

**FIVE ISLANDS NATURE RESERVE**

**PLAN OF MANAGEMENT**

**NSW National Parks and Wildlife Service**

**Part of the Department of Environment and Conservation (NSW)**

**October 2005**

**This plan of management was adopted by the Minister for the Environment on 28 October 2005.**

## **Acknowledgments**

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- Sydney South Region Advisory Committee members, particularly Mirian Verbeek;
- Members of the public and organisations who provided submissions in response to the exhibition of the Issues Paper and/or who participated in the community workshops; and
- Dr Ian Armstrong.

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## FOREWORD

Five Islands Nature Reserve includes five small islands clustered off the coast of Port Kembla, immediately south of the city of Wollongong within the Wollongong Local Government Area. The islands are clustered between approximately 0.5 kilometres and 3.5 kilometres off the coast.

The five islands are Flinders Islet, Bass Islet, Martin Islet, Big Island and Rocky Islet, which together make up an area of approximately 26 hectares.

Five Islands Nature Reserve is of significance for its biological values. It provides habitat and breeding sites for the threatened sooty oystercatcher, breeding sites for the wedge-tailed shearwater and short-tailed shearwater and habitat for the white-bellied sea-eagle.

Five Islands Nature Reserve is also of importance to the Aboriginal community due to continuing cultural associations and past occupation of the area.

The *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each nature reserve. A plan of management is a legal document that outlines how the area will be managed in the years ahead.

A draft plan of management for Five Islands Nature Reserve was placed on public exhibition from 7 May until 23 August 2004. The exhibition of the plan of management attracted 5 submissions that raised 7 issues. All submissions received were carefully considered before adopting this plan of management.

This plan of management establishes the scheme of operations for Five Islands Nature Reserve. In accordance with Section 73B of the *National Parks and Wildlife Act 1974*, this plan of management is hereby adopted.

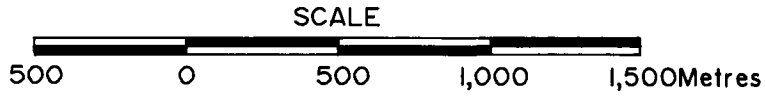
**Bob Debus**

**Minister for the Environment**

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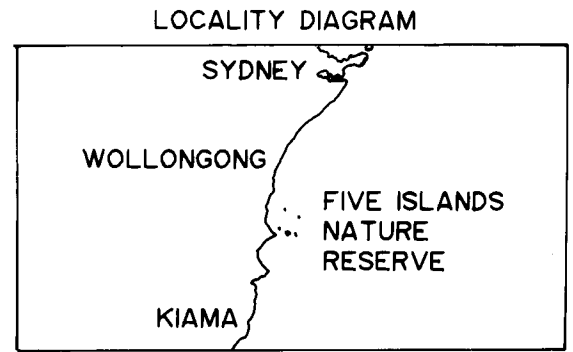
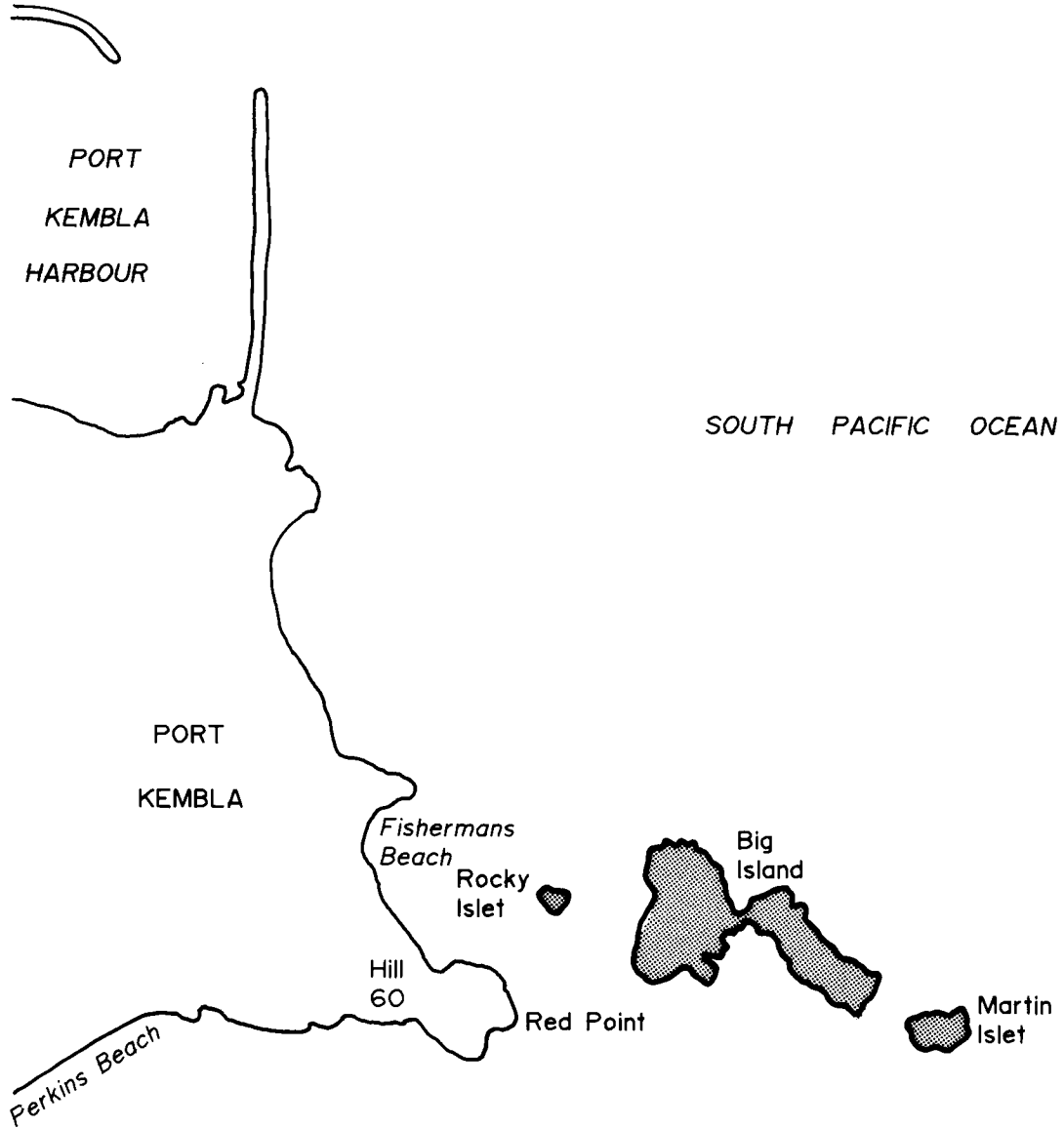
# FIVE ISLANDS NATURE RESERVE



Flinders Islet



Bass Islet



## 1. INTRODUCTION

### 1.1 LOCATION, GAZETTAL AND REGIONAL SETTING

Five Islands Nature Reserve (FINR) includes five small islands clustered off the coast of Port Kembla, immediately south of the city of Wollongong within the Wollongong Local Government Area. The location and setting of FINR is shown on Map 1.

FINR encompasses a combined area of approximately 26 hectares, consisting of Flinders (“Toothbrush”) Islet (2.73 ha), Bass Islet (2.63 ha), Martin Islet (2.33 ha), Big (“Rabbit” or “Perkins”) Island (17.7 ha) and Rocky Islet (0.5 ha). The islands are clustered between approximately 0.5 kilometres and 3.5 kilometres off the coast. Rocky and Martin Islets, and Big Island are tightly clustered close to the mainland off Red Point while Flinders and Bass Islets are more distant.

The islands were originally dedicated in 1960 as Five Islands Fauna Reserve No. 16 under the *Fauna Protection Act 1948*. In 1967, the *National Parks and Wildlife Act 1967* replaced this Act and the islands became Five Islands Nature Reserve managed by the NSW National Parks and Wildlife Service (NPWS). This Act was subsequently replaced by the *National Parks and Wildlife Act 1974*. The boundary of FINR extends to the mean high water mark of each island.

The adjacent mainland area comprises primarily industrial use, centred on Port Kembla Harbour and, to a lesser extent, residential land use. The Port Kembla sewage treatment plant and outlet is located at Red Point, approximately 0.5 kilometres from Big Island. The operation of this plant is planned to be substantially scaled down in the near future. A public open space reserve at Hill 60 provides a closely located mainland vantage point to the FINR, particularly the southern cluster of Rocky and Martin Islets and Big Island. Two mainland beaches, Fishermans and North Beach are directly adjacent to the FINR.

### 1.2 LANDSCAPE

Natural and cultural heritage and on-going use are strongly inter-related and together form the landscape of an area. Much of the Australian environment has been influenced by past Aboriginal and non-Aboriginal land use practices and the activities of modern day Australians continue to influence the landscape through recreational use, cultural practices, the presence of introduced plants and animals and in some cases air and water pollution.

During the last glacial period all of the islands would have been accessible by land, as would the shallow shelf on which they lie. The rise in sea level isolated the islands and would have submerged and eroded much evidence of Aboriginal uses of the area although middens remain on Big Island and at Hill 60 on the mainland. The islands have Aboriginal cultural significance as Dreaming stories, and Aboriginal people have an ongoing association with the islands.

Big Island is the only relatively easily accessible island of FINR and was the only one settled by Europeans. The island was used for grazing and the Parkyns family lived on the island for a number of years in the 19<sup>th</sup> Century.

Both Aboriginal and non-Aboriginal people place cultural values on natural areas, including aesthetic, social, spiritual, recreational and other values. Cultural values may be attached to the landscape as a whole or to individual components, for example to plant and animal species used by Aboriginal people. This plan of management aims to conserve both natural and cultural values. For reasons of clarity and document usefulness natural and cultural heritage, non-human threats and on-going use are dealt with individually, but their inter-relationships are recognised.

## 2. MANAGEMENT CONTEXT

### 2.1 LEGISLATIVE AND POLICY FRAMEWORK

The management of nature reserves in NSW is in the context of a legislative and policy framework, primarily the *National Parks and Wildlife Act 1974*, the *National Parks and Wildlife Regulation*, the *Threatened Species Conservation Act 1995* and the policies of the NPWS. NPWS policies relate to nature conservation, cultural heritage conservation, recreation, commercial use, research and communication and reflect legislative requirements and internationally accepted principles of park management.

