

**STAPLETON PARK
PLAN OF MANAGEMENT**



PITTWATER COUNCIL

July 1995

Landuse Planning Table (Adopted for this plan by Council 12/2/2001)

| Permissible Uses Exempt (these may be subject to approval under Part 5 of the EPA Act 1979) | Permissible Uses Requiring Development Consent | Prohibited Uses |
|---|--|--|
| Bush regeneration, habitat restoration and weed control | Utility installations and similar | Extractive industries and agriculture |
| Fire hazard reduction activities | Buildings ancillary or incidental to the reserve | Sporting facilities |
| Ecological burns | Major public drainage works | Permanent private access across a reserve |
| Multi-use tracks other than motor vehicle | Major rock / soil stabilization works and earthworks | Commercial signage |
| Boardwalks and minor bridges | Major facilities (not buildings) being viewing platforms, bridges, educational facilities and the like | Dumping of refuse (including building materials, soil, fill, household wastes, etc.) |
| Temporary activities or developments requiring a lease or licence under the Local Government Act (1993) | Commercial Eco-tourism Activities | Vegetation removal not in accordance with Councils Tree Preservation and Management Order |
| Appropriate sustainable low impact recreation activities and facilities (other than buildings) | Vehicle access (emergency access, fire breaks and service trails). | Private alienation or encroachment |
| Minor public drainage and stormwater works | | Introduction of exotic flora and fauna |
| Minor fences | | Playground facilities |
| Compliance, directional, interpretive, identification and safety signs | | Flood structures (damming and reduction of environmental flows) |
| Environmental education activities | | Removal of habitat features such as soil, leaf litter, rocks, stones, pebbles and the like |
| Any use as permitted under Council's Tree Preservation and Management Order | | Recreational motor sports (including 4 wheel driving, motorbike riding, etc.) |
| Minor rock works and earthworks associated with soil stabilization and erosion control | | Domestic drainage outlets |
| Any activity as defined in Management Plans consistent with the core objectives and management objectives | | Horse riding facilities |
| Feral animal control and eradication. | | Unleashed dog exercise areas |
| Biodiversity recovery and enhancement | | Water extraction |

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Executive Summary

Stapleton Park is a remnant bushland reserve located in the suburb of Avalon, on the ridge crest and slopes on either side of Riviera Avenue. The Park is owned and managed by Pittwater Council. In 1988, when the Park was managed by Warringah Shire Council, a bushland survey of the Park was undertaken by The National Trust of Australia (NSW). Subsequent to that survey, bush regeneration work has been carried out in the Park by professional bush regeneration contractors under Council's supervision.

The Park is an area of urban bushland and is subject to State Environmental Planning Policy No 19. As an area of community land the Park is also subject to certain provisions of the Local Government Act 1993. These include requirements to categorise the land, and to prepare a plan of management which sets performance targets, means of achieving the targets and measures to assess performance.

Land Category

Stapleton Park is categorised as a natural area in terms of the Local Government Act 1993, and includes areas of bushland and watercourse.

Significance

Stapleton Park has significance as an example of the urban bushland in Sydney, which is one of few major cities in the world with substantial areas of natural bushland.

Urban bushland areas throughout the Sydney region are significant because :

- ❖ they contribute to the landscape quality of the city,
- ❖ they provide habitat for plants and animals, which would otherwise become regionally extinct,
- ❖ they provide a corridor for the movement of migratory and nomadic animals, particularly birds, through the urban area,
- ❖ they provide an educational resource and the first contact point with nature for many urban residents,
- ❖ they enable urban residents to undertake recreational pursuits in a bushland setting,
- ❖ they are important for scientific studies, providing a record of the original landscape and vegetation and the changes wrought by urban development.

Stapleton Park has particular significance because :

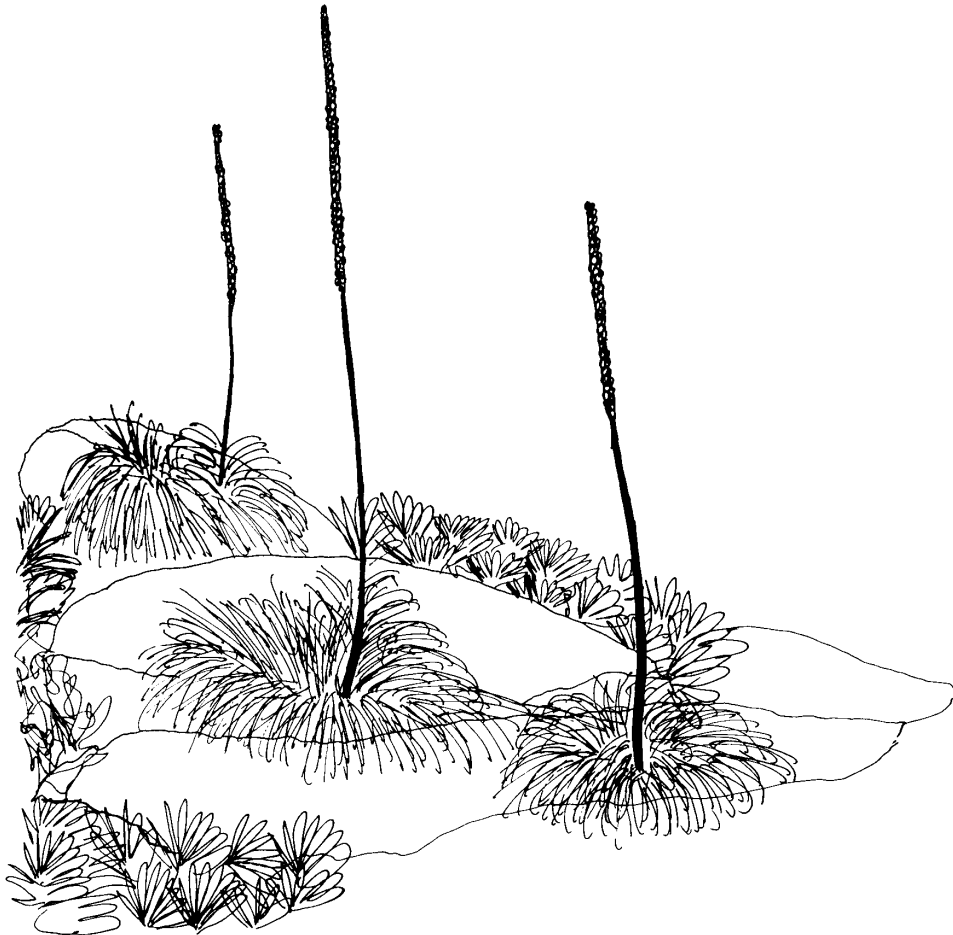
- ❖ it includes samples of Spotted Gum Forest, a community which is characteristic of the Pittwater area and which is inadequately conserved in New South Wales,
- ❖ it protects populations of one plant species which has regional conservation significance; *Craspedia variabilis*,
- ❖ it protects populations of two plant species with local significance; Bolworra (*Eupomatia laurina*) and Port Jackson Cypress (*Callitris rhomboidea*),
- ❖ it provides suitable habitat and food trees for four fauna species considered to be of special conservation significance, Koalas, Long-nosed Bandicoots, Squirrel Gliders and Glossy Black-cockatoos,
- ❖ it supports a population of the Long-nosed Bandicoot, a once widespread species which has become rare in the Sydney metropolitan area,
- ❖ it is an important refuge for the local Koala colony. This species is listed as Vulnerable and Rare on Part 2 of Schedule 12 of the National Parks and Wildlife Act and is under considerable threat of local extinction,
- ❖ it has a range of fauna despite its small size and considerable edge disturbance. It is particularly important for the on-going maintenance of the Barrenjoey Peninsula's populations of Long-nosed Bandicoots, Koalas, gliders and insectivorous birds,
- ❖ it is one of the few urban bushland sites in the Sydney region which exhibits a lack of disturbance and which occurs on a ridge crest not subject to urban run-off, making it valuable as a reference site.

Management Objectives

The management objectives for Stapleton Park are :

- ❖ to protect the natural features of the Park, particularly populations of significant plant species and communities and animal species listed in this Plan; namely, *Craspedia variabilis*, Port Jackson Cypress, Spotted Gum Forest, Koala, Long-nosed Bandicoot and Squirrel Glider,
- ❖ to prevent weed invasion and control weed species occurring in the Park,
- ❖ to minimise dieback of eucalypts and angophoras in the Park,
- ❖ to maintain a natural range of structural and floristic diversity of bushland within the Park,
- ❖ to maintain and enhance suitable habitat for significant fauna species within and adjacent to the Park,

- ❖ to prevent damage to the Park from urban run-off and stormwater,
- ❖ to protect human life and property in and adjacent to the Park from wildfire and maintain ecological processes in the Park by seeking to maintain a near-natural fire regime in the body of the Park,
- ❖ to control and eradicate where possible feral animals within the Park,
- ❖ to provide opportunities for low impact recreational and educational use of the Park, consistent with other objectives,
- ❖ to encourage community and neighbour participation in bushland management.



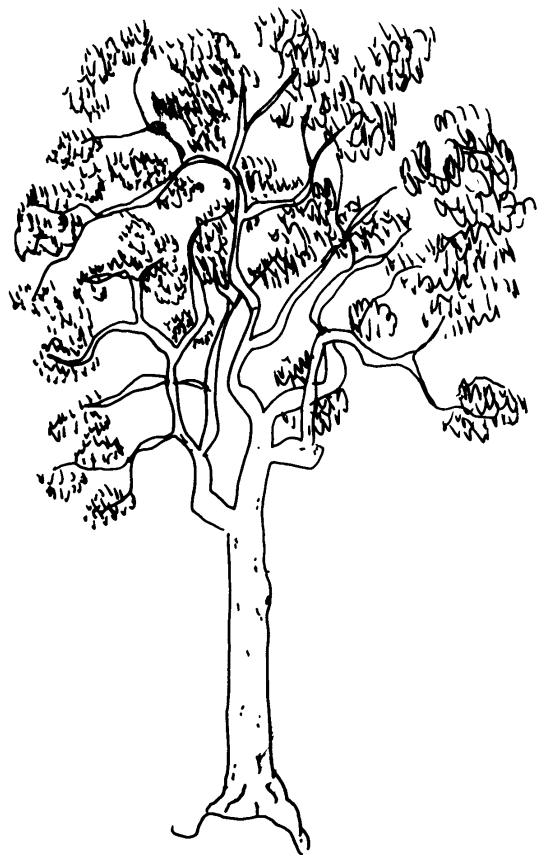
1.0 Introduction

Stapleton Park is an important area of remnant bushland in Avalon, which has provided habitat for Pittwater's koala population. The Park is heavily vegetated by woodland and forest and straddles an east-west ridgeline, with steep south and north facing slopes. The Park is particularly important as a reference site as it is free of the problems of urban development in the catchment which plague other urban bushland reserves in the Sydney region.

Stapleton Park includes lands reserved under the County of Cumberland Planning Scheme in the 1950's and subsequent open space contributions from subdivisions in the area. The Park is now owned and administered by Pittwater Council. The Park has been known locally as 'The Sanctuary' for a considerable period.

Warringah Shire Council, who then owned the Park, commissioned the National Trust to carry out a bushland survey of the Park in 1988. Bush regeneration work commenced in the Park and was carried out by the National Trust from 1989 - 1991 and from 1992-94 was carried out by the Sydney Bush Regeneration Company under contract to Pittwater Council.

This Draft Plan of Management has been prepared to guide the Council's management of the Park, to provide a basis for future bushland regeneration work in the Park and to plan for future recreational use of the Park.



2.0 Planning Context

2.1 Plans of Management for Community Land

The Local Government Act 1993 (Section 36) requires that Council prepare a draft plan of management for community land. Such a plan must identify :

- ❖ the category of the land;
- ❖ the objectives and performance targets of the plan with respect to the land;
- ❖ the means by which these objectives and performance targets will be achieved;
- ❖ the methods which will be used to assess whether performance targets and objectives are being achieved.

In terms of Section 36 (4) of the Local Government Act, Stapleton Park falls within the natural area category and can be further categorised as including areas of bushland and watercourse.

2.2 State Environmental Planning Policy No 19

State Environmental Planning Policy No 19 - Bushland in Urban Areas was made to protect remnant bushland in urban areas within New South Wales. The Policy applies to land zoned or reserved as Public Open Space. Under the Policy Councils may prepare plans of management for bushland areas within such land. Circular No B13 of the Department of Planning states that a management plan should :

- ❖ describe the bushland in light of the aims and objectives of the Policy;
- ❖ include measures to enable the recreational use of bushland, where appropriate;
- ❖ specify the intended methods of bushfire hazard reduction,
- ❖ specify measures to prevent bushland degradation and restore degraded areas.

The Department has also published management guidelines for urban bushland. The guidelines identify the need to prepare a resource inventory of the bushland area, to identify management objectives and strategies, and to derive an action plan for the bushland.

2.3 Local Environmental Plan

The Pittwater Local Environmental Plan 1993 zones Stapleton Park as 6(a) Existing Recreation.



3.0 Park Description

3.1 Location, Description & History

Stapleton Park occupies an area of just over 8 hectares in the suburb of Avalon. The Park straddles an east-west ridge extending down steep north and south facing slopes on either side of the ridge. There are some parts of the Park with moderate slopes, notably the ridge south of Riviera Avenue.

Riviera Avenue bisects the park along the ridgeline. The north-east corner of the Park borders the junction of Kevin and Park Avenues. The southern boundary runs above residences which front Burrendong Place and Nandina Terrace.

