NSW NATIONAL PARKS & WILDLIFE SERVICE

Bouddi National Park

Planning Considerations

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Cover photo: Coastline view looking north to Maitland Bay. John Yurasek/DPIE

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How to use this document

This planning considerations document outlines the matters considered in preparing the Bouddi National Park Plan of Management, including the park's key values, management principles and management considerations. Further information is provided in the appendices, including an outline of relevant legislation (Appendix A) and scientific names for common names of species (Appendix B).

It is recommended that readers of this document also read the plan of management. The plan of management describes the desired outcomes for the park's values and actions that National Parks and Wildlife Service (NPWS) proposes to undertake to achieve these outcomes. It also sets out the recreational and commercial activities that are permitted in the park and any requirements to undertake these activities, including whether consent must be sought from the National Parks and Wildlife Service to undertake them.

This planning considerations document will be updated when appropriate, for example if we have new information on:

- the values of the park (e.g. new threatened species)
- management approaches (e.g. new pest management techniques)
- new programs.

Changes will only be made to this document if they are consistent with the plan of management.

Acknowledgments

National Parks and Wildlife Service acknowledges that Bouddi National Park is in the traditional Country of the Darkinjung People.

This document was prepared by staff of NPWS, part of the Department of Planning, Industry and Environment, in consultation with Hunter Central Coast Regional Advisory Committee.

Contact us

For more information or any inquiries about this document or Bouddi National Park, contact the NPWS Central Coast Area Office, Girrakool 2250 or by telephone on (02) 4320 4200

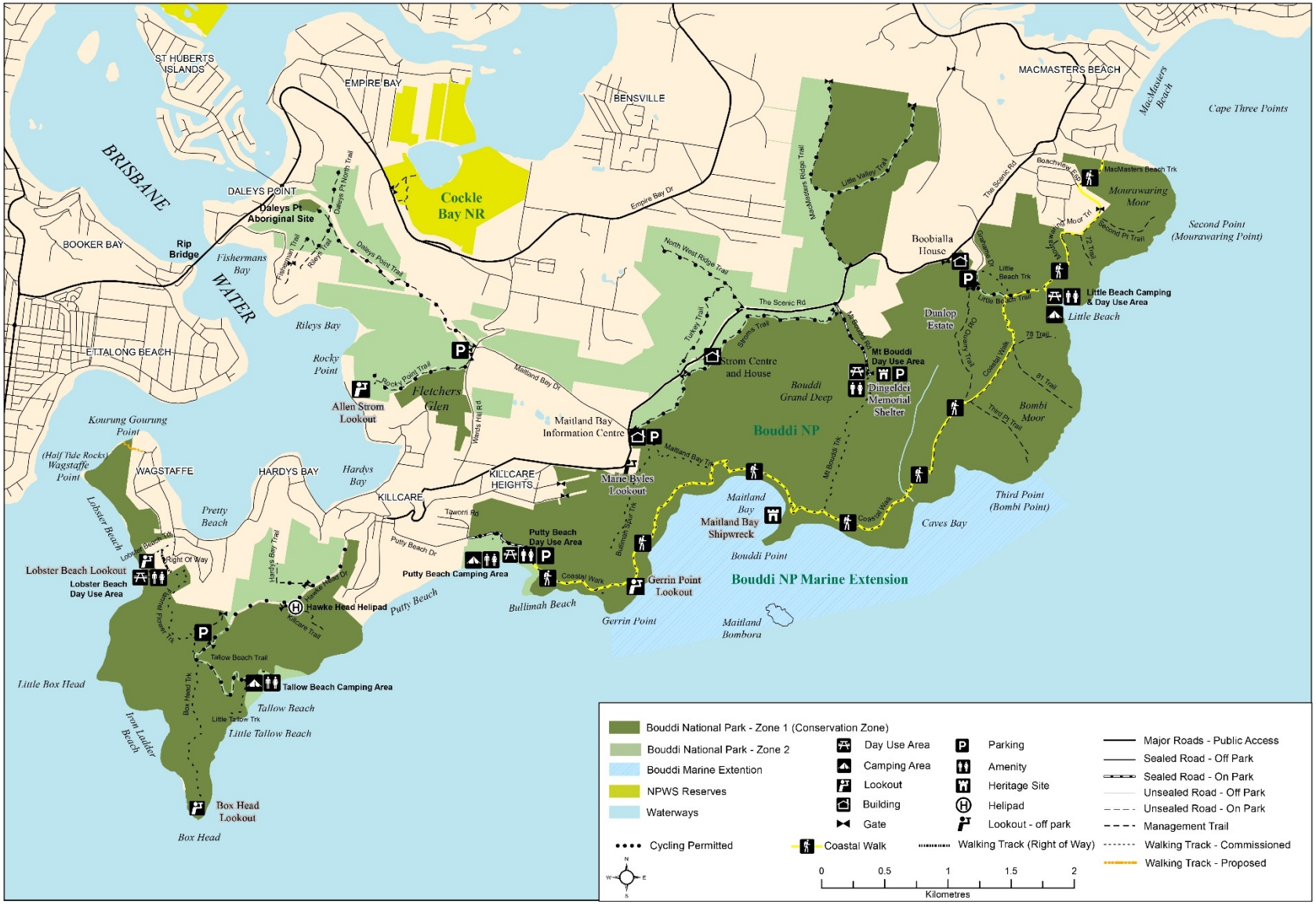

Figure 1 Map of Bouddi National Park

1. Bouddi National Park

1.1 Landscape setting

Bouddi National Park (see Figure 1) is located on the NSW Central Coast, 20 kilometres south-east of Gosford (Figure 2). The park is adjacent to low-density residential development and small semi-rural holdings in the MacMasters Beach, Bensville, Killcare Heights, Killcare, Hardys Bay, Pretty Beach, Empire Bay, Wagstaffe and Daleys Point areas.

Bouddi National Park forms the northern scenic gateway to Broken Bay, with visual links to other national parks along the Hawkesbury River and locally significant landscape features, including Box Head, Maitland Bay, Third (Bombi) Point and Second (Mourawaring) Point. It includes diverse landscapes and vegetation including beaches and steep cliffs, rainforest and heathland. The coastline in Bouddi National Park has spectacular headlands, rock platforms, bays, beaches, barrier dunes and lagoons.

The park is 1532 hectares. It covers a large portion of the Bouddi Peninsula from Wagstaffe in the west to MacMasters Beach in the north-east, and includes 18.5 kilometres of coastline and estuarine foreshore, including the intertidal zone down to mean low water mark. It also includes an area known as the 'Bouddi Marine Extension', which encompasses 287 hectares of ocean floor and overlying offshore waters between Gerrin Point and Third (Bombi) Point, including the Maitland Bombora, as shown on Figure 1.

The Bouddi Marine Extension lies in the Hawkesbury Shelf Bioregion (Commonwealth of Australia 2006). The Hawkesbury Shelf marine bioregion extends between Newcastle, Sydney and Wollongong and includes the coastline, estuaries, coastal lakes and lagoons, beaches and ocean waters out to the continental shelf.

The terrestrial portion of the park is situated within the north-east part of the Sydney Basin Bioregion (Thackway & Cresswell 1995), on the coastal fall of the Hornsby Plateau. Together with Ku-ring-gai Chase National Park, the park provides a natural gateway to Broken Bay, Brisbane Water and the Hawkesbury River.

What is the Sydney Basin Bioregion?

Australia is divided into bioregions. Bioregions are relatively large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems. Bioregions do not recognise administrative boundaries. Bioregions are characterised by climate, landform and biodiversity. The Sydney Basin Bioregion covers about 4.53% of New South Wales. It is one of the most species-diverse bioregions in Australia. This is a result of the variety of rock types, topography and climates.

The park was originally reserved in 1935 as Bouddi Natural Park, a Reserve for Public Recreation under the *Crown Lands Consolidation Act 1913*, to protect a narrow strip of land (263 hectares) from Putty Beach to MacMasters Beach. This area and 267 hectares of additional lands were dedicated as Bouddi State Park (530 hectares), one of the original areas reserved under the *National Parks and Wildlife Act 1967*.

In 1971 the park's area was expanded to include the Bouddi Marine Extension and was one of the first NSW national parks to include a marine area. The marine and terrestrial areas of Bouddi State Park became Bouddi National Park under the *National Parks and Wildlife Act 1974* on 1 January 1975. In 2002 the intertidal zone to mean low water mark was added to the park. Subsequent additions, including land from Central Coast Council's Coastal Open Space System, have increased the area of the park to its current size.

The park is located within the administrative areas of the Darkinjung Local Aboriginal Land Council, Greater Sydney Local Land Services and Central Coast Council. NSW National Parks and Wildlife Service's (NPWS) management of the Marine Extension is shared with relevant regulatory authorities — at the time of publication these were the Department of Primary Industries (DPI) – Fisheries and NSW Maritime (a division of the NSW Roads and Maritime Services).

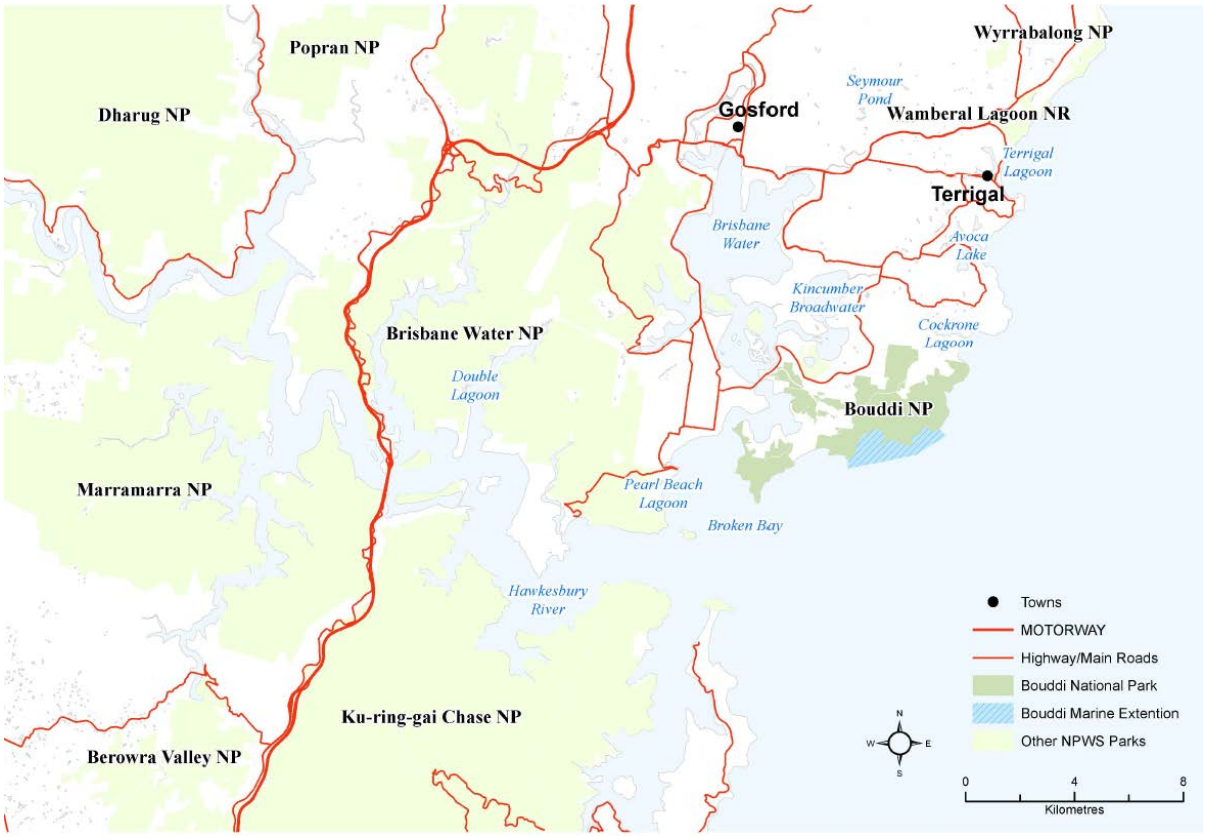

Figure 2 Location of Bouddi National Park

The area surrounding Bouddi National Park has been extensively cleared, resulting in a high loss of biodiversity and fragmentation of habitat in the region. Long-term conservation of biodiversity depends on the protection, enhancement and connection of remaining habitat across the landscape, incorporating vegetation remnants on both public and private lands. Habitat connectivity to the park has been addressed through initiatives under Central Coast Council's Coastal Open Space System and other mechanisms such as conservation agreements and wildlife refuges, but ongoing effort is required.

2. Protecting the natural environment

2.1 Geology and landform

Bouddi National Park is located within the north-east part of the Sydney Basin Bioregion, on the coastal fall of the Hornsby Plateau.

Geology and landform of the Sydney Basin Bioregion

The Sydney Basin is a geological basin filled with near-horizontal sandstones and shales of Permian to Triassic age that overlie older basement rocks of the Lachlan Fold Belt. The dominant sandstone is often referred to as Hawkesbury Sandstone, named after the

Hawkesbury River, where this sandstone is particularly common. The Sydney Basin includes uplifted landscapes in the west (such as found in Blue Mountains National Park) and coastal landscapes of cliffs, beaches and estuaries in the east (such as Bouddi National Park). Coastal cliffs are often spectacular and feature exposed 'layer cake' geology and well-developed rock platforms.