Other legislation, international agreements and charters may also apply to management of the area. In particular, the *Environmental Planning and Assessment Act 1979* requires the prior assessment and mitigation of the environmental impact of all activities and works proposed to be undertaken in the nature reserve.

#### International Agreements

The NPWS has obligations relating to the management of migratory sea birds breeding on FINR under international agreements ratified by the Australian Government. These agreements are:

- The Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); and
- The Agreement between the Peoples Republic of China and the Government of Australia for the Protection of Migratory Birds and their Environment (CAMBA).

The agreements with Japan and China list a number of species that utilise FINR. A similar agreement is currently being negotiated with the Russian Government.

The presence of “Listed Migratory Species” brings into effect the Commonwealth’s *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This Act regulates actions that will, or are likely to, have significant impacts on matters of national environmental significance (NES matters). The Commonwealth and the NSW State Government are negotiating a bilateral agreement whereby most State environment assessment processes will be accredited under the Commonwealth legislation. In the interim the NPWS needs to consider, in addition to the normal environmental assessment process for on-park activities, the possibility of requiring the Commonwealth approval under the EPBC Act.

#### Plan of Management

The plan of management is a statutory document under the National Parks and Wildlife (NPW) Act. No operations may be undertaken within FINR except in accordance with this plan. The plan will also apply to any future additions to FINR. Where management strategies or works are proposed for the nature reserve or any additions that are not consistent with this plan, an amendment to the plan will be required.



## 2.2 NATURE RESERVES IN NEW SOUTH WALES

Nature reserves are “Protected Areas” as defined under the International Union for the Conservation of Nature and Natural Resources (IUCN, 1994). A Protected Area is defined as:

An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of nature and associated cultural resources, and managed through legal or other effective means.

Five Islands Nature Reserve equates to the IUCN Category 1a, “Strict Nature Reserve”, that is:

An area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features, and/or species, available primarily for scientific research and/or environment monitoring.

Nature reserves are reserved under the NPW Act to identify, protect and conserve areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena. Under the Act, nature reserves are to be managed in accordance with the following principles:

- the conservation of biodiversity, the maintenance of ecosystem function, the protection of geological and geomorphological features and natural phenomena,
- the conservation of places, objects, features and landscapes of cultural value,
- the promotion of public appreciation, enjoyment and understanding of the nature reserve’s natural and cultural values,
- provision for appropriate research and monitoring.

Nature reserves differ from national parks in that they do not have as a management principle to provide for visitor use.

### 3. KEY VALUES AND MANAGEMENT DIRECTIONS

#### 3.1 VALUES OF FIVE ISLANDS NATURE RESERVE

Five Islands Nature Reserve is of international and national significance for its biological values and of regional significance for its cultural heritage and research values.

**Key natural values** include:

- Evidence of geological and geomorphologic processes related to the formation of the Sydney Basin and subsequent landscape evolution;
- Habitat and breeding sites for the sooty oystercatcher (*Haematopus fuliginosus*), classified as "vulnerable" under the *Threatened Species Conservation Act 1995*. A "vulnerable" species is one that is likely to become endangered unless the circumstances or factors threatening its survival or evolutionary development cease to operate; and
- Breeding sites for the wedge-tailed shearwater (*Puffinus pacificus*) and the short-tailed shearwater (*Puffinus tenuirostris*) which are listed under JAMBA, and habitat for the white-bellied sea-eagle (*Haliaeetus leucogaster*) which is listed under CAMBA.

The key **cultural heritage values** comprise:

- Importance to the Aboriginal community due to continuing cultural associations and past occupation of the area.

**Research and educational values** include:

- Conservation of sea birds; and
- Habitat restoration;

#### 3.2 MANAGEMENT DIRECTIONS

In support of the general objectives of management, the following specific objectives apply to the management of FINR:

- The protection and conservation of seabirds of conservation significance and their habitats;
- The recovery of the natural ecology of the islands;
- The continuing cultural values of the islands to the Aboriginal people incorporated into the management of FINR; and
- The involvement of the community in the conservation of FINR.

## 4. CONSERVATION OF NATURAL AND CULTURAL HERITAGE

### 4.1 GEOLOGY AND LANDFORMS

The rocks of the islands are about 250 million years old and are part of the Permian "Gerrington volcanics". The volcanics are part of the "Bowen Tectonic Stage" of the formation of the Sydney Basin and are localised to the southern part of the Basin. In other areas the later sedimentary rocks of the Basin overlie the volcanics. Big Island and Martin and Bass Islets are composed of the Dapto-Saddleback Latite Member, while Flinders Islet is composed of the Bombo or Five Islands Latite Member. Rocky Islet is composed of volcanic sandstones from the Broughton Formation, which are also exposed on Big Island (Davis, C., M.F. Fay and D.F. Waterhouse, 1938; Mills, 1990; Branagan and Packham, 2000).

Big Island geology displays differential weathering due to different forms of the latites (creating the isthmus between the two higher plateaux) and recent (Tertiary) basic dykes. The latites demonstrate weathering along joint planes. In addition, a compacted illuvial horizon where older soils have evolved to a soft sandstone-like layer, which demonstrates soil formation processes, was identified by Davis *et al.* (1938).

Up until the end of the last Ice Age the islands were part of the mainland and probably dune covered as a result of marine sand pushed up onto the shelf with continuous dunes covering the shelf and all of what is now FINR, and nearby Hill 60 on the mainland.

The rise in sea level over the last 18,000 years separated the islands from the mainland, eroding sand and soil from most of the islands, and drastically changed the climate for vegetation resulting in low growing, salt tolerant species dominating the islands. About five thousand years ago, when the sea level was at its maximum, much of the smaller islands, and parts of Big Island, would have been sea swept (if not covered) and probably bare rock (like Rocky Islet is now) leaving only the higher parts of Big Island and Flinders and Martin Islets with residual marine sands and shell material, and any soil cover. The coastline at Hill 60 is the mainland remnant from this erosional episode. The islands are now cut off from sources of sand and, with soil formation very slow, any erosion on the islands now is effectively irreversible.

The soils of the islands would have been fertile, being derived from the underlying latites. Big Island and Flinders and Martin Islets were reported in the 1930s as having good soils, usually well drained and fertile, although often shallow. The deepest soils on Big Island were about 50cm, and soils of the other islands much shallower (Davis *et al.*, 1938).

The majority of Big Island now has very little soil due to erosion. There is documented evidence of the impacts from grazing on Big Island but Davis *et al.* (1938) considered that significant erosion ("blowouts") had occurred prior to European settlement. They postulated that burrowing seabirds could have destabilised the root systems of the covering plants reducing soil cover and leading to wind erosion. There is much evidence of severe erosion since European settlement. Photographs and records in Davis *et al.* (1938) show widespread erosion due to grazing animals introduced by settlers. Mills (1990) quotes Battam *et al.* in a report from 1968 where:

*Grass disappearing from all grassed areas on both islands. Up to 18" depth of soil has eroded from southern half and eastern side of Shearwater Rookery on West side of No1 island (Big Island) and up to 4 feet depth of soil has eroded from top of No.1 island since December 1962. Shearwater burrows are collapsing. Some grass is regenerating in a few areas on No. 1 island but appears to be heavily grazed.*

The introduced species Kikuyu Grass, which was first noted on Big Island in 1969, is now the dominant vegetation cover on Big Island. Kikuyu is a very good soil stabiliser as it forms dense mats and spreads quickly via runners and was almost certainly deliberately introduced to control the erosion noted by Battam et al in 1968. Its dominance on Big Island has, therefore, resulted in the stabilisation of the soil although exposed areas remain where Kikuyu appears to be suppressed by salt spray. Indiscriminate removal of Kikuyu has the potential to result in future soil erosion problems on Big Island and potential loss of sea bird burrows

Davis *et al.* (1938) reported that Flinders Islet had good soil cover remaining on the top of the plateau and considered it to have the richest vegetation of the group with sixteen species "common". Bitou bush is now dominant on the Islet but does not appear to prevent the seabirds from forming burrows.

Davis *et al.* (1938) include evidence that nesting seabirds added to the nitrogen content of the soils. The majority of the cover on Big Island now is sand with low humus content. On Big Island, guano from the large permanent population of silver gulls that now occupies the island, has contributed to a higher than normal nutrient content. Care must be taken with management practices that may result in the addition of further nutrients to the soil, such as the use of herbicides, as elevated soil nutrient levels aids the success of introduced vegetation species such as Kikuyu.

In addition to the habitats provided by the terrestrial vegetation, Davis *et al.* noted four other habitats on the islands:

- Pool;
- Rock;
- Kelp (although not terrestrial provides food resources for terrestrial species); and
- Bare sand.

The pool habitats, ranging from saline to freshwater, included:

- "Triangle pool" on Big Island, which is located about nine metres above mean tide level, and is of low salinity;
- Freshwater springs on Big Island, which have been dug out to a depth of about 1.5 metres;
- A Phragmites soak on Big Island, which flowed at all times except very dry seasons; and
- Pools of high salinity, above the reach of high tides and filled by salt spray. These pools can have very variable salinity depending on recent rainfall or extended dry periods.

Rock habitats included:

- Lichen on rock surfaces;
- Boulders, which form useful animal habitat and provide shelter; and
- Mosses and liverworts, although this habitat is quite restricted and may not be exclusive to any species.

There has been no further work on the general ecology of the islands since that of Davis *et al.* (1938). The importance of these habitats, their communities, and their variability is unknown. Some are specific to Big Island, especially the pools, but others might be found on other islands of FINR. Some of these habitats are located in the intertidal zone, which is not part of FINR.

### **Intended Outcomes**

- Soils protected from erosion and with soil structure and nutrient status that favours original ecology.
- The natural geology and landform of the islands maintained and protected from non-essential disturbance

### **Strategies**

- *Avoid, and where essential for management minimise the effects of, activities likely to have adverse impacts on the soils, geology or landform of the islands.*

## **4.2 NATIVE PLANTS**

There have been four documented vegetation surveys of FINR, with the major focus on Big Island. The first comprehensive study of the vegetation of the Islands was conducted in 1938 (Davis *et al.* 1938). However, by this time the vegetation on Big Island had already been significantly disturbed by human activities from the late 1860s. By 1938, therefore, the islands were already covered by a mixture of native and exotic vegetation.