Stapleton Park was occupied by aboriginal people of the Guringai group. Aboriginal people lived in the area for several thousand years prior to 1788.

The Park was part of an area of 1 200 hectares granted to Rev J.J Therry in 1833. The area including the Park remained largely undeveloped over the years and has been known locally as 'The Sanctuary'. Early in the 1900's the area was known as Crowley's Hill. At this time it was owned by the Sydney Mutual Insurance Company. The area remained a rough bush block. There is no evidence that it was used for grazing, however some timber extraction may have taken place in accessible areas. The Park's name arises from the real estate developer, Stapleton and Company. The Park reserves much of the area of least capability for urban development, nevertheless it includes one of few ridge crests protected within an urban

bushland park in the Pittwater Council area.

The Park consists of several parcels of land. Portions 13, 14 & 15 in DP 404581, Riviera Avenue, and Lots 44 and 46 in DP 21259, Park Avenue, were acquired from the County of Cumberland in 1957 and 1958 for the purposes of dedication as a reserve for public recreation. Further residential subdivision of the area around Stapleton Park which took place in 1964 and 1965 resulted in the addition of Lot 45 in DP 21259, Park Avenue, and Lot 18 in DP 231634, Burrendong Place. These were open space contributions of the respective subdivisions.

3.2 Topography, Geology, Soils and Land Units

Elevation ranges from 30 to 115 metres above sea level. Typical slopes in the Park are about 25%, with flatter areas on the northern spur where slope averages about 15%. The ridge crest along Riviera Avenue is the only flat part of the Park with slopes of less than 10%.

The ridge crest geology is Hawkesbury sandstone of medium to coarse grained quartz sandstone, with very minor shale and laminite lenses. A short distance downslope the Narrabeen shales and sandstones of the Newport Formation outcrop. These sediments underlie most of the Park.

Soils on Hawkesbury sandstone geology are generally, shallow, stony, highly permeable and of low fertility. Soils on Narrabeen shales are fine-grained, of moderate fertility and classed as part of the Watagan soil landscape.

3.3 Vegetation

A survey of the Park by the National Trust (1988) found that three different plant communities occur in the Park. These are Spotted Gum (*Eucalyptus maculata*) / Grey Ironbark (*E. paniculata*) Open-forest; Smooth-barked Apple (*Angophora costata*) / Sydney Peppermint (*E. piperita*) Open-forest / Woodland and Rainforest elements. The latter community described by the National Trust reflected a characteristic of the understorey strata, rather than the dominant species in the canopy.

The Sydney Bush Regeneration Company prepared a more detailed breakdown of the vegetation of the Park. They used the National Trust classification as a basis for their classification with the three primary communities listed above. Each primary community was subdivided into sub-classes: five sub-classes within the Spotted Gum / Grey Ironbark community; three within the Smooth-barked Apple / Sydney Peppermint community and two within the Rainforest Elements map unit. The sub-classes apparently represented understorey characteristics.

As part of the studies towards the preparation of this Plan a flora survey of the Park was undertaken. Field surveys of the Park took place from May to June 1994. Aerial photograph interpretation was undertaken to identify plant communities present in the Park. Colour aerial photographs at a scale of 1 : 16 000 dated 07/02/91 were used in the interpretation. As a result of this work and previous surveys it was decided that the plant communities present in the Park could be best described as three communities : Spotted Gum Forest, Stapleton

Sandstone Ridgetop Woodland and Vine Scrub. The Spotted Gum Forest can be further divided into two understorey types, the first with rainforest components and the second, grassy. Descriptions of these plant communities are provided below.

Spotted Gum Forest

Spotted Gum Forest occurs widely on the slopes within the Park. Dominant tree species are Spotted Gum (*Eucalyptus maculata*) and Grey Ironbark (*E. paniculata*). Associated canopy tree species include Turpentine (*Syncarpia glomulifera*) and Red Mahogany (*E. resinifera*). Tree height averages 25 metres. There is a broad area close to the ridge crest where sandstone and shale species appear to intermix.

This community corresponds to community 5 of Thomas and Benson (1985), namely Open-forest on shales of the Narrabeen Group dominated by Spotted Gum and Grey Ironbark.

Understorey with rainforest components

In areas of Spotted Gum Forest with south-facing aspects and sheltered gullies with deeper soils the understorey is characterised by medium to high densities of rainforest associated shrubs and trees. The most common tall shrub or small tree is Forest Oak (*Allocasuarina torulosa*). Rainforest elements include the small trees; Wilkiea (*Wilkiea huegeliana*), Murrogun (*Cryptocarya microneura*), Lilly Pilly (*Acmena smithii*), Australian Ebony (*Diospyros australis*), Brush Muttonwood (*Rapanea howittiana*), Cheese Tree (*Glochidion ferdinandii*) and Cabbage

Tree Palm (*Livistona australis*), and the shrubs Bolworra (*Eupomatia laurina*), Blueberry Ash (*Elaeocarpus reticulatus*), Muttonwood (*Rapanea variabilis*) and Tree Heath (*Trochocarpa laurina*).

The ground layer is dominated by ferns such as False Bracken Fern (*Calochlaena dubia*) and Rasp Fern (*Doodia aspera*). Vines are also common, including Slender Grape Vine (*Cayratia clematidea*), Water Vine (*Cissus antarctica*) and Native Grape (*Cissus hypoglauca*).

Grassy Understorey

On a drier north facing slope, the understorey has a more grassy appearance, with a shrub layer of low to medium density.

Common shrub species in this understorey type include Forest Oak (*Allocasuarina torulosa*), Elderberry Panax (*Polyscias sambucifolius*) and Hickory (*Acacia implexa*).

The ground layer is dominated by grasses but includes ferns and herbs. Common ground layer species include *Entolasia marginata*, Basket Grass (*Oplismenus imbecillis*), Weeping Meadow Grass (*Microlaena stipoides*), Kidney Weed (*Dichondra repens*), *Glycine* spp. and Common Maidenhair Fern (*Adiantum aethiopicum*). Burrawangs (*Macrozamia communis*) are a common and distinctive feature of the understorey.

Spotted Gum Forest is not well represented in nearby conservation reserves, being absent from Garigal National Park and present in only small areas of Ku-ring-gai Chase National Park. Benson and Howell (1990) identify Spotted Gum Forest as

being characteristic of the Pittwater area. Thomas and Benson (1985) record this plant community as being present on Narrabeen Group sediments on the western foreshores of Pittwater, generally outside the boundary of Ku-ring-gai Chase National Park. Similar forests are found in McKay Reserve, Scotland Island and the National Trust property, Burley Griffin Lodge. They also occur north of Broken Bay, in the Gosford district. Spotted Gum Forests are poorly conserved in New South Wales. The Spotted Gum Forest at Stapleton Park has conservation significance at a state level.

Stapleton Sandstone Ridgetop Woodland

The woodland vegetation of the ridge crest on either side of Riviera Avenue includes a range of tree species indicating a variety of influences on its development. The dominant species as identified in previous surveys are Smooth-barked Apple (*Angophora costata*) and Sydney Peppermint (*E. piperita*). Associated with these are the sandstone-associated species Grey Gum (*E. punctata*) and Red Bloodwood (*E. gummifera*). The presence of Spotted Gum (*Eucalyptus maculata*), Rough-barked Apple (*Angophora floribunda*), Grey Ironbark (*E. paniculata*) and Port Jackson Cypress (*Callitris rhomboidea*) indicate a shale influence, possibly a shale lens as discussed previously. Bangalay (*E. botryoides*) and Large-leaved White Mahogany (*E. umbra* ssp. *umbra*) in this case indicate a coastal influence.

The understorey is variable and may point to minor changes in geology and past fire history. There are areas of tall shrubs of high density, areas of shrubby understorey of medium to

high density and a patch of grassy understorey.

Shrub species include Black She-oak (*Allocasuarina littoralis*), Old Man Banksia (*Banksia serrata*), Hairpin Banksia (*Banksia spinulosa*), Sweet-scented Wattle (*Acacia suaveolens*), Broad-leaved Geebung (*Persoonia levis*) and Broom Heath (*Monotoca elliptica*).

Ground layer species include Flannel Flower (*Actinotus helianthi*), Kangaroo Grass (*Themeda australis*), Burrawang (*Macrozamia communis*) and *Digitaria parviflora*.

Stapleton Sandstone Ridgetop Woodland is similar to plant communities on Hawkesbury sandstone, but differs in the range of tree species present and the existence of a grassy area which supports the significant species, *Craspedia variabilis*. Open-forest on Hawkesbury sandstone dominated by Smooth-barked Apple, Sydney Peppermint and Red Bloodwood is widespread in Ku-ring-gai Chase National Park (Thomas and Benson 1985). The community at Stapleton Park is considered to have significance at the local level. The lack of disturbance and the existence of this community on a ridge crest not subject to urban run-off problems make this site valuable as a reference site. Few sites with these characteristics remain in an urban situation in the Sydney region.

Vine Scrub

An area on the south-facing slope supports vines and small rainforest trees. The area appears on earlier aerial photographs as part of the Spotted Gum Forest, however dieback

over the past forty years has resulted in the death of the eucalypt canopy trees.

Species now present include trees Lilly Pilly (*Acmena smithii*) Cabbage Tree Palm (*Livistona australis*), Bleeding Heart (*Omalanthus populifolius*) Cheese Tree (*Glochidion ferdinandii*), Crabapple (*Schizomeria ovata*) Wilkea (*Wilkea hugellana*), Acronychina (*Acronychina oblongifolia*), Red Ash (*Alphitonia excelsa*) Bastard Mahogany (*Synoum glandulosum*) and vines such as Native Grape (*Cissus hypoglauca*) and Water Vine (*Cissus antartica*).

This community is considered to be structurally closed scrub, with many vines, and has affinities with subtropical rainforest, in particular suballiance 20 (*Acmena smithii*- *Ficus* spp.- *Livistona* - *Podocarpus*), with some warm temperate rainforest elements such as Crabapple (*Schizomeria ovata*). The development of Vine Scrub appears to have been after a localised occurrence of dieback, however the cause of the tree death at this location is unknown. The management of the vine scrub will be to exclude fire to allow survival of the rainforest species.

Significant Plant Species

The National Trust identify occurrences in the vicinity of Stapleton Park of the plant species Black Apple (*Planchonella australis*) and Bolworra (*Eupomatia laurina*) as being of significance due to their rarity in the Pittwater area. Bolworra was found to occur within the Park during the survey for this Plan. Another species of interest recorded in the survey is the daisy, *Craspedia variabilis*, which, although widespread in New South Wales, is rarely recorded in

contemporary flora surveys of the Sydney region and is recorded as vulnerable in western Sydney by Benson and McDougall 1991. The presence of Port Jackson Cypress (*Callitris rhomboidea*) is also of interest as this species is rarely recorded in the Pittwater area.

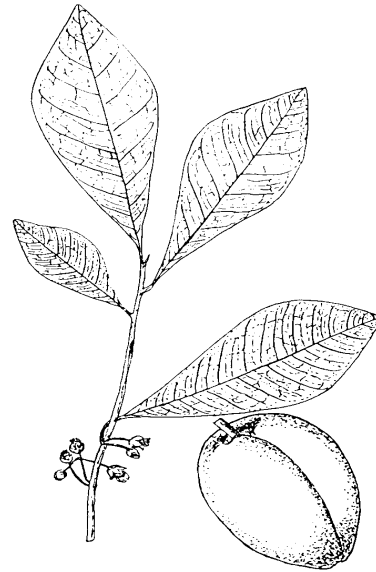
Black Apple (*Planchonella australis*) is a rainforest tree which has smooth, elliptic leaves to 10 cm and large, black, plum-like fruit. It occurs in rainforest communities along the coast, including Royal National Park, Evatt Park in Peakhurst and in the Wyong district. The National Trust record Black Apple as occurring on private land near Stapleton Park.

Bolworra (*Eupomatia laurina*) is a shrub or small tree with spreading branches from near the base. It occurs in rainforest or wet forests along the coast and Blue Mountains, including Darling Mills Creek at Baulkham Hills and Royal and Ku-ring-gai Chase National Parks. In the Barrenjoey area it has been recorded at Crown of Newport Reserve, Angophora Reserve, Bangalley Head, McKay Reserve and Stapleton Park and nearby private lands.

Craspedia variabilis is a small daisy to 20cm in height which was located in Stapleton Sandstone Ridgetop Woodland in an area characterised by a grassy understorey. This species appears to be rarely recorded in contemporary vegetation surveys in the Sydney region.

The presence of Port Jackson Cypress (*Callitris rhomboidea*) is of interest as this species is rarely recorded in the Pittwater area, being known from the western slopes of Scotland Island on shale and the western foreshores of

Pittwater in Ku-ring-gai Chase National Park also on shale parent material.



Planchonella australis



Eupomatia laurina

plant communities

3.4 Fauna

As part of the studies undertaken in preparation of this Plan of Management a fauna survey of the Park was undertaken. The survey took place during the months of May and June 1994, a time when a number of fauna species may have been absent or overlooked due to seasonal conditions. In all, 18 birds, four mammals, one reptile and one frog were found in the Park during the field survey. As this survey was undertaken in winter these numbers would be lower than those expected during spring and summer when animals are at their most active.

As with other reserves in the Pittwater area the fauna assembly is depauperate. This is probably due to the isolation of the Park from other bushland areas, its small size and predation of fauna by domestic pets and foxes. However, there are a number of habitat features which make Stapleton Park suitable for fauna. These include:

- ❖ the sandstone outcrops which provide shelter for frog and reptile species,
- ❖ the wide variety of flowering plants providing a continual source of food for mammals, birds and insects,
- ❖ mature trees with hollows large enough for possums, gliders, bats, owls and parrots,
- ❖ the occurrence of a small but healthy population of Grey Gums - the Avalon Koala colony's major food source,

- ❖ diversity in vegetation structure, type, and a relatively low edge to area ratio.