The park is part of a system of sandstone reserves protecting a representative sample of coastal landscapes including steep coastal cliffs interspersed with small sandy beaches, barrier dune systems and rock platforms. The coastal fall is characterised by rolling to steep hills and sandstone plateau outliers. The park contains several locally significant topographic points, including Maitland Bay, Box Head, Second (Mourawaring) Point and Third (Bombi) Point. Together with First (Copacabana) Point (to the east of the park), Second and Third points are collectively called Cape Three Points.

Two main sedimentary rock units dominate the surface geology of the park. In order of deposition these are the Triassic Narrabeen Group and the Middle Triassic Hawkesbury Sandstone. The Narrabeen Group comprises several subgroups and formations. The Terrigal Formation is the uppermost stratum and consists of quartz-lithic sandstone interbedded with siltstone and claystone (McDonnell 1974). It occurs extensively throughout the park and is evident on the coastal slopes and headlands. Hawkesbury Sandstone overlies the Narrabeen Group and consists of medium- to coarse-grained quartz sandstone with minor shale and laminate lenses (Dept of Mines 1966; Brunker & Rose 1967). Hawkesbury Sandstone plateau outliers are located at Box Head, Killcare Heights, North-West Ridge, Wards Hill and Mount Bouddi. Elevated dunefields of aeolian (i.e. windblown) sands occur on the Bombi Moor and Mourawaring Moor. These dunefields occur between 90 and 120 metres above sea level and have resulted from past variations in climate and sea level (Chapman & Murphy 1989).

Shale lenses in sandstone contain fossils of plants, fish and amphibians. In the late 1970s part of the lower jaw (mandible) of a very large labyrinthodont (extinct amphibian), a large crocodile-like amphibian up to three metres in length was excavated and collected by the Australian Museum from a rock platform at Little Beach. The fossil is from the Terrigal Formation and is Early to Middle Triassic in age, about 250 to 135 million years old (Jones 2013). The park's landscape is also characterised by interesting coastal landform features including the stratigraphy of Killcare Headland, tessellated or tile-like pavements, honeycomb weathering and circular mineral patterns (known as Liesegang rings). Examples of these features can be found along the Bouddi Coastal Walk.

Soils on the Hawkesbury Sandstone include those from the Gymea, Lambert and Hawkesbury soil landscape classifications (Chapman & Murphy 1989). They are generally shallow, stony, of low fertility and considered to be a high erosion hazard. A plateau of iron-rich lateritic soils occurs at Killcare Heights. Lateritic soils are described as the Somersby soil landscape and are characterised by the presence of a layer of ironstone gravel overlying a pallid, clayey zone of iron depletion.

The soils derived from the Narrabeen Group tend to be finer grained, deeper and slightly more fertile than Hawkesbury-derived soils. These soils are part of the Erina and Watagan soil landscapes and are highly susceptible to erosion when disturbed (Chapman & Murphy 1989). Aeolian deposits include both the North Head (perched sand dunes) and Tuggerah (hind dunes) soil landscapes. Both sand deposits are nutrient-poor and suffer from wind and water erosion when disturbed. The latter is also affected by localised flooding and permanently high water tables.

Along major watercourses and estuarine foreshores there are quaternary alluvium soils consisting of unconsolidated sands, silts, clays and gravels of the Cockle Bay soil landscape. These soils are prone to severe sheet and rill erosion when disturbed. On the beaches and coastal foredunes, there are sands classified as the Narrabeen soil landscape. These areas are of low soil fertility and are extremely vulnerable to wind and wave action.

Extensive clearing for residential development in the area has affected various soil-related problems including landslips, flooding, erosion and sedimentation of drainage systems. Some sites within the park have experienced erosion as a result of previous vehicle use and infrastructure (Wards Hill Road) and fire (near Taworri Road).

The seabed adjoining the oceanic coastline of Bouddi National Park is dominated by a rocky reef system that is shallow and continuous to the shore and extends at least one kilometre offshore. This reef includes the Maitland Bombora (also known as Eastern Reef). The reef is generally continuous from MacMasters Beach in the north to Putty Beach in the south, the only discontinuities being unconsolidated sediments around Little Beach. Further west, Putty, Tallow and Lobster beaches are dominated by shallow and intermediate soft sediments (DECCW 2010a). The main beaches in the park are characterised as intermediate energy beaches. They include variable configurations of bars and rips with medium-grained sands and moderately sloped beach faces (Short 2007).

Bouddi National Park protects several small catchments each with intermittent watercourses, and two semi-permanent coastal lagoons at Putty Beach and Maitland Bay. From the central ridgeline of the Bouddi Peninsula, creeks flow east towards the ocean and west into the Brisbane Water estuary.

Photo 1 Above left and right: Tessellated pavement. DPIE

In the 1960s, heavy mineral sand mining took place on Putty Beach and Tallow Beach before they became part of the park. Subsequent dune restoration altered the natural sand dune contours and vegetation succession and introduced the weed bitou bush into the park. At Little Beach, a 50-hectare area west of Bombi Moor (known as Dunlop Estate) was mined for sand in the 1960s.

The soils of the park have naturally high erosion potential and sand mining sites and other previously disturbed areas are particularly susceptible to erosion. There is also some unauthorised use of management trails and walking tracks by trail bikes and cyclists on mountain bikes, which is causing erosion on some sections. Informal tracks created by walkers and cyclists are often poorly sited and also subject to erosion (see Section 4).

Residential development along The Scenic Road appears to have resulted in disturbance to the water quality and hydrology of many of the park's catchments. There are three catchments in the park that are relatively unaffected by surrounding development (Maitland Bay, Rileys Bay and Tallow Beach), although the latter has been disturbed through previous sand mining operations.

Stormwater and sewage runoff from neighbouring lands reduces water quality and catchment values. In the park, toilet facilities are provided at Putty Beach, Little Beach, Tallow Beach, Lobster Beach and Mount Bouddi day use areas, and some of these may also pose a pollution risk.

2.2 Plants and animals

2.2.1 Native plants

The park is within the Wyong and Pittwater subregions of the Sydney Basin Bioregion and the Central Coast botanical division. The Central Coast botanical division covers the area between Lake Macquarie and the Shoalhaven River. Rainforests of relatively low species diversity occur in the moister or more sheltered sites and eucalypt forests are widespread. Areas of nutrient-poor sandstone, for example, Hawkesbury Sandstone, characteristically support hard-leaved, shrubby vegetation with many species (McCauley 2006).

The vegetation of the Bouddi Peninsula has been documented by various authors, including:

- a number of studies on the ecology of coastal heath communities (Siddiqi 1971; Siddiqi, Carolin & Anderson 1972; Siddiqi & Carolin 1976; Siddiqi, Carolin & Myerscough 1976)
- some park-specific vegetation surveys (Strom 1986; McRae 1990; Payne 1997; Kelly 2003)
- a number of regional vegetation studies that included the park (Benson 1986; Benson & Howell 1994; Bell 2004, 2009).

Over 600 plant species within 22 vegetation communities have been recorded within the park.

The vegetation of the park includes a variety of structural forms including saltmarsh, grassland, heath, woodland, shrubland, rainforest and open and closed forest communities. Of the 22 vegetation communities found in the park, eight have been identified as threatened ecological communities under the *Biodiversity Conservation Act 2016*. A further two communities demonstrate floristic similarities to threatened ecological communities and so, for management purposes, are treated as regionally significant (see Table 1). Further investigation to confirm whether or not they meet the criteria for those threatened communities is required. The park's vegetation communities are described in Appendix C.

Table 1 Vegetation communities in the park
(ordered from greatest area in the park to least area in the park)

Vegetation community	Equivalent threatened ecological community (BC Act, short title)
Narrabeen Coastal Blackbutt Forest	
Coastal Narrabeen Moist Forest	
Coastal Headland Shrubland	
Coastal Sand Wallum – Heath	*Possibly* Eastern Suburbs Banksia Scrub CEEC [1]
Coastal Headland Low Forest	
Coastal Sand Apple – Blackbutt Forest	
Bouddi Sandstone Coastal Heath	
Wagstaffe Spotted Gum – Ironbark Forest	Pittwater and Wagstaffe Spotted Gum Forest EEC
Coastal Warm Temperate Rainforest	Lowland Rainforest EEC
Killcare Hawkesbury Woodland	*Possibly* Duffys Forest Ecological Community EEC [1]
Coastal Narrabeen Ironbark Forest	
Exposed Hawkesbury Woodland	
Coastal Sand Banksia Scrub	

Vegetation community	Equivalent threatened ecological community (BC Act, short title)
Coastal Headland Grassland	Themeda Grassland on Seacliffs and Coastal Headlands EEC
Coastal Sand Foredune Scrub	
Coastal Headland Gully Scrub	Littoral Rainforest [2]
Swamp Mahogany – Paperbark Forest	Swamp Sclerophyll Forest on Coastal Floodplains EEC
Estuarine Swamp Oak Forest	Swamp Oak Floodplain Forest EEC
Estuarine Saltmarsh/Grassland	Coastal Saltmarsh EEC [3]
Hawkesbury Banksia Scrub – Woodland	
Phragmites Rushland	Freshwater Wetland on Coastal Floodplains EEC
Estuarine Mangrove Scrub	

Source: Bell 2004, 2009.

BC Act = Biodiversity Conservation Act; CEEC = critically endangered community under BC Act; EEC = endangered community under BC Act.

1 Regionally significant communities, not currently recognised as a community listed under either BC Act or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

2 Equivalent to Littoral Rainforest and Coastal Vine Thickets of Eastern Australia which is listed as critically endangered under EPBC Act.

3 Equivalent to Subtropical and Temperate Coastal Saltmarsh which is listed as vulnerable under EPBC Act.

The Narrabeen substrate supports a range of forest communities with rainforest in sheltered gullies, moist forest on southern aspects and open forest on drier slopes. Along the coastline, the Narrabeen series supports lower vegetation communities with woodland on the main ridge and exposed slopes, heath on headlands and windy slopes, and grassland on exposed sites below cliffs. The Hawkesbury Sandstone outcrops support woodland and low shrubland on windswept ridges. The elevated dune fields found on Bombi and Mourawaring moors support closed heath and low woodland.

The dominant vegetation communities are Narrabeen Coastal Blackbutt Forest (19%) and Coastal Narrabeen Moist Forest (17%). There are also relatively large areas of Coastal Headland Shrubland (13%), Coastal Sand Wallum – Heath (10%) and Coastal Headland Low Forest (9%).

Small patches of estuarine vegetation are found on alluvial mudflats including mangroves, saltmarsh, rushland and swamp oak forest. The larger beaches are backed by simple sand dune systems with spinifex, prostrate wattle and honeysuckle banksia. The marine habitats in the park include algae-dominated fringe habitats and kelp forests.

A remnant of Killcare Hawkesbury Woodland occurs at Killcare Heights on laterite soils. This vegetation type is poorly represented within the park and has been extensively cleared off-park for agriculture (Bell 2004, 2009). Some of the exposed coastal headlands of the park (Mourawaring Moor, Bombi Moor and Putty Beach Headland) support an extremely fragile open clay heath plant community dominated by sparse clusters of stunted vegetation. These small areas are vulnerable to damage from trampling, disturbance and erosion. Measures are required to protect these areas from inappropriate use.

There are five threatened plant species recorded in the park (see Table 2).

Photo 2 **Smooth-barked apple. DPIE**

Table 2 **Threatened plants in the park**

Common name	Scientific name	Status	
		BC Act	EPBC Act
Biconvex paperbark	*Melaleuca biconvexa*	Vulnerable	Vulnerable
Magenta lilly pilly	*Syzygium paniculatum*	Endangered	Vulnerable
Netted bottle brush	*Callistemon linearifolius*	Vulnerable	
Scrub turpentine	*Rhodamnia rubescens*	Critically endangered	
Tranquillity mint-bush	*Prostanthera askania*	Endangered	Endangered

BC Act = Biodiversity Conservation Act; EPBC Act = Environment Protection and Biodiversity Conservation Act.

A number of other species of conservation significance are known from the park. The wrinkled kerrawang is listed as a rare or threatened Australian plant (ROTAP) (Briggs & Leigh 1996). River mangrove and grey mangrove are protected marine vegetation under the *Fisheries Management Act 1994*. The following species are also considered to be regionally significant (Benson 1986; Benson & Howell 1994; Payne 2001; Bell 2004, 2009): bearded tylophora, brown stringybark, a daisy (*Olearia nernstii*), forest maple, hard fern, howittia, large-fruited red mahogany, leafy wedge pea, native ginger, native violet, shining grape, silkpod, small supplejack, snow wood and a wattle (*Acacia quadrilateralis*).

2.2.2 Native animals

Bouddi National Park protects important coastal habitat for native animals on the NSW Central Coast. The diversity of habitats in the park supports populations of 275 native vertebrate species: 135 bird species, 49 mammals (including five marine mammals), 30 reptiles, 11 frogs and over 50 fish. Of these, 34 species are listed as threatened under the Biodiversity Conservation Act (see Table 3).

