Willoughby Fauna Study 2001

A snapshot of Willoughby's wildlife

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1.0 Executive Summary

1.1 Rationale of the Fauna Study

A detailed fauna study of the Willoughby Local Government Area (LGA) was a requirement of the Urban Bushland Plan of Management (1997). The results of the fauna study will be incorporated in existing and future Reserve Action Plans that deal with the long-term management of the bushland reserves. The fauna study surveyed 19 of the 20 bushland reserves in the Willoughby LGA and sought to provide a comprehensive assessment of the current vertebrate fauna of each reserve. The results of the fauna study will be a "yardstick" against which the results of subsequent fauna surveys will be compared. Follow-up surveys carried out in the same manner will provide information about the security of the fauna in each reserve and provide valuable insights into the needs of the fauna.

Willoughby LGA contains many bushland reserves that are sufficiently large and relatively undisturbed to retain native fauna. The condition of the reserves has enabled native wildlife to survive here whereas in other areas of Greater Sydney these animals have long since disappeared. As Sydney's population continues to increase, there will be more and more threats on bushland reserves through weed invasion, feral and domestic animals and greater public usage of the sites. Willoughby City Council has been pro-active in identifying these threats and initiating management strategies that are appropriate. The management of urban wildlife is a new skill that Council is seeking to add to its charter to conserve bushland areas.

1.2 General Findings

The Willoughby LGA contains important areas of native bushland. The bushland reserves vary greatly in size and condition. Some reserves, such as Sailors Bay Park and Fullers Road Reserve were small and highly impacted by surrounding urban development. Other reserves are larger and less modified. No reserves were free of urban impacts.

The types of impacts on the bushland areas varied but included:

* weed invasion
* dumping of garden wastes and household rubbish
* planting of non-native or non-endemic plants
* uncontrolled fires that alter plant communities
* contamination of creeks and ground water
* changes in flow patterns of creeks through storm water control
* increased erosion of creek banks
* loss of ephemeral freshwater habitat
* ground compaction through foot traffic
* penetration of bushland by walking tracks, roads and easements

* feral animals, such as foxes, cats. dogs, rats and mice
* high density of native, predatory birds
* night-light pollution from street lights and house lights
* noise and movement disturbance
* edge effects

Some of these impacts are being addressed by Willoughby City Council and an active bush rehabilitation program is currently under way. These programs are required to ameliorate the impacts experienced by the reserves, but are confined to the rehabilitation of flora. The rehabilitation of fauna is much more difficult and more contentious but is not possible without the conservation and management of bushland habitat areas.

1.3 Willoughby Fauna

Some animal groups in the original fauna of Willoughby have fared badly in the wake of urbanisation, others have survived relatively unscathed. The groups most seriously affected by urban development in the Willoughby Local Government Area are:

- terrestrial mammals
- large reptiles
- frogs

Terrestrial mammals (such as native rodents, bandicoots and wombats) have almost completely disappeared in the area. The only remaining native terrestrial mammals are:

- Echidnas (Explosives and Harold Reid Reserve)
- Eastern Bush Rat (Flat Rock Reserve)
- Brown Antechinus (H.D Robb, Willis Park, Explosives Reserve, North Arm Reserve, Castlecrag Escarpment, Clive Park, Flat Rock Reserve, Castlehaven and Blue Gum Reserve)
- Scats that may be from Swamp Wallabies were collected from Fullers Road Reserve

The main reason for the loss of terrestrial mammals appears to be through predation by exotic animals, such as foxes, cats and dogs.

Large reptiles have generally been eliminated. This includes goannas, large snakes, dragons (such as Bearded Dragons) and large skinks (such as Blue-tongue lizards). Many of these reptiles appear to have either been deliberately killed (mainly snakes), accidentally killed or killed by domestic animals.

The only large reptiles still remaining in the Willoughby area are:

- Diamond Pythons (Castlecrag Escarpment, Flat Rock Reserve)

- Eastern Water Dragons (Willis Park, North Arm Reserve, Harold Reid Reserve, Northbridge Park, Watergate Reserve, Flat Rock Reserve, Sailors bay Park, Blue Gum Reserve, Mowbray Park and Fullers Reserve)
- Eastern Blue-tongue Lizard(Explosives Reserve, North Arm reserve, Harold Reid Reserve and Flat Rock Reserve)

Frogs have suffered a precipitous decline in Willoughby. A number of bush reserves have no frogs at all or just one or two species. There appears to be several reasons for the decline of frogs:

- loss of ephemeral or still-water flooded sites
- loss of creek catchment habitat
- poor water quality
- introduced predatory fish (notable the Plague Minnow, *Gambusia holbrooki*).

Pond-breeding species are now confined to back-yard habitats and have been lost from creek areas. Most tree frogs have disappeared despite the amount of woodland and forest that has been retained. This is a direct consequence of the loss of breeding habitat.

Most other animal groups have shown declines in diversity.

The fauna groups that are still well represented in the area are forest and woodland birds. In many bushland reserves the tall canopy has been retained and reserves are close together so that birds can move freely between bushland areas. The birds that have declined markedly are the small passerines that require mid-canopy cover for protection and wading birds.

1.4 Recommendations

The Fauna Study assessed the animal life in the bushland reserves in terms of the species that have coped well with urban impacts and will survive with minimal assistance, to those species that are poorly represented and need considerable assistance. The report also considered those species or groups of species that are absent.

Recommendations aimed at maintaining the maximum diversity of animals in the LGA are presented at two levels; generic recommendations (see Section 4.0) that apply to all or most of the bushland sites, and specific recommendations that refer to particular reserves. These recommendations will be incorporated in existing Reserve Action Plans.

Recommendations concerned issues such as the creation of specific habitat areas, the establishment of buffer strips around reserves, the enhancement of fauna corridors between bushland areas through the use of suitable street trees and encouraging residents to plant appropriate vegetation around their houses, the need for ongoing control of weed and feral animals (particularly

foxes) and the protection of critical habitat areas for endangered or threatened species.

Willoughby City Council already has an active bush regeneration program and many of the recommendations support existing management practices.

2.0 Introduction

2.1 Background

Willoughby Local Government Area (LGA) contains some of the finest bushland reserves in the Sydney Metropolitan Area. The reserves, although highly valued by residents and conservationists alike, came to be as the result of complicated patterns of land settlement, difficulties with site access and the establishment of public utility easements. Regardless of the mechanism for the establishment of the reserves, bushland areas have become an identifiable feature of the Willoughby landscape.

Urbanisation

Urban development did not occur at uniform rates around Sydney Harbour. Areas south of Port Jackson were inhabited first because the land on the south side of the harbour was flatter and appeared to be more fertile (Watkin Tench 1789).

With the construction of the Sydney Harbour Bridge in 1933, the North Shore area became the focus of rapid urban development. Few farms had been established as fertile land was confined to a few narrow valleys. A road link to the Hawkesbury River was established along the ridge top that ran between Middle Harbour and the Lane Cove River valley. This ridge eventually became the route for the Pacific Highway.

The dissected sandstone plateau that formed the lower North Shore could be crossed easily from north to south but with more difficulty from east to west. The central ridge supported thin clay soils, which in turn supported low scrub, heath and open woodland. In protected areas below the ridge line, stands of tall Sydney Blue Gums dominated. Below the ridges, narrow gullies fell away to the east and west. These gullies were forested and supported tall trees and dense thickets. Steep sandstone escarpments led down to Middle Harbour and prominent timbered headlands remained difficult to reach.

On the western side of the central ridge, narrow gullies led down to the Lane Cove River valley. Lesser escarpments were present and access to the river was easier (although the easiest access was still by boat). The river flat was narrow and saline and useless for agriculture.

Because of the dissected nature of the landscape, the development of urban areas tended to follow the creation of ridge-top roads. Once the ridge tops were cleared and settled, neighbouring areas on the gentler slopes were cleared for the next stage of residential development.

This pattern of growth has meant that the last areas to be reached by residential development were those that were inaccessible by road. The

narrow gullies and areas of steep escarpment were not cleared and are now reminders of a historic landscape.

Remnant Bushland

For the Willoughby area, urbanisation has meant that all of the higher ridge areas were cleared and settled. Major roads were located at the peak of ridges and smaller, lateral roads branched from the main thoroughfares to lower levels. Virtually none of the original ridge-top vegetation survived land clearing. Fortunately, several areas of gully vegetation and sandstone headland were not overtaken by the urban sprawl and remain as green oases in a sea of bricks, tar and cement.

The bushland reserves of Willoughby have become an integral part of the nature of this Local Government Area (LGA). Green spaces and forested headlands soften the harshness of buildings and roads and create a much more attractive setting, increasing the value of residential properties nearby and providing a retreat for those wishing to escape suburbia.

In recent years, Councils in Sydney have found that bushland reserves have changed focus in the community. Originally, they were spaces that escaped development and were pleasant places to visit. With the increasing urgency for urban consolidation, a movement towards greater protection of remnant areas has resulted (e.g. Green Web Project for Sydney). Bushland reserves are no longer areas that can be left to their own devices, they need to be managed and maintained. In short, bushland reserves are areas of conservation for both native plants and animals.

For Sydney city councils, a role in fauna and flora conservation has not existed until recently. Councils are seeking to become managers of bushland and the animals and plants that occur within. Willoughby City Council was one of the first metropolitan councils to accept this role and an initial plan of management for the bushland reserves was prepared in 1984 (Fox). A more recent Plan of Management was prepared in 1997 that included responsibilities and actions for the conservation of native fauna and their habitats.

The present Fauna Study was an objective of the Plan of Management (1997).

2.2 Aims of the Fauna Study

In July 2000, Willoughby City Council commissioned Biosphere Environmental Consultants to undertake a systematic fauna survey of the bushland reserves. These surveys had two primary aims:

1. to provide a current assessment of the range and abundance of wildlife in the bushland reserves; and

2. to provide reference data that can be used to assess future changes to the diversity and abundance of wildlife in the reserves.

From the Fauna Study, recommendations were prepared that were intended to improve the survival prospects of native animals which will lead to the creation of more secure fauna habitats within the reserves (see Plan of Management, Volume 2; 1997).

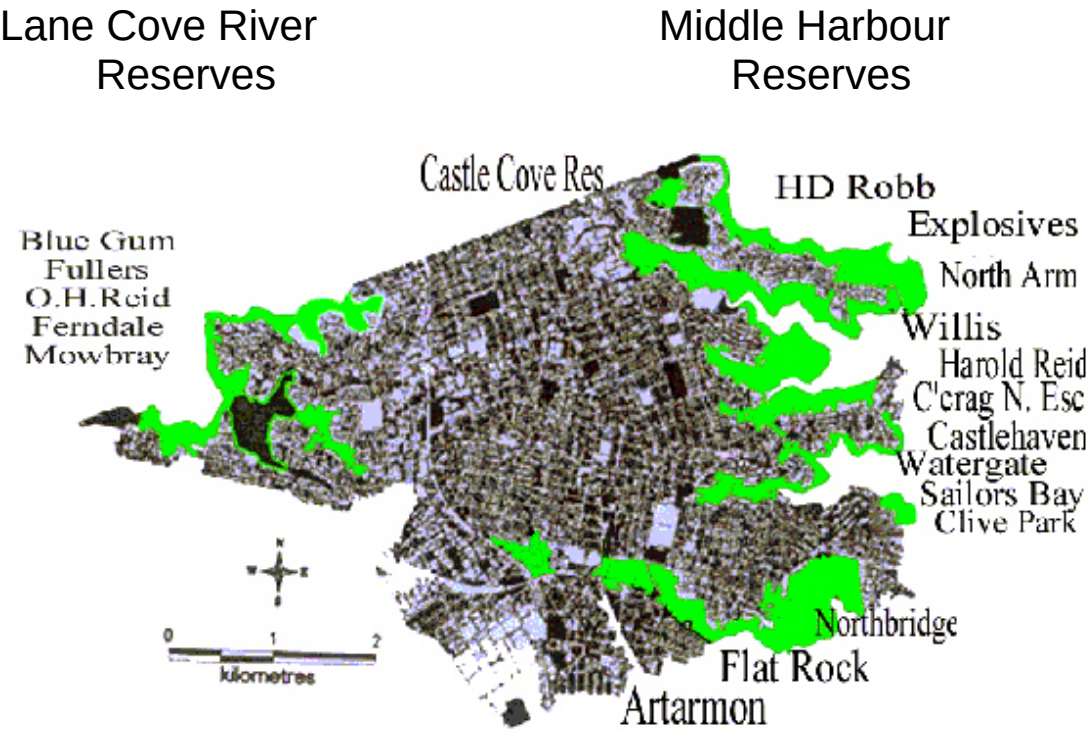
2.3 Description of the Study Area

Willoughby LGA is endowed with twenty bushland reserves that typify some of the pre-European ecosystems that occurred on the northern side of Sydney Harbour. Eighteen reserves were included in the fauna survey (Coolaroo Reserve was excluded as this reserve was fully represented elsewhere). In general, the bushland areas were located in two distinct regions; an eastern series of reserves that were associated with Middle Harbour and a western group of reserves that were associated with the Lane Cove River (Figure 1).

For management purposes, the reserves were grouped according to location and habitat interconnectivity (POM p24). The Fauna Study also uses these reserve groupings when listing and considering fauna results.

Figure 1

Location of the Bushland Reserves Surveyed in the Fauna Study



Middle Harbour Reserves:

The largest number of bushland reserves occurred along the western side of Middle Harbour. Many of these reserves occupy headlands and bays that project into Middle Harbour. Some of the reserves abut each other and formed a continuous green corridor along the shoreline. The longest corridor of bushland extends from Roseville Chase to Castlecrag and includes H.D. Robb Reserve, Explosives Reserve, North Arm Reserve, Willis Park, Harold Reid Reserve and Castlecrag Escarpment, creating an unbroken 9.6 kilometre stretch of bushland.

A number of other reserves occupy valleys that have water courses draining into Middle Harbour. The upper parts of the valley containing Scotts Creek also contain Willis Park and a section of North Arm Reserve; the tributaries of Sugarloaf Creek are bounded by Harold Reid Reserve and the Castlecrag Escarpment; Sailors Bay Creek passes through Watergate Park and Sailors Bay Park while Flat Rock Creek flows the entire length of Flat Rock Gully.

The only reserve that is isolated from valleys or headlands is Castle Cove Reserve, it occupies an area above a high sandstone escarpment.

Thirteen eastern bushland reserves were included in the fauna study (Table 1).

Table 1 Middle Harbour Reserves

Reserve Group Number	Reserve Group Name	Reserve Name	Area (Ha)	Description
1	Castle Cove	Castle Cove	6.2	Bushland confined to area between oval and escarpment
2.	H.D. Robb	H.D. Robb	11.2	Steep foreshore reserve overlooking Middle Harbour and Killarney heights
3.	Explosives	Explosives	24.6	Occupies eastern headland of Castle Cove.
4.	North Arm	North Arm	37.9	Foreshore reserve that surrounds the North Arm of Sugarloaf Bay.
5.	Willis Park	Willis Park	10.1	Broad valley associated with Scotts Creek
6.	Harold Reid	Harold Reid	39.5	Large headland reserve overlooking Sugarloaf Bay.
7.	Castlecrag	Castlecrag Northern Escarpment Castlehaven	15.7 3.1	Long and steep escarpment area that includes Sugarloaf Creek and Camp Creek. Narrow shoreline reserve overlooking Sailors Bay
8.	Warners Bay	Watergate Sailors Bay	0.5 2.3	Narrow gully associated with Sailors Bay Creek Narrow foreshore reserve at the western end of Sailors Bay.
9.	Clive Park	Clive Park	5.7	Eastern headland of Northbridge.
10.	Northbridge	Northbridge	46.7	Bushland strips around Northbridge Golf Course.
11.	Flat Rock	Flat Rock	24.6	Partly reclaimed land and gully centred around Flat Rock Creek
12.	Artarmon	Artarmon	9.6	Oval and isolated gully bushland.

Lane Cove River Bushland Reserves:

Five western bushland reserves were included in the fauna study; all of these overlook or are associated with the Lane Cove River valley. O.H. Reid Reserve and Mowbray Park form part of the river shoreline. Fullers Park and Blue Gum Reserve are located along Blue Gum Creek valley, a tributary of Lane Cove River while Ferndale Park occupies the upper sections of Swaines Creek valley.

Table 2 **Lane Cove River Reserves**

Reserve Group Number	Reserve Group Name	Reserve Name	Area (Hectares)	Description
13.	**Blue Gum**	**Blue Gum** **Fullers**	**6.2** **1.2**	**Gully reserve centred around Blue Gum Creek.** **Narrow, river flat area.**
14.	**O.H. Reid**	**O.H. Reid**	**11.2**	**Bushland strips around Chatswood Golf Course and O.H. Reid Memorial Park.**
15.	**Ferndale**	**Ferndale**	**9.6**	**Long, thin reserves centred around Swaines Creek.**
17.	**Mowbray**	**Mowbray**	**22.6**	**Large riverine park on Lane Cove River.**

Vegetation Communities

The vegetation communities in the bushland reserves have been classified using the scheme of Benson and Howell (1994). Table 3 lists the native vegetation communities that are present. The account for each reserve contains a vegetation map depicting the distribution of the vegetation communities. These maps do not show replanted areas or areas of high weed infestation.

Many of the bushland reserves are heavily wooded. Several types of sandstone woodland are present and well represented in a number of reserves. Conversely, heath and shrub lands are poorly represented while fresh water wetlands and native grasslands are not represented at all.

Table 3

Reserve Group	Reserve Name	Vegetation Communities Present
Castle Cove	Castle Cove	10 ar Sydney Sandstone Ridgetop Woodland 10 agi Sydney Sandstone Gully Forest
H.D. Robb	H.D. Robb	10 ar Sydney Sandstone Ridgetop Woodland
Explosives	Explosives	10 ar Sydney Sandstone Ridgetop Woodland 10 ag Sydney Sandstone Gully Forest 21giii Coastal Sandstone Heath
North Arm	North Arm	10 ar Sydney Sandstone Ridgetop Woodland 10 agi Sydney Sandstone Gully Forest 4a Estuarine Complex
Willis Park	Willis Park	10 ar Sydney Sandstone Ridgetop Woodland 10 agi Sydney Sandstone Gully Forest 4a Estuarine Complex
Harold Reid	Harold Reid	10ar Sydney Sandstone Ridgetop Woodland 10 agi Sydney Sandstone Gully Forest 10 agiii Sydney Sandstone Gully Forest 4a Estuarine Complex
Castlecrag	Northern Escarpment Castlehaven	10 ar Sydney Sandstone Ridgetop Woodland 10 ag Sydney Sandstone Gully Forest 10 agi Sydney Sandstone Gully Forest
Warners Bay	Watergate Sailors Bay	10 agi Sydney Sandstone Gully Forest 10 ar Sydney Sandstone Ridgetop Woodland 10 agi Sydney Sandstone Gully Forest
Clive Park	Clive Park	10 agi Sydney Sandstone Gully Forest
Northbridge	Northbridge	10 agi Sydney Sandstone Gully Forest 21gviii Coastal Sandstone Heath
Flat Rock	Flat Rock	10 ar Sydney Sandstone Ridgetop Woodland 10 ag Sydney Sandstone Gully Forest 10 agi Sydney Sandstone Gully Forest 21 gviii Coastal Sandstone Heath
Artarmon	Artarmon	10 agii Sydney Sandstone Gully Forest
Blue Gum	Blue Gum Fullers	10 ag Sydney Sandstone Gully Forest 10 agi Sydney Sandstone Gully Forest 10 agiii Sydney Sandstone Gully Forest 6b Blue Gum High Forest 10 agi Sydney Sandstone Gully Forest 4 ai Estuarine Complex
Ferndale	Ferndale	10 agi Sydney Sandstone Gully Forest 10 agiii Sydney Sandstone Gully Forest
O.H. Reid	O.H. Reid	10 agi Sydney Sandstone Gully Forest 10 agii Sydney Sandstone Gully Forest 4 ai Estuarine Complex
Mowbray	Mowbray	10 agi Sydney Sandstone Gully Forest 10 agii Sydney Sandstone Gully Forest 4 a Estuarine Complex 4 ai Estuarine Complex

3.0 Methods

3.1 Fauna Survey

a) **Historical Data**: Although the purpose of the study was to create a snapshot understanding of the fauna of the Willoughby LGA, efforts were made to locate historic data for the area. Willoughby City Council had a partial fauna database created from records collected by participants in Willoughby Wildlife Watch. These records are not the results of systematic surveys but rather they constitute opportunistic sightings. Some care had to be taken with accepting some of the sightings. The records listed in the appendix of this report are those that have either been corroborated or appear to be correct. Uncorroborated records have not been included.

In addition, once the surveys commenced contact was made with a number of local residents and council staff working in the LGA. People were asked specific fauna questions and details were noted and later crosschecked.

b) **Field Surveys**: The following techniques were used to sample the fauna:

Small Ground Mammals:
Single entrance, baited hair tubes were used in all of the bushland areas. These tubes proved very successful in surveys carried out in other council areas (eg. Kogarah Bushland Reserves: Biosphere Environmental Consultants 1997, Rockdale LGA: Biosphere 1999). The tubes are used in preference to traps as they do not cause concern with the general public and are usually not interfered with by passers-by. Hair tubes remained at each site for a minimum of five days. They were then collected and the hair samples forwarded to Dr David Read in Bathurst for hair analysis.

The number of hair tubes set out depended on the size of the reserve. Table 1 lists the number of hair tubes that were used.

Table 1 Hair Tube Numbers

RESERVE NAME	NO. of HAIR TUBES	LOCATION OF TUBES
Blue Gum Reserve	50	Off centre walking track
Castlecrag Northern Escarpment	50	25 along Cottage Area 10 near Sugarloaf Point 15 near Sugarloaf Creek
Castle Cove Reserve	25	Northern end of reserve
Castlehaven Reserve	25	10 Cheyne Walk westwards 15 The Barricade eastwards
Clive Park	25	Below picnic area
Explosives Reserve	60	40 Off lookout loop track 10 below escarpment northern side 10 around western knoll
Ferndale Reserve	50	Off centre walking track
Flat Rock Gully	100	60 off track to Tunks Park 20 Escarpment and quarry area northern side 20 off Dawson St. circuit
Fullers Park	25	Off centre walking track
Mowbray Park	50	30 off Ulm St. track 20 around escarpment below Avian Cr
North Arm Reserve	100	20 A.C Press Park 60 Willis Dr. to Mannerim Place 25 Mannerim to Scotts Ck 15 Scotts Ck to Harold Reid
Northbridge Park	40	15 Monkey Rocks Lookout 10 Weemalla Rd to shore 15 Cliff Ave to Shore
Harold Reid Reserve	50	Around lower walking track
O.H. Reid Reserve	25	Below Reid Drive
H.D. Robb Reserve	50	25 below Neerim Rd 25 Below Willowie Rd
Sailors Bay Park	25	15 below Rockley St 10 below The Barbette
Watergate Reserve	10	off The Rampart track
Willis Park	25	Along Scotts Ck

In addition, animal tracks, burrows, diggings, shed fur or feathers and scats were searched for and collected. Many scats and fur samples were collected by bush regeneration staff in the field. If these contained bone or hair samples they were forwarded to Dr Read for analysis.

Arboreal Mammals:

Arboreal mammals were detected mainly by spotlighting at night. In general, all of the walking tracks in each reserve were walked slowly while panning a spotlight either side of the track. If an animal's eye shine was detected, the location of the animal was approached directly, keeping the spotlight on the animal so that it did not move away. In most cases, the animal could be identified visually. In a few instances (e.g. sugar gliders) the animals were identified by call.

Spotlighting was carried out during the first three hours after dusk. Most reserves could be adequately covered in this time; some of the larger reserves (e.g. North Arm reserve) required more than one night of spotlighting to cover the length of the reserve.

In addition, an examination of trees for scratch marks and drays took place during daylight hours.

Bats:

Flying foxes were detected by spotlighting at night whereas insectivorous bats were detected using ultra-sonic (ANABAT) bat recorders. The recorders are hand-held and carried through the reserves at night while spotlighting was in progress. On two evenings a boat was used to reach the upper sections of Scotts Creek, Sugarloaf Creek, Castlehaven Reserve, Sailors Bay Park and Northbridge Park. Bat recordings were made from the boat.

Recorded bat calls were later analysed using Anabat 5.0 software.

Day Birds:

Birds were not included in the brief for this study as there had been a recent, thorough study of the birds of Willoughby by Burton (2000). However, as I was often in the reserves early in the mornings doing reptile searches the obvious birds were recorded. This was not done in a systematic manner.

Owls and Night Birds:

Owl surveys were conducted at night using a small portable amplifier. Owl calls were broadcast at night for Southern Boobook Owls, Powerful Owls, Sooty Owls, Masked Owls and Barn Owls. Calls were played at several sites each night and the amplifier was aimed away from nearby residences before the sounds were played. A listening period of 5 minutes followed the playing of each tape. If it was possible to visually identify the responding owl, all attempts were made to do so.

Owl calls were played from two sites on at least five evenings; the two sites were the point of Explosives Reserves (overlooking Middle Harbour towards Bantry Bay) and from the southern end of the loop track in Explosives

Reserve (overlooking Sugarloaf Bay towards Castlecrag Escarpment). These areas were repeatedly visited because of unusual owl responses and enabled some observations of owl movements.

Tawny Frogmouths, Owlet Nightjars and Night Herons were spotlighted during night surveys.

Reptiles:

Reptiles were searched for by hand during the day. On sunny mornings, the survey areas were walked and all potential reptile shelter sites examined. Where possible, reptiles were caught, identified and immediately released. Other signs of reptiles were searched for, such as the presence of burrows, shed skins and droppings. A minimum of two mornings (i.e. about six hours) searching was devoted to each reserve.

Frogs:

Frog surveys were carried out at night under suitable (wet) weather conditions. Calling frogs were identified, non-calling frogs were caught, identified and released. Searches of the area were carried out using head lamps.

During daylight hours, hand-netting was carried out to search for tadpoles. Tadpoles were immediately returned to the water once identified. If the tadpoles were too small to be readily identified they were kept and reared in captivity until they could be confidently identified and then released.

Fauna Survey Dates

Reserve	Ground Mammals	Tree Mammals	Bats	Birds	Reptiles	Frogs
Blue Gum Reserve	13-18.11.00	20.12.00	20.12.00	15.12.00 17.12.00	15.12.00 17.12.00	20.12.00 23.12.00
Castlecrag Northern Escarpment	17-23.11.00	17. 11.00 20.11.00	17. 11.00 20.11.00	17.11.00 20.11.00	17. 11.00 20.11.00	18.11.00
Castle Cove Reserve	10-16.11.00	8.11.00	8.11.00	8.11.00 13.11.00	8.11.00 13.11.00	16.11.00
Castlehaven Reserve	3-8.11.00	30.11.00 4.1.01	30.11.00 4.1.01	3.11.00 4.11.00	3.11.00 4.11.00	19.11.00
Clive Park	16.12.00	8.12.00 13.1.01	4.12.00 13.1.01	16.12.00 20.12.00	16.12.00 20.12.00	9.11.00
Explosives Reserve	27-11.00- 1-12.00	27.10.00 8.11.00	27.10.00 8.11.00	24.10.00 26.10.00	24.10.00 26.10.00	9.11.99
Ferndale Reserve	5-10.12.00	7.10.00 19.1.01	7.10.00 19.1.01	7.10.00 8.10.00	7.10.00 8.10.00	13.11.00
Flat Rock Gully Bicentennial Park	30.11.00- 3.11.00	15.11.00 10.1.01	15.11.00 10.1.01	30.11.00 31.11.00	30.11.00 31.11.00	13.11.00
Fullers Park	4-9.1.01	7.1.01 8.2.01	7.1.01 8.2.01	7.1.01 8.1.01	7.1.01 8.1.01	18.1.01
Mowbray Park	22-26.11.00	21.11.00 6.1.01	21.11.00 6.1.01	22.11.00 3.3.01	22.11.00 3.3.01	20.1.01
North Arm Reserve	10-15.11.00	13.11.00 15.11.00	13.11.00 15.11.00	7.11.00 21.11.00	7.11.00 21.11.00	20.11.00 19.1.01
Northbridge Park	4-10.12.00	4.12.00 23.1.01	4.12.00 23.1.01	13.12.00 6.1.01	13.12.00 6.1.01	19.1.01
Harold Reid Reserve	24-29.10.00	1.11.00 3.11.00	1.11.00 3.11.00	24.10.00 26.10.00	24.10.00 26.10.00	20.11.00
O.H. Reid Reserve	13-17.1.01	10.1.01 14.2.01	10.1.01 14.2.01	13.1.01 16.1.01	13.1.01 16.1.01	20.1.01
H.D. Robb Reserve	10-14-1.01	30.11.00 28.1.01	30.11.00 28.1.01	10.1.01 14.1.01	10.1.01 14.1.01	19.1.01
Sailors Bay Park	16-21.1.01	30.11.00 15.1.01	12.1.00	16.1.01 23.1.01	16.1.01 23.1.01	18.1.01
Watergate Reserve	2-7.2.01	30.1.01 2.2.01	30.1.01 2.2.01	2.7.01 4.2.01	2.7.01 4.2.01	22.1.01
Willis Park	10-14.11.00	16.1.01 27.2.01	16.1.01 27.2.01	11.11.00 13.1.01	11.11.00 13.1.01	23.1.01

4.0 Issues and General Recommendations

The Plan of Management (Volume 2) lists a range of actions that will be carried out across the bushland reserves in Willoughby LGA. These actions are refined to specific actions in the Reserve Action Plans. To date, Reserve Action Plans have been prepared for most reserves but have been confined to issues relating to weed control and bush regeneration, fire management and feral animal control. The input from the Fauna Study will allow the Reserve Action Plans to be widened to encompass actions that better target native fauna conservation.

A number of general issues highlighted in the following chapter overlap with actions stated in the Plan of Management, however, the recommendations that follow are solely focussed on methods of assisting wildlife survival. These recommendations are further supported by specific recommendations listed for each reserve in Chapter 5.

1. Conserving biodiversity through conserving habitats

The bushland reserves of the Willoughby LGA serve a dual role; they provide green enclaves that break up an otherwise continuous urban landscape, and they provide a conservation area for remnant flora and fauna. If conservation is a prime aim of these reserves, what should they be conserving?

There are two main arguments to consider, are the bushland reserves conserving the original flora and fauna (i.e. are they historical reminders of how the area was before European settlement), or are they an attempt to conserve as many native species as possible? Conserving existing habitats is easier to do but is often unsatisfying because so few habitats are represented. For example, in Willoughby, many of the reserves are based around steep, sandstone gullies that were unsuitable for residential development. Thus, Sydney Sandstone Woodland is the major habitat present in many reserves. Many habitats are not present in sandstone gullies or headlands and so are not conserved by this approach.

Trying to conserve the maximum number of species is a fine ideal but it is also fraught with hazards. The amount of land available for conservation purposes is limited. If a reserve is to be altered to create a new habitat, the existing habitat will be lost (and not replaced elsewhere). The decision about which species to conserve is also a difficult decision as the conservation of one is often done at the expense of another.

Often these decisions are made on purely pragmatic grounds. It is often easier and cheaper to conserve existing habitat. The creation of specific habitats does not guarantee that the target species will survive, as often we are not aware of all of the habitat requirements for each species.

The vegetation communities that are contained within the reserves are listed in Table 3.

Usually, if new habitats are created, they are created in areas of bushland that have become so badly degraded that they no longer represent the original habitat. If habitats are to be recreated in Willoughby, the habitats that could be recreated are:

* mid-canopy shrublands
* native grasslands
* ephemeral freshwater habitats
* wet and dry heath

None of these habitats are alien to the Willoughby area, some would require the procurement of seed stock from nearby bushland areas as parent plants no longer exist in the Willoughby LGA.

2. Improving the Habitat Value of Existing Reserves

The existing bushland reserves suffer from a loss of terrestrial fauna. In many cases this is due to predation by foxes, cats, dogs, black rats or native birds. Predation has taken a heavy toll because there is a lack of shelter sites in the reserves. Dead trees, fallen logs and branches and rocks usually provide the best shelter habitat along with understorey plants. In many reserves the understorey is still present (albeit not completely in tact) but the logs and fallen timber have gone. In some cases they have been removed as part of a program of reducing fuel for bush fires. In other instances they have been removed because they look messy or block tracks. Dead trees are often felled because they are considered a danger to walkers.

The lack of ground shelter is a major impediment for the survival of many native terrestrial species. Given the conflicting demands on reserves, it appears that fallen timber and branches will not be permitted to accumulate. This situation does not prevent the use of artificial shelters for terrestrial animals. Although this is not a widely accepted practice, animal shelters in trees have been used for parrots and possums. These tree shelters replace the dead tree hollows that are lost from reserve habitats.

To replace terrestrial shelter habitat, recycled plastic shelter trays of the design shown in Figure 2 below could be used. These trays are non-combustible, weather-resistant, can be painted so that they fit in with the landscape and are thermo-insulators. The tray offers a variety of openings so that more than one species can use the tray at one time. Or alternately piles of branches and or rocks, figure 3, could provide appropriate habitat for many terrestrial animals.

Figure 2
Fauna Shelter Tray

Figure 3
Alternative Fauna Shelter

3. Bush Regeneration

Willoughby Council has undertaken an active bush regeneration program in the LGA and the positive impact of this work is obvious in a number of reserves. Bush regeneration is preferred to replanting in areas where there is sufficient seed bank to allow the endemic plants to grow and develop under the prevailing conditions. Plant communities that establish by themselves, after the removal of weeds and introduced plants, are more capable of surviving in the long term that deliberately planted species.

The disadvantage of bush regeneration practices is that it is a slow and time-consuming process. The gradual replacement of unwanted plants by native species is a sequential process and the results of this change are not immediately obvious. For this reason, it is very easy for bush care officers (and nearby residents) to become impatient with the process and seek to speed up the rate of change in the plant community. Such actions are not in the best interest of the native fauna.

With all bush regeneration work, the impact of weed removal on the existing flora cannot be understated. Weed removal (and the associated disturbance to soil, leaf litter and plant roots) causes some stress in the bushland. For this reason, and to allow for the development and strengthening of native plants in areas previously touched by bush regeneration, bush regeneration should be staggered and only affect relatively small areas at a time.

These principles require that bush regeneration teams have a plan of what areas are to be regenerated, how long they should be left to recover and what follow-up works are likely to be required. Bush regeneration teams therefore need to be constantly moving between and within reserves to be most effective.

The only time that clearing of a site should occur is when the weed density is so great that native plants have no opportunity to recover. In these instances, site clearing should be partial and not absolute. Many native animals are forced to use weeds as alternate shelter areas when the native equivalent is absent. The removal of large areas of weeds can easily dislocate the fauna within.

4. Controlled Re-planting

As indicated above replanting is not the preferred option in bush regeneration but there are times when it is necessary. In general, replanting should be considered only when native plants cannot naturally re-establish themselves. Replanting is most often used:

i) to quickly cover an area that is bare or have been cleared
ii) to create a buffer zone around bushland areas
iii) to create habitats that have been lost from an area
iv) to replace non-breeding or diseased endemic plants (through seed collection and propagation)

The use of controlled planting to create buffer zones will be discussed below (in 5) while their use in creating habitats will be discussed in 6.

5. Buffers Planting to combat Edge Effects

One of the problems that all bushland reserves suffer from is “edge effect”. This term describes a variety of impacts that are experienced by bushland that is in contact with non-bushland areas. In Willoughby, this usually means contact with residential areas, streets and recreational parkland.

The plants along the boundary of reserves are subject to much more physical damage and changes than the plants deeper in the reserve. Damage is caused by greater exposure to strong winds, sun and rain, and by regular contact with walkers who accidentally knock leaves and small branches or deliberately break off projecting shoots or stems. In addition, the fringes of reserves are constantly bombarded with exotic seeds (borne by wind or storm water) and are further assaulted by mowing and slashing of regrowth. Garden wastes and rubbish is also deposited along the edges of the reserves. The combined effects of these pressures is to eliminate the more sensitive native plants and create gaps in the vegetation (that are later exploited by fast-growing weeds).

Disturbance to the plants along the edges of reserves is a problem that will not end. Ideally, bushland reserves need to be shielded from these impacts by a wall of more resilient, native plants that can tolerate greater physical damage and exposure. Such plants can create a buffer between the natural bushland and the urban interface. Buffer plants must be hardy, native, non-invasive and easy to maintain. In short, they must not have the potential to become a pest in themselves.

Many of the bushland reserves in Willoughby contain woodland (10 ar) with an open understorey. The wide spacing of the ground plants makes it easy for weeds to become established and to eventually become the dominant ground cover. A buffer comprising tall, dense shrubs (such as *Kunzea, Hakea,*

Monotoca, Melelauca and *Grevillea*) would greatly reduce the seed load entering the reserves and block off areas containing sensitive plants.

6. Creating Habitats

Many of Willoughby's bushland reserves contain open woodland (10 ar). While these woodlands were widespread in the area in pre-European time, they were not the only habitats present. A number of habitats are missing from Willoughby; their absence is partly reflected by the absence of particular groups of native birds. The two prime habitats that are not represented in bushland reserves are:

- tall heath (21 g)
- native grasslands (21 a)

These two habitats could be restored in Willoughby. A large area of disturbed land is available in Fullers Reserve that could be converted to both heath and grassland. Similarly, space is available at Flat Rock Gully and Bicentennial Reserve for the extension and creation of heath areas.

In addition, some low scale planting of insect-attracting plants in most other reserves would help boost the biomass of insects in the reserves.

7. Feral species control

A conspicuous component of the fauna of Willoughby that is missing are the native terrestrial mammals. Bandicoots appear to be completely absent while native rodents are reduced to a small area of Flat Rock Gully. With their absence, the introduced Black Rat and House Mouse has expanded to become the dominant terrestrial mammals. The main reason for the demise of native ground-dwelling mammals appears to be heavy predation by foxes, cats and dogs.

Fox-baiting programs have commenced in a number of reserves and these undoubtedly have had some impact on fox numbers. Unfortunately, not enough foxes appear to be taking baits and there appears to be an ample supply of cubs and vagrant adult foxes to replace any lost foxes.

Foxes will never be eradicated from the bushland reserves but their numbers can be culled. In other council areas of Sydney, efforts to control foxes have been most successful when fox dens are targeted. Dens are located and, during the day when the foxes are inside, are sealed and cyanide pellets released inside the den. Cyanide works quickly and death is very rapid. The dens are left sealed for several days during which residual cyanide is broken down and rendered inactive. The den is then filled in.

By making dens the focus of the fox control program foxes are not being replaced by the next generation. Vagrant foxes will still be present and these could be culled through a baiting program.

8. Control of domestic animals in reserves

Cats and dogs are a problem in bushland reserves. Cats are a particular problem at night as they are able to hunt birds and mammals under cover of darkness. Many of the cats seen in the reserves at night appear to be domestic cats. Residents who live close to bushland reserves must be encouraged to keep cats inside at night.

Dogs are also a problem. Dogs roaming bushland areas disturb a lot of wildlife and their constant presence in the reserves is sufficient to cause native animals to abandon the reserves. Dogs also kill some animals; more dead Blue-tongue lizards were seen than live lizards during this survey. Almost all of the Blue-tongue lizards had been mauled by dogs and left to die. Possums were also found that had been savaged.

Some bushland reserves should be no-domestic animal reserves. People do take their dogs for walks through bushland reserves, and this generally does little damage if the dogs stay to the tracks. Unfortunately, some dog owners do not control their dogs and the dogs are allowed to venture into the bush, out of their owner's sight.

A scheme whereby dog–owners can take dogs into reserves needs to be prepared and advertised to residents. Some bushland reserves and parts of reserves should be excluded. These areas include places where dogs (controlled or uncontrolled) will cause fauna dislocation. The areas where dogs should be excluded include:

i) All of Explosive Reserve
ii) The lower half of Blue Gum Reserve
iii) North Arm Reserve from Mannerim Place, Scotts Creek to Harold Reid Reserve
iv) All of Castlecrag Northern Escarpment
v) The lower area of Flat Rock Gully, from the bottom of the tip face through to Tunks Park
vi) The lower tracks in Harold Reid Reserve
vii) Clive Park
viii) Willis Park
ix) Ferndale Park

9. Compost heaps as habitats

Human-made habitats sometimes prove to be successful for animal use. While doing this survey, it became clear that one human-made habitat that was used regularly by reptiles were the compost heaps (covered by black

plastic sheeting) that were left by bush regeneration teams. The green waste in the mounds would normally be taken away and disposed of. However, the mounds were serving a very useful purpose of their own.

Instead of removing the green wastes, it may be more beneficial to ensure that there are always a few compost mounds in each reserve, particularly over winter.

10. Street Lighting

As many of the bushland animals are nocturnal species, street lighting can be a problem. For creatures such as Ring-tail Possums and owls, light pollution can force these animals out of reserves. Indeed, most nocturnal animals avoid street lit areas, the only exception being Tawny Frogmouths which have learned to sit above street lights and be concealed in the shadow while waiting for moths to be drawn towards the light.

Street lighting does not need to be aimed into reserves. Shielding on the back of street lights greatly reduce the amount of light entering bushland area.

In a similar way, residences that back onto bushland areas do not need to have back yard spot lights pointing into the reserves. A single back yard spotlight can dislocate fauna for 50 metres either side of the light source.

11. Corridors between reserves

Some of the bushland reserves are totally isolated from other bushland areas. This isolation diminishes the survival prospects of various animals and limits the capacity of migratory species to use the reserves while moving across Sydney. To create corridors between reserves will require the creation of suitable habitat outside of the reserves. There appears to be two ways that this can be done:

1. Sympathetic street planting. Instead of using ornamental or totally decorative street trees, trees that provide habitat value (either as dense canopy, food or nesting sites) should be utilised. As most of the reserves contain woodland, the types of tree that would serve this purpose include red Bloodwood *Corymbia gummifera*, Sydney Red Apple *Angophora costata*, Grey Gum *Eucalyptus punctata* and Scribbly Gum *E. haemastoma.*

2. Sympathetic backyard planting. Residents who live in areas between reserves could be encouraged by Council to plant suitable trees and shrubs to assist with the creation of green corridors between reserves. Council could provide the seedlings for these residents or offer some other incentive for residents who actively convert their backyard flora into sympathetic habitat.

In each of these examples, the seedlings should come from seeds collected from local trees.

12. Stormwater overflow areas

Many stormwater systems overflow into bushland reserves. Often the discharge from these systems is short-lived but dynamic. To reduce the erosional effects of these rapid discharges of stormwater, concrete troughs and basins have been created to disrupt the energy of the water. These structures could easily be modified to also provide frog habitat.