One of the features of the Park is its population of small insectivorous birds, particularly Brown Thornbills (*Acanthiza pusilla*), Golden Whistlers (*Pachycephala pectoralis*) and Grey Fantails (*Rhipidura fuliginosa*). These species are generally absent from surrounding residential areas due to the loss of a shrubby / small tree understorey. This habitat feature provides food, protection from predators and nesting locations for these birds.

As well as being important to resident birds the Park is habitat for winter and summer migrants such as Yellow-faced Honeyeaters (*Lichenostomus leucotis*) and cuckoos. It is probably also a 'stop-off point' for birds moving between conservation reserves to the north and south.

Future studies should be conducted over Spring and Summer to complement the current study and should include a bat survey which was not carried out.

Species of Significance

Bandicoots

Long-nosed Bandicoots (*Perameles nasuta*) also appear to be common in the Park as the conical holes they dig are ubiquitous. As these animals are no longer common in suburban Sydney and are susceptible to domestic pet attack, Stapleton Park represents an important refuge for the species' local population. Long-nosed Bandicoots shelter in nests of leaf litter raked

together with a chamber and a loose area in each end for entry and exit. They also occasionally rest in hollow logs and under stones or grass tussocks (Walton and Richardson (eds), 1989). These habitat features are well represented in the Park.

Koalas

The recent household species survey conducted by Council indicated that there were three sightings of Koalas (*Phascolarctos cinereus*) in the vicinity of Stapleton Park in the period 1987 to 1992. Though this is few, the Koalas may use the Park more often than this and not be noticed by passers-by. Planting of additional Grey Gums on the crown of the Park would help compensate for the loss of food trees in the surrounding area.

Gliders

The Park is also known to be habitat for gliders. Fanning (1993) reported a Sugar Glider (*Petaurus breviceps*) in a residence in Cannes Drive, adjacent to the Park, and there was a report of a glider near Sanctuary Avenue in the Household Species Survey of 1993. The endangered Squirrel Glider (*Petaurus norfolcensis*) may also occur in the Park as two pouch young were recorded from the Careel Bay area in 1989 (Linda Gibson [Australian Museum] quoted in Smith & Smith, 1993), from Palmgrove Road, Avalon in March 1994 (Linda Gibson [Australian Museum] pers. comm.) and from Prince Alfred Parade, Avalon in June 1994 (Smith and Smith 1994).

As the Squirrel Glider and Sugar Glider are similar in appearance there is often difficulty in identification. Both species feed on exudates and insects found on eucalypts and wattles

as well as pollen and nectar. Tree hollows are used for shelter and breeding (Suckling, 1983). The Park represents one of the few areas locally where their habitat requirements are fully met.

3.5 Aboriginal Sites

At the height of the last Ice Age, the coastline was 20 to 45 kilometres east of its present location. Pittwater was a valley between Barrenjoey Ridge and the Lambert Peninsula. Gradual warming led to a rise in sea levels, with the coastline 12 kilometres east of its present location 10,000 years B.P. (before present).

Stapleton Park was occupied by aboriginal people of the Guringai group. Aboriginal people lived in the area for several thousand years prior to 1788.

There are a number of shelter sites in the vicinity of the Park which have associated middens or artwork. This includes an art site close to the northern edge of the Park. Further sites may be located in the future. Based on predictions made by Koettig (1993) the most likely locations where sites could be found within the Park are the ridge crest where engravings or grinding grooves could be found and steep, rocky escarpments where there is a possibility that shelter sites exist. Such sites may become more evident following disturbance such as wildfire or following bush regeneration work. Searches should be conducted in the Park in an effort to locate any aboriginal sites.



3.6 European Heritage

The National Trust's list of sites of significance for industrial archaeology does not record any sites in Stapleton Park. No such sites are evident in the Park and the land use history of the Park indicates that sites of European cultural significance are unlikely to occur in the Park. As such sites can be more evident following fires it is recommended that searches for European heritage items could be undertaken at such times.

3.7 Recreational Usage

Recreational usage of the Park appears to be restricted to low level use of the picnic area and vicinity. There may be some use of the northern part of the Park for bushwalking, however there is not a clearly used route from the ridge to the northern boundary of the Park. There is no easy route from the ridge to the lower slopes on the southern side of the Park. There is an informal play area that requires review.

The Park appears to be most used by local residents for passive recreation.

There is some potential for increased usage without causing significant damage to bushland within the Park. Increased usage could be accommodated by a through track from the southern boundary of the Park to the ridge crest and a loop track on the northern side of Riviera Avenue. The National Trust, in their bushland survey (1988) identified suitable locations for walking routes.

Their plan proposed that walking tracks gradients be reduced by a series of zig-zags, however in some areas well constructed steps would be preferable

due to the narrow nature of access from Burrendong Place, the likelihood of cutting of corners by walkers and the lesser impact on vegetation. A map indicates proposed locations for walking tracks which would be subject to detailed environmental impact assessment at design stage.

3.8 Significance of the Park

Few major cities the size of Sydney have substantial areas of natural bushland within their boundaries. Sydney's urban bushland makes an important contribution to the city's character as a place of great natural beauty.

Urban bushland areas throughout the Sydney region are significant because :

- ❖ they contribute to the landscape quality of the city,
- ❖ they provide habitat for plants and animals, which would otherwise become regionally extinct,
- ❖ they provide a corridor for the movement of migratory and nomadic animals, particularly birds, through the urban area,
- ❖ they provide an educational resource and the first contact point with nature for many urban residents,
- ❖ they enable urban residents to undertake recreational pursuits in a bushland setting,

- ❖ they are important for scientific studies, providing a record of the original landscape and vegetation and the changes wrought by urban development,

Stapleton Park has particular significance because :

- ❖ it includes samples of Spotted Gum Forest, a community which is characteristic of the Pittwater area and which is inadequately conserved in New South Wales,
- ❖ it protects populations of one plant species which has regional conservation significance; *Craspedia variabilis*,
- ❖ it protects populations of two plant species with local significance; Bolworra (*Eupomatia laurina*) and Port Jackson Cypress (*Callitris rhomboidea*)
- ❖ it provides suitable habitat and food trees for four fauna species considered to be of special conservation significance, Koalas, Long-nosed Bandicoots, Squirrel Gliders and Glossy Black cockatoos,
- ❖ it supports a population of the Long-nosed Bandicoot, a widespread species which has become rare in the Sydney metropolitan area,
- ❖ it is an important refuge for the local Koala colony. This species is listed as Vulnerable and Rare on Part 2 of Schedule 12 of the National Parks and Wildlife Act and is under considerable threat of local extinction,

- ❖ it has a range of fauna despite its small size and considerable edge disturbance. It is particularly important for the on-going maintenance of the Barrenjoey Peninsula's populations of Long-nosed Bandicoots, Koalas, Gliders and insectivorous birds,

- ❖ it is one of the few urban bushland sites in the Sydney region which exhibits a lack of disturbance and which occurs on a ridge crest not subject to urban run-off, making it valuable as a reference site.



4.0 Management Objectives

The management objectives for Stapleton Park are :

- ❖ to protect the natural features of the Park, particularly populations of significant plant species and communities and animal species listed in this Plan; namely, *Craspedia variabilis*, Spotted Gum Forest, Koala, Long-nosed Bandicoot and Squirrel Glider,
- ❖ to prevent weed invasion and control weed species occurring in the Park,
- ❖ to minimise dieback of eucalypts and angophoras in the Park,
- ❖ to maintain a natural range of structural and floristic diversity of bushland within the Park,
- ❖ to maintain and enhance suitable habitat for significant fauna species within and adjacent to the Park,
- ❖ to prevent damage to the Park from urban run-off and stormwater,
- ❖ to protect human life and property in and adjacent to the Park from wildfire and maintain ecological processes in the Park by seeking to maintain a near-natural fire regime in the body of the Park,
- ❖ to control and eradicate where possible feral animals within the Park,
- ❖ to provide opportunities for low impact recreational and educational use of the Park, consistent with other objectives,

- ❖ to encourage community and neighbour participation in bushland management



5.0 Management Issues

5.1 Weed Invasion and Bush Regeneration

The National Trust survey in 1988 showed that extensive areas of the Park were affected by weed invasion with 38 weed species recorded. The highest cover of weeds were found at the south-eastern corner of the Park. The Spotted Gum Forests had moderate to high cover of weeds whilst the Stapleton Sandstone Ridgetop Woodland had low to moderately high weed cover.

The National Trust started bush regeneration work in Stapleton Park following their 1988 bushland survey until 1991. The Sydney Bush Regeneration Co. were contracted in 1991 and currently works in the Park. Voluntary work including establishment and maintenance of picnic facilities in the Park has been carried out in the past by members of the Avalon Preservation Trust, however in recent years little voluntary work has taken place.

The weed cover in the Park has apparently changed dramatically since 1988. Inspections undertaken for the preparation of this Plan show that over much of the Park weed cover is now low to moderate, with high weed cover being restricted to the south-eastern corner and areas adjacent to properties. This reduction in weed cover through the Park reflects the success of the bushland management within the Reserve. The integration of bush regeneration with a bushland management burn undertaken in 1991 has apparently made a significant contribution to this success.

The fact that the Park includes the ridge crest and is accordingly largely free of impact from urban

development, particularly urban run-off and drainage problems means that bush regeneration has a high likelihood of long term success.

Weed sources include seed brought into the Reserve by exotic and native birds, seeds and propagules from vehicle and foot traffic, escapes from adjacent gardens, garden rubbish and wind-blown seed.

The most widespread and prolific weeds in Stapleton Park identified by the National Trust were Lantana (*Lantana camara*) and Bitou Bush (*Chrysanthemoides monilifera*). Other bushland weeds were recorded by the Trust as occurring sporadically. Formosa Lily (*Lilium formosanum*) and Asparagus Fern (*Protasparagus aethiopicus*) are weeds which require a significant amount of time to remove.

Weed control priorities identified in 1993 were :

- ❖ in the north-eastern corner of the southern half of the Park - control of Lantana and Bitou Bush,
- ❖ along the northern edge of the southern half - control of Lantana,
- ❖ along the eastern and western edges - weeds associated with the bushland/urban boundary,

Priorities identified in 1994 are :

- ❖ maintenance of all areas which have been burnt in 1991 and 1993, targeting Bitou Bush and other major invasive weeds.
- ❖ the first priority is follow up of the southern burnt site (Site 1), followed by maintenance of the

major part of the north burnt in 1991,

- ❖ the second priority is to concentrate on the regeneration of remaining edge infestations on the northern half of the park,
- ❖ the third priority is weeding in and around the picnic area on the southern side.

Council will limit the invasion of introduced plants from impacts of urbanisation from impact of the power line easement and public access. Future work will concentrate on consolidating previous work and high profile areas.

Management Strategies

Weed invasion in Stapleton Park will be reduced by:

- ❖ classification of known problem weeds as Noxious Weeds within the Pittwater Council area
- ❖ developing species and location specific control strategies for known problem weeds, and the pervasive weeds, Formosa Lily and Asparagus Fern, as part of the bushland regeneration program for the Reserve.
- ❖ educating neighbours about the problems caused by weeds escaping into the Reserve and by dumping garden waste into the Reserve, encouraging them to plant bush gardens using locally indigenous plants and to replace lawns adjacent to the Reserve with mulched bush gardens.
- ❖ ensuring that activities of Sydney Electricity in the Reserve are undertaken in a manner

sympathetic to the management objectives of the Reserve,

- ❖ encouraging and promoting voluntary site-specific bush regeneration in the Park by local residents,
- ❖ regular monitoring of areas regularly used by the public so that any weed problems arising from use of the Reserve are addressed at an early stage,
- ❖ employment of bush regeneration contractors on a three-year contract to ensure the development of an effective strategic approach to bush regeneration in the Reserve,
- ❖ planting in the Reserve will only take place in areas approved by the Council's Environmental Officer. Plantings will only consist of local plant species propagated from material obtained in the Reserve; Consideration will be given to planting of *Planchonella australis* in the areas of suitable habitat to improve its conservation status,
- ❖ co-ordination of bush regeneration activities by local residents and contractors will be the responsibility of Council's Environmental Officer,
- ❖ weed control priorities will be identified in discussion between contractors and Council officers. Work by volunteers or contractors will be based on the agreed weed control priorities. Volunteers work will be supervised by suitably trained Council employees.

weed invasion

5.2 Eucalypt Dieback

Dieback and death of eucalypt trees has been recognised as a major problem in bushland areas on the Barrenjoey Peninsula. A report prepared by Council staff found that dieback was present in bushland reserves and private properties.

In Stapleton Park the worst affected areas are those on the south-facing slopes of the Park.

Based on the Council report the primary cause of dieback in bushland in Pittwater is urban runoff. This is not the cause at Stapleton Park as the Park includes the ridgeline and urban development is not in the catchment of the worst affected sites. There is some indication that absence of fire from the Park over the past fifty years may be a contributing factor together with the possible occurrence of a localised pathogen or insect infestation. Such indicators include the presence in drier ridge areas of plant species normally associated with sheltered, moist locations and large unburnt skirts on *Xanthorrhoea* trunks. Controlled use of fire to promote eucalypt regeneration could be important in addressing the problem.

