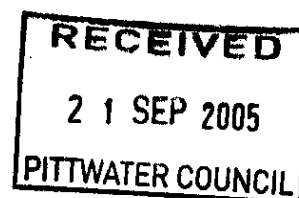


Urban Bushland Inventory and Action Plan



Volume 2 South Ward Reserves

 Pittwater Council

Natural Resources Unit
April 1997

Acknowledgements

The vegetation sections were prepared by Roger Lembit, the fauna sections by Paul Burcher and bat surveys by Margaret Turton. The remainder was prepared by Diane Campbell, Polly Thompson, Chris Williams and Skye Addison with desktop publishing and graphics by Tanya Carmont.



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Reserves not covered within Urban Bushland Plan of Management South Ward Reserves are as follows:
 Narrabeen Headland Reserve, Turimetta Headland & Beach Reserves, Warriewood Beach, Boondah Reserve (west), Hunter Street Reserve, Warriewood Wetlands, Narroy Park, Tatiara Crescent Reserve, Eungai Place Reserve, Lakeside Park, Pat Hynes Reserve, Kalang Road Reserve and Bilarong Reserve.

1.0 Vegetation Overview

1.1 Introduction

As part of the development of a Plan of Management for Urban Bushland in the Pittwater Council area, this report describes the vegetation within urban bushland in the area. The plant communities occurring in the Pittwater area are described and compared to those occurring in nearby conservation reserves and the Sydney region generally. The vegetation within reserves is discussed and special features detailed.

A review of the occurrence of rare or threatened species and plant species of conservation significance is presented.

The extent of weed invasion and its impact on native vegetation is discussed.

1.2 Methods

Information relating to the vegetation of urban bushland within the Pittwater area was reviewed. This included existing management plans and draft plans for urban bushland reserves, reports by bush regeneration contractors and volunteers, student reports and broader surveys conducted by the Royal Botanic Gardens and the National Parks and Wildlife Service.

The field survey work undertaken as part of this study was directed at sampling replicated sites across a range of environmental variables, namely, geology, aspect and topographic location. In all, 37 sites were sampled and analysed. The information obtained was used in the plant community descriptions for the reserves detailed later in this report.

The methods used in the field survey component of the inventory were :

- 1) Identification of suitable survey sites based on location of previous detailed survey work and the need to locate sites in replicated samples across the range of environmental variables occurring across the study area.
- 2) Vegetation sampling at the survey sites used standard techniques adopted by the National Parks and Wildlife Service and the Royal Botanic Gardens. At each vegetation sample site a 20x20 metre quadrat was established. Records were made on standard forms of site location, topography, geology, slope class, mapped soil type, altitude, aspect, evidence of past disturbance,

weed control history, fire history, vegetation structure, height, cover and dominant species of each plant stratum, each individual plant species present and the cover of each species present on a modified Braun-Blanquet scale.

- 3) The aim was to survey forty (40) sample sites and make incidental records of species occurring in bushland areas outside of the sample sites. At the completion of the survey 37 sites had been sampled. A search for plant species of conservation significance including species listed as Rare or Threatened (ROTAP's) on a national basis was undertaken.
- 4) Field surveys were conducted in association with Council officers, local volunteers and bush regenerators.

Sample sites were located in the following bushland reserves (number of sample sites in brackets):

Avalon	Stapleton Park (4) Bangalley Head (1) Angophora Reserve (3)
Bayview	Minkara Reserve (2) Walter Road Reserve (1)
Bilgola	Hewitt Park (1)
Elanora Heights	Deep Creek Reserve (4) Epworth Park (1) Dewrang Reserve (1) Kundibah Reserve (1)
Elvina Bay	Elvina Park (1) Rocky Point (1)
Ingleside	Ingleside Park (2)
Mona Vale	Mona Vale Headland Reserve (1) Mona Vale Beach (1)
Newport	Bungan Beach (1) Attunga Reserve (2)
North Narrabeen	Irrawong Reserve (1)
Palm Beach	Sunrise Reserve (1) Hordern Park (1) Annie Wyatt Reserve (1)
Scotland Island	Elizabeth Park (2)
Warriewood	Narrabeen Headland Reserve (1) Turimetta Headland Reserve (2)



1.3 Broad Vegetation Types

Vegetation mapping of the Sydney 1 : 100 000 map sheet by the Royal Botanic Gardens (Benson & Howell 1994) identifies seven vegetation map units within the Pittwater Council area. These map units include areas of similar vegetation structure and floristics and recognisable geological and landscape characteristics. Another of the vegetation map units identified by Benson & Howell (1994) was found to occur in the Pittwater area. The eight map units found in the Pittwater area are listed below.

Spotted Gum-Blackbutt Forest (9g)
 Narrabeen Slopes Forest (9h)
 Duffys Forest (9sf)
 Sydney Sandstone Gully Forest (10ag)
 Sydney Sandstone Ridgetop Woodland (10ar)
 Coastal Clay Heath (21a)
 Coastal Sandstone Heath (21g)
 Coastal Swamp Forest Complex (27a)

More intensive survey within a localised area may reveal particular variations and another level of detail regarding the distribution of plant communities represented by the map units. The present survey has added to the knowledge of the plant communities which exist in the Pittwater area. Further detail on these communities is presented in the next section of this report.

1.4 Plant Communities of the Pittwater Area

Plant communities occurring in the Pittwater area are described below.

Spotted Gum-Blackbutt Forest Communities

Spotted Gum Forest

Spotted Gum Forest occurs on lower slopes of McKay Reserve along Barrenjoey Road, in Dark Gully Park, Stapleton Park, Angophora Reserve and is widespread along the western foreshores of Pittwater, including Elvina Park. Towards the north of McKay Reserve it extends onto higher slopes, in an area of sheltered aspect. The plant community is associated with Newport formation geology on soils of the Watagan soil landscape unit (Chapman and Murphy 1989). The dominant tree species is Spotted Gum (*Eucalyptus coryimba*), with associated species including Grey Ironbark (*E. paniculata*) and Bangalay (*E. botryoides*). Tree height is generally over 20 metres tall with individuals reaching 30 metres.

The canopy density in some areas has been reduced due to dieback over the years. This problem appears to be continuing.

There is a layer of tall shrubs and small trees of medium to high density. The most common species include Forest Oak (*Allocasuarina torulosa*), Cheese Tree (*Glochidion ferdinandii*), Blueberry Ash (*Elaeocarpus reticulatis*) and Sweet Pittosporum (*Pittosporum undulatum*). Other associated species include Mock Olive (*Notelaea longifolia*), Hop Bush (*Dodonaea triquetra*) and the introduced Lantana (*Lantana camara*).

The ground layer is dense and in wet areas dominated by ferns. Elsewhere grasses and sedges are common. Frequent ground layer species include Bracken Fern (*Pteridium esculentum*), False Bracken (*Calochlaena dubia*), Common Maidenhair Fern (*Adiantum aethiopicum*), Bordered Panic (*Entolasia marginata*), Variable Sword-sedge (*Lepidosperma laterale*), Spiny Mat-rush (*Lomandra longifolia*), Kangaroo Grass (*Themeda australis*) and the introduced Asparagus fern (*Protasparagus aethiopicus*). Common climbers include Wonga Vine (*Pandorea pandorana*), Sweet Sarsaparilla (*Smilax glycyphylla*) and *Morinda jasminoides*.

Spotted Gum Forest was formerly widespread on the lower slopes of the western side of the Barrenjoey Peninsula. The extent of this community has been greatly affected by urban development, but examples remain in McKay Reserve, Angophora Reserve and Stapleton Park. Barrenjoey Peninsula was formerly a significant part of its distribution. Other examples occur on Scotland Island, the western shores of Pittwater and at Burley Griffin Lodge, Avalon, a property owned by the National Trust. All remaining examples have conservation significance at a state level.

Narrabeen Slopes Forest Communities

Newport Bangalay Woodland

Newport Bangalay Woodland is found in areas along creeklines on sites with Newport Formation Geology. Examples occur in McKay Reserve, Dark Gully Park, Crown of Newport Reserve and along the western foreshores of Pittwater. The dominant tree species are Bangalay (*E. botryoides*), Spotted Gum and Smooth-barked Apple (*Angophora costata*).

Underneath the canopy, a dense layer of rainforest trees is present. Common species include Cabbage-Tree Palm (*Livistona australis*), Sweet Pittosporum, Lillypilly (*Acmena smithii*) and Port Jackson Fig (*Ficus rubiginosa*). Weed species are common and prevent regeneration of native species. Common weeds include Wandering Jew (*Tradescantia albiflora*), Fishbone Fern (*Nephrolepis cordifolia*) and Morning Glory (*Ipomoea indica*). Native ground layer plants include False Bracken, Prickly Rasp Fern (*Doodia aspera*).

Newport Bangalay Woodland has a restricted distribution on Barrenjoey Peninsula. Examples exist at McKay Reserve, Dark Gully Park and Crown of Newport Reserve. More generally it is restricted to Newport Formation geology. Other examples exist at Cicada Glen Creek and McCarrs Creek within Kuring-gai National Park.

Cabbage Tree Palm Forest

Sheltered gullies of eastern aspect such as at Hewitt Park support Cabbage Tree Palm Forest. The structural formation is Closed-forest with Cabbage Tree Palm (*Livistona australis*) being the dominant species. Associated tree species include Guioa (*Guioa semiglauc*), Forest Oak (*Allocasuarina torulosa*) and Veiny Wilkiea (*Wilkiea huegeliana*). Emergent Broad-leaved White Mahogany (*Eucalyptus umbra*) trees are also present.

Duffys Forest Community

Bilgola Plateau Forest

On lateritic soils on the Bilgola Plateau an open-forest community dominated by Silvertop Ash (*E. sieberi*), Scribbly Gum (*E. haemastoma*) and Red Bloodwood (*Corymbia gummifera*) occurs.

This community includes a distinct range of species some of which are uncommon or not found elsewhere in the Council area. These include Woody Pear (*Xylomelum pyrifolium*) and Waratah (*Telopea speciosissima*).

Sydney Sandstone Gully Communities

Hawkesbury Sandstone Open-Forest

This community occurs on moderate to steep slopes associated with soils of the Hawkesbury soil landscape unit (Chapman and Murphy 1989), with an occurrence in McKay Reserve on flatter land south-west of Cynthea Road. The structure is variable with open-forest to woodland formation being present.

The most common tree species are Smooth Barked Apple, Sydney Peppermint (*E. piperita*) and Red Bloodwood (*E. gummifera*). Associated trees include Bastard Mahogany (*E. umbra*) and Grey Gum (*E. punctata*). Tree height varies from 10 metres on exposed slopes to over 25 metres in sheltered gullies. In more sheltered areas such as the upper part of Dark Gully Creek, the low tree layer consists of small trees of 10 to 12 metres with Forest Oak (*Allocasuarina torulosa*), Cheese Tree (*Glochidion ferdinandii*), Cabbage-tree Palm (*Livistona australis*) and Lillypilly (*Acmena smithii*). Along this creek the three latter species form a narrow strip of rainforest trees.

There is a well developed understorey of low trees about 8 metres in height. Black She-oak (*Allocasuarina littoralis*) is common and in some places forms a dense low closed forest with few eucalypts present. Old Man Banksia (*Banksia serrata*) is also found in this understorey stratum.

The shrub and ground layers are quite variable in composition and density. Common shrubs include Blueberry Ash (*Elaeocarpus reticulatus*), Mock Olive (*Notolaea longifolia*), Broad-leaf Star-hair (*Astrotricha latifolia*) and Pink Spider Flower (*Grevillea sericea*). Herbs include Paroo Lily (*Dianella caerulea*), Wiry Panic, Tall Saw-sedge (*Gahnia clarkei*), a grass tree (*Xanthorrhoea media*), Spiny Mat-rush (*Lomandra longifolia*) and Black Bog Rush (*Schoenus melanostachys*). In wet areas common ferns are False Bracken (*Calochlaena dubia*). Climbers include Sweet Sarsaparilla (*Smilax glycyphylla*), Wonga Vine (*Pandorea pandorana*) and Wombat Berry (*Eustrephus latifolius*).

Hawkesbury Sandstone Open-forest due to its presence on steeper land has not been affected to as great a degree as other plant communities by urban development. It is present in many Council bushland reserves including at Angophora Reserve, McKay Reserve, Ingleside Park and Stapleton Park. Elsewhere it is adequately conserved in Kuring-gai National Park, Muogamarra Nature Reserve and Brisbane Water National Park and on a statewide basis (Benson 1989).

Coachwood Closed-forest

Sheltered gullies protected from fire support a closed-forest community dominated by Coachwood (*Ceratopetalum apetalum*) and Lilly Pilly (*Acmena smithii*). Examples are at Crown of Newport Reserve, Hewitt Park, Epworth Park and in Deep Creek Reserve.

Associated species include Bastard Rosewood (*Synoum glandulosum*), Veiny Wilkiea (*Wilkiea huegeliana*), Cheese Tree (*Glochidion ferdinandii*), False Bracken Fern (*Calochaena dubia*) and Gristle Fern (*Blechnum cartilagineum*).

Sydney Sandstone Ridgetop Communities

Red Bloodwood - Scribbly Gum Woodland

Red Bloodwood - Scribbly Gum Woodland occurs on Hawkesbury Sandstone towards the top of the Palm Beach plateau at McKay Reserve. The terrain is flatter and less rocky than the bulk of the Reserve. The area supporting this plant community in the Reserve is restricted to 1.5 hectares. The community also occurs in Ingleside park and Deep Creek Reserve.

The dominant tree species are Red Bloodwood (*Eucalyptus gummifera*) and Scribbly Gum (*E. haemastoma*). Associated tree species include Smooth Barked Apple (*Angophora costata*) and Grey Gum (*E. punctata*). Tree height averages about 12 metres.

Smaller trees to about 9 metres in height include Black She-oak (*Allocasuarina littoralis*) and Old Man Banksia (*Banksia serrata*). There is also a shrub layer of medium density to 2 metres in height. Common shrub species include Needle-bush (*Hakea sericea*), Rock Banksia (*Banksia oblongifolia*), Hair-pin Banksia (*Banksia spinulosa*) and Pink Spider Flower (*Grevillea sericea*).

A dense ground layer to 50 cm tall is dominated by sedges, grasses and low shrubs. Common ground layer plants include Wiry Panic (*Entolasia stricta*), the sedges, *Ptilantherium deustum* and *Cyathochaeta diandra*, Twisted Mat-rush (*Lomandra obliqua*) and Pale Mat-rush (*Lomandra glauca*).

The extent of this community along the Barrenjoey Peninsula has been greatly reduced by urban development. Elsewhere this community is present in Kuring-gai National Park, Muogamarra Nature Reserve and Brisbane Water National Park. The community is considered to be adequately preserved in New South Wales (Benson 1989), but has local significance as a remnant of the local vegetation.

Hawkesbury Sandstone Heath

Skeletal soils on Hawkesbury sandstone support scrub or heath communities dominated by Heath-leaved Banksia (*Banksia ericifolia*), *Hakea gibbosa*, *Leptospermum trinervium* and Scrub She-oak (*Allocasuarina distyla*).

Areas of closed-scrub, open-scrub or open-heath formation are of restricted distribution in the Pittwater Council area. This is in contrast to the relatively widespread areas of scrub/heath further west in Kuring-gai Chase National Park. Examples in the Pittwater area occur at Walter Road Reserve and at Ingleside.

Coastal Clay Heath Communities

Headland Open-scrub

At Mona Vale Headland and parts of Turimetta Headland the native vegetation consists of an open-scrub formation dominated by Scrub She-oak (*Allocasuarina distyla*) and Coastal Teatree (*Leptospermum laevigatum*). Shrub height is generally between 2 and 3 metres. Associated shrub species include Coast Rosemary (*Westringia fruticosa*), Rusty Petals (*Lasiopetalum ferrugineum*) and Coast Wattle (*Acacia sophorae*).

There is a ground layer of medium to high density dominated by grasses and sedges. Ground layer species include Kangaroo Grass (*Themeda australis*), *Ptilantherium deustum*, *Xanthosia tridentata*, Spiny Mat-rush (*Lomandra longifolia*) and *Dianella caerulea* var. *producta*.

Kangaroo Grass also dominates much of the mown grassland areas at Mona Vale Headland.

Coastal Scrub

Shale soils associated with headlands and sheltered areas on dunes support an open-scrub dominated by Coast Banksia (*Banksia integrifolia*), Coast Rosemary (*Westringia fruticosa*) and Coastal Teatree (*Leptospermum laevigatum*). Associated shrubs include Black She-oak and Rusty Fig (*Ficus rubiginosa*).

There is a ground layer of medium density, with a range of grasses, vines and grass-like plants. These include Kangaroo Grass (*Themeda australis*), Sea Rush (*Juncus kraussii*), Dusky Coral Pea (*Kennedia rubicunda*), *Dianella revoluta*, Spiny Mat-rush (*Lomandra longifolia*), Scented Marsdenia (*Marsdenia suaveolens*) and Old Man's Beard (*Clematis aristata*).

Exotic weeds are common, particularly in disturbed areas or those affected by nutrient charged run-off. Weed species present include Mirror Plant (*Coprosma repens*), Gazania (*Gazania rigens*), Madeira Vine (*Anredera cordifolia*), Blackberry (*Rubus ulmifolius*), Asparagus Fern (*Protasparagus aethiopicus*), Lantana (*Lantana camara*), Bitou Bush (*Chrysanthemoides monilifera*), Kurnell Curse (*Hydrocotyle bonariensis*) and Mother-of-Millions (*Kalanchoe tubiflora*).

Examples of this community occur towards the southern end of Mona Vale Beach and South Mona Vale Headland Reserve.

Coastal Dune Heath Communities

Coastal Closed-Heath

Stabilised dunes behind Mona Vale, Avalon and Bungan beaches support a closed-heath community dominated by Coast Wattle (*Acacia sophorae*). The dominant shrub layer varies between 1 and 2 metres in height. Tree Broom-heath (*Monotoca elliptica*), *Breynia oblongifolia* and Black She-oak (*Allocasuarina littoralis*) are associated shrub species.

The ground layer is of low density and dominated by herbs and creepers. Common species include Beach Fan Flower (*Scaevola calendulacea*), Kidney Weed (*Dichondra repens*), Spinifex (*Spinifex hirsutus*) and Guinea Flower (*Hibbertia scandens*).

Exotic species are common. These include Gazania (*Gazania rigens*), Bitou Bush (*Chrysanthemoides monilifera*), Fern Asparagus (*Protasparagus aethiopicus*), Lantana (*Lantana camara*) and Kurnell Curse (*Hydrocotyle bonariensis*).

This plant community is not identified as occurring in the Pittwater area by Benson & Howell (1994) as it is of limited extent, not possible to map at the broader scale of their survey.

Cliff-face Open-heath

Areas on cliff-faces of Hawkesbury Sandstone along the coast support an open-heath community dominated by Coast Rosemary (*Westringia fruticosa*) and Coast Wattle (*Acacia sophorae*). Associated native shrub species include Scrub She-oak (*Allocasuarina distyla*), Coastal Teatree, Hop Goodenia (*Goodenia ovata*) and Sweet Pittosporum (*Pittosporum undulatum*). Ground layer species include Kangaroo Grass (*Themeda australis*) and Spiny Mat-rush (*Lomandra longifolia*).

Coastal Swamp Forest Complex

Swamp Mahogany Forest

Flat low-lying areas in the Warriewood area such as at Irrawong Reserve support an open-forest community dominated by Swamp Mahogany (*Eucalyptus robusta*). Associated tree species include Cabbage Tree Palm and *Melaleuca linariifolia*. The ground layer includes wetland plants such as Common Reed (*Phragmites australis*) and Swamp Pennywort (*Centella asiatica*).

Swamp Oak Woodland

Areas of alluvial flats at McCarrs Creek and Boondah Reserve at Warriewood support woodland dominated by Swamp Oak (*Casuarina glauca*). Associated tree species include Rough-barked Apple (*Angophora floribunda*) and Cheese Tree (*Glochidion ferdinandi*). Ground layer species include *Gahnia sieberiana*, *Juncus kraussii*, *Phragmites australis* and *Sporobolus virginicus*.

Table 2 Conservation Status of Plant Communities

Plant Community	Code	KCNP	GNP	PC	Notes
Spotted Gum Forest	PC01	+	-	L	Significance at state level
Newport Bangalay Woodland	PC02	+	-	L	
Cabbage Tree Palm Forest	PC03	*	-	*	Very restricted, regionally significant plants
Bilgola Plateau Forest	PC04	*	+	*	Only at Plateau Reserve
Hawkesbury Sandstone Open-forest	PC05	W	W	W	
Coachwood Closed-forest	PC06	+	-	*	Very restricted, regionally significant plants
Red Bloodwood-Scribbly Gum Forest	PC07	W	W	L	
Walter Road Reserve Woodland	PC08	-	-	*	Unusual species combination
Hawkesbury Sandstone Heath	PC09	W	+	*	
Headland Open-scrub	PC10	-	-	L	
Coastal Scrub	PC11	-	-	L	
Coastal Closed-heath	PC12	-	-	L	
Cliff-face Open-heath	PC13	-	-	L	
Swamp Mahogany Forest	PC14	-	-	*	Very restricted, regionally significant
Swamp Oak Woodland	PC15	L	-	L	Restricted, regionally significant

Notes

W Widespread + Present at several locations L Limited distribution*

*Found only in small areas - Not present

1.5 Rare, Threatened and Significant Plant Species

This section of the report seeks to identify those plant species which are in some way special within the Pittwater area. Such species include those which are considered to be rare or threatened on a national basis, or which have been listed under the Threatened Species Conservation Act, 1995, those which are considered to be of regional significance due to their restricted distribution or due to the fact they are at a range limit, and those species which are restricted in the Pittwater area, including those rarely recorded during recent surveys of the Pittwater area.

The following table, which relates to Appendix 2, has been updated from the Council's 1995 State of the Environment Report lists the significant plants and their occurrence within the Pittwater area.

Scientific Name	Common Name	Notes
<i>Acacia falcata</i>	Sickle Wattle	Disjunct local population. Former TAFE site, Mona Vale. 1 and Ingleside Road
<i>Acronychia oblongifolia</i>	Common achronychia	Rare local populations at Clareville, Stapleton Park & Bilgola Bends. 26
<i>Allocasuarina verticillata</i>	Drooping She-Oak	Disjunct local population. Newport to Mona Vale, Turimetta Head Reserve & Bungan Beach Reserve. 2
<i>Arthrochilus prolixus</i>	Elbow Orchid	Only location in Sydney Region. Angophora Reserve. 3
<i>Bertya brownii</i>		ROTAP 2RC- southern limit. Katandra, Mona Vale. 4 See also D. Windfield's report on Mullet Creek Bushland
<i>Bossiaea prostrata</i>		Rare local population. Former TAFE site, Mona Vale. 5
<i>Callitris rhomboidea</i>	Port Jackson Cypress	Rare in Pittwater. Stapleton Park, Scotland Island & western foreshores. 6
<i>Cassine australis</i>	Red Olive Plum	Locally uncommon. Bungan Beach. 27 Browns Bay, Warriewood Beach
<i>Craspedia variabilis</i>		Locally uncommon. Stapleton Park. 7
<i>Daviesia umbellulata</i>		Rare local population. McKay Reserve. 8
<i>Eucalyptus camfieldii</i>	Heart-leaved Stringybark	Ku-ring-gai Chase National Park. 9
<i>Eucalyptus capitellata</i>	Brown Stringybark	Locally uncommon. Walter Rd Reserve. 10
<i>Eucalyptus oblonga</i>	Sandstone Stringybark	Restricted in Sydney Region. 11
<i>Eucalyptus robusta</i>	Swamp Mahogany	Locally uncommon, rare in Sydney Region. Warriewood Wetlands, Irrawong Reserve. 12 Bayview Golf Course
<i>Eucalyptus scias</i>	Large-fruited Red Mahogany	Rare local populations. McKay Reserve, Bilgola Bends. 13
<i>Eupomatia laurina</i>	Bolworra	Locally uncommon. Stapleton Park, Crown of Newport Reserve, Bilgola Bends. 14 Warriewood Beach, Irrawong Reserve
<i>Flagellaria indica</i>	Whip Vine	Only recorded location between Broken Bay & Port Hacking. Barrenjoey Head. 15
<i>Grevillea caleyi</i>		ROTAP 2eci local endemic. NPWS Species Recovery Plan. 16
<i>Pararchidendron pruinatum</i>	Snow-wood	Locally uncommon. McKay Reserve, Dark Gully Park, Barrenjoey Head & Crown of Newport Reserve. 17
<i>Planchonella australis</i>	Black Apple	Rare in Pittwater. Private land near Stapleton Park. 18
<i>Platysace clelandii</i>		ROTAP 2rca. Ingleside. 19
<i>Pomaderris sp. B</i>		Undescribed species restricted to headlands at Bulli and Mona Vale to Bungan. Mona Vale Headland Reserve. 20
<i>Prostanthera denticulata</i>	Rough Mint-bush	Local endemic. Stapleton Park & Bilgola Bends. 21 Irrawong Reserve
<i>Pultenaea hispidula</i>		Local populations, uncommon. Ingleside. 22
<i>Rulingia hermannifolia</i>		ROTAP 3rca. Bangalley Head. 23
<i>Schizomeria ovata</i>	Crabapple	Uncommon in coastal Sydney. Crown of Newport Reserve & Bilgola Bends 24. Irrawong Reserve, Browns Bay
<i>Syzygium paniculatum</i>		ROTAP 3vci. Browns Bay & Scotland Is. 25

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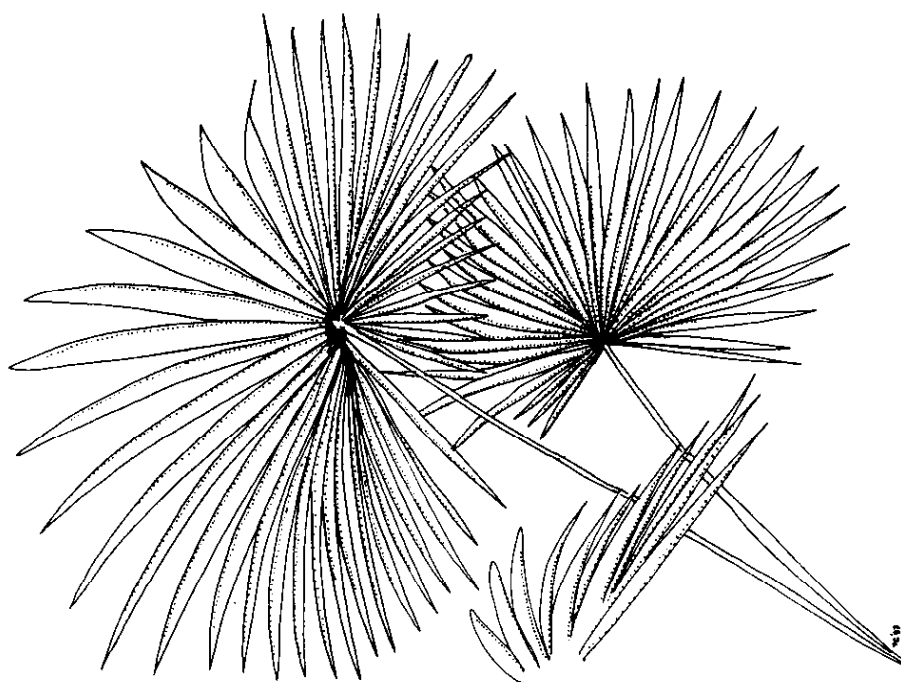


Table 1 Plant Community Relationships in the Pittwater Council Area

COMMUNITY R Lembit	Pittwater Code	RBG	RBG Code	DOMINANT SPECIES	NOTES	Smith & Smith	Cunningham
Spotted Gum Forest	PC01	Spotted Gum - Blackbutt Forest	9g	<i>Corymbia maculata</i>	Lower slopes on Newport formation geology	<i>C. maculata</i> <i>Eucalyptus paniculata</i> - <i>E. punctata</i> #2	
Newport Bangalay Woodland	PC02	Narrabeen Slopes Forest	9h	<i>E. botryoides</i> <i>C. maculata</i> <i>Angophora costata</i>	Creeklines on Newport formation geology	<i>E. botryoides</i> <i>E. botryoides</i> - <i>C. maculata</i> <i>E. botryoides</i> - <i>E. paniculata</i> <i>A. floribunda</i> - <i>E. botryoides</i>	
Cabbage Tree Palm Forest	PC03	Narrabeen Slopes Forest	9h	<i>Livistona australis</i>	Sheltered gullies		
Bilgola Plateau Forest	PC04	Duffys Forest	9sf	<i>E. sieberi</i> <i>E. haemastoma</i> <i>C. gummifera</i>	Lateritic soils on Bilgola Plateau		
Hawkesbury Sandstone Open-forest	PC05	Sydney Sandstone Gully Forest	10ag	<i>A. costata</i> <i>E. piperita</i> <i>C. gummifera</i>	Moderate to steep slopes on Hawkesbury Sandstone geology	<i>A. costata</i> - <i>C. maculata</i> #3 <i>A. costata</i> - <i>E. botryoides</i> #4	5. Tall Open Forest 6. Open Forest 3. Closed Forest
Coachwood Closed-forest	PC06			<i>Ceratopetalum apetalum</i> <i>Acmena smithii</i>	Sheltered gullies		
Red Bloodwood - Scribbly Gum Woodland	PC07	Sydney Sandstone Ridgeline Woodland	10ar	<i>C. gummifera</i> <i>E. haemastoma</i>	Flat ridgetops on Hawkesbury Sandstone	<i>C. gummifera</i> - <i>E. haemastoma</i> <i>A. floribunda</i> - <i>E. haemastoma</i> <i>C. gummifera</i> - <i>A. costata</i> <i>C. gummifera</i> - <i>A. floribunda</i>	7. Woodland 8. Low Woodland #1
Walter Road Reserve Woodland	PC08	Sydney Sandstone Ridgeline Woodland	10ar	<i>C. gummifera</i> <i>E. punctata</i> <i>E. capitellata</i>	Ridges and higher slopes at Walter Road Reserve on moderately deep soils		

Hawkesbury Sandstone Heath	PC09	Sydney Sandstone Ridgeline Woodland	10ar	<i>Banksia ericifolia</i> <i>Hakea teretifolia</i> <i>Allocasuarina distyla</i>	Shallow soils and rocky areas on Hawkesbury Sandstone	9. Heath 10. Rocky Heath
Headland Open -scrub	PC10	Coastal Clay Heath	21a	<i>Al. distyla</i> <i>Leptospermum laevigatum</i>	Exposed headlands on shale geology	
Coastal Scrub	PC11	Coastal Clay Heath	21a	<i>B. integrifolia</i> <i>Westringia fruticosa</i> <i>L. laevigatum</i>	Sheltered areas of headlands and coastal dunes	
Coastal Closed-heath	PC12	Coastal Sandstone Heath	21g	<i>Acacia sophorae</i>	Coastal dunes	
Cliff-face Open-heath	PC13	Coastal Sandstone Heath	21g	<i>W. fruticosa</i> <i>Ac. sophorae</i>	Coastal cliff-faces on Hawkesbury Sandstone	
Swamp Mahogany Forest	PC14	Coastal Swamp Forest Complex	27a	<i>E. robusta</i>	Creek flats on alluvium	1. Warriewood Wetland 4. Swamp Mahogany
Swamp Oak Woodland	PC15	Coastal Swamp Forest Complex	27a	<i>Casuarina glauca</i>	Creek flats on alluvium	

#1 Some overlap with Hawkesbury Sandstone Heath

#2 May overlap with Newport Bangalay Woodland

#3 Transition between Hawkesbury Sandstone Open-forest and Spotted Gum Forest

#4 Areas exposed to coastal breezes

2.0 Fauna Overview

The Pittwater area is favoured by a range of factors which have contributed to the area's faunal diversity. On a broad scale, these are the large amount of remnant bushland within the area; variations in topography, geology and soil types; and its coastal location adjacent to large areas of reserved habitat in Ku-ring-gai Chase and Garigal National Park and proximity to Bouddi and Brisbane Waters National Parks.

