and proximity to water when determining suitability for weed control.
26. Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Native Fauna and Habitat

27. Record wildlife sightings and observations in Council's Wildlife Watch database. Share this information with NSW BioNet and the Commonwealth's ALA.
28. Identify and protect nesting, roosting and breeding sites of threatened, vulnerable or locally significant fauna.
29. Minimise disturbance to wildlife, enhance habitat where needed and improve the condition/connectivity of wildlife corridors between adjoining reserves.
30. Protect, maintain and restore quality fauna foraging habitat using a diverse mix of endemic native species. Retain habitat features such as fallen and standing dead wood, rock piles, hollow-bearing trees, natural debris, dead standing trees, forest litter, logs and branches.
31. Short-term strategies to maintain fauna habitat provided by mesic and weed species may require retention yet containment of dense areas of weed, vines and mesic species. In the longer-term, aim to establish a self-maintaining fabricated vegetation community in these areas composed of native species adapted to changed site conditions (abiotic factors) that enhance biodiversity and habitat availability.
32. Before any unfavourable trees are de-limbed, assess for habitat potential e.g. tree hollows.
33. Where suitable, install fauna nesting boxes and create hollows in suitable dead trees to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed.
34. Investigate financial opportunities to invest in habitat enhancing research and developing methodologies.

Threatened species

35. Identify threatened or endangered, rare or locally rare species of flora and fauna. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs.
36. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened species.

Ecological Burns

37. Hazard reduction and ecological burns are based on a strategic burn program consistent with the Mosman North Sydney Willoughby Bushfire Risk Management Plan. Ecological burn regimes are to be in a mosaic pattern to improve bushland function and biodiversity. Areas of high bushfire risk or core ecological resilience are usually prioritised in the annual burn program.
38. Maintain land management zones where bush adjoins residences and implement site stabilisation measures.
39. Over the next 10 years, prioritise prescribed burns at sites at risk of diminishing flora diversity.
40. For pre-fire preparation: (a) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (b) reduce seedbank of dominant natives to control seeding cycle; (c) increase seed bank of uncommon/ rare species with brush matting (collect from donor sites where seed removal will not affect biodiversity).
41. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds.
42. Implement post-fire monitoring and bush rehabilitation strategies. Monitor regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time period post-burn.

Pests and Illegal Activity

43. Monitor and control feral or aggressive/territorial fauna activity, cats, unleashed dogs and illegal activity with appropriate measures e.g. trapping, community education programs, penalty notices or camera observation. If applicable, manage reserves in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 and relevant North Sydney Council policies.
44. Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
45. Monitor the impacts of drones and implement management measures if required.
46. Address instances of unauthorised activities in bushland incl. orienteering; rock climbing; geocaching; mountain biking; camping etc.

Tracks, Water and Erosion

47. Close informal tracks to prevent damage to habitat; impede feral animals and reduce weed spread.
48. Implement track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, track widening and degrading track conditions.
49. Assess the need for additional directional and / or interpretive signage.
50. Stabilise steep slopes, ephemeral flow lines and highly erosive areas using local native species, particularly ground covers, to re-establish appropriate vegetation community structure where natural regeneration is

poor or absent. Install sedimentation fences, terracing, coir logs, matting or other appropriate measures where needed to stabilise washout areas and improve access and safety.

51. Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater tolerant natives.

Aboriginal and non-Aboriginal Heritage

52. All identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1974* and *Heritage Act 1977*.
53. Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual.
54. As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance.
55. Bushland management staff consult with the Aboriginal Heritage Office or Council's heritage officer prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey.
56. Discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol.

Community

57. Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
58. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
59. Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan.
60. When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council.

Reserve Specific Rehabilitation Actions

Priorities will be given to programs with long term benefit to the reserves or where natural assets are at greatest risk to avert irreversible deterioration or loss.

Flora

1. Where appropriate, expand buffer areas on the northern boundary interface between Mortlock Reserve and Tunks Park to enhance a buffer to lawn edge, protect biodiversity from disturbances caused by fragmentation and edge effect and help embellish wildlife corridors. Define the edge between the bushland and lawn interface by using natural log borders or densely planted Lomandra, with or without spray edges where appropriate.
2. Collaborate with Willoughby City Council to source suitable seed or tube stock that originates from Flat Rock Gully or Northbridge Golf Course to increase plant diversity and resilience.
3. Do not encourage large canopy species on unstable areas where they cannot be supported and may cause future hazards e.g. on the steep narrow slope between Brothers Ave and Vernon St where trees can fall onto Brothers Ave or on the steep narrow slope between Currawang St and Vernon St where trees can fall onto Vernon St. Instead encourage endemic heathland species such as *Grevillea sp*., *Kunzea sp*. and *Banksia sp*. on this slope. Particularly encourage juvenile *Banksia integrifolia* where senescing adult population is occurring.
4. Liaise with Council's traffic engineers when planning to plant near traffic sight lines or near stormwater easements.
5. In Judith Ambler Reserve, revegetate the grassy area zoned RE1 in the gully to the east of the bushland with ferns and shade loving ground covers to create more diverse ecosystem types in this small reserve.
6. In Judith Ambler Reserve strategically remove non-endemic or exotic trees e.g. Brushbox (*Lophostemon confertus)* that interfere with ecosystem function or structure and replace with suitable endemic species e.g. Blackbutt (*E*. *pilularis).*

Fauna

7. In conjunction with North Sydney and Willoughby Open Space Management and Bushland Management teams, improve wildlife corridors linking with bushland in Tunks Park and Northbridge Golf Course that include native trees, shrubs and thickets of shrubs. Enhance an interconnecting canopy over Brothers Ave to Tunks Park. For Judith Ambler Reserve also improve wildlife corridors to upslope residential areas in Cammeray via Tiley St and Pine St/Arkland St Reserve e.g. with interconnecting canopy.
8. Promote appropriate management of domestic pets as the reserves adjoins a Wildlife Protection Area (Tunks Park).
9. Investigate zoning Mortlock Reserve as a 'Wildlife Protection Area' under the *Companion Animals Act, 1998.*

Threatened Species

10. If *Acacia terminalis* subsp. *terminalis* is found to occur in Mortlock Reserve, work in collaboration with the Saving Our Species program managed by the NSW Office of Environment and Heritage and the NSW Herbarium to identify, monitor and protect *Acacia terminalis* subsp. *terminalis* and contribute to the preparation of best practice guidelines for the species.

Illegal Activity

11. Dinghy and kayak storage is prohibited within Mortlock Reserve.
12. Monitor the eastern boundary of both reserves for encroachments and remove invasive plants. Consider installing a small temporary silt fence or natural log border.

Tracks, Water and Erosion

13. Discourage informal track creation within Mortlock Reserve, especially along the foreshore from Tunks Park.
14. Use sedimentation fencing, wooden logs and berms as a management tool for erosion and weed spread and install terracing in appropriate areas on steep slopes to stabilise washout areas and improve access and safety e.g. between Vernon St and Brothers Ave and Currawang St and Vernon St.

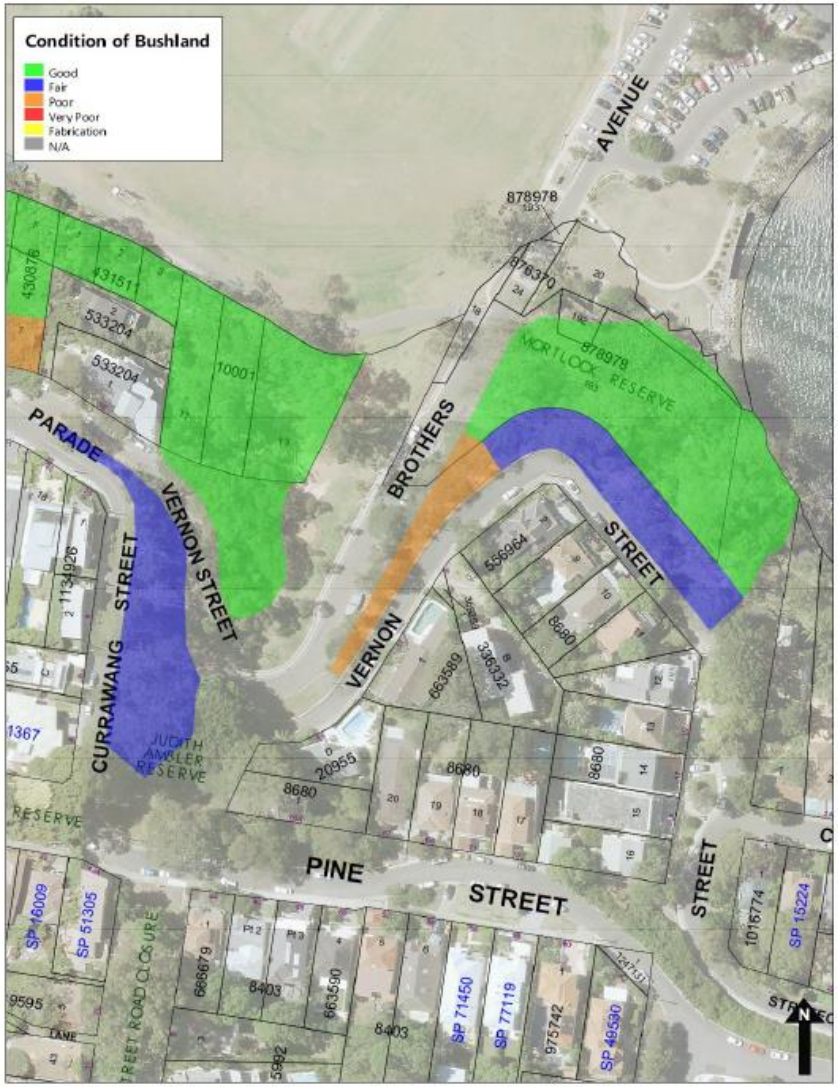
Ecological Burns

15. Refer to Map 3 Fire History and Future Managed Burns.

Capital Projects

16. Investigate improving the ecological value of the open stormwater culvert on the eastern boundary of Mortlock Reserve and the adjoining area with appropriate hydrological design, habitat enhancement and plant selection (medium priority).
17. Investigate managing surface flow along Vernon Street so that it no longer flows uncontrolled into Mortlock Reserve (medium priority).

Map 1: Vegetation Communities (NAS 2010)



North Sydney Council

Further details can be obtained by calling (02) 9936 8300 or e-mail mapping@northsydney.nsw.gov.au

Table 1: Common species recorded in Mortlock/Judith Ambler Res.

Scientific name	Common name	Vegetation Community
Acacia linifolia	Flax-leaved Wattle	AF; DS
Acacia longifolia	Sydney Golden Wattle	AF; DS
Allocasuarina littoralis	Black She-oak	AF; DS
Angophora costata	Sydney Red Gum	AF; DS
Breynia oblongifolia	Coffee Bush	AF; DS
Cassytha pubescens	Common Devil's Twine	AF; DS
Cissus hypoglauca	Giant Water Vine	AF; DS
Commelina cyanea	Scurvy Weed	AF; DS
Dianella caerulea	Blue Flax Lily	AF; DS
Dianella revoluta	Spreading Flax Lily	AF; DS
Digitaria parviflora	Small-flowered Finger Grass	AF; DS
Dodonaea triquetra	Common Hop Bush	AF; DS
Elaeocarpus reticulatus	Blueberry Ash	AF; DS
Entolasia marginata	Bordered Panic	AF; DS
Entolasia stricta	Wiry Panic	AF; DS
Eustrephus latifolius	Wombat Berry	AF; DS
Ficus rubiginosa	Port Jackson Fig	AF; DS
Glochidion ferdinandi	Cheese Tree	AF; DS
Glochidion ferdinandi var. pubens	Hairy Cheese Tree	AF; DS
Grevillea linearifolia	White Spider-flower	AF; DS
Hibbertia dentata	Twining Guinea Flower	AF; DS
Imperata cylindrica	Blady Grass	AF; DS
Kunzea ambigua	Tick Bush	AF; DS
Lepidosperma laterale	Variable Sword-sedge	AF; DS
Lomandra longifolia	Spiny-headed Mat-rush	AF; DS
Microlaena stipoides	Weeping Grass	AF; DS
Myrsine variabilis	Muttonwood	AF; DS
Notelaea longifolia	Large Mock-olive	AF; DS
Oplismenus aemulus	Basket Grass	AF; DS
Pandorea pandorana	Wonga Wonga Vine	AF; DS
Paspalidium distans		AF; DS
Pittosporum revolutum	Rough-fruit Pittosporum	AF; DS
Pittosporum undulatum	Pittosporum	AF; DS
Podocarpus spinulosus	Plum Pine	AF; DS
Pteridium esculentum	Bracken	AF; DS
Smilax glyciphylla	Sweet Sarsaparilla	AF; DS
Xanthorrhoea arborea	Broad-leaf Grass-tree	AF; DS

AF: Angophora Foreshore Forest DS: Disclimax Sandstone Scrub

Map 2: Condition of Bushland and Resilience (2018)

Condition of Bushland and Resilience Key

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural re-cruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/ replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience – limited regeneration
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed sandstone)

Map 3: Fire History & Future Managed Burns

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Table 2: Species of Special Conservation Concern

COMMON NAME	SCIENTIFIC NAME	CAUSE OF DECLINE
Sulpher-crested Cockatoo Australian Brush Turkey King Parrot Pacific Baza Golden-crowned Snake Yellow-tail Black Cockatoo Silver Gull Australian Raven Grey Butcherbird Laughing Kookaburra White-faced Heron Eastern Water Dragon Common Garden Skink Noisy Minor Eastern Bent-wing Bat Boobook Owl Powerful Owl Crested Pigeon Long-nosed Bandicoot Black Cormorant Little Black Cormorant Crimson Rosella Eastern Rosella Tawny Frogmouth Ring-tail Possum Eastern Whipbird Red Whiskered Bulbul Channel-billed Cuckoo White-browed Scrubwren Pied Currawong Blue-tongue Lizard Rainbow Lorrikeet Brush-tail Possum	*Cacatua galerita* *Alectura lathami* *Alisterus scapularis* *Aviceda subcristata* *Cacophis squamulosus* *Calyptorhynchus funereus* *Chroicocephalus novaehollandiae* *Corvus coronoides* *Cracticus torquatus* *Dacelo novaeguineae* *Egretta novaehollandiae* *Intellagama lesueurii* *Lamprolpholis guichenoti* *Manorina melanocephala* *Miniopterus schreibersii oceanensis* *Ninox novaeseelandiae* *Ninox strenua* *Ocyphaps lophotes* *Perameles nasuta* *Phalacrocorax carbo* *Phalacrocorax sulcirostris* *Platycercus elegans* *Platycercus eximius* *Podargus strigoides* *Pseudocheirus peregrinus* *Psophodes olivaceus* *Pycnonotus jocosus* *Scythrops novaehollandiae* *Sericornis frontalis* *Strepera graculina* *Tiliqua scincoides* *Trichoglossus haematodus* *Trichosurus vulpecula*	- Reduction of Tall Eucalypt Forest in North Sydney; - Loss of habitat /Declining canopy cover - Reduction and degradation of bush-land habitat in North Sydney; - Ecosystem degradation general loss of species diversity; Urban ecology expansion is beneficial to larger common birds; - Fragmented populations confined to small native bushland remnants are at risk of local extinction; - Lack of constant food source; - Predation from cats, dogs and urban predatory birds such as Currawongs and butcher birds. - Scarcity of natural breeding hollows - Altered stormwater system causing habitat loss; stormwater pollution; Sedimentation; Chytrid fungus; & Isolation of small populations.
Coastal Banksia Baumea Red Bloodwood Sydney Peppermint Prickly Beard-heath Tree Broom-heath Kangaroo Grass Wilkstomia	*Banksia integrifolia* *Baumea juncea* *Corymbia gummifera* *Eucalyptus piperita* *Leucopogon juniperinus* *Monotoca elliptica* *Themeda australis (blue form)* *Wilkstromia indica*	- Altered fire regimes; - Ecosystem degradation; general loss of species diversity; - Fragmented populations confined to small bushland remnants; - Lack of connectivity between bush-land limits pollination pathways and seed dispersal - Community use pressures - Stormwater pollution, erosion and sedimentation

Table 3: Plant species affecting biodiversity and stability of Bushland

Common Name	Botanic Name	Habit	Common Name	Botanic Name	Habit
African love grass	*Eragrostis curvula*	Grass/Ground layer	Purple top	*Verbena bonariensis*	Ground layer
Barbed wire grass	*Cymbopogon refractus*	Grass/Ground layer	Thick head	*Crassocephalum crepidioides*	Ground layer
Couch	*Cynodon dactylon*	Grass/Ground layer	Thistle sp	*Cirsium vulgare*	Ground layer
Crows foot grass	*Eleusine indica*	Grass/Ground layer	Trad	*Tradescantia fluminensis*	Ground layer
Ehrharta	*Ehrharta erecta*	Grass/Ground layer	Turkey rhubarb	*Acetosa sagittatus*	Ground layer
Foxtail grass	*Pennisetum alopecuroides*	Grass/Ground layer	Balloon vine	*Cardiospermum grandiflorum*	Climber
Kikuyu	*Pennisetum clandestinum*	Grass/Ground layer	Cape Ivy	*Delairea odorata*	Climber
Weeping grass	*Microlaena stipoides*	Grass/Ground layer	Honeysuckle	*Lonicera japonica*	Climber
Palm grass	*Setaria palmifolia*	Grass/Ground layer	Madeira vine	*Anredera cordifolia*	Climber
Parramatta grass	*Sporobolus indicus*	Grass/Ground layer	Morning glory coastal	*Ipomea cairica*	Climber
Paspalum	*Paspalum dilatatum*	Grass/Ground layer	Morning glory	*Ipomea indica*	Climber
Red natal grass	*Melinis repens*	Grass/Ground layer	Moth vine	*Araujia sericifolia*	Climber
Summer grass	*Digitaria sanguinalis*	Grass/Ground layer	Corky Passionfruit	*Passiflora suberosa*	Climber
Asthma weed	*Parietaria judaica*	Ground layer	Box Elder	*Acer negundo*	Canopy/Shrub
Asparagus fern	*Protasparagus aethiopicus*	Ground layer	African olive	*Olea europaea ssp. cuspidata*	Canopy/Shrub
Bidens	*Bidens pilosa*	Ground layer	Castor oil plant	*Ricinus communis*	Canopy/Shrub
Scurvy weed	*Commelina cyanea*	Ground layer	Camphor laurel	*Cinnamomum camphora*	Canopy/Shrub
Crofton	*Ageratina adenophora*	Ground layer	Cassia	*Senna pendula*	Canopy/Shrub
Fishbone fern	*Nephrolepis cordifolia*	Ground layer	Cheese Tree	*Glochidion ferdinandi*	Canopy/Shrub
Fleabane	*Conyza spp*	Ground layer	Coral Tree	*Erythrina sp*	Canopy/Shrub
Mist flower	*Ageratina riparia*	Ground layer	Lantana	*Lantana camara*	Canopy/Shrub
Montbretia	*Crocosmia X crocosmiiflora*	Ground layer	Ochna	*Ochna serrulata*	Canopy/Shrub
Mother of millions	*Bryophyllum delagoense*	Ground layer	Port Jackson Fig	*Ficus rubiginosa*	Canopy/Shrub
Mustard weed	*Brassica spp.*	Ground layer	Sweet Pittosporum	*Pittosporum undulatum*	Canopy/Shrub
Paddys lucerne	*Sida rhombifolia*	Ground layer	Small leaf Privet	*Ligustrum sinense*	Canopy/Shrub
Pampas lily of the valley	*Salpichroa organifolia*	Ground layer	Large leaf Privet	*Ligustrum lucidum*	Canopy/Shrub
Pareuvian lily	*Alstroemeria pulchella*	Ground layer	Wild tobacco	*Solanum mauritianum*	Canopy/Shrub

2.2.3 Primrose Park (incl. Folly Point) Bushland Rehabilitation Plan

Description

Size: Primrose Park and Folly Point 7.6 Ha

Access: Primrose Park is accessed via Grafton St, Earle St, Young Street, Denos Lane and Matora Lane, Cremorne and Lambert St and Churchill Cres, Cammeray. Folly Point is accessed via Cammeray Rd and Folly Point (Road), Cammeray.