Management Strategy

Eucalypt dieback in Stapleton Park will be addressed by :

- ❖ implementing recommendations of the report 'Dieback in Pittwater Municipality', namely by; managing fire to promote eucalypt regeneration, monitoring tree health and educating residents on practices which reduce adverse impacts on the Reserve.

- ❖ implementing the findings of any future applicable research into eucalypt dieback in the area.



die back

5.3 Altered Drainage

Stapleton Park is unlike many other bushland reserves in that it does not have urban development at the head of its catchment. Urban run-off problems are not as evident in the Park as in these other reserves. Run-off from gardens adjacent to the Reserve may make a minor contribution to increased nutrient loads and transport of weed seeds into the Reserve.

The amount of run-off from urban areas is greater than that for undisturbed bushland due to the presence of hard surfaces which fail to absorb water. The level of nutrients, particularly Phosphorus, is much greater. Sources of Phosphorus include garden fertilisers and dog faeces.

Management Strategy

The impacts of urban run-off and stormwater drainage on Stapleton Park will be reduced by :

- ❖ implementation of Council's on-site detention policy which seeks to control rate of release of stormwater,
- ❖ ensuring that all new Development and Building Applications on land adjacent to bushland include requirements for disposal of roofwater to roads which do not drain into the Reserve. In cases where this is not feasible roofwater should be directed to on-site absorption trenches in areas not subject to landslip.
- ❖ ensuring that run-off from Riviera Avenue continues to be diffuse and spread along the road edge rather

than concentrated into discharge points,

- ❖ acting against illegal disposal of poolwater, grey water or septic tank effluent,
- ❖ developing solutions for any localised drainage and flooding problems for dwellings adjoining the Reserve.

5.4 Fire

Wildfires have been a feature of the natural environment of Stapleton Park for a considerable period. Aerial photographs from the 1940's show an open canopy characteristic of an area which had been recently affected by a wildfire. The area was used during this period for army exercises and there is anecdotal evidence to suggest a wildfire in the area in 1942-43. An extensive wildfire swept through the Avalon area in 1939. It was described as 'the worst fire in living memory' (Smith and Smith 1990).

Fire management in urban bushland needs to ensure that the threat of fire to life or property is minimised whilst protecting the natural features of the bushland. Fires have occurred as a natural disturbance to bushland in the Sydney region for tens of thousands of years. Many of the plant species found in Sydney's bushland areas have characters which enable them to regenerate after wildfires. Changes to the fire regime (the frequency, intensity and season of fires) can have a severe effect on some species to the point where some species may become locally extinct under an inappropriate fire regime.

In general, urban bushland reserves pose a lesser threat to life and property than larger forested areas as they are often small, isolated areas of bushland in a predominantly urban environment. They are more readily accessed by fire fighters than more remote bushland locations and fires are generally observed at an early stage. The changes to vegetation caused by nutrient increases and urban runoff act to reduce the flammability of urban bushland.

On the other hand the remaining urban bushland is often steep land, and by its nature unsuitable for urban development. The steep nature of the land means that bushfire threat is greater. On days of extreme fire danger even small reserves may pose a threat to life and property.

Residents adjoining Stapleton Park can take action on their own land to reduce the threat posed by a wildfire occurring in the Park. They can place wood piles away from close proximity to buildings, regularly clear roof gutters of leaf litter and prune branches overhanging roofs. Landscaping should make use of species with leaves which do not burn readily or those which do not provide fires with a ladder to the canopy e.g. local rainforest species or trees with smooth bark e.g. Spotted Gum (*Eucalyptus maculata*), Grey Gum (*Eucalyptus punctata*) and Smooth-barked Apple (*Angophora costata*).

A fuel reduced zone within the Park should be maintained to reduce threat. The width of this zone is based on Department of Planning Circular C10 and on the guidelines prepared by the Department of Bush Fire Services and related to slope and aspect within the zone. In most area of the Park where

houses back onto land with slopes of greater than 10° a Fuel Reduction Zone of 40 metres should be maintained to reduce risk to life and property. At the ridge crest along the western edge of the Park on Riviera Avenue where slopes are less than 10° a Fuel Reduction Zone of 20 metres should be maintained. Fuel reduction aims to reduce the amount of fine fuel (less than pencil thickness) in the understorey. It may be carried out by use of fuel reduction burns or by mechanical means including bush regeneration. Where significant rainforest plants occur fuel reduction will be by bush regeneration techniques. The Council has adopted both techniques in the past in an effort to reduce fuel levels.

Urban bushland fire management needs to take into consideration the ecological needs of the plants and animals of the bushland, in addition to the risk posed by wildfires to life and property. There is considerable evidence that fire regimes have changed significantly in urban bushland areas since European settlement. In general terms, wildfires are less frequent, however the regime for hazard reduction may reflect local priorities, pressures and ease of access and may be cooler and controlled more quickly. The changed fire regime is contributing to the loss of species which competed more successfully under the previous fire regime. Such species include members of the families Fabaceae and Proteaceae. In the Barrenjoey Peninsula area it appears that the changed fire regime may also be contributing to dieback of Eucalypts and proliferation of rainforest species such as Cheese Tree and Sweet Pittosporum. Recent scientific evidence points to the need to maintain variability in fire regimes

if the objective of preventing local extinction of plant species is to be achieved.

In order to meet the dual objectives of ensuring the continued presence and regeneration of the range of species present in the Park and ensuring that hazard reduction burns are carried out in a safe manner it is considered that the next bushland management burn should be a medium to hot burn in autumn. Future burns should seek to achieve variability in the fire regime, subject to expert advice on ecological considerations as well as the need to protect life and property.

The bushland management burn conducted in 1991 succeeded in reducing fuel loads in the northern part of the Park, promoting regeneration of native plant species and reducing the degree of weed invasion. The burn was of a relatively high intensity which proved beneficial to management of the natural bushland of the Park. The burn conducted in the southern half of the Park in 1993 did not achieve the same outcome as the burn was in general much lower intensity, except for smaller higher intensity areas, limiting the extent of germination of hard seeded native plants and promoting weed invasion. Future burns within the Park should seek to avoid cooler low intensity fires and be integrated with bush regeneration.

Repeated frequent, broad-scale burning throughout the Park could lead to a loss of biodiversity and local extinction of flora and fauna species. Stapleton Park supports a range of plant species associated with both wet and dry conditions. Regeneration of rainforest shrubs following the 1991 fire indicates that

these species have occupied wetter parts of the northern half of the Park for many years. Fire management practices need to be sufficiently flexible to allow this dynamic interaction between various elements of the vegetation to continue.

Fires of low intensity may exacerbate weed problems in areas susceptible to invasion. Follow-up weeding will be implemented where necessary to minimise this problem.

The protection of a diverse range of fauna species in the Park may not be able to be achieved if too much of the Park is burnt at one time. Low intensity fires can render areas uninhabitable by some bird species (Smith 1989). Unburnt refuge areas need to be maintained in any hazard reduction regime. On the other hand the food available in a small burnt area some months after burning may favour ground mammals to the extent that they become easy prey for predators.

Where necessary fire may be used as a tool in regeneration of plant and animal species and habitats. Ecological burns are to be subject to monitoring of their impact and success in achieving the stated objectives to conserve biodiversity.

Management Strategies

Fire hazard to life and property will be reduced by :

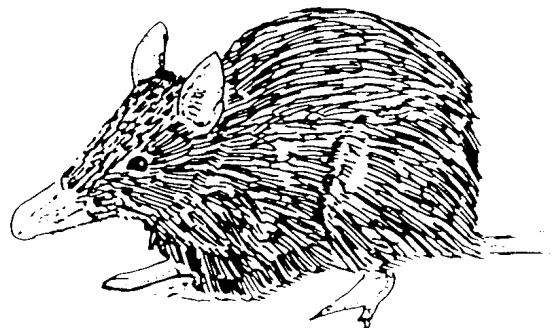
- ❖ management of a fuel reduced zone along the edges of the Park adjacent to urban development. Fuel will be reduced by use of fire or mechanical means, which may include hand clearing,

- ❖ providing information to property owners adjoining the Park on measures which can be taken on their land to reduce the threat of wildfire,
- ❖ use of Council's powers under the Bushfire Act to ensure that property owners reduce fire threat on their own land. This shall include removal of hazardous stores of firewood and undergrowth. Action will be taken against landowners who create fire hazards by dumping of garden waste into the Park,

dominated by Vine Scrub and rainforest species; and where necessary using mechanical fuel reduction carried out by qualified bush regenerators.

The dual aims of fire hazard reduction and biodiversity conservation will be achieved by :

- ❖ undertaking hazard reduction burns in a manner which will promote germination of a range of native plant species i.e. hazard reduction burns will be of a frequency, seasonality and intensity to achieve significant germination of members of the Fabaceae and Proteaceae families,
- ❖ undertaking mechanical fuel reduction when burning is inappropriate in the fuel reduced zone, in a manner which seeks to promote the retention of a native plant ecosystem; this would include targeting of weed species and integration of follow up with mechanical fuel removal.
- ❖ monitoring of the response of bushland to fire hazard reduction and ecological activities, including assessing the success of seed germination following hazard reduction burns, ecological burns and mechanical fuel removal, excluding fire from the area



fire

5.5 Introduced Predators

A major threat to the fauna of Stapleton Park is the presence of cats and dogs in the surrounding residential area. Cats particularly are likely to hunt in the Park at night and take bandicoots, possums, small birds and reptiles. They are also a source of the disease toxoplasmosis which has been known to kill bandicoots and other wildlife in the northern Sydney area (Wildlife Information & Rescue Service, pers. comm.) and is a potential threat to human health. Dogs are regarded as one of the major causes for decline of the Avalon Koala colony accounting for 20-40% of koala deaths (Smith & Smith, 1990). Large, powerful dogs were seen being walked through the Park unleashed.

The only practical way of reducing this threat is an on-going public education programme highlighting the negative impact that domestic pets have on fauna. Interpretative signage at the Park's picnic area should also include information on the detrimental impact of unrestrained domestic pets on native fauna.

Black Rats were also found in the Park. This species is an omnivore and may prey on the eggs of reptiles and birds. Considering the likely rapid replacement of rats in the Park by those from nearby residences a control program may be ineffective. Foxes have also been detected at McKay Reserve (Smith & Smith, 1992) and would be likely to also prey on fauna at Stapleton Park. Trapping programs targeting areas on the peninsula would assist native fauna recovery.

Management Strategies

The threat to native fauna populations within and adjacent to Stapleton Park will be reduced by :

- ❖ control within the Park of introduced predators including foxes, and domestic cats and dogs. Control of foxes should be by trapping and humane euthanasia by a veterinarian,
- ❖ control of domestic cats and dogs through a public education campaign and by impoundment of free-roaming dogs,
- ❖ use to the fullest extent possible of the legal measures available to Council to control domestic cats and dogs.

5.6 Access

Stapleton Park is dissected by Riviera Avenue which separates the two large viable sections of the park. Although access is required for houses, adverse effects of the road may be minimised by slowing traffic to 40km/hr, erecting signage about fauna crossing and not directing drainage into the bushland.

The Park can be accessed directly from Riviera Avenue and by laneway from Nandina Terrace. Rights of way or access reserves also exist off Burrendong Place, Buyuma Place, Sanctuary Avenue and Capua Place. Access from Burrendong Place is currently difficult due to weed growth and dumping of garden waste. Access from Capua Place is shared with access to private battle-axe blocks.

Management Strategy

Council will provide and enhance access to the Park by :

- ❖ ensuring that rights of way and access reserves are maintained free of exotic weeds and rubbish and signposted to encourage use by Park visitors,
- v taking appropriate measures to slow traffic on Riviera Avenue, and erect advisory signs about fauna crossing.

5.7 Recreation, Walking Tracks and Infrastructure

There are no formal walking tracks within the Park. Informal tracks are apparently used infrequently as no obvious footpaths pass through the Park, apart from a track from Nandina Terrace to Sanctuary Avenue.

The National Trust proposed a system of walking tracks for the Park in their 1988 bushland survey. The proposed tracks extended between access points and Riveira Avenue (see map). The tracks would greatly assist public appreciation of the Park.

Increased usage could be accommodated by a through track from the southern boundary of the Park to the ridge crest and a loop track on the northern side of Riviera Avenue. These tracks can generally be constructed on low to medium grades, but steps will be necessary along parts of the track, particularly in the vicinity of Burrendong Place due to the narrow nature of the access, to direct bushwalkers, and to reduce impact on vegetation.

Opportunities for passive recreation in the Park are provided by provision of seats and picnic tables on the ridge crest south of Riviera Avenue. The scale of development is appropriate given the setting and value of the ridge crest bushland. Maintenance of the picnic area and structures needs to ensure an attractive, low key facility exists for local residents and visitors, whilst reviewing the safety aspects of the informal play area. Use of local wood for fires should be discouraged. Council will consider installation of a gas barbeque should usage levels and

the degree of local impact indicate this is required.

Management Strategy

Council will promote low impact recreation in the Park by :

- ❖ providing walking track access through the southern half of the Park, with a loop track on the northern side,
- ❖ maintaining picnic facilities including delivering wood for the barbeque on the ridge crest south of Riviera Avenue until a gas barbeque can be installed.



5.8 Boundaries and Neighbours

At Stapleton Park there are some management problems arising from adjacent urban development. The problems include minor rubbish dumping, straying by domestic pets and escape of garden plants. In the past minor encroachment into the Park has occurred. These encroachments have been removed over recent years.

The absence of clear definition of the boundary between private land and the Park could lead to future management problems, but the current informal boundary is part of the character of the locality. The erection of low scale, sympathetic fencing between private property and the Park should be required where applicable as a condition of consent for new buildings or development.