A range of habitat types are represented within Pittwater's reserve system. In the southern parts most commonly the reserves are heaths, woodlands or open forests dominated by typical Hawkesbury sandstone vegetation. Important habitat components within these habitats are hollow-bearing trees, rock outcrops, watercourses and the diversity in structure and species composition of the vegetation. The larger of these reserves, and those contiguous with privately-owned bushland (eg Ingleside and Epworth Parks) are able to sustain a diverse fauna assembly including top-order carnivores and threatened species. In such reserves species unable to adapt to suburban gardens (eg insectivorous birds, larger reptiles) survive. Even the smaller reserves such as those in Elanora Heights provide important refuge and breeding niches for fauna which may venture into local gardens.

The 'wetter' forests on the Narrabeen sandstone of the slopes around the Pittwater have habitat features not available on the Hawkesbury sandstone vegetation such as winter flowering spotted gums, a higher nutrient foliage level and rainforest fruits. Examples of species preferring such habitats are squirrel gliders and topknot pigeons.

The coastal heaths and scrubs represented at reserves such as Bangalley Headland and Bungan Beach provide the winter food resource of heath-leaved Banksia, which is important to both resident birds and mammals and seasonal migrants such as honeyeaters.

Important wetlands occur at Warriewood and North Narrabeen. Although these have been degraded they are habitat for species such as tawny grassbirds and golden-headed cisticolas which do not utilise dry land habitats. The wetlands also contain stands of swamp mahogany, a winter flowering eucalypt favoured by a range of mammals, including the koala, and birds - particularly resident and migratory honeyeaters.

Based on a review of fauna records for the region and available habitat types in the reserves, it is estimated around 220 native vertebrate species could inhabit Pittwater's bushland reserves. Of particular note is the presence of a wide range of top order predators (eg quolls, owls and hawks) indicating an abundant prey population.

28 species listed as threatened in NSW have been recorded in Pittwater, eleven of which are known extant residents. Probably the most significant of these is the squirrel glider which occurs on the peninsula. This is the only Sydney population of the species and Council has applied to the National Parks and Wildlife Service to have it listed as an endangered population under the provisions of the Threatened Species Conservation Act. A number of fauna species now rare or missing from other Sydney suburban areas, such as the long-nosed bandicoot and pheasant coucal, are also represented in council reserves.

However, the future of Pittwater's diverse biota is not secure. For example, the local koala colony has declined from more than 123 individuals in 1970 to about eight in 1990 (Smith and Smith, 1990). Other species which are likely to decline in the long term are long-nosed bandicoots, squirrel and sugar gliders, and the wide range of smaller bush birds such as fantails, thornbills and whistlers which require the structurally diverse native vegetation, and other habitat features, represented in reserves.

2.1 Description of Habitat Types

Hawkesbury Sandstone Woodlands

This habitat type is widespread in the Ingleside area with a few remnants on plateaux on the Peninsula eg Plateau Park. The shrub layer is very diverse with a range of plants requiring pollination by birds, or by invertebrates which attract birds. However, the low nutrient status of the soils on which the woodlands grow results in low faunal densities. During profuse flowering events this may change.

Another important feature of these woodlands is the mosaic of fire history. Time since fire can determine the presence or absence of various species eg the rare southern brown bandicoots is at higher densities in the first few years after fire (Opie et al, 1990).

Ephemeral drainage lines in this habitat type are able to hold enough water to support reproduction of the threatened red-crowned toadlet and giant burrowing frog. These two sandstone specialists also forage in the woodlands for ants.

Rock outcrops are common and harbour reptiles, mammals and frogs. They are therefore important protection during fires.

Hawkesbury Sandstone Forest

This habitat type is well represented in the Elanora Heights-Ingleside area on slopes with soils derived from Hawkesbury sandstone. As a consequence of this rock outcrops are a common feature and provide shelter and sunning areas for reptiles. Like the sandstone woodlands there is a diverse range of flowering plants.

Hollows suitable for habitation by possums, bats, parrots and owls are common in this habitat type mainly due to the abundance of smooth-barked apples. Decorticating bark on trees provides roosting niches for insectivorous bats. These bats feed on invertebrates attracted to the trees as do many nocturnal and diurnal birds such as frogmouths, owls, cuckoos, pardalotes, whistlers and fantails.

Coastal Heaths and Scrubs

This habitat type occurs on the exposed headlands and behind beaches. There is a wide variety of flowering plants - the most notable being the autumn-winter flowering *Banksia ericifolia* and *B.integrifolia*. These species attract a large number of migratory and nomadic honeyeaters and lorikeets.

These birds reside and pass through the peninsula as they move northwards during the cooler months. Insectivorous birds such as the white-browed scrub wren are also afforded protection by the thick vegetative cover. The small raptors - black shouldered kite and Australian Kestrel - can often be seen hovering prey in more open areas where grasses dominate.

Narrabeen Group Forest

Although this habitat type is not as floristically diverse as the woodlands it is more structurally diverse and thus provides a greater range of habitat niches for fauna. As it is usually on better soils than other habitat types its higher nutrient status means it can support greater densities of fauna than other habitats.

A features of this habitat type is the presence and often dominance of the winter flowering eucalypts - spotted gum on slopes at Bayview and on the peninsula and swamp mahogany in alluvial flats such as Avalon, Warriewood and Deep Creek. Apart from the abundant nectar favoured by a honeyeaters, lorikeets and possums and gliders, these trees also develop hollows. Wattles such as *Acacia irrorata* also provide pollen and exudates consumed by gliders.

The thick groundcover, fallen limbs and occasional rock outcrops also provide shelter areas for species inhabiting the forest floor. The regionally significant long-nosed bandicoots is probably the most obvious species favoured by this habitat feature.

Table 1 Relationship Between Habitat Type and Vegetation

Habitat Type	Vegetation Communities	Significant Habitat Features
Coastal Heaths & Scrubs	10, 11, 12, 13	Dense vegetative cover, Autumn-winter flowering Banksias
Hawkesbury Sandstone Woodland	4, 7, 8, 9	floristic diversity, rock outcrops; fire mosaics
Narrabeen Group Forest	1, 2,	winter flowering spotted gums, structural diversity; thick groundcover
Closed Forest	3, 6	rainforest fruits; thick cover; rock outcrops; creek lines
Wetlands	14	Swamp mahogany (winter flowering); permanent/semi permanent water; thick cover
Hawkesbury Sandstone forests	5	tree hollows, thick groundcover, structural diversity, creek lines, rock outcrops

Closed Forest

Along creek lines and in moist gullies rainforest plants tend to dominate. Fruits produced by plants such as cabbage palm, blueberry ash, native sarsaparilla, native grape, lilly pilly and corkwood are popular with birds ranging from the pied currawong to the rarer brown cuckoo-dove and topknot pigeon. Arboreal mammals resident in adjacent open forest are also likely to use this resource.

Where this habitat type occurs in Ingleside and Bayview it is used by roosting Powerful Owls. It is likely this species (and possibly the sooty owl) would have used this habitat type on the peninsula prior to white settlement.

Wetlands

Wetlands occur in alluvial flats at North Narrabeen (Narroy and Nareen parks) and at Warriewood. Parts of these wetlands are dominated by swamp mahogany which is an important habitat tree as it is a profuse winter flowerer. Other areas are dominated by cumbungi and native reed which provide thick cover and food resources necessary for wetland specialists such as grassbirds and swampheens. The stationary permanent water in the wetlands also makes them suitable for a variety of frogs though degradation of water quality and introduction of predatory mosquito fish has resulted in a decline in frog species diversity.

2.2 Summary of Significant Fauna

Threatened Fauna

The following species are listed as threatened in NSW (Schedules 1& 2 of the Threatened Species Conservation Act, 1995)

Australasian Bittern

This species inhabits shallow vegetated freshwater or brackish swamps and has declined due to drainage, salinization and overgrazing of swamps (Garnett ed, 1993).

It is a nomadic species and has been recorded from Garigal National Park and North Narrabeen Lake and would be likely to occur along the creek at Deep Creek Reserve. With rehabilitation of wetlands at Warriewood and North Narrabeen it may also be induced to inhabiting these areas.

Black Bittern

The black bittern inhabits shallow, fresh and brackish waters with densely vegetated margins (particularly *Melaleuca* and *Casuarina*) and occasionally mangroves (Morris et al, 1981).

It has been recorded in recent years from Deep Creek and may have formerly occurred at Warriewood. As with the Australasian Bittern improvement of water quality and rehabilitation of wetlands would benefit this species.

Glossy Black-cockatoo

This species inhabits woodlands, open forests and scrubs containing plants of the Casuarinaceae family on which it almost exclusively feeds (Blakers et al, 1984). One study (Clout, 1989) found glossy black-cockatoos spend 88% of their time foraging. The species is an autumn-winter breeder generally using a hollow limb or hole in a dead tree standing in a forest clearing (Forshaw, 1962). Threats to the species are destruction and clearing of (Allo)Casuarina forest (Kennedy 1990). Due to the species' longevity the effect of habitat loss on population levels may not yet be evident (Garnett, 1993).

It appears that there are two local populations of glossy black-cockatoos frequenting the Pittwater area. One is from the Deep Creek and Middle Creek area of Garigal National Park. The other from West Head in Ku-ring-gai Chase National Park. Though there seem to be no reports of the Garigal population venturing north of Deep Creek reserve, the West Head population is a frequent visitor to Pittwater Council area. Apart from reserves on the western foreshore of Pittwater they have been recorded at Elizabeth Park, McKay Reserve, and East McCarrs Creek Reserve. Other reserves likely to be visited are Stapleton Park, and Angophora Reserve, Avalon; and Minkara, Loquat Valley/Pindari and Ilya Avenue Reserves in Bayview; night fly-overs in Irawong Reserve. They have also been detected recently in the privately owned bushland below Minkara Reserve (P Antcliff pers comm). It is also likely to use foreshore areas such as Careel Bay where swamp oaks grow.

Management strategies for this species should include preservation of stands of swamp oak and forest oak and location and preservation of nests sites. Thick growth of black she-oak can result from bushfire hazard reduction and stifle the growth of many other species. Conservation of stands of black she-oak for the cockatoo must be balanced with the need to maintain floristic diversity in woodlands and drier forests.

Swift Parrot

Swift Parrots breed in Tasmania during summer and disperse throughout south-eastern Australia during winter. Winter movement seems to be associated with eucalypt flowering and lerp abundance (Blakers *et al.*, 1984).

The major threats to the species are removal of breeding habitat in Tasmania and diminution of ironbark forest on the mainland (Garnett (ed), 1993).

Though there are a number of records in recent years from western Sydney, there is only one record of this species in Pittwater - from the Ingleside area in 1986. It would be a very uncommon winter migrant to the area

Powerful Owl

The Powerful Owl lives solitarily or in pairs and has territories in the order of 800-1000ha (Blakers *et al.*, 1984) though where prey is abundant these may be smaller. It is strongly associated with tall open forest and open forest for roosting and breeding though it also occurs in riparian and woodland habitats. Its main prey items are arboreal mammals (possums, gliders, bats) though it will also take birds and ground mammals (Hollands, 1991; Debus & Chafer, 1994). In lowland coastal forests of NSW common ring-tailed possums are the main prey item (Debus & Chafer, 1994).

From research carried out so far it is unclear whether there is one or two pairs of powerful owls in the Pittwater area. It is known the species forages in the area stretching from Bayview through Ingleside and down to the Warriewood wetlands. Records from the peninsula (Newport, Bungan Beach) are probably the same birds extending their range due to shortage of prey. It is possible that a separate pair inhabits the Cicada Glen and McCarrs Creek drainage systems. A juvenile was found in this area during December 1995 indicating successful breeding during the winter of 1995. Although almost all probable roosting nesting areas were inspected during 1995 no sites of permanent habitation were found. The species is also known from Deep Creek so it is possible the Ingleside and Deep Creek owls are one and the same.

The following reserves are considered important habitat for the powerful owl: Deep Creek, Ingleside, Epworth, Irrawong, Minkara, Walter Road, Kennedy and East McCarrs Creek.

The viability of the local population would be severely compromised by further land clearing in the Ingleside-Warriewood area. Even if nesting and roosting habitat was protected there would be a likely long-term decline in the owls' main prey item the ringtail possum. Ringtail possums are more sensitive to human incursion into their habitat than the hardier brushtail possums. They are also more susceptible to attack by cats. They do not roost in tree hollows but construct 'dreys' in the understorey made of sticks and other material. Hazard control burning and underscrubbing associated with development are likely to diminish the availability of this prey item locally

Management of the powerful owl should include locating nesting/roosting sites and protecting these accordingly. "Twitching" of owls has been identified as a threat to suburban populations and for this reason the location of nesting/roosting sites should be restricted. Ensuring that local prey items, particularly ringtail possums, are conserved must also be a priority in this species management. Hazard control burning of reserves should be planned so that a viable understorey shrub layer remains.

Masked Owl

The masked owl inhabits a range of habitats including tall open forest, open forest, and wooded farmlands. Prime habitat has a combination of tall or dense vegetation for roosting and nesting and more open areas for hunting. They commonly use interfaces between wooded and cleared areas and are often detected along roads. Masked owls usually roost in tree hollows but have also been recorded from caves and thick vegetation. Tree hollows are also used for nesting. Prey consists mainly of small and medium-sized mammals. In disturbed areas introduced species such as house mouse (*Mus domesticus*) and black rat (*Rattus rattus*) are important prey items. (Hollands, 1991; Debus & Rose, 1994). It is seldom detected probably due to lack of recognition of its call and confusion with the more common barn owl, (*Tyto alba*) (Blakers *et al.*, 1984).

Historical records of the masked owl include a sighting at Newport in 1965 and roosting in a Cabbage tree palm in Avalon in 1935 (Debus & Rose, 1994). It was also known to occur in the Warriewood wetlands prior to construction of the shopping centre (Kavanagh pers comm). Kavanagh also considers it likely to still occur in the broken country of the Ingleside-Warriewood-Mona Vale area. Important reserves would be Ingleside, Epworth and Irrawong. It is also likely to occur in Garigal National Park and West Head. Therefore, suburbs adjacent to these parks would be part of their range if only occasionally utilised.

Generally, measures aimed at conserving the local powerful owl population would also aid the masked owl.

Eastern Grass Owl

The eastern grass owl inhabits dense grasslands and wetlands where it preys on rodents. Being a ground nesting species it is vulnerable to nest robbing and disturbance. The Sydney region is the southern limit of its distribution.

The species was recorded attempting breeding in the Warriewood wetlands in 1974. This habitat area has been reduced and modified since that time. It may, however, still be extant in the region or could recolonise.

Apart from the Warriewood wetlands, important reserves would be Irrawong and Narroy/Nareen.

Regent Honeyeater

This endangered species occurs in temperate woodlands and open forest of south-east Australia. It is nomadic and appears to visit areas in response to flowering eucalypts.

The species was recorded in Bayview in the 1970s and is occasionally seen in swamp mahoganies on the Central Coast. The possible use by regent honeyeaters of swamp mahogany stands at Bayview, Warriewood and Avalon therefore adds to the conservation significance of those stands. Council could contribute to the recovery of the regent honeyeater by implementing policies to conserve and enhance its stands of swamp mahogany.

Spotted-tailed Quoll

This carnivorous marsupial inhabits a wide range of habitats including swamps and woodlands though it prefers moist forests. It has a wide range of prey including arboreal and terrestrial mammals, macropods, birds and insects (Strahan ed, 1983; D.Andrew pers. comm.)

The status of this species in Pittwater is not exactly known though it is clear that it has suffered a serious decline since urbanisation. The moist forests of the Peninsula and the Bayview area would have been prime habitat.

The most recent records of the species locally was an individual which was captured in Elanora Heights in 1993 and later turned up in Granville and another which raided a guinea-pig pen at Elvina Bay in the early 1990s (P. Thompson pers. comm.).

The quoll may be resident in the Ingleside area or may venture into that area from Garigal or Ku-ring-gai Chase National Parks. Reserves within their potential habitat area are Deep Creek, Ingleside Park, Walter Road, Epworth Park and Irrawong as well as those on the western side of Pittwater.

Southern Brown Bandicoot

This species inhabits heaths and woodlands with a mosaic of burnt and unburnt patches. It is at the northern limit of its range in Sydney and has been recorded nearby at West Head in Ku-ring-gai Chase national park.

Although not detected during the Ingleside - Warriewood fauna survey it may be extant in that area. Ingleside Park and Walter Road Reserve would be important reserves.

Squirrel Glider

Squirrel Gliders nests in leaf-lined tree hollows (Strahan (ed), 1983) and have a diet of Eucalypt and Banksia blossom and invertebrates (Quin, 1995; Smith per comm). Their similarity in appearance to the sugar glider often results in misidentification. For this reason some of the records in the Council's household species survey which indicated a wide distribution of squirrel gliders locally must be questionable. However, there have been definite records of the species from the spotted gum forests of the Peninsula and this population is the only one in the Sydney region. Important reserves for the species are Stapleton Park, Angophora Reserve and Attunga Reserve. Smaller reserves such as Palmgrove and Toongari would also be vital links between these habitat areas.

It is recommended that Council undertake a specific recovery programme for this species which, like the koala, is in danger of local extinction. Measures need to be taken immediately to ensure its survival. Conservation measures for the species should include planting of hollow forming trees (or provision of nesting boxes), planting of winter flowering trees and shrubs (esp *Eucalyptus robusta* and *Banksia integrifolia*) and public education on the threat of domestic pets.

Koala

A separate management plan for this species is being carried out under the provision of SEPP 44.

Common Bent-wing Bat

The Common Bent-wing Bat uses caves, old mines, and a variety of structures such as buildings and stormwater drains as diurnal roosts. It is typically found in well timbered areas where it forages above the tree canopy on small insects. This species will travel large distances between roost sites according to seasonal and local needs (Strahan ed, 1983).

This bat has been recorded from Deep Creek and McKay Reserves (Turton, 1996) and is likely to forage over forested areas of the municipality. Rather than targeting particular reserves for the species management, its conservation within Pittwater would be better managed by encouraging retention of forested areas and discouraging insecticide use.

Greater Broad-nosed Bat

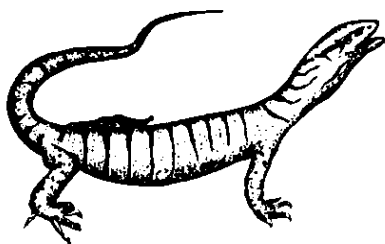
The Greater Broad-nosed Bat is a large vespertilionid bat which forages for insects in open areas on the edges of forests or along tree-lined creeks and which utilises tree hollows for diurnal roosting sites. Preferred habitat for this species is the moist river and creek systems of the ranges, but it has been recorded in lower numbers in near coastal habitat. It extends along the coast from Atherton in Queensland to Orbost in Victoria and is considered uncommon to rare throughout its range.

During the urban bushland survey it was only recorded at Deep Creek Reserve (Turton, 1996). It has also been recorded at Bilgola Beach in 1982 (Long, 1983) and may forage throughout the municipality particularly in areas of good quality habitat eg Ingleside-Warriewood.

Heath Monitor

This species, which is seldom recorded, inhabits coastal heaths and has a very restricted distribution in NSW where it is confined to the Sydney and Canberra regions.

It is known to occur in bushland near the Council's nursery. Although this area of bushland is contiguous with Ku-ring-gai Chase National Park the only reserve within it is the small Walter Road Reserve. Residential development in that locality would make the local population susceptible to threats such as dog attack and road death.



Red-crowned Toadlet

This species which is restricted to the Sydney sandstone formation has specific habitat requirements. It is only found on sandstone ridge-tops with some shale influence resulting in yellow podsollic soils. It breeds in feeder creeks with depressions forming puddles after heavy rain. These puddles must last at least 28 days to allow tadpoles to develop into adults. In the feeder creeks it uses leaf litter and debris for nesting. When not breeding they disperse and inhabit moist microclimates under rocks, logs etc (K. Thumm pers comm, Cogger, 1992).

The species would have been widespread in the Hawkesbury sandstone areas of Pittwater prior to degradation of drainage lines by urban run-off. During surveys for the Urban Bushland Management Plan this species was found on a ridge-top in Deep Creek Reserve. It has also been recorded from privately-owned bushland in the Ingleside area. Ingleside Park and Walter Road could therefore represent important reserved habitat. Maintenance of good water quality in and around these reserves is necessary to ensure suitable habitat is available.

Giant Burrowing Frog

This species inhabits open forests and breeds in hollows in sandy stream banks (Cogger, 1992). Although occurring in similar habitat to the red-crowned toadlet it occurs at much lower densities. The Giant Burrowing Frog was located during the Urban Bushland Survey (January 1996) at Ingleside Park and in nearby privately-owned bushland in 1994. Both Deep Creek Reserve and Walter Road Reserve and its environs are potential habitat areas. Tracks and horse faeces which would degrade water quality, are particular threats to this species in these reserves and their surrounds. Prohibition of horse riding in Ingleside Reserve is strongly recommended as it is not compatible with its status a bushland reserve.

Green and Golden Bell Frog

This threatened species favours waterbodies with a reliable water supply, vegetated edges and large amounts of sun. It was once common in Sydney but suffered a decline in the last three decades - one factor being the introduction of mosquito fish (*Gambusia affinis*) into its environment. It has recently been found in a number of proposed development sites many of which are disturbed.

Although as yet unconfirmed in the Pittwater area, it is possible the species inhabits the Warriewood wetlands and the wetlands of Narroy and Nareen Reserves,

North Narrabeen. A survey of these potential habitats in summer has as yet been unable to confirm their presence.

Table 2 Known and Predicted Occurrences of Threatened Fauna

Species	Known Reserves/nearest recent record	Predicted Reserves
Australasian Bittern	Deep Creek	-
Black Bittern	Deep Creek	Irrawong
Regent Honeyeater	Bayview 1970s; Kilcare 1995	Irrawong/Epworth
Glossy Black-cockatoo	E. Mc Carrs, McKay, Elizabeth, Deep Creek, Irrawong	most reserves with she-oaks
Swift Parrot	Ingleside area Irrawong	-
Powerful Owl	E. Mc Carrs, Ingleside, Walter Rd, Deep Creek, Minkara	Elizabeth, Epworth, Irrawong Attunga, Elvina
Masked Owl	Ku-ring-gai Chase NP	Irrawong , Epworth, Ingleside
Grass Owl	formerly in Warriewood wetlands; St Albans 1994	Deep Ck, Irrawong
Tiger Quoll	Kundibah, Elvina Bay	Irrawong , Epworth, Ingleside
Squirrel Glider	Palmgrove, Stapleton	Attunga, Angophora, Pinnacle, Mackay
Koala	Palmgrove Stapleton, Angophora, Plateau	most reserves (with food trees)
Southern Brown Bandicoot	West Head	Walter Rd, Ingleside
Common Bent-wing Bat	Deep Creek, McKay	most reserves
Greater Broad-nosed Bat	Deep Creek	Ingleside, Attunga, Angophora, Mackay, Stapleton
Heath Monitor	Walter Road	
Green and Golden Bell Frog	Roseberry	Narroy/Nareen
Red-crowned Toadlet	Deep Creek	Ingleside, Walter Rd
Giant Burrowing Frog	Ingleside	Walter Rd

Regionally Significant Fauna

The following species are regarded as regionally significant as they are rarely recorded in the Sydney metropolitan area.

Peregrine Falcon

One of the world's fastest fliers, this raptor inhabits a range of habitats but particularly favours cliffed areas. It suffered a serious decline world-wide with the advent of organophosphates but the Australian subspecies appears to be stable (Garrett ed, 1993). It was previously listed on Schedule 12 of the National Parks & Wildlife Act.

There appears to be two separate populations occurring in Pittwater. One pair forages along the coastal escarpment of the Barrenjoey Peninsula and West Head/Broken Bay areas and has been recorded nesting at Lion Island (Morris & Burton, 1995). The other nests along the Deep Creek escarpment and forages over Narrabeen Lakes and the Warringah area. Reg Angus (pers. comm.) reports large flocks of autumn-winter migrating honeyeaters congregate at Barrenjoey. These would be a source of favoured prey for this species. As the cliffines suffer little from human disturbance and prey is plentiful, the peregrine falcon is probably secure in Pittwater.

Pacific Baza

This crested hawk inhabits the canopy of rainforests and open forest where it preys on insects, small reptiles and frogs. The Sydney region is the southern limit of its range and it still has not been recorded breeding in the area. In Pittwater it has been recorded at Deep Creek (Morris & Burton, 1995). Suitable habitat also occurs throughout much of the Peninsula and in Ingleside/Warriewood and Bayview. Management practices aimed at conserving diversity and abundance of lower vertebrates and insects would have a consequential benefit for this species.

Brush Turkey

This mound-building fowl which favours wetter forests and rainforests occurs at Elvina Bay. The only other records in the Sydney region are from near Bobbin Head and at Ku-ring-gai Willflower Garden. Like the other ground dwelling fauna mentioned in this text it would be susceptible to attack from dogs, cats and foxes.

Lewin's Rail

Like the pheasant coucal this is a ground-dwelling bird that usually only flies when alarmed or migrating. It is nomadic and inhabits damp areas with thick undergrowth. Being a ground bird it would be susceptible to dog, fox and cat attack. Lewins rail is rarely seen in Sydney, however, it has been recorded at Deep Creek and at Bungan Beach. Suitable habitat is available along a number of creek lines and in swamp areas such as the Warriewood wetlands and Narroy/Nareen Park.

Topknot Pigeon

The topknot pigeon mostly inhabits rainforests and wetter open forest and feeds on fruits in the canopy. It is highly nomadic and is most conspicuous between April and November (Morris et al, 1981). Important reserves for the species as it passes through Pittwater are those with cabbage trees and other rainforest species eg Mackay, Stapleton, Angophora, Attunga and Irrawong. The species is an important disperser of rainforest fruit and would help maintain a genetic link between mesic plant species in the central coast, Pittwater and Royal National park areas. Conversely, it probably also aids the dispersal of the introduced camphor laurel. Although some of its potential habitat has been lost locally due to clearing, the topknot pigeon has probably been aided by the proliferation of cabbage tree palms along nutrient enriched drainage lines.

Pheasant Coucal

Pheasant Coucals are an unusual cuckoo in that they are sedentary and do not parasitise other birds' nests. As they forage on the ground they mostly favour areas with thick undergrowth such as heaths and swamps.

The only regular sites for the species around Sydney are at Deep Creek and in bushland at Ingleside (Morris & Burton, 1994; Reg Angus pers comm). The species has been observed in woodland at Ingleside Park (pers obs) and in swamp vegetation near the Council offices and Irrawong Reserve (P. Thompson pers comm). It was also recorded during the 1970s at Clareville (NPWS database) and Bungan Beach (BBPS, undated). Their distribution in Pittwater has suffered a decline due to habitat removal and domestic pet and fox predation. Its continued existence locally would depend on minimising these threats.

Noisy Pitta

This uncommon migratory rainforest bird has been recorded in recent years at Scotland Island and Elvina Bay. Pittwater may represent a stopover point in their winter migration. Their ground-frequenting habits make them vulnerable to attack by predators. This is underlined by the specimen at Elvina Bay being a recent kill (Alan Yuille pers comm) and Morris and Burton's (1993) comments that "domestic and feral cats appear to be well and truly implicated in the deaths of migrating Pittas"

Yellow-footed Antechinus

This species has recently been recorded at Irrawong Reserve (Pittwater Council, 1996) this being the only record of the species in the Sydney region. Clarification of its taxonomy should be undertaken prior to formulating specific conservation measures.

Long-nosed Bandicoot

This ground dwelling marsupial inhabits forest heaths and woodland where it feeds on invertebrates and plant tubers and roots. When digging for food it leaves characteristic conical holes in the ground. Once common in Sydney's suburbs, the northern beaches are its last stronghold. Important habitat areas for the species are Ingleside, Bayview, and Newport-Avalon. This means that reserves such as Stapleton, Minkara and Ingleside Park are vital in providing secured habitat for them. The implementation of the joint council/NPWS feral animal control programme will aid this species as well. However, it is crucial that Council continue to educate residents about the threat domestic pets are to this species. This problem is highlighted by the recent attack on a long-nosed bandicoot by a cat at Bilgola Heights (SMH, 19/12/95).

Table 3 Known and Predicted Occurrences of Regionally Significant Fauna in Bushland Reserves

Species	Known Reserves	Predicted Reserves
Peregrine Falcon	Deep Ck, Bangalley, Bungan Beach	All coastline reserves
Pacific Baza	Deep Ck	Irrawong, Mackay, Attunga, Angophora
Brush Turkey	Elvina	-
Lewin's Rail	Deep Ck., Bungan Beach	Irrawong, Narroy, Nareen
Topknot Pigeon	Irrawong	Mackay, Angophora, Stapleton, Palmgrove
Pheasant Coucal	Ingleside, Walter Rd, Deep Creek, Irrawong	Irrawong, Epworth
Noisy Pitta	Elvina	Mackay, Angophora, Stapleton
Long-nosed Bandicoot	most reserves	
Yellow-footed Antechinus	Irrawong	Epworth, Deep Ck

Locally Significant Fauna

The following table lists species that are considered to be of conservation significance in the Pittwater Council area. These species have been listed as they are either top order carnivores, rarely seen in the area; or their habitat type is under threat due to removal, fragmentation or modification (eg by weeds).