Ownership: Primrose Park is crown land under Council's management. Folly Point is owned by Council.

Catchment: Middle Harbour

Configuration / Connectivity: A narrow U-shaped strip of bushland surrounding the Willoughby Bay foreshore and lower slopes above the adjoining grassed playing fields. The bushland forms part of a larger, semi-connected remnant incorporating Brightmore and Wonga Reserves and is bordered to the west, south and east by medium density urban development. Folly Point is a small parcel of land bordered by Willoughby Bay / Long Bay to the north / east and Cammeray Rd / residential development to the south / west.

Hydrology: Willoughby Falls, located off Grafton St is the main point of entry for stormwater from Cammeray and Cremorne to the creekline that flows via the park to Willoughby Bay. After flowing through a natural creekline for approximately 50m, water is diverted into an open concrete channel to the Bay via an energy dissipater. All other surface runoff from the park and upslope residential areas also drains to Willoughby Bay via a smaller network (~300mm diameter) Council stormwater pipes and informal private pipes enter bushland from residential property boundaries.

Geology: Hawkesbury Sandstone of medium to coarse grained quartz sandstone with minor shale and laminate lenses and sandstone outcrops.

Soil Landscape: Hawkesbury Soil Landscape consisting of shallow, poor sandy soils, highly erosive with low soil fertility. Localised Yellow and Red Podzolic Soils are associated with shale lenses. Some areas below roads and residential boundaries are disturbed with fill.

Slope: Steep to moderate slopes towards the playing fields and Willoughby Bay.

Facilities / Infrastructure: Stormwater collected from Warringah Expressway and surrounding suburbs is treated and used to water playing fields at Primrose Park as part of the North Sydney Stormwater Reuse Project. The Pipeline extends from Fall St / Grafton St via the Willoughby Falls creekline to holding tanks in Primrose Park. There are two formal walking tracks which pass through the bushland. The main track starts on the northern side of the Primrose Park Tennis Centre and finishes at Folly Point (off Cammeray Rd). This track allows access to Lambert Street and includes timber stairs and boardwalks. The 'Zig Zag' track is shorter and steeper. It starts at the rear of the Tennis Centre and finishes at the Grafton Street lookout. Informal tracks throughout the bushland are relatively insignificant. Dinghy storage racks are located at Folly Point. In addition to the tennis centre and playing fields, Primrose Park includes amenities such as cricket nets, flood lights, change rooms, toilets and BBQs, a designated carpark off Young St and limited on-street parking. Elements of the former sewage works structure, including the engine and compressor houses, have been converted to hockey and tennis club houses. The concrete effluent surge tanks and associated channels are still visible.

Plant Community:
Primrose Park

- Blackbutt Gully Forest – an open or tall open forest with *Eucalypt pilularis* as the dominant tree species.
- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species found along the foreshore.
- Disclimax Sandstone Scrub – an altered community of open to closed scrub, or a forest of mixed and variable composition due to disturbance and lack of fire.

Folly Point

- Estuarine Swamp Oak Floodplain Forest at Folly Point - An open forest dominated by *Casuarina glauca* that grows beside the intertidal zone.
- Refer to Map 1 for the plant communities; Table 1 for common flora species and Table 2 for plant species of special conservation concern in Primrose Park / Folly Point

Wildlife Habitat:

- Primrose Park bushland contains greater fauna diversity than the adjoining Cremorne reserves due to its range of habitat comprising open forest and open and closed scrub, rocky foreshore, drainage areas, rocky outcrops and dense weedy areas.
- Primrose Park forms an important habitat link to Brightmore and Wonga Reserves.
- Despite limited connectivity of vegetation with larger areas of bushland, the park and Folly Point are within range for many wildlife species that move between reserves such as the Common Brushtail (*Trichosurus Vulpecula*) and Ringtail Possums (*Pseudocheirus peregrinus*), microbats, woodland and sea birds. Remnant small range species include skinks, lizards, geckoes, snakes and frogs.
- Primrose Park and Folly Point lack nesting hollows and roosting sites for birds and arboreal mammals due to the absence of mature native trees. Such creatures play an important role in the ecology of the vegetation communities, assisting in pollination, seed dispersal and germination processes.
- Habitat for Powerful Owl (*Ninox strenua*) and microbats have been augmented near the tennis courts with the carving of hollows in dead trees.
- Wildlife corridors have been created along the top of the car park on Young St as an extension of native vegetation from existing bushland in Primrose Park. The goal is to improve wildlife linkages to Wonga and Brightmore Reserves. Works have included under planting existing trees with native mid/understorey species and providing an interconnecting canopy over Young Street for arboreal mammals and small bird species.
- A lengthy thicket of *Lantana camara* is located below Churchill Cres forming a monoculture in the mid-storey that is important habitat for many species of small birds

e.g. White-browed Scrub-wrens, Silvereyes, Superb Fairy-wrens, Whip-birds etc. Sensitive management of the site is required to conserve habitat and minimise disturbance.
- Refer to Table 2 for fauna species of special conservation concern.

Condition and Resilience:
- The bushland in Primrose Park consists a relatively narrow strip containing some pockets of resilient vegetation in good to fair condition as well as pockets of vegetation in poor to very poor condition with little to no resilience.
- Folly Point has low long-term resilience and viability due to its small area and fragmentation from other bushland. It contains degraded Swamp Oak Floodplain Forest comprising Blackbutt (*Eucalyptus pilularis*) and Swamp Oak (*Casuarina glauca*). The mid-storey and understorey have been converted to lawn but some intact remnants exist on the eastern edge of the Point. This area is heavily utilised for small boat storage.
- Bushland condition and resilience has been compromised in Primrose Park by historic land-uses including timber getting in the 1800s, quarry activities, decades of dumping and major sewerage and stormwater infrastructure works. The original seed bank has been destroyed or buried in many areas, nutrient levels have increased and soil structure, stability and composition has changed to favour weeds. Areas particularly affected have been the creekline, areas below roads and areas below gardens. Major soil disturbance limits the application of assisted natural regeneration. Replanting for vegetation-type-conversion is the most appropriate approach in areas where resilience is lost and site conditions have been permanently altered.
- Native mesic species are successfully colonising areas of open forest and flourish in elevated soil moisture and nutrient conditions, as well as in areas where fire has been excluded for long periods.
- A large monoculture of Lantana (*Lantana camara*) exists below Churchill Crescent. Other areas have been degraded by exotic vines and the spread of invasive mesic species (native and introduced).
- Some areas bordered by lawn require constant maintenance to prevent spread into bushland.
- Bush regeneration activities are carried out by Council's Bushland Management Team, bush regeneration contractors, the Primrose Park Bushcare Group (who manage a section in the south west of the Park, near Lambert St) and community members involved in the Adopt-a-Plot Program.
- Refer to Map 2 Condition of Bushland and Resilience.

Zone / Classification:
- The bushland is zoned E2 Environmental Conservation under the *North Sydney LEP 2013.* It is classified public bushland in *SEPP No. 19 Bushland in Urban Areas (*and in the draft SEPP (*Environment)* that will supersede *SEPP 19*).
- The park and Folly Point are identified as a Coastal Environment Area and Coastal Use Area under *SEPP (Coastal Management*).

Statement of Significance:
Historic Values
- The bushland is a legacy of past land management by the traditional Aboriginal custodians, the Cammeraygal, who originally occupied the area. Aboriginal historic items and sites including rock art and shell middens are found within the park. Other signs of Aboriginal presence may exist but remain undiscovered. Places, objects and features of significance to Aboriginal people are protected under the NSW *National Parks and Wildlife Act 1974*.
- In 1891, the land on which the sports fields now stand was converted from a natural estuarine bay to North Sydney's first sewage treatment works. Land was reclaimed by dredging at the head of the bay. The sewage works closed in the late 1920s and the area was dedicated as parkland in 1930 and converted to playing fields. The surrounding bushland was also acquired to retain natural beauty around the recreation asset. The Park was named after HL Primrose, Mayor of North Sydney from 1926 to 1932, and later NSW Minister for Health. Heritage items within the park that are listed on the North Sydney *LEP 2013* are: 'Willoughby Falls remains' (Grafton St, Opposite Fall St); Folly Point Sewerage Treatment Works, and "Primrose Park'. Unlisted heritage items are also scattered throughout the bushland including sandstone rock platforms, walls, remnant tracks and possibly debris.

Natural Values
- Primrose Park and Folly Point play a significant role in maintaining biodiversity in the region and assist in conservation of species and habitat function.
- The bushland forms part of an important habitat corridor along the foreshore linking Wonga and Brightmore Reserves. Together, these remnants are known to provide habitat for 87 fauna species and a high number of bird species due to the diversity of habitat types in a highly-urbanised environment.
- Primrose Park (incl. Folly Point) has been declared a Wildlife Protection Area under the NSW *Companion Animals Act 1998*, prohibiting the free movement of domestic cats to help minimise cat predation of native wildlife. The reserves are signposted and neighbouring properties are informed of the restrictions. Community education regarding responsible pet ownership is ongoing.
- The reserves provide habitat for threatened and declining fauna species including the Powerful Owl (*Ninox strenua*) (listed as vulnerable in NSW under the *Biodiversity Conservation Act 2016* (*BC Act*)) and the Grey-headed flying-fox (*Pteropus poliocephalus*) (listed as vulnerable under the *BC Ac*t and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999*).
- The Cremorne Reserves contain large stormwater culverts that are highly significant roost sites for the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) (listed as vulnerable under the NSW *BC Act*) and may also be a mating site in Autumn. Other species recorded in the Cremorne reserves include the Little Bentwing Bat (*Miniopterus australis*), Eastern Freetail Bat (*Mormopterus norfolkensis*) and Southern Myotis (*Myotis macropus*) (all listed as vulnerable under the NSW *BC Act*)
- Estuarine Swamp Oak Forest at Folly Point is listed as an endangered ecological community (EEC) under the NSW *BC Act*.
- Blackbutt Gully Forest and Angophora Foreshore Forest are threatened at a local level.
- The endangered *Acacia terminalis* subspecies *terminalis* listed under the Commonwealth *EPBC Act* and the NSW *BC Act* has been recorded in the Cremorne reserves. It typically occurs in Angophora Foreshore Forest, Blackbutt Gully Forest and Disclimax Sandstone Scrub.

Primrose Park also contains the locally rare *Calystegia marginata*, *Persoonia levis* and *Persoonia pinifolia*.

Recreation / Educational Values

- Primrose Park and Folly Point are a valuable educational, nature appreciation and bushwalking resource for the local community and visitors.

Fire History:

- Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity in resilient parts of Primrose Park.
- Past burns have resulted in the successful germination of native endemic flora species.
- Planned hazard reduction / ecological broad area burns are conducted from time to time. Refer to Map 3 Fire History and Future Managed Burns.

Threats:

- The limited size and linear shape of Primrose Park amplifies its vulnerability to fragmentation and edge effects from the surrounding urban environment.
- Primrose Park bushland has 35 adjoining properties along the bushland interface. Past and present impacts that have led to (and continue to perpetuate) bushland degradation in this zone include: garden escape weeds; dumping of garden clippings; illegal clearing of bushland (including weeds); illegal property encroachments; tree vandalism; informal tracks through the reserve and storage of watercraft in the bushland zone.
- Sewerage leaks are a recurring problem along all bushland interfaces due to old terracotta pipes. Runoff from hard surfaces, irrigation and swimming pools increase nutrient loads, moisture and erosion on the slopes below. Garden fertiliser leaches into the bush, increasing nutrients which favour weeds over natives.
- Widespread dumping of fill over many decades, as well as past and more recent dumping, significantly compromises soil stability and structure, seedbank viability and bushland resilience. The waste comprises a range of material including garden clippings, building rubble, domestic and industrial waste and foreign soil.
- *Phytophthora cinnamomi* (root rot*)* affects the health of the bushland and is widespread in North Sydney.
- Willoughby Falls is the main point of entry for stormwater in to the creekline below, which is a source of weed seed and increased nutrient pollution from the upper catchment. The stormwater drain carries considerable force during heavy rainfall, causing erosion and transporting contaminants from the upper catchment. Past episodes of stormwater contamination have resulted in dieback of mature trees e.g. Lambert Street drain.
- In heavy rainfall periods, effluent leaks from concrete pop-top lids along the sewer pipeline that parallels the main walking track below Churchill Cres; increasing moisture, nutrients, contaminants and weeds.
- Inaccessible/unstable cliff areas such as Willoughby Falls and below Young Street make safe access for weed removal challenging. This results in persistent weed infestations.
- Native and exotic vines, mesic species and weeds are a serious threat to the stability of resilient cores and long term viability of biodiversity. Refer to Table 3 for plant species affecting biodiversity and stability of bushland assets.
- Areas where bushland is bordered by lawn grass species e.g. along Grafton and Lambert Streets, are continually impacted by exotic grass encroachment.
- Native bats and birds can introduce new flora species and weeds that have the potential to change vegetation structure and composition over time.
- At times, foxes (*Vulpes vulpes*), domestic cats (*Felis cattus*) and off-leash dogs (*Canis lupus familiaris)* are observed in the reserve and along the foreshore. These animals predate, scare and disturb wildlife, pollute with their faeces and spread weed seed. Shorebirds are particularly impacted by dogs off lead.
- Some species (introduced or endemic) are territorial and compete for habitat, limiting species diversity.
- Periodically cockatoos congregate in large numbers within the bushland and over-trim the canopy.
- Inappropriate weed removal can reduce fauna habitat with greater impacts on short range species (incl. regionally significant small bird species).
- Visitor impacts include graffiti and trampling around rock overhangs and cliff faces, informal track creation, soil compaction, soil erosion, exposure of Aboriginal middens and destruction / harm to native foreshore vegetation from unauthorised dinghy/kayak storage.
- Illegal boat storage along the foreshore of Folly Point and Primrose Park damages bushland and soil stability along the foreshore and requires regular supervision.
- Artificial night lighting from the playing fields and adjoining residential development can detrimentally affect nocturnal fauna, particularly microbats.
- Increased drone usage may be causing disturbance to fauna that occur in the canopy.
- Climate change is an ongoing threat. Anticipated impacts include increased threat of bushfire and extreme weather events. Raised sea levels are predicted to inundate shoreline vegetation, eroding the foreshore and destroying Aboriginal middens. Intensified storm events will result in higher volumes of of stormwater runoff which is likely to result in erosion to drainage lines and creeks. Increased temperatures are likely to affect biodiversity and ecosystems, favouring some species over others and changing the structure and function of the bushland. The rate of climate change may be faster than the rate of natural adaptation. Increased temperatures will harm sensitive fauna such as bats, impacting their important ecosystem function.
- Non-passive recreational activities (incl. orienteering; rock climbing; geo-caching, camping and mountain biking) cause substantial damage to native vegetation and soil stability. These activities are prohibited in North Sydney's bushland reserves.

Bushland Management Goals

a. Maintain and enhance biodiversity and habitat for long term ecosystem resilience and function
b. Conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve
c. Strategically restore bushland (prioritise areas of highest resilience)
d. Enhance habitat connectivity
e. Preserve genetic integrity of the vegetation community
f. Manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality
g. Conserve the natural landscape and heritage values
h. Provide for ecologically sustainable recreation needs of the community
I. Implement the strategic fire hazard reduction program and manage fuel loads to protect life, property and endemic biodiversity.

Rehabilitation Principles and Procedures:
General

1. Bush regeneration is a long-term process of staged weed removal to ensure endemic biodiversity, native plant establishment and continued habitat for local wildlife. It relies on site assessments that identify values and how best to restore and enhance ecosystem function and structure. Routine site monitoring, evaluation of field strategies and periodic native flora and fauna surveys inform management priorities over time. Works normally proceed from bush in good condition with high resilience. Degraded areas are a lower priority but the weeds always require containment.

Planning, Evaluation and Review

2. The Bushland Management Team should regularly evaluate bushland rehabilitation plans and the success of field strategies to inform management priorities early.
3. Establish photo points to monitor projects.
4. In the bushland rehabilitation planning process, consider the potential impact of future infrastructure earthworks, or access requirements on bushland, habitats, green corridors or active rehabilitation sites.
5. The Bushland Management Team must approve all contractor project proposals before implementation.
6. All Work, Health and Safety requirements must be adhered to by Council staff, volunteers and contractors before, during and after site works.

Native Flora

7. Record uncommon flora species to determine risk of extinction in the reserve. (Use North Sydney flora survey record template).
8. Prioritise protection / rehabilitation in areas of highest resilience.
9. Buffer areas should protect biodiversity from disturbances caused by fragmentation and edge effects: (a) monitor to identify gaps in buffer vegetation and senescing / restored vegetation and organise replacement planting; (b) where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a medium/long term solution to stop herbaceous weeds and grasses from spreading into bushland; (c) control vines, noxious weeds and other plant species affecting stability of adjoining bushland.
10. When natural regeneration is ineffective, locally source all plant material for supplementary planting to maintain genetic integrity of native vegetation in accordance with Flora Bank Guidelines https://www.greeningaustralia.org.au/florabank. Only plant when natural regeneration is ineffective to boost biodiversity, with the aim to achieve 80% survival rates. Plant in stages, basing species selection on the target vegetation community/structure, successional stage, habitat requirements and physical constraints. This process involves collaboration from Council's nursery supervisor, bush regeneration team, Bushcare volunteers and bush regeneration contractors.
11. In areas lacking diversity and structure; direct seed, transplant and use appropriate tube stock to enhance existing plant communities. When planning a replanting site: (a) prepare a suitable plant list based on rehabilitation objectives and prevailing site condition; (b) allow time for seed collection and propagation (9-12 months ahead of planting); (c) identify where seed harvesting/cuttings will be gathered; (d) prepare area (e.g. reduce density of dominant species on ground layer or mesic species in shrub layer); (e) schedule planting for early Autumn during or after soaking rain.
12. Collect seed of suitable locally rare species from nearby bushland areas, propagate and plant in appropriate areas of the reserve to enhance biodiversity and ensure the long-term viability. For species that are difficult to propagate, explore other methods such as seed scarification / raking treatment / seedbank translocation etc.
13. Implement a canopy replacement program in areas where remnant canopy is absent, senescing or failing to regenerate or where non-endemic trees have been removed.
14. Do not encourage large canopy species on unstable areas or under electricity easements where they cannot be supported and may cause future hazards.
15. Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team: (a) pile burn where appropriate; (b) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (c) reduce seedbank of dominant natives - control seeding cycle; (d) lightly disturb mulch / organic matter to stimulate regeneration; (e) increase seed bank of uncommon/ rare species with brush matting techniques (collect from donor sites where seed removal will not affect biodiversity); (f) propagate senescing plant species at risk of extinction in the reserve (i.e. due to an inadequate fire regime) and plant tubestock in suitable locations.
16. When planting along bushland edges, select species in consideration of their potential to compliment views from residential or public viewing areas and design to enhance habitat / connectivity (e.g. for small birds).
17. Conserve and protect naturally regenerating / colonising canopy species providing they are in sustainable locations.

Weeds and Pathogens

18. Implement the *Biosecurity Act 2015* consistently and effectively, in accordance with bushland management objectives and processes.
19. Residential properties adjoining bushland can contribute to weed spread. Monitor and address invasive garden plants in accordance with the Biose*curity Act 2015* and promote Council's Native Havens / Habitat Stepping Stones Programs.