A concrete basin, off-centre to the main flow, would cater for the more generalist frog species. After heavy rain, the basin would fill and retain water for many weeks. Fringing plants need to be established around the ponds to help frogs avoid predators. The ponds would also serve as drinking stations for other native species.

13. Fallen timber, dead trees

A concern in urban bushland is that of fire. For this reason, fallen timber and dead tress are often removed from bushland areas. This practice deprives many animals species of a place to live and may explain the lack of some hollow-nesting species in the Willoughby LGA.

Fallen timber could still be removed from around the edges of reserves but not taken out of the reserve. Instead, they could be use to create timber stacks or wood rows in areas where they do not constitute a fire hazard (e.g. close to the shore line for reserves on Middle Harbour).

14. Community care of bushland areas – public education campaign

The health and longevity of bushland reserves is often dependent on community interest. Without it, Council money will be redirected to other purposes. Accordingly, low-level education campaigns need to be maintained to make residents aware of the conservation value of the bushland (and how it increases the retail value of their own land). Willoughby Council has an active Wildlife Watch program and conducts organised tours through bushland areas. Local conservation groups need to work with Council in protecting bushland areas. Community awareness programs need to be maintained.

15. Monitoring the use of reserves

It is difficult to get information about the level of use of each reserve. This information would be useful as it will provide a quantitative measure for

assessing the resilience of bushland areas. Such information will become increasingly important as the population density of Willoughby increases in the future. A census of the public use of reserves would consist of monitoring pedestrian traffic across bushland tracks, and the use of rest and picnic areas. Knowledge of the level of visitation of reserves will help planners rationalise the use of these public lands.

The Willoughby Fauna Study has provided a snap-shot look at the state of the fauna in the LGA. It is likely that the fauna will change as years go by, and the changes may not be predictable. However, this study has provided a set of base figures against which subsequent fauna studies may be based. As the methods used in this study are repeatable, any changes in the fauna detected by future studies should reflect real changes in the biota and not merely sampling bias in the survey.

The fauna survey should be repeated in five to ten years' time. The follow-up survey may need to be brought forward if there are believed to be significant changes to the fauna (e.g. as a result of bush fires, or disease).

The follow-up survey should include birds as part of its focus and a standard method of bird survey used for that survey. The bird results from the present survey were not collected in a standard fashion and have limited comparative use.

16. Conservation Areas

Urbanisation results in many changes to the natural landscape. Even remnant bushland areas that are not directly developed for residential or industrial purposes are impacted by the presence of surrounding artificial habitats. These impacts usually result in the loss of native species and their gradual replacement by other, often unwanted species.

Willoughby LGA is fortunate in having a number of relatively in tact bushland reserves that are large enough to protect a range of native animals. However, despite their size and location these reserves are also subject to ongoing pressures from the surrounding areas, particularly from the neighbouring residents who can "love the area to death". Certain parts of the reserves are able to withstand the pressure of regular human activity without the loss of more species; other areas are much more fragile. There are some sections of the bushland reserves that are critical for the maintenance of particular native animals. If these areas are left open to regular disturbance, their conservation value will diminish and the species that occur there will be lost.

The realisation that certain areas of bushland require different levels of protection is an important factor in the management of bushland reserves. Implicit in this realisation is the need for careful planning. Bushland reserves serve a dual purpose of conservation of native flora and fauna as well as providing a venue for passive relaxation. Unfortunately, the two functions can be mutually exclusive, especially where the habitat of threatened or rare

animal species is concerned. The few areas where critical fauna habitat is present need to have restricted public access if they are to remain useful habitat. In addition, some of these areas need to be enhanced to provide greater protection for the resident species. Without increased protection, the significant species will be lost.

The Willoughby Fauna Study identified a number of areas that provided critical habitat for native animals. Some of the animals involved (e.g. Powerful Owl, Red-crowned Toadlets) are listed at state (*NSW Threatened Species Conservation Act 1995*) or commonwealth level (federal *Environment Protection and Biodiversity Conservation Act 1998*) and there is a legislative requirement to protect the habitats of the nominated species. Other species (e.g. echidna, Glebe Gully Skink, Bibrons Toadlet) are not considered to be threatened species at a state-wide level but are species that have become uncommon (and are now locally significant) in the Greater Sydney Region. Table 4 lists the critical habitat areas identified in the fauna study and recommends some basic protective measures that could be employed to protect the nominated animal species. The areas are listed in order of priority, habitat areas of immediate concern have been given a high priority while those under less immediate threat have been given a lower priority. Further to this it is recommended that consideration be given to the establishment of wildlife protection areas within these reserves.

Area Number	Name of Bushland Reserve	Location of Critical Habitat	Significant Animal Species Present	Recommendations
1	Blue Gum Reserve	Lower River flat, off Blue Gum Creek	Powerful Owl	Relocate walking track away from nesting area Tree screening of street lights into this part of reserve
2	Bicentennial Reserve	Southern embankment	Burtons legless Lizard Glebe Gully Skink	Create rock piles and log piles along embankment Encourage local residents to keep cats in at night. Rock piles need some direct exposure to sunlight, limit of remove some screen trees from embankment.
3	Flat Rock Gully	Southern regeneration area	Glebe Gully Skink	Additional rock piles needed in sunny areas
4	Flat Rock Gully	Northern Quarry Site	Bibrons Toadlet	Maintain ephemeral nature of wet area below rock wall (do not allow this area to become a pond) Flatten out basin below rock wall to create a flat grassed area that is periodically covered by water
5	North Arm Reserve	Scotts Creek crossing	Powerful Owl	No artificial lighting in this area Keep track minimal.
6	North Arm Reserve	North Arm Track	Red-crowned Toadlet	Maintain seepage areas alongside track Track maintenance will need to include the maintenance of the side gutters (but not the removal of leaf litter from the gutters)
7	Explosive Reserve	Hermits Cave Area	Red-crowned Toadlets	Maintain seepage areas (ie no stormwater diversion works that will result in changes in ground water flow) Do not develop track to the cave
8	Explosives Reserve	Middle harbour headlands	Powerful Owl	No track lights or lighting along walking track or foreshore
9	Explosives Reserve	Central area	Echidna	Create wood piles in central area to create a more regular food resource away from the walking tracks
10	Harold Reid Reserve	Camp Creek	Powerful Owl	Block off public access to creek Increase tree screening between walking track and north side of creek No improvement of walking track in this area or divert walking track further away from the creek gully.
11	Harold Reid Reserve	Northern and southern slope	Echidna	Create wood piles as more secure food source away from walking tracks and road.
12	Harold Reid Reserve	Camp Creek	Red-crowned Toadlets	Maintain seepage to areas beside walking track Maintain gutters alongside track (don't remove leaf litter) In boggy areas, do not lay planks across the mud, use stepping stones or elevated spans.
13	Mowbray Park	Foreshore of Lane Cove River	Eastern water rat	Maintain line of mangroves along water's edge, especially below Willandra Street
14	Blue Gum reserve	Dalrymple Street end of reserve	White-striped Mastiff Bat	Reduce street lighting penetration into reserve.
15	Flat Rock Reserve	Dawson Street	Eastern Bush Rat	Establish additional native grassland areas and provide logs or other cover in the grassland areas. No track lighting in this area.

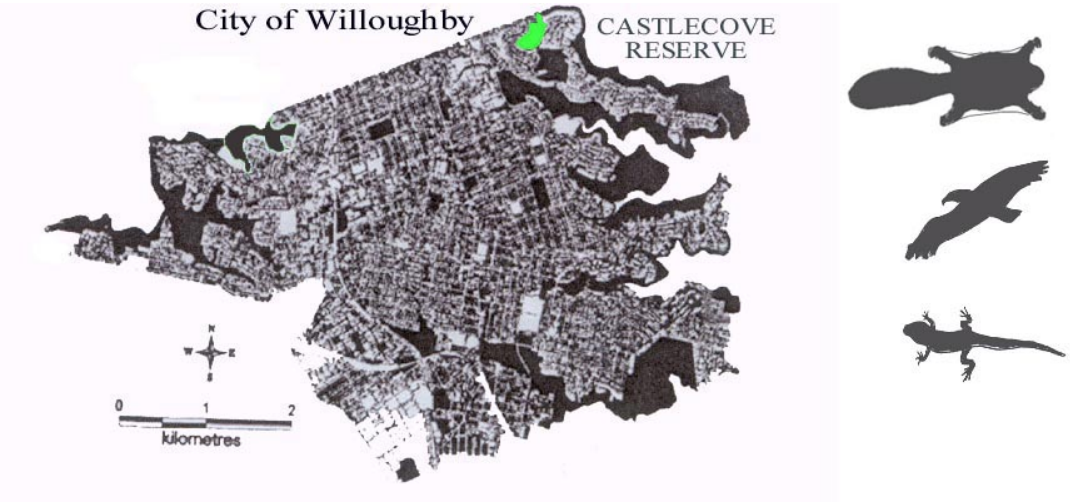
Table 4

5.0 Fauna of the Bushland Reserves

Reserve Group 1: Castle Cove Group

Castle Cove Reserve

Location: Castle Cove



Description of Reserve:

Castle Cove Reserve is comprised of two parts; a central recreational area (Castle Cove Park) and an outer bushland area. The total area of the reserve is 6.1 Ha. Castle Cove Park consists of a large sports field, dressing sheds, toilets and a playground facility. Bushland almost completely surrounds the park. The park faces onto Holly Street and this is the only part of the park that does not have a bushland corridor around it.

The park and southern area of bushland occupy reasonably flat land. The northern portion of bushland is below the level of the sports fields but drops away quickly further north of the park. Here there are no formal walking tracks through the bushland.

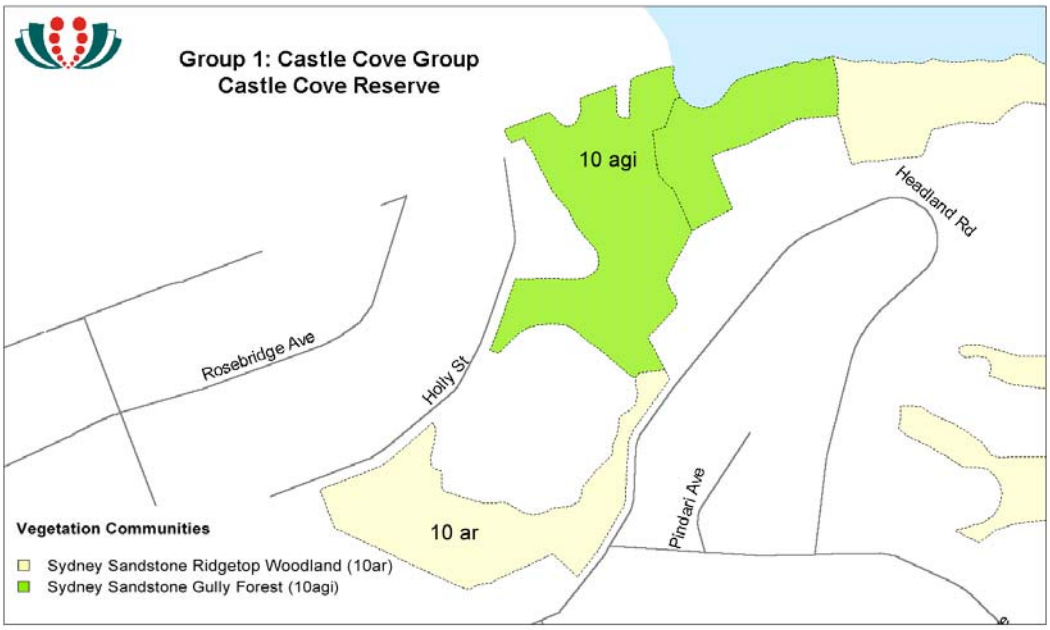
The northern end of Castle Cove Reserve is almost continuous with Sydney Sandstone Ridgetop Woodland (10 ar) in H.D. Robb Reserve.

Description of Vegetation and Habitats in the Reserve:

Castle Cove Park consists of a large, mowed lawn area that is demarcated by a boundary fence. The bushland areas form a green backdrop to the sports field. Replanted areas of native bush have been established facing Holly Street and along the northern embankment of Castle Cove Park.

The bushland of the southern side of the oval main is mainly Sydney Sandstone Ridgetop Woodland (10 ar), comprising Sydney Red Apple *Angophora costata*, Black She-oaks, *Allocasuarina littoralis* and Mock Orange *Pittosporum undulatum* predominating. In some areas, exotic plants have invaded the woodland.

The bushland on the northern side of the oval is mainly Sydney Sandstone Gully Forest (10 agi) and contains Blackbutt *Eucalyptus pilularis*, Sydney Red Apple *Angophora costata* and a mixture of native and exotic shrubs. These plants form dense undergrowth around a small open watercourse that seeps over the escarpment to the north. A dense bank of Coral Fern *Glychenia sp.* marks the edge of the escarpment.



Impacts and Threats to the Reserve:

The bushland areas of Castle Cove Reserve have been affected by the sports field and the surrounding residences. These impacts include:

1. Extensive weed invasion of the reserve.
2. Large “edge effect” due the presence of Castle Cove Park
3. Disruption of the woodland canopy by Castle Cove Park
4. Light pollution from Holly Street and Headland Road.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: Castle Cove Reserve has a restricted fauna. Many species of native animal are unable to use the bushland areas in Castle Cove Reserve because the woodland is too narrow to provide adequate protection from aerial and terrestrial predators.

Mammals: Seven species of mammals were detected in Castle Cove Reserve, three of these were introduced species (dog, black rats and mice). Common Brushtail Possums, Ringtail Possums and Sugar Gliders were present in the bushland areas of the reserve. Flying foxes were observed flying overhead and some were observed to roost in fig trees nearby. No insectivorous bats were detected in the park.

Common Brushtail Possum *Trichosurus vulpecula.*

Brushtail Possums were spotted in both the northern and southern bushland areas.

Common Ringtail Possum *Pseudecheirus peregrinus*

Ringtail Possums were also present in low numbers in both the northern and southern bushland areas.

Sugar Glider *Petaurus breviceps*

Three Sugar Gliders were spotted in the northern bushland area on the evening of the 8th of November 2000.

Dog *Canis familiaris*

Dogs were spotted on Castle Cove Oval at night and in the northern bushland area.

Black Rat *Rattus rattus*

Black rats were detected by hair tubes in both the northern and southern bushland areas.

House Mouse *Mus musculus*

Mice were detected by hair tubes in revegetation areas along Holly Street and in the northern bushland area.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the park, some were observed to roost in fig trees.

Birds: Forty two species of birds were recorded in Castle Cove Reserve during the present survey. These are listed below. Burton (2000) did not survey the bushland area but did survey Castle Cove Golf Course where 15 bird species were recorded.

	Fauna Study (2001)
White-faced Heron	2000
Australian White Ibis	2000
Black-shouldered Kite	2000
Nankeen Kestrel	2000
Masked Lapwing	2000
* Spotted Turtle-dove	2000
Crested Pigeon	2000
Sulphur-crested Cockatoo	2000
Galah	2000
Rainbow Lorikeet	2000
Musk Lorikeet	2000
Crimson Rosella	2000
Eastern Rosella	2000
Common Koel	2000
Southern Boobook Owl	2000
Laughing Kookaburra	2000
Superb Fairy-wren	2000
Variegated Fairy-wren	2000
Brown Thornbill	2000
Red Wattlebird	2000
Noisy Miner	2000
New Holland Honeyeater	2000
Eastern Spinebill	2000
Golden Whistler	2000
Magpie-lark	2000
Willie Wagtail	2000
Black-faced Cuckoo-shrike	2000
Olive-backed oriole	2000
Grey Butcherbird	2000
Australian Magpie	2000
Pied Currawong	2000
Australian Raven	2000
* House Sparrow	2000
Red-browed Finch	2000
* Red-whiskered Bulbul	2000
* Common Starling	2000
* Common Myna	2000

* = exotic species

Reptiles: Four species of lizard were found in Castle Cove Reserve.

Eastern Water Skink *Eulamprus quoyii*

Eastern Water Skinks were present in both the northern and southern bushland areas.

Garden Skink *Lampropholis guichenoti*

Garden Skinks were found around the edges of Castle Cove Park.

Delicate Skink *Lampropholis delicata*
Delicate skinks were common in the revegetated areas.

Eastern Blue-tongue Lizard *Tiliqua scincoides*
A dead Blue-tongue Lizard was found in the northern bushland area.

Snake-eyed Skink *Cryptoblepharus virgata*
Several snake-eyed skinks were found in the revegetation areas along Holly Street and in the northern bushland area.

Frogs: Three species of frogs were found in Castle Cove Reserve.

Common Eastern Froglet *Crinia signifera*
Froglets were present in the water course in the northern bushland area.

Striped Marsh Frog *Limnodynastes peroni*
Striped Marsh Frogs were present in the water course in the northern bushland area.

Peron's Tree Frog *Litoria peronii*
Peron's Tree Frogs were present in the northern bushland area.

Fauna Conservation Measures

The Plan of Management lists a number of actions designed to enhance habitat for native fauna. The following measures are specific actions for Castle Cove Reserve that complement the recommendations in the Plan of Management.

1. **Weed Control:** Weed penetration of the bushland areas is very patchy. The largest areas of weeds and exotic plants occur in the northern bushland area. This area is currently under a bush rehabilitation program. Weeding in the northern area needs to be tempered by the need to establish cover plants before all of the weeds are removed. Small native animals currently use weeds as their main shelter plants.

2. **Edge Effect:** The structure of Castle Cove Reserve renders bushland areas in the reserve vulnerable to a host of disturbance factors. Castle Cove Park occupies the central position in the reserve and creates a large open space in the centre of the reserve. Bushland areas have limited depth and so weed are able to penetrate easily, native plants are easily damaged exposing the more sensitive species that inhabit the inner bushland. Noise, light and movement in the neighbouring houses and streets can be noticed in most parts of the bushland; timid species are dislocated by this effect.

   The only bushland area where the edge effect can be dissipated is the northern area. This area is protected from urban-based disturbance on the

northern side by the sandstone escarpment. Buffer planting along Holly Street and Headland Road can create a more protected environment for animals in this area.

3. **Disruption to Woodland Canopy:** The woodland canopy is disrupted by the presence of the central expanse of Castle Cove Park and the driveway and entrances off Holly Street. The canopy is continuous along the eastern side of Castle Cove Park but becomes quite narrow beside Headland Road. The effect of these interruptions to the canopy is to virtually isolate the northern and southern bushland areas from each other.

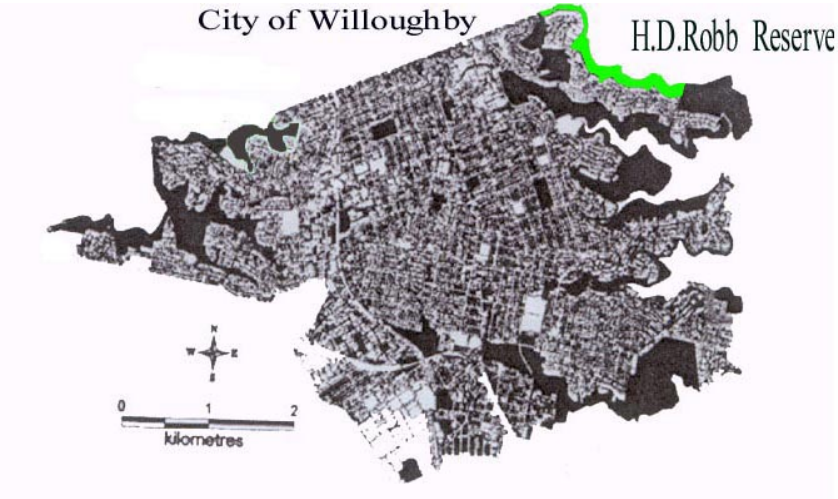
   Revegetation along Holly Street has helped to extend the canopy along the western side of the reserve but there will still be a disjunction on this side of the reserve. Deliberate replanting of tall eucalypt species and tall shrubs wherever possible along the edge of the bushland will help to extend the canopy.

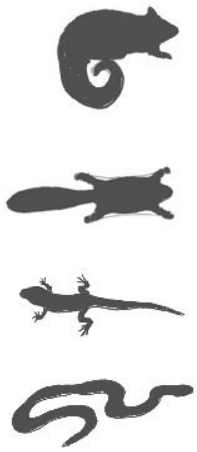
4. **Light Pollution:** Street lighting from Holly Street and Headland Road has a deleterious effect on the nocturnal animals in the bushland reserve. These lights need to be shielded so that they direct light onto streets and footpaths and not scatter stray light in bushland areas.

Reserve Group 2: H.D. Robb Group

H.D. Robb Reserve

Location: Castle Cove





Description of Reserve:

H.D. Robb Reserve is a ribbon-like reserve that occupies the northern escarpment of Castle Cove. It is sandwiched between the residence on the Castle Cove ridge and Middle Harbour.

All of the reserve is steeply sloped. In most places the reserve commences at the uppermost sandstone escarpment on the ridge and then falls away, over a series of sandstone ledges to the water front. The reserve is covered by tall forest that is unbroken from its northern boundary (near Castle Cove Reserve) to its southern continuation with Explosives Reserve.

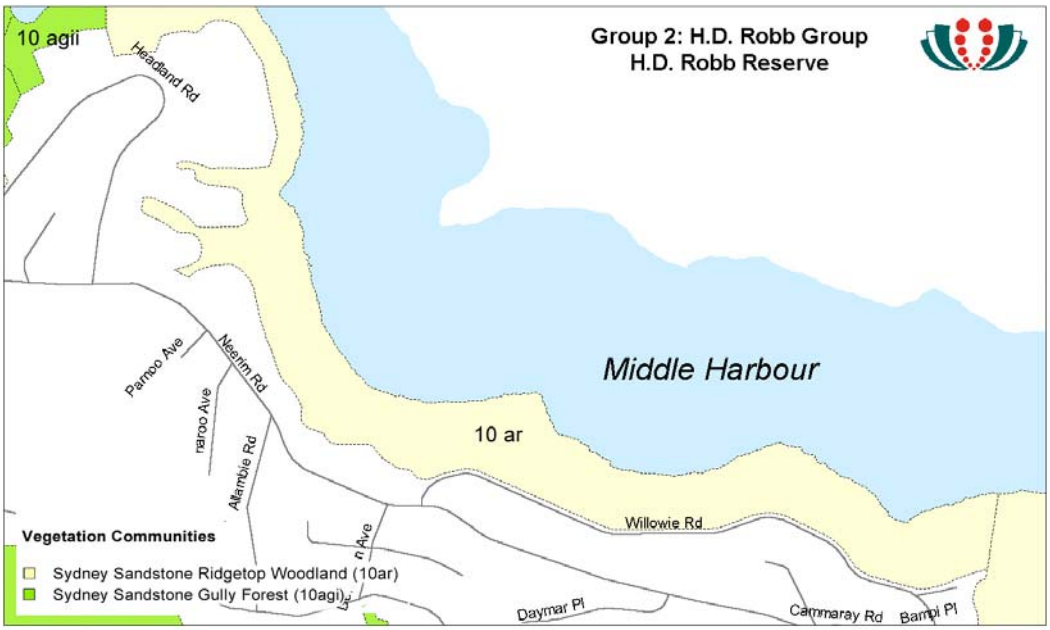
There are no walking tracks or marked paths in the reserve.

Description of Habitats in the Reserve:

H.D. Robb Reserve is covered by Sydney Sandstone Ridgetop Woodland (10 ar) along its entire length. The canopy is continuous with that in Explosives Reserve but is slightly interrupted where it approaches Castle Cove Reserve.

The woodland is dominated by Blackbutt *Eucalyptus pilularis*, Sydney Red Apple *Angophora costata*, Black She-oaks, *Allocasuarina littoralis* and Mock Orange *Pittosporum undulatum*. Sydney Red Apple *Angophora costata* tends to occupy the shore line and exposed areas on the escarpment. In some areas along the southern boundary of the reserve, exotic plants have invaded the woodland.

There is a small area of Closed Forest below Neerim Road. This consists mainly of a cluster of Fig Trees *Ficus rubiginosa* and *F. hilli* in a narrow, elevated gully. Black Wattles *Callicoma serratifolia* are the main understorey plant while a grove of Acacias flanks the forest.



Impacts and Threats to the Reserve:

The bushland areas of H.D. Robb Reserve are relatively protected from outside disturbance by the inaccessible nature of the site and its position below the residential areas. Nonetheless some impacts have affected the reserve including:

1. Weed invasion along the southern boundary of the reserve.
2. Feral animals use the reserve as a refuge area; foxes breed in this reserve.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: H.D. Robb Reserve has a good woodland fauna but is lacking in native terrestrial animals. Native arboreal and flying species

fare reasonably well in the woodland environments. Terrestrial species are heavily preyed upon by exotic predators.

Mammals: Nine species of mammals were detected in H.D. Robb Reserve, four of these being introduced species (fox, dog, cat and black rat). Common Brushtail Possums, Ringtail Possums and Sugar Gliders were present in the bushland areas of the reserve. Flying foxes were observed flying overhead and some were observed to roost in the reserve. No insectivorous bats were detected in the reserve.

Mammals:

Common Brushtail Possum *Trichosurus vulpecula.*

Brushtail Possums were spotted along the shore line and along the southern boundary of the reserve.

Common Ringtail Possum *Pseudecheirus peregrinus*

Ringtail possums were the most commonly seen possum and were particularly common in the lower parts of the reserve.

Sugar Glider *Petaurus breviceps*

Sugar Gliders were heard calling from woodland below Neerim Road on the 14th January 2001.

Brown Antechinus *Antechinus stuartii*

Antechinuses were detected in hair tubes placed below Neerim Road.

Fox *Vulpes vulpes*

Foxes were seen along the southern boundary of the reserve and along the shore line.

Dog *Canis familiaris*

Dogs were spotted in the southern boundary region of the reserve.

Cat *Felis cattus*

A cat was seen in the upper reserve near Neerim Road.

Black Rat *Rattus rattus*

Black rats were spotted along the shore line as well as being detected by hair tubes throughout the reserve.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve, some were observed to roost in fig trees.

Birds: Thirty species of birds were recorded in H.D. Robb Reserve. This list is likely to under-represent the diversity of birds present. Access into the reserve is difficult and it is not possible to effectively survey all of the reserve.

	Burton (2000)	Fauna Study (2001)
Little Pied Cormorant		2000
Pied Cormorant		2000
Little Black Cormorant		2000
White-faced Heron	1995	
Silver Gull		2000
* Spotted Turtle-dove	1995	2000
Rainbow Lorikeet	1995	2000
Australian King Parrot		2000
Crimson Rosella		2000
Eastern Rosella	1995	
Fan-tailed Cuckoo		2000
Common Koel	1995	2000
Laughing Kookaburra		2000
Dollarbird	1995	
Superb Fairy-wren		2000
Variegated Fairy-wren	1995	
Spotted Pardalote	1995	
Red Wattlebird	1995	2000
Little Wattlebird	1995	
Noisy Miner	1999	2000
Eastern Whipbird	1995	
Willie Wagtail		2000
Black-faced Cuckoo-shrike		2000
Grey Butcherbird	1999	
Australian Magpie	1999	2000
Pied Currawong	1995	2000
Australian Raven	1995	
Red-browed Finch		2000
Silvereye		2000

* = exotic species

Reptiles: Four species of reptile, including one species of snake, were found in H.D. Robb Reserve.

Eastern Water Skink *Eulamprus quoyii*
Eastern Water Skinks were most common along the shore line.

Delicate Skink *Lampropholis delicata*
Delicate Skinks were present in both woodland habitats.

Snake-eyed Skink *Cryptoblepharus virgata*
Snake-eyed Skinks were commonly found in trees along the southern boundary of the reserve.

Green Tree Snake *Dendrolaphus punctatus*
A Green Tree Snake was spotted near the Closed Forest below Neerim Road.

Frogs: Two species of frogs were found in H.D. Robb Reserve.

Common Eastern Froglet *Crinia signifera*
Froglets were present in the Closed Forest area below Neerim Road.

Peron's Tree Frog *Litoria peronii*
Tree frogs were heard calling from an area to the west of the Closed Forest.

Fauna Conservation Measures

1. **Weed Control:** Weed penetration of the bushland is limited to the southern boundary of the reserve. A variety of weeds, garden-escape plants and deliberately planted exotic species have degraded this strip of bushland. Residents need to be encouraged to use non-invasive plants in their gardens and to remove seed heads from exotic plants that could spread into the reserve.

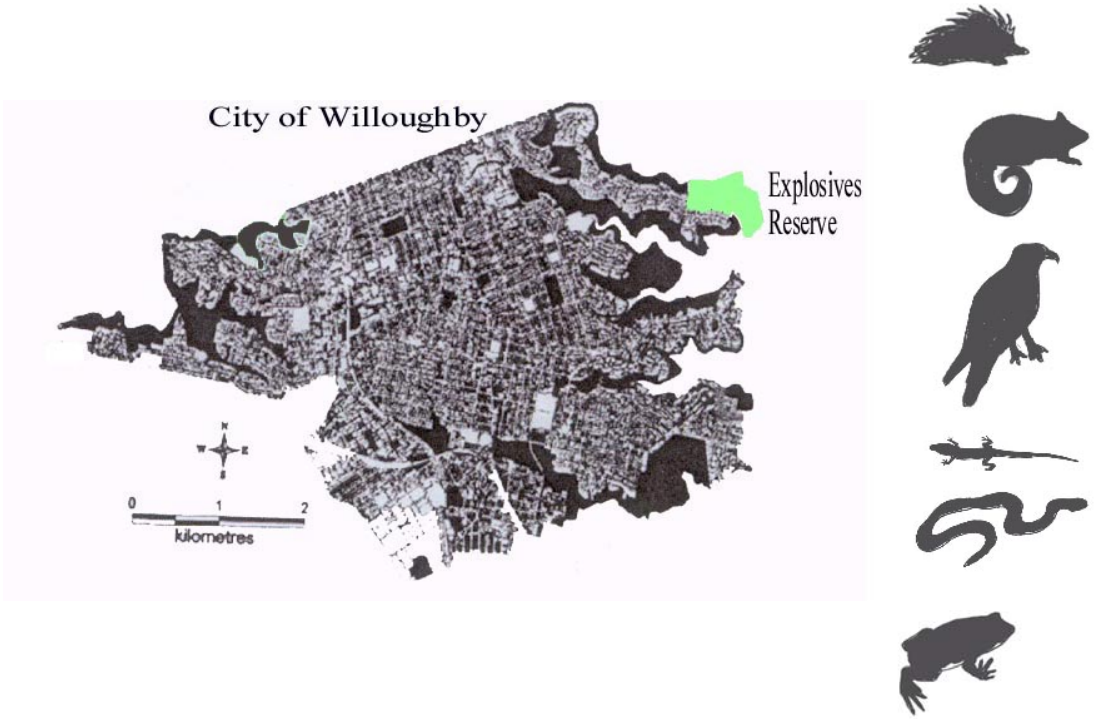
2. **Feral Species Control:** Feral animals survive well in H.D. Robb Reserve because of the limited access and ample shelter available in the reserve. Fox pups were seen in the reserve in November 2000 and adult foxes constantly roam the edges of the reserve in search of food. Dogs also patrol the edges of the reserve.

   The control of feral animals in the reserve will be difficult because of access problems. Baiting stations could be established along the southern boundary and along the shore line.

Reserve Group 3: Explosives Reserve

Explosives Reserve

Location: Castle Cove



Description of Reserve:

Explosives Reserve occupies the eastern headland of Castle Cove. The reserve occupies a prominent, rounded sandstone headland (sometimes called the Little Sugarloaf) and is fully covered by native trees and shrubs. The western portion of the reserve culminates in an exposed sandstone knoll (at about 100 metres above sea level). The headland has a broad, relatively flat area of shallow, sandy soils, dominated by groves of She-oaks (*Casuarina glauca*). The shoulders of the headland fall away steeply to Middle Harbour.

There are no roads or buildings in Explosives Reserve. There are a few walking tracks through the reserve, the main one entering from the gates at Cammaray Road and leading on to a loop track that enables excellent views of Seaforth, Bantry Bay and Middle Harbour.

Description of Habitats in the Reserve:

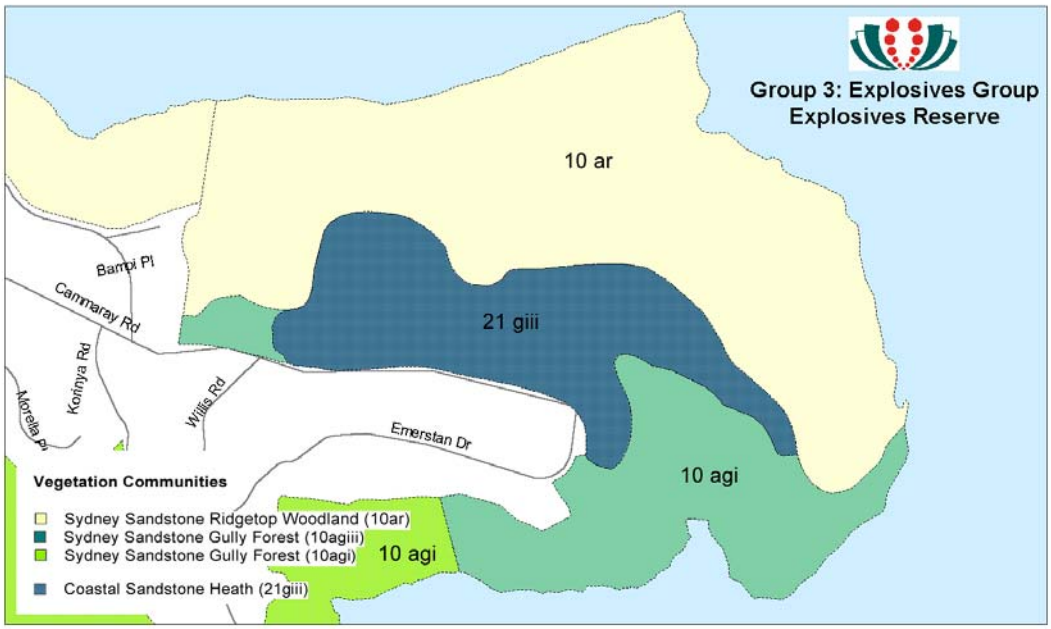
Explosives Reserve contains a variety of woodland and forest habitats. The upper, flatter areas are covered in She-oak woodland. The thick needle leaf-litter in this area prevents the growth of understorey plants. Consequently, the She-oaks form an almost continuous stand, interrupted by an occasional Old

Man Banksia *Banksia serrata* or stunted Red Bloodwood *Corymbia gummifera*.

The northern slopes of the headland contain the tallest forest areas. Protected from southerly winds, and nestled in deeper sandy soils, tall blackbutts *Eucalyptus pilularis,* Sydney Red Apple *Angophora costata*, Sydney Blue Gums *E. saligna* and Red Bloodwoods *Corymbia gummifera* form a tall forest rampart between the headland and the harbour.

On the southern slopes, the forest is more moderate and is dominated by Sydney Red Apple. The trees here are more windswept and twisted and often missing their upper branches. A more protected area exists close to the fire trail that marks the dividing line between Explosives Reserve and North Arm Reserve. A narrow gully contains Blueberry Ash *Elaeocarpus reticulatus* and Black Wattle *Callicoma serratifolia.*

Areas of exposed sandstone, including the rocky knoll in the western part of the site, are dominated by Sydney Red Apple. These trees reach up to 25 metres in height and emerge from crevices in the sandstone, their roots often clamped around sandstone boulders like octopus tentacles.



Impacts and Threats to the Reserve:

Explosives Reserve has not suffered greatly as a consequence of the surrounding residential developments. This may be a reflection of the level of protection offered to the site while it was Commonwealth land. However, as a public reserve it is open to greater use and potential impacts.

For local residents the reserve is an ideal escape from suburbia. Many residents and visitors wander the tracks of the reserve or sit on the rocky overhangs to watch the harbour. While there is a strong affection for the area, the area may be “loved to death”. Already the central track through the reserve has had to be relocated because of the exacerbated erosion that has taken place. Track placement and maintenance will be ongoing issues for this reserve. The upper portion of the headland only contains skeletal soils and the loss of any soil is serious.

Explosives Reserve also appears to be visited by a large number of foxes. Foxes were spotted on two occasions, both near the southern loop track. Thirteen fox scats were collected from the site in November 2000. The reserve contains very little ground fauna and is virtually devoid of ground mammals, which may be partly due to the prevalence of these exotic predators.

The edges of the reserve, particularly on the southern side, have suffered from weed invasion.

Description of the Fauna: Explosives Reserve contains a variety of woodland and forest animals. It is depauperate in ground mammals and other native terrestrial animals. The full list of species is presented in the Appendix.

Mammals: Explosives Reserve had a relatively large variety of native and exotic mammals. Terrestrial native mammals included Echidnas and Antechinuses. Foxes, black rats, mice dogs and cats were also present in the reserve. Fortunately, the large areas of intact woodland and forest have enabled three species of arboreal mammals (Common Brushtail Possums, Ringtail Possums and Sugar Gliders) to thrive in the reserve.

Short-beaked Echidna *Tachyglossus aculeatus*

An echidna was seen near the Knoll and diggings were seen in several places on the northern side of the loop track.

Common Brushtail Possum *Trichosurus vulpecula.*

These possums are not common in the reserve. Brushtail Possums were spotlighted near the southern fire trail gate and in trees on the northern escarpment.

Common Ringtail Possum *Pseudecheirus peregrinus*

These possums are particularly numerous in the reserve. They are present in all of the woodland and forest areas but appear to be particularly abundant in the She-oak forest on the upper parts of the site. During a night spotlighting on the 8th of November 2000, 13 ringtail possums were seen. However, during the daytime a walk around the loop track and southern track revealed the presence of 37 Ringtail Possum dreys, the majority of these were in the She-oak woodland.

Sugar Glider *Petaurus breviceps*

Sugar Gliders were spotted and heard calling from near the looped section of the main track. Two Sugar Gliders were heard on the evening of the 8th of November 2000.

Brown Antechinus *Antechinus stuartii*

Antechinuses were detected near the sandstone escarpment on the northern side of the reserve.

Red Fox *Vulpes vulpes*

Only two foxes were sighted in the reserve, both were seen from southern loop track. Scats were found along the length of the loop track whereas scats were not common near the beginning of the track or across the centre of the reserve. No dens were found although a fox was heard yowling from an area to the east of the Hermit's Cave on the northern slopes of the reserves.

Dog *Canis familiaris*

Dogs were seen in the lower part of the reserve near H.C. Press Park. Dog scats were also collected from this area.

Cat *Felis cattus*

Cats were spotted near the Knoll and along the Cammaray Road edge of the reserve.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve and occasionally roosting in *Eucalypt sp.* flowers.

Black Rat *Rattus rattus*

Black rats were not spotted but were detected by hair tubes at the southern end of the reserve. Black rat fur was only present in one fox scat from Explosives Reserve suggesting that they are not a common component of the fauna.

House Mouse *Mus musculus*

House mice were detected by hair tubes. Tubes set near the western knoll and near the southern boundary (along Cammeray Road) contained mouse fur. Three fox scats found in Explosives Reserve contained mouse fur or bones.

Domestic Cat *Felis cattus*

A cat was spotted in the northern escarpment area on the evening of the 8th of November 2000. It was not possible to determine whether this was a domestic cat or a feral cat. No cat scats were found in the reserve.

No insectivorous bats were detected

Birds: The reserve is home for quite a range of native woodland and forest birds. Burton (2000) recorded 44 bird species in a recent survey of which only one was exotic. The current survey has increased the list for this reserve to 59 species. Unusual sightings in the reserve include White-bellied Sea Eagle, Whistling Kites and White-throated Needletail. The present survey observed the presence of Powerful Owls in the reserve and found recently killed Ringtail Possums. A search failed to locate nesting or permanent roosting sites. Calling by a Powerful Owl was heard on the night of the 22nd of December 2000 coming from the Davidson State Recreation Area.

	Burton (2000)	Fauna Study (2001)
Australian White Ibis	1999	
White-bellied Sea Eagle	1995	Nest
Whistling Kite	1995	
Silver Gull	1999	2000
Crested tern		2000
* Spotted Turtle-dove	1998	
Crested Pigeon	1998	
Topknot Pigeon		2000
Sulphur-crested Cockatoo	1999	2000
Yellow-tailed Black Cockatoo		2000
Cockatiel		2000
Rainbow Lorikeet	1999	2000
Musk Lorikeet	1999	
Australian King-parrot		2000
Crimson Rosella	1999	2000
Eastern Rosella	1996	
Fan-tailed Cuckoo	1999	2000
Shining Bronze Cuckoo	1999	2000
Common Koel	1995	2000
Channel-billed Cuckoo		2000
Powerful Owl		2000
Southern Boobook		2000
Tawny Frogmouth		2000
Laughing Kookaburra	1998	2000
Sacred Kingfisher	1995	
Dollarbird	1995	2000
Superb Fairy-wren		2000
Variegated Fairy-wren	1999	
Spotted Pardalote	1999	
White-browed Scrub Wren	1999	2000
Brown Gerygone		2000
Brown Thornbill	1999	2000
Red Wattlebird	1999	2000
Little Wattlebird	1999	
Noisy Friarbird	1996	2000
Noisy Miner	1999	2000
Yellow-faced Honeyeater	1999	
New Holland Honeyeater	1995	

White-cheeked Honeyeater	1999	2000
Eastern Spinebill	1999	2000
Eastern Yellow Robin	1999	2000
Eastern Whipbird	1995	
Golden Whistler	1999	2000
Grey Shrike-thrush	1999	2000
Black-faced Monarch	1995	
Grey Fantail	1999	
Willie Wagtail		2000
Black-faced Cuckoo-shrike	1999	2000
Olive-backed Oriole	1995	
Grey Butcherbird	1999	
Australian Magpie	1999	2000
Pied Currawong	1999	2000
Australian Raven	1999	2000
Red-browed Finch	1996	2000
Welcome Swallow		2000
* Red-whiskered Bulbul		2000
Silvereye	1999	2000
* Common Starling		2000

* = exotic species

Reptiles: Explosives Reserve contains a variety of reptiles. Two species of snakes were recorded during the recent survey (Yellow-faced Whip Snake and Golden Crown Snake) while seven species of lizards were also found. The majority of the small skinks were found in the upper parts of the site, whereas the snakes were found lower down on the northern slopes.