Table 3 Threatened animals in the park

Common name	Scientific name	Status	
		BC Act	EPBC Act
Frogs			
Red-crowned toadlet	*Pseudophryne australis*	Vulnerable	
Birds			
Barking owl	*Ninox connivens*	Vulnerable	
Black-browed albatross	*Thalassarche melanophris*	Vulnerable	Vulnerable
Bush stone-curlew	*Burhinus grallarius*	Endangered	
Eastern osprey	*Pandion cristatus*	Vulnerable	
Flesh-footed shearwater	*Ardenna carneipes*	Vulnerable	
Gang-gang cockatoo	*Callocephalon fimbriatum*	Vulnerable	
Glossy black-cockatoo	*Calyptorhynchus lathami*	Vulnerable	
Little lorikeet	*Glossopsitta pusilla*	Vulnerable	
Little tern	*Sterna albifrons*	Endangered	
Masked owl	*Tyto novaehollandiae*	Vulnerable	
Pied oystercatcher	*Haematopus longirostris*	Endangered	
Powerful owl	*Ninox strenua*	Vulnerable	
Regent honeyeater	*Anthochaera phrygia*	Critically endangered	Endangered
Sooty owl	*Tyto tenebricosa*	Vulnerable	
Sooty oystercatcher	*Haematopus fuliginosus*	Vulnerable	
Spotted-tailed quoll	*Dasyurus maculatus*	Vulnerable	
Swift parrot	*Lathamus discolor*	Endangered	Critically endangered
Varied sittella	*Daphoenositta chrysoptera*	Vulnerable	
Wandering albatross	*Diomedea exulans*	Endangered	Endangered
White-bellied sea-eagle	*Haliaeetus leucogaster*	Vulnerable	
Mammals			
Eastern bentwing-bat	*Miniopterus schreibersii oceanensis*	Vulnerable	
Eastern false pipistrelle	*Falsistrellus tasmaniensis*	Vulnerable	
Eastern freetail-bat	*Mormopterus norfolkensis*	Vulnerable	
Golden-tipped bat	*Kerivoula papuensis*	Vulnerable	

Common name	Scientific name	Status	
Greater broad-nosed bat	*Scoteanax rueppellii*	Vulnerable	
Grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable	
Koala	*Phascolarctos cinereus*	Vulnerable	
Large-eared pied bat	*Chalinolobus dwyeri*	Vulnerable	Vulnerable
Little bentwing-bat	*Miniopterus australis*	Vulnerable	
Squirrel glider	*Petaurus norfolcensis*	Vulnerable	
Yellow-bellied glider	*Petaurus australis*	Vulnerable	
Yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*	Vulnerable	
Humpback whale	*Megaptera novaeangliae*	Vulnerable	
Southern right whale	*Eubalaena australis*	Endangered	

BC Act = Biodiversity Conservation Act; EPBC Act = Environment Protection and Biodiversity Conservation Act.

The koala and spotted-tailed quoll were previously known from the area but have not been recorded for several years. Offshore birds, such as the wandering albatross (listed as endangered under the Biodiversity Conservation Act and vulnerable under the Environment Protection and Biodiversity Conservation Act) and flesh-footed shearwater (listed as vulnerable under the Biodiversity Conservation Act) have also been recorded in the park, however, they do not rely on the habitat in the park.

Eleven species of amphibians have been recorded, including the threatened red-crowned toadlet. This species occupies drainage lines within the park and is sensitive to impacts from fire, trail maintenance and pollution.

The coastal headlands of the park provide important habitat for many locally restricted bird species, such as the peregrine falcon, brush bronzewing, tawny-crowned honeyeater, southern emu-wren, eastern reef egret and white-throated needletail. The eastern reef egret, white-throated needletail, caspian tern, fork-tailed swift, short-tailed shearwater, wandering albatross and white-bellied sea-eagle are all listed migratory species under the Environment Protection and Biodiversity Conservation Act. The park also provides potential breeding habitat for little penguins, particularly on the scree slopes of Box Head.

Four species of large forest owls (masked, sooty, barking and powerful) have been recorded within the park in areas of mature forest and woodland that support tree hollows, which are essential for nesting. As top-order predators, they play an important role in the functioning of forest ecosystems.

The mammal diversity of the park is regionally significant, with 49 native mammal species being recorded. Terrestrial mammal diversity is well represented by the bats, including 18 species of insectivorous micro-bats, and a variety of small ground mammals including bandicoots, rodents and carnivorous marsupials. However, most of the medium to large native animals have declined in abundance. The variety of age and structure of vegetation types provides particularly important habitat for many mammal species. Some resident animal species, such as the yellow-bellied glider, are also reliant on the retention of suitable habitat and habitat corridors outside the park for their long-term survival.

Box 1. Bouddi Marine Extension

The marine environment of Bouddi National Park contains a diversity of ecosystems and habitats that support a variety of marine species, including rocky reefs of urchin-grazed sand barrens and sponge-dominated reefs. The Bouddi Marine Extension is frequented by a variety of marine animals including whales, seals and turtles. In winter, humpback whales (listed as vulnerable under the Biodiversity Conservation Act and Environment Protection and Biodiversity Conservation Act) and southern right whales (listed as endangered under those Acts) visit the park during their annual migration. Occasionally seals haul out on beaches and rock platforms to rest. Threatened birds such as pied oystercatchers, sooty oystercatchers, osprey and migratory waders utilise the resource-rich estuarine and coastal environments.

Maitland Bay seaweed

The marine habitats present in the park support a wide diversity of reef fish species including blue groper, red morwong and blackfish (Gladstone 2004). Fish in the Bouddi Marine Extension have been protected since 1973 by a temporary fishing closure declared under the Fisheries Management Act. This closure prohibits the taking of fish, worms, nippers, shellfish and crustaceans of every description, by any method, and is periodically reviewed.

Research (Gladstone 2004) has found that exclusion of fishing from Bouddi Marine Extension has led to increases in fish species richness, density, biomass and length, compared to areas outside. The protected Maitland Bay rock platform also supports a high diversity of marine invertebrates, including several locally rare molluscs and ascidians (Gladstone et al. 2007).

The temporary fishing closure is reviewed periodically (approximately every five years) and has been renewed at each review. There has been discussion about a proposed marine park for the Hawkesbury Shelf Bioregion, which included a sanctuary zone at Bouddi. A sanctuary zone would allow for permanent protection and management arrangements within the Marine Extension. Improved coordination between NPWS, DPI Fisheries and Roads and Maritime Services is needed to assist in managing illegal fishing and boating activities in the Marine Extension. The boundaries of Bouddi Marine Extension have not been identified in situ with boundary markers and buoys.

2.2.3 Programs to protect threatened species

Strategies for the recovery of threatened species, populations and ecological communities have been set out in a statewide *Biodiversity Conservation Program* (OEH 2017). These actions are currently prioritised and implemented through the *Saving our Species* (SoS) program, which aims to maximise the number of threatened species that can be secured in the wild in New South Wales for 100 years (OEH 2013a). Other biodiversity related actions will be implemented through relevant departmental biodiversity and wildlife strategies.

Individual recovery plans may need to be prepared for threatened species listed under the Environment Protection and Biodiversity Conservation Act, and some recovery plans were previously prepared for some species listed in New South Wales to consider management needs in more detail. There is a national recovery plan for magenta lilly pilly, an approved NSW recovery plan for tranquillity mint-bush and approved conservation advice under the Environment Protection and Biodiversity Conservation Act for biconvex paperbark. Recovery plans have been prepared for yellow-bellied glider, little tern, barking owl and the large forest owls (powerful, sooty and masked owls). A national recovery plan has been prepared for the regent honeyeater.

The tranquillity mint-bush has been assigned to the site-managed species stream under the SoS program. Key management sites for this threatened species have been identified under the SoS program. Currently, there are four management sites identified including a site within Bouddi National Park. Management and monitoring actions are being implemented to ensure the population is sustained with the aim to minimise impacts from recreational activities and reduce and maintain weed levels at low densities.

2.2.4 Weeds and pest animals

Weeds and pests are plants, animals and pathogens that have negative environmental, economic and social impacts and are most commonly introduced species. An introduced species is defined in this plan as any plant or animal species not native to the park. Pests and weeds negatively impact a range of park values, including biodiversity, cultural heritage, and catchment and scenic values.

The *Biosecurity Act 2015* and its regulations provide specific legal requirements for the response, management and control of biosecurity risks, including weeds and pest animals. These requirements apply equally to public lands and privately owned land. Under this framework, Local Land Services (LLS) has prepared regional strategic weed and pest animal management plans for each of its 11 regions, including the Greater Sydney Region.

The *Greater Sydney Strategic Weed Management Plan* (Greater Sydney LLS 2017) and *Greater Sydney Strategic Pest Management Plan* (Greater Sydney LLS 2018) identify priority weeds and pest animals for the region, plus the appropriate management response for the region (i.e. prevention/alert, eradication, containment or asset protection).

NPWS prepares pest management strategies that identify the operations and control actions undertaken by NPWS to meet the priorities from regional strategic pest and weed management plans (OEH 2012a). The NPWS strategies also include other important programs such as the *Biodiversity Conservation Program* (see Sections 2.2.1 and 2.3.1).

The overriding objective of the NPWS pest management strategies is to minimise adverse impacts of introduced species on biodiversity and other park and community values while complying with legislative responsibilities. These strategies are regularly updated. Reactive programs may also be undertaken in cooperation with neighbouring land managers, particularly in response to emerging issues.

Over 100 introduced plant species have been recorded within the terrestrial part of the park. The high number of weed species in the park is largely the result of past land uses such as mining and land clearing, proximity to residential development and soil disturbance. Populations and distribution of weeds need to be monitored and appropriate treatment applied as required.

Although weeds are found generally throughout the park, the main weed infestations are asparagus ferns, bitou bush, lantana, bridal creeper, camphor laurel, cassia, privets, blackberry, crofton weed, morning glory and honeysuckle.

An emerging weed for the park is sea spurge, which has been found at Maitland Bay and Putty Beach in small numbers and is a priority weed under the *Greater Sydney Regional Strategic Weed Management Plan*. Other significant environmental weeds within the park include ochna, turkey rhubarb and black-eyed susan.

In contrast, there is limited information on weed species in the marine parts of Bouddi National Park, including the Bouddi Marine Extension. Invasive aquatic weeds may be present, especially aquarium caulerpa, which has been detected in Brisbane Water.

An integrated approach to weed management within the terrestrial parts of the park uses a range of techniques at critical times of the year, often targeting more than one species. Methods include physical removal, herbicide use including aerial spray programs, fire, biological control and revegetation. Key weed control programs include bush regeneration undertaken by NPWS staff, volunteers, contractors funded through external grants and students through government employment initiatives. Site-specific plans may be developed to guide control programs and monitoring programs that focus on the conservation of threatened ecological communities and threatened species and improving the amenity of core recreation areas. Site-specific weed management plans are in place for the priority areas of Rileys Bay, Lobster Beach and Mourawaring Moor and will be prepared for other priority areas, including Maitland Bay and Tallow Beach.

Box 2: Bitou bush and lantana – priority control

Bitou bush and lantana are listed as Weeds of National Significance. Invasion by bitou bush and lantana leads to a decline in the species diversity of affected plant communities, and the fauna that depend on them, and both are listed as key threatening processes under the Biodiversity Conservation Act (NSW SC 1999). They readily invade a wide variety of disturbed and undisturbed coastal plant communities, out-competing native vegetation.

Bitou bush was originally planted to reduce dune erosion, but spread rapidly. Established infestations are widespread throughout the park, with highest densities occurring in previously disturbed areas (sand mining), moist gullies and along cliff lines where access and control are difficult. Invasion by bitou bush threatens threatened ecological communities (in particular Themeda Grassland on Seacliffs and Coastal Headlands, and Lowland Rainforest), locally rare plants (e.g. wrinkled kerrawang) and habitat for native animals, including threatened species.

Lantana is widespread throughout the park, also impacting on Themeda Grassland and Lowland Rainforest threatened ecological communities, threatened plants (tranquillity mint-bush and biconvex paperbark) and the habitat of native animals including threatened species. A national *Plan to Protect Environmental Assets from Lantana* (Biosecurity Queensland 2010) has been developed, which establishes national conservation priorities for the control of lantana. It identifies the research, management and other actions needed to ensure the long-term survival of native species and ecological communities affected by the invasion of lantana.

Management of bitou bush and lantana will be guided by the relevant key threatening process strategies.

Myrtle rust is a plant disease caused by the fungus *Austropuccinia psidii.* It was first detected on the NSW Central Coast in 2010 and is now established along the NSW coast from the Shoalhaven River north into Queensland. It is widely distributed within the Central Coast Local Government Area and is considered to pose a threat to the park's biological values.

Myrtle rust infects young, actively growing shoots, leaves, flower buds and fruits of plants in the family Myrtaceae. The spores of myrtle rust are spread by wind, animals and human activity. It was first identified in the park in December 2012, affecting mainly scrub turpentine. Other genera of the Myrtaceae family recorded within the park include *Acmena*, *Angophora*, *Backhousia*, *Baeckea*, *Callistemon*, *Calytrix*, *Corymbia*, *Eucalyptus*, *Euryomyrtus*, *Harmogia*, *Kunzea*, *Leptospermum*, *Melaleuca*, *Syncarpia*, *Syzygium* and *Tristaniopsis*.