20. Ongoing weed management should: (a) prioritise good bush areas; (b) target species threatening stability e.g. vines, woody or canopy weeds; (c) interrupt seed cycle of target species, especially annual and grass weeds; (d) prioritise areas where plant diversity is most affected by mesic shift and vines. (In consideration of fauna habitat needs, schedule works from Autumn through Winter before bird breeding season.)
21. Monitor sites to identify, report and manage early stages of weed outbreaks or shifts in plant species assemblages likely to become detrimental to biodiversity. Manage according to the issues they raise. Report other threats to ecosystem function.
22. All compost weed material is removed off site.
23. Retain weeds on highly erodible or dangerous slopes and use methods of weed suppression that will not create potential for soil erosion. Incorporate abseiling activities on cliff faces to remove weeds that are a constant weed seed source.
24. Strategically remove non-endemic or exotic trees that interfere with ecosystem function or structure. Assess for habitat potential before they are de-limbed.
25. Consider all potential impacts of herbicide and proximity to water when determining suitability for weed control.
26. Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Native Fauna and Habitat

27. Record wildlife sightings and observations in Council's Wildlife Watch database. Share this information with NSW BioNet and the Commonwealth's ALA.
28. Identify and protect nesting, roosting and breeding sites of threatened, vulnerable or locally significant fauna.
29. Minimise disturbance to wildlife, enhance habitat where needed and improve the condition/connectivity of wildlife corridors between adjoining reserves.
30. Protect, maintain and restore quality fauna foraging habitat using a diverse mix of endemic native species. Retain habitat features such as fallen and standing dead wood, rock piles, hollow-bearing trees, natural debris, dead standing trees, forest litter, logs and branches.
31. Short-term strategies to maintain fauna habitat provided by mesic and weed species may require retention yet containment of dense areas of weed, vines and mesic species. In the longer-term, aim to establish a self-maintaining fabricated vegetation community in these areas composed of native species adapted to changed site conditions (abiotic factors) that enhance biodiversity and habitat availability.
32. Before any unfavourable trees are de-limbed, assess for habitat potential e.g. tree hollows.
33. Where suitable, install fauna nesting boxes and create hollows in suitable dead trees to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed.
34. Investigate financial opportunities to invest in habitat enhancing research and developing methodologies.

Threatened species

35. Identify threatened or endangered, rare or locally rare species of flora and fauna. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs.
36. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened species.

Ecological Burns

37. Hazard reduction and ecological burns are based on a strategic burn program consistent with the Mosman North Sydney Willoughby Bushfire Risk Management Plan. Ecological burn regimes are to be in a mosaic pattern to improve bushland function and biodiversity. Areas of high bushfire risk or core ecological resilience are usually prioritised in the annual burn program.
38. Maintain land management zones where bush adjoins residences and implement site stabilisation measures.
39. Over the next 10 years, prioritise prescribed burns at sites at risk of diminishing flora diversity.
40. For pre-fire preparation: (a) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (b) reduce seedbank of dominant natives to control seeding cycle; (c) increase seed bank of uncommon/ rare species with brush matting (collect from donor sites where seed removal will not affect biodiversity).
41. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds.
42. Implement post-fire monitoring and bush rehabilitation strategies. Monitor regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time period post-burn.

Pests and Illegal Activity

43. Monitor and control feral or aggressive/territorial fauna activity, cats, unleashed dogs and illegal activity with appropriate measures e.g. trapping, community education programs, penalty notices or camera observation. If applicable, manage reserves in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 and relevant North Sydney Council policies.
44. Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
45. Monitor the impacts of drones and implement management measures if required.
46. Address instances of unauthorised activities in bushland incl. orienteering; rock climbing; geocaching; mountain biking; camping etc.

Tracks, Water and Erosion

47. Close informal tracks to prevent damage to habitat; reverse reserve fragmentation; impede feral animals and reduce weed spread.
48. Implement track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, track widening and degrading track conditions.
49. Assess the need for additional directional and / or interpretive signage.
50. Stabilise steep slopes, ephemeral flow lines and highly erosive areas using local native species, particularly ground covers, to re-establish appropriate vegetation community structure where natural regeneration is poor or absent. Install sedimentation fences, terracing,

coir logs, matting or other appropriate measures where needed to stabilise washout areas and improve access and safety.

51. Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater tolerant natives.

Aboriginal and non-Aboriginal Heritage

52. All identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1974* and *Heritage Act 1977*.
53. Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual.
54. As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance.
55. Bushland management staff consult with the Aboriginal Heritage Office or Council's heritage officer prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey.
56. Discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol.

Community

57. Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
58. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
59. Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan.
60. When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council.

Reserve Specific Rehabilitation Actions

Priorities will be given to programs with long term benefit or where natural assets are at greatest risk to avert irreversible deterioration or loss.

Flora

1. In Primrose Park, contain dense weed infestation below Churchill Cres and slowly reduce extent by expanding good bush edges (in consideration of fauna habitat needs). Identify appropriate canopy planting locations within this zone and plant locally endemic canopy species. Over time, clear and plant small islands of natives around establishing canopy.
2. Incorporate abseiling weed control on cliff faces e.g. Willoughby Falls; below Young St.
3. Collect seed of locally rare species e.g. *Calystegia marginata* from adjacent bushland areas, propagate and plant in appropriate areas to increase the population size and ensure the long-term viability.
4. Complete establishment of native buffers along bush edges and private property interface e.g. above Matora Lane. Include a shrub layer to provide a habitat corridor for small birds.
5. When planting along bushland edges select species in consideration of their potential to compliment views from residential areas to the Bay
6. Define the edge between the bushland and tracks, lawn and residential interface by using (for example) natural log borders; with or without spay edges and planting dense Lomandra, where appropriate.
7. Commission an arborist to assess the health of *Eucalypt pilularis* trees in lower Denos Lane, Cremorne, identify the disease and appropriate actions to ensure their longevity.
8. At Folly Point, expand bushland over weedy and lawn areas to meet the rock outcrop. Re-turf areas where required with native grass e.g. *Microlaena stipoides* and maintain.

Fauna

9. Manage the reserve in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 that apply to Primrose Park and Folly Point and relevant North Sydney Council policies.
10. Retain yet contain dense vines, mesic and exotic plants below Churchill Cres for fauna habitat until suitable habitat in adjacent sections of the bushland are mature enough to ensure survival of small bird species.
11. Inhibit access to microbat roost sites and adjoining habitat areas. Maintain flight paths and ensure favourable conditions for microbat roosting. Aim to schedule any mandatory infrastructure works to the drains during times when bats would not be roosting.
12. Protect, maintain and restore quality bat foraging habitat (e.g. areas with high moisture), using a diverse mix of locally appropriate native species.
13. In conjunction with Open Space Management staff, improve wildlife corridors to bushland in Wonga Reserve and Brightmore Reserve.
14. Design future replacement night lighting to reduce impacts on nocturnal fauna e.g. microbats.

Threatened Species

15. If *Acacia terminalis* subsp. *terminalis* is found to occur in Primrose Park or Folly Point, work in collaboration with the Saving Our Species program managed by the NSW Office of Environment and Heritage and the NSW Herbarium to identify, monitor and protect *Acacia terminalis* subsp. *terminalis* and contribute to the preparation of best practice guidelines for the species.
16. Preserve and enhance the habitat of threatened microbat species; Powerful Owl (*Ninox strenua*) and Grey-headed Flying fox (*Pteropus poliocephalus*).

Illegal Activity

17. At Folly Point, monitor dinghy storage for impacts to flora, bank stability and Aboriginal Heritage sites.
18. Informal/unauthorised storage of small watercraft is prohibited within the reserve and along its foreshore. Arrange removal of illegally stored watercraft with Council Rangers.
19. To prevent erosion and protect vegetation, public access to the foreshore via informal tracks is prohibited
20. Report all illegal drug and alcohol use locations and associated damage to Council's Ranger team. All affected areas are to be listed on Council's register for such sites and collaboration is required with the Police to implement management strategies
21. Illegal encroachments and unauthorised paths leading from private property in to the reserve will be referred to Council's Compliance Team for action.

Tracks, Water and Erosion

22. Implement edge stabilising along residential boundaries (e.g. above Matora Lane).
23. Assess track condition and implement upgrades as required to address soil stability, safety and protect Aboriginal Heritage.
24. Update bushland interpretive and directional signage.
25. Prevent estabilishment of informal paths and close existing pathways that are damaging bushland condition or compromising rehabilitation works.

Aboriginal and Non-Aboriginal Heritage

26. Where bushland is encroaching on heritage sites or Council infrastructure, assess on a case by case basis and consult with relevant Council officers to determine appropriate action.
27. Assess the heritage significance of unrecorded items within Primrose Park using qualified professionals. Formulate recommendations and appropriate management measures.

Ecological Burns

28. Refer Map 3 Fire History and Future Managed Burns.
29. Investigate potential for pile burning to trigger natural regeneration in Folly Point.

Community

30. Plan replanting projects to coincide with National Tree Day.
31. Engage local residents in Bushcare Programs (e.g. Bushcare; Adopt-a-Plot; Native Havens; Wildlife Watch)

Capital works

32. Install signage to deter illegal storage and dumping of dinghies and small watercraft along foreshore in the northern sections of Primrose Park. Implement notification and removal strategies when required.
33. Implement stormwater/creekline rehabilitation projects e.g. below Grafton St; Lambert St and Churchill Cres.

34. Work with Council's Engineering Team to implement fauna-sensitive sea-wall upgrades
35. Investigate installation of vehicle guard rail on Matora Lane to address safety and minimise illegal dumping.
36. Carry out improvements at the designated dinghy storage location on Folly Point to minimise degradation as needed
37. Investigate feasibility of aerial fauna bridges across Young Street to link Primrose Park, Brightmore and Wonga Reserves.
38. Install a gate requiring human interaction for access at the footbridge linking the sport fields to bushland to control unaccompanied dogs.

Map 1: Vegetation Communities (NAS 2010)

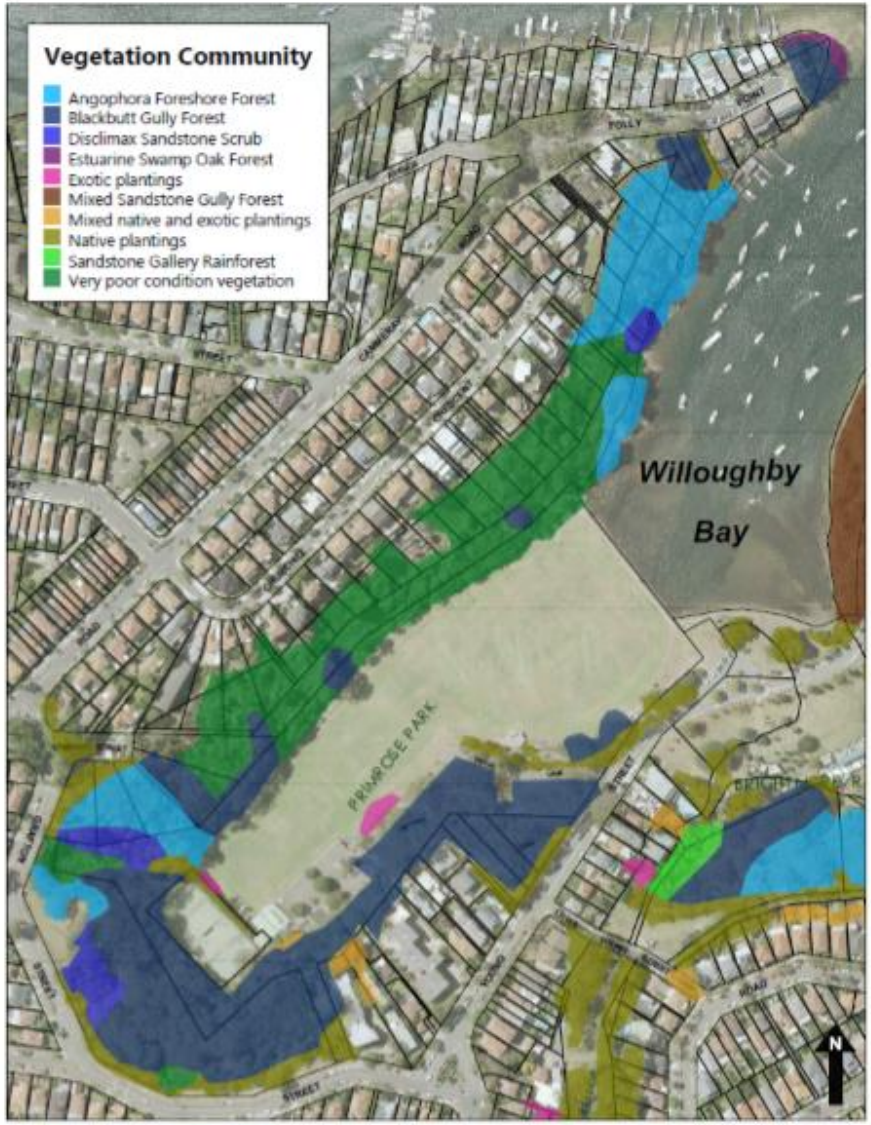
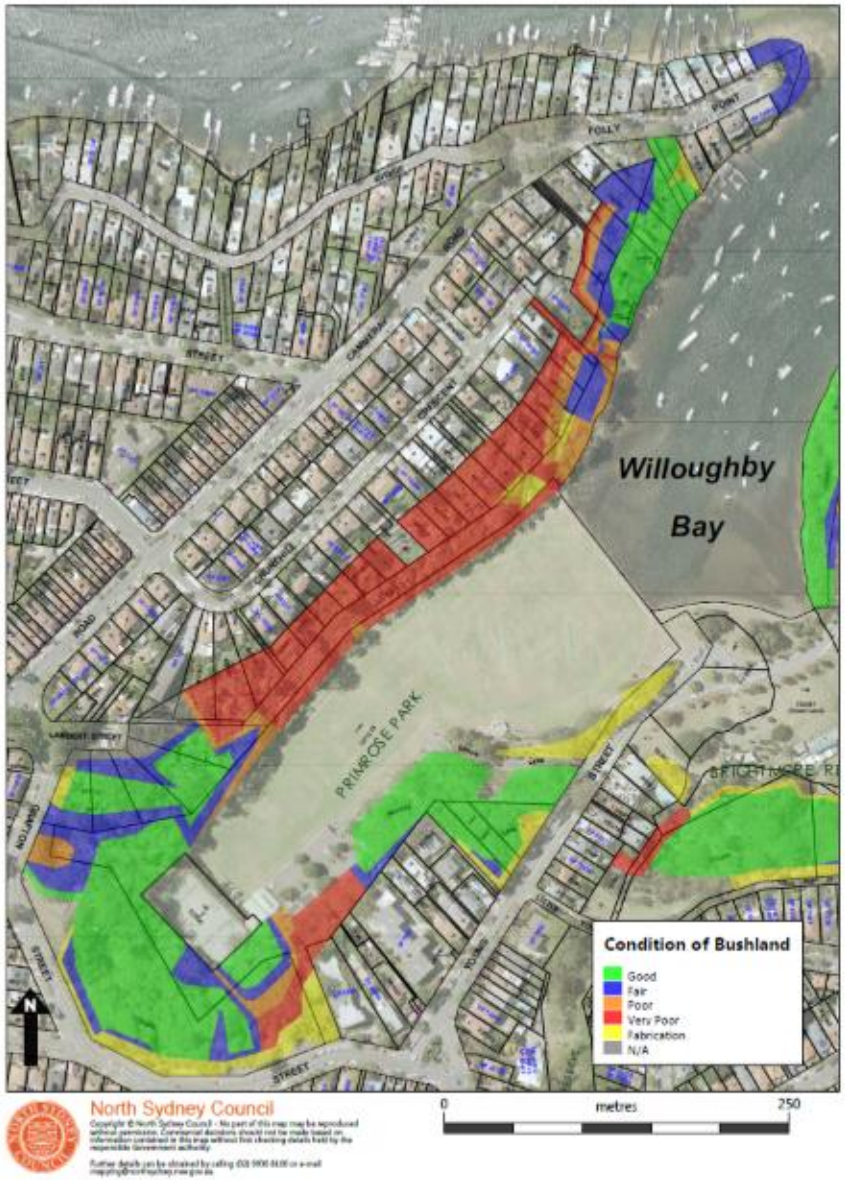


Table 1: Common species recorded in Primrose Park/Folly Point

Scientific name	Common name	Vegetation Community
Acmena smithii	Lilly Pilly	AF; DS; GR
Allocasuarina littoralis	Black She-oak	AF; BG; DS
Angophora costata	Sydney Red Gum	AF; BG; DS; SO
Asplenium australasicum	Bird's Nest Fern	AF; DS; GR
Avicennia marina	Grey Mangrove	SO
Banksia integrifolia	Coast Banksia	AF; DS
Banksia serrata	Old Man Banksia	AF; BG; DS
Calochlaena dubia	Common Ground Fern	AF; BG; DS; GR
Casuarina glauca	Swamp Oak	AF; SO
Commelina cyanea	Scurvy Weed	AF; BG; DS; GR; SO
Crowea saligna		AF; BG; DS
Dianella caerulea	Blue Flax Lily	AF; BG; DS; GR; SO
Elaeocarpus reticulatus	Blueberry Ash	AF; BG; DS; GR
Entolasia stricta	Wiry Panic	AF; BG; DS; GR; SO
Eucalyptus piperita	Sydney Peppermint	AF; BG; DS
Eustrephus latifolius	Wombat Berry	AF; BG; DS; GR; SO
Ficus rubiginosa	Port Jackson Fig	AF; BG; DS; GR
Glochidion ferdinandi	Cheese Tree	AF; BG; DS; GR; SO
Hibbertia dentata	Twining Guinea Flower	AF; BG; DS; GR
Kunzea ambigua	Tick Bush	AF; BG; DS
Lomandra longifolia	Spiny-headed Mat-rush	AF; BG; DS; GR; SO
Microlaena stipoides	Weeping Grass	AF; BG; DS; GR; SO
Notelaea longifolia	Large Mock-olive	AF; BG; DS; GR; SO
Oplismenus aemulus	Basket Grass	AF; BG; DS; GR; SO
Oplismenus imbecillis	Basket Grass	AF; BG; DS; GR
Pandorea pandorana	Wonga Wonga Vine	AF; BG; DS; GR; SO
Pittosporum undulatum	Pittosporum	AF; BG; DS; GR; SO
Poa affinis		AF; BG; DS; GR
Pteridium esculentum	Bracken	AF; BG; DS; SO
Sarcocornia quinqueflora	Samphire	SO
Smilax glyciphylla	Sweet Sarsaparilla	AF; BG; DS; GR; SO
Xanthorrhoea arborea	Broad-leaf Grass-tree	AF; BG; DS
Zieria smithii	Sandfly Zieria	AF; BG; DS; GR

AF: Angophora Foreshore Forest BG: Blackbutt Gully Forest DS: Disclimax Sandstone Scrub
GR: Sandstone Gallery Rainforest SO: Swamp-Oak Floodplain Forest

Map 2: Condition of Bushland and Resilience (2018)



Condition of Bushland and Resilience Key

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural recruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting Poor indicative resilience
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience – limited regeneration potential (1-2 species)
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed sandstone)