Common Blue Tongue Lizard *Tiliqua scincoides*

Single lizard found next to western boundary on 27th of October 2000.

Eastern Water Skink *Eulamprus quoyii*

Not common, mainly seen close to shoreline at the southern end of the reserve.

Weasel Skink *Saproscincus mustelina*

Two lizards were found in dense bush on the northern slopes.

Copper-tail Skink *Ctenotus taeniolatus*

Four Copper-tail Skinks were seen on the northern side of the Scotts Creek crossing.

Grass Skink *Lampropholis guichenoti*

Common around the southern gully area.

Garden Skink *Lampropholis delicata*

The most common lizard in the reserve. Widespread across the She-oak woodland and other forest areas.

Eastern Snake-eyed Skink *Cryptoblepharus virgata*

Only four lizards seen. Most were seen on dead Banksias near the southern loop track.

Southern leaf-tailed Gecko *Phyllusurus platurus*

Not common. Spotted near the western knoll and near a sandstone exposure on the southern loop track.

Yellow-faced Whip Snake *Demansia psammophis*

A single snake was found under branch debris on the northern slope area.

Golden Crown Snake *Cacophis squamulosus*

Two small snakes were found in the southern gully area.

Frogs: Only one species of frog was found in Explosives Reserve, namely the Red-crowned Toadlet.

Red-crowned Toadlet *Pseudophryne australis*

Red-crowned Toadlets were found throughout the survey period in a seepage area on the northern slopes (Hermits Cave). Adult frogs were frequently found sitting in tiny pools in the wet sandstone seepage and eggs and tadpoles were present in a semi-permanent pool from October 2000 through to January 2001.

Fauna Conservation Measures

1. **Red-crowned Toadlets:** Red-crowned Toadlets are a threatened species and only occur in a few sites in the Willoughby Local Government Area. The population in Explosives Reserves appears to be totally isolated from other populations and has a tiny area of habitat available to them. The population is totally dependent on water seepage through sandstone for breeding sites. A man-made trough has helped their cause by entrapping water for longer periods. This type of interference with an animal's habitat is hazardous and could easily render the site of more value to other species.

I would recommend that this population be monitored each year to ensure that it is a breeding population. Similarly, access to the site should be discouraged. There should not be any formal tracks to the site and logs and branches could be placed across the existing rough track to dissuade casual walkers from venturing into the area.

2. **Powerful Owls:** Powerful Owls visit Explosives Reserve on a regular basis. Evidence of owl visits was found in the form of recently killed Ringtail possums draped in low trees and owl pellets. No evidence was found of roosting or nesting sites. The often heard calling of Powerful Owls from Davidson State Recreation Area suggests that the owls may be flying across Middle harbour periodically and feeding in timbered reserves in the Willoughby Local Government Area.

   In order to permit these owls to continue to feed in this manner, street lights should be aimed away from the reserve and no interior lighting should be erected. Similarly, tracks through the reserve should be kept to a minimum size so that they are not likely to be used at night.

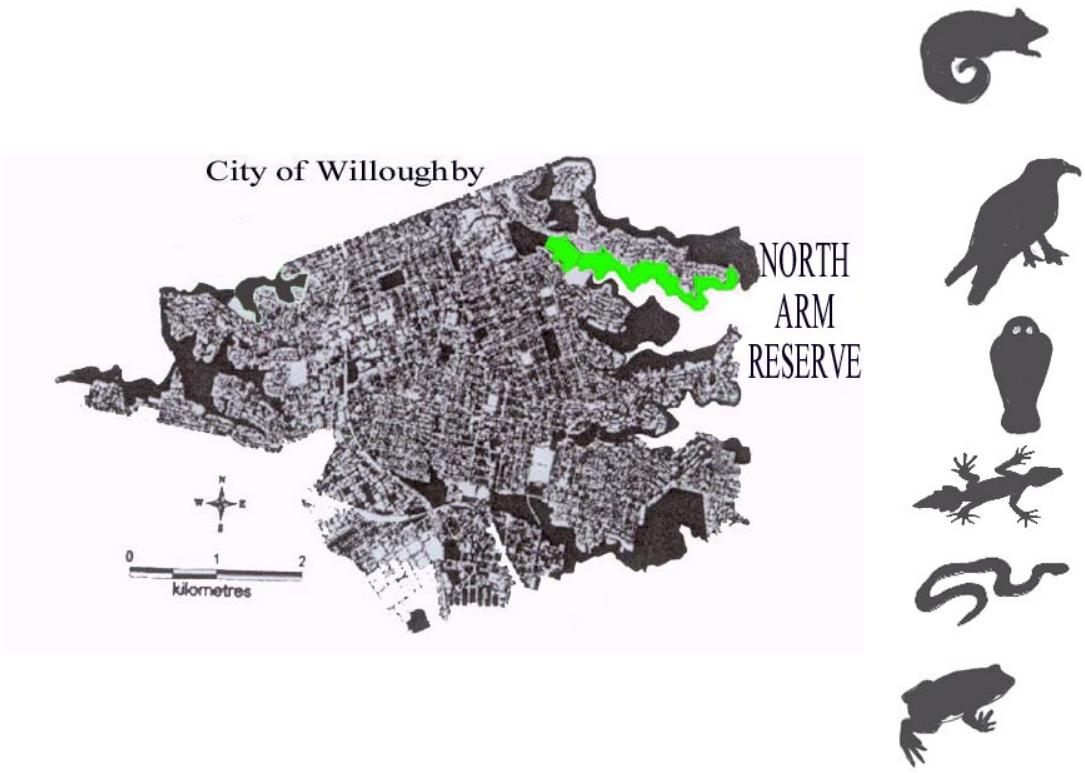
3. **Fox control**: Foxes pass through and feed in Explosives Reserve on a regular basis. Although most of the fox scats found contained bird feathers and bones, or fur from Black Rats and House Mice, the presence of foxes prevents the ground fauna from ever becoming re-established in the reserve.

   A fox-baiting program is currently under way and this program many need to be sustained indefinitely.

Reserve Group 4: North Arm Group

North Arm Reserve

Location: Castle Cove and Middle Cove



Description of Reserve:

North Arm Reserve is a long, sinuous area of land that follows the northern shoreline of Sugarloaf Bay. It forms part of a continuous green corridor around Castle Cove with Explosives Reserves to the north, and Willis Park to the west. For the purpose of this study, H.C. Press Park is considered to be part of North Arm Reserve. North Arm Reserve continues around the southern bank of Scotts Creek and extends as far as Harold Reid Reserve. North Arm Reserve occupies stepped sandstones slopes that lead down to Scotts Creek and the North Arm of Sugarloaf Bay and is bordered by houses along most of its northern boundary.

One of the main features of the reserve is the North Arm Walking Track. This track commences in Explosives Reserve and passes the full length of North Arm Reserve; it enters Willis Park and crosses Scotts Creek where it continues along the southern foreshore of Sugarloaf Bay to Harold Reid Reserve where it terminates. The total length of the walking track is 4.5 kms

and is uninterrupted bushland, except for a short section of sealed roadway leading to the Water Board Pumping Station above Scotts Creek.

As the reserve is geologically uniform and of similar topography along its length, it is dominated by a single forest type, namely Sydney Sandstone Gully Forest (10 agi). The forest is punctuated in a few places by stands of Black She-oaks *Allocasuarina littoralis.* These stands mark the position of previous fires that have cleared competing vegetation away and have allowed the She-oaks to germinate and take over the cleared site.

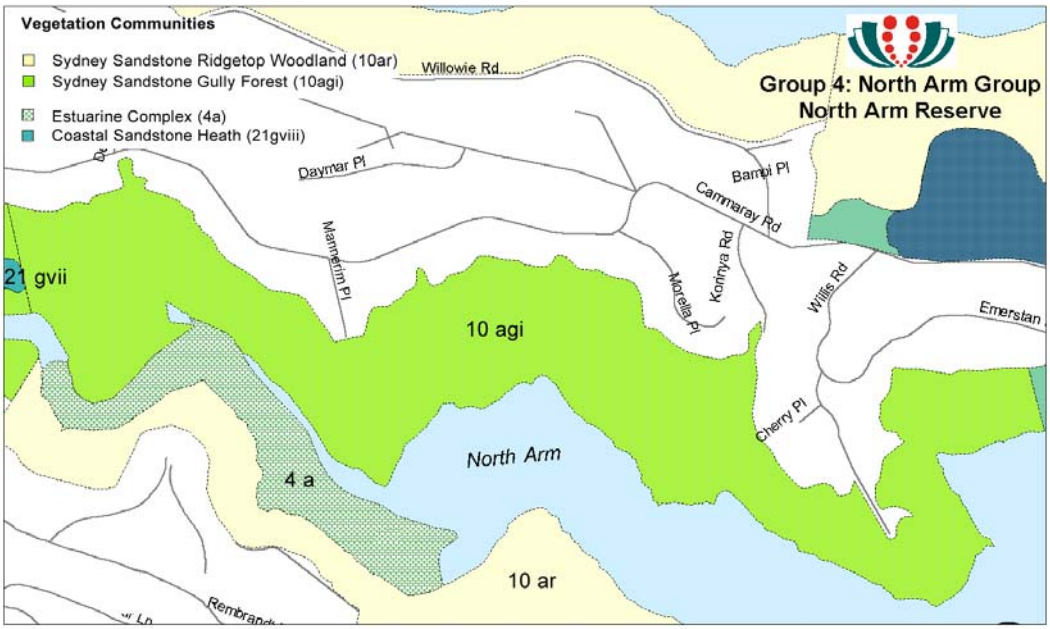
The only major intrusion into the reserve occurs below Deepwater Road where the Water Board has constructed an access road and pumping station.

Description of Habitats in the Reserve:

As mentioned above, North Arm Reserve is dominated by a single forest type. Sydney Sandstone Gully Forest typically grows on shallow sandy soils overlaying sandstone ledges. This forest is dominated by Sydney Red Apple trees *Angophora costata*, Red Bloodwoods *Corymbia gummifera*, Black She-oak *Allocasuarina littoralis*, Old Man Banksias *Banksia serrata* and occasional Grey Gums *Eucalyptus punctata* and Blackbutts *E. pilularis*. The ground cover is typically thin and non-continuous with a variety of dry heath plants predominating. In some sections, seepage from the sandstone above has created damp soil areas and these are often vegetated by dense banks of Coral Fern *Glychenia sp.* with Swamp Roses *Bauera ruboides* and mosses nearby.

The Sandstone Woodland is punctuated in several places by stands of Black She-oaks, testimony to previous fires in the reserves.

The other obvious habitat that can be seen in the reserve are the mangroves that occupy the mud flats at the mouth of Scotts Creek. The mangrove areas are wide and extend for ½ a kilometre upstream into Willis Park. At low tide, only a narrow channel between 1 to 2 metres wide divides the banks of mangroves on either side of the creek. The mangroves grow to be tall and thin in the protection of Middle Cove headland and they form an enclosing canopy over the creek.



Impacts and Threats to the Reserve:

North Arm Reserve is particularly susceptible to disturbance by virtue of its shape; it is a long, thin reserve that is bisected along its longest axis by a walking track. These features mean that there are few parts of the reserve that are more than several metres away from areas that are affected by people.

Threats and impacts to the reserve include:

1. High “edge effect” due to shape
2. High population of predatory birds (e.g. kookaburras, butcherbirds, currawongs)
3. Fire damage causing changes to plant and animal communities
4. High weed invasion along tracks and around boundaries of reserve
5. Regular fox predation in reserve

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: North Arm Reserve is dominated by Sydney Sandstone Gully Forest (10 agi). The fauna that occurs there are species that can utilise the canopy, flowers and fruits of these trees. The undergrowth, in comparison offers very limited resources.

Mammals: Like many other reserves, North Arm Reserve appears to have lost most of its native ground mammals. The only ground mammals found in the reserve were exotic (foxes, cats, black rats and mice). Hair tubes revealed

the presence of *Antechinus* in two sections of sandstone escarpment on the northern side of Scotts Creek.

As with other reserves fox and cats scats contained mainly the remains of rats and mice. Apart from fruit and insects, the other part of their diet appeared to be made up of birds (such as Spotted Turtledoves, Wattlebirds and Currawongs).

The large areas of intact woodland and continuous canopy cover in North Arm Reserve provides excellent protection and food for three species of arboreal mammals (Common Brushtail Possums, Ringtail Possums and Sugar Gliders); the prior two species appear to be numerous in the reserve.

Common Brush-tail Possum *Trichosurus vulpecula*

Brushtail Possums are not common in the reserve but were distributed throughout the reserve. Most often these possums were seen at the edges of the reserve or in vegetation in houses neighbouring the reserve.

Common Ringtail Possum *Pseudecheirus peregrinus*

These possums are particularly numerous in the reserve. During the spotlighting surveys held on the 17th and 28th of November 2000, 18 and 39 Ringtail Possums were seen respectively. A count of dreys visible from the North Arm Track was conducted on the 18th of October and 56 drays were noted in the section from Willis Road to the Scotts Creek crossing.

Sugar Glider *Petaurus breviceps*

Sugar Gliders do not appear to be very common in North Arm Reserve and only one animal was spotted and another heard calling during two nights of survey.

Brown Antechinus *Antechinus stuartii*

Antechinuses were detected in areas in the western part of the reserve.

Fox *Vulpes vulpes*

Foxes were not spotted in the reserve but scats were collected from along the length of North Arm Track.

Cat *Felis cattus*

Two cats were spotted in the southern part of the reserve but scats were collected from both sides of Scotts Creek.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve and occasionally roosting in eucalypts that were in flower.

Black Rat *Rattus rattus*

Black Rats were detected throughout the reserve. Only at the extreme western end of the reserve, near Willis Park, did the incidence of Black Rat detection increase above 1 in ten traps.

House Mouse *Mus musculus*

House Mice were not seen but were detected by hair tubes set on both sides of Scotts Creek. They did not appear to be particularly numerous and were only detected in four out of eighty hair tubes.

Birds: North Arm Reserve contains a large variety of native birds. The combined bird list from Burton (2000) and the present study showed that 63 bird species were present. Significant records for the reserve include Powerful Owl, Osprey, White-bellied Sea-eagle, Whistling Kite, Pacific Baza and Peregrine Falcon.

	Burton (2000)	Fauna Study (2001)
Australian Wood Duck		2000
Pacific Black Duck	1999	2000
Chestnut Teal	1999	
Little Pied Cormorant	1999	2000
Great Cormorant	1998	
Australian Pelican	1999	
White-faced heron	1997	2000
Striated Heron	1999	
Nankeen Night Heron	1999	2000
Australian White Ibis	1999	
Spoonbill sp.	1999	
Osprey	1997	
Pacific Baza	1999	2000
Whistling Kite	1999	2000
White-bellied Sea-eagle	1999	
Grey Goshawk	1999	2000
Peregrine Falcon		2000
Silver Gull	1999	2000
Crested Tern	1999	2000
* Spotted Turtle-dove	1999	
Crested Pigeon		2000
Wonga Pigeon		2000
Sulphur-crested Cockatoo	1999	
Rainbow Lorikeet	1999	2000
Australian King-parrot	1999	2000
Crimson Rosella	1999	
Eastern Rosella	1995	
Fan-tailed Cuckoo	1999	
Common Koel	1998	2000
Channel-billed Cuckoo		2000
Powerful Owl		2000
Tawny Frogmouth		2000
Laughing Kookaburra	1999	2000

Sacred Kingfisher	1995	
Dollarbird	1999	2000
Superb Fairy-wren		2000
Variegated Fairy-wren	1999	2000
Spotted Pardalote	1999	2000
White-browed Scrub Wren	1999	2000
Brown Thornbill	1999	2000
Red Wattlebird	1996	2000
Little Wattlebird	1999	
Noisy Miner	1999	2000
Yellow-faced Honeyeater	1996	
New Holland Honeyeater		2000
Eastern Spinebill	1999	
Eastern Yellow Robin	1999	2000
Eastern Whipbird	1999	
Golden Whistler	1999	
Grey Shrike-thrush	1999	
Magpie-lark	1997	2000
Grey Fantail	1995	
Willie Wagtail	1999	
Black-faced Cuckoo-shrike	1999	2000
Olive-backed Oriole	1995	
Grey Butcherbird	1999	2000
Australian Magpie	1999	2000
Pied Currawong	1999	2000
Australian Raven	1999	2000
* House Sparrow		2000
Red-browed Finch	1999	2000
Welcome Swallow	1998	2000
* Red-whiskered Bulbul	1999	
Silvereye	1999	2000
* Common Myna	1995	

* =exotic species

Reptiles: North Arm Reserve contained 13 species of reptiles. Four species of snakes were recorded during the recent survey (Red-bellied Black Snake, Green Tree Snake, Golden Crown Snake and Eastern Brown Snake). The record for the Eastern Brown Snake is based on a sighting by a local resident and, although the observer was adamant about the identity of the snake, the record needs to be verified. Nine species of lizards were also found. The largest diversity of reptiles was found around the boundary of the Scotts Creek mangrove forest and the Sydney Sandstone Gully Forest.

Eastern Water Dragon *Physignathus lesueuri*

These lizards were only detected along the upper sections of Scotts Creek.

Common Blue Tongue Lizard *Tiliqua scincoides*

A dead Blue Tongue Lizard was found on the southern section of the North Arm Track in mid- November 2000.

Eastern Water Skink *Eulamprus quoyii*

Very common around the Scotts Creek crossing and around the edges of the mangroves.

Grass Skink *Lampropholis guichenoti*

Common on the higher parts of the site, especially along the edges of the North Arm Track.

Delicate Skink *Lampropholis delicata*

The most commonly seen reptile in the reserve and found in all parts of the reserve.

Weasel Skink *Saproscincus mustelinus*

Weasel skinks were seen in leaf litter in several places along the North Arm Track.

Eastern Snake-eyed Skink *Cryptoblepharus virgata*

Seen only in the drier and more exposed parts of the woodland.

Southern Leaf-tailed Gecko *Phyllurus platurus*

Common in a few places ain the reserve. Present on both sides of Scotts Creek.

Red-bellied Black Snake *Pseudechis porphyriacus*

A single Black Snake was sighted near the Scotts Creek crossing in October 2000.

Eastern Brown Snake *Pseudonaja textilis*

Unconfirmed sighting of a “Brown Snake” from Deepwater Road in October 2000.

Green Tree Snake *Dendrelaphis punctatus*

A Green Tree Snake was found near the mangrove area on the southern side of Scotts Creek.

Golden Crown Snake *Cacophis squamulosus*

Five Golden Crown Snakes were found or reported during the surveys, all were from the northern side of Scotts Creek.

Frogs: Four frog species were found in the reserve. One species, Red-crowned Toadlets were found in four locations close to the North Arm Track.

Red-crowned Toadlet *Pseudophryne australis*

Toadlets were located in four areas on the northern side of Scotts Creek. All of the sites were close to the North Arm Track and one site

was in the gutter beside the sealed road leading to the pumping station. Eggs were found in two of these sites in early November 2000.

Common Eastern Froglet *Crinia signifera*

This frog was present in shallow drains and soaks along the North Arm Track and around the edges of the mangrove forest.

Peron's Tree Frog *Litoria peronii*

These large, brown tree frogs were found in two locations; one at the start of the Water Boards road off Deepwater Road, the other near the pumping station.

Striped Marsh Frogs *Limnodynastes peronii*

Striped Marsh Frogs were only heard and seen in boggy areas near the Scotts Creek crossing.

Fauna Conservation Measures

1. **Powerful Owls:** Powerful Owls search the forests of North Arm Reserve on a regular basis for food. There is no evidence to suggest that they roost in North Arm Reserve. Nevertheless, foraging owls are subject to disturbance while hunting. Owls were not detected in areas where there was street lighting or wide tracks (e.g. Willis Road section of the North Arm Track). However, they were detected in areas such as the Scotts Creek crossing where they apparently fly over Scotts Creek to the opposite forest area.

   Street lighting that faces away from the reserve and minimal walking tracks will assist these birds to continue to forage in this area.

2. **Fox and Cat Control:** Foxes and cats appear to be scattered throughout the reserve. To date, the analysis of scats has indicated that most prey items are introduced rats and mice. *Antechinus* remains have not been found in the scats. While these predators are able to plunder the ground at night, the chances for the recovery of vulnerable animals (such as Blue Tongue Lizards and Bearded Dragons, Bandicoots and native rodents) are remote. Control programs will need to be an on-going part of the maintenance of this reserve.

3. **Red-crowned Toadlet Sites:** Many of the sites where Red-crowned Toadlets were found are close to the North Arm Track. This may not be co-incidental, instead it appears that the cutting of the track through wet banks has created micro-habitats along the edges of the tracks. In areas where underground seepage is high (often indicated by the establishment of thick banks of Coral fern), the cutting and levelling of the track has created a barrier to water seepage and water pools along the inside of the track. Where there is sufficient leaf litter for shelter, the toadlets have exploited these artificial sites for breeding. Great care must be taken with track maintenance in these areas: firstly, to ensure that egg masses in the

leaf litter beside the track are not destroyed, secondly, to prevent the wet areas beside the track from becoming too permanent through water build up caused by the placement of the track. Other frogs can displace toadlets from open water sites.

4. **Water Flow from Scotts Creek:** Scotts Creek receives storm water run-off from a large residential area bounded by North Chatswood and East Roseville. Water is discharged from the drains under the Eastern Valley Way almost continually. As there is a great scarcity of freshwater sites in the municipality, an opportunity exists to create freshwater habitat at the headwaters of Scotts Creek. The excavation of overflow ponds would greatly assist the aquatic fauna as well as provide large drinking spaces for creatures such as bats.

5. **Weed Control:** Weed invasion is a particular problem for this reserve. The reserve is long and thin and subject to weed invasion and weed penetration easily. Lantana, Privet, Bamboo, Honeysuckle, Crofton Weed and a large variety of smaller weeds have become established in this area.

Mammals

Photo 1: Brown Antechinus *Antechinus stuartii*

Photo 2: Short-beaked Echidna *Tachyglossus aculeatus*

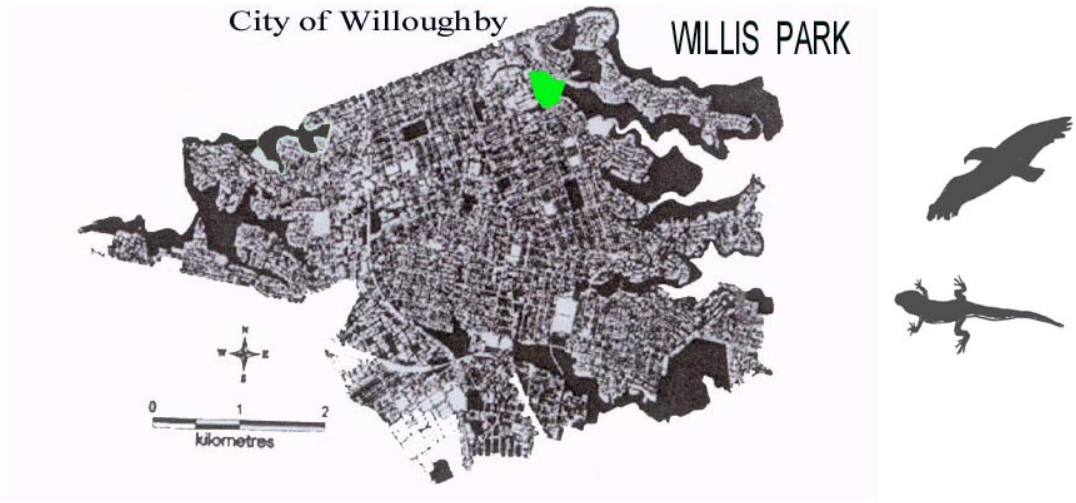
Photo 3: Sugar Glider *Petaurus breviceps*

Photo 4: Common Brushtail Possum *Trichosurus vulpecula.*

Reserve Group 5: Willis Park Group

Willis Park

Location: Castle Cove



Description of Reserve:

Willis Park is quite a large park (10.1 Ha) but is not a park that is amenable for public use. It occupies a steep gully that forms the headwaters of Scotts Creek. Storm water collected in the catchment west of Eastern Valley Way passes under this road in two large culverts. The culverts terminate at a sandstone cliff and the water spills over a spillway and then over the sandstone wall as a cascade. During heavy rain, sudden water surges can make this waterfall quite spectacular and make the crossing of Scotts Creek in North Arm Reserve dangerous.

As Willis Park occupies such steep terrain, accessibility to the reserve is limited. Pedestrians walking along Eastern Valley Way and Castle Cove Drive can look down into the valley but access from these areas is not possible.

The higher edges of Willis Park have been greatly modified and replanted with a mixture of native and exotic trees. The lower slopes also contain a mixture of native and introduced plants with many garden and weed species becoming established whenever the native vegetation has been removed. The greatest concentration of exotic plants occurs around Scotts Creek where flood-like surges have stripped away the original fringing vegetation and opened up areas for non-native plants to become established.

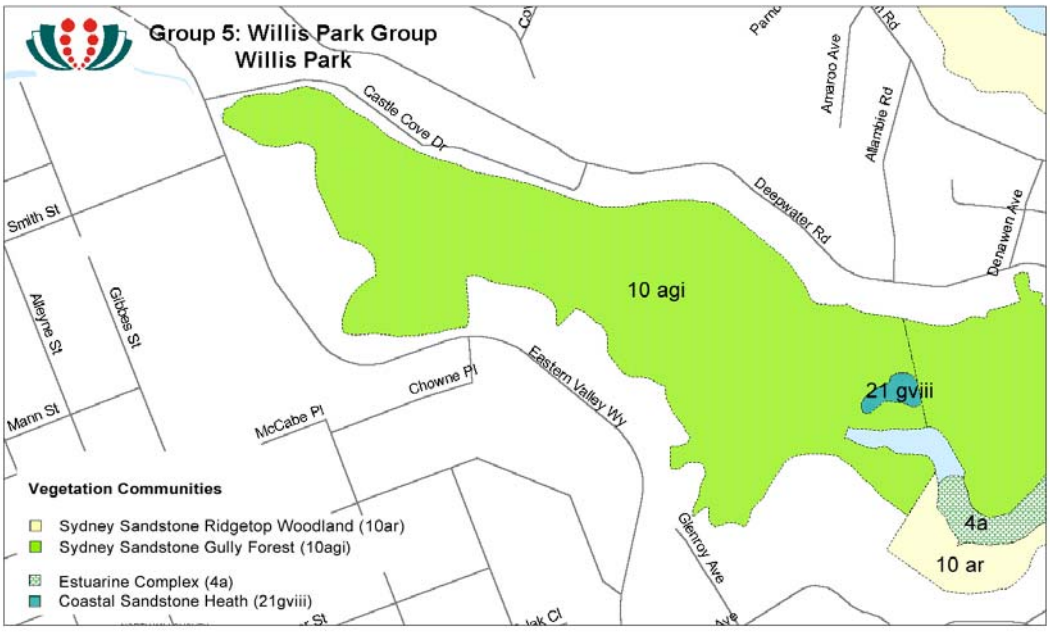
Scotts Creek passes over a few, low sandstone shelves before reaching the valley floor. There are several large rock pools on these ledges and a deep waterhole at the end of the sandstone watercourse. In the valley floor, Scotts

Creek meanders slowly towards North Arm Reserve where the creek finally enters large mangrove areas.

Description of Habitats in the Reserve:

Willis Park contains mainly Sydney Sandstone Gully Forest (10 agi) that has been disturbed to some extent. The mid-slope regions of Willis Park contain the best examples of intact woodland which is dominated by Black She-oak *Allocasuarina littoralis* and contains scattered Sydney Red Apple *Angophora costata*, Mock-orange *Pittosporum undulatum* and Sydney Green Wattle *Acacia decurrens.* The higher part of the reserve contains a mixture of native and non-native trees, all of which have been planted. Numerous weeds have invaded the slopes of the park, particularly Lantana, Morning Glory, Bamboo, Cane Grass, Cestrum, Privet and Honeysuckle.

The lower sections of Willis Park, around Scotts Creek have been greatly altered as a result of storm water surges through the valley. These surges have scoured the upper creek line and created banks where invasive plants have established. The creek edges contains various weeds such as Date Palms, Bamboo, Crofton Weed, Privet and Wandering Jew. The surges have also deposited mounds of flotsam in the form of plastic bottles and bags, foam balls, litter and leaves.



Impacts and Threats to the Reserve:

Willis Park is a highly disturbed area that is likely to continue to be disturbed in the future. Storm water surges will continue to disrupt the vegetation in the

valley floor and additional weed species are likely to become established. Because of the difficulty with access, efforts to control or rehabilitate areas are thwarted.

The impacts can be summarised as follows:

1. High level of on-going disturbance associated with surges of storm water.
2. High potential for continuous weed invasion.
3. Minimal scope for rehabilitation due to steepness of terrain and difficulty with site access.
4. Continual build up of refuse and organic debris to the valley floor.

These impacts have changed the nature of the park and altered its fauna as well.

Description of Fauna: Willis Park has a depleted fauna. Many native species that are found in adjoining reserves are absent from Willis Park.

Mammals: Seven species of mammal were detected in Willis Park, four of which were exotic. No insectivorous bats were detected and the number of native mammal sightings was quite low.

Common Brushtail Possum *Trichosurus vulpecula*

4 Brushtail Possums were spotted in the reserve on the evening of the 27th of December 2000. The possums were all located high up the slopes of the park, none were seen near the valley floor.

Common Ringtail Possum *Pseudecheirus peregrinus*

Ringtail Possums were found in two main areas of the reserve, at a mid-slope level on the northern and southern side of the park. Only seven Ringtail Possums were spotted on the evening of the 27th of December 2000.

Brown Antechinus *Antechinus stuartii*

Antechinuses were detected in hair tubes set below Eastern Valley Way.

Fox *Vulpes vulpes*

Foxes were not spotted in the park but scats were collected near Castle Cove Drive on the northern side of the park.

Dog *Canis familiaris*

A dog was spotted in the reserve below the bowling green area.

Cat *Felis cattus*

Four cats were spotted in the park, all on the southern side of the park. A cat scat was collected which contained bird feathers.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed in figs trees below Eastern Valley Way.

Black Rat *Rattus rattus*

Black rats were seen near the storm water culvert at Eastern Valley Way, behind the bowling club area and on the upper southern slope of Willis Park.

House Mouse *Mus musculus*

House mice were detected by hair tubes set on the southern side of the park.

Birds: Scotts Creek in Willis Park was surveyed by Burton (2000). Bird records obtained during the fauna study were collected from along Scotts Creek as well as from the slopes that form the northern and southern boundaries of the park.

	Burton (2000)	Fauna Study (2001)
Pacific Black Duck	1999	2000
Chestnut Teal	1999	2000
White-faced heron	2000	2000
Striated Heron		2000
Nankeen Night Heron		2000
Australian White Ibis	1997	
Dusky Moorhen		2000
Galah	1999	
Sulphur-crested Cockatoo	1999	2000
* Rock Dove	1999	
* Spotted Turtle-dove	2000	2000
Crested Pigeon	2000	
Rainbow Lorikeet	2000	2000
Musk Lorikeet	1999	
King Parrot	1999	
Crimson Rosella	2000	
Eastern Rosella	1999	
Fan-tail Cuckoo	1996	
Common Koel	1995	2000
Powerful Owl	1996	2000
Tawny Frogmouth		2000
Laughing Kookaburra	1999	2000
Sacred Kingfisher		2000
Superb Fairy-wren		2000
Variegated Fairy-wren	1996	
Spotted Pardalote	1999	
White-browed Scrub-wren	1999	
Brown Thornbill	1999	

Red Wattlebird	1999	2000
Little Wattlebird	1995	2000
Noisy Friarbird		2000
Noisy Miner	2000	2000
Yellow-faced Honeyeater	1996	
New Holland Honeyeater		2000
Eastern Spinebill	1996	2000
Eastern Yellow Robin	1997	2000
Eastern Whipbird	1999	
Golden Whistler	1996	
Magpie-lark	1999	2000
Grey Fantail	1995	2000
Willie Wagtail	1995	2000
Black-faced Cuckoo-shrike	1999	2000
Olive-backed Oriole	1995	
Southern Figbird		2000
Grey Butcherbird	1999	2000
Australian Magpie	1999	2000
Pied Currawong	1999	2000
Australian Raven	1999	
White-winged Chough	1999	
* House Sparrow		2000
Red-browed Finch	1999	2000
Welcome Swallow	2000	2000
Silvereye	2000	2000
* Red-whiskered Bulbul	1999	
* Common Myna	2000	

* = exotic species

Reptiles: Only five species of reptiles were found in Willis Park

Eastern Water Dragon *Physignathus lesueuri*

These lizards were only detected around Scotts Creek.

Eastern Water Skink *Eulamprus quoyii*

These were the most common lizard seen in the valley and around Scotts Creek.

Garden Skink *Lampropholis guichenoti*

Four Garden Skinks were caught on the upper slope near Castle Cove Drive.

Delicate Skink *Lampropholis delicata*

The most commonly seen reptile in the reserve and found in all parts of the reserve.

Golden Crown Snake *Cacophis squamulosus*

A single Golden Crown Snake was found on the southern slope of the park.

Frogs: Two frog species were found in the Willis Park, both were found in the valley floor next to Scotts Creek

Common Eastern Froglet *Crinia signifera*

These frogs appeared to be quite common in the pools around the debris piles in the lower valley.

Striped Marsh Frogs *Limnodynastes peronii*

Striped Marsh Frogs were only detected in a pool in the valley floor. The frogs were calling from beneath a mound of water-deposited branches and leaves.

Fauna Conservation Measures

1. **Reduction of storm water scouring of valley floor:** The storm water discharge into Scotts Creek from Eastern Valley Way is a high energy system. Sudden surges of water create scouring downstream, opening up new areas for weed invasion. Flow dissipation devices are needed to reduce the erosion effect of the water release.

2. **Fox and Cat Control:** Foxes and cats appear to be scattered throughout the reserve. To date, the analysis of scats has indicated that most prey items are introduced rats and mice and *Antechinus* has not been found in the scats. While these predators are able to plunder the ground at night, the chances for the recovery of vulnerable animals (such as Blue Tongue Lizards and Bearded Dragons, Bandicoots and native rodents) are remote. Control programs will need to be an on-going part of the maintenance of this reserve.

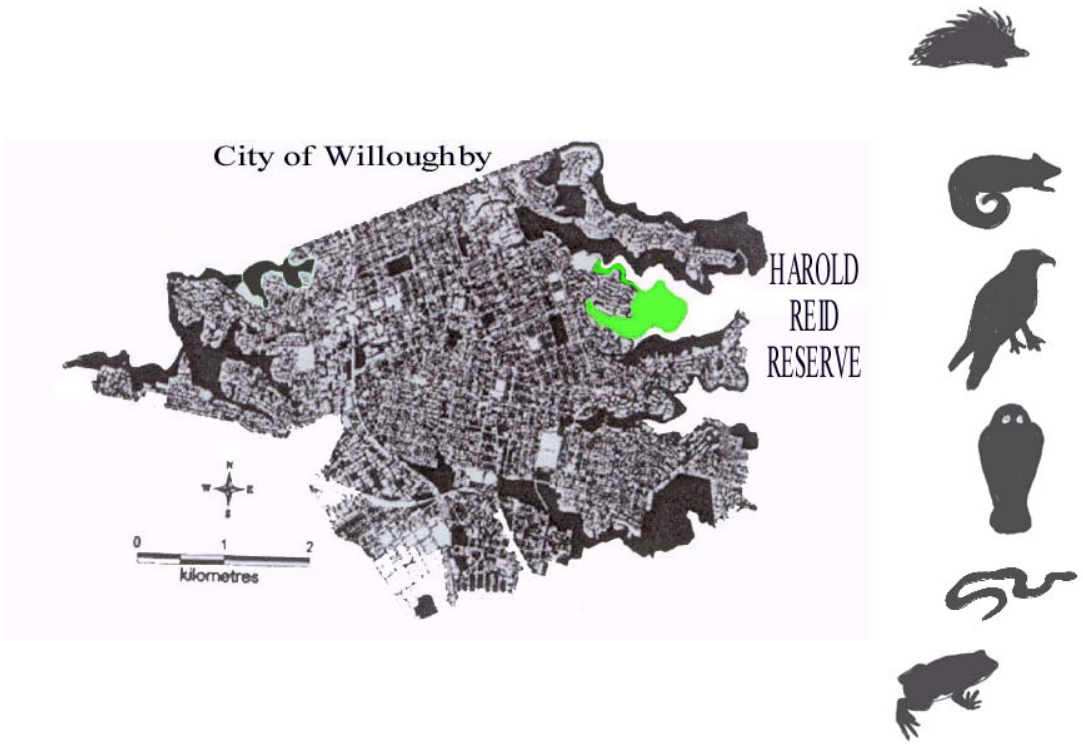
3. **Habitat Creation – freshwater pools overflow channels**: If the storm water surges in Scotts Creek can be reduced, it then becomes possible to develop fauna habitats along the valley floor. In particular, overflow lagoons can be created that receive run off only during periods of high water flow. This would require the construction of a high flow diversion channel into the lagoon. The lagoon would not be in the main channel of Scotts Creek but to the side of the valley (where it would miss the main force of the high water flow).

4. **Weed Control:** Weed invasion is a particular problem for this reserve. The reserve is long and thin and subject to weed invasion and weed penetration easily. Lantana, Privet, Bamboo, Honeysuckle, Crofton Weed and a large variety of smaller weeds have become established in this area.

Reserve Group 6: Harold Reid Group

Harold Reid Reserve

Location: Middle Cove



Description of Reserve:

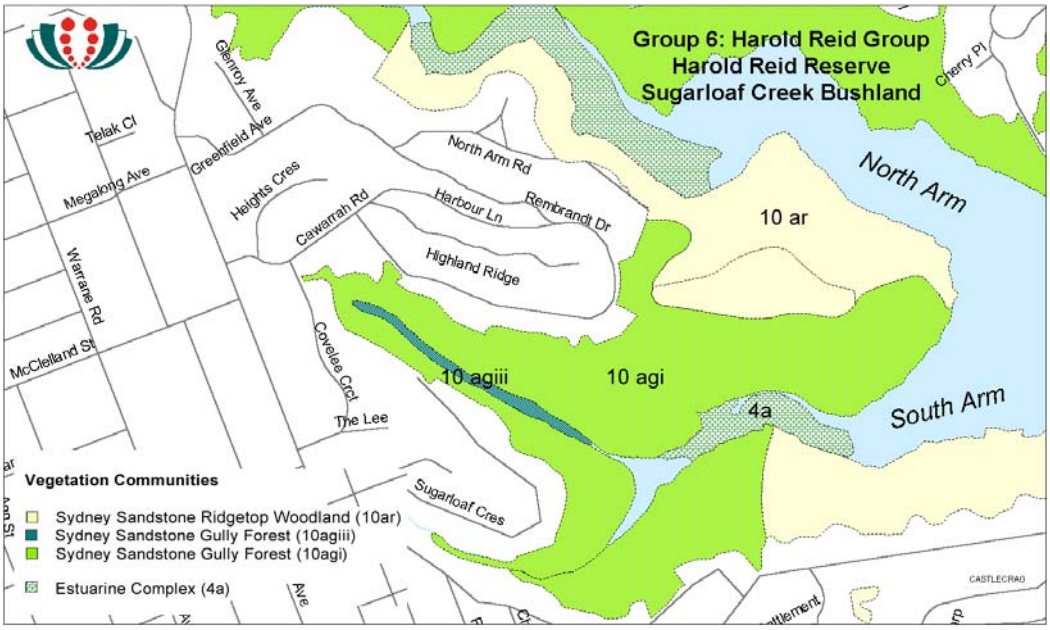
Harold Reid Reserve occupies a prominent headland in Sugarloaf Bay. The large, rounded eminence is known locally as “Willoughby Sugarloaf” or simply “The Sugarloaf”. The reserve is bounded by water on three sides; the north arm of Sugarloaf Bay separates Harold Reid Reserve from the Castle Cove Peninsula while the south arm of Sugarloaf Bay separates the reserve from Castlecrag. Harold Reid Reserve is continuous with North Arm Reserve and the North Arm Track winds its way around the north arm of Sugarloaf Bay to join up with tracks in Harold Reid Reserve. Apart from the central Sugarloaf area of the reserve, a southern extension takes in the lower valley of Camp Creek.

There are no buildings in the reserve but a sealed, loop roadway extends over the top of the Sugarloaf. One arm of the roadway (which commences at Rembrandt Drive) passes through a deep sandstone cutting.

Description of Habitats in the Reserve:

Harold Reid Reserve contains a variety of forest and woodland types. The higher parts of the Sugarloaf are covered in tall stands of Sydney Red Apple *Angophora costata*, Red Bloodwood *Corymbia gummifera* and Old Man Banksia *Banksia serrata.* These form the main forest type that can be seen from the loop road. There is a lookout and a barbecue area at the end of the road loop.

The slopes of the Sugarloaf contain wetter forest types. The northern slope of the Sugarloaf is dominated by tall Blackbutt trees *Eucalyptus pilularis* with smaller Sydney Red Apple trees *Angophora costata* flourishing along the sandstone ledges. The southern slopes contain occasional Blackbutt and Grey Gum *E. punctata* trees. The forest slowly intergrades into Coachwood *Ceratopetalum apetalum* and Black Wattle *Callicoma serratifolia* as it nears Camp Creek.



Impacts and Threats to the Reserve:

Harold Reid Reserve has been impacted by the surrounding residential developments and the activities of casual visitors in a number of ways. These include:

1. High population of feral and domestic cats.
2. High population of predatory birds (e.g. kookaburras, currawongs).
3. Fires causing changes to plant and animal communities.

4. Reduced water quality in Camp Creek.
5. Regular fox predation in reserve.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: Harold Reid Reserve, like many overlooking Middle Harbour, is dominated by forest growing in sandstone layers. It contains a high number of arboreal animals (birds, possums and tree skinks) but lacks much of its original ground fauna.

Mammals: Harold Reid Reserve appears to have lost most of its native ground mammals; the glaring exception to this is the presence of echidnas in the reserve. An echidna was sighted in November 2000 near the start of the loop road. It is suspected that echidna numbers are very low as the last sighting in Harold Reid Reserve was in 1995. As echidnas are secretive and avoid areas of activity and movement, it is impossible to make meaningful estimates of their abundance based on these sightings. Despite this, their presence in the reserve is most pleasing.