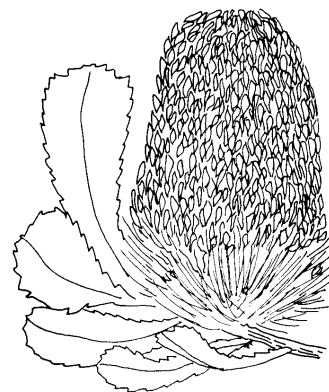
Whilst the urban areas adjacent to the Park are established residential areas they will undoubtedly be subject to future development and building works. Under State Environmental Planning Policy No 19, Council is required to take into account the effect of development on urban bushland, and, in particular, on soil erosion, the siltation of streams and waterways and the spread of weeds and exotic plants.

In approving such development in areas adjacent to Stapleton Park the Council will seek to prevent future impact on the Park. Conditions which may be attached to approvals for development adjacent to Stapleton Park include :

- ❖ that fencing of the boundary between the Park and the private property be erected where applicable,
- ❖ that on-site detention of stormwater be achieved in

accordance with Council's on-site detention policy. This should include use of absorption trenches in areas not susceptible to landslip and examination of alternative, suitable stormwater disposal mechanisms. Any direct disposal of roofwater should be to roadways rather than into the Park. Where this is not feasible due to topographic or geological conditions, roofwater to be piped to an absorption trench or other suitable disposal alternative on site,

- ❖ that run-off from Riviera Avenue continues to be allowed to enter the Park on a diffuse basis rather than concentrated in gutters and drains,
- ❖ that landscaping works are compatible with the management of bushland in the Park and seek to re-establish or maintain any wildlife corridors adjoining or extending from the Park.



6. 0 Performance & Priorities

The Local Government Act 1993 requires that plans of management for community lands include performance targets, an implementation strategy for the targets and how performances will be assessed.

Performance assessment will take place in the context of the annual State of the Environment Report required under the Local Government Act 1993. As part of these reporting requirements an annual audit of Stapleton Park will be undertaken.

The emphasis in performance assessment for Stapleton Park will be on methods which are simple and practical given the resource and financial constraints on management - the performance assessment should not divert scarce funds and resources away from Park management tasks.

6.1 Neighbours

Performance Targets

A spirit of co-operation between the Parks neighbours, the Council, bush regenerators and volunteers in addressing management problems in the Park will be promoted through regular liaison.

Public understanding of the value of the Park, the threats to the Park and the actions that individuals can take to protect the significant values of the Park will be improved by publication of this Plan. Residents will be informed on progress in the Park management program on an annual basis through the State of the Environment Report.

Implementation Strategy

Conduct regular open days for Park neighbours and volunteers.

Assessment of Performance

The attitude of neighbours and the public will be monitored through systematic recording of responses to information days, complaints and compliments. More detailed assessment by formal survey techniques will be considered as part of a Council-wide survey of residents attitudes every five years.

6.2 Weed Control and Bush Regeneration

Weeds in the Park will be controlled and where feasible eliminated by continuation of the existing bush regeneration contract and site-specific work by volunteers. The bush regeneration contract will enable automatic renewal subject to satisfactory progress. Weed management priorities will be determined by Council staff in consultation with bush regeneration contractors and volunteers. Volunteer work will be under the supervision of suitably trained Council employees. Should any more residents wish to become involved in bush regeneration in the reserve, they will be invited to join Council's volunteer program.

Overall priority should be given to control of weeds around the boundaries of the Park, weed infestations at the top of catchments, follow up weeding after fires and to high usage areas such as the picnic area.

Performance Targets

Specific priorities are :

- ❖ maintenance of all areas which have been burnt in 1991 and 1993, targeting Bitou Bush and other major invasive weeds,
- ❖ the first priority is follow up of the southern burnt site (Site 1), followed by maintenance of the major part of the north burnt in 1991,
- ❖ the second priority is to concentrate on the regeneration of remaining edge infestations on the northern half of the park,
- ❖ the third priority is weeding in and around the picnic area on the southern side.

Once existing priorities are addressed priority should be given to access ways and further work in the southern half of the Park, from the ridge crest down.

Sydney Electricity will be informed of the contents of this Plan and requested to take account of the Plan in planning or carrying out operations in or adjacent to the Park and in preparing Environmental Impact Assessment reports for proposed operations in the Park.

Implementation Strategy

Continue with the program of bush regeneration in Stapleton Park. Priorities are to consolidate sites subject to bushland management burns over the past few years, protect significant plants and communities, control weeds near access points and along Park boundaries and complete primary and secondary work in the southern half of the Park working from the ridge crest downslope. Continued maintenance weeding will be

conducted in the long-term to control weeds such as Bitou Bush introduced by birds travelling through the Park.

Assessment of Performance

Bush regenerators will be asked to keep records of flora species occurring in the Park by completing a checklist each six months in autumn and spring. This information will be supplemented by photographic records of the Park. Photo points will be identified from which photos will be taken at the time of completing the flora checklist and at the time of any significant environmental perturbation e.g. wildfire. Analysis will be undertaken by Council staff, with advice from external experts such as the Royal Botanic Gardens.

Review of the work undertaken by contractors will be undertaken by requiring quarterly and yearly reports which summarise the work completed. The yearly reports should include a map of the areas worked and the weed densities/intensities occurring in the Park at the conclusion of each year. The success of plantings carried out by bush regeneration contractors will also be monitored by location of photographic points in areas where plantings have occurred and occasional inspections of plantings by Council staff.

6.3 Dieback

Performance Targets

Dieback in the Park will be monitored and research into causes and solutions conducted where appropriate. Efforts will be made to encourage eucalypt regeneration in degraded areas by use of bushland management burns. Areas subject to such burns will be assessed in the following months to determine the extent of germination of ridge associated species such as members of the families Myrtaceae, Fabaceae and Proteaceae. Where germination is poor, alternative strategies such as the use of pile burns of Lantana will be used in an effort to obtain a higher intensity burn and ash bed to promote germination of these species. Spot replanting using plant stock collected from the Park may be used if these measures fail.

Implementation Strategy

Where necessary ecological burns will seek to promote canopy species in dieback affected areas. Germination of canopy species in these areas will be assessed annually as will indications of tree dieback spreading to other areas.

Assessment of Performance

Monitoring of the problem of eucalypt dieback will be undertaken on a Council-wide basis.

6.4 Fire

Performance Targets

Fuel in the fuel reduced zone will be reduced by use of fire or mechanical

means as and when appropriate. Fire regimes will be flexible and seek to ensure no extinction of native plant or animal species from the Park.

Implementation Strategy

Any hazard reduction, ecological burn or mechanical fuel removal will be jointly planned and implemented by Council's Environmental Officer and Fire Control Officer in accordance with the protection of life and property and the protection of biodiversity. Residents will be advised of any proposed burns.

Assessment of Performance

The assessment of the success of fire protection policies and strategies will be undertaken by monitoring fire occurrences and their impact. Records of fires occurring in the Park and the damage they cause will be maintained. Review of policies and strategies will take place in light of this experience.

Ecological requirements of fire management in the Park will be assessed through regular observations by bush regeneration contractors, Council staff and residents; through photographs and by monitoring of fauna species in the Park.

6.5 Fauna

Performance Targets

Records of fauna species present in the Park will be maintained by Council staff. The Council will act to increase public awareness on the significance of the Park's fauna.

Control of feral animals will be undertaken as necessary on a target specific basis using up-to-date techniques. Volunteers may be used to assist trapping programs. Records of feral animal sightings, trap records and

successes will be maintained by Council.

The impact of domestic animals on urban wildlife will be reduced by improving public awareness of the problem and by enforcing legislation controlling domestic animals.

Council will seek to involve local residents in improving fauna habitat in and around the Park. Within the Park planting programs will consider the needs for fauna habitat improvement.

Implementation Strategy

Fauna Survey

- ❖ conduct a spring/summer survey of fauna to provide a more comprehensive sample of the fauna using the Park. On-going monitoring could be conducted by local organisations, such as the species care group or Barrenjoey High School, with guidance by a biologist,
- ❖ periodic surveys of residents observations of the fauna of the area will be undertaken.

Habitat Improvement

The bush regeneration program will seek to aid in habitat improvement as well as controlling weeds species occurring in the Park. This will include planting of Grey Gum (*Eucalyptus punctata*) in suitable locations on the ridge crest to improve koala habitat; and Coast Banksia (*Banksia integrifolia*), *Acacia irrorata* and *A. implexa* to improve glider habitat.

- ❖ the fire regime will recognise the needs of fauna as well as

vegetation management and protection of life and property,

- ❖ local residents will be encouraged to plant locally indigenous plant species, particularly those of high value for fauna.

Public Awareness

- ❖ signage along Riviera Avenue will caution motorists to be aware of fauna crossing the road. Council will seek to impose a 40km/h speed limit through the park to highlight the need for caution,
- ❖ an interpretive sign will be placed in the picnic area illustrating some of the fauna species present.

Introduced Predators

- ❖ local residents will be informed of threats to fauna posed by domestic pets. Regulations controlling domestic pets will be enforced by rangers,
- ❖ foxes in the Park will be controlled by use of appropriate and humane trapping, with the aid of local residents.

Assessment of Performance

Regular (every five years) survey of residents regarding the urban wildlife in their areas, particularly the endangered species within the Council area. Species specific monitoring programs may be established for fauna species of particular interest.

6.6 Cultural Heritage

Performance Targets

Council officers will maintain records of any sites of Aboriginal or cultural heritage significance found in the Park and monitor their condition.

Implementation Strategy

Any such sites will be monitored on an annual basis. If condition appears to be deteriorating advice will be sought from appropriate cultural resources specialists.

Assessment of Performance

Reporting of any heritage items found to occur in the Park in the annual State of the Environment Report to ensure that protection of heritage items is consistent with the provisions of the Burra Charter, the National Parks and Wildlife Act and the Heritage Act.

6.7 Access

Performance Targets

Pedestrian access to the park will be maintained by clearing the Rights of Way by 1996. The impact of the road on the park will be monitored.

Implementation Strategy

Bush regeneration contractor to undertake weed clearance in the two southern access ways.

Assessment of Performance

Performance assessment regarding access will include monitoring of the public's views regarding the acceptability of the improved access, monitoring of vegetation along tracks to ensure that weed problems are not being caused by the presence of access

tracks and monitoring of the impacts of the road on the park.

6.8 Recreation

Performance Targets

Council will investigate construction of a system of walking tracks in the Park to provide through routes from access points in the southern part of the Park to the ridge crest along Riviera Avenue by 1996 and to provide a loop track on the northern side of the Park by 1998. The picnic area facilities on the ridge crest will be maintained in a manner consistent with the overall objective of protecting bushland within the Park.

Implementation Strategy

Investigation and design of detailed track route and dimensions will be undertaken by 1995 and 1997 respectively.

Assessment of Performance

Progress on design and construction will be reported in the Annual State of the Environment Report.

6.9 Stormwater & Drainage Control

Performance Targets

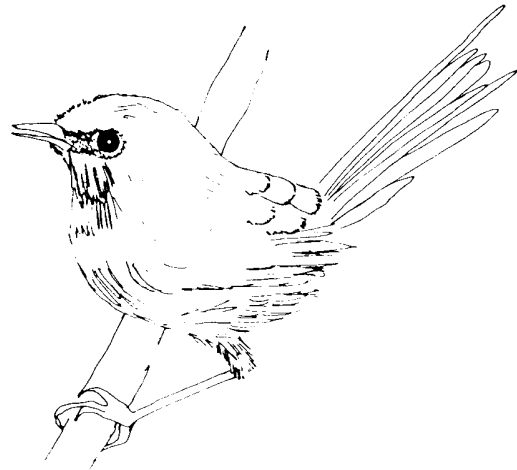
Development controls will ensure that stormwater control on properties adjacent to the Park is consistent with Council's on-site detention policy. Disposal of roofwater from neighbouring properties will be directed to roadways or absorption trenches rather than into the Park. Run-off from Riviera Avenue will be allowed to enter the Park on a diffuse basis rather than concentrated in gutters and drains.

Implementation Strategy

- ❖ incorporate requirements for improved roofwater disposal in development control,
- ❖ retain diffuse run-off of stormwater along Riviera Avenue.

Assessment of Performance

Weed monitoring and observations of evidence of erosion , nutrient or sediment problems will be undertaken by Council staff and the bush regeneration contractor.



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Acknowledgements

This report was prepared by Roger Lembit, Environmental Consultant and Paul Burcher, AES Consultancy Services. The report was directed and edited by Diane Campbell, Environmental Officer and Polly Thompson, Assistant Environmental Officer, Pittwater Council. The cover photo, graphics and design was done by Tanya Carmont, Graphics Officer, Pittwater Council. Appendix 3 information on butterflies was provided by Bart Hacobian, 9 Sanctuary Avenue Avalon.