The *Management Plan for Myrtle Rust on the National Parks Estate* (OEH 2011c) outlines how myrtle rust will be managed. Regional priorities are implemented through the pest management strategy on national park estate. It incorporates strategies to limit the spread of myrtle rust and minimise impacts on threatened species and ecological communities. Scrub turpentine, recently listed as critically endangered under the Biodiversity Conservation Act, is the only Myrtaceae species currently affected in the park and opportunistic monitoring indicates that myrtle rust is killing the majority of known specimens.

Box 3: Pest animal priority control – red fox

Fox monitoring, Bouddi National Park

The red fox is a regional priority for control (Greater Sydney LLS 2018) due to impacts on the biodiversity values of the park, neighbouring landholders and domestic stock. Foxes suppress native animal populations, particularly medium-sized ground-dwelling and semi-arboreal mammals, ground-nesting birds and freshwater turtles. Foxes have also been implicated in the spread of weeds such as bitou bush and blackberry and have been known to prey on poultry on neighbouring properties.

Predation by the red fox is a key threatening process listed under the Biodiversity Conservation Act (NSW SC 1998) and Environment Protection and Biodiversity Conservation Act (DoE 2009). Management of foxes will be guided by the relevant key threatening processes strategy.

Foxes occur as widespread populations across the park and also in the surrounding rural and urban areas. Native species most likely to be impacted in the park include small mammals, birds and frogs. A cooperative landscape fox control program has been implemented in the park in conjunction with Central Coast Council.

The red fox is currently the only significant pest animal in the park. Deer numbers in the area are increasing and this is an emerging threat to the park. Several other vertebrate pest species occur in relatively small numbers in the park and have only relatively minor impacts. These include cat, goat, rabbit, black rat, house mouse, common myna, mallard, spotted turtle-dove, pigeon and the common starling.

Pest species that are also key threatening processes may be managed under the *Biodiversity Conservation Program* where it includes strategies for them. The SoS program has developed targeted strategies for managing key threatening processes using the best available information to minimise current and future impacts of key threatening processes on priority biodiversity values, including threatened species and ecological integrity.

Appendix D lists pest animal and weed species which are known to occur in the park, as well as the status of each species.

Box 4: Fire in the park

The fire history of the park has been well documented since 1968 and indicates that the majority of the park (except Bouddi Grand Deep) has experienced fire during this period. Three wildfires, in 1968, 1974 and 1976, together burnt most of the park. The 1968–69 fire season was the most significant, with approximately 70% of the park being burnt in one fire event.

Fires, particularly extensive wildfires, are a particular risk for the park. Several gullies within the park (Bouddi Grand Deep, Fletchers Glen, Iron Ladder catchment, and eastern aspects along MacMasters Ridge) support significant areas of Lowland Rainforest Endangered Ecological Community. This vegetation is extremely sensitive to impacts from fire and, where possible, fire will be excluded from these areas.

Grass trees (*Xanthorrhoea*) on fire (left) and regenerating post-fire (right)

A fire management strategy that defines the fire management approach for the park has been prepared (DECC 2008). It guides protection of the natural and cultural assets in and adjacent to the park. It also outlines the recent fire history of the park, key assets within and adjoining the park, including sites of natural and cultural heritage value, fire management zones and fire control advantages such as management trails, asset protection zones and water supply points. The strategy includes biodiversity thresholds of at least 2 years between fires in the Coastal Headland Grasslands, and between 6 and 35 years for the remaining communities, except Coastal Narrabeen Moist Forest which has a threshold of 25 to 60 years and estuarine and rainforest communities where fire should be avoided.

NPWS maintains cooperative arrangements with surrounding landowners and the Rural Fire Service and is a member of the Central Coast Bush Fire Management Committee.

2.2.5 Fire

The primary objectives of NPWS fire management are to protect life, property, community assets and cultural heritage from the adverse impacts of fire, while also managing fire regimes in parks to maintain and enhance biodiversity. NPWS also assists in developing fire management practices that contribute to conserving biodiversity and cultural heritage across the landscape and implements cooperative and coordinated fire management arrangements with other fire authorities, neighbours and the community (OEH 2013b).

Fire is a natural feature of many environments and is essential for the survival of some plant communities. However, inappropriate fire regimes can lead to loss of particular plant and animal species and communities, and high-frequency fires is now listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2000a).

2.2.6 Climate change

Human-induced climate change has been listed as a key threatening process under the Biodiversity Conservation Act (NSW SC 2000b) and the associated loss of habitat is listed on the Environment Protection and Biodiversity Conservation Act (TSSC 2001).

The latest information on projected changes to climate are from the NSW and ACT Regional Climate Modelling ('NARClim') project (OEH 2014). The climate projections for 2020–2039 are described as 'near future' and projections for 2060–2079 are described as 'far future'. The snapshot shown in Table 4 is for the Hunter Central Coast Branch which includes Bouddi National Park (OEH 2014).

Table 4 Central Coast climate change snapshot

Projected temperature changes	
Maximum temperatures are projected to **increase** in the near future by 0.3–1.0°C	Maximum temperatures are projected to **increase** in the far future by 1.4–2.5°C
Minimum temperatures are projected to **increase** in the near future by 0.4–0.8°C	Minimum temperatures are projected to **increase** in the far future by 1.4–2.5°C
The number of hot days (i.e. > 35°C) will **increase**	The number of cold nights (i.e. < 2°C) will **decrease**
Projected rainfall changes	
Rainfall is projected to **decrease** in spring and winter	Rainfall is projected to **increase** in summer and autumn
Projected Forest Fire Danger Index changes	
Average fire weather is projected to **increase** in summer and spring	Severe fire weather days are projected to **increase** in summer and spring

Source: OEH 2014.

The projected increases in temperature, number of hot days and severe fire weather days (OEH 2014) are likely to influence bushfire frequency and intensity across the Hunter Central Coast Branch and the fire season is likely to be extended (DECCW 2010b). Higher rainfall in summer and autumn will lead to more frequent flooding of low-lying areas, and increased erosion and sediment-shedding from the hinterland (DECCW 2010b). Potential risks within the park are damage to infrastructure in low-lying areas at Putty Beach and Little Beach and erosion and slumping at Lobster Beach.

Climate change may significantly affect biodiversity by changing the size of populations and the distribution of species and altering the geographical extent and species composition of

habitats and ecosystems. Species most at risk are those unable to migrate or adapt, particularly those with small population sizes or with slow growth rates.

The potential impact of climate change on the park is difficult to assess since it depends on the compounding effects of other pressures, particularly barriers to migration and pressure from introduced animals. Low-lying coastal ecosystems and fragmented ecosystems are at highest risk.

NPWS will continue to manage threats to park values from climate change in a collaborative way with other land managers and park neighbours. Programs to reduce the pressures arising from other threats, such as habitat fragmentation, invasive species, bushfires and pollution, will help reduce the severity of the effects of climate change.

2.2.7 Research

The diversity of the natural and cultural values of Bouddi National Park and the Bouddi Marine Extension provide excellent opportunities for field-based research. The majority of previous studies have focussed on the ecology, status and distribution of plant and animal species and communities, Aboriginal sites and water quality. More recently, studies have concentrated on biodiversity and the impact of threatening processes (such as fire, weeds and pest animals), with greater emphasis on management responses.

Research in the Bouddi Marine Extension and the intertidal zone supports the biodiversity conservation benefits attributed to marine protected areas, especially for fish and rock platform invertebrates. There has been extensive research into the diversity of fish and invertebrate species in rocky reef and rocky shore habitats within the marine and intertidal sections of Bouddi National Park.

Research opportunities in the park were enhanced through the opening of the Strom Centre in 2007. The centre is the former property of the late Allen and Beryl Strom who were local conservationists, environmental educators and historians. The property was bequeathed to NPWS on the condition that it ‘be developed and used as a centre for the administration and management of Bouddi National Park and for housing educational resources including the deceased’s collection of papers, photographs and other material relating to Bouddi National Park and its surrounds’. The centre facilitates research, environmental education and fieldwork that support the management of the park. Resource information regarding the park is available to the general public (by appointment) at the Strom Centre.

Photo 3 Red-crowned Toadlet, *Pseudophryne australis*. DPIE

3. Looking after our culture and heritage

Both Aboriginal and non-Aboriginal people place values on cultural and natural landscapes. These values may be attached to the landscape as a whole, or to parts of the landscape (e.g. a particular plant, animal or place). All landscapes contain the imprint of human use. On any given area of land, some historical activity will have taken place. Much of the Australian environment has been influenced by past Aboriginal and non-Aboriginal land-use practices, and people continue to influence the land through residential development, agriculture, recreational use, cultural practices, the presence of introduced plants and animals and in some cases air and water pollution.

3.1 Aboriginal culture and heritage

The Central Coast is the traditional Country of the Darkinjung Aboriginal People. The Darkinjung People occupied land to the north of the Hawkesbury River and to the west of Mooney Mooney Creek.

> **What is 'Country'?** To Aboriginal people, the landscape is made up of many features that are interrelated. These include land, water, plants and animals, places and stories, historical and current uses, and people and their interactions with each other and place. These features are central to Aboriginal spirituality and contribute to Aboriginal identity. They are inseparable and make up what is known as 'Country'.

Aboriginal communities have an association with and connection to the land. Aboriginal communities associate natural resources with the use and enjoyment of foods and medicines, caring for the land, passing on cultural knowledge, kinship systems and strengthening social bonds. Aboriginal heritage and connection to nature are inseparable and need to be managed in an integrated manner across the landscape.

Bouddi is the Aboriginal name for the eastern headland of Maitland Bay and gives the park its name. The origin of the word is uncertain and has multiple possible meanings including 'nose', 'the heart' and 'water breaking over rocks' (Strom 1986). Other Aboriginal place names used in the area include Bombi Trig, Bullimah, Gerrin Point, Kourung Gourung Point and Mourawaring Head (a variant name for Second Point).

Aboriginal sites provide a valuable insight into Aboriginal peoples' traditional lifestyles, and interactions with the environment. The Aboriginal heritage within the park is important to present-day Aboriginal people.

> **Aboriginal sites** are places with evidence of Aboriginal occupation or places that are related to other aspects of Aboriginal culture. They are important as evidence of Aboriginal history and as part of the culture of local Aboriginal people.

Over 70 Aboriginal sites containing more than 200 objects have been recorded in the park and nearby areas, and other sites are almost certain to exist. Aboriginal occupation is evident in the form of open middens and camp sites, rock engravings, grinding grooves, rock shelters with art (charcoal and pigment drawings, stencils and paintings) and other archaeological deposits. Figures commonly depicted in the art include humans, marine animals, kangaroos and wallabies.

Photo 4 Grinding grooves, Daleys Point. DPIE

Vinnicombe (1980) carried out a detailed study of Aboriginal sites on the Bouddi Peninsula. The Hardys Bay, Pretty Beach, Rileys Bay and Fishermans Bay catchments facing Brisbane Water have the highest concentration of Aboriginal sites in the park. Evidence of Aboriginal usage of estuarine and open coastal environments is reflected in the different species of shellfish found in middens.

The Aboriginal site at Daleys Point is particularly important as it provides concentrated evidence of long-term Aboriginal occupation.

Vandalism of Aboriginal sites in the park has occurred. Protection measures such as interpretation, education and access barriers have been implemented. An effective way to protect sites from vandalism is not to publicise their location. Sites are also subject to natural erosion and the unintentional impacts of human activity.

Although the NSW Government has legal responsibility for the protection of Aboriginal sites, it acknowledges the right of Aboriginal people to make decisions about their own heritage. Aboriginal communities will be consulted and involved in the management of Aboriginal sites and related issues and in the promotion and presentation of the park's Aboriginal culture and history. The local Aboriginal community is supported to access Country to maintain, renew or develop cultural connections and practices. NPWS supports non-commercial cultural use of wild resources, such as medicinal plants and bush tucker, subject to NPWS policies and licensing.

NPWS maintains close liaison with the Darkinjung Local Aboriginal Land Council regarding the ongoing management of Aboriginal values of the park.

3.2 Shared cultural heritage

History has taken place across the landscape. This includes the history of the first Australians, that is Aboriginal people, and our shared history since European settlement. Cultural heritage comprises places and items that may have historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance. NPWS conserves the significant heritage features of NSW parks and reserves. Heritage places and landscapes are made up of living stories as well as connections to the past, which can include natural resources, objects, customs and traditions that individuals and communities have inherited and wish to conserve for current and future generations.

The establishment of Bouddi National Park was the result of efforts by local bushwalkers, environmentalists and community conservation groups. It was lobbying by Marie Byles, who recognised the area's potential in 1922, which led to the initial reservation of 263 hectares in 1935. The efforts of locals, such as Allen and Beryl Strom, also led to numerous additions to the park over the years. Several features of the park reference this community conservation involvement, including Allen Strom Lookout and Strom's property (bequeathed to NPWS by Beryl Strom), Dingeldei Memorial Shelter (built by local bushwalkers) and Marie Byles Lookout (just outside the park's boundary).

European settlement of the area began in the 1820s with subsistence farming, where the main sources of income were timber-getting, boat building and gathering shells for lime production. The Murray family occupied the foreshore area of Rileys Bay. Their house, built around 1836, is one of the earliest known in the area and is listed in the 1841 census (Strom 1986). The house site, now within the park, contains sandstone remains of a six-room house, including foundations, wall remnants and a fireplace. Substantial work around the site has cleared weeds from the structure.