The only other ground mammals found in the reserve (other than echidnas) were exotic (cats, foxes, black rats and mice). Most fox and cats scats contained remains of rats and mice and it appears that few native animals (other than occasional birds) are being taken by these predators. The large areas of intact woodland and forest provide excellent protection and food for three species of arboreal mammals (Common Brushtail Possums, Ringtail Possums and Sugar Gliders), which appear to be numerous in the reserve.

Short-beaked Echidna *Tachyglossus aculeatus*

An echidna was seen near the start of the loop track in November 2000.

Common Brushtail Possum *Trichosurus vulpecula*

Brushtail Possums are far less numerous than Ringtail Possums. Spotlighting surveys conducted in the reserve on the 1st and 3rd of November 2000 only located four and two Brushtail Possums respectively. Most possum sightings were near the picnic area and near the start of the loop road.

Common Ringtail Possum *Pseudecheirus peregrinus*

These possums are particularly numerous in the reserve. During the spotlighting surveys held on the 1st and 3rd of November 2000, 14 and 17 Ringtail Possums were seen respectively. A count of dreys visible from the lower walking track was conducted on the 31st of October and 41 dreys were noted.

Sugar Glider *Petaurus breviceps*

Sugar Gliders were spotted and heard calling on both nights of the spotlight surveys. Three sugar gliders were heard calling from below the eastern extremity of the lower walking track on the evening of the

1st of November, and a glider was spotted near the entrance gate on the same night. On the evening of the 3rd of November, a glider was heard calling from the southern part of the reserve while one was spotted a further 100 metres along the track.

Brown Antechinus *Antechinus stuartii*

Antechinuses were detected on the northern and southern sides of the reserve.

Fox *Vulpes vulpes*

Foxes were not spotted in the reserve but scats were collected from the loop roadway and along the lower walking track.

Dog *Canis familiaris*

Dogs were seen in the lower part of the reserve and near the entrance.

Cat *Felis cattus*

Only one cat was spotted in the reserve but scats were collected from a number of locations. The high density of cat scats suggests that both domestic and feral cats are feeding in the reserve.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve and occasionally roosting in eucalypt trees that were in flower.

Gould's Wattle Bat *Chalinolobus gouldii*

Gould's Wattle Bats were detected flying on the southern side of the reserve, near Camp Creek.

Black Rat *Rattus rattus*

Black rats were spotted in several sites close to the shoreline. They were detected in a number of hair tubes and appear to be scattered throughout the reserve.

House Mouse *Mus musculus*

House mice were not seen but were detected by hair tubes. They were present in all ten hair tubes set parallel with Rembrandt Drive, near the entrance way into the reserve.

Birds: The reserve is used by a good variety of native birds, particularly woodland and forest species. Burton (2000) recorded 57 bird species of which only two were exotic. During the current survey only 22 species were noted. Significant records for the reserve include Powerful Owl, Eastern Whipbird, White-bellied Sea-eagle and Whistling Kite.

	Burton (2000)	Fauna Study (2001)
Mallard	1997	
Pacific Black Duck	1999	
Chestnut Teal	1999	
Little Pied Cormorant	1999	
Pied Cormorant	1999	
Little Black Cormorant	1999	
Great Cormorant	1999	
Australian Pelican	1995	
White-faced Heron	1998	
Striated Heron	1999	
Nankeen Night Heron	1999	
Aust. White Ibis	1999	2000
Spoonbill sp.	1999	
Osprey	1997	
Pacific Baza	1999	
Whistling Kite	1999	
White-bellied Sea-eagle	1999	
Silver Gull	1999	2000
* Spotted Turtle Dove	1999	
Crested Pigeon		2000
Topknot Pigeon	1998	2000
Yellow-tail Black Cockatoo	1997	
Sulphur-crested Cockatoo	1999	2000
Rainbow Lorikeet	1999	2000
Aust. King Parrot	1999	
Crimson Rosella	1999	2000
Eastern Rosella	1999	
Fan-tailed Cuckoo	1999	2000
Common Koel	1995	2000
Channel-billed Cuckoo	1995	
Powerful Owl	1998	2000
Southern Boobook	1999	2000
Tawny Frogmouth	1999	2000
White-throated Needletail	1999	2000
Laughing Kookaburra	1999	2000
Sacred Kingfisher	1995	
Dollarbird	1995	
Superb Fairy-wren		2000
Variegated Fairy-wren	1999	
Spotted Pardalote	1999	
White-browed Scrub Wren	1999	
Brown Gerygone	1998	
Brown Thornbill	1999	
Red Wattlebird	1998	2000
Little Wattlebird	1998	
Noisy Miner	1999	2000
Yellow-faced Honeyeater	1996	
Eastern Spinebill	1999	2000
Eastern Yellow Robin	1999	2000

Eastern Whipbird	1999	
Golden Whistler	1998	
Grey Shrike-thrush	1997	
Magpie-lark	1999	2000
Grey Fantail	1999	
Rufous Fantail	1995	
Willie Wagtail	1995	2000
Black-faced Cuckoo-shrike	1999	2000
Olive-backed Oriole	1999	
Grey Butcherbird	1999	
Australian Magpie	1999	2000
Pied Currawong	1999	2000
Australian Raven	1999	2000
Red-browed Finch	1998	2000
Welcome Swallow	1999	2000
* Red-whiskered Bulbul	1999	2000
Silvereye	1999	
* Common Starling		2000
* Common Myna		2000

* = exotic species

Reptiles: Harold Reid Reserve contains a good variety of reptiles. Two species of snakes were recorded during the recent survey (Red-bellied Black Snake and Green Tree Snake) while seven species of lizards were also found. The majority of the reptiles were found on the river flat, in open or disturbed areas.

Eastern Water Dragon *Physignathus lesueuri*
These lizards were only detected along Camp Creek.

Common Blue Tongue Lizard *Tiliqua scincoides*
A single Blue Tongue Lizard was found on the southern walking track in early November 2000.

Eastern Water Skink *Eulamprus quoyii*
Most common around Camp Creek but also occurs higher up in the reserve.

Grass Skink *Lampropholis guichenoti*
Common on the higher parts of the site and around the barbecue area.

Delicate Skink *Lampropholis delicata*
Very common in the reserve and found in all parts of the reserve.

Eastern Snake-eyed Skink *Cryptoblepharus virgata*
Seen on trees in the drier sandstone woodland areas.

Southern Leaf-tailed Gecko *Phyllusurus platurus*

Common but not widespread in the reserve. They appear to be confined to sandstone outcrops below the southern walking track and along the escarpment area on the northern slopes.

Red-bellied Black Snake *Pseudechis porphyriacus*

A single Black Snake was sighted where the North Arm Track crosses Camp Creek December 2000.

Green Tree Snake *Dendrelaphis punctatus*

A dead Green Tree Snake was picked up from Rembrandt Drive in November 2000. None were seen in the reserve.

Golden Crown Snake *Cacophis squamulosus*

Two Golden Crown Snakes were found during the surveys, one near the barbecue area, the other near Camp Creek.

Frogs: Only two frog species were found in the reserve. The main reason for the paucity of frogs is due to the lack of moist areas in the reserve. Camp Creek gully provides the only source of permanent water but this water is not of high quality. Apart from the creek, there were seepage areas above Camp Creek gully and an old sandstone gutter that periodically filled with rain water.

Red-crowned Toadlet *Pseudophryne australis*

Toadlets were located in three seepage areas on the southern side of the reserve, above Camp Creek Gully. All of the sites are close to the southern walking track and the toadlets could be heard calling at each site from the track. One of these sites appears to be a shallow, earthen pit, while another is associated with an old sandstone gutter. Eggs were found in two of these sites in early November 2000.

Common Eastern Froglet *Crinia signifera*

This frog was the only species found in Camp Creek gully. During heavy rain, froglets were also found higher up the slope, in the watercourses that run down from below Rembrandt Drive.

Fauna Conservation Measures

1. **Powerful Owls:** Powerful Owls were regularly detected in the reserve. The birds responded to playback calls, were glimpsed in spotlights and dead possums were found, killed by talons that had pierced the chest and cranium. All of the owl calls were made from birds in Camp Creek gully whereas dead possums were found on either side of the reserve. The majority of sightings by residents over the past four years have been of owls roosting in trees in Camp Creek gully.

   A search of the Camp Creek gully area located owl scats but failed to locate a nest. The impression is that this is an often-used roosting area

but may not be a breeding site. Further observations are needed to confirm this.

The owls presumably use Camp Creek gully as it is not visited by people and has dense canopy cover that shields the birds from disturbance, noise and light. At present, the southern walking track passes above the roosting area and it is not easy to locate the roost site from the track. Any increase in human traffic through the area would have a significant impact on the owls. Therefore, if the track is required to be upgraded in the future, a barrier or screen may need to be created to block out noise and movement. Wildlife Watch walks should avoid this area.

2. **Fox and Cat Control:** Foxes and cats appear to be freely roaming over the reserve at night. Analysis of scats indicates that most prey items are introduced rats and mice but some native fauna is also consumed. Fox and Cat control programs may need to be an on-going part of the maintenance of this reserve.

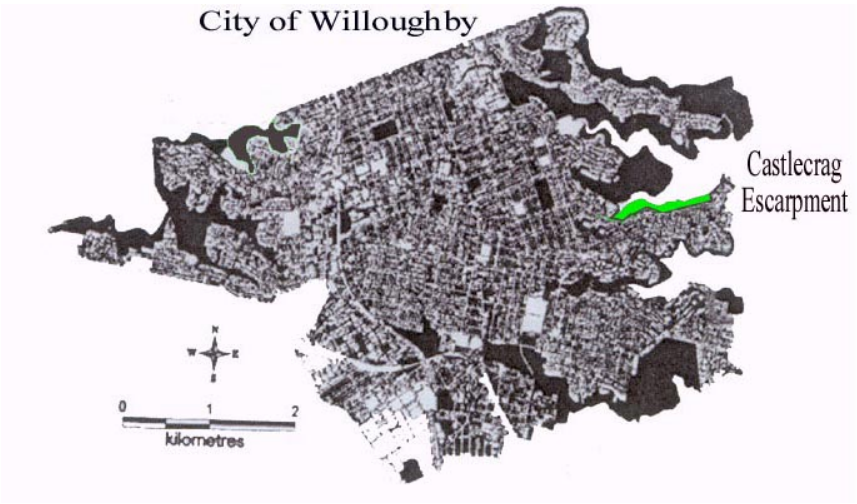
3. **Water quality of Camp Creek:** Camp Creek receives storm water run-off from residential lots in Middle Cove and along the Eastern Valley Way. Water flow is episodic with large surges following local rain. Under drier conditions, there is a steady trickle of water passing down the creek. It is during the drier times that the creek water noticeably deteriorates, the water is often smelly and has a surface slick. Some litter and leaves also get washed into the creek. The creek does not offer secure habitat for aquatic wildlife in its present form.

4. **Weed Control:** Weed invasion is a particular problem along the southern slopes and in Camp Creek gully. Lantana, Privet, Honeysuckle, Crofton Weed and a variety of smaller weeds have become established in this area. These weeds threaten to displace the native ground cover plants along the gully and along the small water courses that feed into the gully.

Reserve Group 7: Castlecrag Group

Castlecrag Northern Escarpment

Location: Castlecrag



Description of Reserve:

Castlecrag Northern Escarpment is a bushland corridor along the northern escarpment of Castlecrag (i.e. the southern shore line of Sugarloaf Bay). The reserve contains land formerly intended for an RTA road corridor (for a now abandoned road link between Castlecrag and Seaforth). The reserve also includes Council land that backs onto houses facing Edinburgh Road. In total, 15.7 Ha of land is included in the reserve (including Cave Reserve and Mills Lookout).

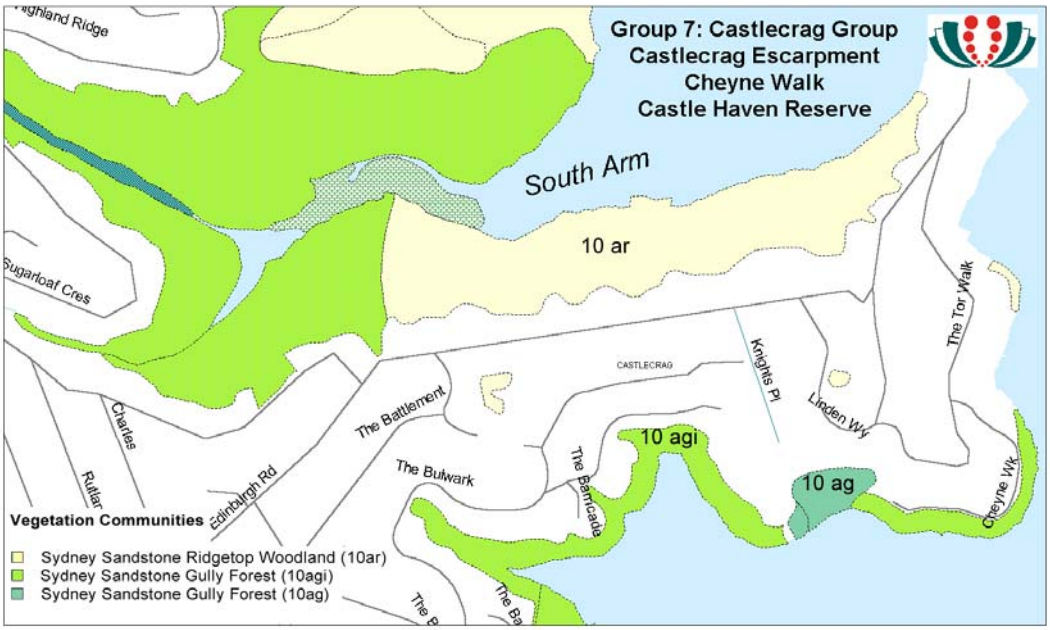
Most of the reserve is steeply sloped. There is an 80 metre drop in elevation from the highest point in the reserve down to Sugarloaf Bay. The land falls away over a series of sandstone ledges before reaching the water's edge. The shore line is steep except in a few places where artificial land platforms have been created. A few cottages are located on the waterline in the central section of the reserve; otherwise the shore line is forested.

Most of the reserve is covered with woodland or trees. The higher parts of the reserve have suffered from invasion by garden escape plants and deliberately planted exotic species. There are a few informal tracks leading down into the escarpment area, the longest of these leads down to the cottages on Sugarloaf Bay. Towards Sugarloaf Point, landscaped areas have been prepared to enable scenic viewpoints of Sugarloaf Bay.

Description of Habitats in the Reserve:

The slopes of the Castlecrag Northern Escarpment consist of woodland and forest. The most evident habitat is Sydney Sandstone Woodland, dominated by Sydney Red Apple *Angophora costata* and containing scattered trees of Black She-oak *Allocasuarina littoralis,* Red Bloodwood *Corymbia gummifera* and Old Man Banksia *Banksia serrata.* Unfortunately, exotic plants have infiltrated sections of the escarpment. The largest areas of establishment by exotic plants are along the southern boundary of the reserve and around the cottage areas of the shoreline.

The only other habitat to note are the mangroves that line the South Arm of Sugarloaf Bay. The Mangroves are so dense that they obscure the watercourse flowing into South Arm. Individual Mangrove trees grow along the southern shore line of Sugarloaf Bay.



Impacts and Threats to the Reserve:

Castlecrag Northern Escarpment has been impacted in a number of ways. The large area of disturbed woodland is testament to the various impacts on the area. The escarpment, although not built upon, has been modified through surrounding developments. Many of the exotic trees found along the southern shore line were established early last century when boat building sheds were in operation in this area. Coral trees and stands of Bamboo were planted behind the boat-building areas.

The intrusion of introduced plants in the higher parts of the reserve are due to a mixture of deliberate planting and escaped garden plants. Recent bush rehabilitation work initiated by Willoughby City Council has started to clear exotic vegetation from the more accessible parts of the escarpment.

The impacts include:

1. High exposure to introduced plants.
2. Large "edge effect" along the southern boundary due to long contact zone with residences and steep down slope impact zone from the residential areas.
3. Regular fox activity in the reserve.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: Castlecrag Northern Escarpment has a depleted fauna despite the size of the reserve. The loss of fauna is most likely due to the large impact zone created by the long boundary with residences facing Edinburgh Road.

Mammals: Castlecrag Northern Escarpment is typical of highly disturbed bushland reserves in that it contains a high proportion of exotic species. It has lost almost all of its native ground mammals. *Antechinus* are still present in the central parts of the reserve. Foxes, cats, Black Rats and mice were abundant in the reserve; the exotic rodents being detected in all parts of the reserve.

Common Brushtail Possum *Trichosurus vulpecula*

Brushtail Possums are more common in this reserve than many others in the Willoughby area. Possums were spotlighted in a number of locations along the reserve as well as being seen in street trees along Edinburgh Road and in gardens of surrounding residences.

Common Ringtail Possum *Pseudecheirus peregrinus*

Ringtail Possums were present throughout the reserve but did not appear to be abundant in any particular location.

Sugar Glider *Petaurus breviceps*

Sugar Gliders were only detected in one location in the centre of the reserve.

Brown Antechinus *Antechinus stuartii*

Antechinuses were detected in several areas along the escarpment.

Fox *Vulpes vulpes*

Foxes were not spotted in the reserve but scats were collected from all parts of the reserve.

Dog *Canis familiaris*

Dogs were encountered in the reserve near Sugarloaf Point.

Cat *Felis cattus*

Cats were spotted in the eastern end of the reserve. No cat scats were found.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying overhead at night but few appeared to roost in the reserve.

Gould's Wattle Bat *Chalinolobus gouldii*

Gould's Wattle Bat was detected near Sugarloaf Creek.

Black Rat *Rattus rattus*

Black Rats were detected throughout the reserve.

Rabbit *Oryctalagus cuniculus*

Rabbits were seen at Sugarloaf Point. They were spotlighted along the shore line as well as detected by hair tubes at higher levels in the reserve.

House Mouse *Mus musculus*

House mice were detected by hair tubes set along the southern boundary of the reserve. Mouse fur was also found in fox scats.

Birds: In view of the size of the escarpment reserve, the bird fauna was not as diverse as expected. Burton (2000) detected 44 species, the fauna study only detected a further eight species.

	Burton (2000)	Fauna Study (2001)
* Mallard	1997	
Pacific Black Duck	1999	
Chestnut Teal	1999	
Little Pied Cormorant	1999	2000
Pied Cormorant	1999	2000
Little Black Cormorant	1999	2000
Great Cormorant	1997	2000
Australian Pelican	1999	
White-faced heron	1997	
Striated Heron	1999	
Australian White Ibis	1999	2000
Masked Lapwing		2000
Grey Goshawk	1999	2000
Silver Gull	1999	2000
Crested Tern	1999	
* Spotted Turtle-dove	1999	
Sulphur-crested Cockatoo	1999	
Rainbow Lorikeet	1999	2000
Australian King-parrot	1999	

Crimson Rosella	1999	2000
Eastern Rosella	1999	
Channel-billed Cuckoo	1999	
Southern Boobook Owl		2000
Sooty Owl		2000
Tawny Frogmouth		2000
Laughing Kookaburra	1999	2000
Superb Fairy-wren		2000
Variegated Fairy-wren	1999	
Spotted Pardalote	1999	
White-browed Scrub Wren	1999	2000
Brown Gerygone	1999	
Red Wattlebird		2000
Little Wattlebird	1999	
Noisy Miner	1999	
Eastern Spinebill	1999	
Eastern Yellow Robin	1999	2000
Eastern Whipbird	1999	
Golden Whistler	1997	
Magpie-lark	1999	2000
Willie Wagtail		2000
Black-faced Cuckoo-shrike	1999	2000
Olive-backed Oriole	1999	
Grey Butcherbird	1999	2000
Australian Magpie	1999	2000
Pied Currawong	1999	2000
Australian Raven	1999	2000
Red-browed Finch	1999	
Welcome Swallow		2000
* Red-whiskered Bulbul	1999	
Silvereye	1999	
* Common Myna	1999	2000

* = exotic species

Reptiles: The reptile fauna was reasonably diverse and contained four species of snake.

Eastern Water Skink *Eulamprus quoyii*
Very common around the shore line and in the South Arm area.

Grass Skink *Lampropholis guichenoti*
Common on the higher parts of the site.

Garden Skink *Lampropholis delicata*
The most commonly seen reptile in the reserve and found in all parts of the reserve.

Eastern Snake-eyed Skink *Cryptoblepharus virgata*
Seen throughout the reserve, especially in the eastern section of the reserve.

Southern Leaf-tailed Gecko *Phyllusurus platurus*

Only two geckoes were seen during the survey, both were found in sandstone crevices near the centre of the reserve.

Red-bellied Black Snake *Pseudechis porphyriacus*

A small Red-bellied Black Snake was seen near Sugarloaf Creek in February 2001.

Diamond Python *Morelia spilota*

A python was sighted near Sugarloaf Point in October 2000.

Green Tree Snake *Dendrelaphis punctatus*

A Green Tree Snake was found near the Mangrove area close to South Arm.

Golden Crown Snake *Cacophis squamulosus*

A Golden Crown Snake was found near the southern boundary of the reserve.

Frogs: Only one frog species was found in the reserve. The scarcity of frogs is due to the steepness of the terrain and the lack of water pooling areas in the reserve.

Common Eastern Froglet *Crinia signifera*

This frog was present near the start of the Mangrove area on the South Arm.

Fauna Conservation Measures

1. **Sooty Owls:** Sooty Owls were detected by call-playback in November and December 2000 at different places along the escarpment. The presence of this species was not expected, as the habitat does not appear to be suitable for it. No signs of roosting or nesting sites could be found and as this is the first record of this species in the area it is assumed that the calling owl not a permanent resident animal. However, it is possible that Sooty Owls visit the site more frequently than we suspect. Therefore, it would be prudent to undertake owl call surveys each spring/summer in order to determine the significance of the site for Sooty Owls.

2. **Weed Control and Replanting:** The extent of weed and exotic plant coverage of the reserve is a serious detraction from the conservation value of the reserve. Areas affected by exotic species are considerable and so it is likely that some seed collection and propagation, leading to replanting of endemic species will be required.

   Residents who live along Edinburgh Road should also be made aware of the impact that they can have on the reserve. Residents should be warned of the dangers of dumping garden wastes in the reserves and encouraged

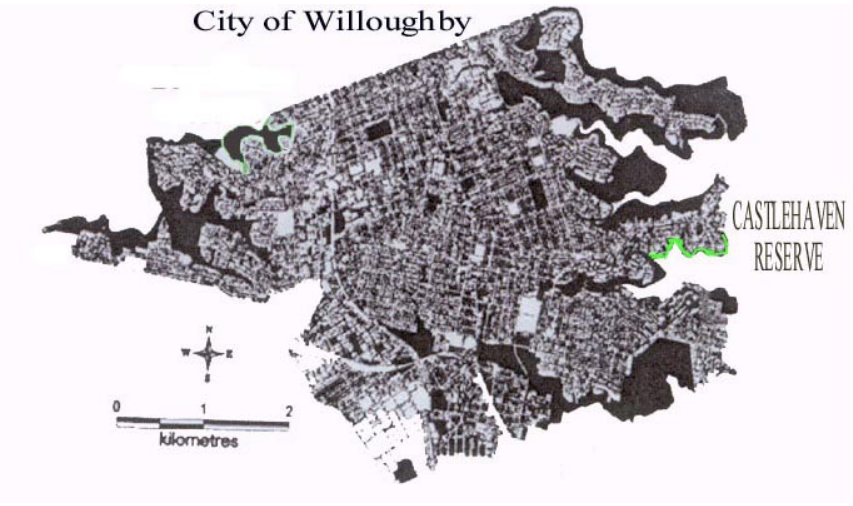
to remove self-seeding exotic species from their gardens and replacing them with more benign species.

3. **Fox and Cat Control:** Foxes and cats appear to be prevalent in the reserve. As with other reserves, scats from foxes contained fur from black rats and mice, but also contained feathers from a variety of large and small birds, as well as lizard bones. Fox control is difficult in this reserve because of its steep nature and the lack of access points into the reserve. Many scats were found close to the shore line and baiting stations could be established using boats to get access to bait sites.

Reserve Group 7: Castlecrag Group

Castlehaven Reserve

Location: Castlecrag



Description of Reserve:

Castlehaven Reserve occupies a narrow strip of bushland along the headland and southern shore of Castlecrag. The reserve is on the steep, lower slope of the Castlecrag peninsula and is less than 50 metres wide in places. For most of its length, residences back onto the reserve except below Knight Place where the abruptness of the sandstone escarpment has prevented residential intrusion further down the slope.

Castlehaven Reserve commences in the east below Cheyne Walk and continues around the headland, along the northern side of Sailors Bay to Sailors Bay Park. There are no formal tracks into the reserve and for much of its length, access is quite difficult from Castlecrag. Access by boat is easier but the steepness of the terrain discourages visitors.

Castlehaven Reserve is wooded along its entire length and creates a green strip around the water line of Castlecrag.

Description of Habitats in the Reserve:

Castlehaven Reserve is extensively covered by Sydney Sandstone Woodland. Tall Sydney Red Apple *Angophora costata* dominate the tree line

but Red Bloodwoods *Corymbia gummifera* and Old Man Banksia *Banksia serrata* are regularly scattered through the woodland.

Unfortunately, along the upper parts of the slope, the woodland has been infiltrated by exotic trees and shrubs or unwanted weeds. In some places the weed growth is quite thick, such as below Knights Place. In most other parts of the reserve the weed density does not become serious until approaching the house line at the top of the reserve.

There are a few isolated Mangrove trees around the water line of the reserve.

Impacts and Threats to the Reserve:

Castlehaven Reserve has been greatly affected by activities in the local area. These impacts include:

1. Extensive weed invasion of the reserve.
2. Large "edge effect" due to the narrowness of the reserve.
3. Many introduced animal species in the reserve.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: The fauna of Castlehaven Reserve is not very diverse. This is partly a reflection of the fact that only one main habitat type is present in the reserve, and that weed and exotic plant invasion has reduced the habitat value of this habitat in particular areas.

Mammals: Castlehaven Reserve contains a large proportion of exotic mammals. One species of native terrestrial mammal (*Antechinus stuartii*) still remain in the reserve. Foxes, dogs and black rats were detected throughout the reserve.

Common Brushtail Possums and Ringtail Possums were present in the reserve. Of these species, Ringtail Possums were the most common with 11 Ringtail Possums spotted on the 30th of November 2000. In comparison, only two Brushtail Possums were sighted. Flying foxes were observed flying overhead. No insectivorous bats were detected in the reserve.

Common Brushtail Possum *Trichosurus vulpecula*

Two Brushtail Possums were spotted close to the shore line below Cheyne Walk and below The Scarp.

Common Ringtail Possum *Pseudecheirus peregrinus*

Eleven Ringtail Possums were spotted in the reserve. Most of these animals were seen in trees close to the shore line.

Fox *Vulpes vulpes*

Fox scats were collected throughout the reserve especially below. The Barricade.

Dog *Canis familiaris*

Dog scats were also found near The Barricade.

Black Rat *Rattus rattus*

Black rats were detected throughout the reserve by hair tubes.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve; none were observed to roost in the reserve.

Birds: Only 15 bird species were recorded for Castlehaven Reserve. Burton (2000) did not survey Castlehaven Reserve.

	Fauna Study (2001)
Little Pied Cormorant	2000
Little Black Cormorant	2000
Silver Gull	2000
Rainbow Lorikeet	2000
Crimson Rosella	2000
Fan-tailed Cuckoo	2000
Laughing Kookaburra	2000
Superb Fairy-wren	2000
Red Wattlebird	2000
Willy Wagtail	2000
Black-faced Cuckoo-shrike	2000
Pied Currawong	2000
Australian Raven	2000
Welcome Swallow	2000
* Common Myna	2000

* = exotic species

Reptiles: Four species of lizards were found in Castlehaven Reserve.

Eastern Water Skink *Eulamprus quoyii*

Eastern Water Skinks were relatively abundant and were present along the shore line of the reserve.

Garden Skink *Lampropholis guichenot*i

Garden skinks were found near Cheyne Walk and The Barricade.

Snake-eyed Skink *Cryptoblepharus virgata*

Two snake-eyed skinks were found near Cheyne Walk.

Southern Leaf-tail Gecko *Phyllurus platurus*

One Leaf-tail Gecko was caught near The Barricade.

Frogs: Two species of frogs were found in the reserve.

Common Eastern Froglet *Crinia signifera*

Froglets were present in a wet area near The Barricade.

Striped Marsh Frog *Limnodynastes peroni*

Striped Marsh Frogs were heard calling from an overgrown area below Knights Place.

Fauna Conservation Measures

1. **Weed Control:** Invasion by exotic plants and weeds is a major problem for Castlehaven Reserve. It decreases the habitat value of the woodland and provides shelter and alternate food sources for unwanted species such as Black Rats.

   The steepness of the terrain and limited access makes the removal of weed and bush rehabilitation a difficult process. Some bush regeneration has already been carried out in the more accessible areas.

2. **Edge Effects:** The long, narrow shape of Castlehaven Reserve means that disturbances to the perimeter of the reserve quickly effect the inner parts of the reserve. The major impact emanates from the residences above the reserve. As the reserve cannot be increased in size, the only other way of protecting the reserve is through the use of sympathetic plants in the residences above the reserve. Residents should be advised as to the plant species that would best serve this purpose and be encouraged to plant these species, particularly along the part of their property that abuts the reserve.

Frogs

Photo 5: Eastern Banjo Frog *Limnodynastes dumerilii*

Photo 6: Leaf-green Tree Frogs *Litoria phyllochroa*

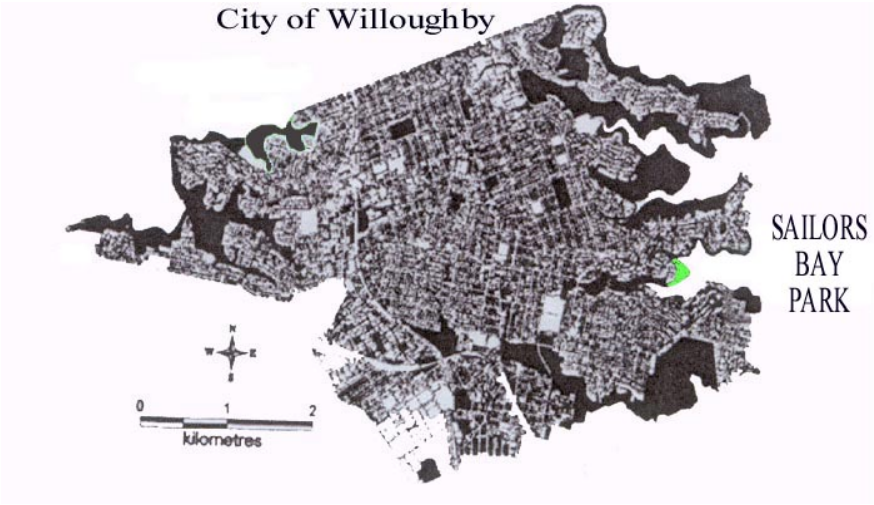
Photo 7: Bibron's Toadlet *Pseudophryne bibroni*

Photo 8: Red-crowned Toadlet *Pseudophryne australis*

Reserve Group 8: Warners Bay Group

Sailors Bay Park

Location: Castlecrag



Description of Reserve:

Sailors Bay Park occupies the headland and southern escarpment of Sailors Bay. Almost all of the site is steeply sloped and descends quickly from the back of residences on Castlecrag to the bay. Consequently, there are few places where the reserve is accessible. The only formal public recreational space in the park is at the end of Rockley Street. A small car park and viewing area over Middle Harbour has been created. Here there are no tracks into the park, but a road snakes down the northern side of the park to the marina below on Mowbray Point.

Sailors Bay Park is accessible by boat but because the park is on such steep land few boats land here.

Most of the park consists of tall woodland, growing out of sandstone ledges that form the headland and escarpment.

Sailors Bay Park is continuous with Watergate Reserve to the south and Castlehaven Reserve to the north.

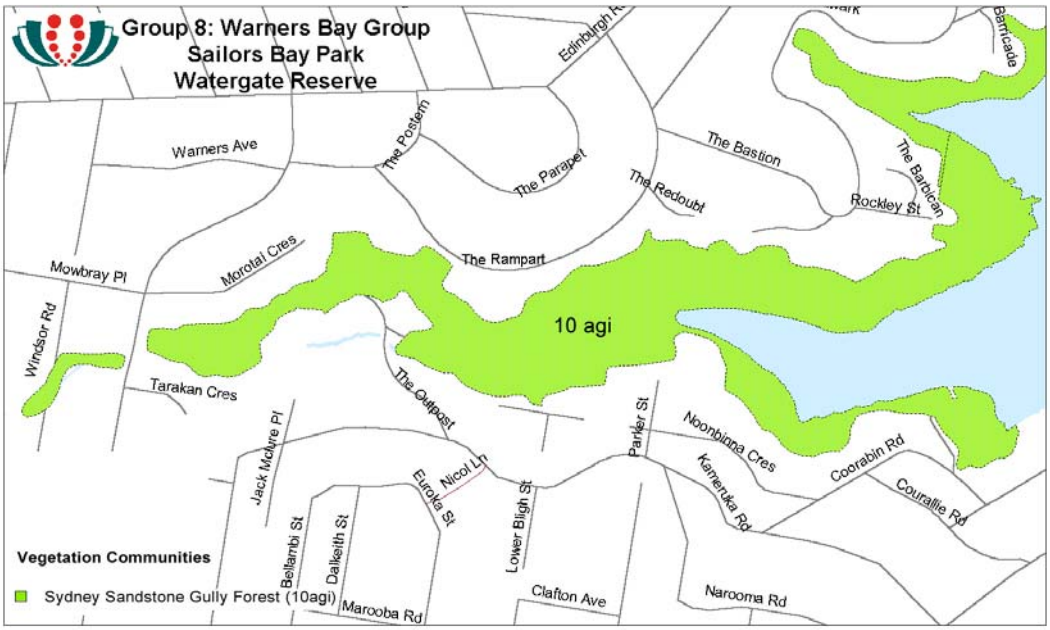
Description of Habitats in the Reserve:

Sailors Bay Park is dominated by Sydney Sandstone Gull Forest (10 agi). Tall Sydney Red Apples *Angophora costata* are very conspicuous along the

escarpment area. Less obvious are the Red Bloodwoods *Corymbia gummifera* and Black She-oaks *Allocasuarina littoralis* that grow between the Red Apples.

The higher parts of the park, near Rockley Street, have been replanted with native trees and shrubs. However, immediately behind the revegetated area is a weed-affected area. A zone of exotic trees and shrubs runs along behind the houses facing onto The Barbette. This area of exotic plants ends abruptly at a dominant sandstone ledge (which demarcates the start of the steep escarpment). Few weeds or exotic plants occur below this level.

The roadway on the north side of Rockley Street leading down to the marina is also weed affected.



Impacts and Threats to the Reserve:

Despite Sailors Bay Park having limited access, it has been affected by activities in the local area. These impacts include:

1. Invasion by weeds and exotic plants in the higher parts of the park.
2. Disruption of the bushland by the marina and access road.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: The fauna of Sailors Bay Park is not very diverse. This is because the site only contains one major habitat type (Sydney

Sandstone Gully Forest). The only other habitat present is provided by exotic vegetation.

Mammals: Sailors Bay Park is dominated by exotic mammals. No native terrestrial mammals were found in the reserve. Foxes, cats, dogs, Black Rats and mice were the most commonly encountered mammals in the reserve.

Two species of arboreal mammals (Common Brushtail Possums and Ringtail Possums) were present in the reserve, both in low numbers. Most Ringtail Possums were spotted low on the headland, often in trees on the immediate shore line. Brushtail Possums were seen near the Rockley Street car park and near the marina.

No insectivorous bats were detected in the reserve. Flying foxes were observed flying overhead.

Common Brushtail Possum *Trichosurus vulpecula*

Brushtail Possums were spotted near the Rockley Street car park and the Mowbray Point marina.

Common Ringtail Possum *Pseudecheirus peregrinus*

Twelve Ringtail Possums were spotted in the reserve. Most of these animals were seen low on the headland, near the water line. Some were observed in trees overhanging the water.

Fox *Vulpes vulpes*

Fox scats were collected near the Rockley Street car park and along the road to the marina.

Dog *Canis familiaris*

Dog scats were found along the road to the marina.

Cat *Felis cattus*

Two cats were spotted in the reserve, both near the Mowbray Point marina.

Black Rat *Rattus rattus*

Black Rats were detected near the Rockley Street car park and near the marina.

House Mouse *Mus musculus*

House Mice were only detected by hair tubes set near the Rockley Street car park.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve. None were observed to roost in the reserve.

Birds: 35 bird species were recorded for Sailors Bay Park of which four were exotic species.

	Burton (2000)	Fauna Study (2001)
Chestnut Teal	1995	
Pied Cormorant		2000
Little Black Cormorant		2000
White-faced Heron		2000
Australian White Ibis		2000
Silver Gull	1999	2000
Crested Tern	1995	
Crested Pigeon		2000
Rainbow Lorikeet	1999	2000
Crimson Rosella	1999	
Eastern Rosella		2000
Common Koel		2000
Laughing Kookaburra	1999	2000
Superb Fairy-wren		2000
Variegated Fairy-wren	1999	
Spotted Pardalote	1999	
White-browed Scrub-wren	1995	
Brown Thornbill	1999	
Red Wattlebird	1999	2000
Noisy Miner	1999	2000
Eastern Spinebill		2000
Eastern Whipbird	1995	
Golden Whistler		2000
Magpie-lark	1995	2000
Willie Wagtail	1995	2000
Grey Butcherbird	1999	
Australian Magpie	1999	2000
Pied Currawong	1999	
Australian Raven	1999	2000
* House Sparrow		2000
Welcome Swallow	1999	2000
* Red-whiskered Bulbul	1995	2000
Silvereye	1995	
* Common Starling		2000
* Common Myna		2000

* = exotic species

Reptiles: Only three species of lizard were found in Sailors Bay Park.

Eastern Water Skink *Eulamprus quoyii*

Eastern Water Skinks were relatively abundant along the shore line of Sailors Bay Park.

Grass Skink *Lampropholis guichenoti*

Grass skinks were present near the Rockley Street car park.

Delicate Skink *Lampropholis delicata*

Delicate skinks were found in the revegetation area at the top of the headland.

Frogs: Only one species of frogs were found in the reserve.

Common Eastern Froglet *Crinia signifera*

Froglets were present in a storm water drain near the Rockley Street car park.

Fauna Conservation Measures

1. **Weed Control:** Weeds and exotic plants are a problem in Sailors Bay Park. Weeds and exotic plants are prevalent close to residences backing onto the reserve and along the roadway to the marina. Unfortunately, the topography of Sailors Bay Park makes weed control a difficult venture. Most of the present weed infestation is concentrated about the higher levels of the reserve.

   The areas of Sydney Sandstone Woodland on either side of the headland have not been greatly impacted by weeds but these areas should be the main focus of rehabilitation efforts.

2. **Disruption of the Reserve by the marina and road access to the Marina:** Although traffic volume using the access road to the marina is quite low, the presence of the road is the single greatest point of impact in the reserve. The road is patrolled by foxes and dogs and provides an easy access to the lower parts of the reserve and the rear of the marina. This roadway should not be street lit.

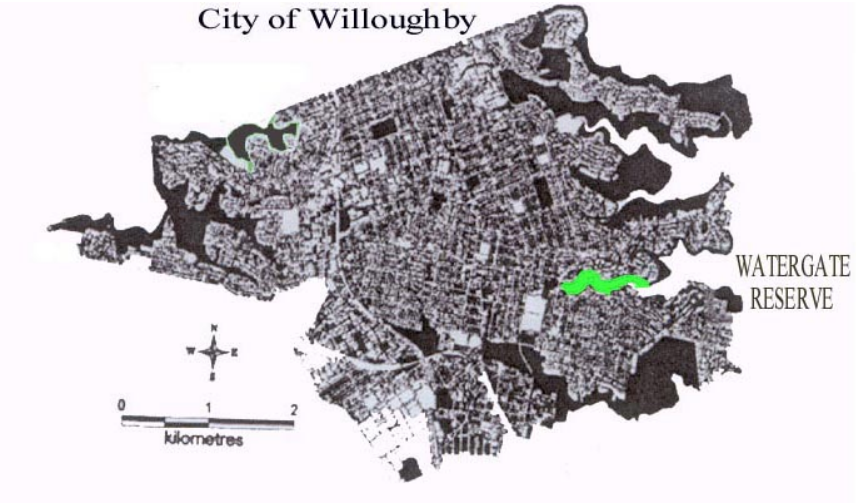
   As the road is likely to remain, regular fox baiting along the road will be required.

   The marina complex has less impact, as it is not in the centre of the reserve and most of its activity is carried out during daylight hours. Nevertheless, the marina was the area where the highest density of black rats was recorded and where cat sightings were made. Particular care needs to be made to ensure that food for feral animals is not left where it can be scavenged.

Reserve Group 8: Warners Bay Group

Watergate Reserve

Location: Northbridge



Description of Reserve:

Watergate Reserve occupies the gully that contains the lower water course for Sailors Bay Creek. Watergate Reserve contains all of Warners Park (which extended from Eastern Valley Way to The Outpost) and bushland on the northern side of the gully.

Watergate Reserve is not accessible from Eastern Valley Way because of the steepness of the descent into the gully from road level. However, recently, a new stepped track has been created from The Rampart that passes across the reserve to The Outpost. The Outpost is a major disjunction in the reserve. Houses (and the Bowling Club) built around The Outpost have created an urban impasse. Sailors Bay Creek runs into a culvert in the area and passes under the houses before re-emerging further downstream.

The gully that encloses Sailors Bay Creek is fairly narrow along its length. Consequently, there is a steep decline from the houses along the northern boundary of the reserve down to the creek. There is no river flat until the creek enters Sailors Bay.

Description of Habitats in the Reserve:

Watergate Reserve contains large areas of mixed native and exotic vegetation. In general, the slopes of the gully are occupied by Sydney Sandstone Gully Forest (10 agi), containing several large specimens of Sydney Red Apple *Angophora costata*. Unfortunately, the woodland is interspersed with a range of exotic trees including Willows, Poplars, Date Palms, Coral Trees and Jacarandas.

The upper parts of the reserve (Warners Park) is dominated by exotic plants and is heavily weed infested. The level of infiltration by exotic plants decreases in the eastern reserve, with relatively intact woodland remaining along the steeper sections of the northern valley.

There is no Mangrove belt at the mouth of Sailors Bay Creek.