Table 4 Locally Significant Fauna

Common Name	Significance & Occurrence
Birds	
Wedge-tailed Eagle	Top-order carnivore; West Head/Ingleside
White-bellied Sea-eagle	Top-order carnivore; coast estuaries
Whistling Kite	Top-order carnivore; coast estuaries
Little Eagle	Top-order carnivore; Ingleside
Collared Sparrowhawk	Top-order carnivore; Deep Creek
Brown Goshawk	Top-order carnivore; Ingleside
Brown Cuckoo-dove	Uncommon; Ingleside
Brush Bronzewing	Uncommon; West Head
Yellow-tailed Black-Cockatoo	Uncommon; Ingleside
Musk Lorikeet	Uncommon; Peninsula
Little Lorikeet	Uncommon; Ingleside
Barn Owl	rare; recorded Bayview 1983 (NPWS database)
Owlet-nightjar	Uncommon; Scotland Island, Ingleside
Superb Lyrebird	Uncommon; Gullies in Ingleside, Cicada Glen
Eastern Yellow Robin	Restricted to larger areas of bushland Irrawong
Rose Robin	Uncommon winter migrant; Deep Creek
Golden Whistler	Restricted to larger areas of bushland Irrawong
Rufous Whistler	Uncommon summer migrant
Grey Shrike-thrush	Restricted to larger areas of bushland
Leaden Flycatcher	Uncommon summer migrant; Deep Creek
Black-faced Monarch	Uncommon summer migrant Deep Creek Irrawong
Rufous Fantail	Uncommon summer migrant; wetter forests
Eastern Whipbird	Restricted to larger areas of bushland Irrawong
Variegated Wren	Uncommon
Origma	Uncommon; restricted to sandstone scarps
White-throated Warbler	Uncommon summer migrant; wetter forests
Brown Warbler	Uncommon summer migrant; wetter forests
Striated Thornbill	Uncommon canopy feeder
Brown Thornbill	Restricted to larger areas of bushland
Sitella	uncommon
White-throated Treecreeper	Restricted to larger areas of bushland; absent from peninsula Irrawong
Brown Treecreeper	rare in area; Ingleside
Lewin's Honeyeater	Restricted to gullies in larger areas of bushland
Satin Bowerbird	Restricted to gullies in larger areas of bushland; Bayview
Mammals	
Short-beaked Echidna	rare - probably declining on Peninsula
Brown Antechinus	Restricted to larger areas of bushland; absent from peninsula Irrawong
Swamp Wallaby	Restricted to larger areas of bushland; Bayview-Elanora
Common Ringtail Possum	Probably declining on Peninsula
Sugar Glider	Probably declining on Peninsula
Feathertail Glider	Rare - only record near Lovett Bay (NPWS database)
Eastern Pygmy Possum	Rare - only recorded West Head (NPWS database)
Bush Rat	Restricted to larger areas of bushland; absent from Peninsula?
Reptiles	
Green Tree Snake	Probably declining on Peninsula Warriewood Wetlands
Brown Tree Snake	Probably declining on Peninsula
Brown Snake	rare; West Head
Diamond Python	rare; recorded from Ingleside and Bayview Irrawong
Lace Monitor	Restricted to larger areas of bushland
Bearded Dragon	Restricted to larger areas of bushland
Eastern Water Dragon	Probably declining on Peninsula Irrawong
Eastern Long-necked Tortoise	Probably declining on Peninsula Macpherson Street
Frogs	
Tusked Frog	restricted to heath in Ingleside
Tyler's Toadlet	restricted to heath in Ingleside

2.3 Fauna Survey Methods

2.3.1 Field Survey Methodology

Fauna Habitat

At each of the reserves visited notes were taken of specific habitat features which are likely favour fauna. Typical habitat features are rock outcrops, tree hollows and the presence of winter flowering plant species eg heath-leaved banksias. Disturbances such as weed invasion were also noted.

Birds

At each of the major reserves an intensive search for birds was done over a 20 minute period on three mornings in summer and winter. This was done by moving through the habitat and actively seeking birds. Casual observations while undertaking other field work were also noted.

Nocturnal birds were searched for at night using a 100volt/12 watt spotlight. Callback tapes of the Powerful and Masked owls were also used in attempt to detect these species. This was done at Deep Creek, Ingleside Reserve, Walter Road, Minkara Reserve, Attunga Reserve and Bushrangers Hill. A suitable vantage point was chosen and a period of 20 minutes allowed for responses and spotlight detection. Searches were also made for their likely roosting and nesting areas during the day.

Mammals

Spotlight searches for arboreal mammals were undertaken in both seasons at the following reserves: Deep Creek, Ingleside, Minkara, Narroy, Epworth, Walter Road, Elizabeth, Loquat Valley (winter only) and Attunga.

Indirect evidence of mammals (burrows, droppings, owl casts) was also be used to determine species presence.

A specific survey for microchiroptern bats was undertaken by Margaret Turton at the following reserves: Deep Creek, McKay, Attunga, Ingleside Park, and Angophora. Four hours over two nights was spent at each of these reserves during February and March, 1996. This involved the use of harp traps, bat detectors and habitat inspection.

Reptiles

Daytime searches for reptiles were undertaken at a number of reserves during summer. This involved searching through typical reptile habitat and shelters including bark, rocks, leaf litter, hollow and fallen logs and man-made debris etc.

Frogs

A spotlight search of creeks and any other wet habitats was undertaken during summer to detect and identify frog species. Species that were calling were identified by using frog call reference tapes. Specific searches for threatened species (green and golden bell frog, red-crowned toadlet, giant burrowing frog) were undertaken in likely habitat.

2.4 Literature Review and Database

All relevant records pertaining to "bushland" fauna in and near the Pittwater municipality were reviewed. Sources included records kept by Council from other Bushland Plans of Management and Impact Assessment reports; the National Parks and Wildlife Service database and records from Garigal National Park; the NSW Field Ornithologists Club and local naturalists.

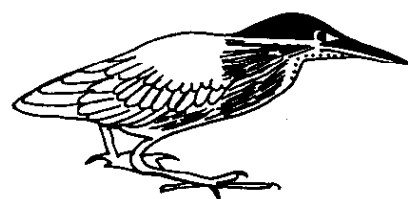
This resulted in the establishment of a database that has been used to catalogue species present at or near each reserve and those that are likely to occur on the basis of habitat preference and local records. A separate database was established to record site details of threatened and regionally significant species within the municipality.

Specific Management Issues

Specific management issues relating to introduced predators and habitat are addressed in the specific action plans.

Removal of Fauna

It is recommended Council continue its policy of prohibiting the removal of "problem" fauna unless it has been shown by residents that there is no other feasible option. The dumping of captured fauna in other habitat areas eg Ku-ring-gai Chase National Park only leads to pressures on individuals and populations on the receiving habitat area and decreases biodiversity in remnant bushland.



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Deep Creek Reserve, Elanora Heights

Reserve Number: 0162

Street Address: via Wakehurst Parkway & Woorarra Avenue, Elanora Heights.

1. Description & Category

1.1 Location and Description

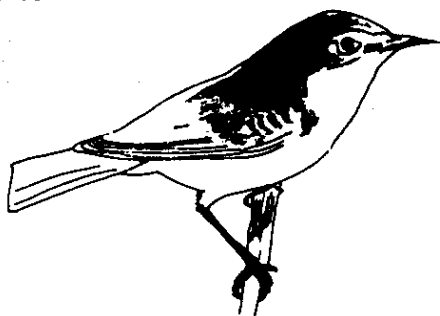
Deep Creek Reserve is located between the Wakehurst Parkway and Narrabeen Lagoon which form the southern boundary, Deep Creek on the western boundary and below Woorarra Avenue on the northern boundary. Residential properties form the eastern boundary. It is 39 ha in size. At the southern end of the reserve there is a active recreation area and picnic facilities. This Plan of Management refers to the bushland.

1.2 Land Tenure, Property Description and Zoning

Deep Creek Reserve is owned and controlled by Council and includes Lot 55, DP 752046, parts of Lots 115-120 and Lots 96-114 in DP 13643, Lot 154 in DP 224239 and Lot 3 in DP 369241. The land is zoned 6(a) Open Space - Existing Recreation.

1.3 Category of the Land

Deep Creek Reserve is community land under the Local Government Act, 1993, and is categorised as a natural area which is further categorised as bushland, escarpment, foreshore, watercourse and wetland. An east west escarpment is a feature of the Reserve. It is adjacent to the foreshore of Narrabeen Lagoon and the watercourse of Deep Creek and includes an unnamed tributary of Deep Creek. A small wetland area occurs at the southernmost part of the Reserve. It meets the definition of bushland described in State Environmental Planning Policy No. 19 - Bushland in Urban Areas.



2. Natural & Cultural Heritage

2.1 Topography, Geology and Soils

Deep Creek Reserve is a south facing example of the steeply dissected valleys of the Hornsby Plateau and includes landform patterns and elements including plateau, escarpment, steep hills, ridges, gullies, rocky benches, stream and floodplain.

The geology includes Hawkesbury Sandstone, of medium to coarse grained Quartz sandstone with very minor shale and laminate lenses, with smaller areas of underlying Narrabeen Group sediments and alluvial and estuarine stream sediments on the flats.

These parent geological types give rise to soils characteristic of the Hawkesbury Soil Landscape, and small areas of the Lambert, Watagan and Deep Creek Soil Landscapes.

2.2 Hydrology

The catchment features two golf course and urban residential properties. Runoff enters the reserve and Deep Creek and flows into Narrabeen Lagoon. A tributary of Deep Creek flows through the Reserve. This unnamed watercourse was the location of a water sampling site in a five month pilot water quality program. Water quality had elevated levels of nitrogen and phosphorus.

2.3 Vegetation

Three vegetation types occur in Deep Creek Reserve. Ridge tops support a type of Sydney Sandstone Ridgetop Woodland which is an open woodland community dominated by Smooth-barked Apple (*Angophora costata*), Sydney Peppermint (*Eucalyptus piperita*) and Red Bloodwood (*Corymbia gummifera*). There is a dense shrub layer and a sparse ground layer. Common shrubs include Sweet-scented Wattle (*Acacia suaveolens*), *Podocarpus spinulosus*, Old Man Banksia (*Banksia serrata*) and Prickly Moses (*Acacia ulicifolia*). Ground layer species include *Xanthorrhoea latifolia*, Bracken Fern (*Pteridium esculentum*), *Hardenbergia violacea* and Oat Spear Grass (*Anisopogon avenaceus*).

Hawkesbury Sandstone Heath subtype occurs dominated by *Eucalyptus leuhmanniana*.

Most of the slopes and gullies support Hawkesbury Sandstone Open-forest. The dominant species are Smooth-barked Apple, Red Bloodwood and Broad-leaved White Mahogany (*E. umbra*). There is often a shrub layer of medium density and a ferny ground layer of medium to high density. Common shrub species include Christmas Bush (*Ceratopetalum gummiferum*), Sunshine Wattle (*Acacia terminalis*), *Podocarpus spinulosus*, *Aotus ericoides* and Old Man Banksia. Ground layer species include *Xanthorrhoea latifolia*, Bracken Fern, *Hardenbergia violacea*, Dusky Coral Pea (*Kennedia rubicunda*) and *Poa affinis*.

There is also a small area of Coachwood Closed Forest dominated by Coachwood (*Ceratopetalum apetalum*) and Lillypilly (*Acmena smithii*) in a sheltered gully. Associated species include Bastard Rosewood (*Synoum glandulosum*), Bleeding Heart (*Omolanthus populifolius*), False Bracken Fern (*Calochlaena dubia*), Gristle Fern (*Blechnum cartilagineum*) and *Oplismenus imbecillis*.

The Reserve extends eastward across Wakehurst Parkway into a Swamp Oak Woodland community that defines the foreshore of Narrabeen Lagoon.

Within the Reserve there are three significant plant communities, namely, two plant communities that are regionally significant, Coachwood Closed-forest which is very restricted and *E. leuhmanniana* heath, and one plant community that is locally significant, Red Bloodwood - Scribbly Gum Forest.

2.4 Fauna

Deep Creek Reserve is at the northern end of a large expanse of bushland that stretches from Elanora Heights to Frenchs Forest. Three habitat types are represented. These are a ridge-top woodland, Sandstone open forest on the slopes and a wet forest on the alluvial flats. Within these habitats are a number of features which are conducive to the presence of a wide range of fauna species. Tree hollows which are used by arboreal mammals, bats and a variety of birds (especially parrots) are common particularly in smooth-barked apples. The rocky outcrops, fallen logs and thick groundcover provide niches for reptiles, frogs and small mammals. The vast array of flowering plants within the reserve are also an important resource for both insectivorous and nectivorous birds and mammals.

This range of habitats and its connectivity to Garigal National Park make Deep Creek one of the most diverse reserves in Pittwater in terms of fauna. It is estimated 130 species would use the reserve with

many of these being resident. Common resident birds are Golden Whistler, Lewin's Honeyeater and Grey Fantail - species which are absent from gardens and smaller reserves in Elanora Heights.

The endangered Red-crowned Toadlet has recently been found in the upper ridge-slopes of the Reserve where there is no urban run-off. This species uses ephemeral drainage lines for breeding and the Reserve's population will probably increase as leaf litter levels in the drainage lines returns to the levels that existed before the 1994 bushfires.

Two threatened bat species were recorded at the Reserve during the summer period of the urban bushland survey. These were the Greater Broad-nosed bat (*Scoteanax rueppellii*) and the Large Bent-wing bat (*Miniopterus schreibersii*). Three other insectivorous bats were recorded indicating the reserve and adjoining National Park represent high quality habitat, the Free-tail Bat (*Mormopterus sp.*), Gould's Wattled Bat (*Chalinolobus gouldii*), Chocolate Wattled Bat (*Chalinolobus morio*). Deep Creek itself is being used as major flyway with bat activity being highest at this site. Although no Grey-headed Flying Foxes were seen during the course of the survey, it is likely that they forage in this area. This reserve was burnt in January 1994, however some mature-age trees are still remaining. Chiropteran habitat exists on this reserve in the form of sandstone cliffs/crevices, hollows and decortivating bark. Pittwater peninsula has many bridges, culverts and buried pipe drains all of which must be considered potential bat habitat.

Five other endangered species have been recorded in the vicinity and are likely to use Deep Creek Reserve. The creek provides habitat for the Australasian Bittern and the Black Bittern. The Glossy Black-cockatoo feeds on the fruits of the swamp oak and black she-oak. The Powerful Owl and Masked Owl which prey on arboreal mammals such as Ringtail Possums and Sugar Gliders have also been recorded in the Deep Creek catchment. Due to the presence of grey gums and scribbly gums, Koalas could also occasionally visit the reserve as could Tiger Quolls which prey on variety of small mammals.

A number of other unusual or uncommon species have been recorded at breeding at Deep Creek including Peregrine Falcons and Leaden Flycatchers. A notable feature is a large nest, presumably of a Whistling Kite, found in the bangalay forest. The regionally uncommon Pacific Baza and Pheasant Coucal have also been recorded at Deep Creek. Regionally significant Long-nosed Bandicoots are also common but may be vulnerable to pets from nearby residences.

Council's Habitat and Wildlife Corridors maps the Reserve as "Major Habitat".

2.5 Aboriginal Sites

A number of Aboriginal sites are present in Deep Creek Reserve, making it an important Aboriginal heritage conservation area in Pittwater. These include several rock shelters with deposits, fire place and stone tools, several rock engraving sites including human figures, wallabies, a shield, three small fish, and an unknown figure and an occupation shelter with deposits.

3. Significance & Objectives

3.1 Statement of Significance

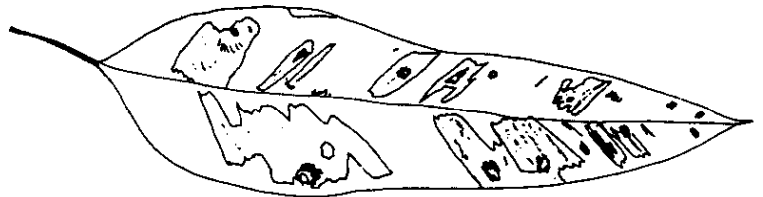
Deep Creek Reserve is significant because:

- ❖ it provides an example of urban bushland and provides a record of the bushland of Elanora Heights and provides a natural visual setting for the hinterland of Narrabeen Lagoon;
- ❖ it includes samples of two plant communities that are regionally significant, Coachwood Closed-forest which is very restricted and *E. leuhmanniana* heath, and one plant community that is locally significant, Red Bloodwood - Scribbly Gum Forest;
- ❖ it provides major habitat for a wide diversity of fauna species in the context of urban bushland in the Sydney Region;
- ❖ its habitat value is increased due to its close proximity to Garigal National Park and Narrabeen Lagoon
- ❖ it provides habitat for the regionally significant Pacific Baza, Pheasant Coucal, Peregrine Falcon and Long-nosed Bandicoots as well as the locally significant Leaden Flycatcher;
- ❖ it provides habitat for three threatened species of fauna, the Red-crowned Toadlet, the Greater Broad-nosed bat and the Large Bent-wing bat, and potential habitat for another five threatened species of fauna, the Australasian Bittern, the Black Bittern, Glossy Black-cockatoo, the Powerful Owl and Masked Owl, Koalas and Tiger Quolls;
- ❖ it protects Aboriginal sites which demonstrate the link between the land and its original human inhabitants.

3.2 Management Objectives:

The management objectives for Deep Creek Reserve are:

- ❖ to protect the natural features of the Reserve, particularly populations of significant plant communities; namely, Red Bloodwood - Scribbly Gum Forest, Coachwood Closed-forest and *Eucalyptus leuhmanniana* low woodland, and habitat for Red-crowned Toadlet, the Greater Broad-nosed Bat, the Large Bent-wing Bat, the Australasian Bittern, the Black Bittern, Glossy Black-cockatoo, the Powerful Owl and Masked Owl, Koalas and Tiger Quolls;
- ❖ identify, preserve and protect Aboriginal sites in the Reserve;
- ❖ to maintain a natural range of structural and floristic diversity of bushland within the Reserve;
- ❖ to adequately manage the bushland/ urban interface in relation to fire management, weed management and stormwater management;
- ❖ to prevent damage to the Reserve from urban runoff, stormwater and pollution;
- ❖ to protect human life and property in and adjacent to the Reserve from wildfire and maintain ecological processes in the Reserve by seeking to maintain a near-natural fire regime in the body of the Reserve and aim to ensure that no species of plant or animal becomes extinct in the Reserve as a result of the fire regime;
- ❖ to control and where possible eradicate introduced animals within the Reserve;
- ❖ to provide opportunities for low impact recreational, scientific and educational use of the Reserve, consistent;
- ❖ to encourage community and neighbour participation in bushland management.



4. Management Issues

4.1 Weed Invasion

In the upper catchment the main areas of weed infestation occur adjacent to residential areas along drainage lines and over disturbed terrain including areas of dumped spoil and under utility service lines. Residents at the top of the reserve are dumping vegetation and there are many instances of garden escapes close to residential areas. Medium infestations of weed are present around the formal dog exercise area intensifying along the creekline towards Deep Creek. Two areas of moderate weed infestation occur along Wakehurst Parkway along the roadside batter spreading towards lagoon and adjacent to and throughout the gully floor at the eastern end of the reserve.

4.2 Bush Regeneration

The steep slopes and upslope residential areas suggest that all bush regeneration work should commence at the top of the catchment to address the weed source. Prior to initiating works the likely disturbance of fauna habitat should be assessed and works adjusted accordingly.

Near Woorarra Lookout a landscape solution is recommended using low growing indigenous plants addressing the area that is currently used by residents for dumping weeds and top lopping.

The sedge swamp requires follow up weeding, as it is understood that work has been undertaken by the Narrabeen Lagoon Committee, which would benefit the Narrabeen Lagoon and is a high profile area adjacent to main road access into Pittwater.

4.3 Stormwater Management

The Reserve receives water from the upstream catchment of Elanora Heights which features urban housing and Elanora Country Club. There is a need to liaise with land owners such as the Golf Course regarding fertiliser practice. Drainage outlets need to be located in the Reserve and water quality and velocity control facilities need to be constructed to dissipate water, retain sediments and uptake nutrients. All streets with grass swales should be retained in favour of kerb and gutter.

4.4 Fire Management

The bushfires of 1994 burnt the Reserve, the adjoining Garigal National Park and caused property damage to adjacent residences. Fire protection zones are required to be implemented as recommended in Circular C10 - Planning in Bushfire Prone Areas. The width of these zones needs to be identified as there are some roads which provide fuel free zones. Private residences should be required to provide fuel free zones within their own properties and fuel reduced zones on the upper boundaries of the Reserve.

Whilst the main objective is to protect human life and property in and adjacent to the Reserve from wildfire, it is also important to maintain ecological processes in the Reserve by seeking to maintain a near-natural fire regime in the body of the Reserve and aim to ensure that no species of plant or animal becomes extinct in the Reserve as a result of the fire regime. Environmental impact assessment will be carried out prior to hazard reductions.

The fuel reduced zones will therefore require a combination of manual and fire fuel reduction when fuel loadings require treatment. Variability in fire regime is recommended. General rules to be followed are:

- ❖ fire should not be totally excluded except for the Coachwood Closed Forest which may act as a natural fire break,
- ❖ fires should not be too frequent ie. more frequent than ten years, or too infrequent ie. less than 40 years (in particular for the *E. leuhmanniana* heath)
- ❖ fires should not always be low intensity or in the same season.

There needs to be follow up weeding after fire as well as consideration of soil erosion issues.

4.5 Management of Native Fauna and Introduced Predators

The habitat of the northern section of this reserve has a weed infested understorey and would benefit from a carefully planned and executed bush regeneration program. This should avoid disruption to species such as eastern whipbirds that require the thick vegetative cover for nesting and foraging. Also located in this bangalay forest is a large raptor nest, possibly of a whistling kite. There are reports of poachers removing bird eggs from nests in this area.

Council will investigate ways of addressing this illegal activity with the National Parks and Wildlife Service.

As Deep Creek Reserve is used as a dog exercise area it would be appropriate to have signs highlighting to dog owners the area's importance to fauna and the need to keep dogs out of the bushland.

The Reserve's proximity to residential areas and Garigal National Park make it susceptible to foxes and feral cats. A Pittwater wide feral animal control program should be introduced.

4.6 Access, Walking Tracks and Recreation

Informal access to the banks of Deep Creek is resulting in damage to creek banks. A combined regeneration and revegetation program along the stream bank of Deep Creek and its tributary is a high priority.

There is one walking track which commences at the north west corner of an active recreation area. This connects to a loop walk that leads into Garigal National Park. There is a dog exercise area, picnic facilities, foreshore access, boating/fishing and numerous community groups that are based within the reserve.

Signposts indicate the reserve's status from the Wakehurst Parkway entrance and signpost Woorarra Lookout.

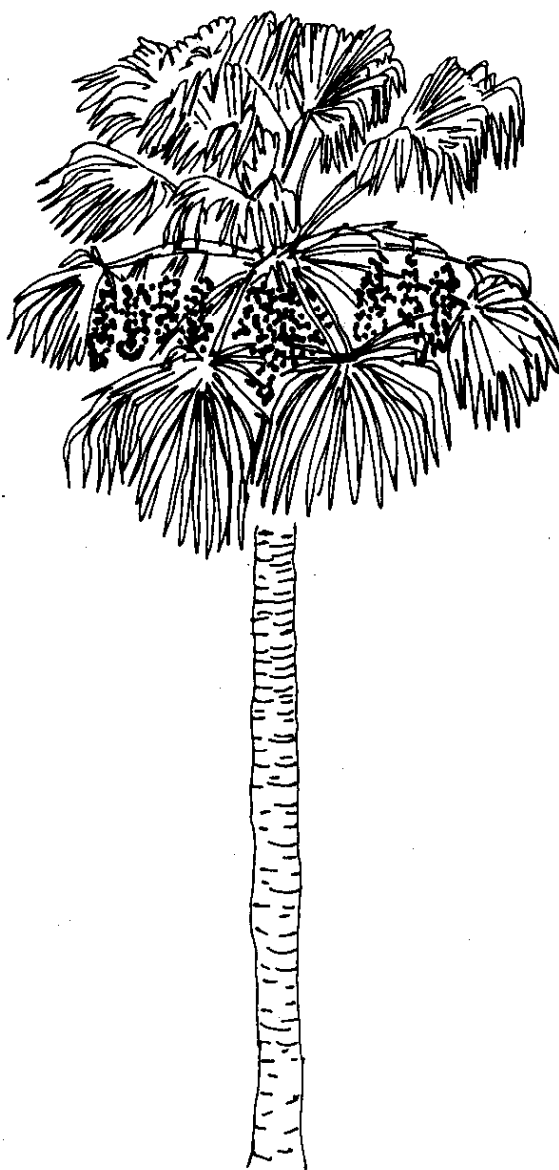
4.7 Boundaries and Neighbours

A program of community awareness is required to educate residents to refrain from dumping vegetation and excavated earth within the bushland reserve, as well as regular top lopping of trees. Several lawn and garden encroachments exist.

Along Woorarra Avenue a landscape solution to the roadside edge should be implemented to provide a visually pleasing bushland edge in conjunction with the education program.

4.8 Public Awareness

There is a need to educate residents about living near bushland and issues including control of domestic animals, dumping of vegetation, bush rock and firewood removal, garden encroachments, lopping of trees and appropriate bush fire hazard reduction practices.



5. Performance

Management objectives	Performance targets (Actions)	Responsibility	Completion date	Capital cost	Recurrent cost	Performance measures
Bush regeneration & weed control	Initiate a bush regeneration & restoration program	Natural Resources	When funds secured	Seek detailed costs of contract program	As required	Regeneration program commenced
Stormwater control & drainage	Identify drains Construct water quality control ponds Liaise with Golf Courses	Natural Resources / Works & Services	When funds available	Seek detailed design and costing	Integrate costing into works & existing maint. programs	Improved water quality
Fire management	Identify FRZ Carry out EIA before HRs Monitor plant & animal response *Followup weeding after fires	Fire Control / Reserves & Natural Resources	Ongoing	Staff time	Staff time	Safe living environment No species extinct through fire practices Assess & follow up weed burns
Management of fauna & introduced predators & periodic fauna surveys	Investigate poachers Retain habitat thickets Signs re fauna Feral animal control	Natural Resources & Compliance	1996/97 poachers Signs & feral animal control when funds available	Seek detailed costings	Costed within a Pittwater wide feral animal control program	Fauna populations extant Public understanding & responsible pet ownership
Access	Restore eroded creek bank & limit access	Reserves & Natural Resources	Within available funding or current works programs	Within bush regen program		Creek bank in good condition with appropriate public access points
Boundaries & neighbours	Encourage community awareness & participation in the reserve & regain encroachments	Natural Resources & Compliance	Ongoing and when funds available	Within the overall restoration program for the reserve	Staff time	Degraded edges converted to bushland & good resident practices

Fauna Species List Deep Creek Reserve

Key

Record

UBS - urban bushland survey summer; UBW - urban bushland survey winter; NPWS - most recent record in National Parks and Wildlife Service database FOC - most recent record NSW field ornithologists club; GNP recorded from adjacent Garigal National Park (undated)

Status

R=resident F=frequent visitor

W=winter migrant

O=occasional or uncommon visitor

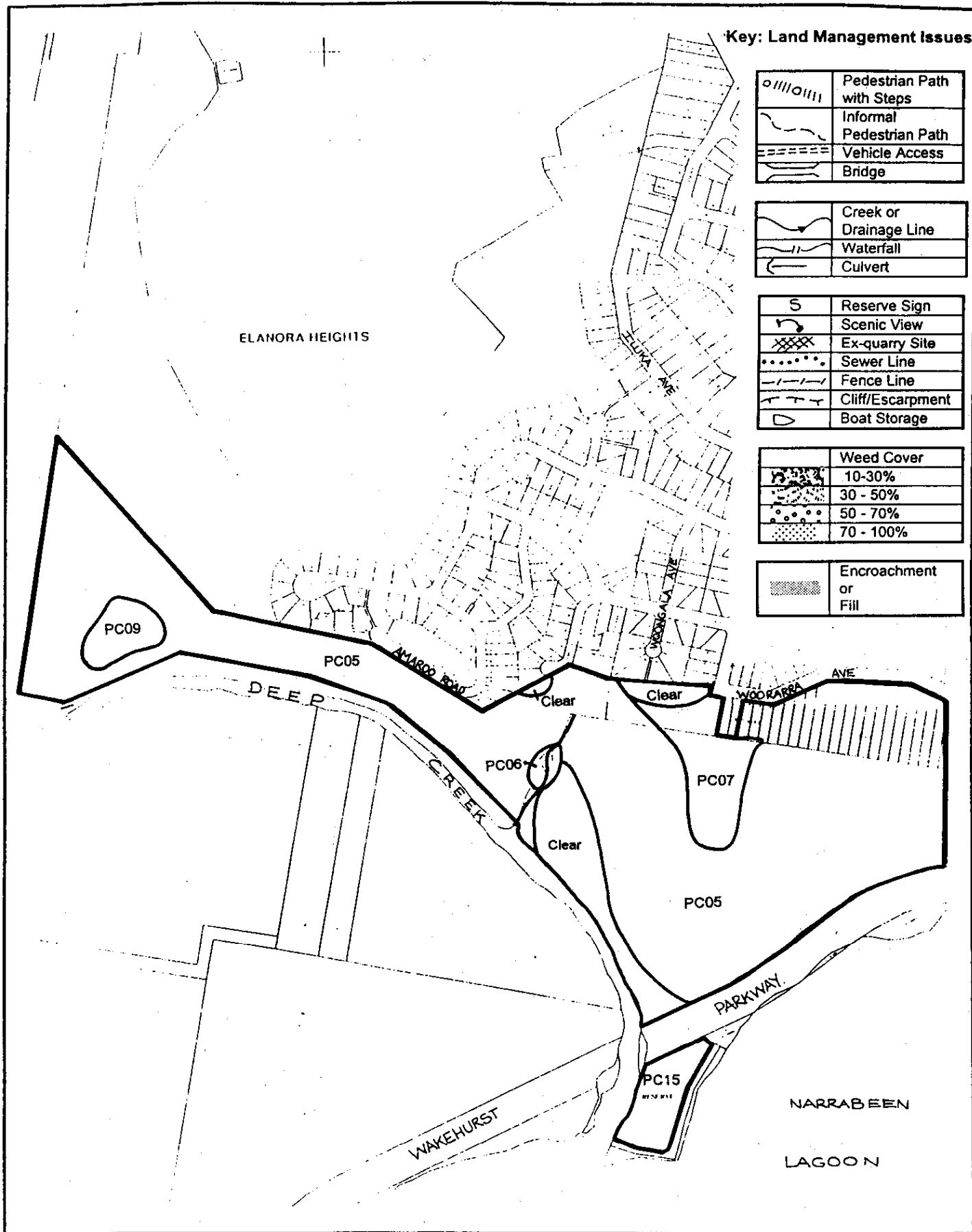
S=summer migrant

Bold = regionally significant sp**Bold Italic** = Threatened sp

Common Name	Scientific name	Record	Status
Birds			
Little Pied Cormorant	Phalacrocorax melanoleucos	UBS	F
Australasian Bittern	<i>Botaurus poiciloptilus</i>	RA	O
Black Bittern	<i>Dupetor flavicollis</i>	RA, FOC (94)	O
Rufous Night-heron	Nycticorax caledonicus	NPWS 91	O
White-faced Heron	Egretta novaehollandiae	UBS	O
Black Duck	Anas superciliosa	UBS	R
Mallard *	Anas platyrhynchos	NPWS 91	F
Blue-winged Shoveller	Anas rhynchotis	NPWS 86	O
Maned Duck	Chenonetta jubata	UBS	F
Pacific Baza	<i>Aviceda subcristata</i>	FOC (93)	R
Brown Goshawk	Accipiter fasciatus	NPWS (91)	O
Collared Sparrowhawk	Accipiter cirrocephalus	NPWS (90)	O
Wedge-tailed Eagle	Aquila audax	GNP	O
White-bellied Sea-Eagle	Haliaeetus leucogaster	GNP	O
Whistling Kite	Haliastur sphenurus	GNP	O
Brown Falcon	Falco berigora	GNP	O
Peregrine Falcon	Falco peregrinus	FOC (93)	O
Lewin's Rail	Rallus pectoralis	FOC 82	O
Buff-banded Rail	Rallus philippensis	FOC 91	O
Baillon's Crake	Porzana pusilla	FOC 82	O
Brown Quail	Coturnix australis	GNP	O
Dusky Moorhen	Gallinula tenebrosa	GNP	R
Purple Swamphen	Porphyrio porphyrio	GNP	R
Spotted Turtle-dove	Streptopelia chinensis	UBS	R
Topknot Pigeon	Lopholaimus antarcticus	GNP	O
Brown Cuckoo-Dove	Macropygia amboinensis	NPWS 89	O
Common Bronzewing	Phaps chalcoptera	GNP	R
Crested Pigeon	Ocyphaps lophotes	GNP, UBS	R
Sulphur-crested Cockatoo	Cacatua galerita	GNP, UBS	F
Galah	Cacatua roseicapilla	GNP, UBS	F
Yellow-tailed Black-Cockatoo	Calyptorhynchus funereus	GNP, FOC (93)	O
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	GNP, FOC (93)	O
Australian King-Parrot	Alisterus scapularis	GNP, UBS	F
Crimson Rosella	Platycercus elegans	GNP, UBS	R
Eastern Rosella	Platycercus eximius	GNP, UBS	R
Little Lorikeet	Glosopsitta pusilla	NPWS 91	O
Scaly-breasted Lorikeet	Trichoglossus chlorolepidotus	GNP	F
Rainbow Lorikeet	Trichoglossus haematodus	GNP, UBS	R
Fan-tailed Cuckoo	Cuculus pyrophanus	GNP, UBS	R
Shining Bronze-Cuckoo	Chrysococcyx lucidus	GNP	S
Common Koel	Eudynamys scolopacea	GNP, UBS	S
Channel-billed Cuckoo	Scythrops novaehollandiae	GNP	S
Pheasant Coucal	<i>Centropus phasianus</i>	NPWS 92	R
Southern Boobook	Ninox novaeseelandiae	GNP, UBS	R
Powerful Owl	<i>Ninox strenua</i>	GNP	F
Barking Owl	Ninox connivens	GNP	O
Barn Owl	Tyto alba	GNP	R
Masked Owl	<i>Tyto novaehollandiae</i>	L	F
Tawny Frogmouth	Podargus strigoides	UBW, UBS, GNP	R
Owlet-nightjar	Aegotheles cristatus	GNP	R