Nine vegetation communities were identified on the islands, with the dominant one being the *Correa-Westringia* (White Correa and Coast Rosemary) community, which covered extensive areas of Big Island as well as the north and south ends of the plateau on Flinders Islet and over a limited area of the western slopes of Martin Islet.

David Walsh, a prominent local naturalist, also recorded observations of the vegetation of Big Island from the 1960s to the late 1970s. A vegetation study by Mills in 1989 (Mills 1990) combined these observations with a further vegetation study of Big Island.

Mills (1990) recorded a total of 64 species on Big Island, compared to 58 species recorded in 1938. However, although the number of species recorded on Big Island in the 1938 and 1989 studies was similar, Mills noted a shift from a largely native flora in 1938 to a largely exotic one in 1989. Mills identified fourteen vegetation associations on Big Island and notable changes included the disappearance of three communities, being the *Correa-Westringia*, which once dominated parts of the island, *Sarcocornia* and the *Scirpus nodosus* communities.

Mills (1990) identified 22 native species on Big Island, although their distribution was quite restricted owing to the dramatic increase in the distribution of Kikuyu. Most of the native species were found on the edge of the island, where saltwater appears to

inhibit the growth of Kikuyu, as well as on the eastern half of the island, where there is a large area of bare rock. Buffalo Grass (*Stenotaphrum secundatum*), which was first recorded in the early 1960s, was also present and Mills noted the more recent arrival of another introduced species, Crowsfoot Grass (*Eleusine indica*), which has invaded the parts of the island where Kikuyu does not grow well.

The vegetation studies of Big Island to date clearly demonstrate that there has been a marked decline (greater than 50%) of native species, most particularly between the study in 1938 by Davis *et al.* and the study in 1990 by Mills. The causes of this decline include:

- Grazing by cattle, rabbits and goats from about the mid-1800s (all since removed or eradicated from the island);
- Human habitation in the late 1860s;
- The introduction and subsequent dominance of Kikuyu, which has restricted the distribution of remaining native species.
- The dramatic increase in the silver gull population from the 1960s; and subsequent increase in soil nutrients largely attributable to Silver gull guano.

Information about the vegetation of the other islands is limited. Photographs of Flinders Islet taken in 1938 and 1970 show dense vegetation. Davis *et al.* regarded Flinders as having the most diverse flora with sixteen species listed as “common”. The Correa-Westringia community was dominant; interestingly it was different from the communities on Big Island. They also noted that the centre of the plateau was bare, for reasons they could not explain. They noted also that burrows under the shrubs were destabilising the plants and leading to erosion. Battam noted in 1976 that vegetation on the plateau of Flinders Islet included Boobiolla (*Myoporum insulare*), Coast Rosemary (*Westringia fruticosa*), Saltbush (*Atriplex cinerea*), Pigface (*Carpobrotus glaucescens*), Pigweed (*Portulaca oleracea*), White Correa (*Correa alba*), Kidney Weed (*Dichondra repens*), Scurvy Weed (*Commelina cyanea*), New Zealand Spinach (*Tetragonia tetragonioides*) and Dusky Coral Pea (*Kennedia rubicunda*) (Battam 1976a). The most recent study, by Wolhuter (1999), identifies the introduced Bitou Bush (*Chrysanthamoides monilifera*) as the dominant species.

Much less is known about Martin and Bass Islets. Martin, with some soils (mostly poorly drained) derived from the latites, was described with four plant species “common” in 1938. Bass, without characterised soils, had herbs usually located in poor soils in rock crevices.

Wolhuter (1999) reported a continuing decline in native species on Big Island and Flinders Islet. His primary goal was to investigate means to promote regeneration from any viable seeds in the soils of the islands and concluded that Big Island no longer retained viable seed banks for regeneration. It is possible that Flinders Islet, with lesser disturbance, may still have a viable seed bank but he was not able to investigate this adequately within the constraints of his study.

Appendix 1 lists all plants species identified on Big Island.

While it is considered desirable to restore the native vegetation communities of the islands there are a number of management issues related to the implementation of a revegetation program on FINR:

- There appears to have been little natural recruitment of native species on Big Island and this may be due to introduced species;
- The native seed-banks on Big Island and Flinders Islet may be sparse and may be inadequate to rely on as a source of propagules for revegetation (Wolhuter 1999);
- The limited availability of propagules means that propagation material may need to be sourced at other locations from native plants that are adapted to coastal conditions. Potential suitable locations for such material will require further research but may include nearby mainland areas or islands that have similar species and climatic conditions to FINR. Any collection of material will be in accordance with the NPWS Environmental Integrity Policy;
- The dense mat of Kikuyu Grass on Big Island currently makes conditions difficult for the re-establishment of native vegetation, even after it has been killed with herbicide, and very few natives are likely to be successful on the island whilst the Kikuyu remains;
- The Kikuyu acts as an effective soil stabiliser and its wholesale removal to allow the growth of seedlings may result in further soil erosion and loss of burrows;
- The potential for colonisation by other introduced species if Kikuyu is removed;
- Existing vegetation cover (eg Bitou Bush) on Flinders Islet appears to stabilise the soil. Any attempt at complete removal without a strategy for replacement by soil stabilising plants could degrade habitat for breeding birds; and
- Management activities must be strategically planned in accordance with Authorised Access Protocols (see 5.5 Access) to avoid impacts on seabird populations (see Section 4.3 Native Animals).

The vegetation survey conducted by Davis et al. (1938) provides the most comprehensive data for FINR prior to the introduction of Kikuyu. Vegetation on other South Coast Islands may also be indicative of the native plant communities of the FINR.

### **Intended Outcomes**

- Native plant communities that are viable and representative of previously recorded vegetation on the islands.

### **Strategies**

- *Prepare and implement revegetation plans for the islands, with priority given to Big Island and Flinders Islet.*
- *Identify, coordinate and facilitate studies to develop a clearer understanding of management requirements to promote protection and restoration of the Islands' plant communities.*

## **4.3 NATIVE ANIMALS**

### **Seabirds**

FINR is an important seabird breeding and refuge area in NSW. The Southern Ocean Seabird Study Association (SOSSA) has undertaken bird-banding operations on the islands for a number of years. SOSSA's research operation has provided the seabird

population data used in this Plan (Table 1); however these studies have not been specifically designed to determine the status of fauna populations or to quantify threats to seabird populations. Currently available data are not sufficient to make robust management decisions.

The sooty oystercatcher (*Haematopus fuliginosus*) utilises the intertidal zone of FINR to breed and to forage for food. The Sooty oystercatcher is classified as "vulnerable" under the *Threatened Species Conservation Act*. The sooty oystercatcher is reliant on off-shore islands for breeding and access to these limited areas poses a threat to this vulnerable species.

**Table 1. Seabirds breeding on Five Islands Nature Reserve**  
(Estimated breeding pairs during 1999-2000 season, SOSSA).

Species		Big Island	Flinders Islet	Martin Islet	Bass Islet
Common name	Scientific name				
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>	4	9	1	2
Little Penguin	<i>Eudyptula minor</i>	100	30	10	10
Wedge-tailed Shearwater	<i>Puffinus pacificus</i>	1,000	30	10	0
Short-tailed Shearwater	<i>Puffinus tenuirostris</i>	200	30	0	0
Crested Tern	<i>Sterna bergii</i>	1,500	0	150	300
White-faced Storm-petrel	<i>Pelagodroma marina</i>	0*	300	0*	0
Silver Gull	<i>Larus novaehollandiae</i>	28,000	0	500	500
Kelp Gull	<i>Larus dominicanus</i>	0	0	0	35
Australian Pelican	<i>Pelecanus conspicillatus</i>	350	0	50	20

\*There are no recent accounts of the White-faced Storm Petrel breeding on Big Island or Martin Islet.

\*\* No accounts of the Reef Egret breeding on Flinders Islet since 1969.

Other birds recorded utilising Five Islands Nature Reserve (but not breeding) are listed in Appendix 2

The current NSW population of sooty oystercatcher is estimated at 200-300 individuals (Keating and Jarman 2002). In their study of the 2001-2002 south-coast shorebird breeding season, Keating and Jarman recorded 22 breeding pairs of Sooty oystercatcher on FINR (more than estimated for 1999 – 2000 although numbers vary seasonally). This represents approximately 35% of the breeding population known along the coast of NSW south of, and including FINR (other breeding sites include Brush and Belowla Islands, south of Ulladulla, and Tollgate Island in Batemans Bay). The south coast population represents the majority of this species and the breeding population on FINR is therefore significant to the overall status of this species.

There is a greater breeding population on Flinders Islet, which has a larger intertidal area and without nesting silver gulls. In addition, because they utilise the intertidal zone habitat, their breeding success is affected by natural threats such as adverse weather conditions. In the 2001-2002 breeding season, unfavourable conditions and high seas led to the inundation of nests and a low number of fledglings (Keating and Jarman, 2002). Sooty oystercatchers breed between approximately October to late February.



The little penguin (*Eudyptula minor*) has been recorded breeding on all islands within FINR excepting Rocky Islet. This species typically nests in burrows, caves or under shrubs. In 1962, approximately 1000 burrows were recorded on Big Island (Gibson, 1976) but since that time numbers have declined to an estimated 100 breeding pairs on Big Island and 30 breeding pairs on Flinders Islet in 1999. The breeding season for the little penguin is between approximately August and April, although August and September appear to be the principal egg-laying months (Gibson, 1976). In addition, the birds come ashore for post-breeding moulting, from approximately February to April (although some have been noted as late as May-June) (Smith and Battam, 1998). The intertidal zone is also important habitat for the little penguin, which uses this area to access their burrows from the water. They have defined access points where they cross the intertidal zone and the presence of people near their pathways may prevent them from coming onshore.

The wedge-tailed shearwater (*Puffinus pacificus*) has been recorded breeding on Big Island and Flinders and Martin Islets. Over 1000 of this species' burrows were reported on Big Island in 1940 and their numbers declined from 1962, possibly owing to habitat degradation and the rapid increase in the silver gull population, which occurred around this time (Gibson 1976). However, during the 1999-2000 breeding season, SOSSA reported an estimated 1000 breeding pairs on Big Island and approximately 30 pairs on Flinders Islet.