Impacts and Threats to the Reserve:

Watergate Reserve has been greatly affected by activities in the local area. These impacts include:

1. Extensive weed invasion of the reserve.
2. Disruption of continuity of reserve by housing and bowling club facility.
3. Poor water quality in Sailors Bay Creek.
4. Many introduced animal species in the reserve.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: The fauna of Watergate Reserve is greatly depleted. The loss of fauna is a consequence of the considerable degradation of the reserve and the disruption of the reserve created by The Outpost and associated buildings.

Mammals: Watergate Reserve is dominated by exotic mammals. No native terrestrial mammals still remain in the reserve. Foxes, dogs, Black Rats and mice were the most commonly encountered mammals in the reserve.

Two species of arboreal mammals (Common Brushtail Possums and Ringtail Possums) were present in the reserve. Ringtail Possums were present in low numbers. Four Brushtail Possums and two Ringtail Possums were spotted during the evening of the 23rd of December 2000. Flying foxes were observed flying overhead. No insectivorous bats were detected in the reserve.

Common Brushtail Possum *Trichosurus vulpecula.*

Brushtail Possums were spotted near The Outpost and near Forsyth Park.

Common Ringtail Possum *Pseudecheirus peregrinus*

Only two Ringtail Possums were spotted in the reserve. Both of these animals were seen downstream from The Outpost.

Fox *Vulpes vulpes*

Fox scats were collected throughout the reserve.

Dog *Canis familiaris*

Dog scats were found along the creek flat. Scats were from domestic dogs as well as stray dogs.

Black Rat *Rattus rattus*

Black Rats were detected by hair tubes set throughout the reserve.

House Mouse *Mus musculus*

House Mice were only detected by hair tubes set near The Outpost.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve, none were observed to roost in the reserve.

Birds: 39 bird species were recorded for Watergate Reserve of which five were exotic species.

	Burton (2000)	Fauna Study (2001)
White-faced Heron	1999	2000
Striated Heron	1999	
Australian White Ibis	1999	2000
Black-shouldered Kite		2000
Silver Gull	1999	
Rock Dove	1999	
* Spotted Turtledove	1999	
Crested Pigeon	1999	2000
Galah		2000
Sulphur-crested Cockatoo	1999	2000
Rainbow Lorikeet	1999	2000
Australian King Parrot	1999	
Crimson Rosella	1999	
Eastern Rosella		2000
Fan-tailed Cuckoo	1999	
Laughing Kookaburra	1999	
Superb Fairy-wren		2000
Variegated Fairy –wren	1999	
Spotted Pardalote	1999	
White-browed Scrub-wren	1999	
Brown Thornbill	1999	
Red Wattlebird	1999	
Little Wattlebird	1999	
Noisy Miner	1999	2000

Eastern Spinebill	1999	
Eastern Whipbird	1999	
Eastern Yellow Robin	1999	
Magpie-lark	1999	2000
Black-faced Cuckoo-shrike	1999	
Grey Butcherbird	1999	
Australian Magpie	1999	2000
Pied Currawong	1999	2000
Australian Raven	1999	2000
* House Sparrow		2000
Welcome Swallow	1999	2000
* Red-whiskered Bulbul	1999	2000
Silvereye	1999	
* Common Starling	1999	2000
* Common Myna	1999	2000

* = exotic species

Reptiles: Only three species of reptiles were found in Watergate Reserve.

Eastern Water Dragon *Physignathus lesueuri*

Water dragons were present in the middle section of Sailors Bay Creek.

Eastern Water Skink *Eulamprus quoyii*

Eastern Water Skinks were relatively abundant and were present along the length of Sailors Bay Creek.

Garden Skink *Lampropholis guichenoti*

Garden skinks were present around The Outpost and near Forsythe Park.

Frogs: Only one species of frogs were found in the reserve.

Common Eastern Froglet *Crinia signifera*

Froglets were present in a wet area near The Outpost.

Fauna Conservation Measures

1. **Weed Control:** Invasion by exotic plants and weeds is a major problem for Watergate Reserve. The high incidence of weeds has greatly degraded other habitats and has helped assist the spread of exotic animals in the reserve. Unfortunately, the entry of weeds into the reserve has been facilitated by the creation of The Outpost which, not only almost bisects the reserve, but provides a weed source area in the heart of the reserve. Similarly, Sailors Bay Creek is a good source of weeds as the storm water coming down the creek is fed by run-off from residential and recreational areas west of Eastern Valley Way. Seeds and sprigs of exotic plants are carried into the reserve from upstream after each rainfall event.

A detention or filter device is required on Sailors Bay Creek in Warners Park to reduce the spread of weeds and refuse in the reserve.

The areas of Sydney Sandstone Gully Forest on the northern side of the gully have suffered relatively modest infiltration by weeds and this habitat should be the main focus of rehabilitation efforts.

Some bush regeneration is already under way in the reserve. As the extent of weed coverage is so great in places, a total replanting of some areas may be required. Few native animal species are using the weed areas as habitat and the removal of large areas of weeds does not appear to be a problem for native fauna.

2. **Disruption to the Reserve:** The creation of The Outpost is a serious disruption to the integrity of the reserve. It creates a physical barrier across the reserve, as well as being a source of continual noise, light and activity disturbance, and another source of exotic plants. As these structures are likely to remain, some efforts should be made to reduce the impact that the houses and associated disturbance has on the reserve. Buffer plantings around the perimeter of The Outpost would help dissipate noise and light pollution and would reduce the spread of wind-blown seeds.

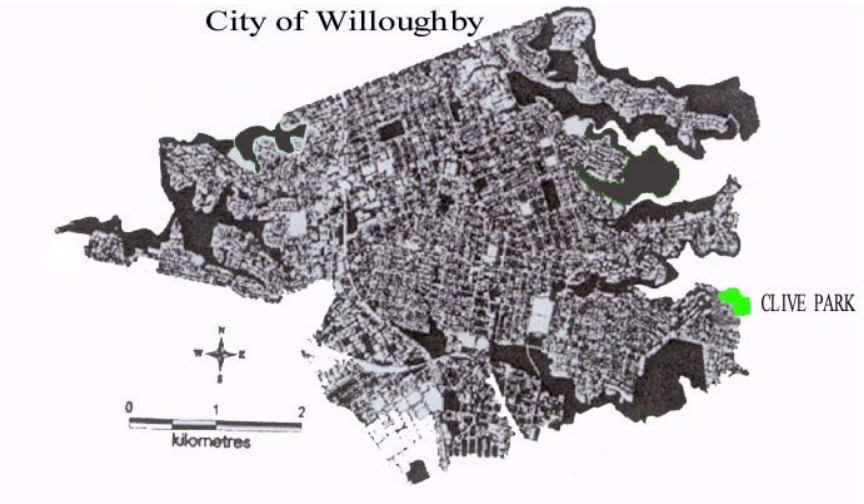
3. **Water quality of Sailors Bay Creek:** Sailors Bay Creek is a source of weeds and rubbish for the reserve. These impacts can be lessened by installing a detention system (and trash rack) across Sailors Bay Creek at the head of Watergate Reserve (this could be in Warners Park or in the paddock area on the western side of the Eastern Valley Way).

4. **High Incidence of Introduced Animals in the Reserve:** One of the main reasons for the high incidence of introduced animals in the reserve is the extent of degradation of the bushland. Introduced animals, such as foxes, rats and mice are able to exploit degraded habitats (at the expense of native wildlife). Efforts to control introduced animals would be compromised by the continuation of degraded habitats. Therefore, the best way to reduce the numbers of introduced animals is by improving the quality of the bushland, through bush regeneration and bush rehabilitation (including replanting).

Reserve Group 9: Clive Park Group

Clive Park

Location: Northbridge



Description of Reserve:

Clive Park occupies the eastern headland of the Northbridge peninsula. It is not a large park, being 5.7 Ha in area. The park is dominated by woodland that extends down to the water's edge.

Clive Park is a bushland reserve that has other recreational use. Because of its strategic location on the western side of middle harbour, it is possible to gain splendid views of the harbour leading to the Spit Bridge and north to Seaforth. A cleared, lawn area has been established near the entrance to the park and barbecue facilities, seats and tables have been provided. A few informal tracks have been created that lead down to the water's edge to scenic vantage points.

The shoreline of Clive Park contains prominent sandstone exposures and overhangs. In addition, the remains of aboriginal middens are still present along the shore line.

Sailors Bay Road terminates at Clive Park. A bus turning circle has been created at the entrance to the park and a toilet block and small playground have been created there. A formed roadway leads down to a flat area below the level of the road. This area has been cleared and established as a picnic area.

Description of Habitats in the Reserve:

Because of its small size and location, Clive Park is dominated by a single forest type; namely Sydney Sandstone Gully Forest (10 agi). This forest commences abruptly at the Sailors Bay Road entrance and continues down to the water's edge. The trees obscure the picnic area inside the reserve and limit the views of middle harbour from the road.

Sydney Sandstone Gully Forest typically grows on shallow sandy soils overlaying sandstone ledges. Clive Park slopes almost continuously from the entrance area to shore line. Sandstone exposures do not become obvious until further down the slope. This forest is dominated by Sydney Red Apple Trees *Angophora costata*, Red Bloodwoods *Corymbia gummifera*, Black She-oaks *Allocasuarina littoralis* and Old Man Banksias *Banksia serrata.* The ground cover is typically thin and non-continuous at the higher levels where the forest canopy is more complete. At the lower levels, the trees are shorter and the canopy more punctuated. The understorey becomes denser in these areas with Sword Grass *Lomandra longifolia* forming dense patches. In some areas on the southern side of the headland, dense bush area of Black She-oak *Allocasuarina littoralis,* Needle Bush *Hakea sericea* and Tick Bush *Kunzea ambigua* are present.

Impacts and Threats to the Reserve:

Clive Park is flanked by houses on its western side and bounded by Middle Harbour on its eastern side. The bushland in the park is not continuous with other areas of bush and so the flora and fauna within cannot seek

replacement from nearby areas. This isolation, combined with the relatively small size of the reserve means that even small scale disturbances can have major impacts on the biota. In addition, the reserve has a public recreational use associated with the views of the harbour. Informal tracks to strategic lookout points along the shore line create erosion areas and establishment areas for weeds. Many of the existing tracks are only used by keen park visitors as they all descend steeply over sandstone rocks and ledges.

Impacts on the park include:

1. High vulnerability due to isolation and small size.
2. High population of predatory birds (e.g. kookaburras, butcherbirds, currawongs), particularly around the picnic areas.
3. Weed invasion along tracks and around boundaries of reserve.
4. Fox, cat and dog predators are high in number.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: Clive Park has a depleted fauna compared to the other, larger reserves overlooking Middle Harbour. In particular, its mammal fauna contains a high proportion of exotic species.

Mammals: Clive Park appears to have lost most of its native ground mammals, only *Antechinus* remains. These small creatures do not venture into the more open parts of the reserve but occupy the steep sandstone ledges of the lower slopes. Foxes, cats, black rats and mice were detected throughout the reserve.

The sandstone woodland supports three possum types: Common Brushtail Possums, Ringtail Possums and Sugar Gliders. The density of these possums does not appear to be very high.

Common Brushtail Possum *Trichosurus vulpecula*

Brushtail Possums were only observed near the entrance to the park.

Common Ringtail Possum *Pseudecheirus peregrinus*

These possums appear to be the most numerous in the reserve. On the evening of the 4th of December 2000, seven Ringtail Possums were observed in the park, whereas only one Brushtail Possum was seen.

Sugar Glider *Petaurus breviceps*

No Sugar Gliders were seen in the reserve but fur and skin from a Sugar Glider were found on the ground in the park. It could not be determined what animal had killed or eaten the glider.

Brown Antechinus *Antechinus stuartii*

Antechinuses were detected in the lower parts of Clive Park, below the picnic area.

Fox *Vulpes vulpes*

Foxes were not spotted in the reserve but scats were collected from near the entrance and the picnic area.

Dog *Canis familiaris*

Dogs were seen near the entrance to the park.

Cat *Felis cattus*

No cats were spotted in the park but scats were collected from the reserve. The scats contain mainly mouse and rat fur.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying Foxes were observed flying over and roosting in the park.

Gould's Wattle Bat *Chalinolobus gouldii*

Gould's Wattle Bats were detected near the picnic area.

Black Rat *Rattus rattus*

Black Rats were detected in hair tubes close to houses on the southern side of the reserve.

House Mouse *Mus musculus*

House Mice were not seen but were detected by hair tubes. Mice were detected near the houses on the southern side of the reserve and near the entrance to the park.

Birds: 37 species of bird have been recorded in Clive Park.

	Burton (2000)	Fauna Study (2001)
Little Pied Cormorant	1998	2000
White-faced Heron	1999	
Australian White Ibis		2000
Black-shouldered Kite		2000
Masked Lapwing		2000
Silver Gull	1999	2000
Crested Tern	1995	
* Rock Dove	1999	2000
Crested Pigeon	1995	2000
Sulphur-crested Cockatoo		2000
Galah		2000
Rainbow Lorikeet	1999	2000
Crimson Rosella	1999	2000
Eastern Rosella	1995	2000
Channel-billed Cuckoo	1998	
Laughing Kookaburra	1999	2000
Superb Fairy-wren		2000
Variegated Fairy-wren	1999	
Spotted Pardalote	1999	
White-browed Scrub Wren	1998	2000
Brown Thornbill	1998	

Red Wattlebird	1999	2000
Noisy Miner	1999	2000
New Holland Honeyeater		2000
Eastern Spinebill		2000
Eastern Whipbird	1999	
Magpie-lark		2000
Willie Wagtail		2000
Black-faced Cuckoo-shrike		2000
Grey Butcherbird	1999	
Australian Magpie	1999	2000
Pied Currawong	1999	2000
Australian Raven	1999	
* House Sparrow		2000
Welcome Swallow	1999	
Silvereye	1995	
* Common Starling		2000
* Common Myna		2000

* = Exotic species

Reptiles: Only four species of reptiles were detected in Clive Park. No snakes were found.

Grass Skink *Lampropholis guichenoti*

Found around the park entrance area and around the picnic area.

Garden Skink *Lampropholis delicata*

These lizards were commonly found in the understorey of the woodland.

Eastern Snake-eyed Skink *Cryptoblepharus virgata*

Several Snake-eyed Skinks were seen on tree trunks and dead branches throughout the reserve.

Southern Leaf-tailed Gecko *Phyllusurus platurus*

Only two geckoes were found in the reserve. Both were located in sandstone cracks in the escarpment area close to the shore line.

Frogs: No frogs were detected in Clive Park.

Fauna Conservation Measures

1. **Exotic Species Control:** Clive Park is subjected to heavy visitation by exotic mammals. Apart from feral animals such as foxes, rats and mice, the park is also visited by domestic cats and dogs. These species reduce the survival prospects of native species and their numbers need to be regulated. In addition, local residents need to be made aware of their responsibilities in controlling domestic animals.

2. **Recreation Use of the Park:** At present, Clive Park is not a heavily used recreational area. Week-ends and school holidays appear to be the main times that the park is used. Being a relatively small reserve it cannot receive large numbers of people and still act as a conservation area for fauna and flora. At present, most recreational use is confined to the higher parts of the park. Although there are tracks leading down to the water's edge many people do not use them because of the steepness and rough footing of the track.

   The level of recreational use of this reserve may change in the future. Increases in recreational use will certainly decrease its conservation value. However, if the situation ever arises whereby greater recreational space is required (presumably in the form of extra lawn area and view points of the harbour) these should occur in areas where the impacts will be more confined. Any development of lawn or picnic areas should only occur near the park entrance (and not in the middle of the reserve). Viewing vantage points could be created at the higher parts of the reserve instead of lower down the slope towards the harbour.

   In general, recreational impact areas should be clustered rather than being scattered throughout the reserve.

3. **Street Lighting:** Street lighting affects the top end of Clive Park, near the park entrance and toilet block area. Street lights should not be directed into the reserve and shields should be used to minimise light pollution in this area.

Reptiles

Photo 9: Diamond Python *Morelia spilota*

Photo 10: Eastern Water Dragon *Physignathus lesueuri*

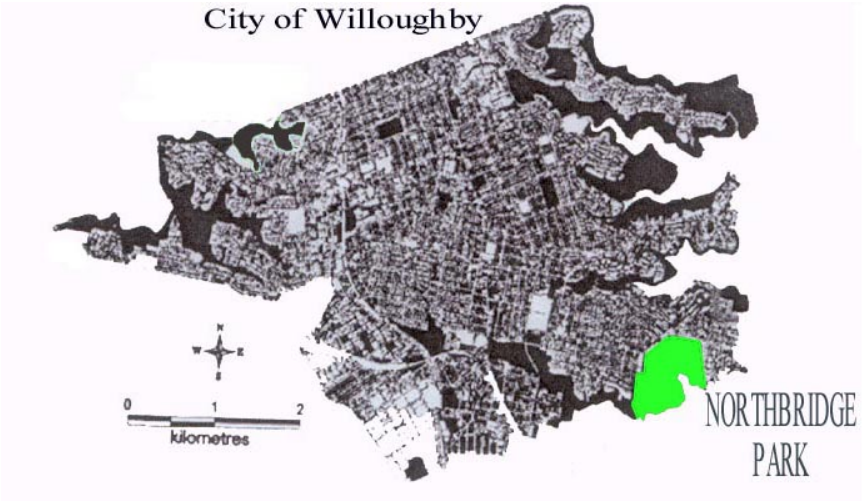
Photo 11: Southern Leaf-tailed Gecko *Phyllusurus platurus*

Photo 12: Burton's Legless Lizard *Lialis burtonis*

Reserve Group 10: Northbridge Group

Northbridge Park

Location: Northbridge



Description of Reserve:

Northbridge Park is a particularly large unit of land. The park occupies a total of 46.7 Ha of land on the northern foreshore of Long Bay. The bulk of the park is devoted to Northbridge Golf Course, which contains 38.5 Ha of the available land. In general, the golf course occupies the more level parts of the park, the level sections being in the central parts of the park. The lower parts of the park, overlooking Long Bay are quite steep while the sections along Sailors Bay Road are less severe.

The north-eastern corner of the reserve contains a bushland area that fronts onto Sailors Bay Road. Sandstone pinnacles (Monkey Rocks Lookout) provide a wide view of the park, Long Bay and Willoughby Bay. A war memorial on Sailors Bay Road is joined to the lookout by some revegetated land.

In the north-western part of the park is a playground and playing field that is used by the local primary school.

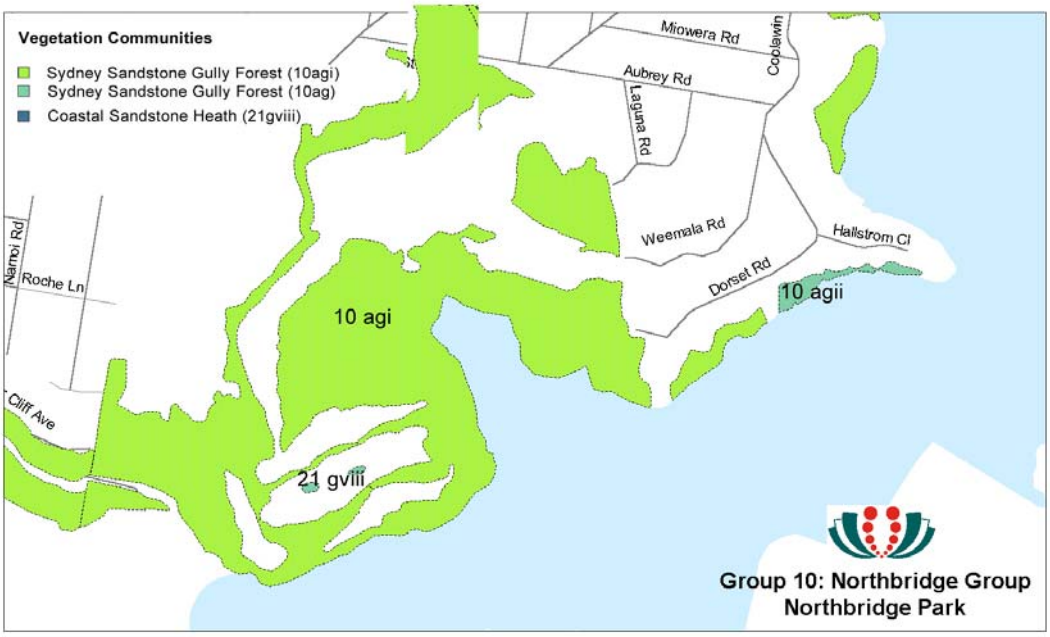
Description of Habitats in the Reserve:

As the bulk of the park is devoted to the golf course, exotic grasses and exotic shrubs take up the largest area of the park. The golf course is generally surrounded by native vegetation, some of which has been replanted. The

largest stands of native vegetation occur between the golf course and Long Bay. Sydney Sandstone Gully Forest (10 agi) is the dominant plant community with tall Sydney Red Apple *Angophora costata*, Red Bloodwoods, *Corymbia gummifera* and Mock Orange *Pittosporum undulatum* predominating. In some areas, exotic plants have invaded the woodland.

The lower section of woodland connects with similar woodland along the northern boundary of Tunks Park.

In the central part of the golf course, a small area of remnant heath remains. This consists mainly of tall paperbarks shrubs *Melaleuca linearifolia*, Tick Bush *Kunzea ambigua*, various Epacrids and Coral Fern *Glychenia retorta*.



Impacts and Threats to the Reserve:

The bushland areas of Northbridge Park have been affected by the golf course and the surrounding residences. These impacts include:

1. Extensive weed invasion of the reserve.
2. Many introduced animal species in the reserve, particularly rabbits and foxes.
3. Nutrient run-off from the golf course.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: The fauna of Northbridge Park is not very diverse. The golf course, which takes up the bulk of the site, offers relatively

little habitat for native animals. Useful habitat areas are confined to the margins of the park, which are often in contact with residential lots.

Mammals: Northbridge Park is dominated by exotic mammals. Foxes and rabbits were particularly conspicuous while dogs, Black Rats and mice were detected throughout the park.

One species of native terrestrial mammal (*Antechinus stuartii*) was found in the park. These small marsupials were located near the Monkey Rocks Lookout in the north-eastern corner of the park. Common Brushtail Possums and Ringtail Possums were present in the reserve. Of these species, Ringtail Possums were the most common with 7 Ringtail Possums spotted on the 4th of December 2000. In comparison, four Brushtail Possums were sighted. Flying foxes were observed flying overhead. No insectivorous bats were detected in the park.

Common Brushtail Possum *Trichosurus vulpecula*

Brushtail Possums were spotted close to Sailors Bay Road and in bushland along the eastern boundary of the park.

Common Ringtail Possum *Pseudecheirus peregrinus*

Seven Ringtail Possums were spotted in the reserve. Most of these animals were seen in trees close to the shore line in the lower part of the park.

Sugar Glider *Petaurus breviceps*

A Sugar Glider was heard calling from the lower bushland area on the evening of the 21st of December 2000. No gliders were spotted.

Brown Antechinus *Antechinus stuartii*

Antechinuses were detected near the Monkey Rocks Lookout.

Fox *Vulpes vulpes*

Fox scats were collected throughout the golf course and around the perimeter of the park.

Dog *Canis familiaris*

A dog was spotted on the golf course.

Black Rat *Rattus rattus*

Black Rats were detected by hair tubes set around the perimeter of the park.

House Mouse *Mus musculus*

Mice were detected by hair tubes in revegetation areas off Sailors Bay Road.

Rabbit *Oryctalagus cuniculus*

Rabbits were spotted mainly on the golf course when they emerged to feed.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the park, none were observed to roost there.

Birds: Forty two species of birds were recorded in Northbridge Park. Burton (2000) recorded thirty species but the shore line area was not included in the survey.

	Burton (2000)	Fauna Study (2001)
Pacific Black Duck		2000
Little Pied Cormorant		2000
Little Black Cormorant		2000
White-faced Heron		2000
Australian White Ibis	1999	2000
Black-shouldered Kite		2000
Masked Lapwing	1995	2000
Silver Gull		2000
* Rock Dove	1995	
* Spotted Turtle-dove	1995	2000
Crested Pigeon	1995	2000
Sulphur-crested Cockatoo	1995	2000
Galah		2000
Rainbow Lorikeet	1995	
Crimson Rosella	1995	
Eastern Rosella		2000
Common Koel	1995	2000
Tawny Frogmouth		2000
Laughing Kookaburra	1995	2000
Dollarbird	1995	
Superb Fairy-wren	1995	2000
Spotted Pardalote	1995	
White-browed Scrub-wren	1995	
Brown Thornbill	1995	
Red Wattlebird		2000
Little Wattlebird	1995	
Noisy Miner	1995	2000
Eastern Spinebill		2000
Eastern Yellow Robin	1995	
Eastern Whipbird	1995	
Magpie-lark	1995	2000
Willie Wagtail	1995	
Black-faced Cuckoo-shrike	1999	2000
Grey Butcherbird	1995	2000
Australian Magpie	1995	2000
Pied Currawong	1995	2000
Australian Raven	1995	2000
* House Sparrow		2000
Welcome Swallow	1995	
* Red-whiskered Bulbul		2000

Silvereye	1995	
* Common Starling	1995	2000
* Common Myna	1995	2000

* = exotic species

Reptiles: Two species of snake and five species of lizard were found in Northbridge Park.

Eastern Water Dragon *Physignathus lesueuri*
Water Dragons were found in the lower part of the park.

Eastern Water Skink *Eulamprus quoyii*
Eastern Water Skinks were present along the shore line of the park and in the central area of heath.

Grass Skink *Lampropholis guichenot*i
Grass Skinks were found throughout the golf course.

Eastern Snake-eyed Skink *Cryptoblepharus virgata*
Several Snake-eyed Skinks were found in the revegetation areas along Sailors Bay Road and in the southern part of the site.

Southern Leaf-tail Gecko *Phyllurus platurus*
One Leaf-tail Gecko was caught near the Monkey Rocks Lookout.

Green Tree Snake *Dendralaphus punctatus*
A Green Tree Snake was spotted in bushland on the south-eastern corner of the golf course.

Yellow-faced Whip Snake *Demansia pasmmophis*
A dead whip snake was found near Dorset Road.

Frogs: Two species of frogs were found in Northbridge Park.

Common Eastern Froglet *Crinia signifera*
Froglets were present in wet areas on the golf course and in the southern part of the park.

Striped Marsh Frog *Limnodynastes peroni*
Striped Marsh Frogs were in a pond on the golf course.

Fauna Conservation Measures

1. **Weed Control:** Invasion by exotic plants and weeds is a serious problem at Northbridge Park. Banks of exotic plants are derived from the golf course as well as from the surrounding residences. Recent revegetation work along Sailors Bay Road and the edges of the golf course will act as a useful buffer against unwanted plants.

Weeds decrease the habitat value of the sandstone woodland and provides shelter and alternate food sources for unwanted species such as rabbits, black rats and mice.

Bush rehabilitation work is under way in the northern part of the park, where access is not a problem. Similar rehabilitation work will need to be extended to the southern part of the site once the northern areas have reached a manageable condition.

2. **Exotic animals:** The artificial nature of the golf course and surrounds means that introduced animals are able to flourish. Groomed fairways provide easy food for rabbits while the fringing bushland provides shelter for many exotic animals. The presence of the golf course will ensure that introduced animals remain abundant in the local area and intensive control measures will be needed to prevent these animals from over-running bushland. Decreasing rabbit numbers will help decrease fox numbers.

3. **Nutrient Run-off From the Golf Course:** In order to maintain fairways and greens, constant mowing and treatment with fertilisers and insecticides are required on the golf course. As Northbridge Park is a sloping site, all run-off from the golf course is directed into the southern bushland areas. To prevent high nutrient run-off from entering the bushland, macrophyte basins or detention basins are required on the drainage lines as they enter bushland areas.

Reserve Group 11: Flat Rock Group

Flat Rock Gully and Bicentennial Reserve

Location: Northbridge/Naremburn

Description of Reserve:

Flat Rock Gully and Bicentennial Reserve are large reserves that occupy the upper catchment of Flat Rock Creek. Bicentennial Park (formerly known as Hallstrom Park) is a large, level recreational area between Willoughby Road and Flat Rock Drive. The majority of the site is lawn with a perimeter of replanted native trees and remnant bushland. The southern bushland area of Bicentennial Reserve contains Henry Lawson's Cave.

Considerable development of Bicentennial Reserve has taken place in the last twenty years. Apart from the development of the large sporting field areas, the Willoughby Leisure Centre has been constructed in the northern part of the reserve (facing onto Small Street). The Leisure Centre is an area of high public use and there are two car parking areas near the centre to cope with the patrons of the centre and playing fields.

Flat Rock Gully, on the eastern side of Flat Rock Drive is very different in nature. The western section of the gully had previously been a council tip. When tipping was completed, the site was re-contoured and replanted to create a mosaic of small natural areas. Small bushland and grassland areas are interconnected by a series of walking paths. An ephemeral creek channel has been created along the northern boundary of the gully (at the base of an old sandstone quarry site), surface water runs through a series of small detention ponds before cascading down the revegetated "tip face" to Flat Rock Creek, which emanates from the base of the tip wall.

Storm water running down Flat Rock Creek travels along the original gully after the tip wall until it passes under North Bridge. Immediately past the bridge, the creek is diverted into culverts and passes under Tunks Park before entering Middle Harbour. Before reaching North Bridge, Flat Rock Creek is joined by Quarry Creek from the south.

Two main walking tracks traverse Flat Rock Gully to Tunks Park; Wilksch Walk travels along the northern face of Flat Rock Gully whereas the Dawson Street Track passes along the southern side of the gully. The two tracks unite near the old sandstone retaining walls along Flat Rock Creek.

Description of Habitats in the Reserve:

Flat Rock Gully and Bicentennial Reserve are very different kinds of reserves. Bicentennial Reserve has a much greater recreational focus and so most of the area of the reserve has been converted to playing fields. Large, mowed areas predominate in this reserve. However, around the western and southern perimeter of the reserve there has been substantial replanting of native trees and shrubs to create a green buffer around the reserve. No natural habitats remain in Bicentennial Reserve.

Flat Rock Gully also contains a number of recreated habitats but the focus of this reserve is on native plants and plant communities. The area above the tip wall has been completely transformed into a series of small wooded or grassed areas. In most cases, native plants have been used to create the habitat areas.

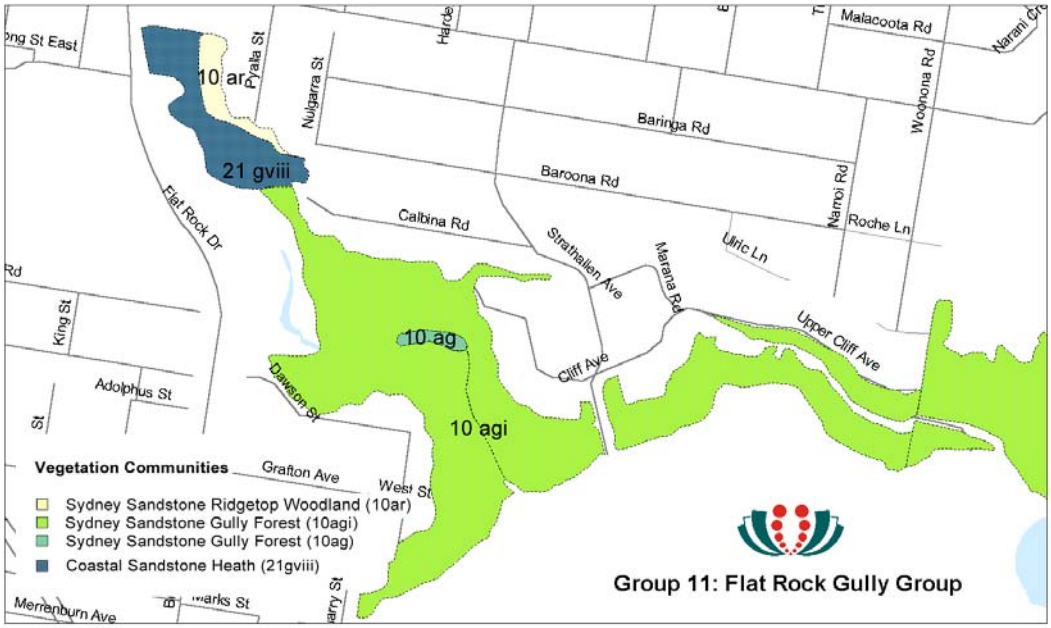
The upper section of Flat Rock Creek is ephemeral. The water course has also been re-configured so that it passes beneath an old sandstone quarry on the northern side of the site. The quarry is a source of seepage for the creek and after prolonged rain, water cascades from the quarry as a waterfall. The water course has three small detention ponds along it; each has been placed so that water will pool for a few months after rain. The banks of the detention ponds have been created using large, sandstone boulders so that the natural characteristics of the area are not spoiled by these structures. A permanent detention pond lies at the base of the tip wall.

Below the tip wall, the water course runs through a narrow, shaded gully. In the more protected parts of the gully, dense Sydney Sandstone Gully Forest

(10 ag) dominated by Coachwoods *Ceratopetalum apetalum* and Lilly-Pillies *Acmena smithii* flank the creek. The southern slope of the gully is the more protected side and this is dominated by tall open forest containing large, emergent Blackbutts *Eucalyptus pilularis*. The northern side of the gully, in contrast, is more exposed and is covered by Sydney Sandstone Woodland where Sydney Red Apple *Angophora costata*, Black She-oaks *Allocasuarina littorialis* and Old Man Banksia *Banksia serrata* co-occur.

Flat Rock Creek descends over a series of sandstone ledges in the narrow part of the gully. The creek line is studded with small pools which eventually coalesce further downstream into larger water bodies. Near Strathallen Avenue the creek lines are subject to increasing weed infestation. The junction with Quarry Creek is obscured by mixed native and exotic growth.

One habitat that is not well represented in the Willoughby Local Government Area is heath. Flat Rock Gully contains a small area of original heath. This area, on the northern side of the gully, is dominated by Tick Bush *Kunzea ambigua*, *Melaleuca linearifolia*, various *Acacia* and Epacrids.



Impacts and Threats to the Reserve:

Bicentennial Reserve and Flat Rock Gully is impacted by the surrounding residential areas and activities within the park in a number of ways. These include:

1. Loss of rarer species due to habitat changes.
2. Dislocation of native fauna due to other public uses of reserve (e.g. dogs in the park).
3. Weed Infestation in lower gully.

4. High fox numbers.
5. Poor creek water quality.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: Bicentennial Reserve contains few native animal species whereas Flat Rock Gully had the highest number of mammals, bird, reptile and frog species of any of the reserves surveyed in the Willoughby Local Government Area.

Mammals: Only two species of mammal were observed in Bicentennial Reserve; namely Brushtail Possums and foxes. Flat Rock Gully contained twelve mammal species of which six were exotic (foxes, dogs, cats, rabbits, Black Rats and mice). The variety of local habitats that are natural or have been created in Flat Rock Gully is responsible for the diversity of mammals. Flat Rock Gully was the only site in Willoughby LGA where Eastern Bush Rats *Rattus fuscipes* were detected.

Common Brushtail Possum *Trichosurus vulpecula*

These possums appear to be more numerous in Bicentennial Reserve than Flat Rock Gully, where they were only sighted in revegetation areas.

Common Ringtail Possum *Pseudecheirus peregrinus*

Ringtail Possums were only sighted in natural woodland areas, particularly along Wilksch Walk.

Brown Antechinus *Antechinus stuartii*

Antechinuses were detected in sandstone escarpment north of the entrance to Flat Rock Gully. They were also detected on the southern side of the gully near Dawson Street.

Fox *Vulpes vulpes*

Fox scats were collected in Bicentennial Reserve and in the revegetation areas of Flat Rock Gully. Two scats were also collected at the end of Flat Rock Gully, near Tunks Park.

Dog *Canis familiaris*

Dogs were seen in Bicentennial Reserve and the upper and lower sections of Flat Rock Gully at night.

Cat *Felis cattus*

Cats were spotted in both Bicentennial Reserve and Flat Rock Gully, particularly in revegetation areas.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over both reserves and to roost and feed in Flat Rock Gully.

Goulds Wattle Bat *Chalinolobus gouldii*

Gould's Wattle Bat was detected in the lower part of Flat Rock Gully, below Northbridge.

Black Rat *Rattus rattus*

Black Rats were spotted and detected by hair tubes throughout Bicentennial Reserve and Flat Rock Gully.

Eastern Bush Rat *Rattus fuscipes*

Native Bush Rats were detected in heath near the entrance to Flat Rock Gully and in the lower gully, near Quarry Creek.

House Mouse *Mus musculus*

House Mice were detected by hair tubes in Bicentennial Reserve and in revegetation areas in Flat Rock Gully.

Rabbit *Oryctalagus cuniculus*

Rabbits were present in both Bicentennial Reserve and Flat Rock Gully.

Birds: Flat Rock Gully is used by many species of native birds, particularly woodland and forest species. Since 1985, Andrew Burton (2000) has recorded 99 bird species in these reserves while the present survey was able to add a further three bird species. A large number of raptors have been recorded from Flat Rock Gully including Peregrine Falcon, White-breasted Sea-eagle and Black Kite. The reserve is also regularly visited by Powerful Owls, a threatened species.

	Burton (2000)	Fauna Study (2001)
Maned Duck	1996	
Pacific Black Duck	1999	2000
Mallard	1998	
Chestnut Teals	1998	2000
Darter	1995	
Little Pied Cormorant	1999	
Little Black Cormorant	1999	2000
Great Cormorant	1996	
Australian Pelican	1998	
White-faced Heron	1999	2000
White-necked Heron	1985	
Great Egret	1997	
Cattle Egret	1996	
Australian White Ibis	1999	2000
Straw-necked Ibis	1996	
Black-shouldered Kite	1998	2000
Black Kite	1995	
Whistling Kite	1998	
White-bellied Sea Eagle	1995	
Brown Goshawk	1998	
Grey Goshawk	1997	

Collared Sparrowhawk	1995	
Brown falcon	1995	
Australian Hobby	1996	
Peregrine Falcon	1999	
Nankeen kestrel	1999	2000
Dusky Moorhen	1996	2000
Masked Lapwing	1999	2000
Silver Gull	1999	2000
* Rock Dove	1999	
White-headed Pigeon	1998	
* Spotted Turtle-dove	1999	2000
Emerald Dove	1996	
Crested Pigeon	1999	2000
Superb Fruit Dove	1992	
Yellow-tailed Black Cockatoo	1998	
Galah	1999	2000
Sulphur-crested Cockatoo	1999	2000
Little Corella	1994	
Major Mitchell Cockatoo	1994	
Cockatiel	1999	
Rainbow Lorikeet	2000	2000
Musk Lorikeet	1999	
Little Lorikeet	1996	
Australian King-parrot	1999	
Superb Parrot	1994	
Crimson Rosella	2000	2000
Eastern Rosella	1999	2000
Fan-tailed Cuckoo	1995	2000
Common Koel	1999	2000
Channel-billed Cuckoo	1998	
Southern Boobook	1993	
Powerful Owl		2000
Tawny Frogmouth	1999	2000
White-throated Needletail	1997	
Laughing Kookaburra	1999	2000
Sacred Kingfisher	1992	
Dollarbird	1999	2000
Superb Fairy-wren	1999	2000
Variegated Fairy-wren	1999	2000
Spotted Pardalote	1999	2000
White-browed Scrub-wren	1999	2000
Brown Gerygone	1999	
Brown Thornbill	1999	2000
Red Wattlebird	1999	2000
Little Wattlebird	1999	
Noisy Friarbird	1999	
Noisy Miner	2000	2000
Yellow-faced Honeyeater	1998	
New Holland Honeyeater		2000
White-cheeked Honeyeater	1996	

Eastern Spinebill	1999	2000
Rose Robin	1991	
Eastern Yellow Robin	1999	2000
Eastern Whipbird	1999	
Golden Whistler	1997	2000
Rufous Whistler	1996	
Grey Shrike-thrush	1998	
Magpie-lark	1999	2000
Rufous Fantail	1997	
Grey Fantail	1999	2000
Willie Wagtail	1999	2000
Spangled Drongo	1996	
Black-faced Cuckoo-shrike	1999	2000
Olive-backed Oriole	1998	
Southern Figbird	1998	
Grey Butcherbird	1999	2000
Australian Magpie	1999	2000
Pied Currawong	2000	2000
Australian Raven	1998	2000
Zebra Finch	1991	
Red-browed Finch	1999	2000
* House Sparrow	1999	2000
Mistletoebird	1996	
Welcome Swallow	2000	2000
Tree Martin	1995	
* Red-whiskered Bulbul	1999	2000
Golden-headed Cisticola	1996	2000
Silvereye	1999	2000
* Common Myna	1999	2000
* Common Starling	1999	2000

* = exotic species

Reptiles: Bicentennial Reserve was home to relatively few reptiles, but did contain the only known location for Burton's Legless Lizard *Lialis burtonis* in the Willoughby LGA. Flat Rock Gully, was home to thirteen species of lizard and snake.

Eastern Water Dragon *Physignathus lesueuri*

These lizards are plentiful below the tip face in Flat Rock Gully.

Common Blue Tongue Lizard *Tiliqua scincoides*

Two lizards were found in December 2000, one was near the tip face area of Flat Rock Gully, while the other was near Dawson Street.

Eastern Water Skink *Eulamprus quoyii*

Abundant along Flat Rock Creek and throughout Flat Rock Gully.

Weasel Skink *Saproscincus mustelina*

Weasel skinks were present in woodland and revegetated areas in Flat Rock Gully.

Glebe Gully Skink *Saproscincus galli*

Glebe Gully Skinks were found in both Bicentennial Reserve and Flat Rock Gully. In each case the lizards were found in revegetation areas on the southern sides of the respective reserves.

Grass Skink *Lampropholis guichenoti*

Common in the grassed and revegetated areas.

Garden Skink *Lampropholis delicata*

Common in revegetated areas and around the boundaries of woodland and heath.

Eastern Snake-eyed Skink *Cryptoblepharus virgata*

Found in woodland and heath areas.

Burton's Legless Lizard *Lialis burtonis*

Burton's Legless Lizards were found on the market garden terrace area on the southern side of Bicentennial Reserve.

Southern Leaf-tailed Gecko *Phyllusurus platurus*

Not common but were present in the sandstone escarpment in Flat Rock Gully.

Red-bellied Black Snake *Pseudechis porphyriacus*

Two Red-bellied Black Snakes were sighted during the survey period, both in Flat Rock Gully near open storm water channels.