White-throated Nightjar	Caprimigulus mystacalis	GNP	S
Spine-tailed Swift	Hirundapus caudacutus	UBS	S
Azure Kingfisher	Ceyx azureus	FOC (93)	S
Kookaburra	Dacelo novaeguinea	UBS, UBS	R
Sacred Kingfisher	Halcyon snacta	NPWS 92	S
Dollarbird	Eurystomus orientalis	UBS	S
Superb Lyrebird	Menura superba	NPWS 92	R
Welcome Swallow	Hirundo neoxena	UBS, UBW	F
Black-faced Cuckoo-shrike	Coracina novaehollandiae	UBS	R
Cicadabird	Coracina tenuirostris	UBW	S
Spotted Quail-thrush	Cinclosoma punctatum	GNP	R
Red-whiskered Bulbul	Pycnonotus jocosus	UBS, UBW	R
Eastern Yellow Robin	Eopsaltria australis	UBS, UBW	R
Rose Robin	Petroica rosea	FOC 93	W
Golden Whistler	Pachycephala pectoralis	UBW, UBS	R
Rufous Whistler	Pachycephala rufiventris	GNP	S
Grey Shrike-thrush	Colluricincla harmonica	UBW, UBS	R
Leaden Flycatcher	Myiagra rubecula	FOC 91	S
Black-faced Monarch	Monarcha melnopsis	NPWS 82	S
Grey Fantail	Rhipidura fuliginosa	UBW, UBS	R
Rufous Fantail	Rhipidura rufifrons	UBS	S
Eastern Whipbird	Psophodes olivaceus	UBW, UBS	R
Superb Fairy-wren	Malurus cyaneus	UBW, UBS	R
Variegated Wren	Malurus lamberti lamberti	GNP	R
White-browed Scrubwren	Sericornis frontalis	UBW, UBS	R
White-throated Warbler	Gerygone olivacea	UBS	S
Striated Thornbill	Acanthiza lineata	GNP	F
Yellow Thornbill	Acanthiza nana	GNP	F
Brown Thornbill	Acanthiza pusilla	UBW, UBS	R
White-throated Treecreeper	Climacteris leucophaea	UBW, UBS	R
Eastern Spinebill	Acanthorhynchus tenuirostris	UBW, UBS	R
Red Wattlebird	Anthochaera carunculatus	UBW, UBS	R
Little Wattlebird	Anthochaera chrysoptera	UBW, UBS	R
Yellow-faced Honeyeater	Lichenostomus chrysops	UBW	W
White-eared Honeyeater	Lichenostomus leucotis	GNP	W
Scarlet Honeyeater	Myzomela sanguinolenta	RA	O
Noisy Miner	Manorina melanoccephala	UBW, UBS	R
Lewin's Honeyeater	Meliphaga lewinii	UBW, UBS	R
White-naped Honeyeater	Melithreptus lunatus	UBW	W
Noisy Friarbird	Philemon corniculatus	UBW, UBS	R
White-cheeked Honeyeater	Phylidonyris nigra	UBW, UBS	R
New Holland Honeyeater	Phylidonyris novaehollandiae	GNP	R
Mistletoebird	Dicaeum hirundinaceum	GNP	O
Spotted Pardalote	Pardalotus punctatus	UBW, UBS	R
Silvereye	Zosterops lateralis	UBW, UBS	R
Red-browed Finch	Neophema temporalis	UBS	R
Common Mynah	Acridotheres tristis	UBW, UBS	R
Olive-backed Oriole	Oriolus sagittatus	GNP	R
Spangled Drongo	Dicrurus hottentotus	GNP	S
Australian Magpie Lark	Grallina cyanoleuca	GNP	R
Dusky Woodswallow	Artamus cyanopterus	GNP	S
Grey Butcherbird	Cracticus torquatus	UBS	R
Australian Magpie	Gymnorhina tibicen	UBW, UBS	R
Pied Currawong	Strepera graculina	UBW, UBS	R
Australian Raven	Corvus coronoides	UBW, UBS	R
Mammals			
Short-beaked Echidna	Tachyglossus aculeatus	GNP	R
Tiger Quoll	Dasyurus maculatus	GNP	O
Brown Antechinus	Antechinus stuartii	NPWS 78	R
Swamp Wallaby	Wallabia bicolor	UBW, UBS	R

Sugar Glider	Petaurus breviceps	UBS	R
Common Ringtail Possum	Pseudocheirus peregrinus	UBW, UBS	R
Common Brushtail Possum	Trichosurus vulpecula	UBW, UBS	R
Koala	Phascolarctos cinereus	NPWS 68	O
Long-nosed Bandicoot	Perameles nasuta	UBW, UBS	R
Bush Rat	Rattus fuscipes	NPWS 78	R
Swamp Rat	Rattus lutreolus	GNP	R
Black Rat	Rattus rattus	GNP	R
Grey-headed Flying-fox	Pteropus poliocephalus	UBS	O
Gould's Wattled Bat	Chalinolobus gouldii	UBS	R
Chocolate Wattled bat	Chalinolobus morio	UBS	R
A Freetail bat	Mormopterus sp	UBS	R
Lesser Long-eared Bat	Nyctophilus geoffroyi	L	O
Gould's Long-eared Bat	Nyctophilus gouldi	L	O
Greater Broad-nosed Bat	Scotenax ruepelli	UBS	R
White-striped Mastiff Bat	Tadarida australis	L	O
Large Bent-wing Bat	Miniopterus schreibersii	UBS	O
Fox	Vulpes vulpes	UBW, UBS	R
Reptiles			
Blind Snake	Ramphotyphlops nigrescens	GNP	R
Green Tree Snake	Dendrelaphis punctulatus	GNP	R
Brown tree Snake	Boiga irregularis	GNP	R
Golden-crowned Snake	Cacophis squamulosus		R
Red-bellied Black Snake	Pseudechis porphyriacus	UBS	R
Yellow-faced Whip Snake	Demansia psammophis	GNP	R
Brown Snake	Pseudonaja textilis	GNP	R
Lace Monitor	Varanus varius	GNP	R
Bearded Dragon	Pogona barbata	GNP	R
Eastern Water Dragon	Physignathus leseurii	UBS	R
Jacky Lizard	Amhibolurus muricatus	L	R
Carpet or Diamond Python	Morelia spilota	GNP	R
Leaf-tailed Gecko	Phyllurus platurus	L	R
Stone Gecko	Diplodactylus vittatus	L	R
Thick-tailed Gecko	Underwoodisaurus milii	L	R
Leseur's Velvet Gecko	Oedura leseurii	L	R
Eastern Water Skink	Eulamprus quoyii	UBS	R
Red-throated Skink	Eulepis platynota	L	R
White's Skink	Egernia whitei	L	R
Cunninghams Skink	Egernia cunninghamii	L	R
Striped Skink	Ctenotus robustus	UBS	R
Copper-tailed Skink	Ctenotus taeniolatus	UBS	R
Grass Skink	Lampropholis delicata	UBS	R
Garden Skink	Lampropholis guichenoti	UBS	R
Weasel Skink	Saproscincus mustelina	L	R
Eastern Long-necked Tortoise	Chelodina longicollis	L	R
Blue-tongued Lizard	Tiliqua scincoides	L	R
Frogs			
Common Eastern Froglet	Crinia signifera	UBS	R
Red-crowned Toadlet	Pseudophryne australis	UBS	R
Brown-striped Frog	Limnodynastes peronii	UBS	R
Green Tree Frog	Litoria caerulea	L	R
Eastern Dwarf Tree Frog	Litoria fallax	L	R
Peron's Tree Frog	Litoria peronii	UBS	R
Leaf Green Tree Frog	Litoria phyllochroa	L	R
Whistling Tree Frog	Litoria verreauxii	L	R



Urban Bushland Plan of Management

Map: Vegetation Communities

Scale: 1:4000

Date: APRIL 1997

Locality:

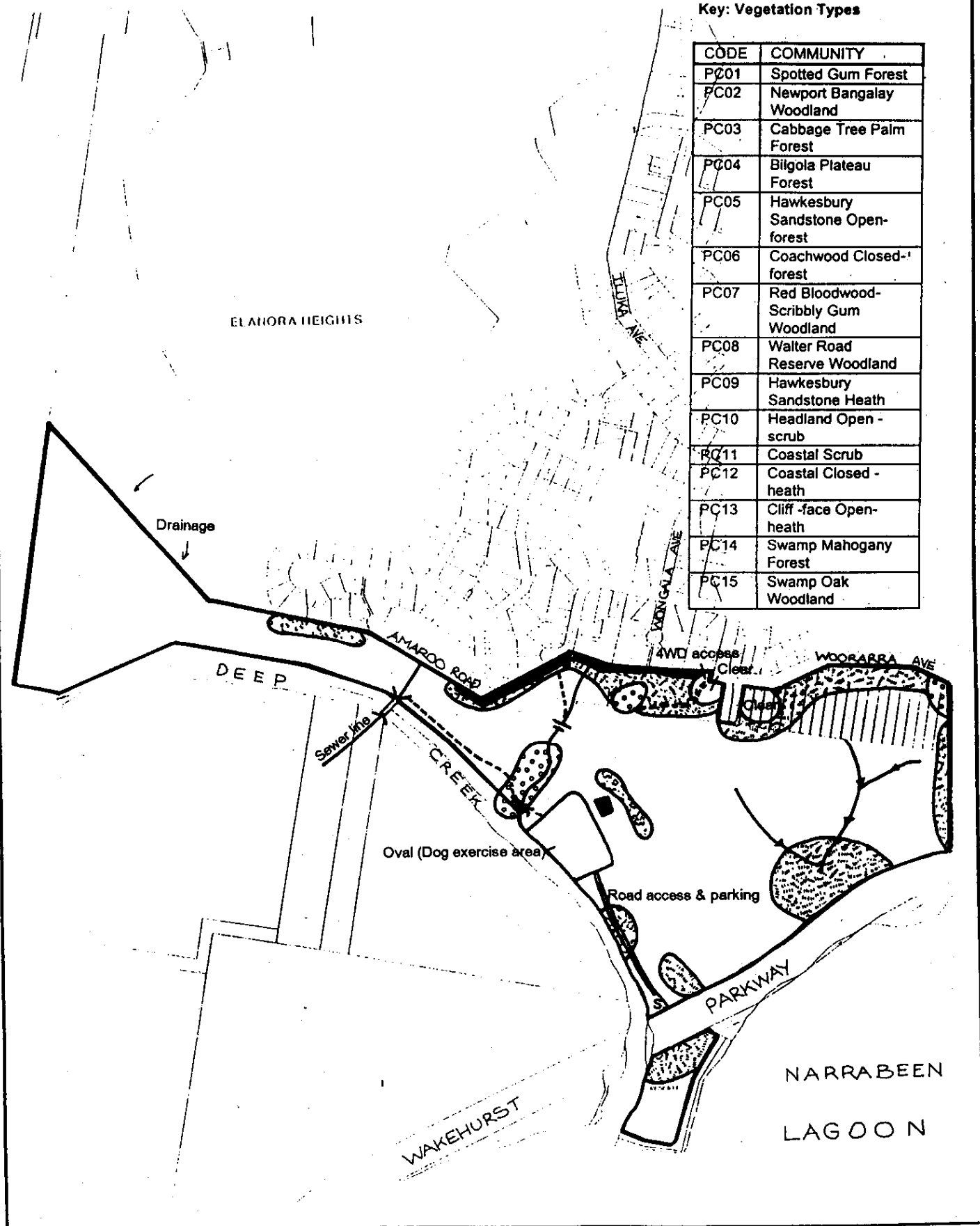
Deep Creek Reserve Elanora Heights



Pittwater Council

Key: Vegetation Types

CODE	COMMUNITY
P001	Spotted Gum Forest
PC02	Newport Bangalay Woodland
PC03	Cabbage Tree Palm Forest
PC04	Bilgola Plateau Forest
PC05	Hawkesbury Sandstone Open-forest
PC06	Coachwood Closed-forest
PC07	Red Bloodwood-Scribbly Gum Woodland
PC08	Walter Road Reserve Woodland
PC09	Hawkesbury Sandstone Heath
PC10	Headland Open-scrub
PC11	Coastal Scrub
PC12	Coastal Closed-heath
PC13	Cliff-face Open-heath
PC14	Swamp Mahogany Forest
PC15	Swamp Oak Woodland



Urban Bushland Plan of Management

Map: Management Issues

Scale: 1:4000

Date: APRIL 1997

Locality:

Deep Creek Reserve Elanora Heights



N
Pittwater Council

Dewrang Reserve, Elanora Heights

Reserve Number: 0159

Street Address: 92A Elanora Road, Elanora Heights.

1. Description & Category

1.1 Location and Description

Dewrang Reserve is located in Elanora Heights between Dewrang Avenue to the south and Elanora Road to the north. It is 1.95 ha in size with bushland comprising approximately 90% of the Reserve. There is a small developed park (10%) with playground equipment at the southern (Dewrang Avenue) boundary and another small developed park (Anana Reserve) at the northern boundary. This Plan of Management addresses the bushland areas of the Reserve.

Residential properties located on Elanora Road are serviced by a private access way off Dewrang Avenue which forms the eastern boundary of the Reserve. Residential back yards from properties on Allawah Ave form the western boundary.

1.2 Land Tenure and Property Description

The Reserve is owned by Council, includes Lot 1 DP 528738 and is zoned 6(a) Existing Recreation.

1.3 Category of Land

Dewrang Reserve is community land and under the Local Government Act, 90% is categorised as a natural area and as bushland. It meets the definition of bushland described in State Environmental Planning Policy No. 19 - Bushland in Urban Areas.



2. Natural And Cultural Heritage

2.1 Topography, Geology and Soils

Dewrang Reserve is situated on a crest which slopes towards the north with a long slope featuring rock outcrops and benches, with a flatter area at Anana Reserve downslope. The parent geology is Hawkesbury Sandstone which is characterised by medium to coarse grained Quartz sandstone with very minor shale and laminate lenses. The geology gives rise to shallow coarsely grained loose sandy loams, clayey sand and sandy clay loam characteristic of the Gynea Soil Landscape.

2.2 Hydrology

Dewrang Reserve contains no permanent water courses. Its location on a crest means there is little or no urban run-off as the Reserve generally sheds water off the slope. However, some drainage has been directed onto the Reserve margins, with pipes from private land. There is a localised impeded drainage depression at the southwest corner of Reserve which has some native wetland plants and some shallow standing water. This area appears to have been previously disturbed and has been invaded by weeds.

2.3 Vegetation

Dewrang Reserve's vegetation includes a small area of Red Bloodwood - Scribbly Gum Woodland with disturbance from areas of mown grass and weed infestation. The larger areas are more intact. Hawkesbury Sandstone Open-forest occurs further downslope.

On upper slopes, the vegetation is dominated by Red Bloodwood (*Corymbia gummifera*), Scribbly Gum (*Eucalyptus haemastoma*) and Broad-leaved White Mahogany (*Eucalyptus umbra*). Common shrub species include Old Man Banksia (*Banksia serrata*) and Scrub She-oak (*Allocasuarina distyla*). Ground layer species include the grass tree, *Xanthorrhoea media*, Pale Mat-rush, Flannel Flower (*Actinotus helianthi*), Bracken Fern (*Pteridium esculentum*) and *Lepyrodia scariosa*.

The conservation status of the Red Bloodwood - Scribbly Gum Forest is considered to be of local significance due to limited distribution.

The lower slopes are dominated by Sydney Peppermint (*Eucalyptus piperita*) and Red Bloodwood (*Corymbia gummifera*) with associated species Bastard Mahogany (*Eucalyptus umbra*) and Black She Oak (*Allocasuarina littoralis*).

2.4 Fauna

Like other small Reserves in the area Dewrang Reserve acts as a refuge for birds which forage in surrounding residences and as a "stepping stone" between larger areas of habitat at Deep Creek and Ingleside. The rocky outcrops of the Reserve also provide shelter for a range of reptiles. The good shrub layer and diversity of flowering sandstone vegetation provides a good food source for native birds.

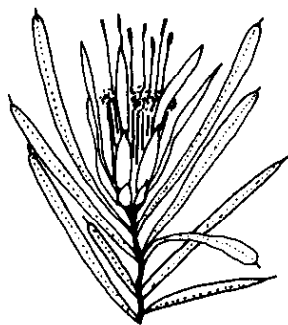
Council's Habitat and Wildlife Corridor Conservation Strategy, maps Dewrang Reserve as "Corridor - Co1" which indicates corridors or habitat areas though disturbed are likely to be of good value due to good crown cover and / or understorey.

2.5 Aboriginal sites

There are no recorded Aboriginal sites within Dewrang Reserve. There is potential for Aboriginal sites to occur in the area. Site observations recently revealed a possible small midden with oyster shells, and would need to be investigated by an archaeologist or by the National Parks and Wildlife Service.

2.6 Non-Aboriginal Sites

Evidence of previous European activity in the Reserve exists in the form of site disturbances of topsoil areas, earlier footings from a building structure, rock cuttings and old sandstone blocks which indicate that part of the Reserve near the western boundary was a sandstone rock quarry.



3. Significance And Objectives

3.1 Statement of Significance

Dewrang Reserve is significant because:

- ❖ it protects an example of the bushland of Elanora Heights in a similar condition to that which occurred when the area was first visited by Europeans,
- ❖ it includes samples of plant communities which are poorly conserved in the Pittwater area, namely Red Bloodwood Scribbly Gum Woodland,
- ❖ it acts to supports the habitat of birds and reptiles and is a stepping stone between larger areas of habitat due to its good shrub layer, diversity of flowering sandstone plants and rock outcrops,
- ❖ it contributes to the landscape quality of Elanora Heights and provides a record of the original landscape and the changes wrought by urban development,
- ❖ it is an educational resource and a contact point with nature for residents, and
- ❖ it allows urban residents to undertake informal recreational pursuits in a bushland setting.

3.2 Management Objectives

The management objectives for Dewrang Reserve are:

- ❖ to protect the natural features of the Reserve, particularly the significant plant community Red Bloodwood - Scribbly Gum Woodland,
- ❖ to maintain the natural range of structural and floristic diversity of bushland in the Reserve,
- ❖ to adequately manage the bushland in relation to encroachments, weed invasion and fire management,
- ❖ to protect life and property from wildfire and to maintain ecological processes by seeking to maintain a near-natural fire regime in the Reserve to conserve native flora and fauna in the Reserve,
- ❖ to control introduced animals in the Reserve,

- ❖ to provide opportunities for low impact recreational and educational use of the Reserve consistent with the other objectives, and
- ❖ to encourage community appreciation and neighbourhood participation in bushland management of the Reserve.

- 5) expand and plant indigenous sedges and appropriate perched wetland grasses in the disturbed impeded drainage area in the southwest corner.

4. Management Issues

4.1 Weed Invasion

The main areas of weed infestation in the Reserve are along the residential and accessway boundaries. The soak depression at the top of the Reserve has large amounts of Hydrocotyle and exotic grasses. Some vegetation dumping in this area has exacerbated the weed problems. A lack of definition between the more formalised park area and the bushland has meant that extended mowing and many tracks into the bushland area have given opportunity for weeds to expand into areas of good native vegetation. Fishbone and asparagus fern have colonised much of the boundary areas on the eastern edge. Other weeds such as Lantana, Cassia, Ginger lily and exotic grasses are evident near the western boundary.

4.2 Bush Regeneration

Council currently supports volunteer bush regenerators working in the Reserve however there is no contract bush regeneration program for Dewrang Reserve.

Bush regeneration is needed to improve the viability of the remnant native vegetation and should follow the principles and priorities:

- 1) working from the intact good bush towards the more weed infested edges;
- 2) creation of an edge between the formal mown playground area of the Reserve and the bushland and revegetation of the edge densely;
- 3) rationalisation and re-vegetation of some of the existing tracks;
- 4) weed control, then planting indigenous species and mulching the areas adjacent to the access way along the eastern boundary and along the western boundary; and

4.3 Fire Regime

According to residents the Reserve had not burnt in over 20 years (L. Benson pers comm.) until a successful hazard reduction and ecological burn was carried out in April 1996 burning approximately 75% of the bushland area in the Reserve.

Management of the fire regime in the Reserve will be undertaken by the Warringah Pittwater Bushfire Management Committee in accordance with Circular C10 - Planning for Bush Fire Prone Areas. The Reserve will be regularly monitored for fuel loadings by Warringah Pittwater Bushfire Services and any hazard reductions required will be undertaken in accordance with the Draft Fuel Management Plan. Ecological considerations will be assessed by Council environmental staff to determine methods of hazard reduction. Following a burn a follow-up program of weeding will be commenced.

4.4 Management of Significant Plant Species and Communities

The conservation of the Red Bloodwood - Scribbly Gum plant community within the bushland requires protection from further weed invasion and a bush regeneration program. An appropriate fire regime needs to be maintained within the Reserve to ensure the continued survival of the sandstone flora. This information may be obtained from work carried out by fire research ecologists.



4.5 Management of Native Fauna and Introduced Predators

Future planting and bush regeneration programs need to consider the habitat value of the Reserve. Maintenance and enhancement of a healthy shrub layer is a priority for bird habitat. Compliance signs at Reserve entrances need to be installed to indicate that removal of bush rock and dead wood is prohibited as they form important microhabitats.

A public awareness campaign to adjoining properties will need to address the value of the bushland as habitat for fauna and how residents can be responsible neighbours by ensuring that domestic cats and dogs do not roam in the Reserve. Rangers will enforce the Dog Act. Fox predation is an issue which needs to be addressed through a well designed feral animal control strategy.

4.6 Signage, Access, Walking Tracks and Recreation

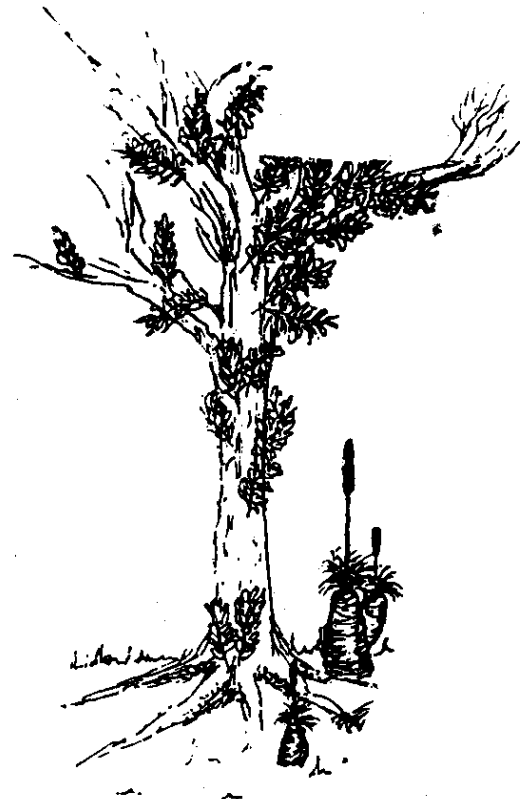
A sign naming the reserve should be installed at Dewrang Avenue. Rationalisation of existing tracks is necessary to define one good walking track through the Reserve that is situated to allow safe and enjoyable access to increase public appreciation of the bushland. Good progress has been made to date removing some of the previous unnecessary car tracks. The two small developed active play areas are on each end of the reserve serving the interests of children, with mown areas and play equipment.

4.7 Boundaries and Neighbours

Dewrang Reserve has a number of encroachments of private use of the Reserve by adjoining residents. There are areas of mown lawn varying between 8 to 12 metres into the Reserve as well as areas where exotic plants (garden escapees) have taken over the bushland. Some of the lawn encroachments have disguised previous dumped spoil from adjoining residential site excavations, which require revegetation works.

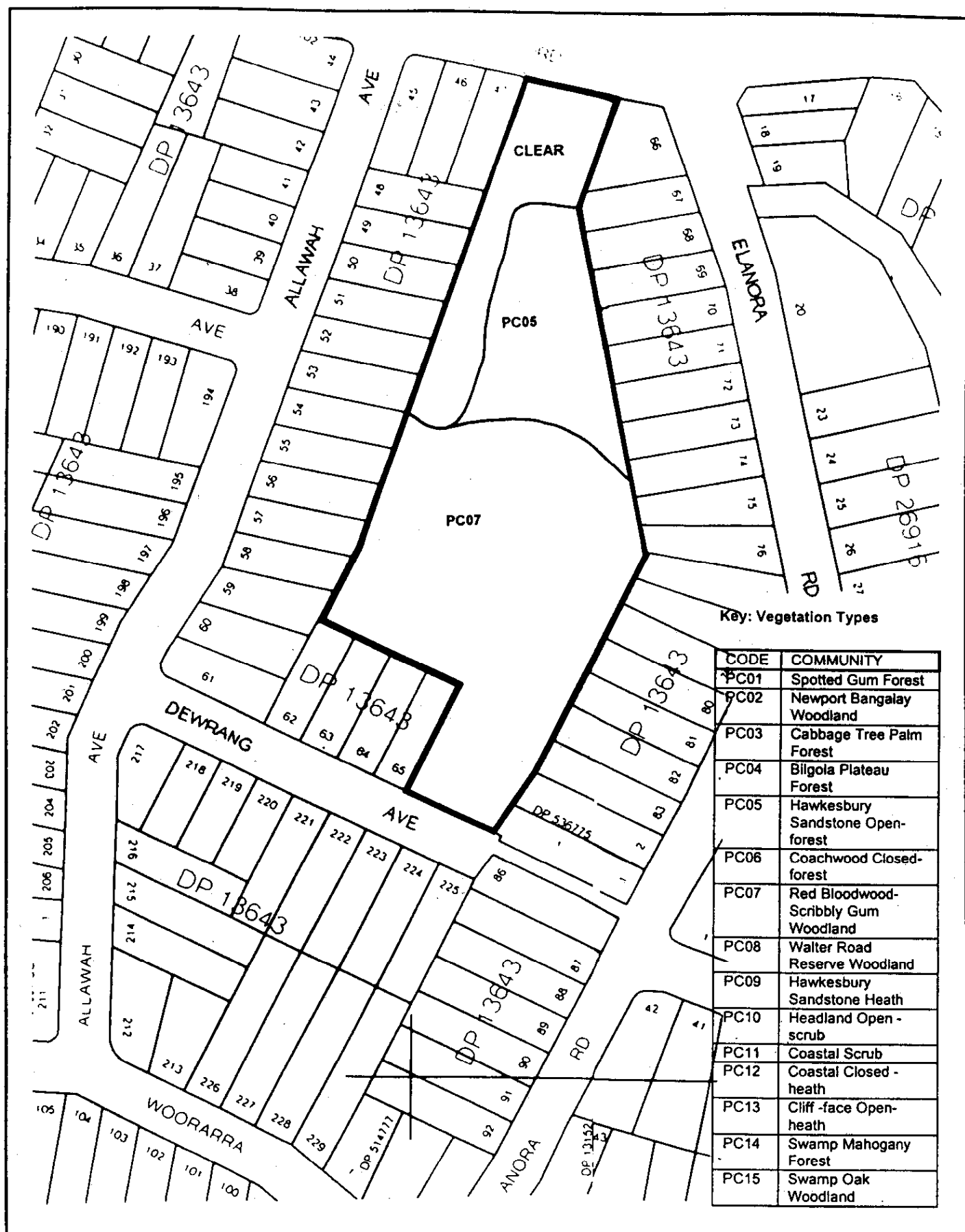
The eastern edge of the Reserve adjoining the private access way is used as a site for storage and parking with building materials, parked cars and dumped fill present. All encroachments are threatening the integrity of this small bushland remnant. There is also evidence of residents dumping garden refuse in the Reserve increasing weed infestation, nutrients and fuel loadings.


Fencing will define the limit of the car accessway on the eastern boundary with a fuel reduced zone within the reserves fenced boundary line.