Settlement and development were slow in the area due to its unsuitability for agriculture and the limited boat access from Sydney. Following the completion of the railway through Gosford in 1889 and construction of The Scenic Road in the late 1920s, residential subdivisions were created adjacent to the present park.

Development surrounding the existing park was mainly confined to the waterfront until the 1960s, when The Scenic Road from Kincumber to Killcare was sealed. The construction of the Rip Bridge in 1974 increased interest in the Bouddi Peninsula, rapidly turning the park into a natural island amidst residential development.

There are many historic sites or elements within the park (see Table 5). Three of these are considered to be locally significant as they demonstrate a strong connection to early settlement and land-use practices of the area. The others have potential heritage significance.

A shelter at Maitland Bay dating back to the 1940s was removed in 2002 because it was structurally unsound and considered unsafe. Non-invasive exotic plants are maintained at Maitland Bay Information Centre, Lobster Beach and Strom's property. These provide links to previous uses of the sites and include citrus and other fruit trees, and garden plants such as hibiscus, hydrangea and lilies.

Boobialla House and Maitland Bay Store have been assessed to be of local significance. **Boobialla House** is a post-war fibro weekender cottage of a form and style typical of that in the immediate areas and the NSW coast in general. It has some historical significance originally as a holiday house and later as a place of residence used by NPWS staff (Suters Architects 2001).

Table 5 Historic sites in the park

Historic site	Date (circa)
Murray's house	1836
Maitland steamship wreck [1]	1898
Koletzke and Hesketh memorial at Lobster Beach	1921
Lobster Beach fishing shacks, foundations and landscaping	1940
Putty Beach sawmill	Unknown
Bombi Point WWII radar emplacements	1939–45
Boobialla House (NPWS staff accommodation)	1940s
Maitland Bay Store (now Maitland Bay Information Centre), water tank and garden [2]	1945–50
Dingledei Memorial Shelter	1962
Iron ladder associated with fishing activities at Iron Ladder Beach	Unknown
Putty Beach sand mine and pipeline	1963–65
Strom's property (includes house and Strom Centre in refurbished garage, and house used for NPWS staff accommodation)	1963
Tallow Beach sand mine, dam, access road and power line	Pre-1975
Dunlop Estate sand mine and pipeline	Pre-1977

1 Listed on the Australasian Underwater Cultural Heritage Database.

2 Site is listed on Gosford Local Environment Plan 2008.

Maitland Bay Store (now Maitland Bay Information Centre) has local historic significance in its association with the establishment of the Bouddi Natural Park (and later the Bouddi National Park) as a venue for conservation group meetings and local social significance as a local general store and minor landmark (Suters Architects 2006a).

Strom's property has been assessed to be of local significance related to the expansion of the park and as the long-term residence of Beryl and Allen Strom. Beryl Strom actively worked for the conservation of the local area's natural and built cultural heritage through active participation in research and publications. Both Beryl and Allen Strom were leaders and participants in local trusts, committees and organisations that actively lobbied for the expansion of Bouddi National Park and the conservation of the natural and built environment on the Central Coast (Suters Architects 2006b).

The ***Maitland*** steamship wreck as well as other shipwrecks in the area are all listed on the *Australasian Underwater Heritage Database*. See Box 5.

The remaining historic items listed in Table 5 are of potential heritage significance but have not been assessed. Before decisions are made about their future management, an assessment of significance is required. Should any of the items be found to be of national, state or high local historic heritage significance, a conservation management plan will be prepared. For simple structures of local heritage significance, a heritage action statement will be prepared to guide future management and works. Heritage guidelines have been prepared for Strom's property and Maitland Bay Store.

Photo 5 **The Maitland Bay Store. Photo: Courtesy of the Wall family**

Box 5: Shipwrecks

The Broken Bay area has historically witnessed more than 70 shipwrecks. The park contains the remains of the paddle steamer *Maitland* and may also contain other relics and shipwreck remains, including those of the *Argument*, *Heath* and *Narooma*. These four wrecks are registered on the *Australasian Underwater Cultural Heritage Database*.

The *Maitland* foundered off Bouddi Point in 1898, resulting in the loss of 26 lives. Nine of the victims were buried locally in the shipwreck cemetery at Booker Bay, west of the park.

Remnants of the ship lie on the seabed, while sections of iron plating lie on the exposed rock platform at Bouddi Point. The ship's bell was recovered and is exhibited in the Henry Kendall Cottage Museum at West Gosford. A replica of the bell is on display outside the Maitland Bay Information Centre.

Shipwrecks and other underwater relics are unique archaeological deposits that often have the potential to yield vital information about the past. All shipwrecks in New South Wales are protected under the NSW *Heritage Act 1977* and the Commonwealth *Underwater Cultural Heritage Act 2018* and are subject to the National Parks and Wildlife Regulation.

4. Providing for visitor use and enjoyment

National parks are reserved under the National Parks and Wildlife Act to protect and conserve areas containing outstanding or representative ecosystems, natural or cultural features or landscapes or phenomena that provide opportunities for public appreciation, inspiration and sustainable visitor or tourist use and enjoyment. Their primary purpose is to conserve nature and cultural heritage. Opportunities are provided for appropriate visitor use in a manner that does not damage conservation values.

4.1 Information

The diverse natural and cultural values of the park provide excellent opportunities for community education and interpretation. The provision of high-quality visitor information and interpretation, both on- and off-park, assists in public appreciation and understanding of the park's values and helps support sustainable visitor use and protection of the park's assets.

Visitor information and interpretation facilities are provided at the NPWS Central Coast Area Office at Girrakool and at the Maitland Bay Information Centre in the park. The information centre is staffed entirely by volunteers and is open weekends and public holidays. Central Coast Council operates visitor information centres at the Entrance and Terrigal, which also provide information about the park.

Interpretative displays are located throughout the park at popular day use areas, camping areas, track heads and other key destinations. Visitor information is also conveyed through the use of directional and public safety signs, publications and the NSW National Parks website and app.

Guided walks, talks and outdoor activities are provided through the NPWS Discovery program and licensed operators. Rumbalara Environmental Education Centre (operated by NSW Department of Education and Communities) uses the park and the Maitland Bay Information Centre for school activities.

4.2 Recreation

Park facilities and services provide opportunities for visitors to enjoy, appreciate and understand the value of our natural and cultural heritage. Visitor opportunities provided in national parks should be ecologically sustainable and contribute to visitor understanding and appreciation of the park.

Bouddi National Park plays an important role in the provision of nature-based tourism and recreation opportunities at a local and regional level. A diverse range of recreational activities are undertaken throughout the park including camping, picnicking, sightseeing, bushwalking, birdwatching, bike riding, land-based whale watching and fishing, and other beach activities. Visitor facilities in the park include the Maitland Bay Information Centre, three camping areas, four-day use areas, walking tracks and lookouts (see Figure 1).

4.2.1 Vehicle access

The park is readily accessible from public roads maintained by Central Coast Council including Wards Hill Road, Maitland Bay Drive, The Scenic Road, part of Putty Beach Drive, Grahame Drive, Beachview Esplanade, Albert Street, Hardys Bay Parade and part of Hawke Head Drive. Park roads that are managed by NPWS and are open to public vehicular use include part of Putty Beach Drive, part of Hawke Head Drive and Mount Bouddi Road (see Figure 1). Parking areas are provided at Little Beach track head, Mount Bouddi Day Use

Area, Maitland Bay Information Centre, Hawke Head Drive (access to Tallow Beach) and Putty Beach. There is a parking area at Wards Hill managed by Central Coast Council providing access to Daleys Point and Rocky Point.

Approximately 26 kilometres of management trails exist within the park, including Daleys Point Trail, which is co-managed with Central Coast Council. Vehicle access to management trails is restricted to authorised vehicles only (see Section 5.1) The network of trails is available for bushwalkers and a number of these trails form part of Bouddi Coastal Walk (see Section 4.2.2).

Vehicle access on beaches is also only permitted with consent, primarily for emergency services and commercial fishers (see Section 5.2). There have been instances of illegal trail bike use in the park. Public vehicle use is only permitted on the public/park roads shown on Figure 1 and all vehicles must be registered and drivers appropriately licensed.

4.2.2 Bushwalking

Bushwalking allows visitors to be in close contact with the environment and can increase understanding and enjoyment of parks and the environment generally. There are walking opportunities across the park through a diversity of vegetation communities and leading to some of the park's major natural and cultural attractions.

The main walking tracks in the park are listed in Table 6 and provide a range of lengths and difficulties, from shorter walks to secluded beaches and lookouts, to the 8-kilometre Bouddi Coastal Walk offering spectacular scenery along the coast from Putty Beach to MacMasters Beach. There are also several shorter tracks that provide direct access to sites and attractions. All walking tracks are shown on Figure 1. In addition to the formal walking tracks, the management trails in the park also provide walking opportunities (see Table 6).

There are some informal tracks that have been created by walkers over time. The walking track from Bulkara Street, Wagstaffe to the waterfront near Kourung Gourung Point, known locally as Half Tide Rocks track passes through the park and is well used by the local community. NPWS is working with the community to formalise this track.

Walking track grades aim to identify the suitability of a track for different user groups and abilities. All walking tracks in the park are Grade 3, generally being formed tracks with some steep sections, and where bushwalking experience is generally recommended. Some sections of track need to be upgraded to ensure a consistent standard along the length of the track.

Table 6 Main walking tracks in the park

Track name (length)	Description	Standard [1]
Bouddi Coastal Walk (8.5 km)	From Putty Beach to MacMasters Beach, including about 3 km of management trail (mgt trail). Gerrin Point Lookout is located on the Putty Beach to Maitland Bay Section	Grade 3 & mgt trail
Box Head (1.3 km)	From Tallow Beach Trail south along Box Head	Grade 3
Bullimah Spur (1 km)	From the Maitland Bay Track to Bullimah Spur	Grade 3
Daleys Point (1.7 km)	From Daleys Point Trail car park north-west along Daleys Point ridge	Mgt trail
Flannel Flower [2] (1.2 km)	From Hawke Head Drive to Lobster Beach Track	Grade 3

Track name (length)	Description	Standard [1]
Lobster Beach [2] (0.5 km)	From High View Road, Pretty Beach, to Lobster Beach	Grade 3
Maitland Bay (1.5 km)	Maitland Bay Information Centre to Maitland Bay	Grade 3
Mount Bouddi (1.2 km)	Dingeldei Picnic Area to Bouddi Coastal Walk	Grade 3
Rocky Point (1 km)	Daleys Point car park south-west to Allen Strom Lookout	Mgt trail
Stroms (2.5 km)	Parallels The Scenic Road from Maitland Bay Information Centre to Mount Bouddi Road	Mgt trail

1 Tracks are classified using the Australian Walking Track Grading System (DSE no date).

2 The Lobster Beach and Flannel Flower tracks are connected by a Right of Way over private property at Pretty Beach.

Photo 6 **Bouddi Coastal Track. John Yurasek/DPIE**

4.2.3 Day use

Day use areas are used for picnicking and as a base for interpretation and education or other activities such as sightseeing, birdwatching, bushwalking, fishing and beach activities. The day use areas and facilities provided in Bouddi National Park are detailed in Table 7.

Table 7 Day use areas in the park

Day use area	Picnic tables	Shelter	BBQ	Seating	Rubbish bin	Toilets	Shower and drinking water	Carpark	Pedestrian beach access	Information panels	Lookout /Platform
Putty Beach	✓	✓	Gas	✓	✓	✓	✓	65	✓	✓	
Mount Bouddi (Dingeldei)	✓	✓	Wood	✓		✓		8			
Little Beach [1]	✓		Gas	✓	✓	✓		12	✓	✓	
Lobster Beach [2]						✓		Road edge	✓		✓

1 Walk-in access.

2 Walk-in and boat access.

Maitland Bay is also a popular day destination along the Coastal Walk but has no facilities. Wood-burning barbecues have been removed from the park due to the potential fire hazard, except in the Dingeldei Memorial Shelter at Mount Bouddi Day Use Area, where two enclosed wood fireplaces have been retained due to their historical association. Their use as fireplaces is not permitted.

Many vantage points in the park offer views along the coast. A formal lookout is provided at Gerrin Point which is accessible via the Bouddi Coastal Walk from Putty Beach. The other formal lookouts in the park are the Allen Strom Lookout at Rocky Point (which can be accessed on foot or bicycle via Rocky Point Trail), Box Head (off Tallow Beach Trail) and Lobster Beach Lookout. Marie Byles Lookout is adjacent to the park on land managed by Central Coast Council. It provides extensive views of the park, Lion Island and northern Sydney and has important historical connections with the formation of the park. This lookout is easily accessible by vehicle.

Swimming is a popular activity at the park's beaches. None of the beaches in the park are patrolled. Most beaches in the park are considered moderately hazardous, with the exception of Lobster Beach which is considered least hazardous (SLSA 2014). Visitors need to use caution at all beaches, but particularly at Tallow and Little Tallow beaches due to the dominance of rips and their feeder currents.