Green Tree Snake *Dendrelaphis punctatus*

A large tree snake was sighted in November 2000 near the tunnel under Flat Rock Drive. A smaller tree snake was sighted in January 2001 in the lower gully, near Northbridge.

Golden Crown Snake *Cacophis squamulosus*

Two Golden Crown Snakes were seen in Flat Rock Gully, near the tip face and near Quarry Creek.

Diamond Python *Morelia spilota*

A small Diamond Python was captured in Flat Rock Gully in January 2001, near the boundary with Tunks Park.

Frogs: Four frog species were detected during the surveys and a fifth (Red-crowned Toadlet) was reported but was not confirmed. Flat Rock Gully was the only known location for Bibron's Toadlet in the Willoughby LGA.

Leaf-green Tree Frogs *Litoria phyllochroa*

Distributed along Flat Rock Creek from below the tip face to Tunks Park.

Striped Marsh Frog *Limnodynastes peroni*

Present in storm water detention ponds in Flat Rock Gully and in Flat Rock Creek near its junction with Quarry Creek.

Common Eastern Froglet *Crinia signifera*

Most common frog species detected, present in both reserves.

Bibron's Toadlet *Pseudophryne bibroni*

Confined to a tiny area on the northern side of Flat Rock Gully.

Fauna Conservation Measures

1. **Diversity of Habitats:** Bicentennial Reserve and Flat Rock Gully contain a wide variety of habitats. For this reason alone, the animal diversity of these reserves exceeds all others in the Willoughby LGA. The diversity is high despite the fact that a large proportion of Bicentennial Reserve has been allocated for recreational use and that much of Flat Rock Gully is reclaimed land.

   The margins of Bicentennial Reserve and the higher parts of Flat Rock Gully have been revegetated and are amenable to the maintenance of a variety of small habitat areas. There is also sufficient area that habitats could be created or extended. The replanted areas around Bicentennial Reserve are more uniform in nature than those in Flat Rock Gully. Plant species were selected in Bicentennial Reserve for their ability to act as visual screens around the reserve. However, there are areas where screen plantings are not required, such as along parts of the southern slopes of Bicentennial Reserve.

   Habitats that could be extended include the Coastal Sandstone Heath (21 gviii), near the entrance to Flat Rock Gully, native grassland and shrubland in the higher parts of Flat Rock Gully. Habitats that could be created include additional native grassland (in Bicentennial Reserve), heath (old quarry area in Flat Rock Gully) and shrubland (old quarry area in Flat Rock Gully). The management of the grassland areas may depend on the irregular use of fire to stimulate reseeding.

2. **Bibrons Toadlets:** The area where Bibron's Toadlet occurs in Flat Rock Gully is very small. Its limited size means that the population is extremely vulnerable to environmental pressures. Ideally, the area of habitat for this species needs to be expanded. However, as a terrestrial species, their habitat requirements are particular.

   There does not appear to be a way of extending the toadlet area in the site that they currently occupy. Indeed, it would be rather dangerous to try to

adapt areas around it in case the core habitat area is impacted. Instead, an area away from the core site could be developed as additional habitat. The most suitable area for this purpose appears to be a moist area of land at the western end of Calbina Road.

At present this site is too boggy for the toadlets but it could be easily adapted for their use. The site would need to be converted into a shallow basin. The embankment on the northern side could be excavated to create a steeper face at the back of the basin. Some of the seepage from the embankment could be directed into the basin while the rest is diverted into smaller channels that lead into Flat Rock Creek. The intention is to create a grassy swale that will fill to about 5 cms depth after heavy rainfall. Sandstone boulders will need to be placed against the northern embankment and in random sites across the grassland.

Given the susceptible nature of the Bibron's Toadlet population in Flat Rock Gully, some low-intensity monitoring of these frogs should be carried out annually. This could consist of three or four night surveys after local rain to determine whether the toadlets are calling, and a hand search to determine whether eggs are being produced. Interference with the population beyond this may be too much for such a small site.

3. **Burton's Legless Lizards:** The Burton's Legless Lizards are another species that will require special protection. The lizards appear to occupy a small section of the southern hillside in Bicentennial Reserve. This hillside has been disturbed a number of times, by garden escape plants and cultivation by residents, and by more recent revegetation programs. The planting of saplings in dense stands may well be a major detriment for these lizards.

   A safer method of assisting these lizards is to extend their foraging habitat areas. The lizards feed mainly on small Grass Skinks and Garden Skinks which thrive in exposed grasslands and low shrub sites. Such habitats can be created on the southern side of Bicentennial Reserve by establishing expanses of native grass land interspersed with large blocks of sandstone (i.e. creating a rocky field).

   Weed spraying must not occur in this area and all weeding should be done by hand. Some saplings will need to be removed to prevent overshadowing of the grassed areas. Hand weeding will be required as introduced shrubs can overgrow the native grasses in these circumstances.

   As for Bibron's Toadlet, the legless lizards should be monitored to ensure that the population in the existing habitat area is viable and that the new habitat area is fulfilling its purpose of increasing the population size of the small skinks and legless lizards in the area.

4. **Fox Control:** Bicentennial Reserve and Flat Rock Gully also suffer from exotic predators, such as foxes, rats and cats. Foxes represent the most

serious threat to wildlife in these reserves and control measures will be required as an on-going aspect of park management.

5. **Improved water quality:** The water quality in Flat Rock Creek has improved but can still be further improved. The detention ponds above the tip face serve a useful purpose in assisting with improving water quality. However, the water that appears below the tip face is much poorer in quality. The low quality water is responsible in part for the high weed density along the lower section of Flat Rock Creek and the elimination of fish in the creek immediately below the tip face.

   One possible solution to this problem is the installation of a large macrophyte basin at the base of the tip face. For these basins to work effectively, they need to be maintained and an access road would need to be created to the basin. Plants harvested from the basins could be composted and used as mulch elsewhere in the reserve.

6. **Weed Control:** Weed control is a major concern for reserves surrounded by residential areas. Council has on-going weed control programs but these need to be assisted through community education. Residents neighbouring the reserves seem to be inconsistent in their regard for the reserves. While appreciating the presence of the reserves, residents still plant invasive species in their back yard or along the reserve boundary. The protection of the reserves cannot be seen as a task only for Council. If this attitude is to prevail the reserves will be lost to weeds as the resources of Council will not be sufficient to stem the spread of weedy plants.

7. **Improving the habitat value of sites:** Flat Rock Gully, in particular, has a variety of small habitat areas and types. Many are created habitats. Their value to terrestrial fauna can be greatly increased through the use of extended ground cover materials, such as rocks, logs, compost heaps, wood rows and artificial shelter materials.

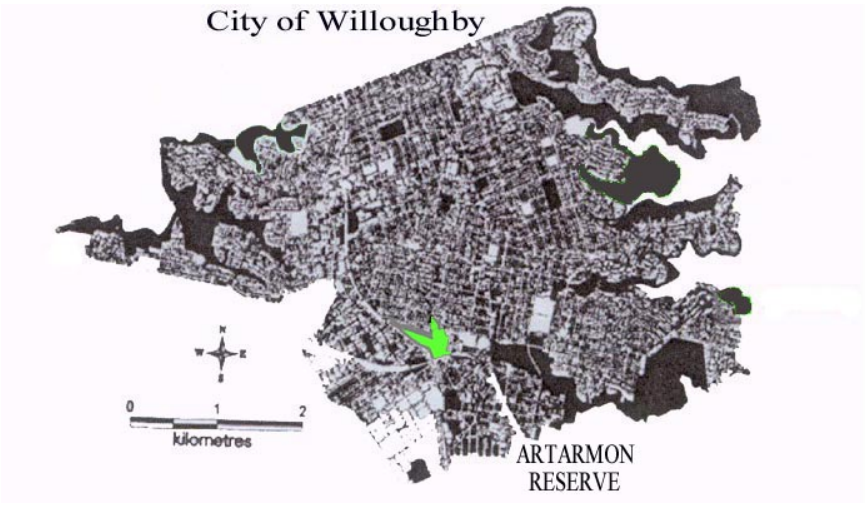
8. **Fauna that requires additional attention:** Two species remain unresolved as a result of this study; namely Red-crowned Toadlets and Powerful Owls. The prior species has been reported in the reserve but was not found during the surveys; the latter species was detected once during the surveys and it is not clear whether this bird is the same as the ones detected around the Castlecrag Escarpment, North Arm Reserve and Explosives Reserves.

   Specific fauna studies aimed at resolving these issues would assist with the management of both species.

Reserve Group 12: Artarmon Group

Artarmon Reserve

Location: Artarmon



Description of Reserve:

Artarmon Reserve is comprised of two parts; an eastern recreational area (Artarmon Oval) and a western bushland area. The oval area consists of a large sports field, dressing sheds, toilets and a playground facility. The bushland area is confined to two gullies and contains the upper catchment of Flat Rock Creek.

The bushland area follows the two gullies that unite west of the oval. The northern arm receives storm water from the Mowbray Ridge while the western arm receives storm water from Artarmon. Both areas of bushland have formal and informal tracks through them.

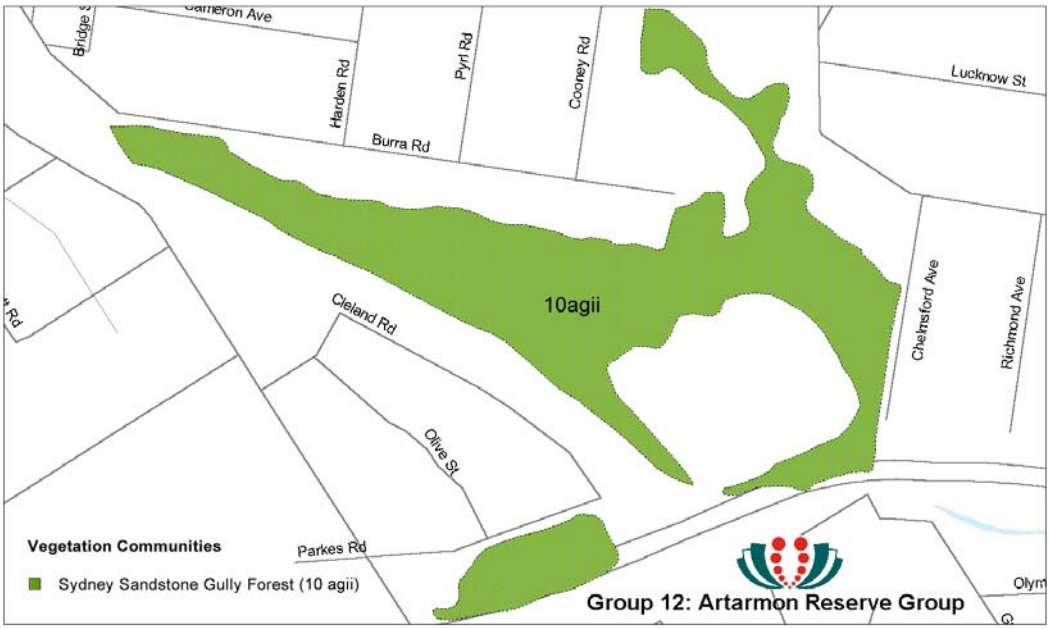
Bushland in Artarmon Reserve is totally isolated from other bushland areas and is surrounded by residential sites.

Description of Vegetation and Habitats in the Reserve:

Artarmon Reserve contains a mixture of natural and planted native vegetation. The main areas of replanted vegetation are near Chelmsford Avenue and near the railway easement. The majority of the bushland is Sydney Sandstone Gully Forest (10 agii).

The main trees in the bushland comprise Sydney Red Apple *Angophora costata*, Blackbutt *Eucalyptus pilularis* and Mock Orange *Pittosporum*

undulatum predominating. In some areas, exotic plants have invaded the bushland.



Impacts and Threats to the Reserve:

The bushland areas of Artarmon Reserve have been affected by the sports field and the surrounding residences. These impacts include:

1. Weed invasion of the bushland.
2. High noise and movement disturbance regime due to train movements and activities associated with the sports field.
3. Complete isolation of the reserve from other bushland areas.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: Artarmon Reserve was not surveyed in the same manner as the other bushland reserves. Intensive surveys were not carried out here because of the high public exposure of the site and its complete isolation from other reserves. Fauna records are confined to opportunistic observations and fauna sightings made by the public during the survey period. Burton (2000) completed a bird survey of Artarmon Reserve.

Mammals: Four species of mammals were observed in Artarmon Reserve. These were Common Brushtail Possums, Ringtail Possums, Grey-headed

Flying Foxes and dogs. No spotlighting or surveys for insectivorous bats were carried out here.

Common Brushtail Possum *Trichosurus vulpecula*

Brushtail possums were observed near the oval and near the railway easement.

Common Ringtail Possum *Pseudecheirus peregrinus*

Ringtail possum dreys were observed in the western arm of the bushland area.

Dog *Canis familiaris*

Dogs were observed around the oval and in the western bushland area. Dog scats were common in the bushland areas.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve.

Birds: Forty species of birds were recorded in Artarmon Reserve by Andrew Burton (2000), five of which were exotic.

	Burton (2000)
White-faced Heron	1999
Brown Goshawk	1991
Peregrine Falcon	1999
Masked Lapwing	1994
* Rock Dove	1995
* Spotted Turtle-dove	1996
Crested Pigeon	1999
Galah	1996
Sulphur-crested Cockatoo	1996
Rainbow Lorikeet	2000
Crimson Rosella	2000
Eastern Rosella	2000
Fan-tailed Cuckoo	1987
Common Koel	1995
Southern Boobook Owl	1993
Tawny Frogmouth	1994
White-throated Needletail	1999
Laughing Kookaburra	1999
Superb Fairy-wren	1996
Variegated Fairy-wren	1999
Spotted Pardalote	1999
White-browed Scrub-wren	1996
Brown Gerygone	1991
Red Wattlebird	1991
Little Wattlebird	1991
Noisy Miner	2000
Yellow-faced Honeyeater	1991
Magpie-lark	1997

Rufous Fantail	1993
Black-faced Cuckoo-shrike	1995
Olive-backed oriole	1991
Grey Butcherbird	1999
Australian Magpie	1999
Pied Currawong	2000
Australian Raven	1999
* House Sparrow	1993
Welcome Swallow	2000
* Red-whiskered Bulbul	1995
Silvereye	1996
* Common Myna	1991

* = exotic species

Reptiles: Four species of reptile were recorded for Artarmon Reserve (see Appendix 1).

Eastern Water Skink *Eulamprus quoyii*

Eastern Water Skinks were recorded from both bushland gully areas.

Garden Skink *Lampropholis guichenoti*

Garden Skinks were found near the oval.

Green Tree Snake *Dendralaphis punctatus*

A Green Tree Snake was sighted in bushland in October 2000 (see Appendix 1).

Golden Crown Snake *Cacophis squamulosus*

A Golden Crown Snake was found run over near the car park at Artarmon Oval in January 2001 (see Appendix 1).

Frogs: Two species of frogs were found in Artarmon Reserve.

Common Eastern Froglet *Crinia signifera*

Froglets were heard calling in the western bushland gully in December 2000.

Striped Marsh Frog *Limnodynastes peroni*

Striped Marsh Frogs were heard calling from the western gully in December 2000.

Fauna Conservation Measures

The Plan of Management lists a number of actions designed to enhance habitat for native fauna. The following measures are specific actions for Artarmon Reserve that complement the recommendations in the Plan of Management.

1. **Weed Control:** Weed penetration of the bushland areas is very patchy. This area is currently under a bush rehabilitation program. Weeding in the western bushland area needs to be tempered by the need to establish replacement cover plants before all of the weeds are removed.

2. **Vegetation Buffer:** The bushland areas are subject to a lot of disturbance, either from trains or from people using the recreational parts of the reserve. This disturbance can be reduced by selective planting of buffer plants around the bushland areas. Buffer plants consist of dense tall shrubs or small trees that will block noise and movement. As they are dense plants they will also help limit the creation of informal tracks through the bushland.

Birds

Photo 13: Pair of Powerful Owls

Photo 14: Pacific Baza

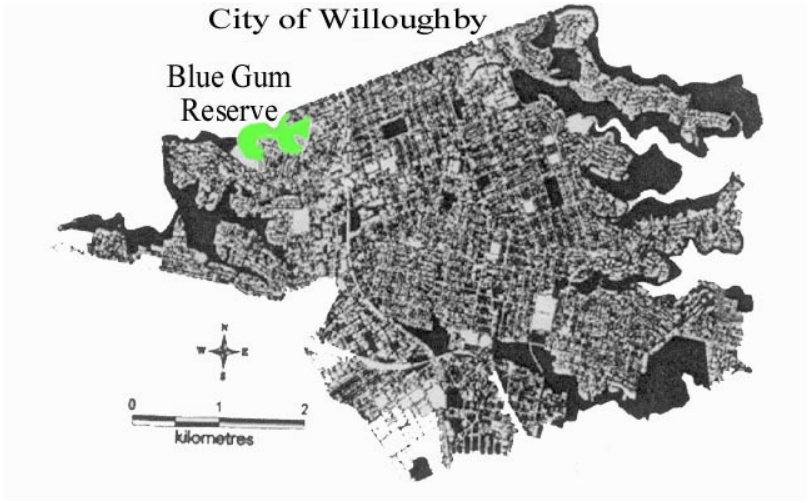
Photo 15: Variegated Wren

Photo 16 Willy Wagtail

Reserve Group 13: Blue Gum Group

Blue Gum Reserve

Location: Chatswood West



Description of Reserve:

Blue Gum Reserve straddles Willoughby and Ku-ring-gai Council boundaries. The portion controlled by Willoughby Council is 12.5 hectares in area and occupies the southern portion of Blue Gum Creek valley. This creek enters the Lane Cove River near Fullers Bridge. The reserve is heavily wooded although weed infestation is a major problem in some areas. Sections of the reserve have been disturbed through the creation of electricity and sewer easements.

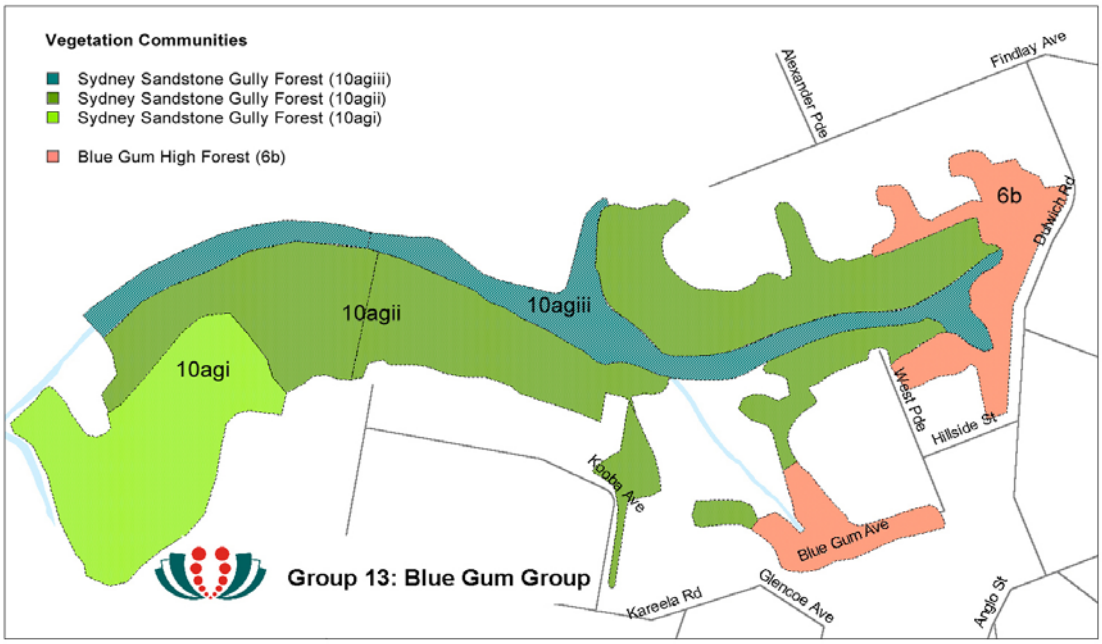
Description of Habitats in the Reserve:

Blue Gum Reserve contains a variety of habitats, some of which are badly disturbed. The eastern portion of the reserve contains three small feeder streams and gullies that form the upper catchment of Blue Gum Creek. The highest part of the catchment contains a stand of Blue Gum High Forest (at the Dulwich Road entrance to the reserve). These quickly give way to narrow

strips of Coachwoods *Ceratopetalum apetalum* and Lilly-Pillies *Acmena smithii* that line the upper water courses as they descend the sandstone layers to the flats below. This wet plant corridor is quite narrow and varies between 10 and 50 metres wide. On the higher slopes of the gullies, eucalypt forest dominates with Blackbutt *Eucalyptus pilularis* and Turpentines *Syncarpia glomulifera* providing the higher canopy.

The western portion of the reserve occupies a river flat. The wetter (gully) forests give way to a drier and more open eucalypt woodland dominated by Red Bloodwoods *Corymbia gummifera,* Sydney Peppermint *Eucalyptus piperita* and Sydney Red Apple *Angophora costata*. The southern portion of the river flat abuts a series of sandstone ledges that are also covered by open woodland, but Scribbly Gum *Eucalyptus haemastoma* and Red Bloodwoods form the dominant tree types. It is only in the river flat area that shrub layers are well developed, often being overgrown by exotic weeds such as Privet and Lantana.

Sections of the river flat have been opened up to create easements for power lines and sewer pipelines. The disturbance of the woodland has created an opportunity for grassland and shrub land habitats to develop.



Impacts and Threats to the Reserve:

Blue Gum Reserve is impacted by the surrounding residential developments in a number of ways. These include:

1. Canopy clearance for power easements.
2. Ground clearance for stormwater and sewer easements.
3. Severe weed infestation.
4. High fox numbers.
5. Poor creek water quality.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: The reserve contains a high diversity of forest and woodland species. It is not as well endowed with terrestrial species such as ground mammals and frogs.

Mammals: Blue Gum Reserve appears to have lost all of its native ground mammals. The only ground mammals present in the reserve are exotic (foxes, black rats and mice). Fortunately, the large areas of intact woodland and forest have enabled three species of arboreal mammals (Common Brushtail Possums, Ringtail Possums and Sugar Gliders) to thrive in the reserve. These tree-dwelling marsupials are particularly abundant in areas dominated by Blackbutt/Turpentine forest.

A number of insectivorous bat species were detected, mainly at the lower (western) end of the reserve.

Foxes appear to be in high numbers in the reserve. Their abundance, combined with the lack of ground cover in most parts of the reserve explains the absence of native ground mammals.

Common Brushtail Possum *Trichosurus vulpecula*

These possums appear to be more numerous along the edges of the reserves where there are old trees present. Possums were spotlighted crossing the road from the reserve into private residences (where presumably they are taking additional food). Most possums were spotted near Dulwich Road and near Kareela Road.

Common Ringtail Possum *Pseudecheirus peregrinus*

These possums appear to be the most numerous possum in the reserve. They are especially abundant in the Turpentine/Blackbutt forest and where there is a tall understorey available. During a nights' spotlighting on the 20th of December 2000, 16 Ringtail Possums were seen. In a day walk from Dulwich Road to the western end of Blue Gum Reserve 13 Ringtail Possum dreys were counted, with 10 of these being seen in the Turpentine forest at the start of the river flat.

Sugar Glider *Petaurus breviceps*

Sugar Gliders were spotted and heard calling from treed areas close to the river flat. Only 2 Sugar Gliders were detected on the night of the 20th of December 2000. On the 23rd of December 2000 only one Sugar Glider was detected.

Brown Antechinus *Antechinus stuartii*

Antechinuses were detected in woodland at the southern end of the reserve.

Fox *Vulpes vulpes*

Foxes were most often sighted in the river flat and most scats were collected from this area. Old dens were found under dense thickets of privet. On the evening of the 23rd of December 2000, three adult foxes were seen on or near the river flat.

Black Rat *Rattus rattus*

Black Rats were spotted and detected by hair tubes throughout the reserve. They were most frequently spotted alongside the creek on the river flat. Of the twenty five hair tubes set out along Blue Gum Creek, nine had hair samples from Black Rats in them.

House Mouse *Mus musculus*

House Mice were detected by hair tubes at the eastern end of the reserve (near Dulwich Road) and on the river flat. Mice were detected in five of the twenty five hair tubes set out in December 2000.

Cat *Felis cattus*

Cats were spotted at various locations in the reserve at night. Most of the cats seen appeared to be domestic animals but some cats seen on the river flat may be feral. On the evening of the 23rd of December 2000, five cats were spotted in the reserve.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve.

Gould's Wattle Bat *Chalinolobus gouldii*

Gould's Wattle Bat was detected at the edges of the tall forest below Greville Street.

White-striped mastiff Bat *Tadarida australis*

Mastiff Bats were detected flying high over the river flat area.

Lesser Long-eared Bat *Nyctophilus geoffroyi*

Long-eared Bats were detected near the western end of the reserve.

Little Forest Bat *Vespedelus vulturnis*

Little Forest Bats were detected at the western end of the reserve, near the edge of the tall forest.

Birds: The reserve is home to many species of native birds, particularly woodland and forest species. It is notably lacking in the smaller, shrub-dwelling and seed eating species (such as finches) as well as water birds. Burton (2000) recorded 47 bird species in a recent survey of which four were exotic. The current survey has added a further seventeen species to the list.

Unusual sightings include Cotton Pygmy-goose and white-browed scrub-wren. The reserve is also home to Powerful Owls, a threatened species.

	Burton (2000)	Fauna Study (2001)
Cotton Pygmy Goose	1998	
Australian Wood Duck	1998	2000
Pacific Black Duck		2000
Little Pied Cormorant		2000
White-faced heron		2000
Australian White Ibis		2000
Black-shouldered Kite		2000
* Spotted Turtle-dove	1999	2000
Crested Pigeon	1999	2000
* Rock Dove		2000
Topknot Pigeon		2000
Galah	1999	
Sulphur-crested Cockatoo	2000	2000
Rainbow Lorikeet	2000	2000
Australian King-parrot	2000	
Crimson Rosella	1999	2000
Eastern Rosella	1999	2000
Fan-tailed Cuckoo	1999	2000
Common Koel	1998	2000
Channel-billed Cuckoo	2000	
Horsfield’s Bronze Cuckoo		2000
Shining Bronze Cuckoo		2000
Powerful Owl	1998	2000
Southern Boobook		2000
Tawny Frogmouth		2000
Laughing Kookaburra	1999	2000
Sacred Kingfisher	1999	
Dollarbird	1998	2000
White-throated Tree-creeper	2000	
Superb Fairy-wren	1999	2000
Variegated Fairy-wren	2000	
Spotted Pardalote	2000	2000
White-browed Scrub-wren	2000	2000
Brown Gerygone	2000	
Brown Thornbill	1999	2000
Yellow Thornbill	1999	
Red Wattlebird	1999	2000
Noisy Miner	2000	2000
Lewin’s Honeyeater	1999	2000
New Holland Honeyeater		2000
Yellow-faced Honeyeater		2000
Noisy Friarbird		2000
Eastern Spinebill	1999	2000
Eastern Yellow Robin	1999	2000
Eastern Whipbird	1999	2000
Golden Whistler	1999	2000

Magpie-lark	1999	2000
Grey Fantail	1999	2000
Willie Wagtail	1999	2000
Black-faced Cuckoo-shrike	1995	2000
Olive-backed Oriole	1998	
Southern Figbird		2000
Grey Butcherbird	2000	2000
Australian Magpie	1999	2000
Pied Currawong	2000	2000
Australian Raven	1998	2000
Satin Bowerbird		2000
Red-browed Finch	1999	2000
* House Sparrow		2000
Welcome Swallow	1998	2000
* Red-whiskered Bulbul	1999	2000
Silvereye	1999	
* Common Blackbird	1998	
* Common Myna	1998	2000

* = exotic species

Reptiles: Blue Gum Reserve contained a wide variety of reptiles. Five species of snakes were recorded during the recent survey (Red-bellied Black Snake, Green Tree Snake, Golden Crown Snake, Yellow-faced Whip Snake and Eastern Small-eyed Snake) while ten species of lizards were also found. The majority of the reptiles were found on the river flat, in open or disturbed areas.

Eastern Water Dragon *Physignathus lesueuri*

In low numbers along the middle and lower section of Blue Gum Creek. During the day on the 21st of December 2000, five Water Dragons were seen along the lower sections of the creek.

Common Blue Tongue Lizard *Tiliqua scincoides*

Two lizards found on river flat on 21st December 2000, one was dead having been bitten by a dog or fox.

Eastern Water Skink *Eulamprus quoyii*

Fairly abundant along the lower sections of Blue Gum Creek. During a day walk through the reserve on the 21st of December 2000, nineteen Eastern Water Skinks were seen.

Bar-sided Skink *Eulamprus tenuis*

A single Bar-sided Skink was seen near the river flat.

Weasel Skink *Saproscincus musteline*

Eight lizards were found in woodland near Dulwich Road and also near Greville Street.

Garden Skink *Lampropholis guichenoti*

Common on river flat, less abundant but still present throughout the rest of the reserve. These skinks were so common that counting stopped after 50 lizards had been seen or caught during a day walk through the reserve on the 21st of December 2000.

Delicate Skink *Lampropholis delicata*

Occur in twos and threes across most of the reserve including forested areas. Found in highest numbers in Scribbly Gum woodland areas where nine skinks were caught in a small area.

Three-toed Skink *Saiphos equalis*

A Three-toed Skink was found in woodland near the river flat.

Eastern Snake-eyed Skink *Cryptoblepharus virgata*

Found on dead trees on river flat. Appear to be common in this area but it was difficult to count them as many would disappear into holes in the tree and under bark when disturbed.

Southern Leaf-tailed Gecko *Phyllurus platurus*

Not common but present in the sandstone areas of the middle section of Blue Gum Creek. On a single night spotlighting on the 20th December 2000, only two geckos were found.

Red-bellied Black Snake *Pseudechis porphyriacus*

A single 1 metre long Black Snake was sighted near the pits of the river flat in December 2000.

Green Tree Snake *Dendrelaphis punctatus*

A juvenile tree snake was spotted in December 2000 in low bush near the eastern boundary of the river flat. A shed skin from a larger Green Tree Snake was found in the same general area.

Golden Crown Snake *Cacophis squamulosus*

A small Golden Crown Snake was caught on the river flat in January 2001.

Yellow-faced Whip Snake *Demansia psammophila*

A small whip snake was caught on the southern bank overlooking the river flat.

Eastern Small-eyed Snake *Rhinoplocephalus nigrescens*

A Small-eyed Snake was spotted at night near the end of the tall forest on the 9th of January 2001.

Eastern Long-necked Turtle *Chelodina longicollis*

An adult Long-necked Turtle was seen in Blue Gum Creek at the eastern end of the reserve.

Frogs: The frog fauna of the reserve is limited to four species. This is mainly due to the degraded nature of the watercourse of Blue Gum Creek and the weed infestation that has occurred along the watercourse. Leaf-green Tree Frogs still occur along the upper gullies of Blue Gum Creek while Striped Marsh Frogs and Common Eastern Froglets dominate along the river flat in side channels and boggy areas. Eastern Banjo Frogs have taken up residence in storm water pits in the lower river flat.

Leaf-green Tree Frogs *Litoria phyllochroa*

Along creek banks in the middle and upstream sections of the river flat. During the night spotlighting on the 20th of December 2000, eleven Leaf-green Tree frogs were seen or heard. No tadpoles were found.

Striped Marsh Frog *Limnodynastes peroni*

Common on river flat. They are frequently heard calling both during the day and night in this area. It was estimated that about 15 male frogs were calling on the evening of the 23rd of December 2000.

Eastern Banjo Frog *Limnodynastes dumerilii*

Only located in detention pits on river flat. On the evening of the 20th of December 2000, two male frogs were heard calling from these pits, on the evening of the 23rd of December 2000, two frogs were again calling and a non-calling male was found on the grassy verge nearby.

Common Eastern Froglet *Crinia signifera*

Most commonly heard on river flat, also present on southern branch of upper Blue Gum Creek. Their density on the river flat was too high to estimate from the calls.

Fauna Conservation Measures

1. **Powerful Owls:** The most significant animal species in the reserve are the Powerful Owls. These birds are roosting in Blue Gum Reserve, an unusual circumstance in urbanised areas. The owls have been able to survive in Blue Gum Reserve because there is still a substantial tree canopy cover, a reasonable supply of arboreal food animals, low risk flight corridors to nearby forested sites and relatively little human activity near their roosting sites.

   The owls will not continue to use Blue Gum Reserve as a roosting and nesting site if human activity increases in the area. At present, there is only one walking track through the reserve and this does not appear to be used frequently. Unfortunately, the track passes close to the owls roosting site. If a walking track is required through the reserve it will need to be relocated away from the owls roosting site and access to this area discouraged through the emplacement of natural barriers.

   Similarly, street lighting from Millwood Avenue and Greville Street, and house lighting from residences on Range Street and Greville Street poses

a risk should the canopy around the edges of reserve be punctuated. An assessment of the effectiveness of the tree screen along the southern side of the reserve will need to be made annually, or after fire or wind storms. Residences in this area should be discouraged from facing night lights into the reserve.

2. **Fox Control:** Foxes were spotted in Blue Gum Reserve every evening that the fauna survey was being carried out in that reserve. Similarly, over 20 fox scats were collected from the reserve for hair and bone identification. The scat analysis indicated that the foxes were consuming a wide variety of food items including plants and insects. The most common vertebrate prey item found in the scats was bird. Although it was not possible to identify many of the bird remains to species, a large proportion were water birds. As Blue Gum Creek appears to contain few water birds, this suggests that the foxes may be foraging away from the reserve and returning to the reserve to consume their prey and to seek shelter.

   Other smaller prey items were found in the scats including mice, lizards and frogs.

   Fox baiting occurs in Blue Gum Reserve as part of the Sydney-north Regional Fox Baiting Program. This program will need to be maintained for a number of years as the fox population along the Lane Cove River Valley appears to be high.

3. **Improved water quality:** Blue Gum Creek is fed by stormwater drains that collect water from Roseville and West Chatswood. The quality of this water is not high and is likely to be responsible for the low abundance and diversity of frogs along Blue Gum Creek. Ideally, some primary treatment of the water is needed in the upper catchment area. This could consist of some gross pollution traps or detention basins. As the upper catchments are narrow and tightly confined, there may not be sufficient space to create water control structures of this kind. However, the river flat is much wider and there may be potential to create macrophyte basins at the head of the river flat. These basins not only improve water quality but also provide frog habitat for a range of riparian and pond species.

4. **Weed Control:** Areas along the lower river flat and the upper branch of Blue Gum Creek near Glencoe Avenue are heavily weed infested. Other sections of the reserve are also affected by weeds. The river flat has been extensively overgrown by Privet and Lantana. These invasive plants have replaced the original creek-side vegetation and in places have formed impenetrable thickets. Some birds have been able to take advantage of the protection offered by this thick mass of vegetation but few native animals are able to utilise these areas. Foxes appear to have constructed breeding dens in these thickets.

   Bush regeneration in these areas may restore the fringing vegetation and shrub layer in these areas. The removal of the privet and lantana thickets will also assist with fox control.

5. **Replanting habitats:** Although large sections of the river flat are disturbed and weed infested, this area of the reserve has the greatest potential for the creation of new habitat areas. In general, many of the bushland reserves in Willoughby Local Government Area occupy forested gullies few provide non-forest habitats. The river flat area is a potential site for the creation of native grasslands and shrub lands. Dense thickets of *Kunzea, Melaleuca* and *Leptospermum* could be established west of Greville Street. Native grass areas containing *Themeda, Danthonia, Cynadon* and other grasses could be established as patches near the shrublands, particularly on the river flat.

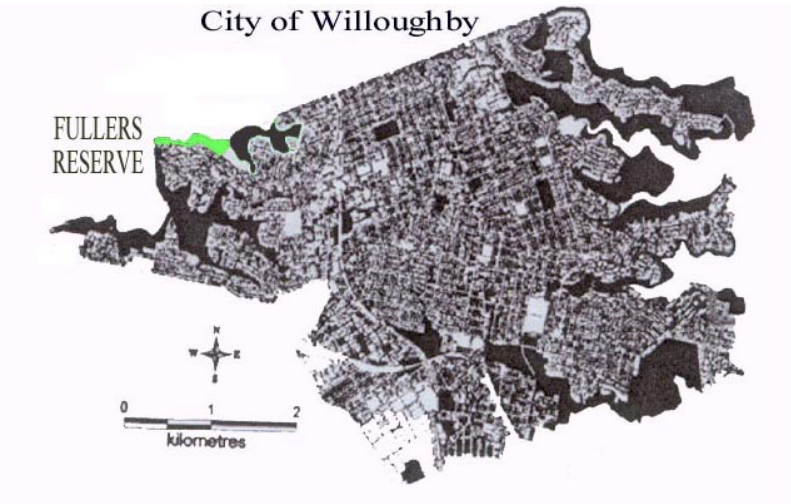
   Native grasses and shrub-lands will restore the habitat for many of the smaller birds, especially the seed-eaters.

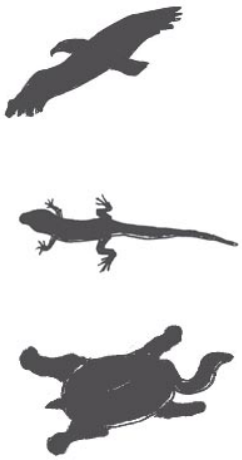
   Lower sections of the river flat will need to be kept free of tree cover because of the power and sewer easement areas across this area.

Reserve Group 13: Blue Gum Group

Fullers Park

Location: Chatswood West





Description of Reserve:

Fullers Park occupies the lower, southern valley of Blue Gum Creek. The reserve commences from the junction of Blue Gum Creek and the Lane Cove River and continues east until it abuts Blue Gum Reserve. Fullers Park is a narrow reserve, being sandwiched between Millwood Avenue to the south and Blue Gum Creek to the north. Millwood Avenue occupies the higher part of the valley and the reserve falls away steeply in most areas to Blue Gum Creek. Fullers Park is widest near its junction with Blue Gum Reserve.

There is a small lawn area near Lady Game Drive that contains a picnic shelter and barbecue facility.

Most of Fullers Park is controlled by the New South Wales National Parks and Wildlife Service (NPWS). Willoughby City Council has control of a road corridor that runs through most of the reserve. This road was used as a service track by Council vehicles and NPWS staff during the construction of storm water pits alongside Blue Gum Creek. A clearing exists near the pits, which has become weed infested.

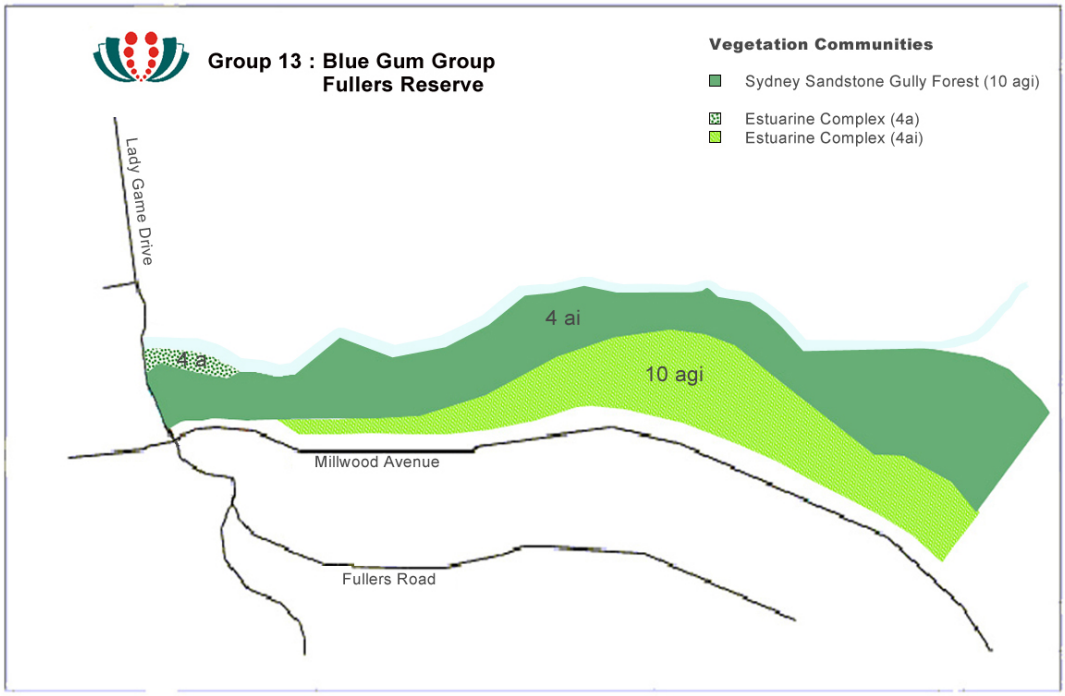
Description of Habitats in the Reserve:

Fullers Park is a long, thin reserve. It contains some Sydney Sandstone Gully Forest along the steeper parts of the valley whereas the valley floor is overgrown by an assortment of introduced plants. Weed penetration into the reserve is extreme and all habitats are weed-affected.

Some areas of revegetation have been established close to Lady Game Drive. The boundaries of the site have also been severely degraded and contain mixed native and exotic species.

The extent of the weed spread in Fullers Park threatens to disrupt the woodland corridor between Blue Gum Reserve and Fullers Reserve.

A few Mangrove trees line the mouth of Blue Gum. Further up the creek, the banks are covered by dense tangles of weeds and exotic plants.



Impacts and Threats to the Reserve:

Fullers Park has been greatly affected by activities in the local area. The impacts include:

1. Extensive weed invasion of the reserve.
2. Service track and work area used by Sydney Water has created a predator and weed corridor through the reserve.
3. Significant traffic noise and movement associated with traffic on Millwood Avenue.
4. Many introduced animal species in the reserve.

The combined effect of these impacts has been to modify the fauna that utilises the park.

Description of Fauna: Fullers Park contains a depleted fauna. This is a consequence of its narrowness, the proximity of a major arterial road and disturbance to creek side habitats.

Mammals: Fullers Park was dominated by exotic mammals. Foxes, dogs, cats, Black Rats and mice were the most commonly encountered mammals in the reserve. A scat that appears to be from a Swamp Wallaby was collected from near Fullers Bridge in November 2000.

Two species of arboreal mammals (Common Brushtail Possums and Ringtail Possums) were present in the reserve but not in high numbers. Two Brushtail and three Ringtail Possums were spotted during the evening of the 27th of December 2000. Flying foxes were observed flying overhead. No insectivorous bats were detected in the reserve.