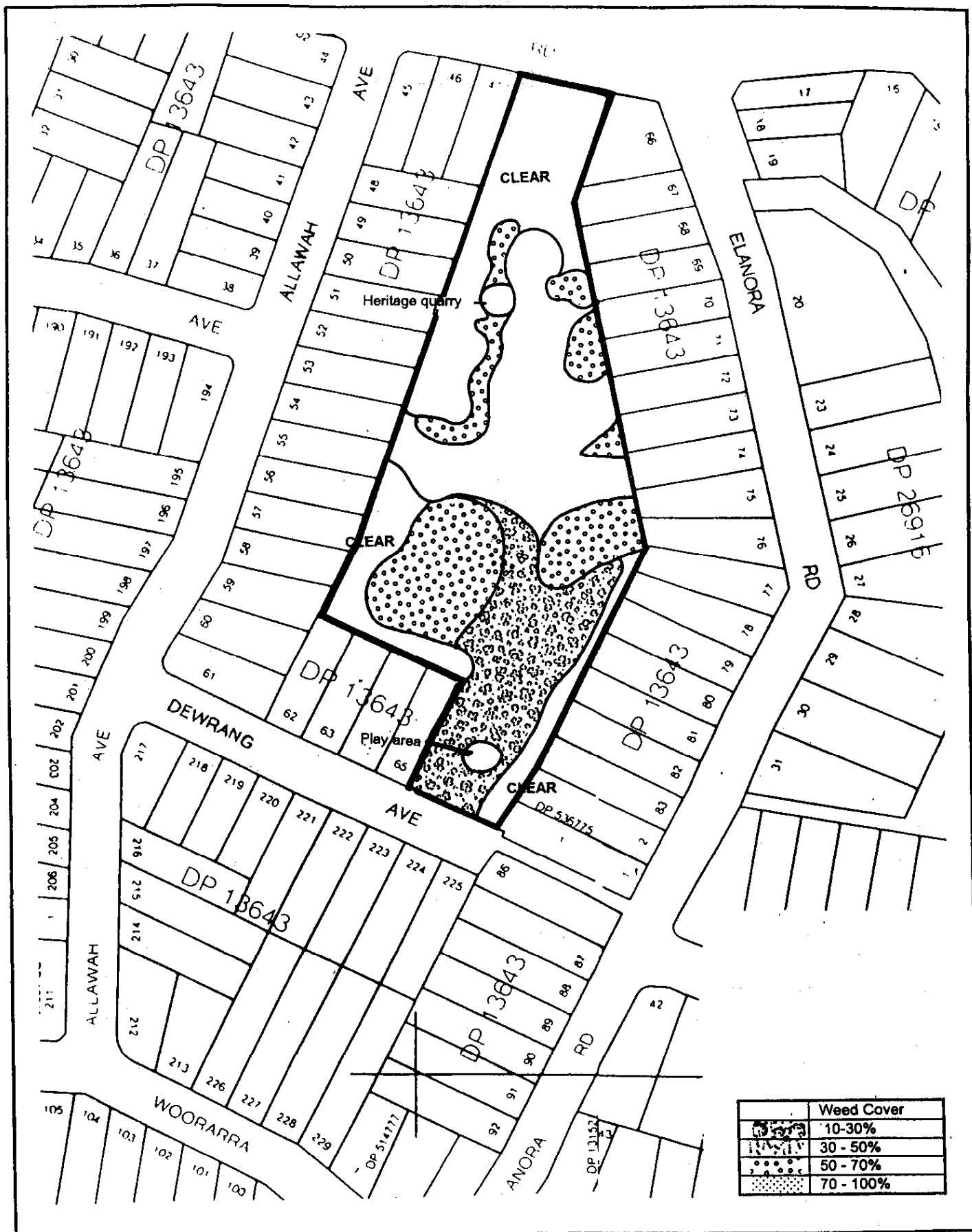



5. Performance

Management Objectives	Performance Targets (Actions)	Responsibility	Target Date	Capital cost estimate	Recurrent Cost estimate	Performance Measures
Bush regeneration & weed control	Support & increase volunteer bush regeneration	Natural Resources	Ongoing		Approx. \$400 pa or as service required	Volunteers continuing to work in the Reserve
Habitat improvement & restoration	Maintain viable bushland habitat through expanding regeneration & planting	Reserves, Natural Resources	When funds available	Obtain detailed costings	Seek on going bushland maintenance program	A viable bushland habitat and increased awareness
Fire management	Maintain appropriate fire regime	Bushfire Services & Natural Resources	Ongoing		Staff Time	Fire regime that caters for safe fuel levels & conservation of plant & animal communities
Fauna management & introduced predators	Public awareness campaign, enforce the Dog Act & Pittwater wide feral animal control program	Natural Resources & Compliance	On-going and when funds available	Seek detailed costings of feral animal control	Staff Time & resources	
Sign, access & walking tracks	Install sign, develop a safe, well designed walking track & regenerate unnecessary tracks.	Reserves & Natural Resources	Signs: 1996/97 track when resources available	Sign \$500 Track - obtain detailed design & costing	Integrate maintenance within staff resources & existing programs	
Boundaries & neighbours	Regain re encroachments, & awareness campaign & signs re dumping of garden refuse in the Reserve.	Reserves, Natural Resources & Compliance	Signs 1996/97 other when resources available	Signs \$400 Obtain detailed costings & implement within a bushland restoration program	Integrate maintenance within staff resources & existing programs	Public appreciation & co-operation to achieve more viable bushland for flora & fauna.



Urban Bushland Plan of Management			 Pittwater Council
Map: Vegetation Communities	Scale: 1:2000	Date: APRIL 1997	
Locality Dewrang Reserve Elanora Heights			



Urban Bushland Plan of Management			 Pittwater Council
Map: Weed Cover	Scale: 1:2000	Date: APRIL 1997	
Locality: Dewrang Reserve Elanora Heights			

Epworth Park, Elanora Heights

Reserve Number: 0150

Street Address: Access via Merridong Road, Elanora Heights.

1.0 Description & Category

1.1 Location and Description:

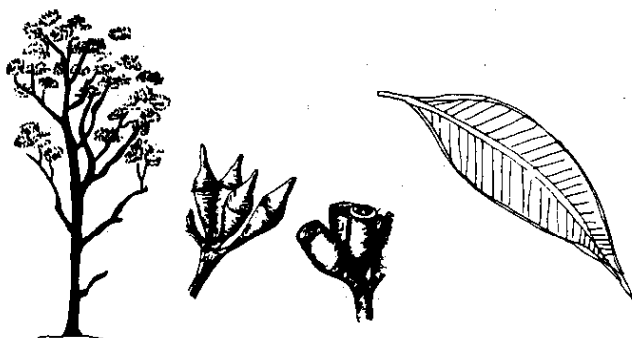
Epworth Park is located in Elanora Heights below Powderworks Road and immediately above Irrawong Reserve, North Narrabeen. It is bounded by Merridong Road, and Epworth Place as well as to the rear of properties located along Wesley Street. It is 2.8 ha in size with a large portion of undeveloped bushland along part of its western boundary. At the southern (upper) end of the reserve is a developed park that includes Tennis Courts and a car-park. This Plan of Management refers to the bushland component of the park.

1.2 Land Tenure, Property Description and Zoning

Epworth Park is owned by Pittwater Council and is described as Lot 62 & 63 in DP 631261. The land is zoned 6(a) Open Space - Existing Recreation.

1.3 Category of Land:

Epworth Park is community land and under the Local Government Act, 90% is categorised as a natural area and is further categorised as bushland, watercourse and escarpment. It meets the definition of bushland described in State Environmental Planning Policy No. 19 - Bushland in Urban Areas.



2.0 Natural And Cultural Heritage

2.1 Topography, Geology and Soils

Epworth Park is situated on the edge of a broad crest and slopes north to the valley floor with two escarpments. The lower cliffline features a waterfall. It borders natural undeveloped land along the Mullet Creek valley.

The parent geology of the upper slopes is Hawkesbury Sandstone that is characterised by medium to coarse grained quartz sandstone. The geology has given rise to shallow coarsely grained loose sandy loams, clayey sand and sandy clay loam characteristic of the Gynea soil landscape. These soils have a high soil erosion hazard.

The lower slopes are characterised by geology of the Newport Formation of the Narrabeen Group. Steep colluvial side slopes, occasional sandstone boulders and benches are characteristic landscape forms associated with the finer grained shale and quartz to lithic-quartz sandstone laminite. The soils derived vary, on sandstone they are shallow and sandy, and on shales they are moderately deep podsolic (red, brown or gleyed) soils.

The slope and toe of the park directly adjoins Irrawong Reserve. The soils have been mapped as the colluvial Watagan soil landscape.

2.2 Hydrology

The Park is located within the Mullet Creek catchment. Three small creeklines in the Park are greatly influenced by urban runoff:

- a) one creek is now a stormwater outlet and is also fed by seepage from the escarpment (near Wesley street accessway)
- b) one creek receives runoff from tennis court and car-park

- c) the third creek is the most natural and flows into the waterfall, receiving waters from the residential developed area above the park

2.3 Vegetation

Hawkesbury Sandstone Open-forest is the most widespread vegetation type in Epworth Park. The dominant canopy species are Smooth-barked Apple (*Angophora costata*), Sydney Peppermint (*Eucalyptus piperita*) and Red Bloodwood (*Corymbia gummifera*). Forest Oak (*Allocasuarina torulosa*) is also common. Shrub species include Common Hop-bush (*Dodonaea triquetra*) and *Astrotricha latifolia*. Ground layer species include Kangaroo Grass (*Themeda australis*) and Spiny Mat-rush (*Lomandra longifolia*).

The lower section of the Park contains a closed forest community dominated by Lilly Pilly (*Acmena smithii*). The common tree species include Cheese Tree (*Glochidion ferdinandi*), Cabbage Tree Palm (*Livistona australis*) and Coachwood (*Ceratopetalum apetalum*). The Swamp Mahogany forest of Irrawong Reserve extends into Epworth Park's lower areas.

2.4 Fauna

Epworth Park's range of habitat features and its location within a major wildlife corridor make it valuable habitat for a range of fauna species. It is estimated that more than 90 species would use the Reserve.

The habitat features of the Reserve contribute to this diversity. The abundant rock outcrops of the Reserve's slopes mean a range of reptile species including Yellow-faced Whipsnake, Lace Monitor and a variety of skinks are expected to occur. The nearby creek and associated vegetation also mean Red-bellied Black Snakes, Water Dragons along with tree and ground frogs would be present.

Many tree hollows exist in the large angophoras and gums that provide nesting and roosting habitat for a range of birds and mammals. The large hollows are suitable for species such as owls, parrots and brushtail possums whereas the small hollows are favoured by lorikeets, sugar and squirrel gliders, flying foxes and Gould's wattled bat.

The stand of Swamp Mahogany at the lower part of Epworth Park is part of the forest that occupies Irrawong Reserve and the Warriewood Wetlands and is regionally significant. Apart from being a favoured koala food tree, the Swamp Mahogany's abundant winter flowering provides a crucial carbohydrate source for birds and mammals. Resident possums and gliders use this resource.

They in turn are prey for the threatened species Powerful Owl and possibly the Masked Owl. Resident birds such as Lorikeets as well as the winter migrants and Honeyeaters feed on this tree. Reports of the threatened Regent Honeyeater, which is also a winter migrant, are becoming more common on the central coast and it is possible it may also visit the Reserve.

Council's Habitat and Wildlife Corridor Strategy maps Epworth Park as "Major Habitat". This signifies a high degree of diversity within the Reserve in both habitat types and species presently using it. Epworth forms part of the link between the low lying alluvial valley and wetlands with the large areas of coastal open forest present in the Ingleside area. This in turn connects fauna with the large natural areas of Ku-ring-gai Chase and Garigal National Parks.

2.5 Aboriginal and Non-aboriginal Sites

There are no recorded Aboriginal sites within the Reserve. There is potential for Aboriginal sites to occur in the area such as engravings and axe grinding grooves due to other sites recorded in the area in the National Parks and Wildlife Service's site register.

There are no recorded sites of European or cultural significance.

3.0 Classification, Significance And Objectives

3.1 Statement of Significance

Epworth Park is significant because:

- ❖ it provides a diverse example of urban bushland, a record of the pre-European landscape present in the Ingleside and Elanora Heights area and the changes wrought by urban development;
- ❖ it contributes to the landscape quality of Elanora Heights and the Ingleside escarpment and has views over the Warriewood valley and the coast;
- ❖ it provides habitat for a wide diversity of fauna species in the context of urban bushland in the Sydney Region especially the Powerful Owl, Masked Owl, threatened and Regent Honey eaters;

- ❖ it provides an important corridor link between low lying habitats of Irawong Reserve and the Warriewood Wetlands, and upland large natural areas and National Parks;
- ❖ it is an educational resource and a contact point with nature for residents; and
- ❖ it allows urban residents to undertake informal recreational pursuits in a bushland setting.
- ❖ it includes samples of plant communities that are regionally significant such as Coachwood Closed Forests and significant at a state level including Swamp Mahogany Forest.

3.2 Management Objectives

The management objectives for Epworth Park are:

- ❖ to protect the natural features of the Park, particularly populations of significant plant communities and fauna species;
- ❖ to maintain a natural range of structural and floristic diversity of bushland within the Park;
- ❖ to adequately manage the bushland/ urban interface in relation to fire management, weed management and stormwater management;
- ❖ to prevent damage to the Park from urban runoff, stormwater and pollution;
- ❖ 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 and aim to ensure that no species of plant or animal becomes extinct in the Park as a result of the fire regime;
- ❖ to control and where possible eradicate introduced animals within the Reserve;
- ❖ to provide opportunities for low impact recreational, scientific and educational use of the Reserve;
- ❖ to encourage community and neighbour participation in bushland management.

4.0 Management Issues

4.1 Weed Invasion & Bush Regeneration

The open forest community immediately below the tennis court and the escarpment has been seriously degraded by landfill from the tennis area. The sewer main through the park has created a disturbance corridor. This area has the highest density and variety of weed species.

Weeds include Castor Oil plant, Lantana, Pampas Grass, *Erythrina x sykesii*, *Solanum nigrum*, Bidens and Inkweed.

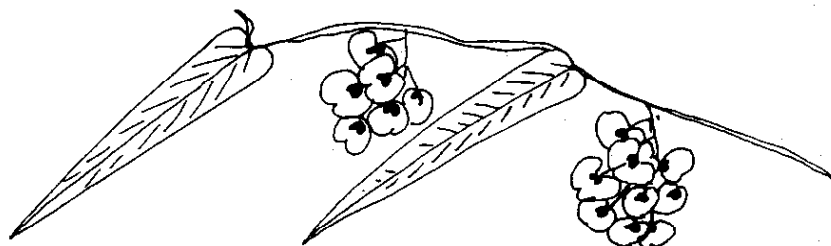
Prior to the January 1994 bushfires, the Reserve was heavily infested with Lantana that is now sparsely re-occurring through the Reserve. The closed forest area has a wandering jew infestation on the forest floor. Rubbish dumping by residents has contributed to the weed infestations particularly around the perimeter of the Reserve.

The January 1994 fires greatly assisted the natural regeneration of the Reserve. The extreme wild fire conditions destroyed much of the weed understorey and created conditions optimum for the germination of natives. A volunteer program commenced several months after the fires.

Any bush regeneration program for Epworth Park should follow the following principles:

- 1) Work should be initiated from the top of the escarpment working down the catchment.
- 2) Work should concentrate on the good areas of bush working out towards the edges and creeklines.
- 3) A concentrated effort should be made to weed the closed forest area in Epworth Park in order to conserve the forest and to link the regeneration sites in the adjacent Irawong Reserve.

A revegetation program of the disturbance corridor associated with the sewer line using indigenous wetland species able to cope with the changed environmental conditions would greatly reduce weed infestation.



4.2 Stormwater Drainage

Urban stormwater from residential development and kerbed roads in the catchment causes increased runoff and affects water quality in the Reserve. Natural creeklines and seepage areas occur within Epworth Park. In the developed section of the Reserve, areas of wet grass are indicative of impeded drainage associated with shallow soil and rock benches.

The sewer line is within the drainage line and future problems with erosion and overflows could occur during storm events. A revegetation program with wetland species should be designed to reduce erosion potential.

There is a discharge of runoff from the bitumen car-park that has created a scour. Dissipation of this runoff is necessary to prevent further erosion. A suitable solution may be the lining of the channel with rock or geotextile combined with revegetation.

4.3 Fire Regime

The Reserve was burnt by wildfire in the January 1994 fires. This event benefited the plant community as it has appeared to have been unburnt for a substantial period (possibly 1979). The wildfire was extremely hot allowing great regeneration of natives while actually killing many weed species. These conditions generally cannot be achieved through prescribed burning.

Several species present are fire sensitive including the rainforest species within the Lilly Pilly Closed Forest and therefore fire is not desirable for this plant community. The Hawkesbury Sandstone Open Forest should not be burnt more often than once in ten years making hazard reduction burning inappropriate in Epworth for several years to come.

Management of the fire regime in the Reserve will be undertaken by the Warringah Pittwater Bushfire Management Committee in accordance with Circular C10 - Planning for Bush Fire Prone Areas. The Reserve will be regularly monitored for fuel loadings by Warringah Pittwater Bushfire Services and any hazard reductions required will be undertaken in accordance with the Draft Fuel Management Plan. Ecological considerations will be assessed by Council environmental staff to determine methods of hazard reduction.

A fuel reduced zone should be implemented along the residential boundaries of 40m. There needs to be follow-up weeding after fire as well as consideration of soil erosion issues.

4.4 Management of Native Fauna and Introduced Predators

Epworth Park provides good habitat for fauna with a variety of habitats available. Foxes and feral cats can move easily into the reserve from the surrounding bushland and domestic cats and dogs from the other two boundaries.

A Pittwater wide public awareness campaign will address the value of bushland as habitat for fauna and how residents can be responsible neighbours by ensuring that domestic cats and dogs do not roam in the Reserve.

Compliance signs can assist in this. Fox predation is an issue that needs to be addressed through a Pittwater wide control strategy.

4.5 Access, Walking Tracks and Recreation

There are informal tracks within Epworth Park, however there are no formalised tracks within the upper reaches of the Reserve. The newly constructed track in Irrawong does loop through the lower closed forest section of Epworth Park. A walking track that links the developed section of Epworth Park with the existing walking track in Irrawong Reserve would allow greater public awareness of the bushland and provide passive recreation for residents as well as a safe walking link between Elanora Heights and Warriewood.

The park contains a large active formal area that includes carparking and tennis courts. Following fires, exposed rock faces are used regularly by rock climbers.

4.6 Boundaries and Neighbours

There are encroachments of private gardens into the bushland reserve along areas of the residential boundaries. These are illegal and need to be addressed. There are also incidences of garden refuse dumping. There is a need for a public awareness and education campaign to link dumping of vegetation, weed infestation and fire hazard to all neighbours of the Reserve.

5.0 Performance

Management objectives	Performance targets (actions)	Responsibility	Target date	Capital cost estimate	Recurrent cost estimate	Performance measures
Weed control & bush regeneration	Continue volunteer support & expand regeneration activities with a contract program	Natural Resources	Ongoing & expand as additional funds available	Seek detailed cost of contract bush regen program	\$1,000 p.a. volunteers supervision & materials	Increased area of reserve with low weed infestation
Hydrology, stormwater control & water quality	Erosion control works on drainage lines & creek revegetation.	Engineers & Natural Resources	When funding available	Seek detailed design & costing	Integrate into works and maintenance programs	Erosion minimised improved water quality & reduced sediment
Management of native fauna & introduced predators	Public awareness campaign for responsible pet ownership, feral animal program & install signage	Natural Resources & Compliance	Signs 97/98, other when funds available	\$400 sign & seek funds for animal programs	Costed within a Pittwater wide feral animal control program	An increase in native fauna in the reserve.
Fire management	Maintain appropriate fire regime	Bushfire Services & Natural Resources	ongoing		Staff Time	Safe fuel levels & conservation of biodiversity
Access & walking tracks	Investigate walking track to link with track in Irawong	Reserves & Natural Resources	When funds available	Seek detailed design & costings	Staff & volunteer maintenance	Track for public use to link existing walkway.
Boundaries & neighbours	Community awareness & participation in the reserve & regain encroachments	Natural Resources & Compliance	When funds available	Within an overall reserve regen program	Staff time	No encroachments or rubbish dumping in the reserve



Fauna Species List Epworth Park

Key

Record (most recent)

UBS - Urban Bushland Survey summer

IPM - Irrawong Plan of Management and year of most recent record therein

L - likely to occur

Status

R=resident; F=frequent visitor; W=winter migrant

O-occasional or uncommon visitor

S=summer migrant

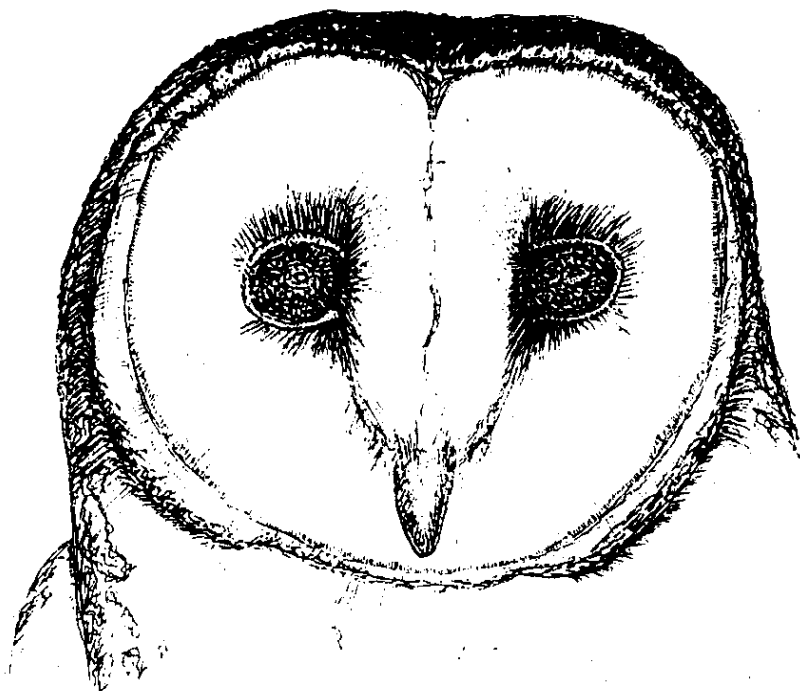
Bold = regionally significant sp **Bold Italic** = Threatened sp

* introduced species

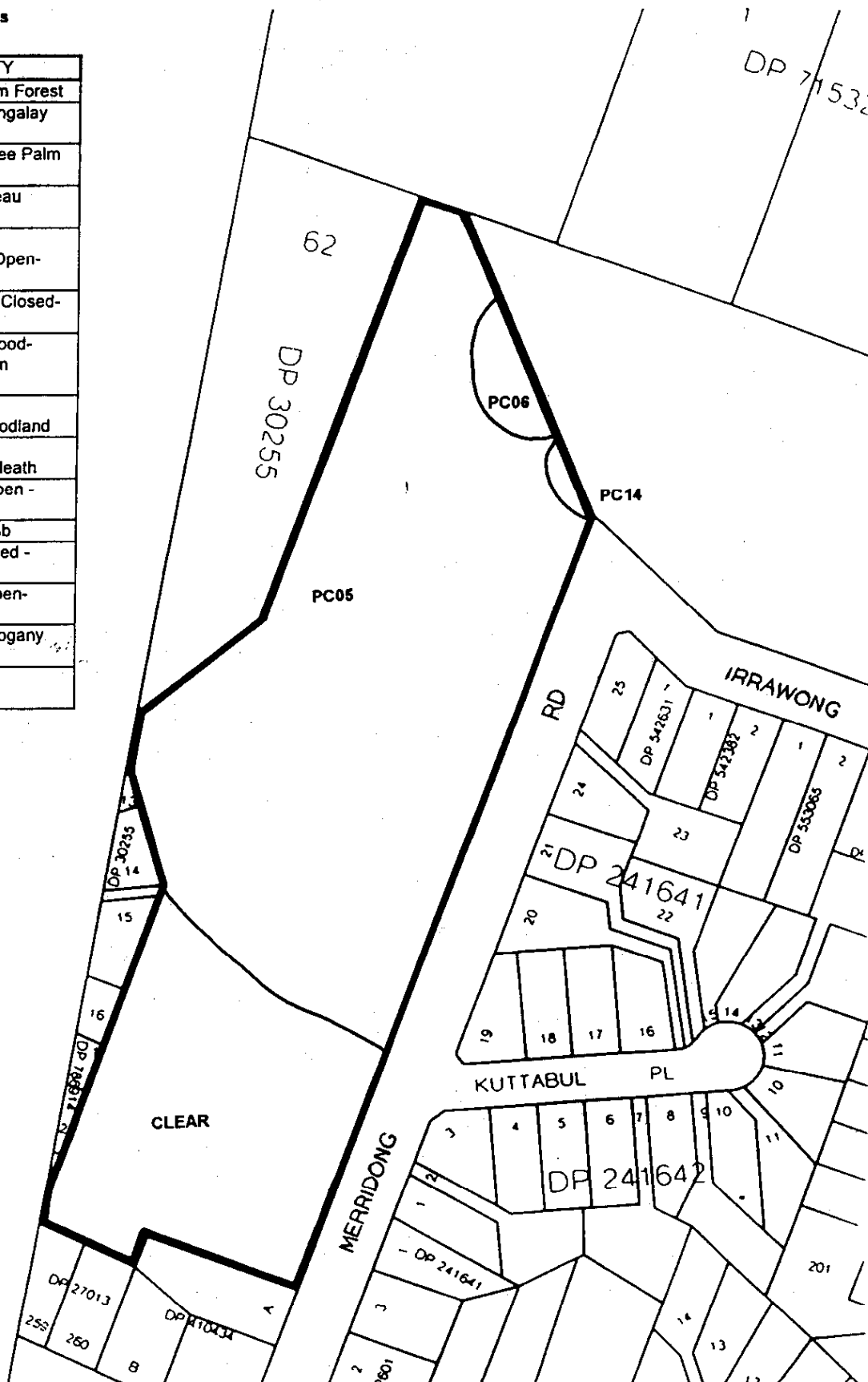
Common Name	Scientific name	Record	Status
Birds			
Brown Goshawk	Accipiter fasciatus	IPM 94	F
Lewin's Rail	Rallus pectoralis	L	O
Spotted Turtle-dove	Streptopelia chinensis	UBS	R
Topknot Pigeon	Lopholaimus antarcticus	IPM 94	O
Brown Cuckoo-Dove	Macropygia amboinensis	L	F
Sulphur-crested Cockatoo	Cacatua galerita	UBS	F
Galah	Cacatua roseicapilla	IPM 95	F
Yellow-tailed Black-Cockatoo	Calyptorhynchus funereus	L	O
Australian King-Parrot	Alisterus scapularis	UBS	F
Crimson Rosella	Platycercus elegans	UBS	F
Eastern Rosella	Platycercus eximius	UBS	F
Little Lorikeet	Glosopsitta pusilla	IPM 95	O
Scaly-breasted Lorikeet	Trichoglossus chlorolepidotus	IPM 95	F
Rainbow Lorikeet	Trichoglossus haematodus	UBS	R
Fan-tailed Cuckoo	Cuculus pyrophanus	UBS	R
Shining Bronze-Cuckoo	Chrysococcyx lucidus	IPM 95	S
Common Koel	Eudynamys scolopacea	UBS	S
Channel-billed Cuckoo	Scythrops novaehollandiae	IPM 94	S
Pheasant Coucal	Centropus phasianus	IPM 93	O
Southern Boobook	Ninox novaeseelandiae	UBS	R
Powerful Owl	Ninox strenua	L	F
Masked Owl	Tyto novaehollandiae	L	O
Tawny Frogmouth	Podargus strigoides	UBS	R
Owlet-nightjar	Aegotheles cristatus	L	R
Spine-tailed Swift	Hirundapus caudacutus	UBS	S
Kookaburra	Dacelo novaeguinea	UBS	R
Sacred Kingfisher	Halcyon sancta	IPM 94	S
Dollarbird	Eurystomus orientalis	UBS	S
Superb Lyrebird	Menura superba	L	O
Welcome Swallow	Hirundo neoxena	UBS	R
Black-faced Cuckoo-shrike	Coracina novaehollandiae	UBS	R
Cicadabird	Coracina tenuirostris	IPM 95	S
Red-whiskered Bulbul	Pycnonotus jocosus	UBS	R
Eastern Yellow Robin	Eopsaltria australis	IPM 95	R
Rose Robin	Petroica rosea	L	W
Golden Whistler	Pachycephala pectoralis	UBS	R
Rufous Whistler	Pachycephala rufiventris	L	S
Grey Shrike-thrush	Colluricincla harmonica	UBS	R
Leaden Flycatcher	Myiagra rubecula	L	S
Black-faced Monarch	Monarcha melanopsis	IPM 95	S
Grey Fantail	Rhipidura fuliginosa	UBS	R
Rufous Fantail	Rhipidura rufifrons	UBS	S
Eastern Whipbird	Psophodes olivaceus	UBS	R
Superb Fairy-wren	Malurus cyaneus	UBS	R
Variegated Wren	Malurus lamberti lamberti	IPM 93	F
Large-billed Scrubwren	Sericornis magnirostris	IPM 95	R

White-browed Scrubwren	Sericornis frontalis	UBS	R
White-throated Warbler	Gerygone olivacea	L	S
Striated Thornbill	Acanthiza lineata	IPM 94	F
Yellow Thornbill	Acanthiza nana	IPM 94	F
Brown Thornbill	Acanthiza pusilla	UBS	R
White-throated Treecreeper	Climacteris leucophaea	UBS	R
Eastern Spinebill	Acanthorhynchus tenuirostris	IPM 95	R
Red Wattlebird	Anthochaera carunculatus	UBS	R
Little Wattlebird	Anthochaera chrysoptera	UBS	R
Yellow-faced Honeyeater	Lichenostomus chrysops	IPM 95	W
White-eared Honeyeater	Lichenostomus leucotis	L	O
Scarlet Honeyeater	Myzomela sanguinolenta	L	O
Noisy Miner	Manorina melanocephala	UBS	R
Lewin's Honeyeater	Meliphaga lewinii	UBS	R
White-naped Honeyeater	Melithreptus lunatus	IPM 95	W
Noisy Friarbird	Philemon corniculatus	UBS	R
White-cheeked Honeyeater	Phylidonyris nigra	IPM 95	R
New Holland Honeyeater	Phylidonyris novaehollandiae	UBS	R
Xanthomyza phrygia	Regent Honeyeater	L	O
Spotted Pardalote	Pardalotus punctatus	UBS	R
Silvereye	Zosterops lateralis	UBS	R
Red-browed Finch	Emblema temporalis	UBS	R
Olive-backed Oriole	Oriolus sagittatus	IPM 95	S
Spangled Drongo	Dicrurus hottentotus	IPM 83	S
Dusky Woodswallow	Artamus cyanopterus	L	S
Australian Magpie Lark	Grallina cyanoleuca	IPM 95	R
Grey Butcherbird	Cracticus torquatus	UBS	R
Australian Magpie	Gymnorhina tibicen	UBS	R
Pied Currawong	Strepera graculina	UBS	R
Australian Raven	Corvus coronoides	IPM 95	R
Mammals			
Short-beaked Echidna	Tachyglossus aculeatus	L	R
Tiger Quoll	Dasyurus maculatus	L	O
Brown Antechinus	Antechinus stuartii	IPM 95	R
Yellow-footed Antechinus	Antechinus flavipes	IPM 95	R
Swamp Wallaby	Wallabia bicolor	IPM 96	R
Sugar Glider	Petaurus breviceps	IPM 95	R
Squirrel Glider	Petaurus norfolcensis	L	R
Common Ringtail Possum	Pseudocheirus peregrinus	UBS	R
Common Brushtail Possum	Trichosurus vulpecula	UBS	R
Koala	Phascolarctos cinereus	L	O
Long-nosed Bandicoot	Perameles nasuta	UBS	R
House Mouse	Mus domesticus	IPM 95	R
Bush Rat	Rattus fuscipes	L	R
Swamp Rat	Rattus lutreolus	IPM 95	R
Grey-headed Flying-fox	Pteropus poliocephalus	IPM 95	O
Chocolate Wattled bat	Chalinolobus morio	L	R
Gould's Wattled Bat	Chalinolobus gouldii	AMBS	R
Freetail bat	Mormopterus sp (loriae)	L	R
Common Bent-wing Bat	Miniopterus schreibersii	L	F
Greater Broad-nosed bat	Scoteanax ruepelli	L	F
White-striped Mastiff Bat	Tadarida australis	L	F
Pale Eptesicus	Vespadelus vulturinus	L	R
Fox*	Vulpes vulpes	IPM 95	F
Cat*	Felius catus	IPM 96	F
Ferret*		IPM 96	F
Rabbit *	Oryctolagus cuniculus	UBS	R