The beaches and rock platforms within the park are popular for fishing. Fishing is permitted in most areas of the park (subject to licensing requirements under the Fisheries Management Act and requirements under the *Rock Fishing Safety Act 2016*). Recreational fishing is not permitted in the Bouddi Marine Extension, which encompasses the areas between Gerrin Point and Third Point from mean high water mark out to the seaward boundary of the Marine Extension (see Figure 1) where a fishing closure has been in place since 1973 (see Box 3). There is a history of antisocial behaviour in Putty Beach and Mount Bouddi day use areas. Night closures will be considered to reduce antisocial behaviour at these sites.

4.2.4 Camping

Provision of camping sites and facilities in parks allows visitors to have a more in-depth experience. The park offers low-key vehicle-based or walk-in camping experiences. Camping facilities are located at Putty Beach, Little Beach and Tallow Beach (see Table 8).

Table 8 Camping areas in the park

Camping area	Style	Defined sites	Approx. number of sites	Access	Rubbish bin	Toilets	Shower	BBQ	Drinking water
Putty Beach	Vehicle-based	✓	20	2WD	✓	✓	✓	✓	✓
Little Beach	Walk-in (750 m)	✓	6	Walk	✓	✓		✓	
Tallow Beach	Walk-in (1.2 km)		6	Walk [1]	✓	✓			

1 4WD vehicle recommended to reach car park at track head.

The camping facilities complement, rather than duplicate, those provided off-park in that they are basic and provide for a more nature-based experience. Facilities for caravans and motor homes are not provided in the park as they exist elsewhere in the area and there is insufficient space available at Putty Beach Camping Area (the only campsite within the park accessible by 2WD vehicles). In order to better manage and service camping areas, as well as minimise visitor impacts, a booking system is in place for all camping areas. Given the popularity of the park, booking is essential. Remote or bush camping outside the designated camping areas is not permitted in the park.

4.2.5 Cycling

Cycling is a popular recreational activity in the area. In accordance with the NPWS *Cycling Policy* (OEH 2018a) and the *Sustainable Mountain Biking Strategy* (OEH 2011a) cycling is permitted on park roads and some management trails. The park offers routes suitable for beginners and intermediate riders on several trails (see Figure 1), including Rocky Point and Stroms trails. Cycling is also permitted on MacMasters Ridge Trail within the park.

Cycling is not permitted on the management trails on Bombi Moor or Mourawaring Moor due to the fragile sandy soils and vegetation in the area or on Daleys Point Trail near Daleys Point Aboriginal Site to protect the Aboriginal cultural values of the site (see Figure 1). Cycling is also not permitted on any of the park's designated walking tracks.

Mountain biking is growing in popularity and the construction of a network of illegal mountain bike tracks over recent years is an emerging issue for the park. Mountain biking and illegal track construction is increasing and undertaken without approval or any environmental assessment. Illegal tracks are often poorly located, and their construction can result in erosion and safety issues. Some tracks are impacting the natural and cultural values in the park.

It is proposed to consider mountain biking opportunities, that may include mountain bike single tracks, through the development of a mountain bike plan in consultation with the

community. In accordance with policy, new cycling experiences may be developed on existing roads or trails, by constructing new tracks or by modifying existing tracks. The appropriateness of cycling experiences is assessed for a park or for a particular location in a park against a set of planning, development and management criteria, including:

- the ecological sustainability of the proposal
- the appropriateness of the location
- the quality of the experience for cyclists
- the need to balance competing visitor demands
- opportunities and demand for cycling across the region, including on other tenures
- visitor safety
- the availability of resources to provide and maintain the experience.

Mountain biking opportunities already provided in the region include a dedicated mountain biking track in Ourimbah State Forest operated by the Central Coast Mountain Bike Club. There are over 30 kilometres of looped trails including Tommos, Rocky Ponds and Warrah Trig loops provided in Brisbane Water National Park; the popular 248 trail in Popran National Park; and the steep and challenging 18-kilometre Dubbo Gully loop trail in Dharug National Park.

Mountain biking opportunities in the park will be assessed in Zone 2 (see Figure 1) and, if appropriate, developed through a separate mountain bike plan. NPWS will engage with the mountain biking community to develop sustainable mountain biking opportunities. The development of mountain bike tracks will be subject to environmental impact assessment (under the *Environmental Planning and Assessment Act 1979*), compliance with NPWS policies and public consultation.

Tracks not assessed as suitable for continued use by mountain bikes will be closed and rehabilitated. The impact of bicycles on the environment, resources and users of areas within parks will be monitored and management prescriptions revised as necessary. Mountain biking opportunities will not be considered within Zone 1 (Conservation Zone) (see Figure 1). The Conservation Zone encompasses areas important for the protection of fragile vegetation communities, soils and cultural values in the park.

The mountain bike plan will address the assessment, development and management of mountain bike use in the park including signage, safety and maintenance of tracks.

4.2.6 Other recreational use

There has been some increased interest in the use of recreational drones in the park. Flying drones in parks can annoy visitors and disturb animals. Drones can also dangerously interfere with fighting bushfires and with other activities for managing parks. For these reasons, and in accordance with the NPWS *Drones in Parks Policy* (OEH 2018b), their use in parks is restricted and subject to consent by local NPWS management.

Drones are considered a type of aircraft and are therefore subject to the Commonwealth *Civil Aviation Act 1988* and the Civil Aviation Safety Regulations 1998.

Jet skis are used in the Tallow and Lobster beach areas and there have been complaints regarding noise and the safety of other beach users. This issue will be dealt in collaboration with the relevant regulatory authority.

Geocaching and virtual geocaching occasionally occur in some areas of the park. Geocaching is an activity where participants use a global position satellite (GPS) to find the location of the cache. Geocachers must obtain written consent from NPWS to place a physical cache in the park.

Horse riding is a popular recreational activity that has cultural associations for many Australians. The provision of horse riding opportunities in the region was assessed under the *Strategic Directions for Horse Riding in NSW National Parks* (OEH 2012b). While horse riding opportunities were identified for other parks in the region, no trails have been set aside for horse riding in this park.

Dog walking is not permitted in NSW national parks. Domestic pets can be a threat to native animals and can disrupt other people's enjoyment of parks. Occasionally dogs enter the park illegally. NPWS will continue to ensure appropriate regulatory signage prohibiting dogs in the park is in place and undertake education and/or compliance action as required.

Rock climbing and abseiling will be allowed, with NPWS consent required for groups greater than eight people. Impacts of rock climbing will be monitored in fragile areas and climbing will be managed by a recognised code of conduct. NPWS may also impose other restrictions, exclusions or closures to manage environmental, visitor experience and safety issues. It is not appropriate for NPWS to install or certify rock bolts. Participants in these activities will need to ensure the safety of fixed anchor points prior to use. NPWS will ensure there is not a proliferation of bolts in the park and, in consultation with climbing representative groups, may remove those that have an unacceptable impact or are no longer required.

4.2.7 Group activities

Tours and organised nature-based activities provide a range of opportunities for interpretation and promotion of the natural and cultural values of the park. Licences and consents provide a mechanism for ensuring that activities, levels of use and behaviour are appropriate to the park and specific locations are suitable for the proposed use. Walking and running events with large numbers of participants can place additional pressures on the park and park infrastructure.

Group gatherings – non-commercial

Non-commercial group gatherings include, for example, family or social gatherings and school tours. Consent is required for groups of more than 40 people, consistent with the National Parks and Wildlife Regulation. Consent is needed for large groups to ensure the limited available space can be sustainably managed, particularly during peak visitor periods.

Events, functions and commercial activities and research

Commercial recreational activities undertaken in the park include guided nature tours, wildlife watching, filming and photographic expeditions and sporting events e.g. running events. Commercial activities require approval, irrespective of group size.

Wedding ceremonies can occur in the park with consent. Public events such as fun runs and non-commercial organised events (e.g. club-based events) also require consent, irrespective of group size.

Scientific and educational research activities that are related to conservation or park management require consent.

4.2.8 Volunteers

Volunteers make a valuable contribution towards the management of Bouddi National Park. The Mourawaring Moor, Lobster Beach and Wagstaffe bush regeneration groups and the Bouddi Bushcare group meet regularly at sites throughout the park, including Maitland Bay, Rileys Bay and Tallow Beach.

The Maitland Bay Information Centre is staffed solely by volunteers and is open to the public on weekends and public holidays.

Photo 7 **Maitland Bay Information Centre**

5. NPWS infrastructure and services

Management operations in the park are coordinated from the NPWS Office and field depot located at Girrakool, within Brisbane Water National Park.

5.1 Management facilities and infrastructure

Supporting infrastructure within the park includes:

- a small works depot located in the park near the Strom Centre on The Scenic Road at Killcare Heights
- Maitland Bay Information Centre located at the intersection of Maitland Bay Drive and The Scenic Road at Killcare Heights
- the Strom Centre located on The Scenic Road at Killcare Heights
- Strom's House (located on The Scenic Road at Killcare Heights) and Boobialla House (located on The Scenic Road at MacMasters Beach), which currently provide accommodation for NPWS staff

- a helipad just off Hawke Head Drive, Pretty Beach
- a manual weather station at Strom's House.

Park management is also supported through park boundary and regulation signs. The boundaries of the Bouddi Marine Extension are not identified in situ with boundary markers and buoys.

5.1.1 Roads and trails

A network of management trails provides management access across the terrestrial part of the park (see Figure 1). In accordance with NPWS policy, vehicle use of these trails is only available for purposes authorised by NPWS.

A number of management trails commence or continue onto neighbouring private land. Use of the off-park sections of some of these trails by NPWS for management purposes needs to be formalised. A reserve access strategy has been prepared to inform strategic and operational planning decisions and to ensure practical access to the park.

A right of way from High View Road provides NPWS vehicular access to Flannel Flower Walking Track for track maintenance works.

Arrangements for the maintenance of a number of public access roads jointly managed with Central Coast Council need to be formalised.

5.1.2 Marine extension

NPWS management of the marine areas in the park is shared with relevant regulatory authorities — at the time of publication these were Department of Primary Industries – Fisheries and NSW Maritime (a division of the NSW Roads and Maritime Services). The management of fishing in these waters (and the enforcement of the prohibition on fishing in the Bouddi Marine Extension) is the responsibility of DPI Fisheries, while recreational boating is the responsibility of NSW Maritime. Fishery closure information is available on the DPI Fisheries Fishsmart App.

6. Non-NPWS infrastructure and services

Many NSW national parks contain infrastructure and other assets owned and operated by other organisations or individuals that are not essential for park management. This includes public utility infrastructure (e.g. pipelines and transmission lines), access to privately owned land (in-holdings) and a range of other uses. Many of these existed before the land was reserved under the National Parks and Wildlife Act; others may have been established under various approval processes. NPWS maintains a public register of leases, easements and rights of way.

All non-NPWS uses require relevant authorisation to lawfully occupy and use such land. This is necessary to ensure there is clarity around arrangements for access, period of occupation, management and maintenance responsibilities and any associated fees or payments.

6.1 Non-NPWS infrastructure

6.1.1 Easements

Sewer mains easements are located within the park at MacMasters Beach (between Beachview Esplanade and MacMaster Parade), at Putty Beach and at MacDonald Street, Killcare. These are maintained by Central Coast Council.

There are several powerlines managed by Ausgrid crossing or alongside the boundary of the park, as listed in Table 9. Only one of the powerlines is covered by a formal easement. In accordance with the *Electricity Supply Act 1995*, a network operator can operate and use the existing powerlines whether or not there is a formal easement in place.

Clearings and vehicle trails along the powerlines have significant environmental and visual impacts. No access or maintenance agreement currently exists with Ausgrid but the company must comply with the National Parks and Wildlife Act and Regulation when carrying out any maintenance or replacement work and will require NPWS consent for certain works.

Table 9 Powerlines through or on the edge of the park

Location	Voltage	Status
Daleys Ave, Daleys Point [1]	High voltage (11kV)	Easement in place
Between Wards Hill Rd, Killcare Heights and Fraser Rd, Killcare	High voltage (11kV)	No easement
Alongside Wards Hill Rd, Empire Bay and Killcare Heights [1]	High voltage (11kV) Low voltage (415V)	No easement
Scenic Road, Bouddi (to service NPWS buildings)	Service lines (415V)	No easement

1 Powerline is situated on the boundary of the park.

Ausgrid also holds a formal easement alongside the park boundary between Wards Hill Road and a property accessed off Maitland Bay Drive, Killcare Heights.

6.1.2 Trigonometric stations

The park includes the following trigonometric stations:

- Bombi (located on Third Point)
- Bouddi (located one kilometre east of Bouddi Point)
- Gerrin (located on Gerrin Point).

An agreement between NPWS and the former Central Mapping Authority (now NSW Spatial Services) provides continued right of access to the trig stations for survey purposes, subject to environmental impact assessment. Only Bombi trig station is accessible by vehicle on a management trail through the park.

6.2 Non-NPWS uses

6.2.1 Commercial beach-hauling access

Commercial beach-hauling occurs along Putty Beach, including within the park. Commercial beach-hauling is an activity regulated under the Fisheries Management Act by the relevant authority. An NPWS commercial fishing vehicle access permit is required for all commercial fishers accessing Putty Beach by vehicle. Before issuing vehicle access permits, NPWS will consider a number of factors such as the likely impacts on natural and cultural values and potential conflicts with park users and management operations in accordance with the *Commercial Fishing Access Policy*.