Common Brushtail Possum *Trichosurus vulpecula*

Brushtail Possums were spotted near Lady Game Drive, at the western end of the reserve.

Common Ringtail Possum *Pseudecheirus peregrinus*

Ringtail Possums were spotted in an area towards the eastern end of the reserve.

Swamp Wallaby *Wallabia bicolor*

A wallaby scat believed to be from a Swamp Wallaby was collected from near Fullers Bridge in November 2000. No hair samples were in the scat and so its identity could not be confirmed.

Fox *Vulpes vulpes*

Fox scats were collected from near Lady Game Drive.

Dog *Canis familiaris*

Dog scats were found along the creek flat. Scats were from domestic dogs as well as stray dogs.

Cat *Felis cattus*

A cat was spotted near Lady Game Drive.

Black Rat *Rattus rattus*

Black Rats were detected by hair tubes set near Lady Game Drive and along the creek edges.

House Mouse *Mus musculus*

House Mice were detected by hair tubes set near Lady Game Drive and near the eastern end of the reserve.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve, none were observed to roost in the reserve.

Birds: 34 bird species have been recorded for Fullers Park of which five were exotic species.

	Burton (2000)	Fauna Study (2001)
Australian Wood Duck	1998	
Pacific Black Duck		2000
Chestnut Teal		2000
Mallard		2000
Great Black Cormorant		2000
White-faced Heron		2000
Dusky Moorhen		2000
Silver Gull		2000
* Spotted Turtledove	1999	2000
Crested Pigeon	1999	2000
Galah	1999	2000
Sulphur-crested Cockatoo		2000
Rainbow Lorikeet	1999	2000
Australian King Parrot		2000
Eastern Rosella	1999	
Laughing Kookaburra		2000
Superb Fairy-wren		2000
Spotted Pardalote		2000
White-browed Scrub-wren		2000
Brown Thornbill		2000
Red Wattlebird		2000
Noisy Miner	1999	2000
Eastern Whipbird		2000
New Holland Honeyeater		2000
Magpie-lark		2000
Willie Wagtail		2000
Grey Butcherbird	1999	
Australian Magpie		2000
Pied Currawong	1999	2000
Australian Raven	1999	2000
* House Sparrow		2000

Welcome Swallow	1999	2000
* Red-whiskered Bulbul		2000
* Common Starling		2000
* Common Myna		2000

* = exotic species

Reptiles: Fullers Park contained seven species of reptiles including two species of turtle. No snakes were found in the reserve during the survey.

Eastern Water Dragon *Physignathus lesueuri*

Water Dragons were present in the upper (eastern) section of Blue Gum Creek.

Eastern Water Skink *Eulamprus quoyii*

Eastern Water Skinks were present along the banks of Blue Gum Creek.

Garden Skink *Lampropholis guichenot*i

Garden Skinks were present throughout the reserve.

Delicate Skink *Lampropholis delicata*

These lizards were scattered throughout the reserve, particularly along the edges of the woodland.

Snake-eyed Skink *Cryptoblepharus virgata*

Two skinks were observed on trees near the sewer viaduct.

Eastern Long-necked Turtle *Chelodina longicollis*

Long-necked turtles were observed swimming and basking in Blue Gum Creek.

Eastern Short-necked Turtle *Emydura signata*

A short-necked turtle was observed in Blue Gum Creek on the 20th of December 2000.

Frogs: Two species of frogs were found in the reserve.

Common Eastern Froglet *Crinia signifera*

Froglets were present in a wet area near the Acoustics Laboratory.

Striped Marsh Frog *Limnodynastes peronii*

Striped Marsh Frogs were only found in a boggy area off Blue Gum Creek.

Fauna Conservation Measures

1. **Weed Control:** The majority of Fullers Park is affected by weeds. Large sections of the reserve along the river flat and around the boundaries of the reserve are dominated by exotic plants. Dense thickets of Privet, Lantana and Ochna obscure Blue Gum Creek in many places. On the slope leading down from Millwood Avenue, tangles of Balloon Vine and Morning Glory strangle native trees and shrubs.

   The area close to Lady Game Drive has been rehabilitated and replanted. This area adjoins the picnic area and is one of the easily accessible spots in the reserve. Away from this area, weeds dominate at the expense of native plants.

   Some bush regeneration is under way in the reserve. The extent of weed coverage is so great that many areas will need to be replanted when the weed cover is removed. Fortunately, few native animal species are using the weed areas as habitat.

2. **Service Track and Storm Water Works Area:** The central and western portion of Fullers Park has been adversely affected by the creation of a service road and the clearance of a work area. The road is used as an easy entry into the reserve (and into Blue Gum Reserve) by foxes; it is also an avenue for weeds to penetrate the reserve. The presence of the cleared work site provides a location for another dense area of weeds to become established.

   If the service track and work area is no longer required, this area should be replanted before the weed infestation becomes acute.

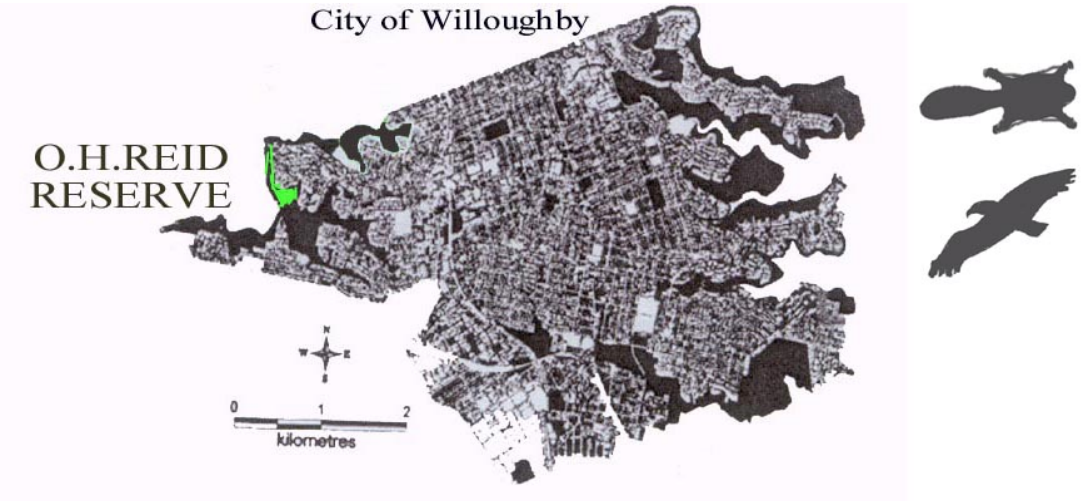
3. **Traffic Noise and Disturbance from Millwood Avenue:** Millwood Avenue is a particularly busy road in the morning and evening. Traffic noise and movement is a particular problem at the western end of the reserve. This area needs to be screen planted to reduce the disturbance effect on native animals.

4. **Recreated Habitats:** The extent of habitat damage and loss in Fullers Reserve provides an opportunity to recreate habitats that are otherwise scarce in the local government area. Fullers Park would be an ideal location for the creation of native grassland and shrubland. Native grasses, such as *Themeda* and *Danthonia* could be established in the works area and along the service track. Shrubland comprising *Kunzea*, *Melaleuca*, *Grevillea*, *Monotoca* and *Acacia* could be established around the grassland and replace the weed thickets.

Reserve Group 14: O.H. Reid Group

O.H. Reid Reserve

Location: Chatswood West



Description of Reserve:

O.H. Reid Reserve is an irregular-shaped reserve that is almost bisected by the Chatswood Golf Course. The golf course occupies the flat area between the Lane Cove River and the sandstone escarpment leading up to Reid Drive. As a consequence, O.H. Reid Reserve occupies the sandstone escarpment from Fullers Road in the north to Hawthorne Avenue in the south. It also occupies the thin mangrove and She-oak strip than runs alongside the river. O.H. Reid Memorial Park is also located within the reserve. This is a playing field area and small playground facility located at the southern end of Reid Drive.

Description of Habitats in the Reserve:

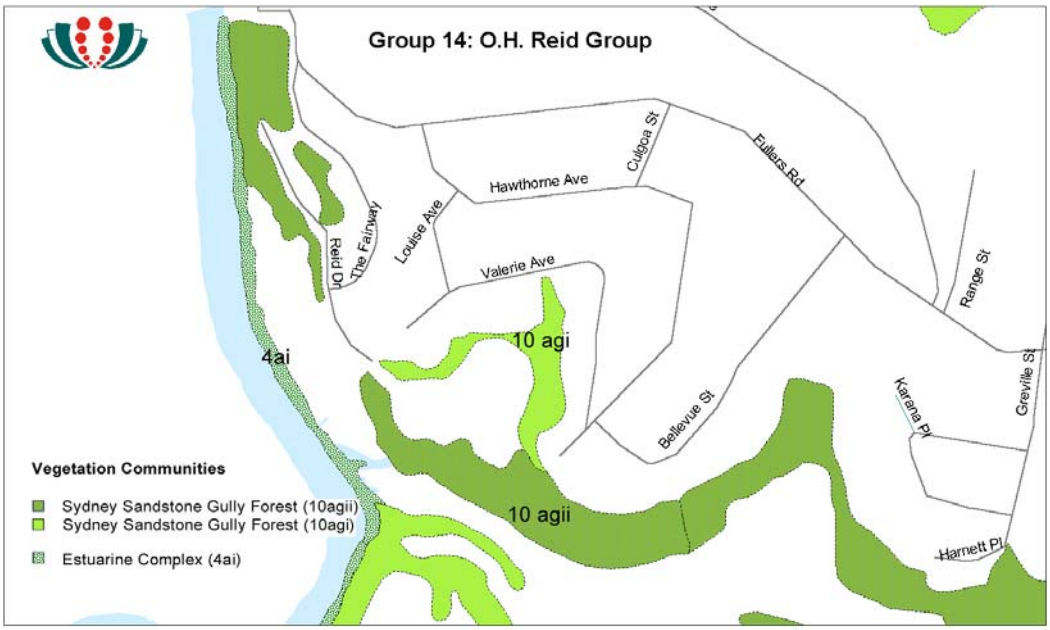
Because of the unusual shape and nature of O.H. Reid Reserve, most of the fauna habitat areas are confined to narrow strips around the golf course or around the memorial park.

The sandstone escarpment area below Reid Drive and surrounding the Memorial Park is dominated by Sydney Sandstone Gully Forest containing tall Sydney Red Apple *Angophora costata,* Red Bloodwoods *Corymbia*

gummifera, Old Man Banksia *Banksia serrata* and Mock-Orange *Pittosporum undulatum*. Isolated Blackbutts *Eucalyptus pilularis* and Sydney Peppermints *E. piperita* are present in a more protected area near the Memorial Park. The understorey in the sandstone gully forest is mostly intact and relatively free of weeds.

The sandstone gully forest is continuous with woodland in Fullers Park to the north, but is not continuous with woodland in Ferndale Park.

The mangrove and She-oak corridor is very thin but is continuous with similar habitat in Fullers Park to the north and Mowbray Park to the south.



Impacts and Threats to the Reserve:

O.H. Reid Reserve is impacted in several ways by the surrounding urban area. The impacts include:

1. Significant loss of habitat value of mangrove and She-oak area along the Lane Cove River.
2. Large “edge effect” due to the narrowness of the reserve.
3. Rabbit and fox numbers high because of the golf course.
4. Woodland discontinuous with Ferndale Park.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: O.H. Reid Reserve has a greatly depleted fauna despite the relatively good condition of the flora in the woodland areas in the reserve. The Mangrove and She-oak area offer little habitat value as they are too narrow and exposed.

Mammals: O.H. Reid Reserve is dominated by exotic mammals. Foxes, rabbits, dogs, rats and mice were spotted or detected throughout the reserve. Rabbits were prevalent and often venture onto the golf course to feed.

Three species of arboreal mammals (Common Brushtail Possums, Ringtail Possums and Sugar Gliders) were present in the reserve but not in high numbers. Only one Brushtail Possum and three Ringtail Possums were spotted during the evening of the 27th of December 2000. A Sugar Glider was heard calling from woodland behind O.H. Reid Memorial Park.

Common Brushtail Possum *Trichosurus vulpecula*

Only one Brushtail Possum was detected in the reserve, this animal was sighted near Reid Drive.

Common Ringtail Possum *Pseudecheirus peregrinus*

Ringtail Possums were only sighted in the woodland behind the memorial park.

Sugar Glider *Petaurus breviceps*

A Sugar Glider was heard calling from trees on the northern side of the memorial park.

Fox *Vulpes vulpes*

Fox scats were mainly collected from along the edges of the golf course. Over half of the scats contained rabbit fur.

Dog *Canis familiaris*

Dog scats were found throughout the reserve. Many of the scats were of domestic dogs (as indicated by the absence of fur and bone in the scat). Only one scat was found containing fur (rabbit fur).

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve.

Lesser Long-eared Bat *Nyctophilus geoffroyi*

Long-eared Bats were detected near the Chatswood Golf Course.

Black Rat *Rattus rattus*

Black Rats were detected by hair tubes set along the edges of the golf course.

House Mouse *Mus musculus*

House Mice were detected by hair tubes set along the edges of the golf course.

Rabbit *Oryctalagus cuniculus*

Rabbits were spotted on the golf course, in the Memorial Park and surrounding woodland.

Birds: 38 bird species were recorded for O.H. Reid Reserve. Burton (2000) recorded the presence of Satin Bowerbirds in the reserve in 1999. This is one of few records of this species in the Willoughby area.

	Burton (2000)	Fauna Study (2001)
Australian Wood Duck	1999	2000
White-faced Heron		2000
Australian White Ibis		2000
Black-shouldered Kite		2000
Rock Dove		2000
Crested Pigeon	1999	
Yellow-tailed Cockatoo	1999	
Galah	1998	2000
Sulphur-crested Cockatoo		2000
Rainbow Lorikeet	1999	2000
Australian King Parrot	1999	
Eastern Rosella	1999	
Common Koel		2000
Tawny Frogmouth		2000
Laughing Kookaburra	1999	2000
Superb Fairy-wren	1999	2000
Spotted Pardalote	1999	
Brown Thornbill		2000
Red Wattlebird		2000
Noisy Miner	1999	2000
Lewins Honeyeater		2000
New Holland Honeyeater		2000
Magpie-lark		2000
Willie Wagtail		2000
Black-faced Cuckoo-shrike		2000
Grey Butcherbird	1999	
Australian Magpie	1999	2000
Pied Currawong	1999	2000
Satin Bowerbird	1999	
Australian Raven	1999	2000
Welcome Swallow		2000
* Red-whiskered Bulbul		2000
* Common Myna		2000

* = exotic species

Reptiles: O.H. Reid Reserve contained few reptiles. Only three species of reptiles were detected during the survey. One species of snake was reported by a local resident.

Grass Skink *Lampropholis delicata*

The most common reptile seen. These lizards were scattered throughout the reserve, particularly along the edges of the woodland.

Eastern Snake-eyed Skink *Cryptoblepharus virgata*

These skinks were observed on trees near Reid Drive.

Golden Crown Snake *Cacophis squamulosus.*

A Golden Crown Snake was seen by a resident in October 2000 near the memorial park.

Frogs: Only one species of frogs were found in the reserve.

Common Eastern Froglet *Crinia signifera*

Froglets were found in an area at the back of the memorial park.

Fauna Conservation Measures

1. **Improvement of Mangrove and She-oak corridor:** The mangrove and She-oak strip along the river has been greatly reduced by the presence of the golf course. This area can be easily restored through the planting of a buffer strip of vegetation along the inside of the *Casuarina* stand. This need not intrude onto the golf course but it will make it a lot harder for golfers to find errant balls.

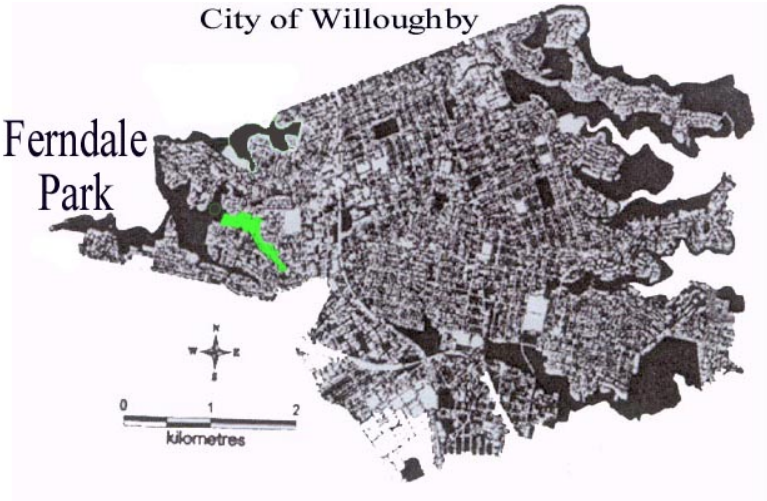
2. **Fox and Rabbit Control:** Rabbits were quite common around and on the golf course. As a consequence, it was not surprising that foxes were also hunting in these same areas. If rabbit numbers were brought down, fox numbers should also be depressed. Pindone poisoned carrots set during the night can be used safely, although the baits should be retrieved the next morning to prevent non-target species taking the bait.

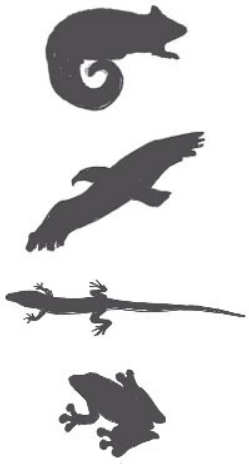
3. **Continuation of Woodland Corridor:** The woodland corridor at O.H. Reid Reserve is narrow in places and bounded by houses and the golf course. However, it offers the best means of creating a fauna corridor to Ferndale Park. This would require replanting around the boundary of the golf course between Hawthorne Avenue and Swaines Creek.

Reserve Group 15: Ferndale Group

Ferndale Park

Location: Chatswood West





Description of Reserve:

Ferndale Park occupies the gullies that form the upper catchment for Swaines Creek, a tributary of Lane Cove River. As the reserve follows a gully system, it is long, narrow and sinuous in nature. Ferndale Park commences in the east, below Campbell Park, a small recreational area of Dalrymple Avenue. Swaines Creek commences from storm water culverts under Dalrymple Avenue and continues down a narrow water course that crosses low, sandstone ledges and pools. The creek normally runs at a low velocity but can become a raging torrent immediately following heavy local rainfall.

There are sign-posted walking tracks in Ferndale Park. The Ferndale Walking Track commences at Dalrymple Avenue and follows the creek line down to Chatswood Golf Course. Smaller side tracks lead off to other street entrances to the park. The gully is also a sewer easement and sewer risers appear at regular intervals close to the creek.

Description of Habitats in the Reserve:

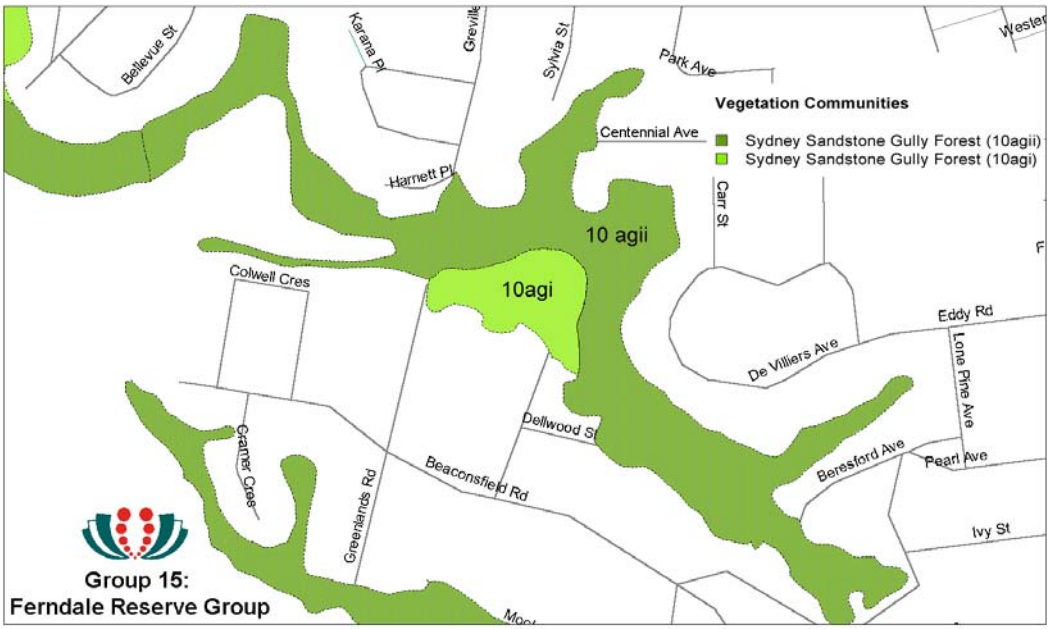
Ferndale Park contains two habitat types: the water course and inner gully are vegetated with Sandstone Sandstone Gully Forest (10agii) whereas the higher (and drier) parts of the gully contain pockets of drier Sydney Sandstone Gully Forest (10 agi). The creekside flora is dominated by Lillypillies *Acmena smithii* with Turpentine trees *Syncarpia glomulifera* forming an almost complete canopy in places. Interspersed between the Lillypilly are tree ferns and Sword Grass *Lomandra longifolia.* Black Wattle *Callicoma serratifolia* are

surprisingly scarce along the creek line. Immediately behind the Lillypilly are stands of Mock Orange *Pittosporum undulatum,* Blueberry Ash *Eleocarpus reticulatus* and various tall shrubs.

The upper slopes of the headwater of Swaines Creek contain Sandstone Gully Forest (10 agii) forest. In the lower parts of the gully Turpentine trees *Syncarpia glomulifera,* Blackbutt *Eucalyptus pilularis* and Sydney Blue Gums *E. salignta* predominate*.* The higher parts of the gully are dominated by less dense gully forest (10 agi), dominated by Sydney Red Apple *Angophora costata* and Blackbutt trees *Eucalyptus pilularis*.

These habitats are also present in nearby Coolaroo Reserve. It is likely that there will also be many faunal similarities between Ferndale Reserve and Coolaroo Reserve.

Unfortunately, Ferndale Park has been invaded by exotic weeds in several areas. The worst areas being at the Beresford Avenue crossing and near the Chatswood Golf Course. There is a lawn area at the park entrance at Dalrymple Avenue.



Impacts and Threats to the Reserve:

Ferndale Park is impacted in several ways by the surrounding urban area. The impacts include:

1. Polluted water entering Swaines Creek during periods of sewer overflow.
2. Large “edge effect” due to the narrowness of the reserve.
3. Weed invasion along creek line.
4. Bushland discontinuous with nearby areas (due to the presence of the golf course at the western end).
5. Presence of many exotic mammal species such as foxes and Black Rats.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: The reserve contains a high diversity of forest and woodland birds but was relatively deplete of other fauna. The reason for the apparent lack of fauna is related to the nature of the habitat and the urban impacts on the park. The park is dominated by gully forest comprising large stands of Turpentine and Lillypilly trees. These plants support a number of bird species but are not widely used by mammals. Reptiles are not in high abundance because of the closed nature of the forest and frogs have suffered because of the poor water quality that enters Swaines Creek.

Mammals: Two species of arboreal mammals (Common Brushtail Possums, Ringtail Possums) are present in the reserve but not in high numbers. Only one Brushtail and six Ringtail Possums were spotted during the evening of the 7th of December 2000. These tree-dwelling marsupials were generally not seen in the Turpentine forest, but along the boundary of the two forest types.

Foxes, dogs, cats, rats and mice were detected in the reserve. Their abundance also did not appear to be particularly high. Of the 40 hair tubes placed in the park, only eight had hair samples in them (these contained fur from Black Rats and mice). Only two fox scats and one dog scat was collected in the park.

Common Brushtail Possum *Trichosurus vulpecula*

Only one Brushtail Possum was spotted in the reserve, this animal being seen near the large bamboo patch below De Villiers Avenue.

Common Ringtail Possum *Pseudecheirus peregrinus*

These possums appear to be more numerous than the Brushtail Possums in the reserve. Most Ringtail Possums were seen along the ecotone between the gully forest types none were seen close to the creek line.

Fox *Vulpes vulpes*

Fox scats were collected near Greville Street. Neither scat contained fur (other than fox fur).

Dog *Canis familiaris*

A dog scat containing bones was collected from near Ferndale Avenue. The bones were from a medium sized bird (such as a currawong or magpie).

Cat *Felis cattus*

Cats were spotted near Beresford Avenue and Dalrymple Avenue.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve and roosting in trees near Dalrymple Avenue.

Gould's Wattle Bat *Chalinolobus gouldii*

Gould's Wattle Bats were detected in tall forest near Dalrymple Avenue.

Lesser Long-eared Bat *Nyctophilus geoffroyi*

Long-eared Bats were detected near the Chatswood end of the reserve.

Little Forest Bat *Vespedelus vulturnis*

Little Forest Bats were detected at the western end of the reserve, near the Chatswood Golf Course.

Black Rat *Rattus rattus*

Black Rats were detected by hair tubes set near Beresford Avenue.

House Mouse *Mus musculus*

House Mice were detected by hair tubes set near Beresford Avenue and near the Chatswood Golf Course.

Birds: 34 species of birds have been recorded in Ferndale Reserve. Ferndale Reserve was the only location where Australian Owlet Nightjars were recorded.

	Burton (2000)	Fauna Study (2001)
Maned Duck		2000
Silver Gull		2000
* Spotted Turtledove	1999	
Galah	1998	
Sulphur-crested Cockatoo	1999	2000
Rainbow Lorikeet	1999	2000
Australian King Parrot	1999	
Crimson Rosella	1999	2000
Eastern Rosella	1999	
Common Koel		2000
Southern Boobook		2000
Tawny Frogmouth	1998	2000
Australian owlet-nightjar		2000
Laughing Kookaburra	1999	2000

Dollarbird		2000
Superb Fairy-wren		2000
Spotted Pardalote	1999	
White-browed Scrub-wren	1999	
Brown Gerygone		2000
Brown Thornbill	1999	2000
Red Wattlebird		2000
Little Wattlebird		2000
Noisy Friarbird		2000
Noisy Miner	1999	2000
Eastern Yellow Robin		2000
Magpie-lark	1999	
Black-faced Cuckoo-shrike		2000
Grey Butcherbird	1999	2000
Australian Magpie	1999	2000
Pied Currawong	1999	2000
Australian Raven	1999	2000
Silvereye		2000
* Common Starling		2000
* Common Myna	1999	2000

* = exotic species

Reptiles: Ferndale Park contained relatively few reptiles. Only one species of lizard was found in the denser gully forest areas while four species of lizard and one snake was found on the higher slopes of the gully.

Eastern Water Skink *Eulamprus quoyii*

Most common along the lower sections of Swaines Creek. In this area, the forest cover is not closed.

Bar-sided Skink *Eulamprus tenuis*

A single Bar-sided Skink was seen near the Chatswood Golf Course end of the park.

Grass Skink *Lampropholis guichenoti*

Not common in reserve. Found in the lawn area near Dalrymple Avenue and near the Beresford Avenue crossing.

Southern Leaf-tailed Gecko *Phylurus platurus*

Not common in the park. Only one gecko was seen on the night of the 7th of December 2000.

Golden Crown Snake *Cacophis squamulosus.*

A small Golden Crown Snake was caught near Dalrymple Avenue.

Frogs: Three species of frogs were found in the park.

Leaf-green Tree Frogs *Litoria phyllochroa*

These frogs were scattered along the full length of the creek. The only section of the creek where they were not found was near Chatswood Golf Course.

Peron's Tree Frog *Litoria peronii*

Peron's Tree Frogs were detected below Eddy Road.

Common Eastern Froglet *Crinia signifera*

These small frogs were found in two spots along the creek, near the Beresford Avenue crossing and near Greville Street.

Fauna Conservation Measures

1. **Creation of Fauna Corridor:** The difference in species between Ferndale Park and Mowbray Park is most striking considering that the two reserves are within 100 metres of each other. One of the reasons for the lower than expected number of terrestrial species in Ferndale Park is its relative isolation from other bushland areas. Chatswood Golf Course divides the two reserves.

   A tree corridor is required that connects Ferndale Park to Mowbray Park. The corridor does not need to be direct and could skirt the golf course (although a corridor that followed Swaines Creek would be the most appropriate location).

2. **Water Pollution:** The water quality of Swaines Creek is highly variable and appears to be most affected by the overflows from the sewer risers in the park. The sewer line follows the creek line for its entire length and discharges at many points along the creek. Fortunately, when the sewer risers overflow, the creek is usually also receiving ample storm water run-off. The high storm water flow helps to dissipate the sewer overflow and flush it downstream.

   A system is needed that can reduce the incidence of sewer overflows.

3. **Edge Effects:** Ferndale Park is prone to urban impacts because of its shape. It is a long and relatively thin reserve that is subject to disturbance from all sides (and within). In particular, it is prone to invasion by garden plants (being a damp area) and light pollution. Residents should be encouraged to have solid fences backing onto the reserve to reduce the incidence of garden plant escape and to reduce the ground lighting in the park. Similarly, backyard flood lights should be discouraged or be directed towards the houses and not into the reserve.

4. **Location of Walking Track:** Ferndale Park is a long, thin park. The Ferndale Walking Track follows Swaines Creek through the centre of the park for its entire length. Ideally, the track should not occupy the banks of the creek but should be relocated higher up the gully. An incentive to

relocate the track for walkers would be that the track would no longer be in the smell radius of the sewer risers.

If the track was relocated, the stream-side vegetation could be replanted to once more form a continuous vegetation strip along the creek.

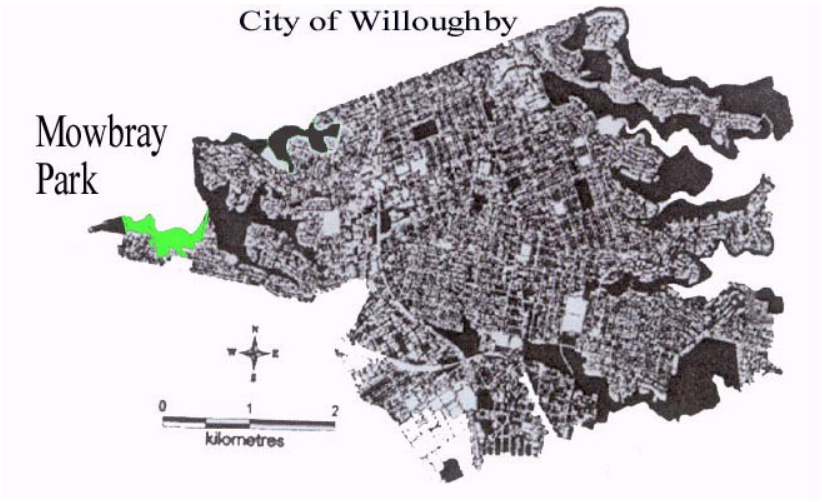
5. **Exotic Plants:** Ferndale Park is subjected to degradation by the spread of a number of weed species. Some of these are common garden plants while others are more general pests. The weed infestation at the downstream end of the park (where it reaches Chatswood Golf Course) is of particular concern as this weed barrier reinforced the geographic separation of the park from Mowbray Park. Not only does this area need to be rehabilitated the plants along the edges of the golf course also need to be replaced. Willows and other exotic trees need to be eliminated and replaced with useful habitat trees and shrubs.

6. **Control of Exotic Animals:** Foxes, Black Rats and mice are present in the reserve. Given its narrow dimensions, their presence prevents native ground animals from surviving in the park. Fox numbers appear to be low and could be controlled through regular baiting. Rat and mouse numbers can be diminished by the extermination of exotic vegetation in the reserve and their replacement with native plants.

Reserve Group 17: Mowbray Group

Mowbray Park

Location: Chatswood West



Description of Reserve:

Mowbray Park occupies the southern shore and surrounds of the Lane Cove River. The river dominates the park although it is outside of the park boundary. There are views of the river from any parts of the park and walking tracks and boardwalks follow the edges of the mangroves or pass through the She-oak *Casuarina cunninghamiana* Forest that grows behind the mangroves.

The park consists of a stepped sandstone hillside that leads down to the river flat. The hillsides are wooded and in places, exposures of sandstone have resulted is eroded overhangs and low escarpment areas being formed. There are several vantage points on the hillside where scenic views of the Lane Cove River valley can be appreciated. The river flat varies considerably in width. In some areas the sandstone slopes abut the edges of the mangroves while in other areas the flats are 50 metres wide and permeated by narrow channels which fill at high tide.

Mowbray Park terminates in the west at the Athletic Field off Mowbray Road. Its eastern boundary is continuous with O.H. Reid Reserve. In this area, Mowbray Park abuts Chatswood Golf Course.

Unfortunately, the park has some areas of major weed infestation. These are concentrated in two areas; the gully between Avian Crescent and Willandra Street and the river flat below Hatfield Street and Beaconsfield Road.

Description of Habitats in the Reserve:

There is an interesting mixture of habitats in Mowbray Park; one set of habitats associated with the sandstone slopes to the south of the Lane Cove River, the second associated with the river flat and mangroves.

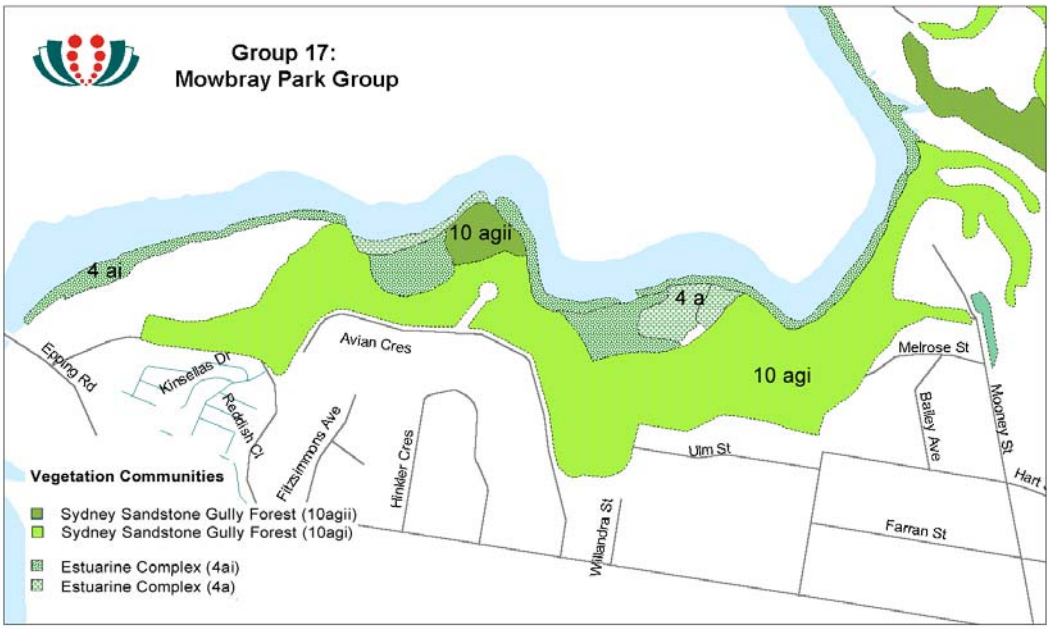
The slopes overlooking the Lane Cove River are mostly covered by Sydney Sandstone Gully Forest (10 agi), dominated by Sydney Red Apple *Angophora costata* and containing scattered trees of Red Bloodwood *Corymbia gummifera,* Black She-oak *Allocasuarina littoralis* and Old Man Banksia *Banksia serrata.* For most of the reserve, this woodland is in good condition. Unfortunately, sections of the southern slopes have been infiltrated by exotic plants. Two main areas of infestation occur in the eastern half of the reserve: the gully between Avian Crescent and Willandra Street contains many escaped garden plants such as Lilies, Ginger, Honeysuckle and Wandering Jew. The area below Hatfield Street is a dense thicket of Privet and Lantana which has formed an almost impenetrable wall across the reserve. A tunnel has been forged through this thicket so that the walking track that follows the river can continue through this area.

An intriguing habitat that occurs between the sloped areas and the river flat is a small woodland of Narrow-leaved Ironbark *Eucalyptus crebra*. These trees are confined to a small area and do not occur in other habitat areas.

The river flat is mostly covered by She-oak Forest *Casuarina cunninghamiana*. In some areas, the drier side of the She-oak forest is lined with Mock Orange trees *Pittosporum undulatum*. The river flat has also been invaded by weeds in some areas, especially by exotic grasses.

The lower section of the gully between Avian Crescent and Willandra Street contains a remnant area of Sydney Sandstone Gully Forest (10 agii). This community typically grows in enclosed sandstone gullies that are heavily shaded and protected from the wind. The plants that typify this community are Black Wattles *Callicoma serratifolia*, Native Tobacco *Nicotiana sp*., Figs *Ficus rubiginosa* and Lilly Pilly *Acmena smithii*. Weed invasion appears to be threatening this small habitat area.

The mangroves that line Lane Cove River form a narrow, but almost complete wall along the banks of the river. The trees do not form dense thickets and the river is visible through the tracks along most of the river walking track.



Impacts and Threats to the Reserve:

Mowbray Park is suffering from extensive invasion by weeds. Bush rehabilitation work is under way and it is hoped that the spread of weeds can be halted. Some habitat areas, such as the Sydney Sandstone Gully Forest (10 agii) are at risk.

The walking tracks through Mowbray Park appear to attract a large number of walkers. Fortunately, the track has been upgraded in some areas with the construction of steps in steeper areas and boardwalks in areas backing onto the mangroves. Other sections of the tracks that pass through low areas of the river flat need to be upgraded.

The impacts on the reserve include:

1. Heavy infestation by introduced plants.
2. Small habitats such as Sydney Sandstone Gully Forest (10 agii) are in danger of being lost to invading weeds.
3. Walking tracks needs to be upgraded, especially on the river flat.
4. Foxes regularly forage in the reserve.

The combined effect of these impacts has been to modify the fauna that utilises the reserve.

Description of Fauna: Mowbray Park's fauna is a curious fauna. The higher woodland is evidently depleted of terrestrial animals whereas the river flat and mangroves have retained the ground fauna. It is probable that the mangroves provide a safe refuge for ground animal when predators are about.

The river corridor also proved to be used by a number of species of insectivorous bats.

Mammals: Mowbray Park contains a high proportion of exotic mammalian species. The upper woodland appears to have lost all of its native ground mammals. Foxes, cats, black rats and mice were abundant in the reserve; these creatures were spotted as well as being detected by hair tubes or through scats.

Common Brushtail Possum *Trichosurus vulpecula*

Brushtail Possums are not common in this reserve. Only one Brushtail Possum was spotlighted on the evening of the 21st of November 2000 and none were detected in fox or dog scats.

Common Ringtail Possum *Pseudecheirus peregrinus*

Ringtail Possums were present throughout the reserve but were only common on the river flat. The possums were usually seen in and around the She-oak forest although dreys were found in areas outside of this habitat (particularly in tall, weed-infested areas).

Fox *Vulpes vulpes*

Foxes were spotted in the reserve but scats were collected from all parts of the reserve.

Dog *Canis familiaris*

Dogs were seen in various parts of the park, particularly along the river corridor.

Grey-headed Flying Fox *Pteropus poliocephalus*

Flying foxes were observed flying over the reserve and roosting in trees near Ulm Street.

Little Forest Bat *Vespedelus vulturnis*

Little Forest Bats were detected at the northern end of the reserve, close to the Chatswood Golf Course.

Cat *Felis cattus*

Cats were not spotted but cat scats were found in the weed-infested areas on the river flat.

Eastern Water Rat *Hydromys chrysogaster*

A water rat was observed diving for shellfish in the mangroves on the afternoon of the 20th of March 2001.

Black Rat *Rattus rattus*

Black Rats were detected throughout the reserve. They were spotlighted along the shore line among the mangroves as well as detected by hair tubes in the weed-infested areas of the park.

House Mouse *Mus musculus*

House Mice were detected by hair tubes set in the weed-infested areas of the park and near the Scout Hall.

Birds: Mowbray Park had a high diversity of birds. The combined list of sightings from Burton (2000) and the present study accounts for 72 species.

	Burton (2000)	Fauna Study (2001)
Maned Duck	1999	2000
Pacific Black Duck	1999	2000
Chestnut Teal	1999	2000
Little Pied Cormorant	1999	
Little Black Cormorant	2000	2000
Great Cormorant	2000	
White-faced heron	1998	2000
Striated Heron	2000	
Nankeen Night Heron		2000
Australian White Ibis	1998	
Osprey	2000	
Whistling Kite	1996	
Brown Goshawk	1996	
Peregrine Falcon	1999	
Dusky Moorhen	2000	2000
Masked Lapwing	2000	
Silver Gull	1999	2000
* Spotted Turtle-dove	2000	
Crested Pigeon	2000	
Topknot Pigeon		2000
Yellow-tailed Black Cockatoo	1999	2000
Galah	1997	
Sulphur-crested Cockatoo	1999	2000
Rainbow Lorikeet	2000	2000
Scaley Breasted Lorikeet	1998	
Musk Lorikeet	1999	2000
Little Lorikeet	1998	
Australian King-parrot	1999	
Crimson Rosella	2000	2000
Eastern Rosella	2000	2000
Fan-tailed Cuckoo	1999	2000
Shining Bronze Cuckoo	1999	
Common Koel	2000	
Channel-billed Cuckoo	2000	
Southern Boobook Owl		2000
Tawny Frogmouth	1996	2000
Laughing Kookaburra	2000	2000

Sacred Kingfisher	2000	2000
Dollarbird	2000	
White-throated Tree Creeper	2000	
Superb Fairy-wren	2000	2000
Variegated Fairy-wren	2000	
Spotted Pardalote	2000	2000
White-browed Scrub Wren	2000	
Brown Gerygone	1998	2000
Brown Thornbill	2000	2000
Yellow Thornbill	2000	
Red Wattlebird	1998	
Little Wattlebird	1997	
Noisy Miner	2000	2000
Lewins Honeyeater		2000
Yellow-faced Honeyeater	2000	
Eastern Spinebill	2000	2000
Rose Robin	1997	
Eastern Yellow Robin	1999	
Golden Whistler	1999	
Magpie-lark	1999	2000
Grey Fantail	1999	
Willie Wagtail	2000	
Black-faced Cuckoo-shrike	2000	2000
Olive-backed Oriole	1999	
Southern Figbird		2000
Grey Butcherbird	2000	2000
Australian Magpie	2000	2000
Pied Currawong	2000	2000
Australian Raven	2000	2000
Red-browed Finch	1999	2000
Welcome Swallow	2000	2000
* Red-whiskered Bulbul	2000	
Silvereye	2000	
Common Starling		2000
* Common Myna	1999	

* = exotic species

Reptiles:

The reptile fauna of Mowbray Park was not particularly high. Only six species of reptiles were found in the park but a seventh species may be present. A Green Tree Snake was run-over on Mowbray Road in October 2000 and this snake may have come from Mowbray Park.