Map 3: Fire History & Future Managed Burns

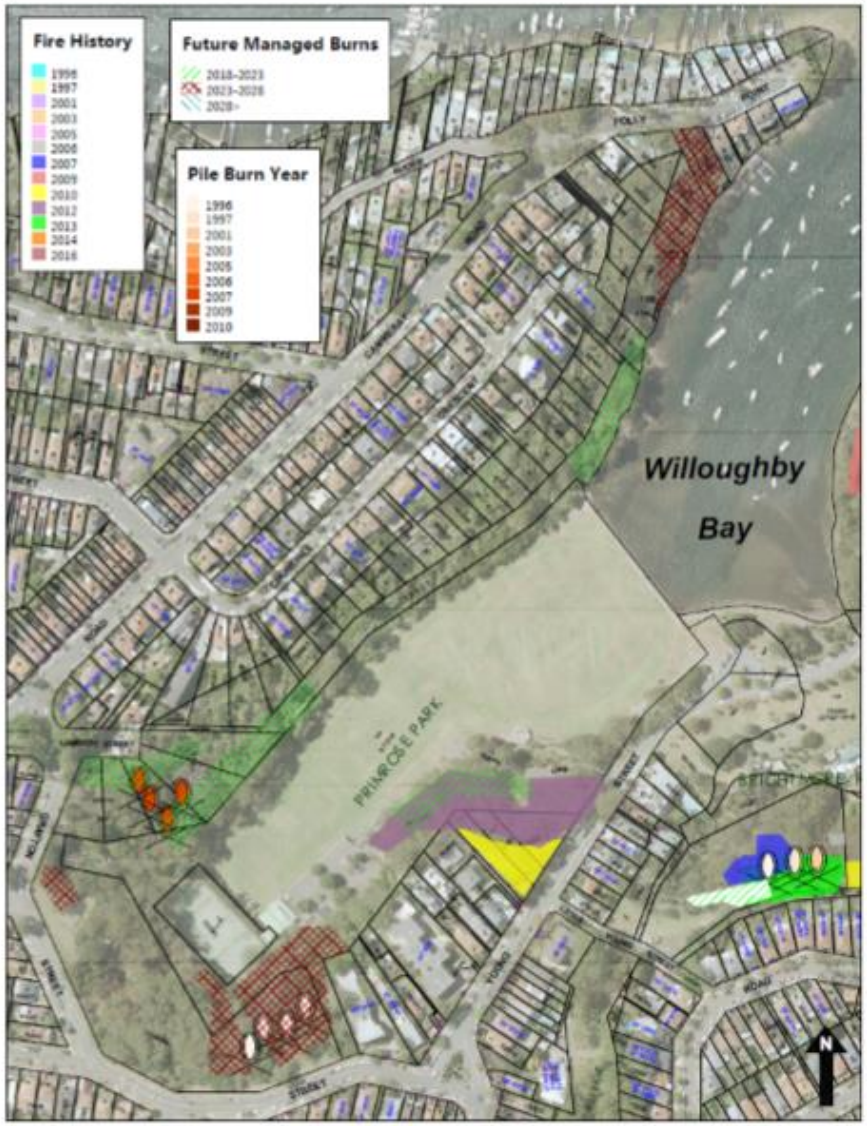


Table 2: Species of Special Conservation Concern

COMMON NAME	SCIENTIFIC NAME	CAUSE OF DECLINE
Yellow Thornbill King Parrot Pacific Baza Brush Cuckoo Golden-crowned Snake Yellow-tail Black Cockatoo Gould's Wattled Bat Black-faced Cuckooshrike Common Tree Snake White-bellied Sea Eagle Whistling Kite Superb Fairly-wren Varigated Fairy-wren Common Bent-wing Bat Eastern Bent-wing Bat Eastern Free-tailed Bat Large-footed Myotis Boobook Owl Powerful Owl Crimson Rosella Eastern Rosella Tawny Frogmouth Eastern Whipbird Grey-headed Flying Fox White-browed Scrubwren Forest Kingfisher Sacred Kingfisher	*Acanthiza pusilla* *Alisterus scapularis* *Aviceda subcristata* *Cacomantis variolosus* *Cacophis squamulosus* *Calyptorhynchus funereus* *Chalinolobus gouldii* *Coracina novaehollandiae* *Dendrelaphis punctulatus* *Haliaeetus leucogaster* *Haliastur sphenurus* *Malurus cyaneus* *Malurus lamberti* *Miniopterus schreibersii* *M. schreibersii oceanensis* *Mormopterus ridei* *Myotis macropus* *Ninox novaeseelandiae* *Ninox strenua* *Platycercus elegans* *Platycercus eximius* *Podargus strigoides* *Psophodes olivaceus* *Pteropus poliocephalus* *Sericornis frontalis* *Todiramphus macleayii* *Todiramphus sanctus*	- Reduction of Tall Eucalypt Forest in North Sydney; - Loss of habitat /Declining canopy cover - Reduction and degradation of bushland habitat in North Sydney; - Ecosystem degradation general loss of species diversity; Urban ecology expansion is beneficial to larger common birds; - Fragmented populations confined to small native bushland remnants are at risk of local extinction; - Lack of constant food source; - Predation from cats, dogs and urban predatory birds such as Currawongs and butcher birds. - Scarcity of natural breeding hollows - Altered stormwater system causing habitat loss; stormwater pollution; Sedimentation; Chytrid fungus; & Isolation of small populations.
Black She-Oak NSW Christmas Bush Red Bloodwood Peppermint Gum Golden Geebung Narrow-leaved Geebung Handsome Flat-Pea Broad-leaf Grasstree	*Allocasurina litoralis* *Ceratopetalum gummiferum* *Corymbia gummifera* *Eucalyptus piperita* *Persoonia laurina* *Persoonia linearis* *Platylobium formosum* *Xanthorrhea arborea*	- Altered fire regimes; - Ecosystem degradation; general loss of species diversity; - Fragmented populations confined to small bushland remnants; - Lack of connectivity between bushland limits pollination pathways and seed dispersal - Community use pressures - Stormwater pollution, erosion and sedimentation

Table 3: Plant species affecting biodiversity and stability of Bushland

Common Name	Botanic Name	Habit	Common Name	Botanic Name	Habit
African love grass	*Eragrostis curvula*	Grass/Ground layer	Purple top	*Verbena bonariensis*	Ground layer
Barbed wire grass	*Cymbopogon refractus*	Grass/Ground layer	Thick head	*Crassocephalum crepidioides*	Ground layer
Couch	*Cynodon dactylon*	Grass/Ground layer	Thistle sp	*Cirsium vulgare*	Ground layer
Crows foot grass	*Eleusine indica*	Grass/Ground layer	Trad	*Tradescantia fluminensis*	Ground layer
Ehrharta	*Ehrharta erecta*	Grass/Ground layer	Turkey rhubarb	*Acetosa sagittatus*	Ground layer
Foxtail grass	*Pennisetum alopecuroides*	Grass/Ground layer	Balloon vine	*Cardiospermum grandiflorum*	Climber
Kikuyu	*Pennisetum clandestinum*	Grass/Ground layer	Cape Ivy	*Delairea odorata*	Climber
Weeping grass	*Microlaena stipoides*	Grass/Ground layer	Honeysuckle	*Lonicera japonica*	Climber
Palm grass	*Setaria palmifolia*	Grass/Ground layer	Madeira vine	*Anredera cordifolia*	Climber
Parramatta grass	*Sporobolus indicus*	Grass/Ground layer	Morning glory coastal	*Ipomea cairica*	Climber
Paspalum	*Paspalum dilatatum*	Grass/Ground layer	Morning glory	*Ipomea indica*	Climber
Red natal grass	*Melinis repens*	Grass/Ground layer	Moth vine	*Araujia sericifolia*	Climber
Summer grass	*Digitaria sanguinalis*	Grass/Ground layer	Corky Passionfruit	*Passiflora suberosa*	Climber
Asthma weed	*Parietaria judaica*	Ground layer	Box Elder	*Acer negundo*	Canopy/Shrub
Asparagus fern	*Protasparagus aethiopicus*	Ground layer	African olive	*Olea europaea ssp. cuspidata*	Canopy/Shrub
Bidens	*Bidens pilosa*	Ground layer	Castor oil plant	*Ricinus communis*	Canopy/Shrub
Scurvy weed	*Commelina cyanea*	Ground layer	Camphor laurel	*Cinnamomum camphora*	Canopy/Shrub
Crofton	*Ageratina adenophora*	Ground layer	Cassia	*Senna pendula*	Canopy/Shrub
Fishbone fern	*Nephrolepis cordifolia*	Ground layer	Cheese Tree	*Glochidion ferdinandi*	Canopy/Shrub
Fleabane	*Conyza spp*	Ground layer	Coral Tree	*Erythrina sp*	Canopy/Shrub
Mist flower	*Ageratina riparia*	Ground layer	Lantana	*Lantana camara*	Canopy/Shrub
Montbretia	*Crocosmia X crocosmiiflora*	Ground layer	Ochna	*Ochna serrulata*	Canopy/Shrub
Mother of millions	*Bryophyllum delagoense*	Ground layer	Port Jackson Fig	*Ficus rubiginosa*	Canopy/Shrub
Mustard weed	*Brassica spp.*	Ground layer	Sweet Pittosporum	*Pittosporum undulatum*	Canopy/Shrub
Paddys lucerne	*Sida rhombifolia*	Ground layer	Small leaf Privet	*Ligustrum sinense*	Canopy/Shrub
Pampas lily of the valley	*Salpichroa organifolia*	Ground layer	Large leaf Privet	*Ligustrum lucidum*	Canopy/Shrub
Pareuvian lily	*Alstroemeria pulchella*	Ground layer	Wild tobacco	*Solanum mauritianum*	Canopy/Shrub

2.2.4 Tunks Park (incl. Hamilton Reserve) Bushland Rehabilitation Plan

Description

Size: Tunks Park 5.62 Ha; Hamilton Reserve 0.9 Ha

Access: Brothers Ave, Rowlinson Parade, The Boulevard, Strathallen Avenue, Hamilton Lane, Bridgeview Ave, West St, Vale St, Cammeray.

Ownership: Crown land under Council's care, control and management. A narrow parcel below the Suspension Bridge is the property of the Roads and Maritime Services of NSW.

Catchment: Middle Harbour

Configuration / Connectivity: Tunks Park comprises a long and narrow strip of bushland. It is bordered by residential properties to the south. Sports fields, the waters of Flat Rock Creek and bushland owned and managed by Willoughby City Council border the Park to the north. Its eastern boundary comprises Brothers Ave, Mortlock Reserve and the foreshore of Long Bay. It bounds Hamilton Lane on the western boundary, Fred Hutley Reserve and residential properties. The bushland forms part of a larger semi-connected remnant incorporating Mortlock Reserve, Munro Park in Flat Rock Gully and Northbridge Golf Course on the northern side of Long Bay.

Hydrology: All surface water drains to Long Bay via Flat Rock Creek on the park's northern boundary. The creek flows beneath the sports fields of Tunks Park via underground concrete channels in a west to east direction to Long Bay. Significant stormwater pipes flow into Quarry Creek on the western boundary of the park at the junction of Marks St and Hamilton Lane, Cammeray. This tributary continues through the bushland and joins Flat Rock Creek. Approximately 10 stormwater pipes and general overland flow from adjoining properties drains water from the upper catchment in Cammeray and Naremburn directly into the bushland. A wetland and weir have been constructed in Flat Rock Creek at the interface where the creek is piped under the playing fields to help prevent debris and sediment entering Middle Harbour from Flat Rock Creek. Stormwater pollution traps have also been installed below Fred Hutley Reserve to filter stormwater draining from the Brook Street Stormwater Catchment to improve water quality in Long Bay.

Geology: Hawkesbury Sandstone of medium to coarse grained quartz sandstone with minor shale and laminate lenses and sandstone outcrops.

Soil Landscape: Hawkesbury Soil Landscape consisting of shallow, poor sandy soils, highly erosive with low soil fertility. Localised Yellow and Red Podzolic Soils are associated with shale lenses. Siliceous Sands and secondary Yellow Earths are along the creeklines. The area below roads and residences is disturbed with fill from past road and building construction and dumping. The estuarine mudflats of Willoughby Bay were in-filled in the 1950's to create sports fields.

Slope: Moderate to steep slopes and steep rocky outcrops.

Facilities / Infrastructure: A formal stepped track links Tunks Park playing fields and the viaduct to The Boulevard in Cammeray. A formal track links Brothers Ave and the car park to the Flat Rock Creek weir and Willoughby City Council bushland track network along the northern boundary of the bushland beside the playing fields. Another formal track links Hamilton Lane to Vale Street, Cammeray. No other formal tracks exist in the bushland areas. A children's playground and picnic tables are located adjacent to Brothers Ave on the eastern edge of the bushland. An amenities block and canteen are located on the southern edge of the playing fields adjoining the bushland. Infrastructure including stormwater drains, sewerage pop tops, a viaduct, and overhead electricity lines are located within the Park.

Plant Community:

- Blackbutt Gully Forest – an open or tall open forest with *Eucalypt pilularis* as the dominant tree species.
- Angophora Foreshore Forest - an open forest with *Angophora costata* as the dominant tree species found along the foreshore.
- Disclimax Sandstone Scrub – an altered community of open to closed scrub, or a forest of mixed and variable composition due to disturbance and lack of fire.
- Allocasuarina Scrub – Open-scrub dominated by Black she-oak (*Allocasuarina littoralis).* Restricted to two sites in Tunks Park on steep slopes on Hawkesbury Sandstone.
- Refer to Map 1 for the plant communities; Table 1 for common flora species and Table 2 for plant species of special conservation concern in Tunks Park.

Wildlife Habitat:

- Tunks Park is dominated by dry sclerophyll forest and woodland type habitat. It contains creeks, a wetland, weir, ephemeral drainage lines, rocky outcrops, cliffs and caves.
- The park forms an important habitat link to larger bushland areas in Flat Rock Gully and Munro Park to the north west, Northbridge Golf Course to the north-east, the aquatic habitat of Long Bay to the east and Mortlock Reserve to the east.
- Tunks Park remnant bushland is a 'biodiversity hotspot' (Smith & Smith 2008) and the most important bushland for small birds in North Sydney (many of which have dramatically declined since 1970). Locally significant small insectivorous birds such as the Eastern Yellow Robin (*Eopsaltria australis*), Superb Blue Fairy-wren (*Malurus cyaneus*) and Silvereye (*Zosterops lateralis*) are known to inhabit Tunks Park. These birds are concentrated in dense weedy thickets of shrubs and undergrowth where they are more protected from predators and territorial birds.
- The park is within range for many wildlife species that move between reserves such as the common brushtail (*Trichosurus Vulpecula*) and ringtail possums (*Pseudocheirus peregrinus*), bats, woodland and water birds. Since the implementation of regionally coordinated fox baiting around 2000, wildlife such as Long-nosed Bandicoots (*Perameles nasuta)*, Superb Lyrebirds (*Menura novaehollandiae*); Swamp Wallabies (*Wallabia bicolor)* and Brush Turkeys (*Alectura lathami*) have naturally re-colonised. Remnant small range

species include skinks, lizards, geckoes, snakes and frogs.
- Flat Rock Creek, wetland and weir provide habitat for several aquatic species including mullet (*Mugilidae sp*.),Common Jolly Tails (*Galaxias maculatus*), Striped Gudgeons (*Gobiomorphus australis*), Long-finned Eels (*Anguilla reinhardtii*), Long-necked Turtles (*Chelodina longicollis*) and water birds.
- The park lacks nesting hollows and roosting sites for birds and arboreal mammals due to the lack of mature native trees. Such creatures play an important role in the ecology of the vegetation communities, assisting in pollination, seed dispersal and germination. Some artificial hollows for birds and arboreal mammals (including microbats) have been created in dead tree trunks and habitat boxes have been installed.
- Council uses dense weedy habitat near the Suspension Bridge as a fauna release area for various wildlife care programs as it provides good protection and is linked to larger areas of bushland.
- The active recreation sections of Tunks Park (Zoned RE1) comprise natural turf grasses and no sportsfield lighting (which results in no night-time sporting activity/low noise conditions). These factors are important and contribute to the high levels of faunal biodiversity that are supported by Tunks Park.
- Refer to Table 2 for the fauna species of special conservation concern found in Tunks Park.

Condition and Resilience:
- The bushland consists of a relatively narrow strip containing some pockets in good to fair condition. Some areas are also in poor to very poor condition. Overall resilience is increased due to connectivity with larger bushland areas in Northbridge and Willoughby (Mortlock Reserve and the bushland of Flat Rock Gully and Northbridge Golf Course.)
- Historic land uses have significantly degraded the bushland. Some areas of the bush were completely cleared in the 1800s for timber getting, farming and quarry activities which has left some areas lacking upper canopy or tree hollows. From the 1940's, industrial and domestic waste was tipped and burnt in the area on both sides of Flat Rock Drive, into Flat Rock Gully and on the estuarine mudflats now converted to playing fields (infilled during the 1950s).
- Bushland condition and resilience has also been compromised by decades of generalised dumping of waste and building materials from the back of residential properties and road verges, as well as major infrastructure works (viaduct and Suspension Bridge)
- Stormwater and garden escapes have destroyed or buried the original seed bank, spread weeds, increased nutrient levels and changed soil structure, stability and composition. Areas particularly affected by weed incursions have been the creeklines, areas adjoining stormwater drains, and areas below roads and gardens. Major soil disturbance limits unassisted native plant regeneration.
- Areas of dense weed absorb moisture, prevent erosion, capture refuse that would otherwise end up in the creek/Willoughby Bay and provide important habitat refugia for small birds and other significant species. These areas are stable and require management to contain their spread into adjoining bush areas.
- Exposed sandstone outcrops have protected areas with high resilience and contain more intact soil structure further down slope.
- Minimal formal walking tracks through the bushland limits impacts from visitors and dogs, maximising the 'core conservation' area of Tunks Park.
- A creekline has been successfully recreated with bedrock and revegetated in a previous culvert carrying stormwater from the Vale St/West Street pipe system. This area needs constant review to improve its biodiversity, ecological function and structure.
- The area below 14 Rowlison St was capped with sandstone and revegetated in 2006-07.
- The Allocasuarina scrub is likely an artefact of disturbance and changed environmental conditions, especially reduced fire frequency. The original vegetation is likely to have been Angophora Foreshore Forest intergrading to Blackbutt Gully Forest.
- The bushland is lacking dense middle story vegetation which takes decades to develop. It is also lacking upper canopy in areas affected by dense weed.
- Native and exotic mesic and vine species require targeted and regular maintenance to manage colonisation / domination in areas of open forest and where elevated soil moisture and nutrient conditions have excluded fire for long periods.
- Bush regeneration activities are carried out by Council's Bushland Management Team, bush regeneration contractors (since 1991), the volunteer Tunks Park East Bushcare Group (formed 1993) and Tunks Park West Bushcare Group (formed 1998).
- Refer to Map 2 Condition of Bushland and Resilience.

Zone / Classification:
- The bushland is zoned E2 Environmental Conservation under *North Sydney LEP 2013.* It is classified public bushland in *SEPP No. 19 Bushland in Urban Areas (*and in the draft SEPP (*Environment)* that will supersede *SEPP 19*.)
- The area below the Suspension Bridge is zoned SP2 Classified Road under *North Sydney LEP 2013*.

Statement of significance:
Historic Values
- The bushland in this park is a legacy of past land management by the traditional Aboriginal custodians, the Cammeraygal people, who originally occupied the area. Aboriginals frequented the valley and used Flat Rock Creek as a fresh water source for many thousands of years. Shell middens and rock art are represented in the area. Other signs of Aboriginal presence may exist but remain undiscovered. Places, objects and features of significance to Aboriginal people are protected under the NSW *National Parks and Wildlife Act 1974*.
- Tunks Park was named after William Tunks, the first Mayor of St. Leonards from 1867-1883. He was also elected to the Legislative Assembly as a member for St Leonards in 1864.
- European heritage that traverses Tunks Park includes the sewage viaduct, constructed as part of the West Middle Harbour Sub-main to the Northern Suburbs Ocean Outfall Sewer in 1927 and the Suspension Bridge that opened in 1892. Both items are listed on the *North Sydney LEP 2013* Schedule 5 as environmental heritage and both are listed as heritage items on S.170 State Agency heritage registers under the NSW *Heritage Act* 1977.
- Unlisted heritage items are scattered throughout the bushland including sandstone rock platforms, walls, remnant tracks and possibly debris from dumping. Possible former track remnants may be associated with the West Street quarry, old wharf on the southern

tributary to Flat Rock Creek, former logging, farming or residential development.