The short-tailed shearwater (*Puffinus tenuirostris*) was first discovered nesting on Big Island in 1960 when 17 burrows were found (Gibson, 1976). Approximately 100 burrows were estimated in 1968 (Smith and Battam 1998) but numbers have since declined to approximately 20 pairs on Big Island and 30 pairs on Flinders Islet in 1999 - 2000. These species arrive late in August, eggs are laid late November to early December and all birds have departed by mid-May (Gibson 1976). Both the wedge-tailed and short-tailed shearwater species are listed for protection under the JAMBA international migratory species agreement.

The white-faced storm-petrel (*Pelagodroma marina*) was recorded as breeding on the higher parts of Big Island in 1955 amongst Mat Rush and Pigface, where more than 200 burrows were located. However, this species has not been recorded as breeding on Big Island since 1969, possibly due to the introduction of Kikuyu around this time and the subsequent loss of those native species that form their breeding habitat, as well as the dramatic increase in the silver gull population. A relatively large colony was discovered breeding on Flinders Islet in 1990 (Smith and Battam, 1998), and which numbered approximately 300 pairs during the 1999-2000 breeding season. This species breeds annually from October to February.

The crested tern (*Sterna bergii*) is present usually from September to February. The colonies have variable locations, depending on seasonal factors and food availability (Smith and Battam 1998). Up to 2000 pairs were recorded breeding on Big Island in 1997 (Smith and Battam 1998) with approximately 1500 in 1999, in addition to approximately 150 pairs and 300 pairs on Martin Islet and Bass Islet respectively. Since 1985, colonies may have been displaced from favoured breeding sites by the increased presence of nesting Australian pelicans.

The Australian pelican (*Pelecanus conspicillatus*) was first recorded breeding on Big Island in 1983. Since that time pelican numbers increased to approximately 500 pairs in 1996 (Smith and Battam 1998). The Australian pelican has been recorded breeding in most months of the year.



The historical record provides evidence for the resilience of the breeding species with variation in both numbers and breeding sites over the years. It is possible that re-establishment of suitable habitat and control of silver gulls would see birds of conservation significance returning to previous nesting sites and an increase in breeding numbers. Issues of concern include:

- Loss of soil for burrows (shearwaters, penguins, and storm petrels);
- The impact of Kikuyu restricting access to burrows and breeding success. The dense mat of Kikuyu now covering most of Big Island 1 forms, in parts, an almost impenetrable barrier to burrowing seabirds such as little penguins, storm petrels and shearwaters;
- Trampling and collapse of burrows (little penguins, short-tailed and wedge-tailed shearwaters, storm petrel);
- The extent of predation by gulls, and the displacement by gulls and pelicans, on the breeding success of birds of conservation significance;
- Disturbance of birds that utilise the intertidal zone (for foraging or accessing nesting sites);
- Destruction of habitat and loss of food resources (sooty oystercatcher); and
- The extent of off-island impacts on the reproductive success of the breeding populations and the variability of those impacts.

Habitat degradation is likely to be a major threat to some species of seabirds, which may account for declines in populations. The little penguin has had reduced breeding success over the last two seasons, due to as yet unexplained causes (Smith and Battam, 1998). More generalised off-island factors may be operating however.

Studies on Montague Island have highlighted the concern that even when breeding numbers are being maintained the age structure of the populations could be shifting (Pacey, 2000). Data has been collected for six of the last seven years on Montague Island, with evidence of low breeding success in five of these seasons. These 'crashes' are characterised by short periods of high chick mortality, driven by insufficient food availability not allowing for sufficient chick provisioning. Further, the data collected suggests the incidence of low food years appears to be a relatively new trend. In addition, population estimates in 1992, 1996, and 1998 have found no decline in the numbers of penguins present at this colony (Nick Holmes, pers. comm.).

FINR does not include the intertidal zone of the islands (the area between the mean high and low water mark). As such, the NPWS has no regulatory control over access and activities in these areas of the islands. The inclusion of the intertidal zone within the FINR would enable the NPWS to manage the intertidal zone consistent with the conservation values of the islands. (See Section 5.5 for further discussion.)

### **Other fauna**

Other vertebrates recorded on FINR include the Australian fur-seal (*Arctocephalus pusillus*) and leopard seal (*Hydrurga leptonyx*), which are known to haul-out in the intertidal zone from time to time. A number of reptile species are also found on the islands, including the eastern water-skink (*Eulamprus quoyii*) (common on Big Island), garden skink (*Lampropholis guichenot*) (Big Island and Flinders Islet), weasel

skink (*Saproscinus mustelina*) (Big Island) and the three-toed skink (*Saiphos equalis*) (Big Island) (Smith and Battam 1998).

Davis *et al.*(1938) also noted that the islands had:

*... land mollusca (one species), insects (16 orders with more than 50 families represented), numerous species of Arachnids, Myriapods (Chilopoda, Diplopoda), Crustacea (terrestrial Isopods and Amphipods; Cladocera and Ostracoda in pool habitats), and one terrestrial species of Oligochaeta.*

### **Intended Outcomes**

- The islands remain important breeding sites for seabirds of conservation significance.
- More informed and improved management through better understanding of all terrestrial fauna with the islands protecting a full range of historically recorded natural habitats.

### **Strategies**

- *Identify, and coordinate and facilitate, studies to develop a clearer understanding of management requirements to promote breeding success of birds of conservation significance breeding on the Islands.*
- *Identify and, where possible, reduce or eliminate threats to breeding success of fauna with priority for species of conservation significance.*
- *Support the implementation of NSW Coastal Policy, as it relates to the inclusion of the intertidal zone within FINR, through a consolidated State-wide approach being pursued by PWD in discussion with Department of Primary Industries: Fisheries and Department of Infrastructure Planning and Natural Resources.*
- *Collate, review and expand existing information and knowledge relating to terrestrial fauna.*
- *Develop, implement, and monitor effectiveness of management strategies for species, particularly silver gulls and pelicans, that threaten the breeding success of birds of conservation significance.*
- *Liaise with relevant authorities regarding the control of mainland food sources for the silver gull and Australian pelican.*

## **4.4 ABORIGINAL HERITAGE**

FINR is located within an area that was occupied by the Wadi Wadi people who spoke a variant of the Dharawal language. Dharawal descendants lived and live in the country from Botany Bay and Campbelltown in the north through the Nepean, Wollondilly, Georges and Cataract catchments<sup>1</sup>, west to Moss Vale and south to the Shoalhaven River and Jervis Bay. Dharawal people are distinguished as fresh water or salt water depending on whether they occupied the coastal regions or the plateaus and inland river valleys. Traditional stories tell of their arrival at the mouth of Lake Illawarra in canoes when the Ancestors were animals. They brought the Dharawal or Cabbage Tree palm with them from the north and are named for this sacred tree.

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<sup>1</sup> 'History of the D'harawal people (rbgsyd.gov.au/mount\_annan\_botanic\_garden)

The islands are significant to the Illawarra Aboriginal Community, having great importance through stories of country and ongoing association.

There are many both fresh water and salt water Dharawal creation stories that relate to the Five Islands. Different groups of Aboriginal people tell different versions of these stories and hold parts of stories that connect the continent.

One version of the creation story was reported in the Illawarra Mercury in 1950:

*The formation of the five islands is explained in the Dreaming. Oola-boola-woo, the West Wind, lived on top of the Illawarra range ('Merrigong') with his six daughters, Mimosa, Wilga, Lilli Pilli, Wattle, Clematis and Geera. With the exception of Geera, these daughters one-by-one became rude and badly behaved. Each time this happened, the West Wind threw the naughty daughter along with the rock she was sitting on into the sea. Each rock formed an island, now known as the Five Islands, and the daughters became little mermaids or dolphins. Geera was left alone on the mountain and became very lonely, sitting year after year hunched with her arms around her ankles gazing down at the islands. She sat so still and quiet that she turned to stone, becoming the part of the mountain range now known as Mount Keira.*

During research by the PWD Illawarra Regional Aboriginal Heritage Study in 2004 an alternate story, which has broad community acceptance, came to light. The following version was recorded by Mathews (1899) and has been augmented by contemporary Dharawal storytellers:

### ***Why the Whale Spouts, the Starfish is Ragged, and the Native Bear has Strong Arms***

*Many years ago all the animals now living in Australia were people. At that time, they lived in a distant land across the ocean, and, having heard of the wonderful hunting grounds in Australia, they decided to leave their country and sail to this sunny land in a canoe. They knew that the voyage would be long and dangerous and that they would need to have a very strong canoe.*

*Wondangar, the whale, who was the biggest of all the people and the best canoe maker, had a great strong canoe that could weather the wildest storm. But he was a very selfish fellow and would not allow anybody to use it. As his companions realised that only his canoe would fit the task they looked out for an opportunity to steal it. But Wondangar was cunning and kept strict watch over the canoe. The other people didn't know what to do and they finally decided to hold a council to solve the problem. Many possibilities were suggested but none of them were practical. It seemed insoluble until Goon na ghun, the starfish, came forward to place his suggestion before the council.*

*Now, Goon na ghun was a very good and close friend of Wondangar, so, when he spoke, everybody was quiet and listened carefully: "Unless we get a very big canoe we won't be able to get to the new place where the weather is always warm, the sand is soft and golden, and there is plenty of food. I shall get my friend, Wondangar, to leave his canoe and distract him for a long time. When I signal to you, take it away as quickly and quietly as you can."*

*Some time later Goon na ghun paid Wondangar a friendly visit and said after chatting for a while, "I have noticed that you have a lot of lice in your hair. You must feel very itchy. Would you like me to kill them for you?"*

*It was true that Wondangar was badly infested with lice and readily agreed to the offer from his friend. Wondangar moored his canoe in deep water and sat on a rock. Goon na ghun placed his friend's head in his lap and proceeded to hunt diligently for the lice with a special stick which was sharpened on one end. While he was doing this, he told funny stories and kept Wondangar's attention. Goon na ghun then gave a signal to the other people who were waiting. They quietly got into the canoe and paddled off fast towards the new country.*

*Meanwhile Wondangar was very suspicious. Every so often he would forget about his canoe, but then he would suddenly remember it and say: "Is my canoe all right?" With great foresight Goon na ghun had provided himself with a piece of bark which he tapped on the rock in imitation of the canoe slapping against the water with the rise and fall of the sea. He would answer, "Yes, this is it I am tapping with my hand. It is a very fine canoe."*