Appendices

Appendix A Legislation and policy

The following laws and policies apply to how we manage our parks (this is not a complete list):

NSW legislation

- *National Parks and Wildlife Act 1974* and NPW Regulation
- *Environmental Planning and Assessment Act 1979*
- *Heritage Act 1977*
- *Biodiversity Conservation Act 2016*
- *Biosecurity Act 2015*
- *Local Land Services Act 2013*
- *Rural Fires Act 1997*

Other NSW laws may also apply to park management

- *Work Health and Safety Act 2011*

Commonwealth legislation

- *Environment Protection and Biodiversity Conservation Act 1999*

NPWS policies and strategies

A range of NPWS policies and strategies may also apply to park management:

- Park management policies
- Pest management strategies
- Fire management strategies

Other laws, policies and strategies may also apply. Please contact NPWS for advice.

Appendix B Scientific plant and animal names

The following table shows the scientific name for common plant and animal names used in this plan.

Native animals

Common name	Scientific name
Fish	
Blackfish	*Girella tricuspidata*
Blue groper	*Achoerodus viridis*
Red morwong	*Cheilodactylus fuscus*
Frogs	
Red-crowned toadlet	*Pseudophryne australis*
Birds	
Barking owl	*Ninox connivens*
Black-browed albatross	*Thalassarche melanophris*
Brush bronzewing	*Phaps elegans*
Bush stone-curlew	*Burhinus grallarius*
Caspian tern [1]	*Hydroprogne caspia*
Eastern osprey	*Pandion cristatus*
Eastern reef egret [1]	*Egretta sacra*
Flesh-footed shearwater	*Puffinus carneipes*
Fork-tailed swift [1]	*Apus pacificus*
Gang-gang cockatoo	*Callocephalon fimbriatum*
Glossy black-cockatoo	*Calyptorhynchus lathami*
Little lorikeet	*Glossopsitta pusilla*
Little penguins	*Eudyptula minor*
Little tern	*Sterna albifrons*
Masked owl	*Tyto novaehollandiae*
Osprey	*Pandion haliaetus*
Peregrine falcon	*Falco peregrinus*
Pied oystercatcher	*Haematopus longirostris*
Powerful owl	*Ninox strenua*
Regent honeyeater	*Anthochaera phrygia*
Short-tailed shearwater [1]	*Ardenna tenuirostris*
Sooty owl	*Tyto tenebricosa*
Sooty oystercatcher	*Haematopus fuliginosus*
Southern emu-wren	*Stipiturus malachurus*
Swift parrot	*Lathamus discolor*

Common name	Scientific name
Tawny-crowned honeyeater	*Gliciphila melanops*
Varied sittella	*Daphoenositta chrysoptera*
Wandering albatross [1]	*Diomedea exulans*
White-bellied sea-eagle [1]	*Haliaeetus leucogaster*
White-throated needletail [1]	*Hirundapus caudacutus*
Mammals	
Eastern bentwing-bat	*Miniopterus schreibersii oceanensis*
Eastern false pipistrelle	*Falsistrellus tasmaniensis*
Eastern freetail-bat	*Mormopterus norfolkensis*
Greater broad-nosed bat	*Scoteanax rueppellii*
Grey-headed flying-fox	*Pteropus poliocephalus*
Golden-tipped bat	*Kerivoula papuensis*
Humpback whale	*Megaptera novaeangliae*
Koala	*Phascolarctos cinereus*
Large-eared pied bat	*Chalinolobus dwyeri*
Little bentwing-bat	*Miniopterus australis*
Southern right whale	*Eubalaena australis*
Spotted-tailed quoll	*Dasyurus maculatus*
Squirrel glider	*Petaurus norfolcensis*
Yellow-bellied glider	*Petaurus australis*
Yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*

1 Migratory species under the Environment Protection and Biodiversity Conservation Act.

Native plants

Common name	Scientific name
Bearded tylophora	*Tylophora barbata*
Biconvex paperbark	*Melaleuca biconvexa*
Brown stringybark	*Eucalyptus capitellata*
(a daisy)	*Olearia nernstii*
Forest maple	*Cryptocarya rigida*
Grey mangrove	*Avicennia marina*
Hard fern	*Blechnum ambiguum*
Honeysuckle banskia	*Banksia integrifolia* subsp. *integrifolia* or *Banksia serrata*
Howittia	*Howittia trilocularis*
Large-fruited red mahogany	*Eucalyptus scias* subsp. *scias*
Leafy wedge pea	*Gompholobium virgatum var. virgatum*
Magenta lilly pilly	*Syzygium paniculatum*

Common name	Scientific name
Native ginger	*Alpinia arundelliana*
Native violet	*Viola betonicifolia*
Netted bottle brush	*Callistemon linearifolius*
Prostrate wattle	*Acacia sophorae* and *Acacia longifolia*
River mangrove	*Aegiceras corniculatum*
Scrub turpentine	*Rhodamnia rubescens*
Shining grape	*Tetrastigma nitens*
Silkpod	*Parsonsia velutina*
Small supplejack	*Ripogonum fawcettianum*
Snow wood	*Pararchidendron pruinosum*
Spinifex	*Spinifex longifolius/Spinifex sericeus*
Swamp oak	*Casuarina glauca*
Tranquillity mint-bush	*Prostanthera askania*
(a wattle)	*Acacia quadrilateralis*
Wrinkled kerrawang	*Rulingia hermanniifolia*

Common plant names from PlantNET (The NSW Plant Information Network System); Royal Botanic Gardens and Domain Trust, Sydney; http://plantnet.rbgsyd.nsw.gov.au [05/08/16].

Appendix C Vegetation communities in the park

General description	Threatened ecological communities
Narrabeen Coastal Blackbutt Forest	
Covers 18.8% of the park. Narrabeen Coastal Blackbutt Forest occurs on the Erina soil landscape on the hills and slopes around Gosford City and east, and down the Bouddi Peninsula. Vegetation here is clearly dominated by blackbutt (*Eucalyptus pilularis*), *Syncarpia glomulifera* subsp. *glomulifera,* and *Allocasuarina torulosa* in the canopy, over a shrubby understorey of *Acacia longifolia, Duboisia myoporoides, Leucopogon margarodes, Gompholobium latifolium, Bossiaea obcordata, Hibbertia aspera, Lomandra obliqua, Xanthorrhoea macronema* and *Pteridium esculentum*. McRae (1990) describes a similar community for parts of the Bouddi Peninsula near Gosford.	
Coastal Narrabeen Moist Forest	
Covers over 17% of the park. Coastal Narrabeen Moist Forest is the dominant vegetation type principally within the Erina Hills region to the east of Gosford City, where it intersects with the Coastal Warm Temperate Rainforest (Unit E1a) of the gullies and protected slopes. It is characterised by a tall moist forest dominated by *Eucalyptus saligna, Allocasuarina torulosa* and *Syncarpia glomulifera*, and to a lesser extent *Eucalyptus acmenioides* and *Eucalyptus pilularis*. Understorey vegetation is comprised of a range of mesic shrub species, with ferns prominent in the ground layer. This vegetation type occupies the high rainfall areas on Narrabeen Sandstone, and in many places has been subject to selective logging. NPWS have also modelled this community within parts of McPherson State Forest, but this requires confirmation.	
Coastal Headland Shrubland	
Covers 13.4% of the park. Coastal Headland Shrubland occurs on Narrabeen series coastal clay headlands and slopes exposed to onshore winds. This community forms a complex of merging vegetation types dependent on local soil conditions and disturbance history, including Grassland (Units E51a), Low Closed Forest (Unit E51c) and Gully Scrub (E51e). In areas subjected to high levels of coastal exposure yet are still protected to some degree, shrublands of species such as *Allocasuarina distyla, Westringia fruticosa, Melaleuca nodosa, Dodonaea triquetra* and *Hakea dactyloides* occur. In some places, bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*) has become highly invasive.	
Coastal Sand Wallum – Heath	
Covers 10.8% of the park. Occurring on the older coastal dune systems, Coastal Sand Wallum – Heath represents a vegetation type with no apparent tree layer, although small localised patches of stunted tree species (e.g. *Corymbia gummifera, Angophora costata, Eucalyptus piperita*) may occur in places. More typical, however, is a dense low heath to tall scrub where wallum banksia (*Banksia aemula*) is characteristic, with other common shrub species such as *Pimelea linifolia, Ricinocarpus pinifolius, Allocasuarina distyla, Monotoca scoparia, Lambertia formosa* and several *Acacia* and Fabaceous species. This vegetation type occurs in generally more exposed areas than the better structured forests and woodlands.	Possibly Eastern Suburbs Banksia Scrub

General description	Threatened ecological communities
Coastal Headland Low Forest	
Covers 8.9% of the park. Coastal Headland Low Forest occurs on coastal clay headlands and slopes exposed to onshore winds. This community forms a complex of merging vegetation types dependent on local soil conditions and disturbance history, including Grassland (Units E51a), Shrubland (Unit E51b & E51d) and Gully Scrub (E51e). In areas with protection from onshore winds away from the immediate coastline, a low closed forest develops. Stunted canopy species such as *Eucalyptus capitellata, Eucalyptus paniculata* subsp*. paniculata, Eucalyptus umbra* and *Angophora costata* occur over a sparse shrub layer, and a normally well-developed herb layer including *Lomandra longifolia* and *Macrozamia reducta*. The ground surface is also often rocky supporting a thin soil.	
Coastal Sand Apple – Blackbutt Forest	
Covers 5.4% of the park. Coastal Sand Apple – Blackbutt Forest occurs in coastal areas on Quaternary Pleistocene Sand deposits, in areas protected from seaward exposure and with good drainage. This vegetation type is characteristic of the NSW North Coast and becomes very disjunct in the Central Coast area. In most locations, blackbutt (*Eucalyptus pilularis*), red bloodwood (*Corymbia gummifera*) and smooth-barked apple (*Angophora costata*) dominate the tree layer, often with *Banksia serrata*. Understorey vegetation typically includes a range of Fabaceae species, together with *Monotoca scoparia, Eriostemon australasius, Monotoca elliptica, Pteridium esculentum, Themeda australis, Gonocarpus teucrioides* and *Amperea xiphoclada* var. *xiphoclada*. Grasstrees (e.g. *Xanthorrhoea arborea*) are often locally common.	
Bouddi Sandstone Coastal Heath	
Covers 5% of the park. On the windswept ridgetops of Bouddi Ridge in Bouddi National Park, and other parts of the Bouddi Peninsula, outcrops of Hawkesbury Sandstone support heath vegetation dominated by *Allocasuarina distyla* and *Banksia ericifolia* var. *ericifolia*. A range of other species is present, including interesting occurrences of stunted *Syncarpia glomulifera, Eucalyptus umbra, Eucalyptus scias* and *Angophora costata*, together with shrubs such as *Hakea teretifolia, Baeckea brevifolia, Platysace lanceolata, Isopogon anemonifolius, Xanthosia pilosa, Philotheca buxifolia, Xanthorrhoea media* and *Dillwynia retorta*. This vegetation type is a coastal variation of the more inland coastal heaths, but is distinct and disjunct enough to be treated as a subcommunity in its own right.	
Wagstaff Spotted Gum – Ironbark Forest	
Covers 3.5% of the park. Wagstaff Spotted Gum– Ironbark Forest occurs only on the Narrabeen Sandstone ridgelines around Wagstaff and Pretty Beach, with disjunct locations across the entrance to Brisbane Water at Mount Ettalong, and within Brisbane Water at Mount Pleasant, Saratoga. This subcommunity has strong similarities to the Pittwater Spotted Gum Forest currently listed as an EEC, which occurs approximately five kilometres to the south across Broken Bay in Pittwater LGA. Dominant species in the Wagstaff Spotted Gum – Ironbark Forest include *Corymbia maculata, Eucalyptus paniculata* subsp*. paniculata* and *Corymbia gummifera* in the canopy, while the understorey is dominated by species such as *Pultenaea flexilis, Acacia ulicfiolia,*	Pittwater and Wagstaffe Spotted Gum Forest