Reptiles			
Blind Snake	Ramphotyphlops nigrescens	L	R
Green Tree Snake	Dendrelaphis punctulatus	L	R
Golden-crowned Snake	Cacophis squamulosus	IPM 95	R
Eastern Small-eyed Snake	Rhiniplocephalus nigrescens	L	R
Red-bellied Black Snake	Pseudechis porphyriacus	IPM 95	R
Yellow-faced Whip Snake	Demansia psammophis	L	R
Brown Snake	Pseudonaja textilis	L	R
Lace Monitor	Varanus varius	L	R
Bearded Dragon	Pogona barbata	L	R
Eastern Water Dragon	Physiagnathus leseurii	UBS	R
Jacky Lizard	Amphibolurus muricatus	L	R
Leaf-tailed Gecko	Phyllurus platurus	L	R
Stone Gecko	Diplodactylus vittatus	L	R
Velvet Gecko	Oedura sp	L	R
Thick-tailed Gecko	Underwoodisaurus milii	L	R
Eastern Water Skink	Eulamprus quoyii	UBS	R
Red-throated Skink	Eulepis platynota	L	R
White's Skink	Egernia whitei	L	R
Striped Skink	Ctenotus robustus	L	R
Copper-tailed Skink	Ctenotus taeniolatus	L	R
Grass Skink	Lampropholis delicata	L	R
Garden Skink	Lampropholis guichenoti	UBS	R
Weasel Skink	Saproscincus mustelina	R	R
Blue-tongued Lizard	Tiliqua scincoides	IPM 96	RV
Eastern Long-necked Tortoise	Chelodina longicollis	IPM 93	R
Frogs			
Common Eastern Froglet	Crinia signifera	UBS	R
Brown-striped Frog	Limnodynastes peronii	UBS	R
Eastern Dwarf Tree Frog	Litoria fallax	L	R
Peron's Tree Frog	Litoria peronii	UBS	R
Leaf Green Tree Frog	Litoria phyllochroa	L	R






CODE	COMMUNITY
PC01	Spotted Gum Forest
PC02	Newport Bangalay Woodland
PC03	Cabbage Tree Palm Forest
PC04	Bilgola Plateau Forest
PC05	Hawkesbury Sandstone Open-forest
PC06	Coachwood Closed-forest
PC07	Red Bloodwood-Scribbly Gum Woodland
PC08	Walter Road Reserve Woodland
PC09	Hawkesbury Sandstone Heath
PC10	Headland Open - scrub
PC11	Coastal Scrub
PC12	Coastal Closed - heath
PC13	Cliff -face Open-heath
PC14	Swamp Mahogany Forest
PC15	Swamp Oak Woodland

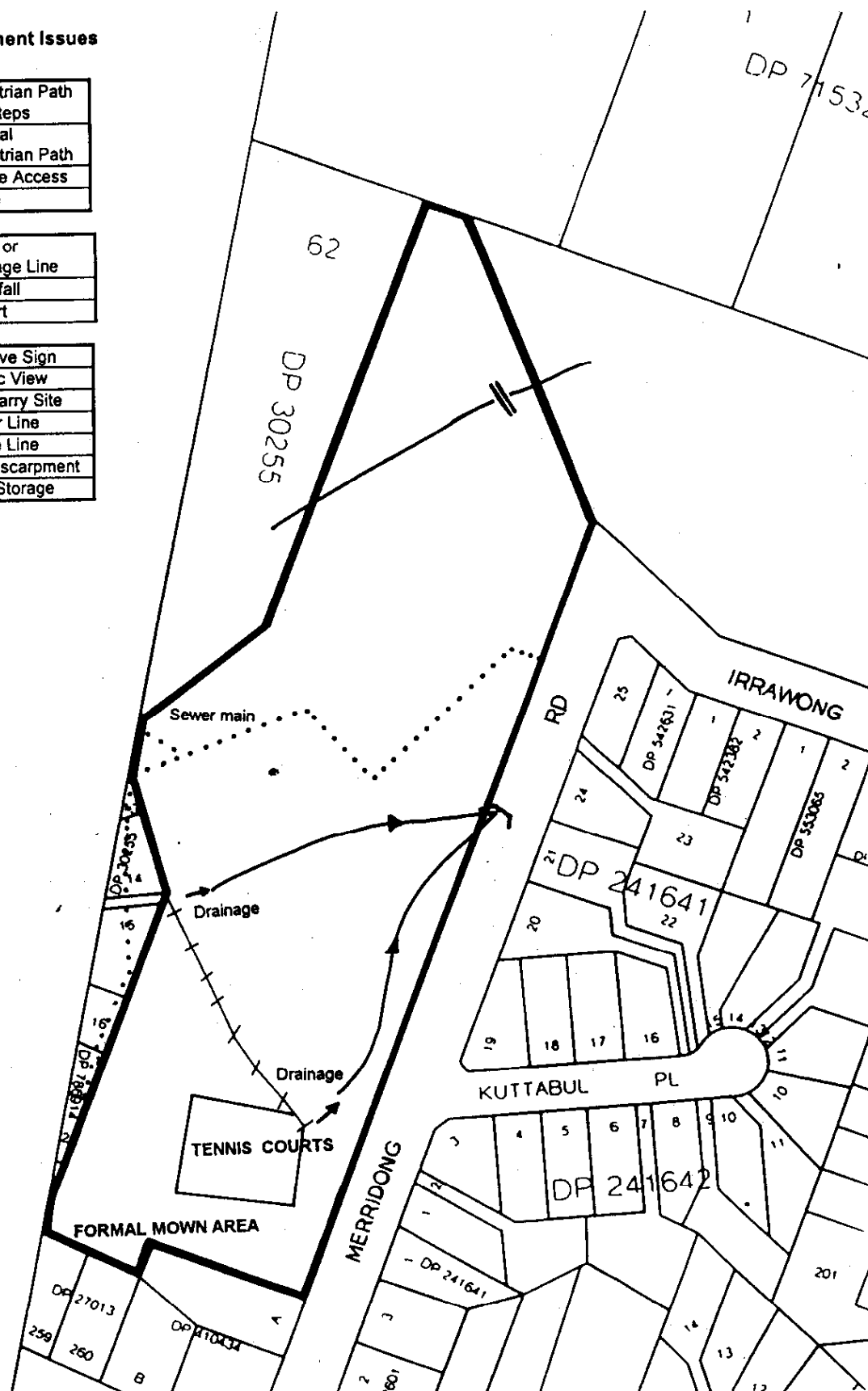


N
Pittwater Council

	Pedestrian Path with Steps
	Informal Pedestrian Path
	Vehicle Access
	Bridge

	Creek or Drainage Line
	Waterfall
	Culvert

S	Reserve Sign
	Scenic View
	Ex-quarry Site
	Sewer Line
	Fence Line
	Cliff/Escarpment
	Boat Storage



Map Management Issues

Scale: 1:2000

Date: APRIL 1997

Locality Epworth Park Elanora Heights



Pittwater Council

Kundibah Reserve, Elanora Heights

Reserve Number: 0158

Street Address: Wyanga Ave, Elanora Heights.

1. Description & Category

1.1 Location and Description

Kundibah Reserve is a bushland Reserve of 1.8ha with access between 9 & 10 Wyanga Avenue, 20 & 21 Georgina Avenue and adjacent to 24 Kundibah Road, Elanora Heights.

The unformed portion of Kundibah Road is the eastern extent of the Reserve that consists of a large escarpment and natural bushland.

1.2 Land Tenure and Property Description

Kundibah Reserve is owned by Council, occupies pt Por 82 in DP 25329 and Lot 22 in DP 30329 and the unformed public road known as Kundibah Road and is zoned 6(a) Open Space - Existing Recreation and unformed road known as Kundibah Road..

1.3 Category of Land

Kundibah Reserve is community land under the Local Government Act, 1993. The land is categorised as a natural area and is further categorised as bushland, watercourse and escarpment. The land meets the definition of bushland described in State Environmental Planning Policy No. 19 - Bushland in Urban Areas.



2. Natural And Cultural Heritage

2.1 Topography, Geology and Soils

Kundibah Reserve is situated along a creekline near the top of the Nareen/Narrabeen catchment. It is primarily a south facing slope with broad convex crests, moderately inclined side slopes with wide benches, localised rock outcrop on low broken scarps and a water fall that drops approximately 6 metres.

The parent geology is Hawkesbury sandstone which is characterised by medium to coarse grained Quartz sandstone with very minor shale and laminate lenses.

The geology gives rise to shallow Yellow Earths and Earthy Sands over the elevated sections and shallow to moderately deep Siliceous Sands and Leached Sands along drainage lines. These are characteristic of the Gynea Soil Landscape.

2.2 Hydrology

The natural hydrology is affected by two stormwater lines discharging near the accessway off Georgina Avenue and near Wyanga Road intensifying the flow. Groundwater seepage along the southern side of the Reserve has resulted in an area of impeded drainage west from the accessway at Georgina Avenue.

2.3 Vegetation

The vegetation at Kundibah Reserve is Hawkesbury Sandstone Open-forest with dominant species being Smooth-barked Apple and Sydney Peppermint. Common species include Old Man Banksia (*Banksia serrata*), *Podocarpus spinulosus*, *Eucalyptus botryoide*, *Eucalyptus umbra* and Blueberry Ash (*Elaeocarpus reticulatus*). Ground and shrub layer species include Flat-leaved Grass Tree (*Xanthorrhoea latifolia*), *Gonocarpus teucrioides*, Flannel Flower (*Actinotus helianthi*) and Bracken Fern (*Pteridium esculentum*). Vines include *Smilax glycyphylla*, *Eustrephus latifolius* and *Cissus hypoglauca*.

In the sheltered gully a thin band of rainforest occurs including Hard Corkwood (*Endiandra sieberi*), Coachwood, (*Ceratopetalum apetalum*), Lilly Pilly (*Acmena smithii*), Bastard Rosewood (*Synoum glandulosum*) and Cabbage tree palms (*Livistona australis*). Hard Corkwood is considered a locally significant species.

2.4 Fauna

This Reserve acts as a local refuge for fauna due to the heavily modified habitat in the surrounding residential area. It can be viewed as "stepping stone" for fauna moving between the larger habitat areas of Garigal National Park and Ingleside - Warriewood. The importance of such refuges is exemplified by the recent capture of a tiger quoll nearby.

Common species are also favoured by the habitat type present in the Reserve. For example, smaller birds such as Superb Fairy Wrens and Pardalotes are able to nest in the thick bush areas of the Reserve. The Reserve features a creek, rock outcrops and a diverse and thick vegetative cover -all features favourable to reptiles, such as the eastern water skink and frogs.

The Powerful Owl is likely to regularly visit this reserve due to the fauna present.

Council's Habitat and Wildlife Corridor Conservation Strategy maps Kundibah Reserve as "Corridor - Co1" which indicates corridors or habitat areas though disturbed are likely to be of good value due to good crown cover and/or understorey.

2.5 Aboriginal Sites

There are no recorded Aboriginal sites within the Reserve. There is potential for Aboriginal sites to occur within the area such as engravings and axe grinding grooves due to these types of sites being recorded in the National Parks and Wildlife Service's site register in similar locations.

2.6 Non-Aboriginal Sites

There are no noted European or cultural sites within the Reserve.

3.0 Classification, Significance And Objectives

3.1 Statement of Significance

Kundibah Reserve is significant because:

- ❖ it protects an example of the bushland of Elanora Heights in a similar condition to that which occurred when the area was first visited by Europeans,
- ❖ it protects a remanent thin band of rainforest which includes locally significant species, Hard Corkwood.
- ❖ it contributes to the landscape quality of Elanora Heights,
- ❖ it provides a record of the original landscape and the changes wrought by settlement and development,
- ❖ it acts as a local refuge for fauna especially the threatened Tiger Quoll and Powerful Owl and is a "stepping stone" between larger areas of habitat due to its diversity of flowering sandstone and rainforest native species,
- ❖ it is a contact point with nature for residents and an educational resource, and
- ❖ it allows urban residents to undertake walking and scenic viewing in an enclosed bushland setting.

3.2 Management Objectives

The management objectives for Kundibah Reserve are:

- ❖ to protect the natural, cultural and landscape features of the Reserve,
- ❖ to maintain the natural range of structural and floristic diversity of bushland in the Reserve,
- ❖ to adequately manage the bushland in relation to encroachments and weed invasion,
- ❖ to utilise fire to maintain the diversity of native plants in the Reserve to conserve native flora and fauna,
- ❖ to control introduced animals in the Reserve,

- ❖ to provide opportunities for low impact recreational and educational use of the Reserve consistent with the other objectives, and
- ❖ to encourage community appreciation and neighbourhood participation in bushland management in the Reserve.

4. Management Issues

4.1 Weed Invasion & Bush

Regeneration

Dumping of vegetation and discharge of stormwater have encouraged weed growth especially along the creek lines and below the stormwater outlets. Medium weed infestation occurs in these areas.

There are two community based bush regeneration teams working in Kundibah Reserve. The area of Reserve adjacent to Morandoo Road has had the attention of residents acting as bush stewards for the past 30 years. Their weeding efforts has resulted in sandstone bushland in near pristine condition.

The group who work below Wyanga Road have weeded the areas affected by increased nutrient and moisture levels. Primary work in this site included the removal of *Ageratina adenophora*, *Lantana camara*, *Cassia*, *Nephrolepis cordifolia*, and *Ligustrum sinense*.

Follow up work has stabilised the ground with mulch and some plantings. A sandstone stormwater dissipator and stilling pond has been constructed at the large stormwater outlet by these volunteers. The group is working under Council supervision and support. Continued encouragement and support to maintain momentum with the weeding of Reserve along the creekline and down the catchment is necessary.

4.2 Stormwater Management

Urban development surrounds the top of the Reserve and water quantity and quality has been affected by urban runoff. This intensification of development in the catchment has caused erosion and siltation of the drainage lines in the Reserve.

Limited instances of eucalypt dieback occur near drainage lines due to nutrient charged urban runoff altering soil conditions. Discharge of swimming pool water and further stormwater drainage into the Reserve should be prevented.

The regeneration of native vegetation is being inhibited by increased soil water and nutrient levels along the creek lines and by the growth of weeds. Native rainforest species are expanding in these areas once weed infestation is removed. The drainage line discharging from Georgina Road could benefit from installation of a sediment trap and stilling pond structure with an associated macrophyte wet filter.

A sandstone stilling pond with velocity dissipator has been installed below the Wyanga Road stormwater outlet by the community based group.

4.3 Fire Management

The Reserve has had a hazard reduction fire within the northeastern section of the Reserve in 1992 with another in 1996.

Management of the fire regime in the Reserve will be undertaken by the Warringah Pittwater Bushfire Management Committee in accordance with Circular C10 - Planning for Bush Fire Prone Areas. Due to the housing and development on all sides and small size of the Reserve, a fuel reduced zone within the bushland needs to be considered carefully in order to prevent degradation of the Reserve. The Reserve will be regularly monitored for fuel loadings by Warringah Pittwater Bushfire Services and any hazard reductions required will be undertaken in accordance with the Fuel Management Plan. Ecological considerations will be assessed by Council environmental staff to determine methods of hazard reduction.

Several species present are fire sensitive, including rainforest species growing along the creeks and drainage lines which should not be burnt. The Hawkesbury Sandstone Open Forest should not be burnt more often than once in ten years.

There needs to be follow-up weeding after fire as well as consideration of soil erosion issues.

4.4 Management of significant plant species and communities

The introduction of a fire management plan and ongoing bush regeneration programs will ensure the continued health of the sandstone flora. Continued regeneration of the creekline areas will enhance the rainforest components within the Reserve with particular management needs of the Corkwood (*Endiandra sieberi*) being considered as it is a locally significant species occurring in Kundibah.

4.5 Management of Native Fauna and Introduced predators

Kundibah Reserve provides good habitat for fauna with a variety of habitats available. A Pittwater wide public awareness campaign will address the value of the bushland as habitat for fauna and how residents can be responsible neighbours by ensuring that domestic cats and dogs do not roam in the Reserve. Fox predation is an issue which needs to be addressed through a Pittwater-wide control strategy.

4.6 Access, Walking Tracks & Recreation

There are walking tracks within the Reserve connecting access from Wyanga Road and Georgina Avenue and another connecting to Morandoo Road. This track runs through a private lot as there is no public accessway from Morandoo Road. Most tracks are used regularly by the public and school children from Elanora Public School. The track between Wyanga and Georgina needs to be formalised and upgraded as it runs across the impeded drainage area and is frequently wet. A seating area and sign are provided near Wyanga Road.

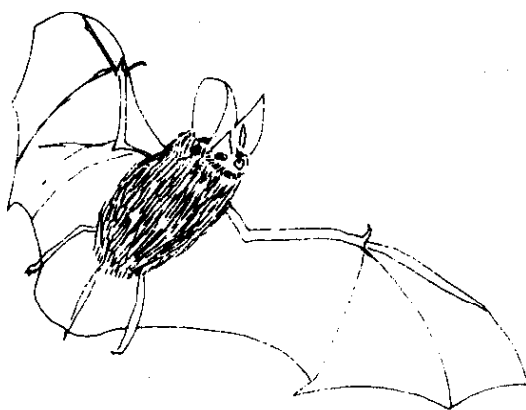
4.7 Boundaries and Neighbours

There is a problem of dumping garden refuse in some areas of the Reserve. There are encroachments along some of the boundaries with a recent large clearing apparent behind residences off Anana Road.



5. Performance

Management objectives	Performance targets (Actions)	Responsibility	Target date	Capital cost estimate	Recurrent cost estimate	Performance measures
Weed control & bush regen	Continue volunteer support & expand regen activities with a 3 yr contract program	Natural Resources	Ongoing in current program & when additional funds available	Seek detail cost of a contract bush regen program	\$1,000 p.a. volunteers supervision + \$400 p.a. for materials	A healthy bushland Reserve & further protection of the rainforest
Stormwater & water quality	Install a structure & wet filter at Georgina Ave. drain	Engineers	When funding available	Seek detailed design & costing	Integrate into works & mainten. program & cost	Erosion & nutrient control / improved creek health
Management of native fauna & introduced predators	Public awareness campaign for responsible pet ownership & feral animal program	Natural Resources & Compliance	When funds available as well as ongoing programs	Ongoing	Costed within a Pittwater wide feral animal control program	An increase in native fauna in the Reserve.
Fire management	Maintain appropriate fire regime	Bushfire Services & Natural Resources	Ongoing		Staff time	Safe fuel levels & conservation
Access & walking tracks	Upgrade heavily used track between Wyanga Rd & Georgina Ave street entrance signage and allowed activities	Reserves & Natural Resources	When funds available	Seek detailed costings	Staff & volunteer maintenance	Good all weather track for public use
Boundaries & neighbours	Encourage community awareness & participation in the Reserve regain encroachments	Natural Resources & Compliance	When funds available	Within an overall restoration program for the Reserve	Staff Time	No encroachments or rubbish dumping in the Reserve



Predicted Fauna Species List Elanora Heights

Key

Status

R=resident F=frequent visitor; W=winter migrant

O=occasional or uncommon visitor; S=summer migrant

L- likely to occur

Bold = regionally significant sp **Bold Italic** = Threatened sp

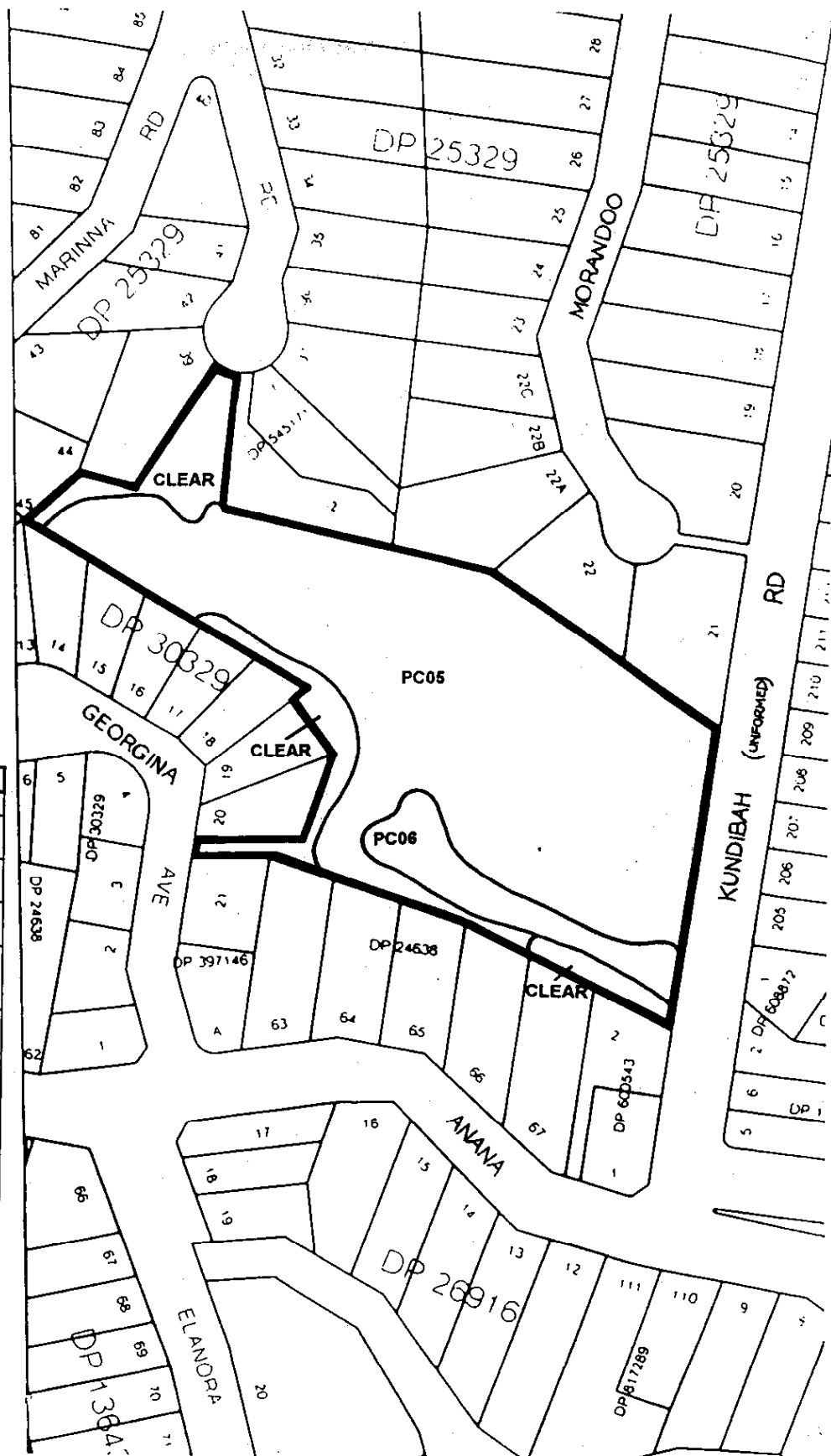
Common Name	Scientific name	Status
Birds		
Sulphur-crested Cockatoo	Cacatua galerita	F
Galah	Cacatua roseicapilla	F
Yellow-tailed Black-Cockatoo L	Calyptorhynchus funereus	O
Australian King-Parrot	Alisterus scapularis	F
Crimson Rosella L	Platycercus elegans	F
Eastern Rosella L	Platycercus eximius	F
Scaly-breasted Lorikeet L	Trichoglossus chlorolepidotus	O
Rainbow Lorikeet	Trichoglossus haematodus	R
Fan-tailed Cuckoo L	Cuculus pyrophanus	R
Common Koel	Eudynamys scolopacea	S
Southern Boobook	Ninox novaeseelandiae	R
Tawny Frogmouth L	Podargus strigoides	R
Spine-tailed Swift L	Hirundapus caudacutus	S
Kookaburra	Dacelo novaeguinea	R
Sacred Kingfisher	Halcyon snacta	S
Dollarbird	Eurystomus orientalis	S
Welcome Swallow	Hirundo neoxena	F
Black-faced Cuckoo-shrike	Coracina novaehollandiae	R
Eastern Yellow Robin L	Eopsaltria australis	R
Golden Whistler L	Pachycephala pectoralis	R
Grey Shrike-thrush L	Colluricincla harmonica	R
Grey Fantail L	Rhipidura fuliginosa	R
Superb Fairy-wren	Malurus cyaneus	R
White-throated Warbler L	Gerygone olivacea	S
Brown Thornbill L	Acanthiza pusilla	R
Eastern Spinebill	Acanthorhynchus tenuirostris	R
Red Wattlebird L	Anthochaera carunculatus	R
Little Wattlebird	Anthochaera chrysoptera	R
Yellow-faced Honeyeater	Lichenostomus chrysops	W
White-eared Honeyeater L	Lichenostomus leucotis	W
Noisy Miner	Manorina melanocephala	R
White-naped Honeyeater L	Melithreptus lunatus	W
Noisy Friarbird L	Philemon corniculatus	R
White-cheeked Honeyeater	Phylidonyris nigra	R
Spotted Pardalote	Pardalotus punctatus	R
Silvereye	Zosterops lateralis	W
Australian Magpie Lark	Grallina cyanoleuca	R
Grey Butcherbird	Cracticus torquatus	R
Australian Magpie	Gymnorhina tibicen	R
Pied Currawong	Strepera graculina	R
Australian Raven	Corvus coronoides	R
Mammals		
Tiger Quoll	<i>Dasyurus maculatus</i>	caught nearby
Sugar Glider L	Petaurus breviceps	R
Common Ringtail Possum L	Pseudocheirus peregrinus	R
Common Brushtail Possum L	Trichosurus vulpecula	R
Grey-headed Flying-fox L	Pteropus poliocephalus	O
Reptiles		
Blind Snake L	Ramphotyphlops nigrescens	R

Red-bellied Black Snake L	Pseudechis porphyriacus	R
Yellow-faced Whip Snake L	Demansia psammophis	R
Eastern Water Dragon L	Physiagnathus leseurii	R
Jacky Lizard L	Amhibolurus muricatus	R
Leaf-tailed Gecko L	Phyllurus platurus	R
Eastern Water Skink	Eulamprus quoyii	R
Red-throated Skink L	Eulepis platynota	R
Striped Skink L	Ctenotus robustus	R
Copper-tailed Skink L	Ctenotus taeniolatus	R
Grass Skink L	Lampropholis delicata	R
Garden Skink	Lampropholis guichenoti	R
Weasel Skink L	Saproscincus mustelina	R
Blue-tongued Lizard	Tiliqua scincoides	R
<u>Frogs</u>		
Common Eastern Froglet	Crinia signifera	R
Brown-striped Frog L	Limnodynastes peronii	R
Green Tree Frog L	Litoria caerulea	R
Eastern Dwarf Tree Frog L	Litoria fallax	R



Key: Vegetation Types

CODE	COMMUNITY
PC01	Spotted Gum Forest
PC02	Newport Bangalay Woodland
PC03	Cabbage Tree Palm Forest
PC04	Bilgola Plateau Forest
PC05	Hawkesbury Sandstone Open-forest
PC06	Coachwood Closed-forest
PC07	Red Bloodwood-Scribbly Gum Woodland
PC08	Walter Road Reserve Woodland
PC09	Hawkesbury Sandstone Heath
PC10	Headland Open - scrub
PC11	Coastal Scrub
PC12	Coastal Closed - heath
PC13	Cliff -face Open- heath
PC14	Swamp Mahogany Forest
PC15	Swamp Oak Woodland



Urban Bushland Plan of Management

Map Vegetation Communities

Scale: 1:2000

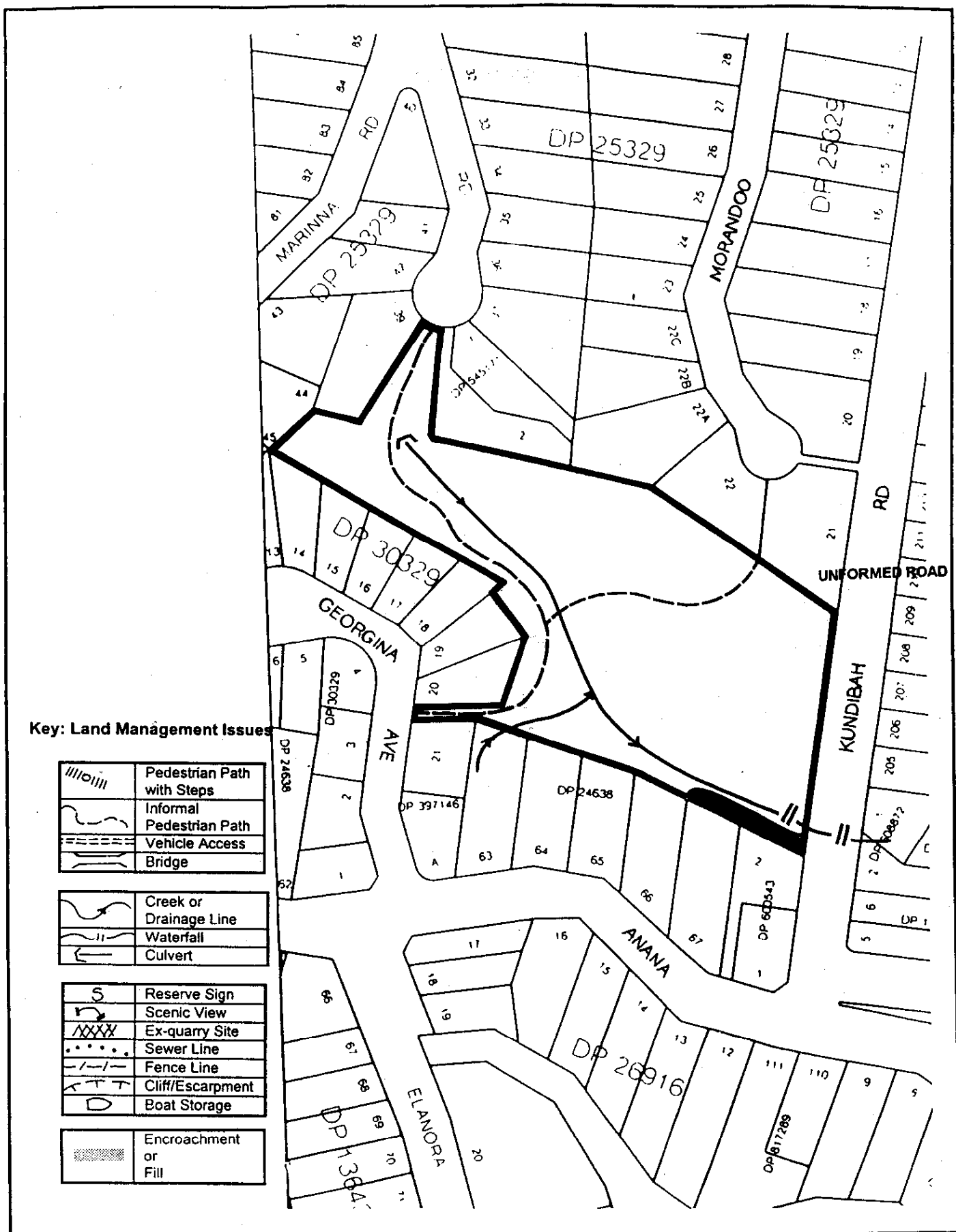
Date: APRIL 1997


Locality

Kundibah Park Elanora Heights



Pittwater Council



Urban Bushland Plan of Management			 Pittwater Council
Map Management Issues	Scale: 1:2000	Date: APRIL 1997	
Locality	Kundibah Park Elanora Heights		

Kywong Reserve, Elanora Heights

Reserve Number: 0151

Street Address: 11A Kywong Rd, Elanora Heights

1. Description & Category

1.1 Location and Description

Kywong Reserve is a remnant pocket of bushland surrounded by residential properties located on St. Andrew's Gate, Kywong and Kalang Roads. Entry to the Reserve is gained by an access way off Kalang Road, an access way off St. Andrew's Gate and three access ways off Kywong Road. It is 0.68 ha in size and features several creek/drainage lines which run through the Reserve.