*He continued to entertain Wondangar with funny stories and at the same time, he scratched very hard around his ears in order to muffle the sound of the other men leaving with the canoe. After some time, Wondangar grew tired of his friend's attention and story-telling, and decided to have a look at the canoe himself. When he looked around and found it missing, he could hardly believe his eyes. He rubbed them and looked again. Away in the distance, he could see the vanishing shape of his canoe and it dawned upon him that he had been tricked.*

*Wondangar was very angry and beat Goon na ghun unmercifully, throwing him upon the rocks. When they started fighting, Goon na ghun still had the stick in his hand and he stabbed Wondangar in the back of the neck in the hope of getting away. Ghun na ghun did escape and started swimming out towards the boat. Wondangar started out towards him but because he'd been stabbed in the head it took him some time to recover. Ghun na ghun got into the boat with Kurrilwa, the koala, and the others and they paddled and paddled with the injured Wondangar coming behind them. Wondangar recovered a bit and chased hard. Kurrilwa, the koala paddled hard. The men in the canoe believed that he was gaining on them, "When he catches us, we shall all be drowned." But Kurrilwa said, "Don't be afraid. My arms are strong enough to paddle fast and keep us ahead of Wondangar." This reassured the others in the canoe and the chase continued.*

*Just as they saw land, Wollongong as it happened to be, Wondangar caught up with them and in his rage smashed the canoe. The five pieces of the smashed canoe became the Five Islands. Because of his strong arms, Kurrilwa managed to swim to shore, but he was so afraid of being hurt by Wondangar that he ran up the closest tree and has been there ever since. That is why koalas stay in the top of trees and don't even come down for water.*

*Wondangar had made such great ragged cuts in Goon na ghun that even to this day starfish have a very ragged and torn appearance and hide themselves in the sand to avoid discovery by Wondangar. This story also explains why whales travel up and down the coast looking for Kurrilwa and Goon na ghun and the others who stole his prized canoe.*

Another version of this story ends differently with Gooradawaak, the brolga, making a hole in the bottom of the canoe, which he pushed a short distance from the shore where it settled and became Gun-man-gang or Windang Island. A third version describes the koala, possum, bandicoot, red-bellied black snake, groper and whale choosing their habitats. An alternative story of the creation of the Five Islands connects the islands to Mt Keira and the west wind. In one story for the creation of Keira and Kembla mountains states that they were two sisters.'

There has been an ongoing utilisation of the islands from pre-European times to the twentieth century for the harvesting of plant and animal resources. Middens and stone artefacts provide evidence of occupation and use of Big Island, although sites on Big Island are now largely covered by vegetation (Mills 1990; NPWS Aboriginal Sites Register). Illawarra elders describe the harvesting of sea birds and eggs from Booidoorong (Big Island) up until the mid-twentieth century from the settlements at Hill 60 and Official camps.

Previous periods of soil erosion have probably destroyed some evidence of past Aboriginal use of the islands, but the remaining Aboriginal sites on FINR have been protected indirectly by access restrictions and, on Big Island, the growth of vegetation over much of the Island. Management activities have the potential to expose or disturb Aboriginal sites and therefore knowledge of the location of Aboriginal sites is required.

While the NPWS has legal responsibility for the protection of Aboriginal sites, it acknowledges the right of Aboriginal people to make decisions about their own heritage. It is NPWS policy that Aboriginal communities be consulted about decisions regarding the management of Aboriginal sites and related issues and how the Aboriginal culture and history of an area managed by the NPWS will be promoted and presented. It is also current NPWS policy to review non-Aboriginal names for existing reserves, excluding historic sites, to identify candidate parks for possible renaming or dual naming.

### **Intended Outcomes**

- The Illawarra Local Aboriginal Land Council, and other relevant Aboriginal communities in the Illawarra, are actively involved in the management, particularly of Aboriginal places and values, of FINR.
- Better informed and improved management of Aboriginal cultural heritage through increased knowledge and understanding of the Aboriginal cultural heritage of FINR, including activities, traditional uses and the location of Aboriginal sites.

### **Strategies**

- *Review the name of Five Islands Nature Reserve to determine whether it should be renamed utilising an Aboriginal name and to identify an appropriate name.*
- *Identify opportunities and develop and implement programs to involve the local Aboriginal community in the management and interpretation of FINR.*
- *Identify, record and assess the significance of Aboriginal places and objects and associations within FINR, in conjunction with the local Aboriginal community.*
- *Protect identified Aboriginal places and objects, in conjunction with the local Aboriginal community.*

- *Finalise the research project to record the Aboriginal history of the Illawarra, including an inventory of sites of significance to Illawarra Aboriginal people in the Illawarra and adjacent regions.*

#### **4.5 HISTORIC HERITAGE**

FINR is of regional significance for its cultural heritage values, particularly the local settlement history of the Illawarra.

The first officially recognised European explorer to the Illawarra region was Captain James Cook, who saw the islands in 1770. Cook could not distinguish Big Island and Martin Islet from the mainland and called it Red Point, a name that was subsequently transferred to the closest adjacent point of the mainland. George Bass and Mathew Flinders (with the boy William Martin) were the next Europeans to explore the Illawarra during an expedition from the Georges River to Lake Illawarra and the Shoalhaven in 1796 and the names of these explorers now identify the three outer islets.

European settlers introduced cattle and rabbits to Big Island before 1861, which is evidenced by an advertisement that appeared in the Illawarra Mercury (13 September 1861) requesting the removal of all cattle on the Island and cautioning people that anyone destroying rabbits on the Island would be prosecuted. In 1867, the Perkins family established a house on Big Island, where they lived until about 1872, grazing cattle and catching sharks for their oil.

In 1925 a mining lease was granted over two hectares of the sea floor on the western side of Big Island, including Parkyns Beach and shells were extracted from the lease for several years.

Although there has been no systematic survey of archaeological sites on the islands, it is believed that the current research hut on Big Island is built over the foundations of the Perkins' family house.

The European use of the islands resulted in the introduction of many introduced species, which have drastically altered the ecology of the islands.

#### **Intended Outcomes**

- Significant historic places and relics recorded, researched and conserved where appropriate.

#### **Strategies**

- *All activities with the potential to impact on historic sites will be preceded by an archaeological assessment and appropriate controls and safeguards implemented.*
- *Identify, record and assess significance of historic heritage sites.*



## 5. PARK PROTECTION

### 5.1 SOIL EROSION

Soil erosion is a major threat to FINR, especially the nesting areas of breeding seabirds, with the greatest erosion on Big Island due to occupation by Europeans. Soil erosion was reduced in the 1960s with the introduction of Kikuyu grass. Erosion has contributed to the loss of burrows for breeding birds as well as middens and other evidence of occupation by Aboriginal people.

Areas of erosion remain where Kikuyu or other species have not established, including areas with nesting burrows.

Any attempt to replace Kikuyu with native species will need to take into account the requirement to prevent further soil erosion.

#### **Intended Outcomes**

- Soil erosion stabilised and soil loss from FINR prevented.

#### **Strategies**

- *Audit, prioritise and manage disturbed/eroded areas on Big Island.*
- *Design, undertake and manage all access and activities on FINR in a manner that avoids, and where necessary for management minimises, soil erosion.*

### 5.2 HYDROLOGY AND WATER QUALITY

Due to the inaccessibility of most of the islands, and the size and topography of Big Island, Big Island has the greatest potential for impacts on hydrology. There are known springs and soaks on the island and care needs to be taken not to contaminate these water bodies and the ground water of the island.

The impacts of pollution pose a threat to native fauna and the seabirds that utilise the islands. The most significant threat to the seabirds comes from litter, particularly discarded fishing lines, nets and plastics. Other pollution sources that have the potential to impact upon the islands include oil spills from ships visiting Port Kembla Harbour.

#### **Intended Outcomes**

- The natural hydrology of the islands maintained.

#### **Strategies**

- *All human wastes to be removed from FINR to the mainland for proper treatment.*
- *Design and undertake all works in a manner that minimises water pollution and impacts on the hydrology of the islands.*
- *Liaise with the EPA and the Illawarra Ports Authority in regard to pollution events that could damage the habitats of FINR.*

### 5.3 INTRODUCED SPECIES

Introduced species within FINR have the potential to have detrimental effects on the islands' ecological values. The *Noxious Weeds Act 1993* places an obligation upon public authorities to control noxious weeds on land that they occupy to the extent necessary to prevent such weeds spreading to adjoining lands. However, in the case of FINR, it is likely that weeds have, and continue to, spread from the mainland to the islands by wind, birds, human visitors and water. The control of noxious weeds on the mainland is therefore required to complement weed control and revegetation actions on FINR.

Davis *et al.* (1938) recorded that Prickly Pear was widespread on the islands. At that time sporadic attempts at control had failed but the introduction of the *Cactoblastis cactorum* moth dramatically reduced the Prickly Pear population by the time the next comprehensive study was undertaken in 1969.

The dominant introduced species identified on Big Island in 1989 was Kikuyu Grass (*Pennisetum clandestinum*), which was first recorded on Big Island by David Walsh in late 1969 (Mills 1990). The scattered nature of its occurrence at this time suggests that it may have been introduced intentionally for erosion control. Mills (1990) notes that:

*The overwhelming dominance of Kikuyu Grass has resulted from the lack of competition from other plant species and high nutrient soils produced by the droppings of thousand of nesting silver gulls. In fact, the dominance of Kikuyu Grass seems to have paralleled the increase in the silver gull population...*

Prior to the establishment of Kikuyu large parts of Big Island consisted of bare soil and sand with visible soil erosion. Although Kikuyu has now stabilised the soils on Big Island, the grass appears to have diminished the habitat for burrow-nesting seabirds on the upper and northern parts of Big Island 1 by forming an almost impenetrable mat, which makes burrowing difficult. The mats are so dense that water penetrates poorly; as a consequence changes to soil moisture levels lead to changes in the ecology of the soils and loss of structure.

It has also been reported that Kikuyu may physically interfere with burrowing birds through entrapment and tangling (Smith and Battam 1998). On the other hand, Kikuyu appears to have increased the quality of nesting habitat for the silver gull, which is a generalist species that can nest in all manner of habitats.

Other introduced species present on the islands, which could become problems if Kikuyu was eliminated, include:

- Bitou Bush (*Chrysanthemoides monilifera*);
- Buffalo Grass (*Stenotaphrum secundatum*);
- Mirror Bush (*Coprosma repens*)
- Crowsfoot Grass (*Eleusine indica*).