Natural Values

- Tunks Park plays a significant role in maintaining biodiversity in the region and assists in conservation of species and habitat function.
- The bushland forms part of an important habitat corridor along the foreshore to Long Bay and Flat Rock Creek, which provides diversity of habitat in a highly-urbanised environment. Tunks Park and Flat Rock Gully have been declared Wildlife Protection Areas under the NSW *Companion Animals Act* 1998 by Willoughby and North Sydney Councils.
- Angophora Foreshore Forest, Allocasuarina Scrub, Disclimax Sandstone Scrub and Blackbutt Gully Forest are threatened at a local level due to limited extent.
- Locally rare species include Birds Nest Fern (*Asplenium australasicum*), Old Man's Beard (*Caustis flexuosa*), *Gahnia melanocarpa*, Lesser Flannel Flower (*Actinotus minor*), Indian Weed (*Sigesbeckia orientalis*), *Bossiaea heterophylla*, Graceful Bush-pea (*Pultanaea flexilis*), *Pomaderris discolor*, Woody Pear *(Xylomelum pyriforme*), *Wikstromia indica*, *Grevillea sericea, Blechnum cartilagineum, Lomandra glauca, Actinotus minor*, Native Holly (*Lomatia ilicifolia*) and Mountain Devil (*Lambertia Formosa*).
- There is potential for the endangered *Acacia terminalis* subspecies *terminalis* listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* and the NSW *Biodiversity Conservation Act 2016 (BC Act)* to occur within the park in Angophora Foreshore Forest, Blackbutt Gully Forest and Disclimax Sandstone Scrub.
- The park provides habitat for threatened and declining fauna species including the Powerful owl (*Ninox strenua*) (listed as vulnerable under the *BC Act*); the Grey-headed flying-fox (*Pteropus poliocephalus*) (listed as vulnerable under the BC Act and *EPBC Act)*; and the Black Bittern (*Ixobrychus flavicollis*), White-bellied Sea-Eagle (*Haliaeetus leucogaster)* and Square Tailed Kite (*Lophoictinia isura)* (all listed as vulnerable under the BC Act).
- In the North Sydney Microbat Survey 2013-14, Tunks Park and Mortlock Reserve had the highest diversity of bats (6) recorded in the North Sydney area. Recorded bat species listed as vulnerable under the *BC Act* were the Eastern freetail bat (*Mormopterus norfolkensis*), the Eastern bentwing bat (*Miniopterus schreibersii oceanensis*), the Southern myotis (*Myotis macropus*), and Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*).

Recreation / Education Values

- The park is a valuable educational, nature appreciation and bushwalking resource. It is also valued as a destination for family outings centred around the adjoining children's playground and grassed picnic area and sports ovals.

Fire History:

- Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity in Badangi Reserve.
- Past burns have resulted in the successful germination of native endemic flora species, including the threatened species *Acacia terminalis* subsp. *terminalis*
- Fire management access zones exist along all boundaries with private property.
- Planned hazard reduction / ecological broad area burns are conducted from time to time. Refer to Map 3 Fire History and Future Managed Burns.

Threats:

- The limited size and narrowness of the park amplifies vulnerability to fragmentation and "edge effects" from the surrounding urban environment. Impacts from adjoining residential properties that facilitate weeds include garden escapes and dumping of garden clippings into the bushland. A recurring problem of broken drainage pipes and old terracotta sewerage pipes servicing adjoining residential properties also increases moisture and nutrification. Runoff from hard surfaces, irrigation and pools increase nutrient loads, moisture and erosion on the slopes below. Garden fertiliser also leaches into the bush increasing nutrients. Other threats include encroachment from adjoining residences due to ambiguous property boundaries, periodic illegal clearing of bushland and tree vandalism.
- Widespread fill over many decades, as well as past and more recent dumping, significantly compromises soil stability and structure, seedbank viability and bushland resilience. The waste comprises a range of material including demolition, domestic and industrial waste, foreign soil and excavated material from adjoining construction sites.
- Significant excavations on upslope construction sites are resulting in some loss of canopy trees adjoining bushland. Silt, building rubble and waste as well as broken stormwater and sewerage pipes have polluted the bushland lower down in some instances. Excavation also impacts on nearby downslope canopy trees, destabilising roots and changing the soil profile and underground water flow. Hay bales used to manage sediment on construction sites can contain agricultural weeds which in-turn spread in to adjoining bushland.
- *Phytophthora cinnamomi* (root rot*)* affects the health of the bushland and is widespread in North Sydney.
- In heavy rainfall periods, sewage leaks from concrete pop-top lids along the sewerage pipeline mains within the park.
- Several major stormwater pipes drain directly into the bushland area and form deep channels from the effects of erosion and high velocity storm-flows. They also result in considerable waste matter/litter being deposited in the bushland and receiving waters such as Willoughby Bay.
- Other above ground or just below ground infrastructure associated with adjoining residential development such as electricity and telephone cables causes hazards and restricts the ability for bushland managers to burn in these areas. This issue is exacerbated by ambiguous property boundaries at the bushland interface.
- Native and exotic vines, mesic species and weeds are a serious threat to the stability of resilient core areas and biodiversity in the long-term. Refer to Table 3 for plant species affecting biodiversity and stability of bushland assets.
- Native bats and birds can introduce new flora species and weeds that have the potential to change vegetation structure over time.
- At times, foxes (*Vulpes vulpes*), domestic cats (*Felis cattus*) and off-leash dogs (*Canis lupus familiaris)* are observed in the reserve and along the foreshore. These animals predate, scare and disturb wildlife, pollute with their faeces and spread weed seed. Shorebirds are particularly impacted by dogs off lead.

- Some introduced or endemic species (such as Noisy Minors) are very territorial and compete for habitat, limiting species diversity.
- Inappropriate weed removal can reduce fauna habitat with greater impacts on short range species and small birds.
- Artificial lighting from the playing fields and adjoining residential development can detrimentally affect nocturnal fauna.
- Increased drone usage may cause disturbance to fauna that occur in the canopy.
- Children make tracks and cubbyhouses in the bushland close to the playground, causing erosion, trampling and loss of vegetative cover/habitat.
- Areas where bushland is bordered by lawn grass e.g adjoining the playing fields and playground, are highly impacted by exotic grass encroachment.
- At the bushland residential interface, the choice of plants in the fire management areas can impact on bushland. Plants chosen are often native but not endemic and can be invasive and cross pollinate if not sourced locally.
- Climate change is an ongoing threat. Anticipated impacts include increased threat of bushfire and extreme weather events. Raised sea levels are predicted to inundate shoreline vegetation, eroding the foreshore and destroying Aboriginal middens. Intensified storm events will result in higher volumes of of stormwater runoff which is likely to result in erosion to drainage lines and creeks. Increased temperatures are likely to affect biodiversity and ecosystems, favouring some species over others and changing the structure and function of the bushland. The rate of climate change may be faster than the rate of natural adaptation. Increased temperatures will harm sensitive fauna such as bats, impacting their important ecosystem function.
- Non-passive recreational activities (incl. orienteering; rock climbing; geo-caching, camping and mountain biking) cause substantial damage to native vegetation and soil stability. These activities are prohibited in North Sydney's bushland reserves.

Bushland Management Goals

a. Maintain and enhance biodiversity and habitat for long term ecosystem resilience and function
b. Conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve
c. Strategically restore bushland (prioritise areas of highest resilience)
d. Enhance habitat connectivity
e. Preserve genetic integrity of the vegetation community
f. Manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality
g. Conserve the natural landscape and heritage values
h. Provide for ecologically sustainable recreation needs of the community
i. Implement the strategic fire hazard reduction program and manage fuel loads to protect life, property and endemic biodiversity

Rehabilitation Principles and Procedures:
General

1. Bush regeneration is a long-term process of staged weed removal to ensure endemic biodiversity, native plant establishment and continued habitat for local wildlife. It relies on site assessments that identify values and how best to restore and enhance ecosystem function and structure. Routine site monitoring, evaluation of field strategies and periodic native flora and fauna surveys inform management priorities over time. Works normally proceed from bush in good condition with high resilience. Degraded areas are a lower priority but the weeds always require containment.

Planning, Evaluation and Review

2. The Bushland Management Team should regularly evaluate bushland rehabilitation plans and the success of field strategies to inform management priorities early.
3. Establish photo points to monitor projects.
4. In the bushland rehabilitation planning process, consider the potential impact of future infrastructure earthworks, or access requirements on bushland, habitats, green corridors or active rehabilitation sites.
5. The Bushland Management Team must approve all contractor project proposals before implementation.
6. All Work, Health and Safety requirements must be adhered to by Council staff, volunteers and contractors before, during and after site works.

Native Flora

7. Record uncommon flora species to determine risk of extinction in the reserve. (Use North Sydney flora survey record template).
8. Prioritise protection / rehabilitation in areas of highest resilience.
9. Buffer areas should protect biodiversity from disturbances caused by fragmentation and edge effects: (a) monitor to identify gaps in buffer vegetation and senescing / restored vegetation and organise replacement planting; (b) where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a medium/long term solution to stop herbaceous weeds and grasses from spreading into bushland; (c) control vines, noxious weeds and other plant species affecting stability of adjoining bushland.
10. When natural regeneration is ineffective, locally source all plant material for supplementary planting to maintain genetic integrity of native vegetation in accordance with Flora Bank Guidelines https://www.greeningaustralia.org.au/florabank. Only plant when natural regeneration is ineffective to boost biodiversity, with the aim to achieve 80% survival rates. Plant in stages, basing species selection on the target vegetation community/structure, successional stage, habitat requirements and physical constraints. This process involves collaboration from Council's nursery supervisor, bush regeneration team, Bushcare volunteers and bush regeneration contractors.
11. In areas lacking diversity and structure; direct seed, transplant and use appropriate tube stock to enhance existing plant communities. When planning a replanting site: (a) prepare a suitable plant list based on rehabilitation objectives and prevailing site condition; (b) allow time for seed collection and propagation (9-12 months ahead of planting); (c) identify where seed harvesting/cuttings will be gathered; (d) prepare area (e.g. reduce density of dominant species on ground layer or mesic species in shrub layer); (e) schedule planting for early Autumn during or after soaking rain.
12. Collect seed of suitable locally rare species from nearby bushland areas, propagate and plant in appropriate areas of the reserve to enhance biodiversity and ensure the long-term viability. For species that are difficult to propagate, explore other methods such as seed scarification / raking treatment / seedbank translocation etc.
13. Implement a canopy replacement program in areas where remnant canopy is absent, senescing or failing to regenerate or where non-endemic trees have been removed.
14. Do not encourage large canopy species on unstable areas or under electricity easements where they cannot be supported and may cause future hazards.
15. Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team: (a) pile burn where appropriate; (b) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (c) reduce seedbank of dominant natives - control seeding cycle; (d) lightly disturb mulch / organic matter to stimulate regeneration; (e) increase seed bank of uncommon/ rare species with brush matting techniques (collect from donor sites where seed removal will not affect biodiversity); (f) propagate senescing plant species at risk of extinction in the reserve (i.e. due to an inadequate fire regime) and plant tubestock in suitable locations.
16. When planting along bushland edges, select species in consideration of their potential to compliment views from residential or public viewing areas and design to enhance habitat / connectivity (e.g. for small birds).
17. Conserve and protect naturally regenerating / colonising canopy species providing they are in sustainable locations.

Weeds and Pathogens

18. Implement the *Biosecurity Act 2015* consistently and effectively, in accordance with bushland management objectives and processes.
19. Residential properties adjoining bushland can contribute to weed spread. Monitor and address invasive garden plants in accordance with the

Biosecurity Act 2015 and promote Council's Native Havens / Habitat Stepping Stones Programs.

20. Ongoing weed management should: (a) prioritise good bush areas; (b) target species threatening stability e.g. vines, woody or canopy weeds; (c) interrupt seed cycle of target species, especially annual and grass weeds; (d) prioritise areas where plant diversity is most affected by mesic shift and vines. (In consideration of fauna habitat needs, schedule works from Autumn through Winter before bird breeding season.)
21. Monitor sites to identify, report and manage early stages of weed outbreaks or shifts in plant species assemblages likely to become detrimental to biodiversity. Manage according to the issues they raise. Report other threats to ecosystem function.
22. All compost weed material is removed off site.
23. Retain weeds on highly erodible or dangerous slopes and use methods of weed suppression that will not create potential for soil erosion. Incorporate abseiling activities on cliff faces to remove weeds that are a constant weed seed source.
24. Strategically remove non-endemic or exotic trees that interfere with ecosystem function or structure. Assess for habitat potential before they are de-limbed.
25. Consider all potential impacts of herbicide and proximity to water when determining suitability for weed control.
26. Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Native Fauna and Habitat

27. Record wildlife sightings and observations in Council's Wildlife Watch database. Share this information with NSW BioNet and the Commonwealth's ALA.
28. Identify and protect nesting, roosting and breeding sites of threatened, vulnerable or locally significant fauna.
29. Minimise disturbance to wildlife, enhance habitat where needed and improve the condition/connectivity of wildlife corridors between adjoining reserves.
30. Protect, maintain and restore quality fauna foraging habitat using a diverse mix of endemic native species. Retain habitat features such as fallen and standing dead wood, rock piles, hollow-bearing trees , natural debris, dead standing trees, forest litter, logs and branches.
31. Short-term strategies to maintain fauna habitat provided by mesic and weed species may require retention yet containment of dense areas of weed, vines and mesic species. In the longer-term, aim to establish a self-maintaining fabricated vegetation community in these areas composed of native species adapted to changed site conditions (abiotic factors) that enhance biodiversity and habitat availability.
32. Before any unfavourable trees are de-limbed, assess for habitat potential e.g. tree hollows.
33. Where suitable, install fauna nesting boxes and create hollows in suitable dead trees to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed.
34. Investigate financial opportunities to invest in habitat enhancing research and developing methodologies.

Threatened species

35. Identify threatened or endangered, rare or locally rare species of flora and fauna. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs.
36. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened species.

Ecological Burns

37. Hazard reduction and ecological burns are based on a strategic burn program consistent with the Mosman North Sydney Willoughby Bushfire Risk Management Plan. Ecological burn regimes are to be in a mosaic pattern to improve bushland function and biodiversity. Areas of high bushfire risk or core ecological resilience are usually prioritised in the annual burn program.
38. Maintain land management zones where bush adjoins residences and implement site stabilisation measures.
39. Over the next 10 years, prioritise prescribed burns at sites at risk of diminishing flora diversity.
40. For pre-fire preparation: (a) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (b) reduce seedbank of dominant natives to control seeding cycle; (c) increase seed bank of uncommon/ rare species with brush matting (collect from donor sites where seed removal will not affect biodiversity).
41. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds.
42. Implement post-fire monitoring and bush rehabilitation strategies. Monitor regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time period post-burn.

Pests and Illegal Activity

43. Monitor and control feral or aggressive/territorial fauna activity, cats, unleashed dogs and illegal activity with appropriate measures e.g. trapping, community education programs, penalty notices or camera observation. If applicable, manage reserves in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 and relevant North Sydney Council policies.
44. Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
45. Monitor the impacts of drones and implement management measures if required.
46. Address instances of unauthorised activities in bushland incl. orienteering; rock climbing; geocaching; mountain biking; camping etc.

Tracks, Water and Erosion

47. Close informal tracks to prevent damage to habitat; impede feral animals and reduce weed spread.
48. Implement track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, track widening and degrading track conditions.
49. Assess the need for additional directional and / or interpretive signage.
50. Stabilise steep slopes, ephemeral flow lines and highly erosive areas using local native species, particularly ground covers, to re-establish appropriate vegetation community structure where natural regeneration is

poor or absent. Install sedimentation fences, terracing, coir logs, matting or other appropriate measures where needed to stabilise washout areas and improve access and safety.

51. Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater tolerant natives.

Aboriginal and non-Aboriginal Heritage

52. All identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1974* and *Heritage Act 1977*.
53. Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual.
54. As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance.
55. Bushland management staff consult with the Aboriginal Heritage Office or Council's heritage officer prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey.
56. Discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol.

Community

57. Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
58. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
59. Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan.
60. When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council.

Reserve Specific Rehabilitation Actions

Priorities will be given to programs with long term benefit to the park or where natural assets are at greatest risk to avert irreversible deterioration or loss.

Flora

1. Collaborate with Willoughby City Council to source suitable seed or tube stock that originates from Flat Rock Gully or Northbridge Golf Course to increase plant diversity and resilience.
2. Manage effects of garden escape weeds and residential stormwater along the reserve boundary with sediment fences, edging and mulch. Use bark-blower technology as required.
3. Continue long-term rehabilitation of the Quarry Creek riparian zone through vine control around desirable canopy and the strategic planting of appropriate canopy species (where absent).
4. Improve structure and diversity of the bushland adjoining Brothers Ave playground.
5. Seek opportunities to enhance green connections with the Cremorne group of bushland remnants.

Fauna

6. Retain yet contain dense vines, mesic and exotic plants near the suspension bridge for fauna habitat until suitable alternative, structurally complex and species diverse habitat in adjacent sections of the reserve is sufficiently regenerated to provide fauna needs.
7. Tunks Park playing fields are currently unlit. In accordance with the objectives of land zoned E2 Environmental Conservation, it is recommended that these playing surfaces remain unlit into the future in order to protect the unique ecological diversity that is present within Tunks Park bushland.
8. Educate adjoining residences regarding the impact of light pollution in bushland, where the need is identified.
9. Collaborate with Willoughby Council Bushland and Open Space Teams to improve wildlife corridor links north and south of the playing fields (incl. to Mortlock Reserve). Promote structurally complex corridors that include native trees, groundcovers and shrub thickets.
10. Coordinate management of Tunks Park with the adjoining Flat Rock Gully Reserve in Willoughby local government area to ensure consistent fauna conservation measures across the entire bushland remnant.
11. Investigate options for improved feral animal control programs in Tunks Park.
12. Continue to monitor for threatened and locally significant species through the implementation of formal ecological surveys every 5-10 years.
13. Promote responsible pet ownership in adjoining residential areas and enforce WPA requirements within Badangi Reserve (i.e. monitor for presence of cats and undertake trapping as required).
14. Excessive noise generated by night-time sporting activities presents an unacceptable risk to the significant diversity of nocturnal native fauna in Tunks Park. In accordance with the objectives of land zoned E2 Environmental Conservation, it is recommended that these playing surfaces remain free of organised sporting activities outside daylight hours.
15. Tunks Park comprise natural turf grass playing surfaces. These areas provide important foraging habitat for a number of endemic species including threatened microbats. Replacement of natural turf with artificial grass would reduce habitat availability and potentially impact wildlife population stability. In accordance with the objectives of land zoned E2 Environmental Conservation, it is recommended that Tunks Park retain the existing natural grass playing surfaces.

Threatened Species

16. If *Acacia terminalis* subsp. *terminalis* is found to occur in the park, work in collaboration with the Saving Our Species program managed by the NSW Office of Environment and Heritage and the NSW Herbarium to identify, monitor and protect *Acacia terminalis* subsp. *terminalis* and contribute to the preparation of best practice guidelines for the species.
17. Preserve and enhance the habitat of threatened microbat species, Powerful Owl (*Ninox strenua*) and Grey-headed Flying fox (*Pteropus poliocephalus*).
18. Promote the retention of Tunks Park as an unlit parkland to protect noctournal fauna (e.g. microbats).