General description	Threatened ecological communities
Macrozamia communis, Pteridium esculentum, Themeda australis, Lomandra confertifolia subsp*. pallida* and *Entolasia stricta*. Higher rocky ridges receiving onshore winds support *Angophora costata* and *Eucalyptus umbra* as the dominant components. In more sheltered locations, *Eucalyptus botryoides* and *Angophora floribunda* occur. Both of these latter variations appear to be included in the determination for the Pittwater Spotted Gum Forest EEC.	
Coastal Warm Temperate Rainforest	
Covers 3.2% of the park. Most of the sheltered gullies on Narrabeen Sandstone in the rugged ranges in the east support rainforest vegetation that is largely warm temperate but with some subtropical influences also occurring. A variety of tree species codominate these rainforests, although the more typical ones include *Acmena smithii, Doryphora sassafras, Cryptocarya glaucescens, Ceratopetalum apetalum, Eucalyptus saligna, Alphitonia excelsa*, *Syncarpia glomulifera* subsp. *glomulifera, Guioa semiglauca, Neolitsea dealbata, Synoum glandulosum, Sloanea australis, Syzygium oleosum, Wilkea huegeliana, Caldcluvia paniculosa, Polyosma cunninghamii, Dysoxylon rufum* and *Syzygium australe*. Understorey vegetation is typically sparse although ferns and climbers are normally prominent. Subtropical influences are generally in the form of epiphytic species (e.g. *Arthropteris tenella, Microsorum pustulatum, Hymenophyllum australe, Asplenium australasicum* forma *australasicum, Microsorum scandens, Platycerium bifurcatum* var. *bifurcatum, Pyrrosia rupestris, Hymenophyllum cupressiform, Plectorrhiza tridentata, Sarcochilus olivaceus, Bulbophyllum exiguum, Dendrobium tetragonum*), tree ferns (*Cyathea leichhardtiana, Cyathea australis*, *Cyathea cooperi*) and palms (*Archontophoenix cunninghamiana, Livistona australis*).	Lowland Rainforest
Killcare Hawkesbury Woodland	
Covers 2.5% of the park. At Killcare Heights on the Bouddi Peninsula, an outcrop of Hawkesbury Sandstone geology supporting soils of the Somersby landscape occurs. Much of this area has been cleared for horticultural pursuits, and only remnant vegetation remains. Sandy colluvial soils support a canopy of *Angophora costata, Eucalyptus piperita, Corymbia gummifera, Syncarpia glomulifera* subsp. *glomulifera*, *Eucalyptus sieberi* and *Eucalyptus resinifera*, with an understorey of *Pultenaea flexilis, Leptospermum polygalifolium, Ceratopetalum gummiferum, Glochidion ferdinandi, Polyscias sambuccifolia* and *Entolasia stricta*. In places, *Syncarpia glomulifera* subsp. *glomulifera* is particularly dominant, and the weed *Lantana camara* is becoming invasive. There are strong similarities to vegetation in the Somersby area of the Somersby Plateau, but several aspects differ, such as the occurrence of the Killcare Hawkesbury Woodland less than two kilometres from the coast and at a much lower elevation (100–150m vs 250–300m ASL). Further survey and analysis may allow a better understanding of the relationships between the two.	Possibly Duffys Forest
Coastal Narrabeen Ironbark Forest	
Covers about 1.6% of the park. Coastal Narrabeen Ironbark Forest occurs on the drier and more exposed ridgetops of the Erina Hills – northern Bouddi Peninsula area, where it merges with the Coastal Narrabeen Moist Forest (Unit E6a). Canopy species here are dominated by *Eucalyptus paniculata* subsp*. paniculata, Eucalyptus punctata, Syncarpia glomulifera* subsp*. glomulifera* and *Eucalyptus*	

General description	Threatened ecological communities
acmenioides. Understorey components include *Synoum glandulosum, Persoonia linearis, Macrozamia communis, Maytenus silvestris, Breynia oblongifolia, Entolasia stricta, Poa affinis* and *Hibbertia dentata*. In general, this subcommunity can be considered a drier variant of the Coastal Narrabeen Moist Forest (Unit E6a), which consistently occurs downslope of this subcommunity. The invasive *Lantana camara* is becoming problematic in some areas.	
Exposed Hawkesbury Woodland	
Covers about 5 hectares. Exposed Hawkesbury Woodland is widely distributed across the major Hawkesbury Sandstone plateaus, from Mangrove to the Hawkesbury River, and east into Brisbane Water National Park. There is considerable variation in both floristics and structure, generally relating to local fire history and soil drainage conditions. Characteristically, the presence of *Eucalyptus haemastoma, Corymbia gummifera* and *Angophora costata* occur as widely spaced trees in the canopy, over a diverse heathy understorey containing many species from the Fabaceae, Mimosoidaceae, Myrtaceae, Proteaceae and Rutaceae families. Fire history and soil drainage are important determiners of local floristic and structural variation.	
Coastal Sand Banksia Scrub	
Covers about 4 hectares. Coastal Sand Banksia Scrub occurs in slightly more sheltered locations than Coastal Sand Foredune Scrub, generally higher up the frontal dune system where the effects of salt and desiccating winds are reduced. Characteristic species in this vegetation type include the tall shrubs *Leptospermum laevigatum* and *Monotoca elliptica*, with occasional emergent of *Banksia integrifolia* subsp. *integrifolia* or *Banksia serrata*. Typically, this vegetation type is very dense with little understorey shrubs or herbs present.	
Coastal Headland Grassland	
Covers about 4 hectares. Coastal Headland Grassland occurs on coastal clay headlands and slopes exposed to onshore winds. This community forms a complex of merging vegetation types dependent on local soil conditions and disturbance history, including Shrubland (Units E51b & E51d), Low Closed Forest (Unit E51c) and Gully Scrub (E51e). In the most exposed areas, grasslands are dominated by *Themeda australis* and *Ptilothrix deusta*, with stunted *Pimelea linifolia, Acacia myrtifolia* and *Lasiopetalum parviflorum*.	Themeda Grassland on Seacliffs and Coastal Headlands
Coastal Sand Foredune Scrub	
Covers about 2.5 hectares. Coastal Sand Foredune Scrub occurs immediately landward of Coastal Sand Beach Spinifex, also as narrow bands on the frontal beach dunes. This vegetation type is dominated by low prostrate shrubs of *Acacia sophorae* and *Acacia longifolia*, with few other species present. Heavy invasion by bitou bush (*Chrysanthemoides monilifera*) has occurred along much of the coastline in the region, impacting on this community.	
Coastal Headland Gully Scrub	
Covers about 1.5 hectares. Coastal Headland Gully Scrub is a poorly defined vegetation type occurring in gully lines on coastal headlands, where exposure to onshore winds is high. It represents a scrubby vegetation where elements of the coastal complex of	Littoral Rainforest

General description	Threatened ecological communities
Shrubland (Unit E51b) and Low Forest (Unit E51c) merge in gully situations. Typically, low emergent eucalypts such as *Eucalyptus umbra* and *Eucalyptus paniculata* occur over a scrubby understorey of various species, which may include littoral rainforest elements such as *Cupaniopsis anacaroides, Acmena smithii* and *Cassine australe*. Further survey and research are required within the Coastal Headland complex of vegetation, as this subcommunity has yet to be sampled in detail. In some areas (such as Wileys Bay), *Eucalyptus botryoides* also occurs in the emergent layer.	
Swamp Mahogany – Paperbark Forest	
Covers about 1 hectare. Swamp Mahogany – Paperbark Forest is typified by the presence of *Eucalyptus robusta* in the canopy and may occur with a range of associates including *Melaleuca linariifolia, Melaleuca sieberi, Melaleuca styphelioides*, *Eucalyptus resinifera, Eucalyptus tereticornis* and *Angophora floribunda*. The understorey is variable, often with a dense shrub layer of species such as *Acacia longifolia, Omalanthus nutans* and *Pultenaea villosa* and the sedge *Gahnia clarkei*. This type is common around coastal estuaries and flats where drainage is impeded and is also present as backswamps along major tributaries of the Hawkesbury River.	Swamp Sclerophyll Forest on Coastal Floodplains
Estuarine Swamp Oak Forest	
Less than 1 hectare. Estuarine Swamp Oak Forest occurs adjacent to tidal estuaries in slightly higher ground than the nearby mangrove-related vegetation types. Swamp oak (*Casuarina glauca*) clearly dominates this community, with an understorey of sedges and rushes such as *Juncus kraussii* subsp. *australiensis* and *Baumea juncea* and the herb *Apium prostratum*.	Swamp Oak Floodplain Forest
Estuarine Saltmarsh/Grassland	
Less than 1 hectare. Estuarine Saltmarsh/Grassland occurs immediately within and adjacent to tidal estuaries. This community occurs in close association with Estuarine Mangrove Scrub but differs structurally and floristically by the clear dominance of species such as *Sarcocornia quinqueflora* subsp. *quinqueflora*, *Samolus repens* and *Suaeda australis* in saltmarsh; and *Zoysia macrantha* and *Sporobolus virginicus* in grasslands.	Coastal Saltmarsh
Hawkesbury Banksia Scrub – Woodland	
Less than 1 hectare. Hawkesbury *Banksia* Scrub – Woodland is a structurally variable vegetation community, ranging from a tall dense scrub dominated by *Banksia ericifolia* var*. ericifolia*, to a more open scrub or low heath with scattered eucalypt emergents. Both forms can occur in a mosaic pattern at the one location, depending on fire history of the site. Species typical of the sparse emergent layer can include any one of *Eucalyptus haemastoma, Banksia serrata, Eucalyptus umbra, Angophora costata* or *Corymbia gummifera*. Below this, *Banksia ericifolia* var*. ericifolia* can be dominant (with occasional *Angophora hispida*), and a variety of other shrubs such as *Banksia oblongifolia*, *Epacris pulchella*, *Hakea dactyloides*, *Lambertia formosa*, *Leptospermum trinervium, Platysace linearifolia, Acacia linifolia, Acacia suaveolens* and *Hakea teretifolia*. Sedges and herbs are also prominent and include *Lepyrodia*	

General description	Threatened ecological communities
scariosa, Cyathochaeta diandra, Ptilothrix deusta, Actinotus minor and *Xanthosia pilosa*.	
Phragmites Rushland	
Less than 1 hectare. Phragmites Rushland occurs in a few localities within Gosford, generally in manmade dams and drainage lines in swampy environments. *Phragmites australis* clearly dominates these areas, where it has generally invaded following human disturbance of swampy areas.	Freshwater Wetland on Coastal Floodplains
Estuarine Mangrove Scrub	
Less than 1 hectare. Estuarine Mangrove Scrub occurs immediately within and adjacent to tidal estuaries. This community can be quite variable structurally but is always dominated by the mangrove *Avicennia marina* subsp. *australasica,* together with *Aegiceras corniculatum* along major river systems (e.g. Hawkesbury River). Tidal gradients within this community also introduce local variations where saltmarsh can be undergoing mangrove colonisation.	

Source: adapted from Bell (2009)

Appendix D Pests and weeds in the park

The following table summarises key information on pests in the park at the time of publication of this plan. Current information on the status of pests and whether they have a threat abatement plan can be found on the Department of Planning, Industry and Environment website. Further pest information on the park is also available in the relevant NPWS Pest Management Strategy. The Local Land Service Act declares certain animals to be pests.

Common name	Scientific name	Common name	Scientific name
Weeds		**Pest animals**	
Aquarium caulerpa	*Caulerpa taxifolia*	Black rat	*Rattus rattus*
Bitou bush [1 2 4]	*Chrysanthemoides monilifera* subsp. *rotundata*	Common myna [7]	*Sturnus tristis*
Blackberry [1 4]	*Rubus fruticosus* agg.	Common starling	*Sturnus vulgaris*
Black-eyed susan	*Thunbergia alata*	Fallow deer [2 7]	*Dama dama*
Bridal creeper [1]	*Asparagus asparagoides*	Feral cat [2 3 7]	*Felis catus*
Camphor laurel [6]	*Cinnamomum camphora*	Goat [2 3 7]	*Capra hircus*
Cassia [6]	*Senna pendula*	House mouse	*Mus musculus*
Crofton weed [6]	*Ageratina adenophora*	Mallard	*Anas platyrhynchos*
Honeysuckle	*Lonicera japonica*	Pigeon	*Columba livia*
Lantana [1 2 4]	*Lantana camara*	Rabbit [2 3 7]	*Oryctolagus cuniculus*
Morning glory	*Ipomoea cairica, I. indica*	Red fox [2 3 7]	*Vulpes vulpes*
Ochna [6]	*Ochna serrulata*	Spotted turtle-dove	*Streptopelia chinensis*
Other asparagus ferns [1]	*A. aethiopicus, A. plumosus, A. scandens*		
Pittosporum	*Pittosporum undulatum*		
Privets [6]	*Ligustrum sinense, L. lucidum*		
Sea Spurge [5]	*Euphorbia paralias*		
Turkey rhubarb [6]	*Acetosa sagittata*		

1 Declared Weed of National Significance.

2 Declared key threatening process under the Biodiversity Conservation Act.

3 Declared key threatening process under the Environment Protection and Biodiversity Conservation Act.

4 Statewide priority weed under the Biosecurity Act.

5 Regional priority weed (Greater Sydney LLS 2017).

6 Other weeds of regional concern (Greater Sydney LLS 2017).

7 Regional priority pest animal (Greater Sydney LLS 2018).

Abbreviations

EEC	Endangered ecological community
DPIE	Department of Planning, Industry and Environment
LGA	Local government area
LLS	Local Land Services
NPWS	National Parks and Wildlife Service
NSW	New South Wales
SoS	Saving Our Species

Glossary

The terms listed in this glossary have specific meanings in this plan of management.

Term	Definition
Asset protection zone	Area where the overall fuel hazard is maintained at moderate or below, often by mechanical means (e.g. mowing or slashing). The objective of an asset protection zone is to protect human life and property, and this objective takes precedence over biodiversity conservation in these zones.
Land management zone	Area of land zoned to meet relevant land management objectives.
Management trail	Vehicle trail that forms part of the park, maintained by NPWS for park management and other authorised purposes. These trails are not available for public vehicle access. They are available for public use by walkers. Some are also available for cyclists.
Park road	Road that forms part of the park, maintained by NPWS for public vehicle access.
Public road	Road that is not part of the park and maintained by NSW Roads and Maritime Services or a local council for public vehicle access.
Single tracks	A narrow track for cycling, only wide enough to accommodate riders in single file.

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