Visitors and silver gulls, which forage daily at local rubbish tips, are potential vectors of propagules to the island.

Wolhuter studied the vegetation of Big Island in 1999, noting that the dense mat of Kikuyu Grass was still dominant, and appeared to show a further probable decline in native species with only 13 natives recorded. Appendix 1 shows a full list of species recorded on Big Island in 1938, 1989 and 1999 respectively.

By 1999, a preliminary assessment of the vegetation on Flinders Islet by Wolhuter showed a dramatic change in vegetation cover. The introduced species Bitou Bush (*Chrysanthamoides monilifera*), which is easily dispersed by birds that eat its fruit, dominated the Islet's vegetation. Isolated patches of Pigface, White Correa, Coast Rosemary, Dusky Coral Pea and some small herbs remained. The Bitou-tip Moth, which feeds on Bitou Bush, was released from Hill 60 for the biological control of Bitou Bush and is likely to have spread to Flinders Islet, although its success on the islet has not been studied. Bitou Bush, which forms a shrub layer, does not appear to prevent burrowing birds from breeding on the islet while being less favourable for silver gulls.

There are no records of introduced mammals on the islands now. It is believed that the goats introduced to Big Island in the 19<sup>th</sup> century were eradicated by about 1917 (Davis *et al.* 1938) and the rabbit population was subsequently eradicated by the late 1960s. The introduction of feral animals, especially cats or rats, onto the island could be devastating for breeding birds.

### **Intended Outcomes**

- Introduced species are reduced and, where possible, eradicated from FINR.

### **Strategies**

- *Prepare an introduced plant species management plan, and implement on-going programs with priority for the control of Kikuyu (*Pennisetum clandestinum*), Bitou Bush (*Chrysanthemoides monilifera*), Buffalo Grass (*Stenotaphrum secundatum*), Mirror Bush (*Coprosma repens*), Crowsfoot Grass (*Eleusine indica*), and other species that:*
  - *are likely to suppress benefits gained from previous control programs*
  - *conflict with another high priority management programs.*

## **5.4 FIRE MANAGEMENT**

Fire is a natural feature of many environments and is essential to the survival of some plant communities. Inappropriate fire regimes, however, can lead to loss of particular plant and animal species and communities. Fire can also damage cultural heritage and management facilities.

Fire is not believed to be an integral part of the FINR ecosystems. Davis *et al.* (1938) report that fire was used in an attempt to control Prickly Pear on Big Island but the NPWS has no other records of fires on the islands.

### **Intended Outcomes**

- Unplanned fire excluded from FINR.

### **Strategies**

- *Manage access and activities to minimise the potential for human ignition of unplanned fires.*
- *Non-management related use of fire shall not be permitted on FINR.*

## 5.5 ACCESS

FINR is well known in the Illawarra region and due to close proximity to the mainland may be appealing as a place to visit. Public access to FINR has been restricted to protect breeding seabirds and their habitats and is generally granted only for management and research activities. Although this restriction is signposted on the islands and at the nearby boat ramp at Port Kembla, unauthorised access to Big Island is a continuing issue and threat to conservation values. The Volunteer Coastguard, who operates from Hill 60, currently provides informal surveillance of the islands, reporting unauthorised visitations to the NPWS.

Potential exists to explore the development of ecotourism opportunities focused on FINR that do not threaten the reserve's conservation values. Suitable opportunities would generally be restricted to off-reserve opportunities such as boat trips around the islands. Subject to satisfactory environmental assessment, periodic guided access to limited areas of Big Island outside of the seabird breeding season may be possible.

### Intended outcomes

- Conservation values protected from unnecessary human access and disturbance.

### Strategies

- *Public access to FINR shall generally only be permitted for authorised management-related purposes. Strictly limited non-management related access may be authorised subject to satisfactory environmental assessment and compatibility with the FINR management directions and intended outcomes.*
- *Install and maintain signs on FINR, Port Kembla harbour and other relevant locations to inform the public of FINR access restrictions.*
- *Develop and implement authorised access protocols for all access and activities administered through the local NPWS office.*
- *Prepare and distribute information regarding access restrictions to appropriate authorities and stakeholder associations.*
- *Prepare and release material to local and regional media at the start of fauna breeding seasons to inform the public of the need for access restrictions to the islands.*
- *Assess the potential, feasibility and public demand for limited ecotourism opportunities, principally those that do not require physical access to the islands.*
- *Negotiate a formal agreement with the Volunteer Coastguard for the reporting of illegal access incidents on FINR.*

## 6. EDUCATION

Promoting public awareness and understanding of the NPWS's conservation responsibilities, the natural and cultural values of the reserve, and the reasons for restricting access is a major aspect of visitor education.

There are strong links between the mainland and the islands (geology, habitats, evolutionary history, Aboriginal history and use of the area) and, given the difficulty of access to the islands under many conditions, the provision of mainland-based interpretative material would be useful for the majority of visitors.

Reserve interpretive displays currently exist at Hill 60 and Port Kembla boat ramp. These provide information on the breeding seabirds, the island ecology and the Aboriginal and historic heritage values of FINR. Hill 60 provides a natural vantage point for viewing Rocky Islet and Big Island and itself is also a significant area for the local Aboriginal community. There is potential to further interpret the rich Aboriginal heritage of the area, including the related cultural significance of FINR and Hill 60, in partnership with the local Aboriginal community.

### **Intended outcomes**

- Increased public and local appreciation and understanding of the natural and cultural heritage values, and management requirements, of FINR.

### **Strategies**

- *Prepare and distribute an interpretive brochure for FINR, including:*
  - *Geological and environmental history, especially in relation to adjacent mainland sites;*
  - *The islands' habitat value for breeding seabirds and the need to avoid disturbance during the breeding season;*
  - *Aboriginal heritage including their use of the islands and coastline;*
  - *European heritage relating to the settlement history of the Illawarra;*
  - *Ongoing research and management activities; and*
  - *Access restrictions and the reserve's sensitivity to inappropriate use.*
- *Regularly liaise with key stakeholder groups, including tourism and recreational fishers, and keep informed of the values and management requirements of FINR.*
- *Develop a collaborative, strategic approach to information provision with the Department of Primary Industries: Fisheries and the NSW Maritime Authority.*
- *Periodically update and maintain reserve interpretive displays at key mainland locations, including Hill 60 and Port Kembla boat ramp.*

## 7. RESEARCH AND MONITORING

Apart from a number of vegetation studies, limited scientific research on FINR has been carried out to date. The NPWS collaborated with the Waste Management Authority (now Waste Service NSW) and the Water Board to research the biology and management of the silver gull. Seabirds breeding on the islands have been banded and recorded by SOSSA for many years. However, this research was not specifically designed to inform the management requirements of the reserve. More targeted and systematic research is therefore required to assist the management and conservation of the seabirds and their habitats.

Research into the resources of FINR, their maintenance requirements, and threatening processes such as the impacts of access is essential to the development of appropriate management practices. Important research topics, identified in other relevant sections of this plan, include:

- The biology and reproductive success of birds breeding on FINR and threats to hatching, and survival of hatchlings;
- The nesting territories, and priorities for management of each bird species;
- The impact of Kikuyu on breeding success, particularly access to areas suitable for burrows, and the entrapment of breeding birds and hatchlings;
- The extent of off-island impacts on the reproductive success of the breeding populations and the variability of those impacts, including ecological changes and/or processes over large scales;
- The impacts of predation by silver and kelp gulls on other breeding birds;
- Methods to promote regeneration of native vegetation while maintaining suitable habitat for breeding sea birds; and
- Identification of all ecologically significant habitats on the islands, the communities associated with these habitats, and management priorities.

Research activities should be carefully managed and researchers need to work collaboratively and in close contact with the NPWS to minimise potential adverse impacts on the conservation values of FINR. The development of a Memorandum of Understanding, based on clearly articulated research goals and programs, with each research organisation would assist with the coordination and management of research activities. A peer review process for each proposal and the interpretation of data would assist in the credibility of the program and ensure consistency.

### **Intended outcomes**

- Research that contributes to improved understanding and management of the natural and cultural heritage of FINR, and the processes that affect them, and which has minimal negative impacts on the ecology and environment of the nature reserve.

### **Strategies**

- *Develop a research prospectus for FINR identifying high priority research opportunities that relate directly to issues of concern to the management of FINR, and promulgate with tertiary education and other relevant research organisations.*

- *Establish formal agreements with non-NPWS persons or research institutions undertaking research on FINR that includes, but is not limited to, requirements such as access protocols, approved research methods and materials, environmental impact assessment, and the provision of research data and results to the local NPWS office.*
- *Review the appropriateness and environmental acceptability of individual research programs annually before renewal of access permits and review the overall program and priorities at least every five years.*

## 8. NPWS MANAGEMENT FACILITIES AND OPERATIONS

The NPWS established a research hut on Big Island in 1988 to facilitate research into the breeding and biology of the silver gull. Upon the completion of this study the hut remained and in recent years SOSSA, with the permission and assistance of the NPWS, have primarily utilised and maintained the hut as their research base (the "Consett Davis Hut").

The appropriateness of maintaining the hut will be reviewed periodically on the basis of the needs of approved research and management programs on the islands. Inevitably the presence of the hut directs research outcomes to Big Island with a corresponding neglect of the other islands of the group.

### **Intended Outcomes**

- Minimal built management facilities that only serve the needs of reserve management and which have acceptable environmental impact.

### **Strategies**

- *Review the need for the research hut on Big Island periodically on the basis of the needs of approved or proposed research proposals. If the hut is found to be non-essential for research activities important to the management of FINR, or detrimental to the reserve's conservation values, it will be removed and the site rehabilitated.*



## 9. PLAN IMPLEMENTATION

Under the NPW Act, where the Minister has adopted a plan of management for a nature reserve it shall be carried out and given effect to by the Director-General. No operations shall be undertaken in relation to the nature reserve unless they are in accordance with the plan.

Implementation of this plan will be undertaken within the annual programs of the NPWS Illawarra Area. Relative priorities for identified activities are set out in the table below. These priorities are determined in the context of NPWS directorate and regional strategic planning, and are subject to the availability of necessary staff and funds and to any special requirements of the Director-General or Minister. The implementation of the plan will be monitored and its success in achieving the identified outcomes will be assessed.