APPENDIX 1

Plant Species List for Stapleton Park

KEY

- NT - Species first recorded in or near the Park by The National Trust (1988)
 SB - Species first recorded in Park by Sydney Bush Regeneration Company (1991)
 RL - Species first recorded in Park during this survey
 MM - Species first recorded in Park in December 1994
 DC - Species recorded by Diane Campbell, Environmental Officer
 RA - Species recorded or expected by Reg Angus, Dee Why
 BH - Species recorded by Bart Hacobian, Stapleton Park.
 SGF - Species occurring in Spotted Gum Forest
 SSW - Species occurring in Stapleton Sandstone Ridgetop Woodland
 VS - Species occurring in Vine Scrub
 Abundance ratings as at December 1994 are based on quadrat records.
 A - Abundant
 F - Frequent
 O - Occasional
 R - Rare
 ? - Uncertain identification
 * - Introduced species or native plants not indigenous to the area
 # - Species not recorded but expected to occur in Stapleton Park as these species occur in similar habitats nearby
 sp. - Species
 ssp. - Subspecies
 var. - Variety

| Plant Community | SG | SSW | VS |
|-----------------|----|-----|----|
| | F | | |

FERNS

ADIANTACEAE

| | | | |
|---|----|---|--|
| Adiantum aethiopicum (Common Maidenhair) | NT | O | |
|---|----|---|--|

ASPLENIACEAE

| | | | |
|---|----|--|---|
| Asplenium flabellifolium (Necklace Fern) | RL | | R |
|---|----|--|---|

BLECHNACEAE

| | | | |
|--|----|---|---|
| Blechnum cartilagineum (Gristle Fern) | RL | R | |
| Doodia aspera (Rasp Fern) | NT | O | O |

| Plant Community | | SG F | SSW | VS |
|--|----|---------|-----|----|
| CYATHEACEAE | | | | |
| Cyathea australis (Rough Tree-fern) | RL | R | | |
| DAVALLIACEAE | | | | |
| Davallia pyxidata (Hare's Foot Fern) | NT | | R | |
| * Nephrolepis cordifolia (Fishbone Fern) | NT | | | |
| DENNSTAEDTIACEAE | | | | |
| Pteridium esculentum (Bracken Fern) | NT | O | A | |
| DICKSONIACEAE | | | | |
| Calochlaena dubia (False Bracken Fern) | NT | R | R | |
| LINDSAEACEAE | | | | |
| Lindsaea linearis (Screw Fern) | NT | | O | |
| GYMNOSPERMS | | | | |
| ZAMIACEAE | | | | |
| Macrozamia communis (Burrawang) | NT | O | F | |
| ANGIOSPERMS | | | | |
| DICOTYLEDONS | | | | |
| ACANTHACEAE | | | | |
| Pseuderanthemum variabile (Pastel Flower) | NT | O | | |
| APIACEAE | | | | |
| Actinotus helianthi (Flannel Flower) | NT | | A | |
| * Hydrocotyle bonariensis (Kurnell Curse) | NT | | | |
| Hydrocotyle laxiflora | NT | R | R | |
| Trachymene incisa | NT | | R | |
| Xanthosia pilosa (Hairy Xanthosia) | NT | | | |
| Xanthosia tridentata | NT | | O | |

| Plant Community | | SG F | SSW | VS |
|---|----|---------|-----|----|
| APOCYNACEAE | | | | |
| Parsonsia straminea (Silkpod Vine) | NT | R | | |
| ARALIACEAE | | | | |
| Astrotricha latifolia | NT | | | |
| * Hedera helix (English Ivy) | NT | R | R | |
| Polyscias sambucifolia (Elderberry Panax) | NT | O | O | |
| ASCLEPIADACEAE | | | | |
| Marsdenia suaveolens | NT | R | | |
| Tylophora barbata (Bearded Tylophora) | NT | R | | |
| ASTERACEAE | | | | |
| * Ageratina adenophora (Crofton Weed) | NT | R | | |
| * Ageratina riparia (Mist-flower) | NT | R | | |
| * Bidens pilosa (Cobblers Peg) | NT | | | |
| Brachycome sp. | NT | | | |
| ?angustifolia ssp. angustifolia | | | | |
| * Coreopsis lanceolata (Coreopsis) | NT | | | |
| * Chrysanthemoides monilifera (Bitou Bush) | NT | R | R | |
| * Conyza sp. (Fleabane) | RL | R | | |
| Craspedia variabilis | RL | | O | |
| * Hypochaeris radicata (Catsear) | NT | R | R | |
| Ozothamnus diosmifolius | NT | | | |
| Senecio sp. | RL | O | | |
| BALSAMINACEAE | | | | |
| * Impatiens walleriana (Balsam) | RL | R | | |
| BASELLACEAE | | | | |
| * Anredera cordifolia (Madeira Vine) | RL | R | | |

| Plant Community | | SG F | SSW | VS |
|---|----|---------|-----|----|
| BIGNONIACEAE | | | | |
| Pandorea pandorana (Wonga Vine) | NT | O | O | |
| CAPRIFOLIACEAE | | | | |
| *Lonicera japonica (Japanese Honeysuckle) | NT | | | |
| CASSYTHACEAE | | | | |
| Cassytha sp. | SB | | | |
| CASUARINACEAE | | | | |
| Allocasuarina littoralis (Black She-oak) | NT | | F | |
| Allocasuarina torulosa (Forest Oak) | NT | F | | |
| CELASTRACEAE | | | | |
| Maytenus silvestris | RL | O | | |
| CONVOLVULACEAE | | | | |
| Dichondra repens (Kidney Weed) | NT | R | | |
| CRASSULACEAE | | | | |
| Crassula sieberiana (Australian Stonecrop) | RL | | R | |
| CUNONIACEAE | | | | |
| Schizomeria ovata (Crabapple) | RL | R | | |
| DILLENIACEAE | | | | |
| Hibbertia aspera | RL | R | R | |
| Hibbertia dentata (Twining Guinea Flower) | NT | R | | |
| Hibbertia obtusifolia | SB | | | |
| Hibbertia riparia | NT | R | | |
| DROSERACEAE | | | | |
| Drosera sp. | NT | | | |
| EBENACEAE | | | | |
| Diospyros australis (Australian Ebony) | NT | R | | |

| Plant Community | | SG F | SSW | VS |
|--|----|---------|-----|----|
| ELAEOCARPACEAE | | | | |
| Elaeocarpus reticulatus (Blueberry Ash) | NT | R | R | |
| EPACRIDACEAE | | | | |
| Epacris longifolia (Native Fuschia) | NT | | | |
| Epacris pulchella (Pink Swamp Heath) | NT | | R | |
| Leucopogon juniperinus (Prickly Beard-heath) | NT | R | | |
| Leucopogon lanceolatus (Lance-leaved Beard-heath) | NT | | | |
| Monotoca elliptica (Broom Heath) | NT | R | R | |
| Monotoca scoparia | NT | | | |
| Trochocarpa laurina (Tree Heath) | NT | R | | |
| EUPHORBIACEAE | | | | |
| Breynia oblongifolia | NT | R | R | |
| Glochidion ferdinandii (Cheese Tree) | NT | R | F | |
| Omalanthus populifolius (Bleeding Heart) | NT | R | R | |
| Phyllanthus gasstroemii | RL | | R | |
| Phyllanthus hirtellus (Thyme Spurge) | NT | F | O | |
| EUPOMATIACEAE | | | | |
| Eupomatia laurina (Bolworra) | NT | R | | |
| FABACEAE | | | | |
| Acacia elongata | NT | | | |
| Acacia floribunda (Gossamer Wattle) | NT | | | |
| Acacia implexa (Hickory Wattle) | NT | R | | |
| Acacia irrorata ssp. irrorata | RL | R | | |
| Acacia longifolia (Sydney Golden Wattle) | NT | R | R | |
| Acacia longissima | NT | | | |
| Acacia suaveolens (Sweet-scented Wattle) | NT | | R | |

| Plant Community | | SG | SSW | VS |
|-------------------------------|----|----|-----|----|
| | | F | | |
| FABACEAE | | | | |
| Acacia ulicifolia | NT | O | F | |
| (Prickly Moses) | | | | |
| Bossiaea ensata | NT | | | |
| Desmodium varians | NT | O | R | |
| Desmodium rhytidophyllum | SB | R | | |
| Glycine clandestina | NT | F | R | |
| Glycine tabacina | RL | R | | |
| Gompholobium latifolium | NT | | | |
| (Golden Glory Pea) | | | | |
| Hardenbergia violacea | NT | R | O | |
| (Purple Twining Pea) | SB | | | |
| Jacksonia scoparia | NT | R | R | |
| (Dogwood) | | | | |
| Kennedia rubicunda | NT | O | O | |
| (Dusky Coral Pea) | | | | |
| Oxylobium ilicifolium | NT | O | | |
| (Native Holly) | | | | |
| Platylobium formosum | NT | R | F | |
| Pultenaea daphnoides | NT | | R | |
| * Senna pendula var. glabrata | NT | R | | |
| (Cassia) | | | | |
| GOODENIACEAE | | | | |
| Dampiera stricta | NT | | | |
| Goodenia heterophylla | NT | | | |
| Scaevola ramosissima | NT | | | |
| LAMIACEAE | | | | |
| Plectranthus parviflorus | NT | R | | |
| (Cockspur Flower) | | | | |
| Prostanthera denticulata | NT | | | |
| LAURACEAE | | | | |
| Cryptocarya microneura | NT | R | | |
| (Murrogun) | | | | |
| Neolitsea dealbata | RL | R | | |
| (White Bolly Gum) | | | | |
| LOBELIACEAE | | | | |
| Pratia purpurascens | NT | R | R | |
| (Purple Pratia) | | | | |
| LOGANIACEAE | | | | |
| Mitrasacme polymorpha | NT | | F | |

| Plant Community | | SG | SSW | VS |
|--|----|----|-----|----|
| | | F | | |
| LORANTHACEAE | | | | |
| Muellerina eucalyptoides | BH | R | | |
| MELIACEAE | | | | |
| Synoum glandulosum (Bastard Rosewood) | NT | R | R | |
| MENISPERMACEAE | | | | |
| Sarcopetalum harveyanum (Pearl Vine) | NT | R | | |
| Stephania japonica var. discolor (Snake Vine) | NT | O | | |
| MONIMIACEAE | | | | |
| Wilkiea huegeliana (Veiny Wilkiea) | NT | O | | O |
| MORACEAE | | | | |
| Ficus rubiginosa (Port Jackson Fig) | NT | R | | |
| Ficus coronata (Sandpaper Fig) | NT | R | | R |
| MYRSINACEAE | | | | |
| Rapanea howittiana (Brush Muttonwood) | NT | R | | |
| Rapanea variabilis (Muttonwood) | NT | O | | |
| MYRTACEAE | | | | |
| Acmena smithii (Lilly Pilly) | NT | R | | |
| Angophora costata (Smooth-barked Apple) | NT | | F | O |
| Angophora floribunda (Rough-barked Apple) | SB | | R | |
| Eucalyptus botryoides (Bangalay) | NT | R | | |
| Eucalyptus gummifera (Red Bloodwood) | NT | F | F | |
| Eucalyptus maculata (Spotted Gum) | NT | A | R | |
| Eucalyptus paniculata (Grey Ironbark) | NT | O | R | |
| Eucalyptus piperita (Sydney Peppermint) | NT | | R | |

| Plant Community | | SG | SSW | VS |
|---|----|----|-----|----|
| | | F | | |
| MYRTACEAE (cont.) | | | | |
| Eucalyptus punctata (Grey Gum) | NT | | R | |
| Eucalyptus resinifera (Red Mahogany) | NT | R | | |
| Eucalyptus umbra (Broad-leaved Mahogany) | NT | | R | |
| Kunzea ambigua (Tick Bush) | NT | | | |
| Leptospermum lanigerum (Hairy Tea Tree) | NT | | | |
| Leptospermum polygalifolium (Yellow Tea Tree) | NT | R | F | |
| Leptospermum trinervium (Paperbark Tea Tree) | RL | | R | |
| Rhodamnia rubescens (Brush Turpentine) | DC | O | | |
| Syncarpia glomulifera (Turpentine) | NT | O | | |
| OCHNACEAE | | | | |
| * Ochna serrulata (Ochna) | NT | | | |
| OLEACEAE | | | | |
| * Ligustrum sinense (Small-leaf Privet) | NT | R | R | |
| Notelaea longifolia (Native Olive) | NT | O | R | |
| * Olea africana (African Olive) | NT | | R | |
| OXALIDACEAE | | | | |
| Oxalis corniculata (Wood Sorrel) | NT | | | |
| PASSIFLORACEAE | | | | |
| * Passiflora edulis (Common Passionfruit) | NT | R | | |
| Passiflora herbertiana (Yellow Passion-flower) | RL | R | | |
| PITTOSPORACEAE | | | | |
| Billardiera scandens (Dumplings) | NT | O | O | |
| Pittosporum revolutum | NT | R | | |

| | | | | |
|---|----|---------|-----|----|
| (Hairy Pittosporum) | | | | |
| Plant Community | | SG F | SSW | VS |
| PITTOSPORACEAE (cont.) | | | | |
| Pittosporum undulatum (Sweet Pittosporum) | NT | R | R | O |
| PLANTAGINACEAE | | | | |
| * Plantago lanceolata (Lambs Tongue) | NT | | | |
| POLYGONACEAE | | | | |
| * Acetosa sagittata (Turkey Rhubarb) | NT | R | | |
| PROTEACEAE | | | | |
| Banksia integrifolia (Coast Banksia) | NT | R | R | |
| Banksia serrata (Old Man Banksia) | NT | | O | |
| Banksia spinulosa (Hairpin Banksia) | NT | | R | |
| Hakea salicifolia (Willow Hakea) | NT | | | |
| Lomatia silaifolia (Crinkle Bush) | NT | | | |
| Persoonia levis (Broad-leaved Geebung) | NT | | R | |
| Persoonia linearis (Narrow-leaved Geebung) | NT | R | R | |
| RANUNCULACEAE | | | | |
| Clematis aristata (Old Man's Beard) | NT | R | | |
| RHAMNACEAE | | | | |
| Pomaderris ligustrina (Privet-leaved Pomaderris) | NT | | | |
| Alphitonia excelsa | BH | | | O |
| ROSACEAE | | | | |
| * Eriobotrya japonica (Loquat) | RL | | R | |
| * Rhamphiolepis indica (Indian Hawthorn) | NT | | | |
| Rubus parvifolius (Native Raspberry) | NT | R | | |
| RUBIACEAE | | | | |