Illegal Activity

19. Illegal encroachments, breaches of Development Consents and construction of unauthorised paths leading from private property into the reserve will be referred to Council's Compliance Team for action.
20. Report all illegal drug and alcohol use locations and associated damage to Council's Ranger team. All affected areas are to be listed on Council's register for such sites and collaboration is required with the Police to implement management strategies

Tracks, Water and Erosion

21. Continue to use fencing and other appropriate measures to deter people trampling/causing erosion to the bushland around the playground and picnic tables.
22. Consult with Sydney Water regarding their access to the viaduct for maintenance purposes to ensure minimal damage to bushland and heritage values within the park.
23. Install sedimentation fencing and edge stabilisation management structures (e.g. timber sleepers, coir logs etc) along the edge of private property boundaries and near stormwater drains where needed.
24. Update interpretive and directional signage.
25. Prevent estabilishment of informal paths and close existing pathways that are damaging bushland condition or compromising rehabilitation works.

Aboriginal and Historic Heritage

26. Assess the heritage significance of unrecorded items within Tunks Park using qualified professionals. Formulate recommendations and appropriate management measures.

Ecological Burns

27. Refer to Map 3 Fire History and Future Managed Burns.
28. Maintain and improve Fire Management Access Zones (FMAZ) around the reserve periphery.
29. Educate reserve neighbours about bushfire preparedness on their own property.
30. Consider fauna habitat / life cycle requirements in burn planning and timing.

Community

31. Plan replanting projects to coincide with National Tree Day.
32. Engage local residents in Bushcare Programs (e.g. Bushcare; Adopt-a-Plot; Native Havens; Wildlife Watch; Bush friendly neighbour program).
33. Develop a bushland neighbour information brochure to help raise awareness of edge effects and the ways local residents can improve their bushland footprint.

Capital Projects

34. Investigate stormwater management measures (in consultation with the NSW Roads and Maritime Services) to address gross pollutants and erosion near the Suspension Bridge.
35. Investigate reinstating the Tunks Park fish-way bypass
36. Undertake additional stormwater drainage line upgrades to improve soil stability; reduce weed infestation and protect surrounding assets (e.g. off The Boulevarde; Rowlison Parade and Cambridge St).

Map 1: Vegetation Communities (NAS 2010)

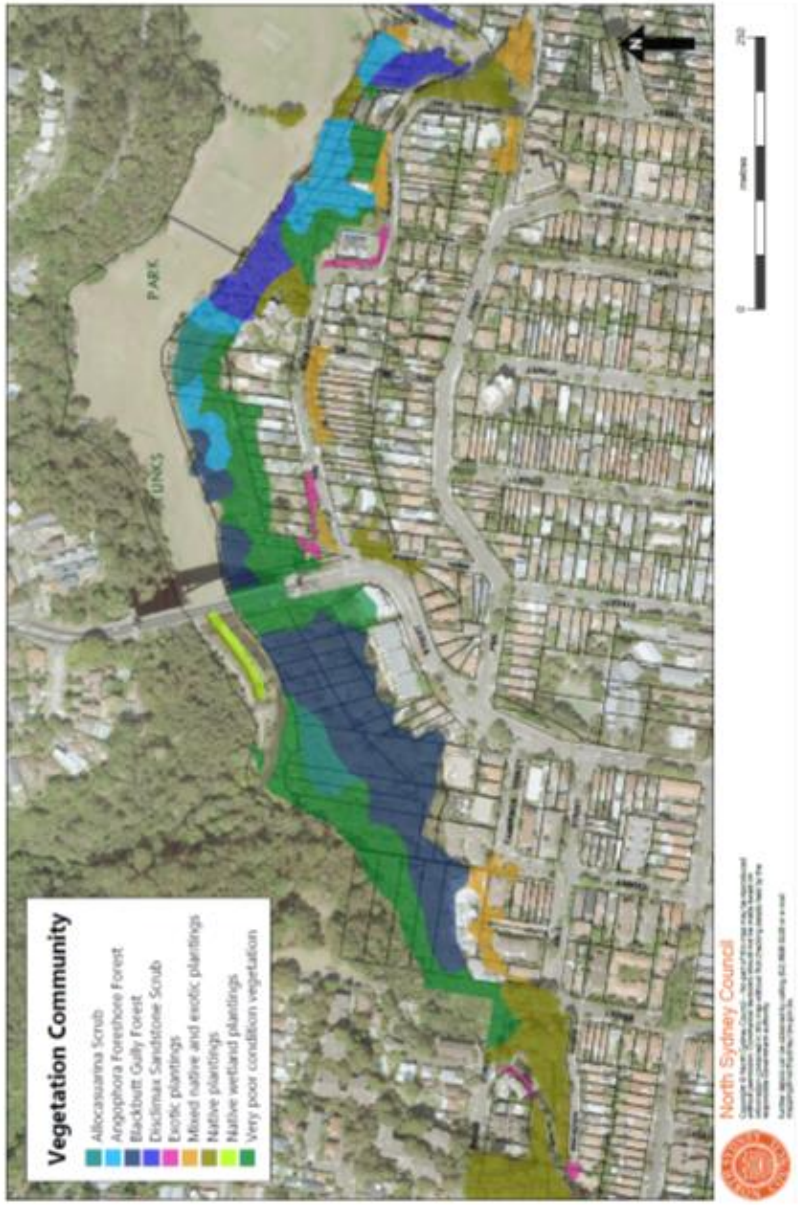


Table 1: Common species recorded in Tunks Park

Scientific name	Common name	Vegetation communities
Acacia longifolia	Sydney Golden Wattle	AF; BG; DS
Allocasuarina littoralis	Black She-oak	AF; BG; DS; AS
Angophora costata	Sydney Red Gum	AF; BG; DS; AS
Banksia integrifolia	Coast Banksia	AF; DS; AS
Dianella caerulea	Blue Flax Lily	AF; BG; DS; AS
Digitaria parviflora	Small-flowered Finger Grass	AF; BG; DS; AS
Dodonaea triquetra	Common Hop Bush	AF; BG; DS; AS
Entolasia stricta	Wiry Panic	AF; BG; DS; AS
Eucalyptus pilularis	Blackbutt	AF; BG; DS
Glochidion ferdinandi	Cheese Tree	AF; BG; DS; AS
Gonocarpus teucrioides	Germander Raspwort	AF; BG; AS
Hakea dactyloides	Broad-leaved Hakea	AF; BG; DS; AS
Imperata cylindrica	Blady Grass	AF; BG; DS
Lasiopetalum ferrugineum	Rusty-petals	AF; BG; AS
Lepidosperma laterale	Variable Sword-sedge	AF; BG; DS; AS
Lomandra longifolia	Spiny-headed Mat-rush	AF; BG; DS; AS
Microlaena stipoides	Weeping Grass	AF; BG; DS; AS
Notelaea longifolia	Large Mock-olive	AF; BG; DS; AS
Oplismenus aemulus	Basket Grass	AF; BG; DS; AS
Pittosporum revolutum	Rough-fruit Pittosporum	AF; BG; DS
Pittosporum undulatum	Pittosporum	AF; BG; DS
Polyscias sambucifolia	Elderberry Panax	AF; BG; DS; AS
Pteridium esculentum	Bracken	AF; BG; DS; AS
Schoenus melanostachys	Black Bog-rush	AF; BG; AS
Stephania japonica	Stephania	AF; DS
Xanthosia tridentata	Rock Xanthosia	AF; AS

AF: Angophora Foreshore Forest **BF: Blackbutt Gully Forest**

DS: Disclimax Sandstone Scrub **AS: Allocasuarina Scrub**

Map 2: Condition of Bushland and Resilience (2018)

Condition of Bushland and Resilience Key

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural recruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting Poor indicative resilience
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience – limited regeneration potential (1-2 species)
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed sandstone)

Map 3: Fire History & Future Managed Burns

Table 2: Species of Special Conservation Concern

COMMON NAME	SCIENTIFIC NAME	CAUSE OF DECLINE
Brown Thornbill Eastern Spinebill Grey Goshawk Pacific Baza Golden-crowned Snake Yellow-tail Black Cockatoo Gould's Wattled Bat Black-faced Cuckooshrike Common Tree Snake Eastern Yellow Robin Oriental Dollarbird Brown Garygone Burtons Legless Lizard Eastern Dwarf Tree Frog Superb Fairly-wren Variegated Fairy-wren Eastern Bent-wing Bat Diamond Python Large-footed Mytis Boobook Owl Powerful Owl Spotted Pardolote Long-nosed Bandicoot Tawny Frogmouth Red-bellied Black Snake Eastern Whipbird Grey-headed Flying Fox Roufus Fantail White-browed Scrubwren Australaisan Figbird Sacred Kingfisher Swamp Wallaby Silvereye	*Acanthiza pusilla* *Acanthorhynchus tenuirostris* *Accipiter novaehollandiae* *Aviceda subcristata* *Cacophis squamulosus* *Calyptorhynchus funereus* *Chalinolobus gouldii* *Coracina novaehollandiae* *Dendrelaphis punctulatus* *Eopsaltria australis* *Eurystomus orientalis* *Gerygone mouki* *Lialis burtonis* *Litoria fallax* *Malurus cyaneus* *Malurus lamberti* *M.schreibersii oceanensis* *Morelia spilota spilota* *Myotis macropus* *Ninox novaeseelandiae* *Ninox strenua* *Pardalotus punctatus* *Perameles nasuta* *Podargus strigoides* *Pseudechis porphyriacus* *Psophodes olivaceus* *Pteropus poliocephalus* *Rhipidura rufifrons* *Sericornis frontalis* *Sphecotheres vieilloti* *Todiramphus sanctus* *Wallabia bicolor* *Zosterops lateralis*	- Reduction of Tall Eucalypt Forest in North Sydney; - Loss of habitat /Declining canopy cover - Reduction and degradation of bush-land habitat in North Sydney; - Ecosystem degradation general loss of species diversity; Urban ecology expansion is beneficial to larger common birds; - Fragmented populations confined to small native bushland remnants are at risk of local extinction; - Lack of constant food source; - Predation from cats, dogs and urban predatory birds such as Currawongs and butcher birds. - Scarcity of natural breeding hollows - Altered stormwater system causing habitat loss; stormwater pollution; Sedi-mentation; Chytrid fungus; & Isolation of small populations.
Flannel Flower Coastal Banksia Red Bloodwood Peppermint Gum Rough Saw-sedge Grey Spider Flower Broad-leaved Hakea Mountain Devil Prickly Beard-heath Long-leaf Lomatia Micranthium Silky Purple-flag Pine-leaved Geebung Black Bog-rush Wilkstromia	*Actinotus minor* *Banksia integrifolia* *Corymbia gummifera* *Eucalyptus piperita* *Gahnia aspera* *Grevillea buxifolia* *Hakea dactyloides* *Lambertia formosa* *Leucopogon juniperinus* *Lomatia myricoides* *Micranthium ericoides* *Patersonia sericea* *Persoonia pinifolia* *Schoenus melanostachys* *Wilkstromia indica*	- Altered fire regimes; - Ecosystem degradation; general loss of species diversity; - Fragmented populations confined to small bushland remnants; - Lack of connectivity between bushland limits pollination pathways and seed dispersal - Community use pressures - Stormwater pollution, erosion and sedimentation

Table 3: Plant species affecting biodiversity and stability of Bushland

Common Name	Botanic Name	Habit	Common Name	Botanic Name	Habit
African love grass	*Eragrostis curvula*	Grass/Ground layer	Purple top	*Verbena bonariensis*	Ground layer
Barbed wire grass	*Cymbopogon refractus*	Grass/Ground layer	Thick head	*Crassocephalum crepidioides*	Ground layer
Couch	*Cynodon dactylon*	Grass/Ground layer	Thistle sp	*Cirsium vulgare*	Ground layer
Crows foot grass	*Eleusine indica*	Grass/Ground layer	Trad	*Tradescantia fluminensis*	Ground layer
Ehrharta	*Ehrharta erecta*	Grass/Ground layer	Turkey rhubarb	*Acetosa sagittatus*	Ground layer
Foxtail grass	*Pennisetum alopecuroides*	Grass/Ground layer	Balloon vine	*Cardiospermum grandiflorum*	Climber
Kikuyu	*Pennisetum clandestinum*	Grass/Ground layer	Cape Ivy	*Delairea odorata*	Climber
Weeping grass	*Microlaena stipoides*	Grass/Ground layer	Honeysuckle	*Lonicera japonica*	Climber
Palm grass	*Setaria palmifolia*	Grass/Ground layer	Madeira vine	*Anredera cordifolia*	Climber
Parramatta grass	*Sporobolus indicus*	Grass/Ground layer	Morning glory coastal	*Ipomea cairica*	Climber
Paspalum	*Paspalum dilatatum*	Grass/Ground layer	Morning glory	*Ipomea indica*	Climber
Red natal grass	*Melinis repens*	Grass/Ground layer	Moth vine	*Araujia sericifolia*	Climber
Summer grass	*Digitaria sanguinalis*	Grass/Ground layer	Corky Passionfruit	*Passiflora suberosa*	Climber
Asthma weed	*Parietaria judaica*	Ground layer	Box Elder	*Acer negundo*	Canopy/Shrub
Asparagus fern	*Protasparagus aethiopicus*	Ground layer	African olive	*Olea europaea ssp. cuspidata*	Canopy/Shrub
Bidens	*Bidens pilosa*	Ground layer	Castor oil plant	*Ricinus communis*	Canopy/Shrub
Scurvy weed	*Commelina cyanea*	Ground layer	Camphor laurel	*Cinnamomum camphora*	Canopy/Shrub
Crofton	*Ageratina adenophora*	Ground layer	Cassia	*Senna pendula*	Canopy/Shrub
Fishbone fern	*Nephrolepis cordifolia*	Ground layer	Cheese Tree	*Glochidion ferdinandi*	Canopy/Shrub
Fleabane	*Conyza spp*	Ground layer	Coral Tree	*Erythrina sp*	Canopy/Shrub
Mist flower	*Ageratina riparia*	Ground layer	Lantana	*Lantana camara*	Canopy/Shrub
Montbretia	*Crocosmia X crocosmiiflora*	Ground layer	Ochna	*Ochna serrulata*	Canopy/Shrub
Mother of millions	*Bryophyllum delagoense*	Ground layer	Port Jackson Fig	*Ficus rubiginosa*	Canopy/Shrub
Mustard weed	*Brassica spp.*	Ground layer	Sweet Pittosporum	*Pittosporum undulatum*	Canopy/Shrub
Paddys lucerne	*Sida rhombifolia*	Ground layer	Small leaf Privet	*Ligustrum sinense*	Canopy/Shrub
Pampas lily of the valley	*Salpichroa organifolia*	Ground layer	Large leaf Privet	*Ligustrum lucidum*	Canopy/Shrub
Pareuvian lily	*Alstroemeria pulchella*	Ground layer	Wild tobacco	*Solanum mauritianum*	Canopy/Shrub

2.2.5 Wonga Reserve (incl. Tobruk Ave Lookout) Bushland Rehabilitation Plan

Description

Size: Wonga Reserve 1.1 Ha; Tobruk Avenue Lookout 0.1 Ha.

Access: Wonga Reserve is accessed via Wonga Road (one way). Tobruk Ave Lookout is accessed via Tobruk Ave and a footpath/stairs from Wonga Rd.

Ownership: North Sydney Council.

Catchment: Middle Harbour

Configuration / Connectivity: Wonga Reserve forms a narrow 25m wide strip of remnant vegetation bordered by Wonga Rd to the east, Willoughby Bay to the west, Primrose Park to the south and a residence to the north. A small triangle to the east of Wonga Rd forms Tobruk Ave Lookout which is bordered by two residences to the south west and one to the north east. Wonga Reserve forms part of a larger U-shaped remnant with adjoining Brightmore Reserve and Primrose Park/Folly Point that together surround Willoughby Bay (also described as "the Cremorne Remnants").

Hydrology: All surface runoff and two Council stormwater pipes drain to Willoughby Bay.

Geology: Hawkesbury Sandstone of medium to coarse grained quartz sandstone with minor shale and laminate lenses and sandstone outcrops.

Soil Landscape: Hawkesbury Soil Landscape consisting of shallow, poor sandy soils, highly erosive with low soil fertility. Localised Yellow and Red Podzolic Soils are associated with shale lenses. Some areas below Wonga Rd are disturbed with imported fill materials.

Slope: The reserve and lookout are located on a steep slope from Tobruk Ave and Wonga Rd to Willoughby Bay.

Facilities / Infrastructure: Tobruk Avenue Lookout, seats and a sealed footpath between Tobruk Ave and Wonga Rd. Two stormwater pipes drain to the foreshore. A sewer line extends through the centre of the reserve from north to south with pop tops and an air vent.

Plant Community:

- Mixed Sandstone Gully Forest - an open forest of mixed tree composition dominated by *Angophora costata, Corymbia gummifera, Eucalyptus pilularis, E. piperita* and *E. sieberi.*
- Disclimax Sandstone Scrub - an altered community of open to closed scrub, or a forest of mixed and variable composition due to disturbance. It develops in sites where the original eucalypt forest vegetation has been subject to clearing, dieback and/or an absence of fire.
- Refer to Map 1 for the plant communities; Table 1 for common flora species and Table 2 for plant species of special conservation concern in Wonga Reserve and Tobruk Ave Lookout.

Wildlife Habitat:

- Wonga Reserve and Tobruk Avenue Lookout are dominated by dry sclerophyll forest and woodland type habitat. The reserve contains rocky foreshore, drainage areas and rocky outcrops and forms an important habitat link to Brightmore Reserve and Primrose Park.
- Despite limited connectivity of vegetation with larger areas of bushland, the reserve is within range for many wildlife species that move between reserves such as the Common Brushtail (*Trichosurus Vulpecula*) and Ringtail Possums (*Pseudocheirus peregrinus*), microbats, woodland and sea birds. Remnant small range species include skinks, lizards, geckoes, snakes and frogs.
- The intertidal rocky foreshore provides habitat for birds, microbats, insects, mammals, crabs, molluscs and fish at different phases of the tide.
- The reserve lacks nesting hollows and roosting sites for birds and arboreal mammals due to the lack of mature native trees. Such creatures play an important role in the ecology of the vegetation communities, assisting in pollination, seed dispersal and germination.
- Stormwater infrastructure adjoining the reserve provides significant roosting and (possibly) mating habitat for several threatened microbat species.
- Refer to Table 2 for the fauna species of special conservation concern found in Wonga Reserve.

Condition and Resilience:

- The bushland is a narrow strip of typical foreshore vegetation on Hawkesbury sandstone.
- The area abutting the foreshore is mostly in good condition with high to medium resilience due to minimal past disturbance.
- Areas directly below Wonga Rd and Tobruk Ave have been subject to fill and disturbance, but canopy replacement and regeneration is occurring.
- Weed species are predominantly found at the most northern end where the reserve abuts residential development. The remainder of the bushland has been successfully regenerated and requires only minimal maintenance.
- Refer to Map 2 Condition of Bushland and Resilience.

Zone / Classification:

- The bushland is zoned E2 Environmental Conservation under *North Sydney LEP 2013.* It is classified public bushland in *SEPP No. 19 Bushland in Urban Areas (*and in the draft SEPP (*Environment)* that will supersede *SEPP 19*.)
- The reserve is identified as a Coastal Environment Area and Coastal Use Area under *SEPP (Coastal Management*).