The environmental impact of all proposed activities to be undertaken in the reserve will be formally assessed at all stages and any necessary investigations will be undertaken in accordance with the requirements of the *Environmental Planning and Assessment Act 1979* and other relevant statutes. This requirement applies to all activities and works proposed whether undertaken by the NPWS or others.

### Strategies

- *Ensure that all activities on FINR are in accordance with this plan of management and that there is effective communication between all relevant parties to assist management activities.*
- *Undertaken an annual review and prepare a report of progress in implementing this plan of management.*
- *Undertake an assessment after 5 years of the effectiveness of managing FINR in accordance with this plan and of the degree of success in implementing the strategies and in achieving the plan's management directions and intended outcomes.*

### PLAN IMPLEMENTATION SCHEDULE

Priority	Strategy	Plan reference
<b>High</b>	Avoid, and where essential for management minimise the effects of, activities likely to have adverse impacts on the soils, geology or landform of the islands.	<b>4.1</b>
	Identify and, where possible, reduce or eliminate threats to breeding success of fauna with priority for species of conservation significance.	<b>4.3</b>
	Manage access and activities to minimise the potential for human ignition of unplanned fires	<b>5.4</b>
	Non-management related use of fire shall not be permitted on FINR	<b>5.4</b>
	Prepare and implement revegetation plans for the islands, with priority given to Big Island and Flinders Islet.	<b>4.2</b>
	Audit, prioritise and manage disturbed/eroded areas on Big Island.	<b>5.1</b>
	Design, undertake and manage all access and activities on FINR in a manner that avoids, and where necessary for management minimises, soil erosion.	<b>5.1</b>
	All human wastes removed from FINR to the mainland for proper treatment.	<b>5.2</b>
	Design and undertake all works in a manner that minimises water pollution and impacts on the hydrology of the islands.	<b>5.2</b>
	Public access to FINR shall generally only be permitted for authorised management-related purposes. Strictly limited non-management related access may be authorised subject to satisfactory environmental assessment and compatibility with the FINR management directions and intended outcomes.	<b>5.5</b>
	Prepare an introduced plant species management plan, and implement on-going programs with priority for the control of Bitou Bush ( <i>Chrysanthemoides monilifera</i> ), Buffalo Grass ( <i>Stenotaphrum secundatum</i> ), Mirror Bush ( <i>Coprosma repens</i> ), Crowsfoot Grass ( <i>Eleusine indica</i> ), and other species that: <ul style="list-style-type: none"> <li>• are likely to suppress benefits gained from previous control programs</li> <li>• conflict with another high priority management program.</li> </ul>	<b>5.3</b>
	Develop and implement authorised access protocols for all access and activities administered through the local NPWS office.	<b>5.5</b>
	Ensure that all activities on FINR are in accordance with this plan of management and that there is effective communication between all relevant parties to assist management activities.	<b>9</b>

Priority	Strategy	Plan reference
<b>Medium</b>	Liaise with NSW Fisheries regarding management, and possible incorporation, of the intertidal zones within FINR.	<b>4.3</b>
	Review the name of FINR to determine whether FINR should be renamed utilising an Aboriginal name and to identify an appropriate name.	<b>4.4</b>
	Identify opportunities and develop and implement programs to involve the local Aboriginal community in the management and interpretation of FINR.	<b>4.4</b>
	Install and maintain signs on FINR, Port Kembla Harbour and other relevant locations to inform the public of FINR access restrictions.	<b>5.5</b>
	Prepare and distribute information regarding access restrictions to appropriate authorities and stakeholder association	<b>5.5</b>
	All activities with the potential to impact on historic sites will be preceded by an archaeological assessment and appropriate controls and safeguards implemented	<b>4.5</b>
	Identify, and coordinate and facilitate, studies to develop a clearer understanding of management requirements to promote breeding success of birds of conservation significance breeding on the Islands.	<b>4.3</b>
	Develop, implement, and monitor effectiveness of management strategies for species, especially gulls and pelicans, that threaten the breeding success of birds of conservation significance	<b>4.3</b>
	Liaise with relevant authorities regarding the control of mainland food sources for the Silver gull and Australian Pelican.	<b>4.3</b>
	Identify, record and assess the significance of Aboriginal places and objects and associations in FINR, in conjunction with the local Aboriginal community.	<b>4.4</b>
	Protect identified Aboriginal places and objects, in conjunction with the local Aboriginal community.	<b>4.4</b>
	Establish formal agreements with non-NPWS persons or research institutions undertaking research on FINR that includes, but is not limited to, requirements such as access protocols, approved research methods and materials and the provision of research data and results to the local NPWS office.	<b>7</b>
	Prepare and release material to local and regional media at the start of fauna breeding seasons to inform the public of the need for access restrictions.	<b>5.5</b>
	Prepare and distribute an interpretive brochure for FINR, including: <ul style="list-style-type: none"> <li>• Geological and environmental history, especially in relation to adjacent mainland sites;</li> <li>• The islands' habitat value for breeding seabirds and the need to avoid disturbance during the breeding season;</li> <li>• Aboriginal heritage including their use of the islands and coastline;</li> <li>• European heritage relating to the settlement history of the Illawarra;</li> <li>• Ongoing research and management activities; and</li> <li>• Access restrictions and the reserve's sensitivity to inappropriate use.</li> </ul>	<b>6</b>
	Develop a research prospectus for FINR identifying high priority research opportunities that relate directly to issues of concern to the management of FINR, and promulgate with tertiary education and other relevant research organisations.	<b>7</b>

Priority	Strategy	Plan reference
<b>Low</b>	Identify, record and assess significance of historic heritage sites	4.5
	Collate, review and expand existing information and knowledge relating to terrestrial fauna.	4.3
	Undertaken an annual review and prepare a report of progress in implementing this plan of management.	9
	Regularly liaise with key stakeholder groups, including tourism and recreational fishers, and keep informed of the values and management requirements of FINR	6
	Liaise with the EPA and the Illawarra Ports Authority in regard to pollution events that could damage the habitats of FINR.	5.2
	Assess the potential, feasibility and public demand for limited ecotourism opportunities, principally those that do not require physical access to the islands.	5.5
	Periodically update and maintain reserve interpretive displays at key mainland locations, including Hill 60 and Port Kembla boat ramp	6
	Review the appropriateness and environmental acceptability of individual research programs annually before renewal of access permits and review the overall program and priorities every five years.	7
	Review the need for the research hut on Big Island periodically on the basis of the needs of approved or proposed research proposals. If the hut is found to be non-essential for research activities important to the management of FINR, or detrimental to the reserve's conservation values, it will be removed and the site rehabilitated.	8
	Undertake an assessment after 5 years of the effectiveness of managing FINR in accordance with this plan and of the degree of success in implementing the strategies and in achieving the plan's management directions and intended outcomes.	9

### Legend

**High** priority strategies are those imperative to achievement of the management directions and intended outcomes. They must be undertaken in the near future to avoid significant deterioration in natural, cultural or management resources.

**Medium** priority strategies are those that are necessary to achieve the management directions and intended outcomes but are not urgent.

**Low** priority strategies are desirable to achieve management directions and intended outcomes but can wait until resources become available.

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<b>APPENDIX 1 Plants species on Big Island</b>
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Plant species recorded on Big Island by Davis *et al.* (1938), Mills (1990) and Wolhuter (1999)

{ Species recorded  
\* Introduced species

Family/Species	Survey		
	Davis <i>et al.</i> (1938)	Mills (1990)	Wolhuter (1999)
<b>Aizoaceae</b>			
<i>Carpobrotus glaucescens</i>	{	{	{
<i>Tetragonia teragonioides</i>	{	{	{
<b>Amaranthaceae</b>			
<i>Amaranthus viridis</i> *		{	
<b>Apiaceae</b>			
<i>Apium prostratum</i>	{		
<i>Hydrocotyle bonariensis</i> *		{	{
<b>Asclepiadaceae</b>			
<i>Marsdenia rostrata</i>	{		
<b>Cactaceae</b>			
<i>Opuntia stricta</i> *	{	{	
<b>Campanulaceae</b>			
<i>Wahlenbergia gracilis</i>	{		
<b>Caryophyllaceae</b>			
<i>Polycarpon tetraphyllum</i> *			{
<i>Spergularia marina</i> *		{	
<i>Stellaria media</i> *		{	{
<b>Centrolepidaceae</b>			
<i>Centrolepis fascicularis</i>	{		
<b>Chenopodiaceae</b>			
<i>Atriplex australasica</i>		{	
<i>Atriplex cinerea</i>		{	
<i>Atriplex patula</i>	{		
<i>Chenopodium album</i> *	{		{
<i>Chenopodium glaucum</i> *		{	
<i>Chenopodium murale</i> *		{	
<i>Einadia hastata</i>	{		
<i>Einadia nutans</i>	{	{	{

<i>Enchylaena tomentose</i>	}	}	}
<i>Rhagodia candolleana</i>		}	
<i>Salsola kali</i> *	}	}	
<i>Sarcocornia quinqueflora</i>		}	
<b>Commelinaceae</b>			
<i>Commelina cyanea</i>	}	}	}
<b>Compositae (Asteraceae)</b>			
<i>Chrysanthemoides moniliferum</i> *		}	}
<i>Cirsium vulgare</i> *	}	}	}
<i>Conyza bonariensis</i> *		}	
<i>Cotula austalis</i>	}		}
<i>Cotula coronopifolia</i>		}	}
<i>Dittrichia graveolens</i> *	}		
<i>Helianthus annuus</i> *		}	
<i>Hypochoeris glabra</i> *		}	
<i>Onopordum acanthium</i> *	}		
<i>Paeudognaphalium luteo-album</i>	}		
<i>Senecio lautus</i>	}		}
<i>Senecio madagascariensis</i> *		}	
<i>Senecio mikanioides</i> *	}		
<i>Sonchus asper ssp. glaucescens</i> *	}		
<i>Sonchus megalocarpa</i>	}		
<i>Sonchus oleraceus</i> *	}	}	}
<i>Xanthium occidentale</i> *		}	
<i>Xanthium spinosum</i> *		}	
<b>Convolvulaceae</b>			
<i>Dichondra repens</i>	}	}	
<i>Ipomea cairica</i> *		}	
<b>Crassulaceae</b>			
<i>Crassula sieberana</i>	}		
<b>Cruciferae</b>			
<i>Brassica rapa</i> *		}	
<i>Cakile edentula</i> *		}	
<i>Cakile maritima</i> *		}	
<i>Coronopus didymus</i> *		}	
<b>Cucurbitaceae</b>			
<i>Cucumis myriocarpus</i> *		}	
<i>Cucurbita maxima</i> *	}	}	