1.2 Land Tenure and Property Description

The Reserve owned by Council and is described as Lot 102 and drainage reserve in DP 16682; and is zoned 6(a) Open Space - Existing Recreation.

1.3 Category of the Land

Kywong Reserve is community land under the Local Government Act, 1993. It is categorised as a natural area and further categorised as bushland and watercourse. It meets the definition of urban bushland described in State Environmental Planning Policy No. 19 - Bushland in Urban Areas.

2. Natural And Cultural Heritage

2.1 Topography, Geology and Soils

Kywong Reserve is situated on an upper north facing slope featuring rock outcrops and gullies at the confluence of drainage lines. The parent geology is Hawkesbury Sandstone which is characterised by medium to coarse grained Quartz sandstone with very minor shale and laminate lenses. The geology gives rise to shallow coarsely grained loose sandy loam, clayey sand and sandy clay loam characteristic of the Gynea Soil Landscape.

2.2 Hydrology

This Reserve is located near the top of the Nareen/Narrabeen Lagoon catchment on shallow sandstone soils with little permeability. Surface water flows into a natural creekline and several drainage paths through the reserve. Adjoining properties have increased the amount of water flowing through the reserve due to an increase in hard surfaces, associated fill areas and changes to the original topography. The Reserve has sewerage and stormwater lines. The roads in the catchment upstream of this reserve, are edged by informal grass swales which greatly assists in increasing infiltration of stormwater.

2.3 Vegetation

The vegetation of Kywong Reserve around the rock outcrops in the middle of the reserve is Hawkesbury Sandstone Open Forest dominated by Sydney Peppermint (*Eucalyptus piperita*), Sydney Red Gum (*Angophora costata*) and Heath-leaved Banksia (*Banksia ericifolia*) with a good shrub layer. Along the creekline there is a small section of Lilly Pilly Closed Forest (*Acmena smithii*).

2.4 Fauna

This small reserve provides habitat for native fauna but its small size and proximity to residences increases threats from predation and habitat degradation. There are small creeks and drainage lines which provide habitat for frogs and aquatic invertebrates, rock outcrops provide shelter for reptiles and flowering vegetation providing pollen and nectar for native birds such as honeyeaters and parrots as well as invertebrates.

Council's Habitat and Wildlife Corridor Conservation Strategy maps Kywong Reserve as "Corridor - Co1" which indicates corridor or habitat areas though disturbed are likely to be of good value due to good crown cover and / or understorey.

2.5 Aboriginal and Non-Aboriginal Sites

There are no recorded Aboriginal sites within Kywong Reserve. There is potential for Aboriginal sites to occur in the area such as axe grinding grooves and engravings. There are no known sites of European Heritage in the Reserve.

3. Classification, Significance And Objectives

3.1 Statement of Significance

Kywong Reserve is significant because:

- ❖ it provides a small sample of urban bushland and provides a record of the original landscape and the changes wrought by urban development
- ❖ it provides habitat for birds, frogs and reptiles and acts as a stepping stone between larger areas of habitat due to its diversity of flowering sandstone plants and rock outcrops
- ❖ it contributes to the landscape quality of Elanora Heights
- ❖ it is a contact point with nature for residents and an educational resource
- ❖ it allows urban residents to undertake informal recreational pursuits in a bushland setting.

3.2 Management Objectives:

The management objectives for Kywong Reserve are:

- ❖ to protect the natural features of the Reserve
- ❖ to maintain the natural range of structural and floristic diversity of bushland in the Reserve
- ❖ to adequately manage the bushland in relation to encroachments, weed invasion, drainage and fire management
- ❖ to protect life and property from wildfire and to maintain ecological processes and conserve native flora and fauna by seeking to maintain a near-natural fire regime in the Reserve

- ❖ to control introduced animals in the reserve
- ❖ to provide opportunities for low impact recreational and educational use of the Reserve consistent with the other objectives, and
- ❖ to encourage community appreciation and neighbourhood participation in bushland management of the Reserve

4. Management Issues

4.1 Weed Invasion and Bush Regeneration

The main areas of weed infestation are along the drainage lines and residential boundaries resulting in moderate weed infestation throughout the Reserve. The creek and drainage lines are heavily weed infested with Crofton Weed, Asparagus Fern, Fishbone Fern, Ginger Lily, Small-Leaved Privet and Large-Leaved Privet, which have flourished in conditions of increased urban run-off from development in the upper catchment. Perimeter boundaries are heavily infested from garden escapees with a large section of Bamboo posing a major threat on the western boundary. Some vegetation dumping and dumped fill are also providing a source for weed infestation in the Reserve. Mown grass encroachments are common and are on level areas adjacent to residences. The formal stormwater drain from Kywong Road through the reserve to Kalang Road is in the form of a swale which is heavily weed infested.

Bush regeneration is needed to improve the viability of the remnant native vegetation. A letterbox drop will be carried out in the area to gauge whether residents may wish to form a volunteer bush regeneration group. Any bush regeneration should follow these principles and priorities:

1. regeneration of the Reserve should commence near the rock outcrops in the middle of the Reserve where the vegetation is relatively weed free and move towards the Reserve perimeters;
2. target weeding should be carried out throughout the Reserve, targeting the large woody weeds (Bamboo, Privets and Cassia) which pose a threat to the remnant vegetation;
3. the creek and drainage lines require weeding from the top of the catchment downwards with attention to re-vegetation of the heavily degraded areas to minimise erosion;

4. there is an opportunity to maximise the natural regeneration potential by the use of fire in the Hawkesbury Sandstone Open Forest; this strategy would require initial primary and target weeding to reduce the potential for re-infestation and to allow some of the weed rubbish as fuel;
5. care is to be taken to maintain and expand the shrub layer to provide nesting opportunities and a food source for small mammals and birds; and
6. a landscape treatment with indigenous species (including trees, shrubs and ground covers to improve habitat) should be applied to the grassed areas which are mainly on dumped fill with little opportunity for regeneration of native vegetation;

4.2 Stormwater Management

The amount of water flowing through creeks and drainage lines in the Reserve has increased due to an increase in hard surfaces through urban development in the catchment. Erosion may occur and water quality decline if water flow is increased by formal kerbing of the roads in the upper catchment. The current system of grass swales is the preferred treatment as it increases infiltration of stormwater from roads as opposed to drains, minimises impacts on the Reserve and should be retained.

4.3 Fire Management

There is no visible evidence of recent fire in the Reserve but consideration to the small size of the reserve, and increased water regime need to be considered in regard to fuel reduced zones. Monitoring of the fuel loads in the reserve will be undertaken by the Warringah Pittwater Bushfire Services in accordance with Circular C10 - Planning for Bush Fire Prone Areas. Any hazard reductions required will be undertaken in accordance with the draft Fuel Management Plan. Ecological considerations will be assessed by Council environmental staff to determine methods of hazard reduction

The Eucalyptus Sandstone Ridgetop plant community will require fire to ensure regeneration of a number of species. The creekline Lilly Pilly closed forest vegetation however should not be burnt as this is fire sensitive and this is more tolerant of the changed hydrological regime.

There needs to be follow-up weeding after fire as well as consideration of soil erosion issues.

4.4 Habitat Improvement and Introduced Predators

There is a need to improve habitat trees, shrubs and ground covers by providing nesting and feeding opportunities for small mammals and birds. This should be part of a bush regeneration program and part of restoration of the mown encroaching areas. Shelter for reptiles should be maintained by ensuring that bushrock and dead wood is not removed from the area. This information should be included on a sign in the Reserve.

Predation by domestic cats and dogs is expected to be an issue that can be addressed by distribution of information brochures and enforcement of the Dog Act. Predation by foxes can be addressed through a Pittwater wide feral animal control strategy.

4.5 Signage and Access

There is a need to install a sign naming the Reserve. Several pedestrian access ways occur into the Reserve from St Andrews Gate and Kalang Road. There are no formal or defined paths. There is an opportunity for a low impact track to be formalised to link Kywong Reserve to St Andrews Gate and to Kalang Road. These measures would increase public awareness of this Reserve.

4.6 Boundaries and Neighbours

Private gardens have been extended into the Reserve in the form of lawns and terraces. Dumping of vegetation clippings is occurring and is a major source of weed infestation. Previous dumping of fill from building works has created grassed terraces which are encroachments. These encroachments are illegal and residents are requested to restore native vegetation to these areas to assist the viability of the bushland.

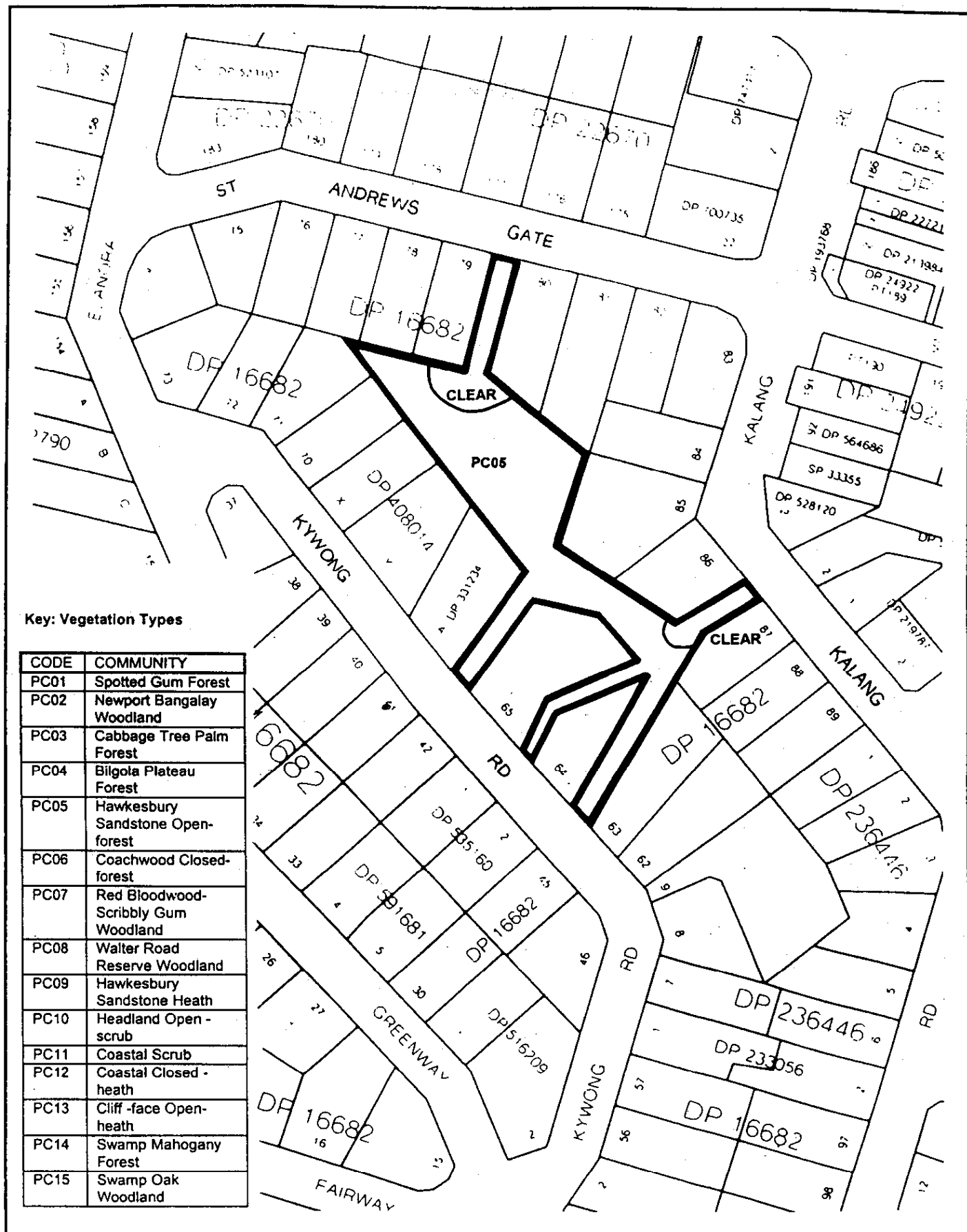
4.7 Public Awareness

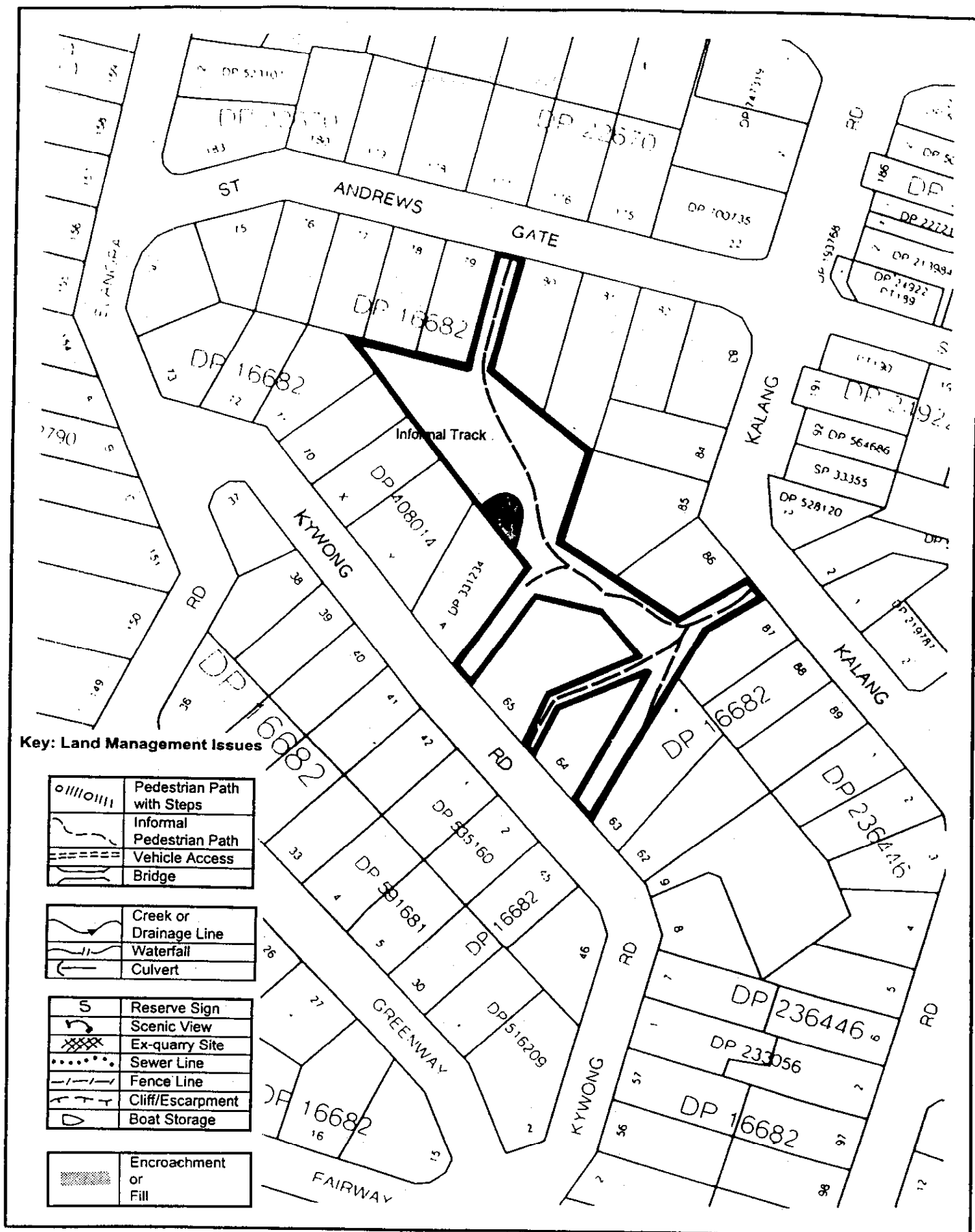
There is a need to distribute "bush friendly" brochures and literature to educate adjoining residents about the problems for the reserve associated with domestic animals, dumping garden clippings, lawn encroachments and the threats to the reserve's viability.



5.0 Performance

Management objectives	Performance targets (actions)	Responsibility	Target date	Capital cost estimate	Recurrent cost estimate	Performance measures
Weed control & bush regeneration	Letterbox drop for volunteer group	Natural Resources	When community demand	Staff time	\$1,400 pa supervision & materials	Group commenced
Stormwater management	Retain informal drains & plant native veg'n along creek/ drainage lines	Reserves & Engineers	Ongoing & works when funds available	Seek detailed design and costs	Integrate into works & maintenance program	Informal drains, less erosion & better water quality
Fire management	Ensure appropriate fire regime	Natural Resources & Fire Control	Ongoing		Staff time	Fire regime protects property & biodiversity
Fauna management and habitat improvement	Habitat included into regen program, public awareness & compliance sign	Natural Resources & Compliance	Sign 1997/98, regen & awareness when funds available	\$400 for signs	Staff time	Understorey plantings increased, dead wood & bushrock retained
Signage & access	Reserve sign & informal path construction	Natural Resources & Reserves	Sign: 1997/98 Path: when funds available	\$400 sign Path: seek detailed design & costs	Maintenance costs & staff time	Appropriate public use of reserve & greater public awareness
Boundaries & neighbours	Public participation in the reserve & regain encroachment	Natural Resources, Reserves & Compliance	ongoing		Seek costs within overall reserve restoration program	No encroachments & boundary areas restored to bushland
Public awareness	Bush friendly information distributed	Natural Resources	1998/99	\$150		Sympathetic public behaviour







Urban Bushland Plan of Management			  Pittwater Council
Map Management Issues	Scale: 1:2000	Date: APRIL 1997	
Locality: Kywong Road Reserve Elanora Heights			

Maralinga Reserve, Elanora Heights

Reserve Number: 0160

Street Address: 11A Koorangi Ave, Elanora Heights.

1. Description & Category

1.1 Location and Description

Maralinga Reserve is partly a bushland Reserve (40%) and partly a developed park (60%). It is 0.94 ha in size and is located between Maralinga and Koorangi Avenue, Elanora Heights. This Plan of Management refers to the bushland.

1.2 Land Tenure and Property Description

The Reserve is owned by Council, includes Lot 85 in DP 217197 and is zoned 6(a) Open Space - Existing Recreation.

1.3 Category of Land

Maralinga Reserve is community land under the Local Government Act, 1993. 40% is categorised as natural area and is further categorised as bushland and watercourse. It meets the definition of bushland described in State Environmental Planning Policy No. 19 - Bushland in Urban Areas.

2. Natural And Cultural Heritage

2.1 Topography, Geology and Soils

Maralinga Reserve is on a south-facing gently to moderately inclined slope with a natural drainage line running through it. The parent geology is Hawkesbury Sandstone which is characterised by med to coarse grained Quartz sandstone with very minor shale and laminite lenses. The geology gives rise to shallow to moderately deep Earthy Sands, Grey and Yellow Earths and Gleyed Podzolic soils in poorly drained areas characteristic of the Lambert Soil Landscape.

2.2 Hydrology

The Reserve is located in the upper reaches of the Deep Creek catchment. The drainage line receives stormwater from the surrounding urban development.

2.3 Vegetation

The Reserve supports a Hawkesbury Sandstone Open-Forest but the full and original complexity has been limited with ongoing clearing of understorey and canopy providing recreational spaces (level playing areas and play structures) and service easements (sewer and stormwater) to the surrounding development.

Tree canopy is good at both street frontages but the understorey is diminished and restricted along the creekline.

The Reserve is dominated by *Eucalyptus haemastoma* and *E. piperita*. There is a wide variety of associated sandstone species including *E. umbra*, *Angophora costata*, *Ceratopetalum gummiiferum*, *Banksia serratifolia* and *Leptospermum trinervium*.

2.4 Fauna

Although most of the understorey vegetation has been cleared at Maralinga Park, some natural vegetation along the creek line provides habitat for small reptiles and frogs which could breed in the creek. Fauna habitat could be improved by decreasing the amount of mown area. This would also assist the parks role in providing a stepping stone between larger areas of habitat. The Reserve is classified as 'Co3' under the Habitat and Wildlife Corridor Conservation Strategy which is described as an area with trees within a residential area.

2.5 Aboriginal sites and Non-aboriginal sites

There are no records of any aboriginal sites within the Reserve nor were any noted upon inspection. There were no European or cultural sites noted within the Reserve.

3.0 Classification, Significance And Objectives

3.1 Statement of Significance:

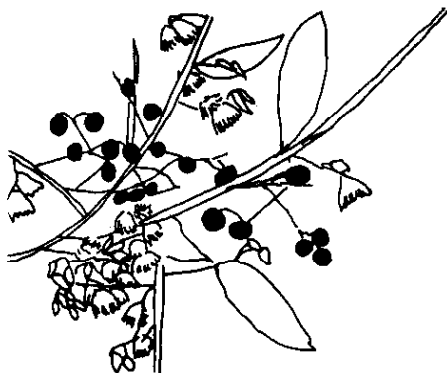
Maralinga Reserve is significant as:

- ❖ it's close to major habitat and Garigal National Park
- ❖ it's a "stepping stone" habitat Reserve
- ❖ the relatively intact canopy contributes to the landscape quality of Elanora Heights and provides a record of the original landscape and the changes that have occurred
- ❖ it provides filtration of residential runoff
- ❖ it is an educational resource and a contact point with nature for residents
- ❖ it allows urban residents to undertake a range of recreational pursuits

3.2 Management Objectives:

The management objectives for Maralinga Reserve are:

- ❖ to protect the natural features of the Reserve, particularly the canopy of the Hawkesbury sandstone Open Forest community
- ❖ to re-establish healthy native vegetation and stabilise the banks in the riparian zone
- ❖ to allow natural vegetation in remnant areas of existing good canopy to regenerate
- ❖ to reduce the mown areas



4. Management Issues

4.1 Weed Invasion and Bush Regeneration

The main areas of weed infestation are restricted to creekline and wet areas and have resulted from soil disturbance and increased runoff along the drainage line. Bush regeneration and revegetation techniques are necessary to restore healthy native vegetation within the riparian zone.

The removal of exotic trees such as Camphor Laurel, Large Leafed Privet and Coral Trees should be staged and programed.

In areas of good canopy and where remnant understorey is partially present promotion of natural regeneration should be initiated by reducing mown areas. The regeneration of exposed areas will need ongoing monitoring.

4.2 Stormwater Management

The Reserve occurs in the mid to upper catchment of Deep Creek and receives urban stormwater from surrounding residential development. The high weed incidence and small algal growth indicates nutrient loading associated with urban development. The amount of water flowing through creeks and drainage lines in the Reserve has increased due to an increase in hard surfaces through urban development in the catchment.

The natural structure of the creek bank is good and could be enhanced by restoration and increased planting of the riparian zone. There is erosion occurring below the top headwall requiring some erosion control treatment to stop mature trees being undermined. There is an opportunity to introduce a structure which would create a ripple and pond system benefiting the natural creekline as well as enhancing habitat value and water quality.

The reduction of tracks will reduce water run-off and allow greater infiltration.

4.3 Fire Management

Management of the fire regime in the Reserve will be undertaken by the Warringah Pittwater Bushfire Management Committee in accordance with Circular C10 - Planning for Bush Fire Prone Areas. Fuel reduce zones exist already within this small Reserve with large mown areas and a dissecting creekline. The Reserve will be regularly monitored for fuel loading by Warringah Pittwater Bushfire Services and any hazard reductions required will be undertaken in accordance with the Draft Fuel Management Plan.

Ecological considerations will be assessed by Council environmental staff to determine methods of hazard reduction.

The Hawkesbury Sandstone Open Forest should not be burnt more often than once in ten years.

There needs to be follow-up weeding after fire as well as consideration of soil erosion issues.

4.4 Habitat Improvement and Introduced Predators

Regeneration and restoration measures for the creekline and the riparian vegetation need to be undertaken. Frog and bird habitat need to be considered by leaving clumps of vegetation along the creekline for habitat within any restoration project. The natural regeneration of native understorey in areas of the Reserve will aid in the establishment of suitable habitat for small birds and mammals providing much needed cover and diversity in food sources.

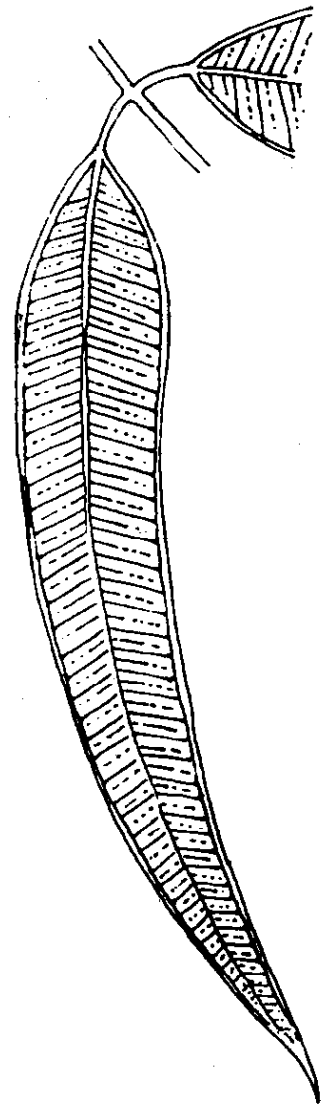
The Reserve is used by families including pets which may predate upon native fauna. This situation highlights the need for pet owners to be aware of the need to keep pets out of bush especially at night.

4.5 Access, Walking Tracks and Recreation

There are no formal walking tracks. The 20 x 50m open grassed field provides for active recreational use as does the grassed informal play area. The reinstatement of understorey within pockets of dominant trees via a "no mow" policy in these areas will assist in distinguishing bushland areas from active recreation areas whilst retaining grassed areas to allow easy access through the Reserve.

4.8 Boundaries and Neighbours

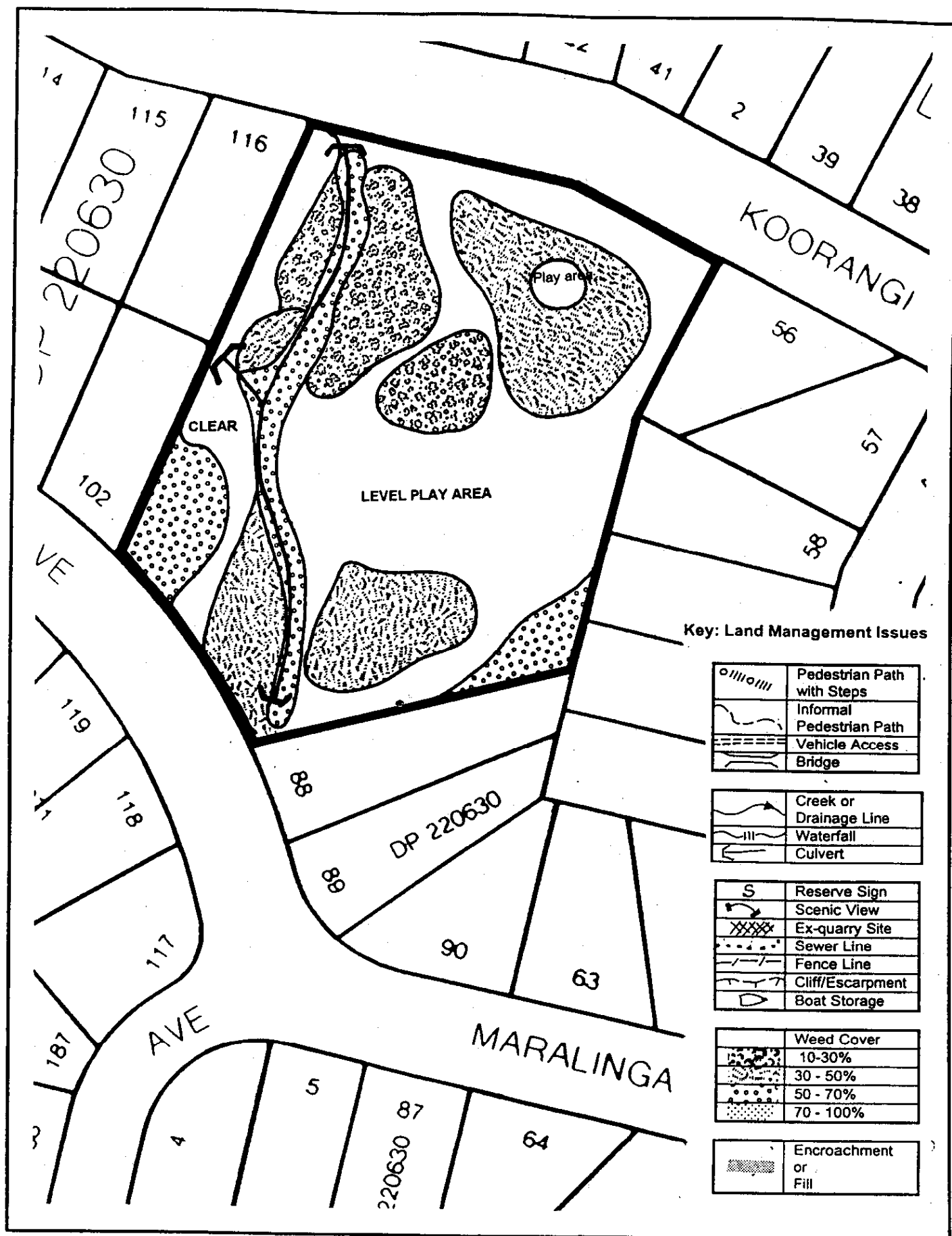
The Reserve is fenced on most of the allotment boundaries and the existence of informal paths suggests frequent use by neighbours with little evidence of rubbish dumping or littering occurring in the Reserve. There are possible encroachments along one boundary which require investigation and restoration.