Statement of Significance:
Historic Values

- The bushland in this reserve is a legacy of past land management by the traditional Aboriginal custodians, the Cammeraygal people, who originally occupied the area. No Aboriginal sites have been recorded to date. Signs of Aboriginal presence may exist but remain undiscovered. Places, objects and features of significance to Aboriginal people which may be present in the reserve are protected under the NSW *National Parks and Wildlife Act 1974*.

Natural Values

- Wonga Reserve and Tobruk Avenue Lookout play an important role in maintaining biodiversity in the region and assist in conservation of species and habitat function. They form part of an important habitat corridor along the foreshore to Primrose Park and Brightmore Reserve which together provide a sanctuary for more than 87 fauna species and a high number of birds in a highly - urbanised environment.

- The reserve provides habitat for threatened and declining fauna species including the Powerful Owl (*Ninox strenua*) (listed as vulnerable in NSW under the *Biodiversity Conservation Act 2016 (BC Act*) and the Grey-headed flying-fox (*Pteropus poliocephalus*) (listed as vulnerable in NSW and under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act*).
- Stormwater infrastructure adjoining the reserve provides significant roost sites for the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) (listed as vulnerable in NSW under the *BC Act*) and may also be used for mating in autumn.
- Other species recorded in Wonga Reserve or adjoining the reserve are the Little Bentwing Bat (*Miniopterus australis*), Eastern Freetail Bat (*Mormopterus norfolkensis*) and Southern Myotis (*Myotis macropus*) (all vulnerable in NSW under the *BC Act*).
- The reserve is high in plant diversity and is the only reserve in the Local Government Area to contain naturally occurring Silvertop Ash *(Eucalyptus sieberi*).
- Wonga Reserve and Tobruk Ave Lookout are the only locations in the local government area where Mixed Sandstone Gully Forest occurs.
- *Acacia terminalis* subsp. *terminalis* listed as endangered under the Commonwealth *EPBC Act and the NSW BC Act* has been recorded in the Cremorne remnants and may occur in Wonga Reserve.
- The reserve also contains the locally rare *Corymbia gummifera, Leionema dentatum, Persoonia laurina, Persoonia levis, Persoonia pinifolia, Pyrrosia rupestris, Themeda triandra* and *Xanthorrhoea arborea.*

Fire History:
- Fire is a fundamental ecological requirement that sustains ecosystem health/function and enhances species diversity in Wonga Road Reserve.
- Past burns have resulted in the successful germination of native endemic flora species.
- Planned hazard reduction / ecological broad area burns are conducted from time to time. Refer to Map 3 Fire History and Future Managed Burns.

Threats:
- The limited size and narrowness of the reserve amplifies vulnerability to fragmentation and edge effects from the surrounding urban environment.
- Genetic inbreeding reduces the fitness and long-term viability of isolated bushland species.
- Significant tree vandalism has occurred in the last 10 years with 60% of *E. sieberi* poisoned.
- Wonga Road has an allocated road reserve that extends into the bushland. Future road works may result in the clearing of bushland within this area.
- High nutrient loads from stormwater drains and sewer line pop tops impact soil quality and promote weeds.
- Fill below Wonga Rd and Tobruk Ave significantly compromise soil stability and structure, seedbank viability and bushland resilience.
- At times, foxes (*Vulpes vulpes*), domestic cats (*Felis cattus*) and off-leash dogs (*Canis lupus familiaris)* are observed in the reserve and along the foreshore. These animals predate, scare and disturb wildlife, pollute with their faeces and spread weed seed. Shorebirds are particularly impacted by dogs off lead.
- Dog waste, vegetation and rubbish are periodically dumped along the roadside.
- Weed encroachment occurs from adjoining gardens.
- Native and exotic vines, mesic species and weeds are a serious threat to the stability of resilient cores and long term viability of biodiversity. Refer to Table 3 for plant species affecting biodiversity and stability of bushland assets. In Wonga Reserve, Running Bamboo, *Acacia prominens*, *E. saligna,* and *Ciccus antarctica* need targeted management.
- Native bats and birds can transport new flora species and weeds into the reserve that have the potential to change its structure over time.
- Some species of introduced or endemic fauna are very territorial and compete for habitat, limiting species diversity.
- Inappropriate weed removal can reduce fauna habitat with greater impacts on short range species and small birds.
- *Phytophthora cinnamomi* (root rot*)* affects the health of the bushland and is widespread in North Sydney.
- Visitor impacts include occasional dinghy storage on the foreshore, trampling of bushland from informal track creation, soil compaction and soil erosion.
- Increased drone usage may cause disturbance to fauna that occur in the canopy.
- Climate change is an ongoing threat. Anticipated impacts include increased threat of bushfire and extreme weather events. Raised sea levels are predicted to inundate shoreline vegetation, eroding the foreshore and destroying Aboriginal middens. Increased temperatures are likely to affect biodiversity and ecosystems, favouring some species over others and changing the structure and function of the bushland. The rate of climate change may be faster than the rate of natural adaptation. Increased temperatures will harm sensitive fauna such as bats, impacting their important ecosystem function.
- Non-passive recreational activities (incl. orienteering; rock climbing; geo-caching, camping and mountain biking) cause substantial damage to native vegetation and soil stability. These activities are prohibited in North Sydney's bushland reserves

Bushland Management Goals

a. Maintain and enhance biodiversity and habitat for long term ecosystem resilience and function
b. Conserve all threatened and regionally significant flora and fauna species known or likely to occur in / naturally colonise the reserve
c. Strategically restore bushland (prioritise areas of highest resilience)
d. Enhance habitat connectivity
e. Preserve genetic integrity of the vegetation community
f. Manage the impacts of stormwater pollution and urban runoff on bushland and creek water quality
g. Conserve the natural landscape and heritage values
h. Provide for ecologically sustainable recreation needs of the community
i. Implement the strategic fire hazard reduction program and manage fuel loads to protect life, property and endemic biodiversity.

Rehabilitation Principles and Procedures:
General

1. Bush regeneration is a long-term process of staged weed removal to ensure endemic biodiversity, native plant establishment and continued habitat for local wildlife. It relies on site assessments that identify values and how best to restore and enhance ecosystem function and structure. Routine site monitoring, evaluation of field strategies and periodic native flora and fauna surveys inform management priorities over time. Works normally proceed from bush in good condition with high resilience. Degraded areas are a lower priority but the weeds always require containment.

Planning, Evaluation and Review

2. The Bushland Management Team should regularly evaluate bushland rehabilitation plans and the success of field strategies to inform management priorities early.
3. Establish photo points to monitor projects.
4. In the bushland rehabilitation planning process, consider the potential impact of future infrastructure earthworks, or access requirements on bushland, habitats, green corridors or active rehabilitation sites.
5. The Bushland Management Team must approve all contractor project proposals before implementation.
6. All Work, Health and Safety requirements must be adhered to by Council staff, volunteers and contractors before, during and after site works.

Native Flora

7. Record uncommon flora species to determine risk of extinction in the reserve. (Use North Sydney flora survey record template).
8. Prioritise protection / rehabilitation in areas of highest resilience.
9. Buffer areas should protect biodiversity from disturbances caused by fragmentation and edge effects: (a) monitor to identify gaps in buffer vegetation and senescing / restored vegetation and organise replacement planting; (b) where possible, plan to install vegetation barrier systems along lawn/bush edge interfaces as a medium/long term solution to stop herbaceous weeds and grasses from spreading into bushland; (c) control vines, noxious weeds and other plant species affecting stability of adjoining bushland.
10. When natural regeneration is ineffective, locally source all plant material for supplementary planting to maintain genetic integrity of native vegetation in accordance with Flora Bank Guidelines https://www.greeningaustralia.org.au/florabank. Only plant when natural regeneration is ineffective to boost biodiversity, with the aim to achieve 80% survival rates. Plant in stages, basing species selection on the target vegetation community/structure, successional stage, habitat requirements and physical constraints. This process involves collaboration from Council's nursery supervisor, bush regeneration team, Bushcare volunteers and bush regeneration contractors.
11. In areas lacking diversity and structure; direct seed, transplant and use appropriate tube stock to enhance existing plant communities. When planning a replanting site: (a) prepare a suitable plant list based on rehabilitation objectives and prevailing site condition; (b) allow time for seed collection and propagation (9-12 months ahead of planting); (c) identify where seed harvesting/cuttings will be gathered; (d) prepare area (e.g. reduce density of dominant species on ground layer or mesic species in shrub layer); (e) schedule planting for early Autumn during or after soaking rain.
12. Collect seed of suitable locally rare species from nearby bushland areas, propagate and plant in appropriate areas of the reserve to enhance biodiversity and ensure the long-term viability. For species that are difficult to propagate, explore other methods such as seed scarification / raking treatment / seedbank translocation etc.
13. Implement a canopy replacement program in areas where remnant canopy is absent, senescing or failing to regenerate or where non-endemic trees have been removed.
14. Do not encourage large canopy species on unstable areas or under electricity easements where they cannot be supported and may cause future hazards.
15. Where mesic shift is occurring and prescribed burns are unfeasible, the following may be undertaken with prior approval of the Bushland Management Team: (a) pile burn where appropriate; (b) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (c) reduce seedbank of dominant natives - control seeding cycle; (d) lightly disturb mulch / organic matter to stimulate regeneration; (e) increase seed bank of uncommon/ rare species with brush matting techniques (collect from donor sites where seed removal will not affect biodiversity); (f) propagate senescing plant species at risk of extinction in the reserve (i.e. due to an inadequate fire regime) and plant tubestock in suitable locations.
16. When planting along bushland edges, select species in consideration of their potential to compliment views from residential or public viewing areas and design to enhance habitat / connectivity (e.g. for small birds).
17. Conserve and protect naturally regenerating / colonising canopy species providing they are in sustainable locations.

Weeds and Pathogens

18. Implement the *Biosecurity Act 2015* consistently and effectively, in accordance with bushland management objectives and processes.
19. Residential properties adjoining bushland can contribute to weed spread. Monitor and address invasive garden plants in accordance with the *Biosecurity Act 2015* and promote Council's Native Havens / Habitat Stepping Stones Programs.

20. Ongoing weed management should: (a) prioritise good bush areas; (b) target species threatening stability e.g. vines, woody or canopy weeds; (c) interrupt seed cycle of target species, especially annual and grass weeds; (d) prioritise areas where plant diversity is most affected by mesic shift and vines. (In consideration of fauna habitat needs, schedule works from Autumn through Winter before bird breeding season.)
21. Monitor sites to identify, report and manage early stages of weed outbreaks or shifts in plant species assemblages likely to become detrimental to biodiversity. Manage according to the issues they raise. Report other threats to ecosystem function.
22. All compost weed material is removed off site.
23. Retain weeds on highly erodible or dangerous slopes and use methods of weed suppression that will not create potential for soil erosion. Incorporate abseiling activities on cliff faces to remove weeds that are a constant weed seed source.
24. Strategically remove non-endemic or exotic trees that interfere with ecosystem function or structure. Assess for habitat potential before they are de-limbed.
25. Consider all potential impacts of herbicide and proximity to water when determining suitability for weed control.
26. Use hygiene protocols in bushland to minimise risk of spreading *Phytophthora cinnamomi.*

Native Fauna and Habitat

27. Record wildlife sightings and observations in Council's Wildlife Watch database. Share this information with NSW BioNet and the Commonwealth's ALA.
28. Identify and protect nesting, roosting and breeding sites of threatened, vulnerable or locally significant fauna.
29. Minimise disturbance to wildlife, enhance habitat where needed and improve the condition/connectivity of wildlife corridors between adjoining reserves.
30. Protect, maintain and restore quality fauna foraging habitat using a diverse mix of endemic native species. Retain habitat features such as fallen and standing dead wood, rock piles, hollow-bearing trees, natural debris, dead standing trees, forest litter, logs and branches.
31. Short-term strategies to maintain fauna habitat provided by mesic and weed species may require retention yet containment of dense areas of weed, vines and mesic species. In the longer-term, aim to establish a self-maintaining fabricated vegetation community in these areas composed of native species adapted to changed site conditions (abiotic factors) that enhance biodiversity and habitat availability.
32. Before any unfavourable trees are de-limbed, assess for habitat potential e.g. tree hollows.
33. Where suitable, install fauna nesting boxes and create hollows in suitable dead trees to augment nesting habitat. Monitor fauna occupation of created habitat hollows, condition of nesting boxes and impacts on the host tree and take appropriate action where needed.
34. Investigate financial opportunities to invest in habitat enhancing research and developing methodologies.

Threatened species

35. Identify threatened or endangered, rare or locally rare species of flora and fauna. Aim to monitor, preserve and enhance their populations and habitat as well as comply with relevant recovery plans, threat abatement plans and biodiversity conservation programs.
36. Ensure relevant Council staff, contractors and volunteers are aware of locations of threatened species.

Ecological Burns

37. Hazard reduction and ecological burns are based on a strategic burn program consistent with the Mosman North Sydney Willoughby Bushfire Risk Management Plan. Ecological burn regimes are to be in a mosaic pattern to improve bushland function and biodiversity. Areas of high bushfire risk or core ecological resilience are usually prioritised in the annual burn program.
38. Maintain land management zones where bush adjoins residences and implement site stabilisation measures.
39. Over the next 10 years, prioritise prescribed burns at sites at risk of diminishing flora diversity.
40. For pre-fire preparation: (a) strategically cull mesic species to increase light and reduce competition in shrub layer (only in Autumn and Winter before bird breeding); (b) reduce seedbank of dominant natives to control seeding cycle; (c) increase seed bank of uncommon/ rare species with brush matting (collect from donor sites where seed removal will not affect biodiversity).
41. Design fire strategies to not adversely impact threatened flora or fauna or regionally or locally rare species such as small birds.
42. Implement post-fire monitoring and bush rehabilitation strategies. Monitor regenerating ground layer to prevent dominant natives or weeds from outcompeting occasional or rare plant species, and if needed, direct seed at an appropriate time period post-burn.

Pests and Illegal Activity

43. Monitor and control feral or aggressive/territorial fauna activity, cats, unleashed dogs and illegal activity with appropriate measures e.g. trapping, community education programs, penalty notices or camera observation. If applicable, manage reserves in consideration of the Wildlife Protection Area provisions under the NSW *Companion Animals Act* 1998 and relevant North Sydney Council policies.
44. Monitor and report tree vandalism, encroachments, damage, sewerage pipe leaks or dumping and take swift and appropriate action e.g. remove pollutants, liaise with relevant property owners, issue penalty notices, implement locally targeted community education programs and refer to relevant council services, policies and procedures.
45. Monitor the impacts of drones and implement management measures if required.
46. Address instances of unauthorised activities in bushland incl. orienteering; rock climbing; geocaching; mountain biking; camping etc.

Tracks, Water and Erosion

47. Close informal tracks to prevent damage to habitat; impede feral animals and reduce weed spread.
48. Implement track maintenance schedule targeting overgrown vegetation, unstable trees, slippery sections, protruding or unstable rocks, erosion, track widening and degrading track conditions.
49. Assess the need for additional directional and / or interpretive signage.
50. Stabilise steep slopes, ephemeral flow lines and highly erosive areas using local native species, particularly ground covers, to re-establish appropriate vegetation community structure where natural regeneration is poor or absent. Install sedimentation fences, terracing, coir logs, matting or other appropriate measures where

needed to stabilise washout areas and improve access and safety.

51. Follow a Total Catchment Management approach using Water Sensitive Urban Design (WSUD) principles to manage stormwater. Rehabilitation and mitigation works may include rock armouring drainage outlets and planting urban stormwater tolerant natives.

Aboriginal and non-Aboriginal Heritage

52. All identified items and sites of Aboriginal or European significance are to be protected and conserved in accordance with the NSW *National Parks and Wildlife Act 1974* and *Heritage Act 1977*.
53. Aboriginal heritage sites are to be managed as per Council's Aboriginal Site Management Report 2011 and all bush regenerators should follow Council's 'Bush Regeneration and Aboriginal Sites' manual.
54. As all Aboriginal and non-Aboriginal heritage is protected in North Sydney LGA, all heritage sites require specialist management and certain bush regeneration practices, monitoring and maintenance.
55. Bushland management staff consult with the Aboriginal Heritage Office or Council's heritage officer prior to activities that have the potential to damage heritage sites or where sites have become unstable and require management to determine appropriate action. This includes before each burn to identify sites and implement protection measures and post-fire survey.
56. Discovery of any new artefacts/sites needs to be reported in accordance with legal procedures and standard protocol.

Community

57. Continue to inform local residents of the scope of works being undertaken adjacent to their properties and the best ways to manage their backyards to minimise impacts on the bushland.
58. Promote Native Havens, Streets Alive and Habitat Stepping Stones programs to nearby residences to enhance backyard habitat and improve wildlife corridor linkages. Also promote appropriate management of domestic pets and involvement in the Wildlife Watch, Bushcare and Adopt-a-Plot programs.
59. Investigate the potential for community, school or corporate planting days and Bushcare groups to achieve the aims of the plan.
60. When homeless people are found to be living in the reserve, manage negative impacts and liaise with the Community Development section of Council.

Reserve Specific Rehabilitation Actions

Priorities will be given to programs with long term benefit to the reserve or where natural assets are at greatest risk to avert irreversible deterioration or loss.

Flora

1. Strengthen buffer edge plantings along the Wonga Road footpath and private property boundary.
2. Collaborate with Council's Open Space Team to expand and improve green corridor connections with Brightmore Reserve and Primrose Park.
3. Contain mesic natives to drainage lines; plant species suited to altered soil conditions to improve diversity.
4. Increase the density and diversity of understorey plantings in areas of the reserve where natirual regeneration is absent or significantly diminished.
5. At Tobruk Avenue Lookout, balance canopy protection with the maintenance of public view lines.
6. Define the edge between the bushland, tracks, lawn and the residential interface by using natural log borders, with or without spray edges at Tobruk Ave Lookout.

Fauna

7. Inhibit access to microbat roost sites and adjoining habitat areas. Maintain flight paths and ensure favourable conditions for microbat roosting. Aim to schedule any mandatory infrastructure works to the drains during times when bats would not be roosting.
8. Protect, maintain and restore quality bat foraging habitat (e.g. areas with high moisture), using a diverse mix of locally appropriate native species.
9. In conjunction with Open Space Team, improve wildlife corridors to bushland in Brightmore Reserve and Primrose Park.
10. Promote appropriate management of domestic pets as the reserve adjoins a Wildlife Protection Area (Primrose Park).
11. Investigate zoning Wonga Reserve as a 'Wildlife Protection Area' under the *Companion Animals Act, 1998.*

Threatened Species

12. If *Acacia terminalis* subsp. *terminalis* is found to occur in the reserve, work in collaboration with the Saving Our Species program managed by the NSW Office of Environment and Heritage and the NSW Herbarium to identify, monitor and protect *Acacia terminalis* subsp. *terminalis* and contribute to the preparation of best practice guidelines for the species.
13. Preserve and enhance the habitat of threatened microbat species, Powerful Owl (*Ninox strenua*) and Grey-headed Flying fox (*Pteropus poliocephalus)*.

Illegal Activity

14. Dinghy and kayak storage is prohibited within the reserve and along its foreshore.
15. Public access to the foreshore via informal tracks is prohibited.
16. Tree vandalism in this reserve has occurred previously. Monitor tree canopy health and investigate suspected vandalism. Educate and engage reserve neighbors through Native Havens Program.

Ecological Burns

17. Refer Map 3 Fire History and Future Managed Burns.

Community

18. Engage local residents in Bushcare Programs (e.g. Bushcare; Adopt-a-Plot; Native Havens; Wildlife Watch; Bush friendly neighbour program).
19. Develop a bushland neighbour information brochure to help raise awareness of edge effects and the ways local residents can improve their bushland footprint.