**Cyperaceae**

<i>Cyperus polystachyos</i>	}		
<i>Isolepis cernua</i>	}	}	
<i>Isolepis nodosus</i>	}	}	

**Dennstaedtiaceae**

<i>Pteridium esculentum</i>	}		
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**Dilleniaceae**

<i>Hibbertia scandens</i>	}		
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**Fabaceae**

<i>Acacia sophorae</i> (pers comm.. NPWS 1999)			}
<i>Kennedia rubicunda</i>	}		}

**Gentianaceae**

<i>Centaurium spicatum</i>	}		
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**Geraniaceae**

<i>Pelargonium capitatum</i> *			}
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**Goodeniaceae**

<i>Scaevola calendulacea</i>	}		
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**Gramineae (Poaceae)**

<i>Agrostis avenacea</i>	}		
<i>Bromus unioloides</i> *		}	}
<i>Cynodon dactylon</i> *	}	}	}
<i>Deyeuxia quadriseta</i>	}		
<i>Digitaria ciliaris</i> *		}	
<i>Echinochloa crus-galli</i> *		}	
<i>Eleusine indica</i> *		}	
<i>Imperata cylindrica</i>	}		
<i>Paspalum distichum</i> *		}	
<i>Pennisetum clandestinum</i> *		}	}
<i>Phragmites australis</i>	}	}	
<i>Poa annua</i> *		}	
<i>Setaria pumila</i> *	}		
<i>Sporobolus virginicus</i>	}	}	}
<i>Stenotaphrum secundatum</i> *	}	}	}
<i>Themeda australis</i>	}		
<i>Zoysia macrantha</i>	}		

**Lamiaceae**

<i>Plectranthus parviflorus</i>	}		
<i>Westringia fruticosa</i>	}		

**Lobeliaceae***Lobelia alata* }**Malvaceae***Lagunaria patersonii* }*Malva parviflora* }**Oxalidaceae***Oxalis corniculata* } }**Phytolaccaceae***Phytolacca octandra* } }**Plantaginaceae***Plantago major* }*Plantago varia* }**Polygonaceae***Rumex brownii* }**Portulacaceae***Calandrinia pickeringii* }*Portulaca oleracea* }**Primulaceae***Anagallis arvensis* }*Samolus repens* } }**Rubiaceae***Coprosma repens* } }**Rutaceae***Correa alba* } }**Solanaceae***Datura stramonium* } }*Lycium ferocissimum* }*Lycopersicon esculentum* }*Physalis peruviana* }*Solanum nigrum* } }*Solanum tuberosum* }**Xanthorrhoeaceae***Lomandra longifolia* } }

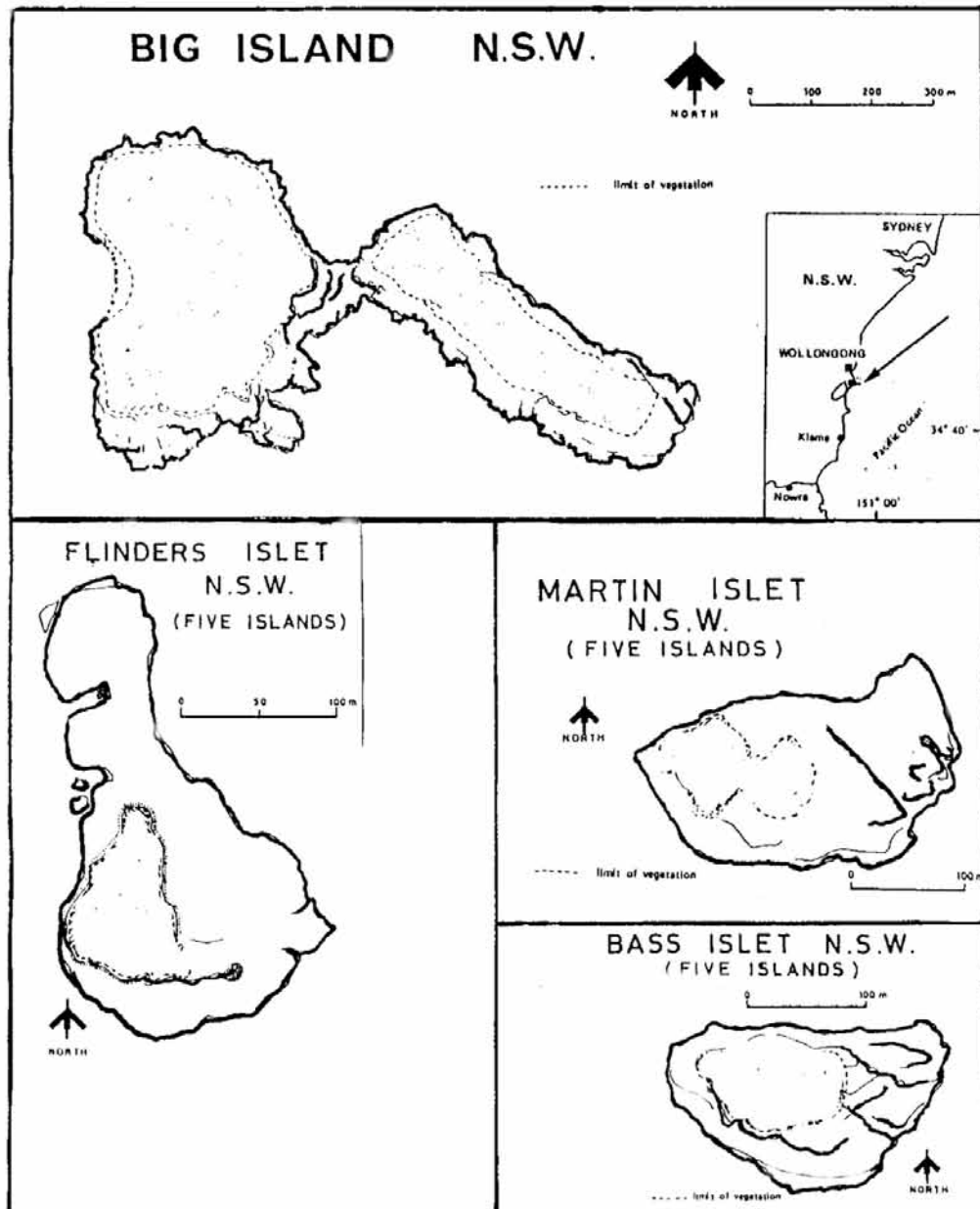
<b>APPENDIX 2 Non-breeding birds of Five Islands Nature Reserve</b>
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<b>Species</b>		<b>Big Island</b>	<b>Flinders Islet</b>	<b>Martin Islet</b>	<b>Bass Islet</b>
<b>Common name</b>	<b>Scientific name</b>				
Brown Quail	<i>Coturnix ypsilophora</i>	X			
Grey Teal	<i>Anas gracilis</i>	X			
Southern Giant-petrel	<i>Macronectes giganteus</i>	X			
Fairy Prion	<i>Pachyptila turtur</i>	X			
Sooty Shearwater	<i>Puffinus griseus</i>	X			
Fluttering Shearwater	<i>Puffinus gavia</i>	X		X	
Australasian Gannet	<i>Morus serrator</i>	X			
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>	X	X		
Pied Cormorant	<i>Phalacrocorax varius</i>	X			
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	X	X	X	
Great Cormorant	<i>Phalacrocorax carbo</i>	X	X	X	X
White-faced Heron	<i>Egretta novaehollandie</i>	X		X	
Australian White Ibis	<i>Threskiornis molucca</i>	X			
Black-shouldered Kite	<i>Elanus axillaris</i>	X			
Black Kite	<i>Milvus migrans</i>	X			
White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>	X	X	X	X
Swamp Harrier	<i>Circus approximans</i>	X		X	
Peregrine Falcon	<i>Falco peregrinus</i>	X	X	X	X
Australian Kestrel	<i>Falco cenchroides</i>	X			
Buff-banded Rail	<i>Gallirallus philippensis</i>	X			
Whimbrel	<i>Numenius phaeopus</i>	X	X	X	X
Grey-tailed Tattler	<i>Heteroscelis brevipes</i>	X	X	X	X
Wandering Tattler	<i>Heteroscelis incana</i>	X	X		
Ruddy Turnstone	<i>Arenaria interpres</i>	X	X	X	X
Pacific Golden Plover	<i>Pluvialis fulva</i>	X			
Masked Lapwing	<i>Vanellus miles</i>	X			
Pomarine Jaeger	<i>Stercorarius pomarinus</i>	X			
Artic Jaeger	<i>Stercorarius parasiticus</i>	X			
Pacific Gull	<i>Larus pacificus</i>	X			
White-fronted Tern	<i>Sterna striata</i>	X	X	X	X
Common Tern	<i>Sterna hirundo</i>	X	X	X	X

Rock Dove	<i>Columba livia</i>	X			
Spotted Turtle-dove	<i>Streptopelia chinensis</i>	X			
Barn Owl	<i>Tyto alba</i>	X			
Leaden Flycatcher	<i>Myiagra rubecula</i>	X			
Willie Wagtail	<i>Rhipidura leucophrys</i>	X			
Australian Raven	<i>Corvus coronoides</i>	X	X	X	X
Richard's Pipit	<i>Anthus novaeseelandiae</i>	X			
Welcome Swallow	<i>Hirundo neoxena</i>	X	X	X	X
Fairy Martin	<i>Hirundo areil</i>	X	X		
Golden-headed Cisticola	<i>Cisticola exilis</i>	X			
Silver Eye	<i>Zosterops lateralis</i>	X	X		
Southern Boobook	<i>Ninox novaeseelandiae</i>		X		

### APPENDIX 3 Island Details

Name of Island	Area (hectares)	Distance from Mainland	Highest elevation
Big Island	17.7	450m	16m
Flinder's Islet	2.73	2550m	10m
Bass Islet	2.63	3050m	10m
Martin Islet	2.33	1350m	13m
Rocky Islet	0.5	280m	1m



**Note:** Rocky Island is only 0.5ha and is not shown above.