| | | | | |
|---|----|----|-----|----|
| Morinda jasminoides | NT | O | | |
| Plant Community | | SG | SSW | VS |
| | | F | | |
| RUBIACEAE (cont.) | | | | |
| Opercularia aspera | NT | O | R | |
| Pomax umbellata | NT | R | R | |
| RUTACEAE | | | | |
| Zieria smithii | NT | R | R | |
| Acronychia oblongifolia | BH | | | O |
| SANTALACEAE | | | | |
| Exocarpos cupressiformis (Native Cherry) | NT | R | | |
| SOLANACEAE | | | | |
| * Solanum mauritianum (Wild Tobacco Tree) | NT | R | | |
| Solanum prinophyllum | SB | R | | |
| Solanum pungetium | NT | R | | |
| STERCULIACEAE | | | | |
| Brachychiton populneum (Kurrajong) | RL | R | | |
| Commersonia fraseri (Brush Kurrajong) | SB | R | | |
| STYLIDIACEAE | | | | |
| Stylidium lineare (Trigger Plant) | NT | | | |
| THYMELAEACEAE | | | | |
| Wikstroemia indica | NT | | | |
| TROPAEOLACEAE | | | | |
| * Tropaeolum majus (Nasturtium) | NT | | | |
| ULMACEAE | | | | |
| Trema aspera (Native Peach) | RL | R | | |
| VERBENACEAE | | | | |
| Clerodendrum tomentosum (Hairy Clerodendrum) | NT | R | | |
| * Lantana camara (Lantana) | NT | R | O | O |
| VIOLACEAE | | | | |

| | | | | |
|---|----|---------|-----|----|
| Hybanthus monopetalus | NT | | | |
| Plant Community | | SG F | SSW | VS |
| VIOLACEAE (cont.) | | | | |
| Viola hederacea (Native Violet) | NT | | | |
| VITACEAE | | | | |
| Cayratia clematidea (Slender Grape Vine) | NT | R | | O |
| Cissus antarctica (Water Vine) | NT | R | | F |
| Cissus hypoglauca (Native Grape) | NT | R | R | F |
| MONOCOTYLEDONS | | | | |
| AGAVACEAE | | | | |
| * Agave americana (Century Plant) | NT | | | |
| ARACEAE | | | | |
| Gymnostachys anceps (Settlers Flax) | NT | R | | |
| ARECACEAE | | | | |
| Livistona australis (Cabbage Tree Palm) | NT | R | R | O |
| CANNACEAE | | | | |
| * Canna indica (Canna Lily) | NT | | | |
| COMMELINACEAE | | | | |
| * Tradescantia albiflora (Wandering Jew) | NT | | | |
| Commelina cyanea | BH | | O | |
| CYPERACEAE | | | R | |
| Carex sp. | RL | | | |
| Cyperus sp. | NT | | | |
| Gahnia sp: | NT | R | | |
| G.sieberana | BH | | | |
| G.melanocarpa (Sword Grass) | BH | | | |
| Isolepis nodosus (Knobby Club Rush) | NT | | O | |
| Lepidosperma laterale | NT | R | R | |
| Schoenus sp. | RL | | | |

| Plant Community | | SG F | SSW | VS |
|---|----|---------|-----|----|
| IRIDACEAE | | | | |
| * Freesia refracta var. odorata (Common Freesia) | NT | | | |
| Patersonia sericea (Native Iris) | NT | | | |
| * Watsonia bulbillifera (Watsonia) | NT | | | |
| JUNCACEAE | | | | |
| Juncus planifolius (Broad-leaved Rush) | NT | | | |
| LILIACEAE | | | | |
| * Agapanthus africanus (Lily of the Nile) | NT | | | |
| Arthropodium milleflorum (Vanilla Lily) | SB | | R | |
| Caesia vittata | NT | R | O | |
| Dianella caerulea (Paroo Lily) | NT | O | | O |
| * Lilium formosanum (Formosan Lily) | NT | O | | R |
| * Protasparagus aethiopicus (Asparagus Fern) | NT | O | | R |
| Schelhammera undulata | NT | R | | |
| Thysanotus tuberosus (Fringe Lily) | SB | | | |
| LOMANDRACEAE | | | | |
| Lomandra filiformis | NT | | R | |
| Lomandra glauca | NT | | R | |
| Lomandra longifolia (Spiny-headed Mat Rush) | NT | R | | R |
| Lomandra obliqua | NT | | | |
| ORCHIDACEAE | | | | |
| Acianthus exsertus (Mosquito Orchid) | NT | | C | |
| Acianthus fornicatus (Pixie Caps) | RA | | | |
| Caladenia sp. | RA | | | |
| Caladenia carnea # (Pink Fingers) | RA | | | |
| Caladenia catenata # (White Fingers) | RA | | | |
| Caleana major | RA | | | |

| | | | | |
|-------------------------------|----|----|-----|----|
| (Flying Duck-orchid) | | | | |
| Plant Community | | SG | SSW | VS |
| | | F | | |
| ORCHIDACEAE | | | | |
| Chiloglottis sp. # | RA | | | |
| Cryptostylis erecta | RL | C | | |
| (Bonnet Orchid) | | | | |
| Dipodium punctatum | MM | | O | |
| (Hyacinth Orchid) | | | | |
| Diuris aurea # | RA | | | |
| (Golden Doubletails) | | | | |
| * Epidendrum ibaguense | NT | | | |
| (Crucifix Orchid) | | | | |
| Microtis sp. # | RA | | | |
| (Onion Orchid) | | | | |
| ?Prasophyllum sp. # | RA | | | |
| (Leek Orchid) | | | | |
| Pterostylis acuminata # | RA | | | |
| (Sharp Greenhood) | | | | |
| Pterostylis nutans # | RA | | | |
| (Nodding Greenhood) | | | | |
| Thelymitra ixioides # | RA | | | |
| (Dotted Sun Orchid) | | | | |
| Thelymitra nuda # | RA | | | |
| (Plain Sun Orchid) | | | | |
| PHILESIACEAE | | | O | |
| Eustrephus latifolius | NT | R | | |
| (Wombat Berry) | | | O | |
| Geitonoplesium cymosum | NT | O | | |
| (Scrambling Lily) | | | | |
| POACEAE | | | R | |
| * Andropogon virginicus | NT | | | |
| (Whisky Grass) | | | F | |
| Anisopogon avenaceus | RL | | R | |
| * Arundo donax | RL | | | |
| (Giant Reed) | | | R | |
| * Bambusa sp. | RL | | | |
| (Bamboo) | | | | |
| * Cortaderia selloana | NT | | | |
| (Pampas Grass) | | | | |
| Cymbopogon refractus | NT | | | |
| (Barbwire Grass) | | | | |
| Dichelachne micrantha | SB | | | |
| Dichelachne rara | RL | R | R | |
| Digitaria parviflora | NT | R | | |
| (Small-flowered Summer Grass) | | | | |
| Echinopogon caespitosus | NT | R | | |

| (Tufted Hedgehog Grass) | | SG | SSW | VS |
|--------------------------------|----|----|-----|----|
| Plant Community | | F | | |
| POACEAE | | | | |
| * Ehrharta erecta | NT | | | |
| (Panic Veldt Grass) | | | R | |
| Entolasia marginata | RL | R | F | |
| Entolasia stricta | NT | F | | |
| (Wiry Panic) | | | O | |
| Eragrostis sp. | RL | | | |
| (Love Grass) | | | O | |
| Imperata cylindrica var. major | NT | R | | |
| (Blady Grass) | | | O | |
| Microlaena stipoides | RL | O | | |
| (Weeping Meadow Grass) | | | O | |
| Oplismenus imbecillis | SB | R | R | |
| Panicum simile | NT | R | | |
| (Two-colour Panic) | | | | |
| Paspalidium distans | SB | | | |
| * Paspalum dilatatum | NT | | | |
| (Paspalum) | | | | |
| * Paspalum urvillei | NT | | | |
| (Vasey Grass) | | | | |
| Poa affinis | NT | | | |
| * Setaria geniculata | NT | | | |
| (Slender Pigeon Grass) | | | F | |
| Themeda australis | NT | F | | |
| (Kangaroo Grass) | | | | |
| SMILACACEAE | | | | |
| Smilax australis | RL | R | | |
| (Lawyer Vine) | | | R | |
| Smilax glycyphylla | NT | R | | |
| (Sweet Sarsaparilla) | | | | |
| XANTHORRHOEACEAE | | | | |
| Xanthorrhoea arborea | RL | | R | |
| Xanthorrhoea resinosa | NT | R | F | |
| ZINGIBERACEAE | | | | |
| * Hedychium gardnerianum | NT | | | |
| (Ginger Plant) | | | | |

APPENDIX 2

List of Fauna Species Occurring or Likely to Occur in Stapleton Park, Avalon

Key: letters next to the scientific name denote the source of fauna records.

- S - May/June 1994 survey of Stapleton Park, Paul Burcher
 A - Angophora Reserve Plan of Management (Smith and Smith 1993)
 M - Mackay Reserve Fauna Survey (Smith and Smith 1992)
 F - Fanning's survey of Lot 129, Cannes Drive, Avalon (Fanning 1993)
 R - Pittwater Council residents survey
 W - Ray Williams (pers. comm.)
 H - Bart Hacobian, 9 Sanctuary Avenue, Avalon
 Mu - Records of the Australian Museum
 * - Introduced Species

| Scientific Name | Common Name |
|-------------------------------------|---------------------------|
| BIRDS | |
| <i>Streptopelia chinensis</i> * A M | Spotted Turtle dove |
| <i>Lopholaimus antarcticus</i> H | Topknot Pigeon |
| <i>Trichoglossus haematodus</i> S | Rainbow Lorikeet |
| <i>T. chlorolepidotus</i> A M | Scaly-breasted Lorikeet |
| <i>Calyptrorhynchus lathamii</i> M | Glossy Black Cockatoo |
| <i>Cacatua galerita</i> S | Sulphur-crested Cockatoo |
| <i>C. roseicapilla</i> A M | Galah |
| <i>Alisterus scapularis</i> S | King Parrot |
| <i>Platycercus elegans</i> S | Crimson Rosella |
| <i>P. eximius</i> A | Eastern Rosella |
| <i>Cuculus pyrrhophanus</i> M | Fan-tailed Cuckoo |
| <i>Eudynamis scolopacea</i> A M | Common Koel |
| <i>Ninox novaeseelandiae</i> F M | Southern Boobook |
| <i>Dacelo novaeguineae</i> S | Kookaburra |
| <i>Halcyon sancta</i> | Sacred Kingfisher |
| <i>Eurystomus orientalis</i> A M | Dollarbird |
| <i>Coracina novaehollandiae</i> S | Black-faced Cuckoo-shrike |
| <i>Pachycephala pectoralis</i> S | Golden Whistler |
| <i>Rhipidura fuliginosa</i> S | Grey Fantail |
| <i>Malurus cyaneus</i> M | Superb Fairy Wren |
| <i>M. lamberti</i> A M | Variegated Fairy-wren |
| <i>Sericornis frontalis</i> S | White-browed Scrubwren |
| <i>Gerygone olivacea</i> M | White-throated Warbler |

| | |
|------------------------------|----------------------------|
| Acanthiza pusilla S | Brown Thornbill |
| Manorina melanocephala A M | Noisy Miner |
| BIRDS (cont) | |
| Anthochaera carunculata A M | Red Wattlebird |
| A.chrysoptera S | Little Wattlebird |
| Philemon corniculatus A M | Noisy Friarbird |
| Lichenostomus chrysops S | Yellow-faced Honeyeater |
| Melithreptus lunatus A M | White-naped Honeyeater |
| Phylidonyris nigra M | White-cheeked Honeyeater |
| | New Holland Honeyeater |
| P. novaehollandiae M | Eastern Spinebill |
| Acanthorhynchus tenuirostris | Mistletoebird |
| Dicaeum hirundinaceum A M | Spotted Pardalote |
| Pardalotus punctatus S | Striated Pardalote |
| P.striatus A M | Silvereye |
| Zosterops lateralis S | Spangled Drongo |
| Dicrurus megarhynchus H | Grey Butcherbird |
| Cracticus torquatus S | Pied Currawong |
| Strepera graculina S | Australian Magpie |
| Gymnorhina tibicen S | Australian Raven |
| Corvus coronoides S | |
| MAMMALS | |
| Perameles nasuta S | Long-nosed Bandicoot |
| Phascogale carolinensis R | Koala |
| Pseudocheirus peregrinus S | Common Possum |
| | Ringtailed Possum |
| Petaurus breviceps R Mu | Sugar Glider |
| P.norfolcensis Mu | Squirrel Glider |
| Trichosurus vulpecula S | Common Brushtailed Possum |
| | Black Rat |
| Rattus rattus* S | Grey-headed Flying Fox |
| Pteropus poliocephalus A M | Gould's Wattled Bat |
| Chalinolobus gouldii W | Red Fox |
| Vulpes vulpes* M | |
| REPTILES | |
| Ramphotyphlops nigrescens M | Blind Snake |
| Cacophis squamulosus M | Golden-crowned Snake |
| Drysdalea rhodogaster Mu | Swamp Snake |
| Dendrelaphis punctulatus | Green Tree Snake |
| Demansia psammophis | Yellow-faced Snake |
| | Whip Snake |
| Pseudechis porphyriacus | Red-bellied Black Snake |
| Pseudonaja textilis | Eastern Brown Snake |
| Phyllurus platurus M | Southern Leaf-tailed Gecko |
| | Copper-tailed Skink |
| Ctenotus taeniolatus A | Striped Skink |
| C. robustus M | |

Egernia cunninghami M

Egernia whitii

REPTILES (Cont.)