Eastern Water Skink *Eulamprus quoyii*

These are the most common lizard in the park and are easily seen along the walking tracks of the river flat.

Bar-sided Skink *Eulamprus tenuis*

Bar-sided skinks are seen occasionally in the areas where the hillside abuts the mangroves (i.e. near the boardwalk area).

Garden Skink *Lampropholis delicata*

These lizards are frequently seen away from the river flat.

Eastern Snake-eyed Skink *Cryptoblepharus virgata*

Several lizards were seen on trees in the woodland above the river flat.

Southern Leaf-tailed Gecko *Phyllurus platurus*

Only two geckoes were seen during the night survey of the 21st of November 2000. There does not appear to be much suitable sandstone habitat for the geckoes in Mowbray Park.

Red-bellied Black Snake *Pseudechis porphyriacus*

Two Red-bellied Black Snakes were seen during the survey, both in the gully between Avian Crescent and Willandra Street. One of the snakes was inside a compost mound.

Frogs: Only two frog species were found in the park. The paucity of frogs may be due to the saline nature of most of the low-lying land.

Common Eastern Froglet *Crinia signifera*

This frog was present in the lower gully between Avian Crescent and Willandra Street.

Striped Marsh Frog *Limnodynastes peronii*

These frogs were found in one location at the eastern end of the reserve (where it abuts the golf course).

Fauna Conservation Measures

1. **Weed Control:** Weed infestation is so severe in parts of Mowbray Park that there are virtually no native plants remaining in some areas. While current bush rehabilitation work is removing weed from areas of low infiltration, the major source areas remain as a source of subsequent reinfestation.

2. **Weeds as Habitats**: Unfortunately, in some areas weeds (Lantana and Privet especially) are the only plants that are providing ground cover and mid-canopy protection for native species. The removal of these heavy weed areas should not attempted until replacement habitat is provided for the animals using these areas as refuges. Dense ground cover plants are required on the river flat and on the wooded hillside.

3. **Protection of Gully Flora:** The small area of Sydney Sandstone Gully Forest (10 agii) is under threat by weeds. This habitat needs to be greatly extended if it is to survive and provide useful fauna habitat. Considering

how much this area has been reduced it is likely that assisted replanting will be required to extend the habitat.

4. **Fox and Cat Control:** Foxes and cats appear to be common in the park. As with other reserves, scats from foxes contained fur from black rats and mice, as well as feathers. Fox control should be reasonably easy in this reserve as the routes available for movement are limited. It is not known whether the cats detected were feral or domestic but considering the open nature of the woodland nearby, domestic cats are likely to be main feline predators in the reserve.

5. **Extended boardwalk across river flat:** The river walking track appears to carry a high numbers of walkers each day. This activity is a major disturbance along the river's edge and is a source of damage to ground plants. An elevated boardwalk through the lower parts of the river flat would help reduce the physical damage to the area and lessen the effect on small terrestrial fauna.

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7.0 Appendices

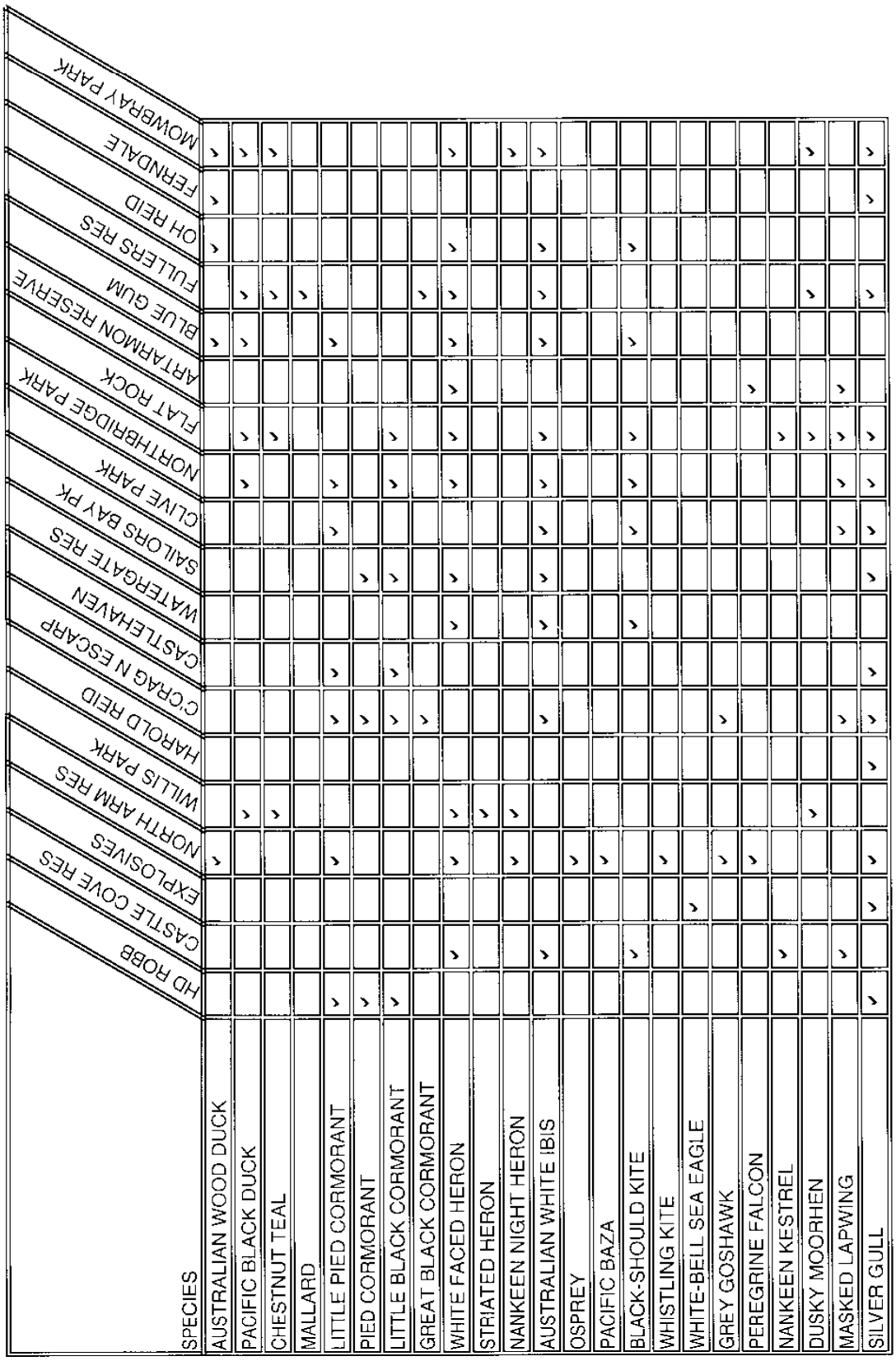
Appendix 1: Fauna Records provided by other observers

	DATE	LOCATION	TYPE	SPECIES	RECORDERS
1	10-Oct-00	Holmes Reserve	Scat	Fox scat-no other ident. fur.	Phil Sarkies
2	14-Oct-00	67 The Bulwark Cas'crag	Sighting	Golden Crown Snake	James Smallhorn
3	24-Oct-00	Castlehaven Reserve	Sighting	2 Ringtail Possums	James Smallhorn
4	25-Oct-00	Blue Gum Reserve	feathers	Currawong	Phil Sarkies
5	25-Oct-00	Artarmon Reserve	Sighting	Weasel Skink	Andrew James
6	25-Oct-00	Artarmon Reserve	Sighting	Wall Skinks	Andrew James
7	25-Oct-00	Artarmon Reserve	Sighting	Common Eastern Froglets	Andrew James
8	25-Oct-00	Artarmon Reserve	Sighting	Eastern Water Skink	Andrew James
9	25-Oct-00	Artarmon Reserve	Sighting	Striped Marsh frog	Andrew James
10	25-Oct-00	Scotts Creek	Sighting	Eastern Water Dragon	Erika Klimpsch
11	26-Oct-00	Monkey Rocks	Bones	Ibis	Phil Sarkies
12	27-Oct-00	4 Greenfield Ave	Sighting	Common Eastern Froglets	Andrew James
13	27-Oct-00	Artarmon Reserve	Sighting	Green Tree Snake	James Smallhorn
14	30-Oct-00	Below 209 Edinburgh Rd	Heard	Sugar Glider	Lorraine Cairnes
15	30-Oct-00	Aboriginal Cave	Sighting	Sugar Glider	David Watts
16	31-Oct-00	Artarmon Reserve	Sighting	Eastern Water Skink	WCC 176
17	31-Oct-00	Artarmon Reserve	Heard	Striped Marsh frog	WCC 176
18	31-Oct-00	Castlehaven Reserve	Sighting	Red Bellied Black Snake	WCC 176
19	31-Oct-00	Coolaroo Reserve	Sighting	Eastern Long-necked Turtle	Nathan Smith
20	31-Oct-00	Mowbray Park-Ulm St	Feathers	Eastern Rosella	Phil Sarkies
21	31-Oct-00	Mowbray Park-Ulm St	Scat	Fox scat-mouse hairs	Phil Sarkies
22	31-Oct-00	Mowbray Park-Ulm St	Scat	Fox scat-no other hairs	Phil Sarkies
23	1-Nov-00	Mowbray Boardwalk	Scat	Black rat	Andrew James
24	1-Nov-00	Mowbray Boardwalk	Bones	Leaf-tail Gecko	Andrew James
25	1-Nov-00	Mowbray Boardwalk	Feathers	Currawong	Andrew James
26	1-Nov-00	Fullers Bridge	Fur	Ringtail Possum	Rachel Eckhard
27	1-Nov-00	Fullers Bridge	Owl Pellets	Ringtail Possum	Rachel Eckhard
28	1-Nov-00	Fullers Bridge	Scat	Swamp Wallaby	Rachel Eckhard
29	1-Nov-00	Fullers Bridge	Scat	Fox Scat-no other hairs	Rachel Eckhard
30	1-Nov-00	Artarmon Reserve	Sighting	Superb Blue Wren	James Smallhorn
31	1-Nov-00	Artarmon Reserve	Sighting	Eastern Water Skink	James Smallhorn
32	2-Nov-00	Willis Park	Sighting	Eastern Water Dragon	M. Wilson
33	2-Nov-00	Willis Park	Sighting	Eel	M. Wilson
34	2-Nov-00	Willis Park	Sighting	Unknown lizard	M. Wilson
35	2-Nov-00	Flat Rock Gully	Fur	Ringtail Possum	Simon Brown
36	2-Nov-00	Millwood Ave-compost	Scat	Fox-no other hairs	Jamie Wright
37	2-Nov-00	Millwood Ave-compost	Skin	Red Bellied Black Snake	Jamie Wright
38	2-Nov-00	Millwood Ave-compost	Owl Pellets	Ringtail Possum	Jamie Wright
39	3-Nov-00	Castlehaven Reserve	Sighting	Ringtail Possum	James Smallhorn
40	3-Nov-00	Castlehaven Reserve	Sighting	Eastern Water Dragon	James Smallhorn
41	3-Nov-00	Sugarloaf Creek	Sighting	Red Bellied Black Snake	WCC 176
42	3-Nov-00	Sugarloaf Creek	Sighting	Ringtail Possum	WCC 176
43	3-Nov-00	Artarmon Reserve	Skin	Snake unidentified	WCC 176
44	3-Nov-00	Artarmon Reserve	Skin	Green Tree Snake	WCC 176

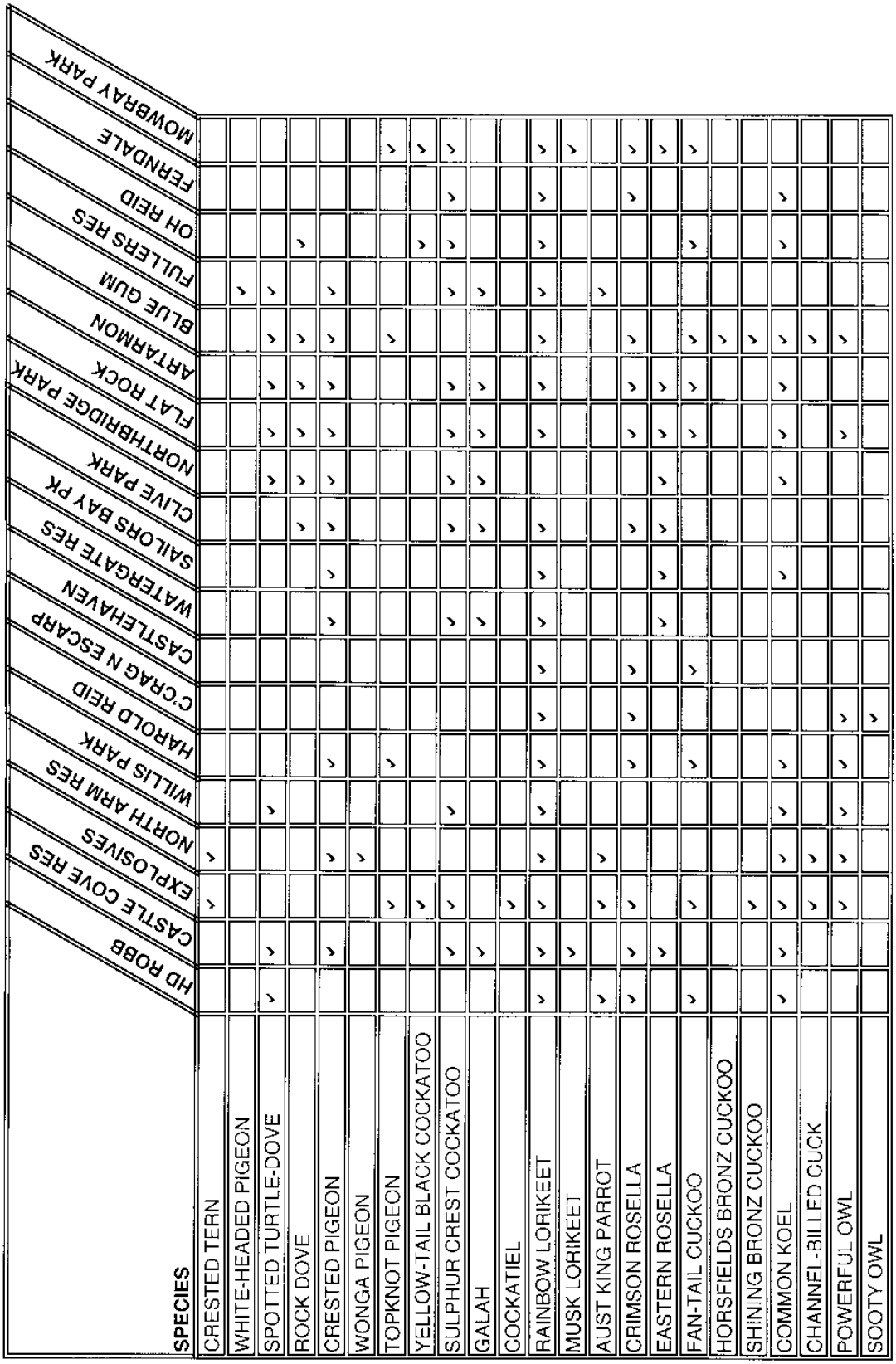
	DATE	LOCATION	TYPE	SPECIES	RECORDERS
45	5-Nov-00	Greenfield Ave,Middle Cve	Sighting	Eastern Blue Tongue Lizard	Cameron Bennell
46	6-Nov-00	High St (Scotts Ck)	Heard	Striped Marsh Frog	Nathan Smith
47	6-Nov-00	High St (Scotts Ck)	Carcass	Black Rat	Nathan Smith
48	6-Nov-00	Explosives Res.-track	Scat	Fox - no other hairs	R. Wilkinson
49	6-Nov-00	Holly Street Burn Area	Scat	Fox - no other hairs	Phil Sarkies
50	6-Nov-00	Holly Street Burn Area	Fur	Ringtail Possum	Phil Sarkies
51	6-Nov-00	Holly Street Burn Area	Scat	Brushtail Possum	Phil Sarkies
52	6-Nov-00	Holly Street Burn Area	Scat	Brushtail Possum	Phil Sarkies
53	6-Nov-00	Holly Street Burn Area	Scat	Ringtail Possum	Phil Sarkies
54	6-Nov-00	Holly Street Burn Area	Scat	House Mouse	Phil Sarkies
55	7-Nov-00	Ferndale Park-Greville St.	Sighting	Leaf-tail Gecko	Cameron Bennell
56	7-Nov-00	Edinburgh Rd-near shops	Sighting	Sooty Owls	resident
57	8-Nov-00	North Arm Track	Sighting	Ringtail Possum	Andrew James
58	8-Nov-00	Sugarloaf Creek	Sighting	Ringtail Possum	Andrew James
59	8-Nov-00	North Arm Track	Sighting	Eastern Water Skink	Andrew James
60	8-Nov-00	North Arm Track	Fur	Brushtail Possum	Trin Pham
61	9-Nov-00	Ferndale Park-Greville St.	Scat	Currawong Scat	
62	9-Nov-00	Holly Street Burn Area	Scat	Fox Scat + plant remains	Rachel Eckhard
63	9-Nov-00	Holly Street Burn Area	Scat	Currawong Scat	Rachel Eckhard
64	10-Nov-00	Clive Park	Sighting	Eastern Water Dragon	Andrew James
65	10-Nov-00	Warners Park	Sighting	Eastern Blue-tongue Lizard	Andrew James
66	10-Nov-00	Warners Park	Sighting	Weasel Skink	Andrew James
67	10-Nov-00	Artarmon Park	Sighting	Eastern Water Skink	Andrew James
68	14-Nov-00	375 Edinburgh Rd C'crag	Sighting	Diamond Python	Katie Cooney
69	16-Nov-00	Linden Way Res	Carcass	Eastern Blue-tongue Lizard	Andrew James
70	17-Nov-00	North Arm Walk	Scat	Fox scat with feathers	
71	21-Nov-00	E Valley Way-ReidsDrain	Scat	Brushtail Possum	Rachel Eckhard
72	21-Nov-00	E Valley Way-ReidsDrain	Bones	Eastern Water Skink	Rachel Eckhard
73	21-Nov-00	Ferndale Park.	Sighting	Eastern Water Dragon	Di Eva
74	21-Nov-00	Mowbray Park	Sighting	Eastern Water Skink	R. Wilkinson
75	21-Nov-00	Mowbray Park	Sighting	Eastern Water Dragon	R. Wilkinson
76	23-Nov-00	Wreck Bay Walking Track	Scat	Ringtail Possum	
77	23-Nov-00	Holly Street Burn Area	Fur	Ringtail Possum	Phil Sarkies
78	23-Nov-00	Holly Street Burn Area	Fur	Brushtail Possum	Phil Sarkies
79	23-Nov-00	Wreck Bay Track	Sighting	Eastern Water Dragon	Di Eva
80	23-Nov-00	11 The Lee Middle Cove	Sighting	Green Tree Snake	Hazel Johnson
81	24-Nov-00	Glenaeon School	Scat	Ringtail Possum	R. Wilkinson
82	27-Nov-00	Cammeray Rd C.Crag	Sighting	Brown Snake ?	R. Wilkinson
83	29-Nov-00	Harold Reid Reserve	Sighting	Echidna	J. George
84	1-Dec-00	Eastern Valley Way	Scat	Fox scat with ringtail fur	
85	8-Dec-00	Eastern Valley Way	Bones	Ringtail Possum	
86	10-Dec-00	Camp Creek	Sighting	Powerful Owl	Michael Dickson
85	18-Dec-00	H.D. Robb	Scat	Fox scat with ringtail fur	Phil Sarkies
86	18-Dec-00	H.D. Robb	Scat	Fox scat no other hair	Phil Sarkies
87	18-Dec-00	H.D. Robb	Scat	Fox scat -E.Water Skink bones	Phil Sarkies
88	Jan-01	Explosives Res.-track	Sighting	Lace Monitor	Andrew Souter
89	Dec. 1999	70-72 Sugarloaf Cres	Sighting	Echidna	Craig Bohm (AMCS)
90	Dec. 1999	70-72 Sugarloaf Cres	Sighting	Rattus fuscipes?	Craig Bohm (AMCS)
91	Dec. 1999	70-72 Sugarloaf Cres	Sighting	Ringtail Possum	Craig Bohm (AMCS)

	DATE	LOCATION	TYPE	SPECIES	RECORDERS
92	Dec. 1999	70-72 Sugarloaf Cres	Sighting	Brushtail Possum	Craig Bohm (AMCS)
93	Dec. 1999	70-72 Sugarloaf Cres	Sighting	Eulamprus tenuis	Craig Bohm (AMCS)
94	Dec. 1999	70-72 Sugarloaf Cres	Sighting	Cryptoblepharus virgata	Craig Bohm (AMCS)
95	Dec. 1999	70-72 Sugarloaf Cres	Sighting	Eulamprus quoyii	Craig Bohm (AMCS)
96	Dec. 1999	70-72 Sugarloaf Cres	Sighting	Lampropholis guichenoti	Craig Bohm (AMCS)
97	Dec. 1999	70-72 Sugarloaf Cres	Sighting	Lampropholis delicata	Craig Bohm (AMCS)
98	Dec. 1999	70-72 Sugarloaf Cres	Sighting	Phyllurus platurus	Craig Bohm (AMCS)
99	Dec. 1999	70-72 Sugarloaf Cres	Sighting	Physignathus lesueuri	Craig Bohm (AMCS)
100	Dec-00	Sugarloaf Creek	Sighting	Red-bellied Black Snake	James Smallham
101	Dec-00	67 Sunnyside Cres	Sighting	Tiliqua scincoides	Gay Spies
102	1987	56 Sugarloaf Cres	Sighting	Pseudechis textilies	Gay Spies
103	1977	66 Sugarloaf Cres	Sighting	Dendrolaphis puncatus	Gay Spies
104	1996	66 Sugarloaf Cres	Sighting	Dendrolaphis puncatus	Gay Spies
105	1991	66 Sugarloaf Cres	Sighting	Varanus varius	Gay Spies
106	2000	67 The Bulwark	Sighting	Cacophis squamulosus	Dr Chambers
107	2000	78 The Bulwark	Sighting	Cacophis squamulosus	Louise Mitchell
108	Dec-00	Artarmon Reserve	Body	Golden Crown Snake	James Smallhorn

Appendix 2: Summary Fauna Tables.

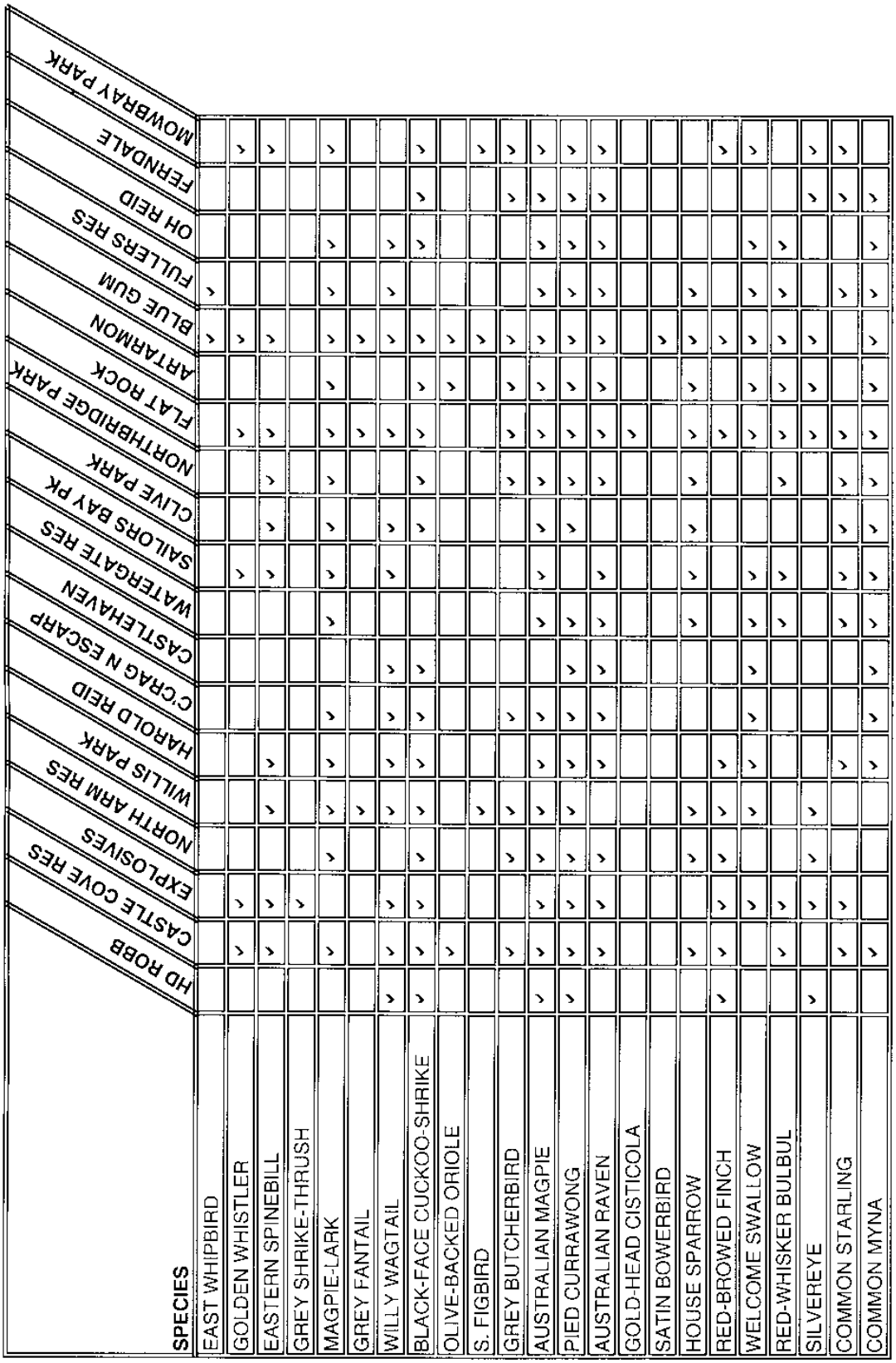


SPECIES	HD ROBB	CASTLE COVE RES	EXPLOSIVES	NORTH ARM RES	WILLIS PARK	HAROLD REID	C.CRAG N ESCARP	CASTLEHAVEN	WATERGATE RES	SAILORS BAY PK	CLIVE PARK	NORTHBRIDGE PARK	FLAT ROCK	ARTARMON RESERVE	BLUE GUM	FULLERS RES	OH REID	FERNDALE	MOWBRAY PARK
AUSTRALIAN WOOD DUCK				✓											✓		✓	✓	✓
PACIFIC BLACK DUCK					✓							✓			✓	✓		✓	✓
CHESTNUT TEAL					✓										✓	✓			✓
MALLARD															✓	✓			
LITTLE PIED CORMORANT	✓			✓		✓	✓	✓		✓	✓	✓		✓					
PIED CORMORANT	✓					✓			✓			✓							
LITTLE BLACK CORMORANT	✓						✓		✓		✓	✓							
GREAT BLACK CORMORANT						✓								✓		✓			
WHITE FACED HERON		✓		✓	✓			✓	✓			✓	✓	✓		✓	✓		✓
STRIATED HERON					✓														
NANKEEN NIGHT HERON				✓	✓														✓
AUSTRALIAN WHITE IBIS		✓				✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	
OSPREY			✓				✓												
PACIFIC BAZA			✓																
BLACK-SHOULD KITE		✓						✓		✓	✓	✓			✓	✓			
WHISTLING KITE			✓																✓
WHITE-BELL SEA EAGLE				✓															
GREY GOSHAWK			✓			✓													
PEREGRINE FALCON			✓										✓						
NANKEEN KESTREL		✓										✓							
DUSKY MOORHEN					✓							✓	✓		✓				✓
MASKED LAPWING		✓				✓				✓	✓	✓	✓						
SILVER GULL	✓		✓	✓		✓	✓		✓	✓	✓	✓						✓	✓

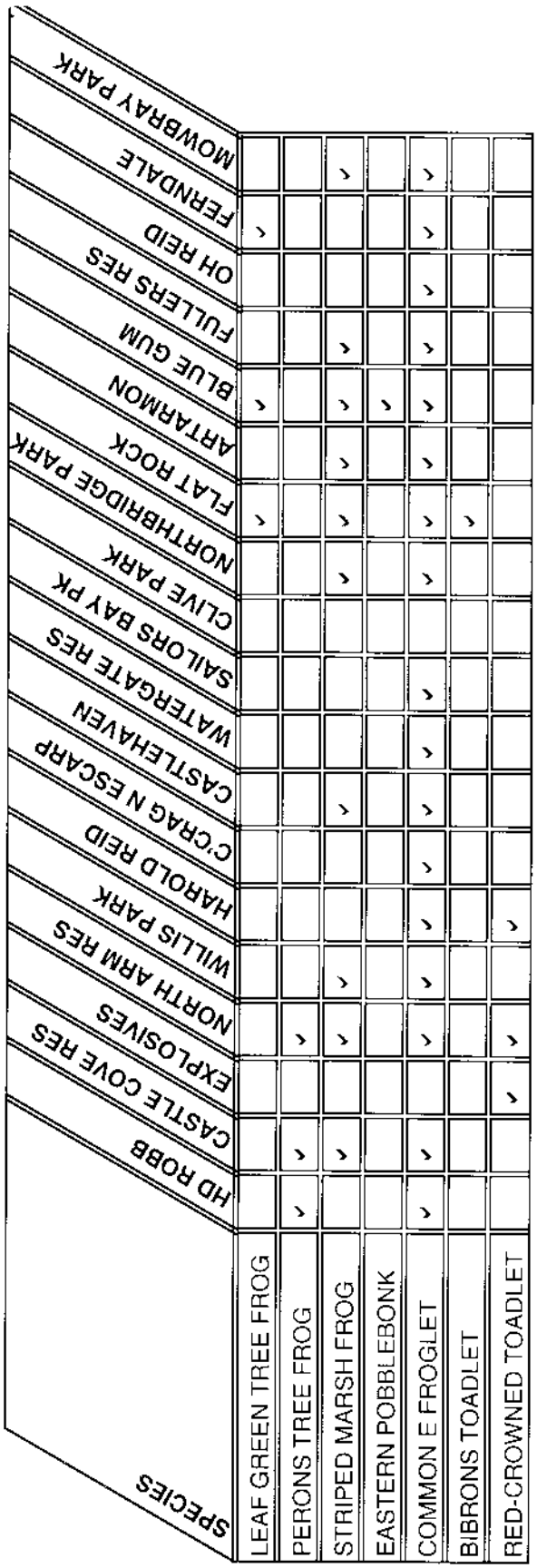


SPECIES	HD ROBB	CASTLE COVE RES	EXPLOSIVES	NORTH ARM RES	WILLIS PARK	HAROLD REID	C.CRAG N ESCARP	CASTLEHAVEN	WATERGATE RES	SAILORS BAY PK	CLIVE PARK	NORTHBRIDGE PARK	FLAT ROCK	ARTARMON	BLUE GUM	FULLERS RES	OH REID	FERNDALE	MOWBRAY PARK
CRESTED TERN	✓	✓		✓															
WHITE-HEADED PIGEON															✓				
SPOTTED TURTLE-DOVE	✓	✓		✓							✓	✓	✓	✓	✓				
ROCK DOVE											✓	✓	✓	✓		✓			
CRESTED PIGEON		✓		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓				
WONGA PIGEON				✓															
TOPKNOT PIGEON		✓				✓									✓				✓
YELLOW-TAIL BLACK COCKATOO		✓														✓	✓		✓
SULPHUR CREST COCKATOO		✓		✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
GALAH		✓						✓	✓	✓	✓	✓	✓	✓					
COCKATIEL			✓																
RAINBOW LORIKEET	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
MUSK LORIKEET		✓													✓				
AUST KING PARROT	✓		✓		✓											✓			
CRIMSON ROSELLA	✓	✓	✓		✓	✓	✓			✓	✓		✓	✓	✓		✓		
EASTERN ROSELLA		✓							✓	✓	✓	✓	✓	✓				✓	
FAN-TAIL CUCKOO	✓		✓		✓	✓	✓						✓	✓			✓		
HORSFIELDS BRONZ CUCKOO			✓											✓					
SHINING BRONZ CUCKOO														✓					
COMMON KOEL	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓			✓		
CHANNEL-BILLED CUCK			✓											✓					
POWERFUL OWL			✓	✓	✓	✓	✓					✓							
SOOTY OWL							✓												

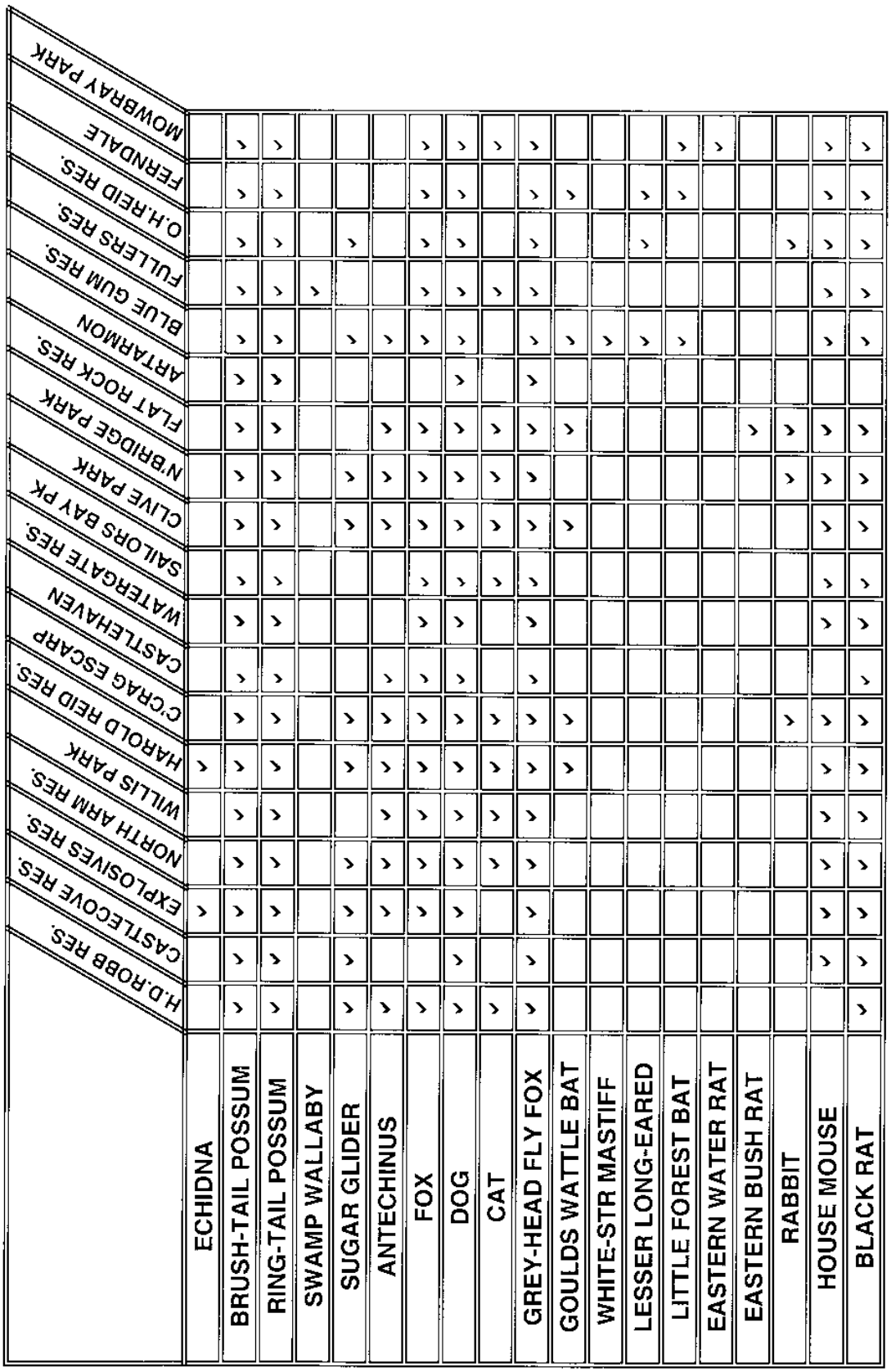
SPECIES	HD ROBB	CASTLE COVE RES	EXPLOSIVES	NORTH ARM RES	WILLIS PARK	HAROLD REID	C.CRAG N ESCARP	CASTLEHAVEN	WATERGATE RES	SAILORS BAY PK	CLIVE PARK	NORTHBRIDGE PARK	FLAT ROCK	ARTARMON	BLUE GUM	FULLERS RES	OH REID	FERNDALE	MOWBRAY PARK
SOUTHERN BOOBOOK OWL		✓	✓		✓	✓	✓							✓				✓	✓
TAWNY FROGMOUTH			✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
AUSTRALIAN OWLET-NIGHTJAR																		✓	
WHITE-THROAT NEEDLE					✓								✓						
LAUGH KOOKABURRA	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SACRED KINGFISHER				✓														✓	
DOLLARBIRD			✓									✓		✓			✓		
SUPERB FAIRY-WREN	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VARIEGATED FAIRY-WREN		✓										✓	✓						
SPOTTED PARDALOTE			✓									✓	✓	✓	✓	✓			
WH-BROW SCRUB WREN			✓	✓		✓				✓		✓	✓	✓	✓				
BROWN GERYGONE													✓				✓	✓	
BROWN THORNBILL		✓	✓									✓		✓	✓	✓	✓	✓	
YELLOW THORNBILL															✓				
RED WATTLEBIRD	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
LITTLE WATTLEBIRD				✓										✓				✓	
NOISY FRIARBIRD		✓		✓											✓			✓	
NOISY MINER	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
LEWINS HONEYEATER															✓		✓		✓
YELLOW-FACED HONEYEATER													✓	✓	✓				
NEW HOLLAND HONEYEATER		✓		✓						✓		✓		✓	✓	✓			
WHITE-CHEEK HONEYEATER			✓																
EAST YELLOW ROBIN			✓	✓	✓	✓						✓			✓			✓	



SPECIES	HD ROBB	CASTLE COVE RES	EXPLOSIVES	NORTH ARM RES	WILLIS PARK	HAROLD REID	C.CRAG N ESCARP	CASTLEHAVEN	WATERGATE RES	SAILORS BAY PK	CLIVE PARK	NORTHBRIDGE PARK	FLAT ROCK	ARTARMON	BLUE GUM	FULLERS RES	OH REID	FERNDALE	MOWBRAY PARK
EAST WHIPBIRD															✓				
GOLDEN WHISTLER		✓	✓						✓					✓	✓			✓	✓
EASTERN SPINEBILL		✓	✓	✓	✓	✓			✓	✓	✓	✓		✓	✓				
GREY SHRIKE-THRUSH			✓																
MAGPIE-LARK		✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
GREY FANTAIL				✓	✓							✓						✓	
WILLY WAGTAIL	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓			
BLACK-FACE CUCKOO-SHRIKE	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓		✓			
OLIVE-BACKED ORIOLE		✓											✓	✓					
S. FIGBIRD				✓	✓									✓					
GREY BUTCHERBIRD		✓	✓	✓	✓	✓	✓				✓	✓	✓	✓			✓	✓	
AUSTRALIAN MAGPIE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
PIED CURRAWONG	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
AUSTRALIAN RAVEN		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	
GOLD-HEAD CISTICOLA													✓						
SATIN BOWERBIRD														✓	✓				
HOUSE SPARROW		✓		✓	✓				✓	✓	✓	✓	✓	✓	✓	✓			
RED-BROWED FINCH	✓	✓	✓	✓	✓	✓						✓	✓	✓	✓				
WELCOME SWALLOW		✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		
RED-WHISKER BULBUL		✓	✓						✓			✓	✓	✓	✓	✓			
SILVEREYE	✓		✓	✓	✓							✓	✓	✓	✓		✓	✓	
COMMON STARLING		✓	✓			✓			✓	✓	✓	✓				✓	✓	✓	✓
COMMON MYNA		✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	



SPECIES	HD ROBB	CASTLE COVE RES	EXPLOSIVES	NORTH ARM RES	WILLIS PARK	HAROLD REID	C.CRAG N ESCARP	CASTLEHAVEN	WATERGATE RES	SAILORS BAY PK	CLIVE PARK	NORTHBRIDGE PARK	FLAT ROCK	ARTARMON	BLUE GUM	FULLERS RES	OH REID	FERNDALE	MOWBRAY PARK
LEAF GREEN TREE FROG													✓		✓			✓	
PERONS TREE FROG	✓	✓		✓	✓								✓						
STRIPED MARSH FROG		✓		✓			✓					✓	✓		✓				✓
EASTERN POBBLEBONK															✓				
COMMON E FROGLET	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
BIBRONS TOADLET													✓						
RED-CROWNED TOADLET		✓	✓		✓														



	H.D.ROBB RES.	CASTLECOVE RES.	EXPLOSIVES RES.	NORTH ARM RES.	WILLIS PARK	HAROLD REID RES.	C.CRAG ESCARP	CASTLEHAVEN	WATERGATE RES.	SAILORS BAY PK	CLIVE PARK	N.BRIDGE PARK	FLAT ROCK RES.	ARTARMON	BLUE GUM RES.	FULLERS RES.	O.H.REID RES.	FERNDALE	MOWBRAY PARK
ECHIDNA			✓			✓													
BRUSH-TAIL POSSUM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RING-TAIL POSSUM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SWAMP WALLABY															✓				
SUGAR GLIDER	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓		✓			
ANTECHINUS	✓		✓	✓	✓	✓	✓			✓	✓	✓		✓					
FOX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DOG	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CAT	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GREY-HEAD FLY FOX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GOULDS WATTLE BAT					✓	✓				✓		✓		✓			✓	✓	✓
WHITE-STR MASTIFF														✓					
LESSER LONG-EARED														✓			✓		
LITTLE FOREST BAT														✓			✓	✓	
EASTERN WATER RAT																			
EASTERN BUSH RAT												✓							
RABBIT						✓				✓	✓	✓		✓		✓			
HOUSE MOUSE	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
BLACK RAT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