Capital Projects

20. Investigate stormwater management measures to address gross pollutants and erosion.

Map 1: Vegetation Communities (NAS 2010)

Table 1: Common species recorded in Wonga Res/Tobruk Lookout

Scientific name	Common name	Vegetation Community
Allocasuarina littoralis	Black She-oak	AF; MF; DS
Angophora costata	Sydney Red Gum	AF; MF; DS
Banksia integrifolia	Coast Banksia	AF; MF; DS
Banksia serrata	Old Man Banksia	AF; MF; DS
Calochlaena dubia	Common Ground Fern	AF; MF; DS
Ceratopetalum gummiferum	Christmas Bush	AF; MF; DS
Commelina cyanea	Scurvy Weed	AF; MF; DS
Corymbia gummifera	Red Bloodwood	AF; MF
Crowea saligna		AF; MF; DS
Cryptostylis erecta	Tartan Tongue Orchid	AF; MF
Dianella caerulea	Blue Flax Lily	AF; MF; DS
Elaeocarpus reticulatus	Blueberry Ash	AF; MF; DS
Entolasia stricta	Wiry Panic	AF; MF; DS
Eucalyptus piperita	Sydney Peppermint	AF; MF; DS
Eucalyptus sieberi	Silvertop Ash	MF
Ficus rubiginosa	Port Jackson Fig	AF; MF; DS
Glochidion ferdinandi	Cheese Tree	AF; MF; DS
Kunzea ambigua	Tick Bush	AF; MF; DS
Lepidosperma laterale	Variable Sword-sedge	AF; MF; DS
Lomandra longifolia	Spiny-headed Mat-rush	AF; MF; DS
Microlaena stipoides	Weeping Grass	AF; MF; DS
Notelaea longifolia	Large Mock-olive	AF; MF; DS
Oplismenus aemulus	Basket Grass	AF; MF; DS
Pandorea pandorana	Wonga Wonga Vine	AF; MF; DS
Pittosporum undulatum	Pittosporum	AF; DS
Polyscias sambucifolia	Elderberry Panax	AF; MF; DS
Pomax umbellata	Pomax	AF; MF; DS
Pteridium esculentum	Bracken	AF; MF; DS
Smilax glyciphylla	Sweet Sarsaparilla	AF; MF; DS
Xanthorrhoea arborea	Broad-leaf Grass-tree	AF; DS
Zieria smithii	Sandfly Zieria	AF; MF; DS

AF: Angophora Foreshore Forest **DS: Disclimax Sandstone Scrub**
MF: Mixed Sandstone Foreshore Forest

Map 2: Condition of Bushland and Resilience (2018)

Condition of Bushland and Resilience Key

Colour Code	Condition of Bushland	Description
Green	Good	*Primary Conservation Zones (PCZ)* >60% indigenous cover Community structure in-place (i.e. canopy, mid-storey, ground covers etc) High level of indicative resilience
Blue	Fair	*Secondary Conservation Zones (SCZ)* 31-60% indigenous cover Major elements of community structure in-place or site has ability to regain structure through natural recruitment over time Moderate indicative resilience
Orange	Poor	*Secondary Conservation Zones (SCZ)* 10-30% indigenous cover Community structure degraded, major elements (canopy, mid-storey, ground covers) partly or completely absent Ability to naturally regenerate is highly compromised – most likely requires assisted regeneration through supplementary planting Poor indicative resilience
Red	Very Poor	*Conservation Buffer Zone (CBZ)* <10% indigenous cover Original community structure completely absent/replaced by modified exotic structure OR Only mature specimens of highest stratum (canopy) remain – no seedlings or saplings due to infestation of understorey with exotics Very poor indicative resilience– limited regeneration potential (1-2 species)
Grey	N/A	Original soil profile replaced by foreign fill material Nil resilience
Yellow	Fabrication	Revegetation area, usually created on imported fill material (clean, crushed sandstone)

Map 3: Fire History & Future Managed Burns

Table 2: Species of Special Conservation Concern

COMMON NAME	SCIENTIFIC NAME	CAUSE OF DECLINE
Yellow Thornbill King Parrot Pacific Baza Brush Cuckoo Golden-crowned Snake Yellow-tail Black Cockatoo Gould's Wattled Bat Black-faced Cuckooshrike Common Tree Snake White-bellied Sea Eagle Whistling Kite Superb Fairly-wren Variegated Fairy-wren Common Bent-wing Bat Eastern Bent-wing Bat Eastern Free-tailed Bat Large-footed Myotis Boobook Owl Powerful Owl Crimson Rosella Eastern Rosella Tawny Frogmouth Eastern Whipbird Grey-headed Flying Fox White-browed Scrubwren Forest Kingfisher Sacred Kingfisher	*Acanthiza pusilla* *Alisterus scapularis* *Aviceda subcristata* *Cacomantis variolosus* *Cacophis squamulosus* *Calyptorhynchus funereus* *Chalinolobus gouldii* *Coracina novaehollandiae* *Dendrelaphis punctulatus* *Haliaeetus leucogaster* *Haliastur sphenurus* *Malurus cyaneus* *Malurus lamberti* *Miniopterus schreibersii* *M. schreibersii oceanensis* *Mormopterus ridei* *Myotis macropus* *Ninox novaeseelandiae* *Ninox strenua* *Platycercus elegans* *Platycercus eximius* *Podargus strigoides* *Psophodes olivaceus* *Pteropus poliocephalus* *Sericornis frontalis* *Todiramphus macleayii* *Todiramphus sanctus*	- Reduction of Tall Eucalypt Forest in North Sydney; - Loss of habitat /Declining canopy cover - Reduction and degradation of bushland habitat in North Sydney; - Ecosystem degradation general loss of species diversity; Urban ecology expansion is beneficial to larger common birds; - Fragmented populations confined to small native bushland remnants are at risk of local extinction; - Lack of constant food source; - Predation from cats, dogs and urban predatory birds such as Currawongs and butcher birds. - Scarcity of natural breeding hollows - Altered stormwater system causing habitat loss; stormwater pollution; Sedimentation; Chytrid fungus; & Isolation of small populations.
Red Bloodwood Bangalay Silver-top Ash Guinea Flower Mountain Devil Monkey Rope Rock Xanthosia	*Corymbia gummifera* *Eucalyptus botryoides* *Eucalyptus seiberi* *Hibbertia aspera* *Lambertia formosa* *Parsonsia straminea* *Xanthosia tridentata*	- Altered fire regimes; - Ecosystem degradation; general loss of species diversity; - Fragmented populations confined to small bushland remnants; - Lack of connectivity between bushland limits pollination pathways and seed dispersal - Community use pressures - Stormwater pollution, erosion and sedimentation

Table 3: Plant species affecting biodiversity and stability of Bushland

Common Name	Botanic Name	Habit	Common Name	Botanic Name	Habit
African love grass	*Eragrostis curvula*	Grass/Ground layer	Purple top	*Verbena bonariensis*	Ground layer
Barbed wire grass	*Cymbopogon refractus*	Grass/Ground layer	Thick head	*Crassocephalum crepidioides*	Ground layer
Couch	*Cynodon dactylon*	Grass/Ground layer	Thistle sp	*Cirsium vulgare*	Ground layer
Crows foot grass	*Eleusine indica*	Grass/Ground layer	Trad	*Tradescantia fluminensis*	Ground layer
Ehrharta	*Ehrharta erecta*	Grass/Ground layer	Turkey rhubarb	*Acetosa sagittatus*	Ground layer
Foxtail grass	*Pennisetum alopecuroides*	Grass/Ground layer	Balloon vine	*Cardiospermum grandiflorum*	Climber
Kikuyu	*Pennisetum clandestinum*	Grass/Ground layer	Cape Ivy	*Delairea odorata*	Climber
Weeping grass	*Microlaena stipoides*	Grass/Ground layer	Honeysuckle	*Lonicera japonica*	Climber
Palm grass	*Setaria palmifolia*	Grass/Ground layer	Madeira vine	*Anredera cordifolia*	Climber
Parramatta grass	*Sporobolus indicus*	Grass/Ground layer	Morning glory coastal	*Ipomea cairica*	Climber
Paspalum	*Paspalum dilatatum*	Grass/Ground layer	Morning glory	*Ipomea indica*	Climber
Red natal grass	*Melinis repens*	Grass/Ground layer	Moth vine	*Araujia sericifolia*	Climber
Summer grass	*Digitaria sanguinalis*	Grass/Ground layer	Corky Passionfruit	*Passiflora suberosa*	Climber
Asthma weed	*Parietaria judaica*	Ground layer	Box Elder	*Acer negundo*	Canopy/Shrub
Asparagus fern	*Protasparagus aethiopicus*	Ground layer	African olive	*Olea europaea ssp. cuspidata*	Canopy/Shrub
Bidens	*Bidens pilosa*	Ground layer	Castor oil plant	*Ricinus communis*	Canopy/Shrub
Scurvy weed	*Commelina cyanea*	Ground layer	Camphor laurel	*Cinnamomum camphora*	Canopy/Shrub
Crofton	*Ageratina adenophora*	Ground layer	Cassia	*Senna pendula*	Canopy/Shrub
Fishbone fern	*Nephrolepis cordifolia*	Ground layer	Cheese Tree	*Glochidion ferdinandi*	Canopy/Shrub
Fleabane	*Conyza spp*	Ground layer	Coral Tree	*Erythrina sp*	Canopy/Shrub
Mist flower	*Ageratina riparia*	Ground layer	Lantana	*Lantana camara*	Canopy/Shrub
Montbretia	*Crocosmia X crocosmiiflora*	Ground layer	Ochna	*Ochna serrulata*	Canopy/Shrub
Mother of millions	*Bryophyllum delagoense*	Ground layer	Port Jackson Fig	*Ficus rubiginosa*	Canopy/Shrub
Mustard weed	*Brassica spp.*	Ground layer	Sweet Pittosporum	*Pittosporum undulatum*	Canopy/Shrub
Paddys lucerne	*Sida rhombifolia*	Ground layer	Small leaf Privet	*Ligustrum sinense*	Canopy/Shrub
Pampas lily of the valley	*Salpichroa organifolia*	Ground layer	Large leaf Privet	*Ligustrum lucidum*	Canopy/Shrub
Pareuvian lily	*Alstroemeria pulchella*	Ground layer	Wild tobacco	*Solanum mauritianum*	Canopy/Shrub

Bushland Rehab Plan - Special Projects matrix

RESERVES	SPECIAL PROJECTS	SHORT TERM			MEDIUM TERM				LONG TERM		
		July 2019 – July 2022			July 2022 – July 2026				July 2026 +		
BADANGI RESERVE	Consider installing signage and barriers in areas where dinghies and kayaks are illegally stored to deter illegal activity.										
	Investigate the feasibility of creekline rehabilitation projects and prioritise according to levels of need in Badangi Reserve. *										
	Implement a walking track upgrade project to reduce informal tracks; improve surface condition; minimise erosion and address safety concerns (e.g. foot bridge).										
	Enhance the Fire Management Access Zone at the rear of Walumetta Drive properties using bark blower technology and consider removal of inappropriate canopy and replacement with endemic species.										
BALLS HEAD RESERVE	Coordinate the redesign and update of visitor facilities, walking tracks and lookouts in Balls Head Reserve.										
	Replace the Balls Head Reserve septic tank with a more appropriate/sustainable waste disposal system.										
	Install boom-gates on the inbound and outbound lanes of Balls Head Drive (where the lanes split) in order to manage public access during severe fire danger. *										
	Redesign Balls Head Drive (where the lanes split) to enable vehicle U-turns when boom-gates are in use. *										
	To reduce the instances of night-time illegal/anti-social activity in Balls Head Reserve, consider closing the reserve from sunset to sunrise.										
	Consider installing signage and barriers in areas where small watercraft are illegally stored.										
	Assess the need to install traffic calming devices along Balls Head Drive on the southern section of the road from the parking area and into the north-bound corner. *										

RESERVES	SPECIAL PROJECTS	SHORT TERM			MEDIUM TERM				LONG TERM		
		July 2019 – July 2022			July 2022 – July 2026				July 2026 +		
	Upgrade and augment fauna awareness and appreciation signage along the Balls Head Reserve roadway and in picnic, parking and fishing areas. Inform the public about rules relating to relocating trapped animals such as possums, not feeding birds and the impacts of cats and dogs on wildlife.										
	In fishing locations, inform the public about the impacts of discarded fishing line/hooks on aquatic wildlife and waterbirds. Provide simple identification of protected aquatic species and maritime fishing rules.										
	Identify areas affected by hard-surface run-off and implement actions to mitigate impacts. *										
BERRY ISLAND RESERVE	Assess the heritage significance of unassessed items within the park and prepare appropriate management measures. *										
	Prepare a landscape plan (in conjunction with Council Parks and Gardens and in consultation with residents and users) for the grassed picnic area that includes enhancing vegetation / wildlife corridor linkages to the Gore Cove Reserve and Badangi Reserve. *										
	Upgrade the Gadyan Track including installing boardwalks, edging, stairs / ramps and seating to improve accessibility and safety. Upgrades will also manage erosion, trampling of the bush and protection of Aboriginal cultural sites.										
	Investigate enhancing signage to improve educational opportunities and reduce impacts on natural and cultural values e.g. signage about fauna habitat and the impacts of dogs as well as signage indicating that dinghy storage is illegal along the foreshore.										
	Consider installing barriers in areas where dinghies and kayaks are illegally stored to deter the illegal activity.										
CREMORNE RESERVE	Assess the need for upgrades to directional and / or interpretative signage and implement as needed.										

RESERVES	SPECIAL PROJECTS	SHORT TERM			MEDIUM TERM				LONG TERM		
		July 2019 – July 2022			July 2022 – July 2026				July 2026 +		
	Extend hardwood fencing along the bushland edge at Robertsons Point to protect it from illegal track creation and damage during New Year's Eve celebrations.										
	Commence stabilising and revegetation work along the Milson Rd foreshore – where accessible.										
	Assess safety fencing in Bushland areas and replace as required.										
FORSYTH PARK	Assess the need for directional and / or interpretative signage and implement as needed.										
	Monitor condition of the bushland walking track and schedule upgrade works as required.										
GORE COVE RESERVE & SMOOTHEY PARK	Monitor small watercraft storage in Gore Cove and install signage/barriers to deter illegal storage in non-permitted areas.										
	Carry out improvements at the designated dinghy storage area in Gove Cove to increase capacity and minimise damage to the fragile foreshore. *										
	Following an assessment and consultation with the Bushcare group, neighbours, track users and Sydney Water, upgrade the Gove Cove track to improve safety accessibility, directional and interpretative signage. *										
	Continue to liaise with Rail Corp and encourage weed management of railway land south of the Men's Shed.										
	Consider the installation of a footbridge across Berry Creek to connect the North Sydney and Lane Cove Council sites of the walking track. *										
BRIGHTMORE RESERVE	Assess the walking track network for upgrade requirements and undertake works based on priority and feasibility e.g. the old access track behind Bennelong Rd. *										
	Update interpretive and directional signage.										
	Undertake stormwater improvement works below Brightmore St and Little Young St.										

RESERVES	SPECIAL PROJECTS	SHORT TERM			MEDIUM TERM				LONG TERM		
		July 2019 – July 2022			July 2022 – July 2026				July 2026 +		
	Assess slope stabilisation needs and undertake works where feasible. *										
	Investigate the feasibility and prioritise creekline rehabilitation projects according to levels of need.										
	Investigate construction of a path linking Wonga Road with the Brightmore Reserve bushland track to complete this connection.										
MORTLOCK RESERVE & JUDITH AMBLER RESERVE	Investigate improving the ecological value of the open stormwater culvert on the eastern boundary of Mortlock Reserve and the adjoining area with appropriate hydrological design, habitat enhancement and plant selection (medium priority).										
	Investigate managing surface flow along Vernon Street so that it no longer flows uncontrolled into Mortlock Reserve (medium priority).										
PRIMROSE PARK & FOLLY POINT	Install signage to deter illegal storage and dumping of dinghies and small watercraft along foreshore in the northern sections of Primrose Park. Implement notification and removal strategies when required.										
	Implement stormwater/creekline rehabilitation projects e.g. below Grafton St; Lambert St and Churchill Cres. *										
	Work with Council's Engineering Team to implement fauna-sensitive sea-wall upgrades.										
	Investigate installation of vehicle guard rail on Matora Lane to address safety and minimise illegal dumping. *										
	Carry out improvements at the designated dinghy storage location on Folly Point to minimise degradation as needed.										
	Investigate feasibility of aerial fauna bridges across Young Street to link Primrose Park, Brightmore and Wonga Reserves. *										
	Install a gate requiring human interaction for access at the footbridge linking the sport fields to bushland to control unaccompanied dogs.										
TUNKS PARK	Investigate stormwater management measures (in consultation with the NSW Roads and Maritime Services) to address gross pollutants and erosion near the Suspension Bridge. *										

RESERVES	SPECIAL PROJECTS	SHORT TERM			MEDIUM TERM				LONG TERM		
		July 2019 – July 2022			July 2022 – July 2026				July 2026 +		
	Investigate reinstating the Tunks Park fish-way bypass.										
	Undertake additional stormwater drainage line upgrades to improve soil stability; reduce weed infestation and protect surrounding assets (e.g. off The Boulevarde; Rowlison Parade and Cambridge St). *										
WONGA RESERVE	Investigate stormwater management measures to address gross pollutants and erosion.										

Projects marked with an asterisk (*) are currently unfunded. These projects will be the subject of future Capital Works bids; external grant applications, or a combination of both.

Glossary

Assisted natural regeneration - Assisted natural regeneration interventions are often needed for sites of intermediate degradation where natural regeneration is ineffective. This may involve planting locally sourced plant material to maintain genetic integrity (in accordance with Flora Bank Guidelines) and to boost biodiversity.

Edge effects - The limited size and narrowness of bushland remnants amplify vulnerability to fragmentation and impacts from the surrounding urban environment. These impacts are collectively known as "edge effects".

Fabricated - A fabricated vegetation community is composed of native species adapted to current abiotic factors that support biodiversity and achieve habitat requirements.

Fire threshold – Most plants in NSW have adapted to a specific fire regime. This means they are able to recover (reach maturity and produce viable seed) within the time between fires for that area's fire regime. That time interval is known as the fire threshold. Changes to the fire regime impacts biodiversity, structure and function of vegetation communities. <http://www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/fire/plants-animals-and-fire>

Key Threatening Process - A threat may be listed as a key threatening process under the NSW *Biodiversity Conservation Act 2016* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* if it:

- adversely affects threatened species, populations of a species or ecological communities
- could cause species, populations of a species or ecological communities to become threatened.

In NSW, key threatening processes are managed under the Biodiversity Conservation Program or with threat abatement plans under the *Saving our Species* program.

Reconstruction - Restoration of degraded sites where the pre-existing community is reintroduced where site conditions can support the pre-existing ecosystem. This method is adopted were biotic components of an ecosystem have been removed and cannot regenerate or recolonise within feasible timeframes.

Resilience - Resilience describes the ability of bushland to regrow without assistance following disturbance. It directly relates to the presence of viable seeds and other native plant propagules in the soil, the presence and scale of factors that reduce its ability to regrow without assistance and the permanence of those factors.

Vegetation Community -

A vegetation community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. They are also known as ecological communities. Structure, composition and distribution are determined by environmental factors including climate, soil type, geology, aspect, altitude, fire frequency and water availability. Vegetation communities include different types of grasslands, woodlands, shrublands and forests. Within each type of vegetation community, native plants and animals have different roles and relationships that contribute to the healthy functioning of that community.

An ecological community may be listed as vulnerable, endangered or critically endangered under the NSW *Biodiversity Conservation Act 2016* or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* depending on the level of threat and risk of its collapse. This can occur because of a significant reduction in its distribution across regions or a decline in ecological function. The decline can occur if there is a change in community structure or composition, disruption of ecological processes, invasion by exotic species, or habitat degradation or fragmentation.