Eulamprus quoyii M A

Lampropholis delicata S

L.guichenoti F

Saiphos equalis

Saproscincus mustelina

Tiliqua scincoides A M

Cunningham's Skink

White's Skink

Water Skink

Garden Skink

Grass Skink

Three-toed Skink

Weasel Skink

Blue-tongued Lizard

FROGS

Limnodynastes peronii A M

Crinia signifera S

Litoria peronii H

Striped Marsh Frog

Eastern Common Froglet

Peron's Tree Frog



APPENDIX 3

Survey Methods

Flora Survey

A field survey of the Park was undertaken in May and June 1994. The Park was surveyed on foot with traverses of the northern and southern slopes of the Park and inspections along Riviera Avenue and the access ways to the Park from Burrendong Place, Nandina Terrace, Sanctuary Avenue and Cannes Drive. During the field survey records were made of the plant species present, the dominant plant species, the nature and composition of understorey strata and the presence of weed species and evidence of disturbance.

Plant communities were mapped on the basis of aerial photograph interpretation and previous studies of the Park. The classification of communities was consistent with the scheme derived by Specht (1970) and the vegetation mapping of the Sydney Region undertaken by the Royal Botanic Gardens. Colour aerial photographs of the area at a scale of 1 : 16 000 taken in February 1991 were used for interpretation.

A floristic list for the Park, which provides information on the occurrence of plant species within the three plant communities found to occur in the Park forms Appendix 1 to this Plan.

Fauna Survey

Fauna Habitat

A search was undertaken for specific sources of native fauna food and shelter, such as dense shrubs, flowering trees, tree hollows and rock outcrops. The presence, or lack, of particular fauna habitat requirements was noted to enable predictions of species which would be likely to utilise the Park. The habitat surrounding the Park was also investigated to gain an appreciation of the relative importance of the habitat which occurs in the Park.

Birds

Bird surveys were undertaken in the morning and afternoons. All bird species seen or heard were identified and recorded. Incidental sightings whilst undertaking other field work were also recorded.

Small and Medium Sized Mammals

One trap line of 13 medium Elliot Live Traps (32 x 9 x 10cm) and one large Elliot Live Trap (46 x 15 x 15cm) was placed in the northern slope of the Park, while 12 medium Elliot Live Traps, one large Elliot Live Trap and one cage trap (20 x 20 x 56cm) were placed in the southern section. Traps were placed with a 5 to 6 metre

spacing and were baited with a mixture of peanut butter, rolled oats and honey and checked over three consecutive mornings. This constituted a total of 84 trap nights.

A search was made for indirect evidence of small to medium sized mammal presence, such as bandicoot holes, droppings and fur.

Arboreal Mammals

Spotlighting was undertaken for a period of six hours over three nights using a 12 volt battery, 50W spotlight and 10 x 50 Gerber binoculars. Spotlighting was undertaken throughout the Park. Weather was fine, cool and still.

Indirect evidence of arboreal mammals, such as scratch marks on trees and faecal pellets, was also searched for.

Reptiles and Frogs

A reptile search was undertaken throughout the Park. This involved looking under rocks, bark, fallen timber and leaf litter, with particular attention given to rock outcrop areas. The site was visited during rainy periods and debris found near moist habitats was checked for the presence of frogs. The type of moist habitats present was noted to allow predictions of frog species likely to occur. Calling frogs were identified by comparison with playback tapes. The timing of the survey in late autumn and early winter meant that it is likely several species of reptiles were not evident during the survey. Further surveys during warmer months would be expected to reveal additional species.

Species Likely to Occur

As stated above the timing of the survey was such that a number of species occurring in the Park, particularly migratory birds and reptiles, were not detected. Accordingly, a list of species 'likely to occur' in the Park based on an analysis of regional distribution, the habitats available in the Park and similar studies in nearby areas, has been included in addition to those which were detected during the field survey.

APPENDIX 4

Butterflies Recorded from South Corner of Stapleton Reserve

during 1993 and 1994

Records supplied by: Bart Hacobian, 9 Sanctuary Avenue, Avalon

Larval host plants are based on the butterflies likely to be utilising the plant as the larval food plant (according to Common and Waterhouse, 1981).

| Butterfly Family | Scientific name | Common name | Larval Host Plant Scientific name | Common name |
|---------------------------|---------------------------------|-------------------------|---|----------------------------|
| Papilionidae | <i>Papilio aegeus</i> | Orchard Swallowtail | <i>Acronychia oblongifolia</i> <i>Zieria smithii</i> | Achronychia sandfly zieria |
| | <i>Graphium macleayanum</i> | Macleays Swallowtail | | |
| | <i>Graphium sarpedon</i> | Blue Triangle | <i>Neolitsea dealbata</i> | White Bolly Gum |
| | <i>Graphium euryplus lycaon</i> | | | |
| Pieridae | <i>Pieris rapae</i> | Cabbage White | | |
| | <i>Anapheis java teutonia</i> | Casper White | | |
| | <i>Appias paulina</i> | Common albatross | | |
| | <i>Delias nigrina</i> | Common jezebel | <i>Muellerina eucalyptoides</i> | Mistletoe |
| | <i>Delias harpalyce</i> | Imperial White | <i>Muellerina eucalyptoides</i> | Mistletoe |
| | <i>Eurema hecabe</i> | Common Yellow Grass | <i>Breynia oblongifolia</i> | Breynia |
| | <i>Eurema smilax</i> | Small Yellow Grass | | |
| Nymphalidae (Danainae) | <i>Euploea core</i> | Common Australian Crow | <i>Parsonsia straminea</i> | Silkpod Vine |
| | <i>Danaus plexippus</i> | Wanderer | | |
| | <i>Danaus chrysippus</i> | Lesser Wanderer | | |
| Nymphalidae (Satyrinae) | <i>Heteronympha merope</i> | Common Brown | <i>Themeda australis</i> | Kangaroo Grass |
| | <i>Hypocysta metirius</i> | Common Brown ringlet | <i>Imperata cylindrica</i> var. <i>major</i> | Blady Grass |
| | <i>Tisiphone abeona</i> | Sword grass brown | <i>Gahnia sieberana</i> <i>Gahnia melanocarpa</i> | Sword grass |
| Nymphalidae (Nymphalinae) | <i>Vanessa kershawi</i> | Australian Painted Lady | | |
| | <i>Vanessa itea</i> | Australian admiral | | |
| | <i>Junonia villida</i> | Meadow Argus | | |

| | | | | |
|-----------------------------|---|-------------------------|--|-----------------------|
| Nymphalidae (Charaxinae) | <i>Polyura pyrrhus sempronius</i> | Tailed Emperor | <i>Brachychiton populneum</i> <i>Acacia irrorata irrorata</i> | Kurrajong |
| Lycaenidae | <i>Zizina labradus labradus</i> | Common Grass-Blue | | |
| | <i>Candalides absimilis</i> | Pencilled Blue | | |
| | <i>Candalides hyacinthinus hyacinthinus</i> | Common dusky blue | <i>Cassytha sp.</i> | |
| | <i>Candalides xanthospilos</i> | Yellow-Spot Blue | | |
| | <i>Catopyrops florinda halys</i> | Speckled lineblue | <i>Trema aspera</i> | Native Peach |
| | <i>Lampides boeticus</i> | Pea Blue | | |
| | <i>Danis hymetus taygetus</i> | Green-banded blue | <i>Alphitonia excelsa</i> | Red Ash |
| | <i>Prosotas felderi</i> | Felders Line-blue | | |
| | <i>Erysichton lineata lineata</i> | Hairy Line-blue | | |
| | <i>Theclinesstes onycha onycha</i> | | <i>Macrozamia communis</i> | Burrawang |
| | <i>Theclinesstes scintillata</i> | Glistening Blue | | |
| | <i>Jalmenus evagoras evagoras</i> | Imperial Blue | <i>Acacia irrorata irrorata</i> | |
| | <i>Nacaduba biocellata biocellata</i> | Double-spotted Lineblue | <i>Acacia irrorata irrorata</i> | |
| | <i>Syntarucus plinius pseudocassius</i> | Plumbago blue | | |
| | <i>Neolucia mathewi</i> | Mathew's Blue | <i>Monotoca elliptica</i> <i>Monotoca scoparia</i> <i>Pultenaea daphnoides</i> | Broom Heath |
| | <i>Hypochrysops delicia delicia</i> | Blue Jewel | <i>Acacia implexa</i> <i>Acacia irrorata irrorata</i> | Hickory Wattle |
| Hesperiidae | <i>Toxidia doubledayi</i> | Doubleday's Skipper | <i>Microlaena stipoides</i> | Weeping Meadow Grass |
| | <i>Toxidia peron</i> | Large dingy skipper | | |
| | <i>Cephrènes augiades sperthias</i> | Orange Palm Dart | <i>Livistona australis</i> | Cabbage Tree Palm |
| | <i>Trapezites symommus symommus</i> | Skipper | <i>Lomandra longifolia</i> | Spiny-headed Mat Rush |
| | <i>Trapezites praxedes</i> | Skipper | <i>Lomandra longifolia</i> <i>Lomandra filiformis</i> | Spiny-headed Mat Rush |
| | <i>Hesperilla picta</i> | Skipper | <i>Gahnia sieberana</i> <i>Gahnia melanocarpa</i> | Sword Grass |
| | <i>Hesperilla ornata ornata</i> | Skipper | <i>Gahnia sieberana</i> <i>Gahnia melanocarpa</i> | Sword Grass |

| | | | | |
|--|------------------------------------|-----------------|---|---------------------------|
| | <i>Hesperilla donnysa donnysa</i> | Skipper | <i>Gahnia sieberana</i> <i>Gahnia melanocarpa</i> | Sword Grass |
| | <i>Hasora khoda</i> | Skipper | | |
| | <i>Ocybadistes walkeri sothis</i> | Skipper | | |
| | <i>Telicota ancilla ancilla</i> | Greenish darter | | |
| | <i>Netrocoryne repanda repanda</i> | Eastern Flat | <i>Notelaea longifolia</i> <i>Brachychiton populneum</i> | Native Olive Kurrajong |

Three Butterfly species of special interest are:

1. The Green-banded Blue (*Danis hymetus taygetus*) is a colourful small rainforest species which feeds exclusively on Red Ash (*Alphitonia excelsa*). Pittwater is recorded as the southern breeding limit of the butterfly in Australia. Specimens of Red Ash are still present in a number of areas of Pittwater (eg. the recently-burned perimeter of Stapleton Reserve, Avalon). However, as the tree is not a traditional garden subject, partly due to difficulty of propagation even under nursery conditions, it is likely that both the tree and the butterfly are on the decline in Pittwater.
2. Another small rainforest butterfly reaching its southern distribution limit in Sydney is the Hairy Line-blue (*Erysichton lineata lineata*). This species is recorded as feeding primarily on Tuckeroo (*Cupaniopsis anarcardioides*). However, it is possible that the species is utilizing other foodplants in Pittwater (such as the closely related rainforest species *Alectryon subcinereus* or even cultivated *Macadamia*).
3. The Blue Jewel (*Hypochrysops delicia*) breeds only on old trees of *Acacia melanoxylon* (and related phyllode-leaf acacias). It requires the presence of borer holes to provide shelter for larvae. Clearing of old acacias and lack of fire to prompt regeneration of replacement trees is leading to decline of this beautiful species in Pittwater. However, the species is widespread in Australia.

In addition, a number of species are of conservation interest as they occur at their southern limit and Council is seeking to maintain species across their range. *Graphium euryplis lycaon* is at its southern limit in Sydney where it is recorded only occasionally between January and April and although present in Stapleton Park, it is not known on which native food plants it feeds. *Eurema hecabe phoebus* is at its southern limit in Sydney and feeds on *Breynia oblongifolia* and various *Acacias*. Migration is a well developed family trait and the genus flies close to the ground. Glistening Blue (*Theclinessthes scintillata*) is not commonly found past its southern range, Grafton.

Other species of interest are *Delias nigrina* and *D. harpalyce* which feed on mistletoes present on eucalypts, in particular, *Muellerina eucalyptoides*, and Macleay's swallowtail (*Graphium macleayanum macleayanum*) is common at altitudes above 300m which flies in Sydney from August to April. The common larval food plants are *Doryphora sassafras*, *Atherosperma moschatum* and the introduced *Cinnamomum camphora* (Camphor laurel).

A recent review (Williams and Adam, 1994) of rainforest pollination by insects considers the problem of the conservation, management and the ongoing viability of diverse lowland subtropical rainforest stands in remnants that have been massively fragmented. They seek to understand and maintain the plant pollination interactions and other regeneration processes. Butterflies have been recorded (Williams, 1993) as pollinators of the vine *Parsonsia straminea* in lowland subtropical rainforest on NSW. Other invertebrates are recorded as pollinators of specialist plant species: minute Agaonidae wasps are thought to be host specific and pollinate the fig, *Ficus coronata*; weevils (*Elleschodes* spp.) pollinate *Eupomatia laurina*; and thrips pollinate *Wilkiea hugeliana*, *Rapanea* and *Maclura*.