5.0 Performance

Management objectives	Performance targets (Actions)	Responsibility	Target date	Capital cost estimate	Recurrent cost estimate	Performance measures
Bush regeneration & weed Control	Regeneration of creekline & increased community participation	Natural Resources	When funding available	Seek detailed costings	Seek costs of restoration maintenance	Little re-infestation of weed species & community assistance
Stormwater management	Install erosion control/ponding structure	Engineers	When funding available	Seek detailed design & costings	Integrate into works & maintenance programs	No further erosion of creek & better water quality
Management of significant plant spp. & communities & habitat improvement	Decrease mown areas	Reserves Branch	1996/97	\$0	\$0	Natural regeneration & increased understorey & habitat value
Fire management	Maintain appropriate fire regime	Bushfire Services & Natural Resources	ongoing		Staff time	Safe fuel levels & biodiversity conservation
Access & walking tracks	Install signage Maintain existing general grassed thoroughfare	Reserves Branch	ongoing		Staff time	Public Use
Boundaries & neighbours	Encourage community participation & awareness Regain any encroachments	Natural Resources, Reserves & Compliance	ongoing		Staff time	Good boundary & bushland interface





Urban Bushland Plan of Management

Map: Management Issues

Scale: 1:1000

Date: APRIL 1997

Locality:

Maralinga Reserve Elanora Heights



Pittwater Council

Ingleside Park, Ingleside

Reserve Number:

Street Address: Ingleside Road, Ingleside

1. Description & Category

1.1 Location and Description

Ingleside Park is located on the eastern side of Ingleside Road and is located on top of the Ingleside escarpment. The Plan of Management includes both Ingleside Park and the adjoining Ingleside Reserve totalling 9.3 ha of bushland. The northern tributary of Mullet Creek flows across the West south-west corner of the park, into the adjoining bushland on private property and into Irrawong Reserve downstream.

The Reserve is currently bordered on 3 sides by natural bushland, with the Park entrance area adjacent to the Westpac Training College on its western boundary.

1.2 Land Tenure and Property Description

Ingleside Park is owned by Council and is described as Public Reserve in DP 11784 and pt Por. 63 in DP 18303, and is zoned 6(a) Open Space - existing recreation.

1.3 Category of Land

Ingleside Park is community land, is categorised as a natural area and further categorised as bushland, escarpment and watercourse under the Local Government Act, 1993. It meets the definition of bushland described in State Environmental Planning Policy No. 19 - Bushland in Urban Areas.

2. Natural And Cultural Heritage

2.1 Topography, Geology and Soils

Ingleside Park covers two topographical units. The western side is situated on the relatively level Hawkesbury Sandstone plateau, changing 10m in height over approximately 230m. The eastern side is located on the north south escarpment.

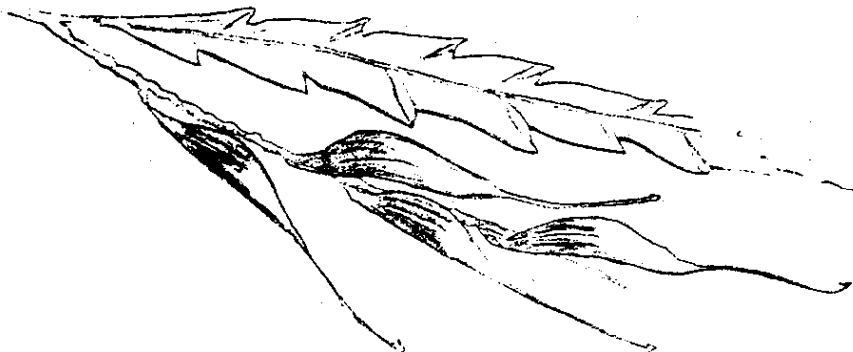
The geology is Hawkesbury Sandstone, with the upper slopes and plateau having developed on medium to coarse-grained quartz sandstones containing some minor shale and laminite lenses. The soils are characteristic of the Oxford Falls Soil Landscape, the Hawkesbury Soil Landscape and the Lambert Soil Landscape and are highly erodible and permeable, covering sandstone rock shelves.

2.2 Hydrology

The northern unnamed tributary of Mullet Creek flows across the south western corner of the Park, and has very large sandstone shelves and boulders. Mullet Creek has shown elevated nutrient levels with the park being located in the mid to upper catchment.

Two stormwater drain outlets flow directly into the Park from the Westpac Training College on the Park's western boundary, and thence into the Mullet Creek tributary. This appears to be greatly contributing to the influx of weeds, along with the urban run-off from the upslope properties on the northern boundary, increasing the nutrient source for weed growth.

A drainage line was created by the car-park kerb and the berm that run parallel to the boundary of Lot A. Runoff from Ingleside Road and natural seepage are concentrated along the path into the reserve compounding the weed problem.



2.3 Vegetation

The vegetation of Ingleside Park is continuous with natural vegetation of the escarpment. It consists of Hawkesbury Sandstone Open-forest dominated by Smooth-barked Apple (*Angophora costata*) and Red Bloodwood (*Corymbia gummifera*). Associated shrub species are Prickly Moses (*Acacia ulicifolia*), Common Hopbush, Black She-oak (*Allocasuarina littoralis*), Sunshine Wattle (*Acacia terminalis*) and Riceflower (*Pimelea linifolia*). Ground layer species include Oat Spear Grass (*Anisopogon avenaceus*), *Lepyrodia scariosa*, Bracken Fern and the vine, Purple Twining-pea (*Hardenbergia violacea*), and an abundance of *Xanthorrhoea* sp.

The western boundary is an area of poor drainage that supports an area of *Allocasuarina littoralis* with a weed understorey. The south-west boundary adjacent to this area supports an area of forest with heath scrub understorey. The dominant species present here are Black Ash (*Eucalyptus sieberi*), Grey Gum (*E. punctata*), with small trees of Old Man Banksia (*Banksia serrata*), understorey of *Banksia ericifolia*, *Hakea teretifolia* and members of the *Epacridaceae* family.

The reserve also provides potential habitat for two significant plant species, *Platysace clelandii* a Rare or Threatened Australian Plant and *Pultenaea hispidula* a regionally significant species.

2.4 Fauna

As part of the large expanse of bushland in the area, Ingleside Park has a diverse fauna assemblage. Apart from this contiguity to surrounding habitat it contains a range of features beneficial to fauna. These include rocky outcrops, fallen logs and leaf litter in which reptiles can harbour. These features and the provision of a creek also make the site suitable for frogs. Habitat components important to birds are the range of plants from which they can collect pollen or take insects, tree hollows and decorticating bark for nesting and protective foliage cover.

Of significance is the occurrence of the top order predators, Brown Goshawk And Powerful Owl. Brown Goshawks overwinter in this area after breeding in the mountains to the west (Aumann, 1993). They prey on small birds which they take in the foliage.

Powerful Owl has been recorded in Ingleside Park (Burcher pers com.). It is a threatened species in NSW and is known to have territories in the order of 800 - 1000 ha. Pellets (regurgitated prey material) collected nearby indicated the regionally significant long-nosed bandicoot is part of their diet. Ring-tailed possum remains were also present in these pellets and Sugar Gliders would also be important to the owls. Due to the juxtaposition of cleared land and bushland nearby, it is likely the endangered Masked Owl would also be present.

Another significant bird species occurring at Ingleside Park is the Pheasant Coucal. Unlike other cuckoos, this ground inhabiting bird builds its own nest. It is now uncommon in the Sydney region probably due to predation by dogs, cats and foxes.

During the urban bushland fauna survey the threatened Giant Burrowing Frog was found at Ingleside Park. Another threatened frog species, the Red-Crowned Toadlet, has also been found nearby. The use of the park by horse riders threatens the integrity of these and other species habitats as faeces elevate nutrient and pH levels.

The occurrence of forest-based predators in the local area and the diversity of other fauna species is an encouraging indicator of the condition of the local bushland. In this respect this reserve's status as one of the few publicly owned reserves in Ingleside underlines its importance.

Microchiropteran habitat exists in this reserve in the form of tree hollows and decorticating bark. Any culverts and buried pipe drains in the surrounding area are all considered potential bat habitat. Ingleside Park provided little in the way of flyway corridors and the bat trap was not used at this site. Bat activity was low at this site. Insectivorous bat calls were detected on only one night, when two species were recorded, the Free Tail Bat (*Mormopterus* sp. probably *loriae*) and Gould's Wattled Bat (*Chalinolobus gouldii*). Although no Grey-headed flying foxes were seen during the course of the survey '96, it is likely that they forage in this area.

Pittwater Council's Habitat and Wildlife Corridor Conservation Strategy maps the Park and adjacent areas as Major Habitat which is defined as having a higher degree of biodiversity, with a wide diversity of habitat types and faunal species.

2.5 Aboriginal Sites

There are no recorded Aboriginal sites within the Ingleside Park area, although there is a high potential for sites to occur, as the general Ingleside area is prolific with identified sites. The presence of Hawkesbury Sandstone outcrops and boulders gives high potential for further location of pre-European engravings and grinding grooves, especially along the Mullet Creek tributary.

2.6 Non-Aboriginal Sites

In the past, Ingleside Park had signposted lookout points, and was used for picnics in an area alongside Mullet Creek.

3. Significance And Objectives

3.1 Statement of Significance

Ingleside Park is significant as:

- ❖ it protects an example of relatively undisturbed bushland of Ingleside and is continuous with other naturally vegetated land on the escarpment;
- ❖ it provides habitat for three threatened species in NSW, namely Powerful Owl, Giant Burrowing Frog and Red-crowned Toadlet and the regionally significant Pheasant Coucal;
- ❖ it is classified as a major habitat area in Council's Habitat and Wildlife Corridors Conservation Strategy, with a high degree of biodiversity and acts as an important habitat and link to the other habitat for faunal species movement;
- ❖ it provides potential habitat for two significant plant species, *Platysace clelandii* a Rare or Threatened Australian Plant and *Pultenaea hispidula*;
- ❖ it is a reserve which is relatively free of urban impacts and is an important local reference site;
- ❖ it contributes to the landscape quality of Ingleside, has expansive views of the Warriewood Valley and ocean, and provides an important natural escarpment as a visual backdrop to the coast as a record of the original landscape;

- ❖ it is an educational resource and a contact point with nature for residents;
- ❖ it allows urban residents to undertake informal recreational pursuits in a bushland setting;
- ❖ it allows the study of post-fire response of vegetation;
- ❖ it provides an example of bushland in a similar condition to that which occurred when the area was first visited by Europeans.

3.2 Management Objectives

The management objectives for Ingleside Park are:

- ❖ to protect the natural features of the Park;
- ❖ to maintain the natural range of structural and floristic diversity of bushland in the Park;
- ❖ to adequately manage the bushland in relation to weed invasion, stormwater and fire management;
- ❖ to reduce the number of tracks and reduce erosion in the Park;
- ❖ to ensure that recreational use does not compromise the other values of the Park;
- ❖ to restore the area of the Mullet Creek tributary that is under considerable pressure from the impacts of surrounding urban development
- ❖ to control introduced animals in the Reserve;
- ❖ to encourage community appreciation and neighbourhood participation in bushland management of the Park.



4. Management Issues

4.1 Weed Invasion and Bush Regeneration

The main areas of weed infestation in the Park occur around the western boundaries. The stormwater outlets drain directly from the Westpac Training College into the Park on the western boundary, allowing the growth of Crofton Weed, Wandering Jew (*Tradescantia albiflora*) to grow as well as Coral Trees (*Erythrina x sykesii*), *Erythrina crista galli* beside the creek.

The major factor influencing weed growth is nutrient enriched runoff from upslope. After rain, runoff from the car-park is directed along a concrete gutter and into the entrance track. Blue metal deposits can be seen along the track, adding to the leaching of further nutrients. Mounded soil is located on the southern side of the access track to prevent flooding to a neighbouring property, while directing weed seeds over a large area towards the creek. Through this area a weed species of *Cyperus* is thriving in the wetter soils.

The surrounding catchment has a history of nutrient intensive farming and horticultural use. This has helped to establish a supply of weed propagules in creek banks and water. Other disturbances such as erosion of tracks by water and human activities has provided a good weed growth medium.

An abundance of Pampas grass (*Cortaderia selloana*) persists on a corridor of land adjacent to the Westpac site, seeding further plants into the Park, the creek line and downslope native vegetation.

A volunteer bush regeneration program supervised by Council has been underway for five years in the entrance to the reserve with Council undertaking occasional larger scale spraying. Council supports the program through provision of technical advice, plants, mulch, herbicide and collection of weed rubbish from the site. The reserve has been used by NSW University students as a bush regeneration demonstration site and community field days have been held in the reserve. These programs could be expanded.

Recently some clearing has occurred near to the regeneration area that requires council action and education to redirect the enthusiasm to better techniques. The clearing has also occurred within the crown land area along the owners other boundary.

4.2 Stormwater Drainage

The stormwater drain outlets from the Westpac College flowing directly into the Park needs to be addressed through implementation of Council's On-site detention policy. In addition to detention of the quantity of water, water quality treatment on the Westpac land needs to be addressed, possibly through use of a macrophyte pond. It is an unacceptable practice to discharge stormwater into bushland.

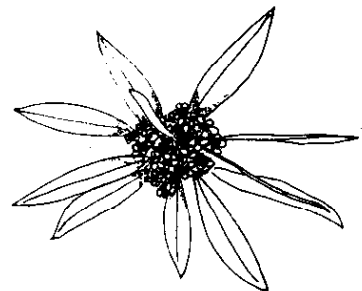
Urban runoff from the upslope properties on the northern boundary and the car-park can be addressed by enlarging the road gully through removal of any excess blue metal from the car-park and any deposits in the reserve, by a spray treatment mulching and planting of indigenous swamp species that can cope with excess drainage, and by placing crushed sandstone and water bars along the track.

4.3 Fire Regime

The history of wildfires in Ingleside Park has assisted in maintenance of the biodiversity of the sandstone flora. Major wildfires have occurred in the late 1950's, 1979 and 1994, with small occasional fires being lit between.

Management of the fire regime in the Park is undertaken by the Warringah Pittwater Bushfire Management Committee in accordance with Circular C10 - Planning for Bush Fire Prone Areas. The Park will be regularly monitored for fuel loadings by Warringah Pittwater Bushfire Services and any hazard reductions required will be undertaken in accordance with the draft Fuel Management Plan. Ecological considerations will be assessed by Council's environmental staff to determine methods of hazard reduction.

There needs to be follow-up weeding after fire as well as consideration of soil erosion issues.



4.4 Management of Significant Plant Species

Searches will be undertaken of Ingleside Park to investigate the presence of the two significant plant species, *Platysace clelandii* and *Pultenaea hispidula*.

Management of the reserve will recognise the significance of the reserve as an important local reference site.

4.5 Fauna Habitats and Introduced Predators

The continued use of this reserve for horse trail rides compromises the integrity of its habitat. The mosaic of tracks fragments habitat and the washing of horse faeces into the reserve's creek elevates nutrient levels. The impacts of horse riding threatens the habitat of the endangered Giant Burrowing Frog which inhabits this reserve and breeds in the creek.

The reserve is bordered by residences, the effect of domestic animals on the local abundance of the regionally significant Long-Nosed Bandicoot and ring-tailed possums. A community wide public awareness program on responsible pet ownership will be undertaken and a Pittwater wide feral animal control strategy.

4.6 Signage, Walking Tracks and Erosion

A sign naming Ingleside Park is required at the entrance. Horse and trail bike riding through the Park has resulted in erosion and sedimentation occurring. Without a defined main track, smaller tracks have been created and erosion has occurred, resulting in collapsed tracks and the establishment of new ones. There is a need to better define and restore the one track for pedestrian use only and close and rehabilitate all other tracks. Horse riding and trail bike riding is currently prohibited from the Park and due to the erosion, sedimentation and weed infestation in this small area of bushland. This requires implementation through a variety of methods including a sign indicating prohibited activities.

4.7 Boundaries and Neighbours

Recently some clearing has occurred near to the regeneration area that requires council action and education to redirect the enthusiasm to better techniques. The clearing has also occurred within the crown land area along the owners other boundary.

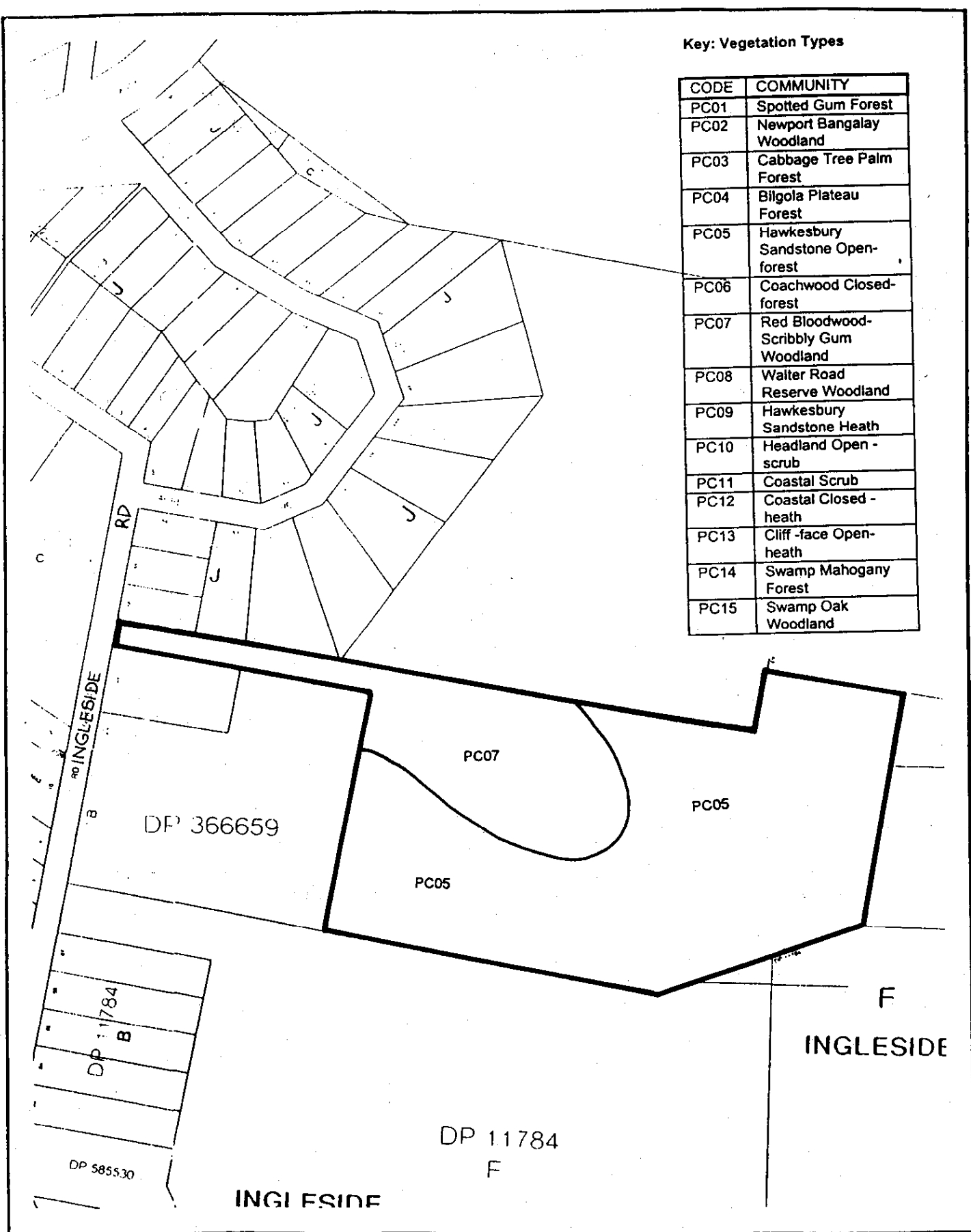


5. Performance

Management objectives	Performance targets (actions)	Responsibility	Completion date	Capital cost	Recurrent cost	Performance measures
Weed control & bush regeneration	Noxious weed notices Support volunteer bush regen with contract B/R assit. Support educational use as demo regen site Liaise with neighbours	Building Inspectors Natural Resources & Reserves Branches	Ongoing	NA	\$400 pa Staff time	Nox weeds removed Volunteer group supported School/unis supported Sympathetic use by neighbours
Stormwater control & drainage	Liaise with Westpac re stormwater Address drainage near car-park	Natural Resources, Reserves & Works & Services	When resources available	Seek detail costings	Staff time	Improvement of quality and quantity of water and amount of erosion in reserve
Fire management	Maintain appropriate fire regime	Bushfire Services & Natural Resources	ongoing		Staff Time	
Management of significant plant communities and species	Undertake a detailed search for ROTAP species	Natural Resources		Staff Time	Seek protection and management strategies if needed	Protection of significant flora within the reserve
Native fauna management & introduced predators	Public awareness campaign for responsible pet ownership & feral animal program	Natural Resources & Compliance	When funds available as well as ongoing programs	Ongoing	Costed within a Pittwater wide feral animal control program	An increase in native fauna in the Reserve.
Signs, tracks & erosion	Install Reserve sign & compliance signage & upgrade track	Natural Resources & Compliance	Signs 1997/98 Track: when funds available	Signs \$800 Detailed costs on track & erosion control	Staff maintenance time	Less damage by illegal activities & less erosion on track
Boundaries & neighbours	Community awareness & prevent illegal clearing	Natural Resources & Compliance	Ongoing		Staff Time	Awareness & no illegal activities by neighbours

Key: Vegetation Types

CODE	COMMUNITY
PC01	Spotted Gum Forest
PC02	Newport Bangalay Woodland
PC03	Cabbage Tree Palm Forest
PC04	Bilgola Plateau Forest
PC05	Hawkesbury Sandstone Open-forest
PC06	Coachwood Closed-forest
PC07	Red Bloodwood-Scribbly Gum Woodland
PC08	Walter Road Reserve Woodland
PC09	Hawkesbury Sandstone Heath
PC10	Headland Open - scrub
PC11	Coastal Scrub
PC12	Coastal Closed - heath
PC13	Cliff -face Open-heath
PC14	Swamp Mahogany Forest
PC15	Swamp Oak Woodland



Urban Bushland Plan of Management

Map: Vegetation Communities

Scale: 1:4000

Date: APRIL 1997

Locality:

Ingleside Park Ingleside



Pittwater Council

Key: Land Management Issues

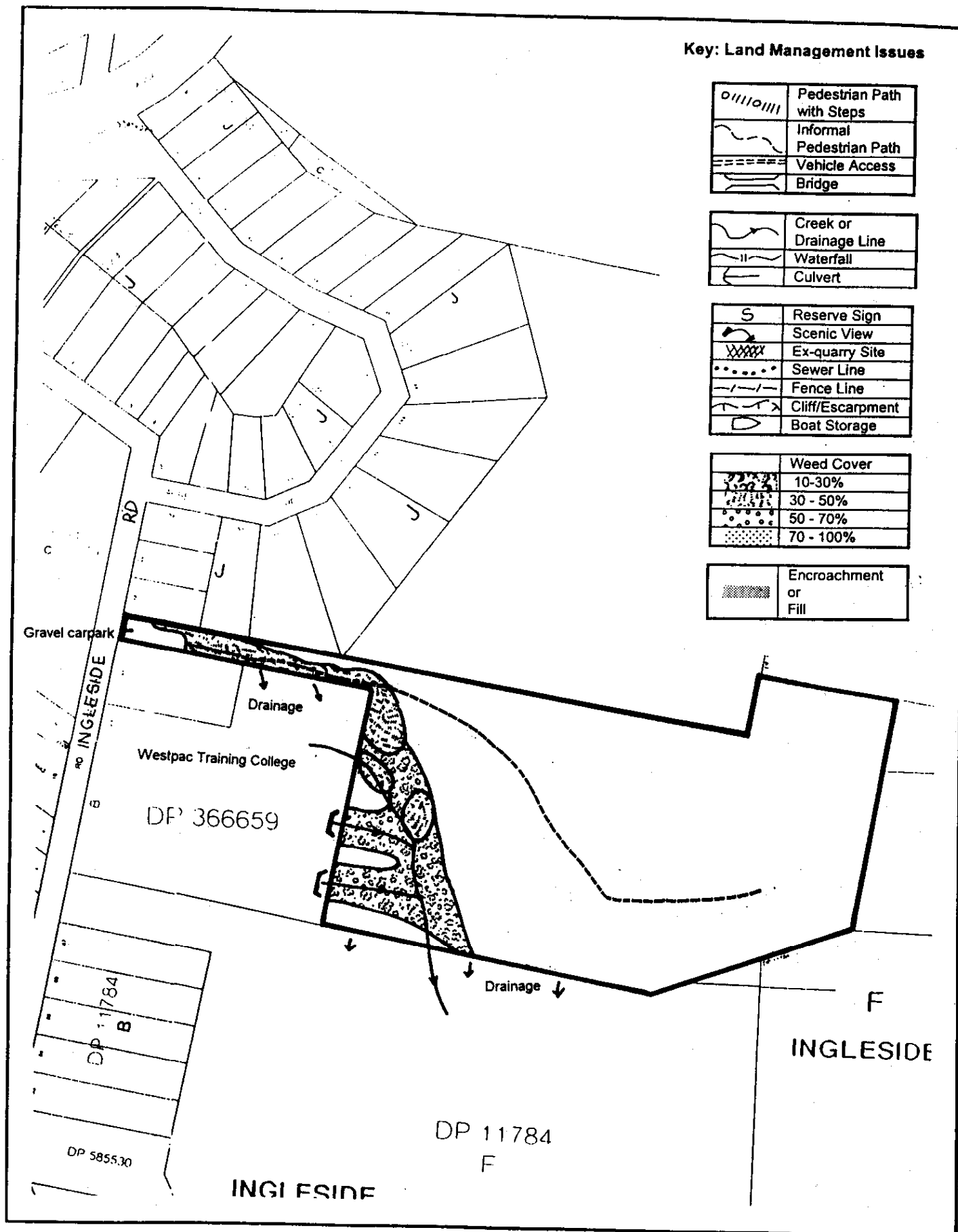
	Pedestrian Path with Steps
	Informal Pedestrian Path
	Vehicle Access
	Bridge

	Creek or Drainage Line
	Waterfall
	Culvert

	Reserve Sign
	Scenic View
	Ex-quarry Site
	Sewer Line
	Fence Line
	Cliff/Escarpment
	Boat Storage

	Weed Cover
	10-30%
	30-50%
	50-70%
	70-100%

	Encroachment or Fill
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Urban Bushland Plan of Management

Map: Management Issues

Scale: 1:4000

Date: APRIL 1997

Locality: Ingleside Park Ingleside



Alleyne Avenue Lookout, North Narrabeen

Reserve Number: 0586

Street Address: Corner Nareen Parade and Pittwater Road, North Narrabeen.

1. Description & Category

1.1 Location and Description

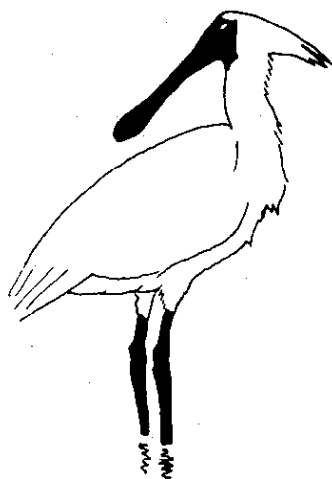
Alleyne Avenue Lookout is located in North Narrabeen on the southern end of Alleyne Avenue and on the corner of Nareen Parade and Pittwater Road. It is 1.0 ha in size. The lookout has views to Narrabeen Beach and Headland, Narrabeen Lagoon, the suburbs of Narrabeen and Collaroy, Jamieson Park and Garigal National Park. Residential properties form the northern boundary of the Reserve. Pittwater Road and Nareen Parade form the eastern and southern boundaries of the Reserve.

1.2 Land Tenure, Property Description and Zoning

Alleyne Avenue Lookout is owned by Council and is described as pt Por. 52 in FP 952461 and is zoned 6(a) Open Space - Existing Recreation.

1.3 Category of the Land

Alleyne Avenue Lookout is community land and is categorised as a natural area which is further categorised as bushland under the Local Government Act. It meets the definition of bushland described in State Environmental Planning Policy No. 19 - Bushland in Urban Areas.



2. Natural And Cultural Heritage

2.1 Topography, Geology and Soils

Alleyne Avenue Lookout is situated on a spur which runs from the north west to south east. At the most south easterly point there is a lookout at approximately 30 metres above sea level. It slopes steeply to the west, south and east. The parent geology is Hawkesbury Sandstone which is characterised by medium to coarse grained Quartz sandstone with a minor shale lens on the crest. This gives rise to soils characteristic of the Gynea Soil Landscape.

2.2 Hydrology

Alleyne Avenue Lookout has two drains which receive water from the road to the north. There are grassed road verges at this end of Alleyne Avenue which greatly assists with infiltration of water and minimises stormwater runoff.

2.3 Vegetation

Vegetation is Hawkesbury Sandstone open forest dominated by the Apple Gum (*Angophora costata*) and some shale and coastal species including Ironbark (*Eucalyptus paniculata*), Bangalay *E. botryoides*, Coast Banksia (*Banksia integrifolia*), *Macrozamia communis* and Kangaroo grass (*Themeda australis*). Several rainforest species occur on the southern slope including Lilly Pilly (*Acmena smithii*) and Cheese Tree (*Glochidion ferdinandi*).

2.4 Fauna

Alleyne Avenue Lookout acts as a refuge for birds which forage in surrounding areas and as a "stepping stone" between larger areas of habitat surrounding Narrabeen Lagoon. Council's Habitat and Wildlife Corridor Conservation Strategy maps the Reserve as "Corridor - Co1" which indicates corridors or habitat areas though disturbed are likely to be of good value due to good crown cover and / or understorey.

2.5 Aboriginal Sites

There are no recorded Aboriginal sites within the Reserve. There is potential for Aboriginal sites to occur in the area such as engravings and axe grinding grooves due to other sites recorded in the area in the National Parks and Wildlife Service's site register.

2.6 Non-Aboriginal Sites

A non operational sandstone quarry is present on the south face of the Reserve and a smaller quarry on its eastern face. The large quarry features evidence of large hardwood timber structures and concrete and iron cylindrical blocks that may have been part of the support for a crane. The site is recommended for assessment by an historical archaeologist. An old access road from Nareen Parade to the quarry is present and is now overgrown. Sandstone blocks that once would have been stairs remain beside more recent concrete stairs to the lookout.

3. Significance And Objectives

3.1 Statement of Significance

Alleyne Avenue Lookout is significant because:

- ❖ it protects a small example of the bushland of North Narrabeen in a similar condition to that which occurred when the area was first visited by Europeans,
- ❖ it contributes to the landscape quality of North Narrabeen as an entrance to Pittwater and a visual linkage to Narrabeen Lagoon,
- ❖ it supports birds and is a "stepping stone" between larger areas of habitat due to its diversity of flowering sandstone plants,
- ❖ it is a contact point with nature for residents and an educational resource, and
- ❖ it allows urban residents to undertake walking and scenic viewing in a coastal bushland setting.

3.2 Management Objectives

The management objectives for Alleyne Avenue Lookout are:

- ❖ to protect the natural, cultural and landscape features of the Reserve,
- ❖ to maintain the natural range of structural and floristic diversity of bushland in the Reserve,
- ❖ to adequately manage the bushland in relation to encroachments and weed invasion,
- ❖ to utilise fire to maintain the diversity of native plants in the Reserve to conserve native flora and fauna,
- ❖ to manage for the safety of users by maintaining fences, steps and rock slope,
- ❖ to control introduced animals in the Reserve,
- ❖ to provide opportunities for low impact recreational and educational use of the Reserve consistent with the other objectives, and
- ❖ to encourage community appreciation and neighbourhood participation in bushland management in the Reserve.

4. Management Issues

4.1 Weed Invasion and Bush Regeneration

The main areas of weed infestation in the Reserve are along the residential and road boundaries. The south western boundary is heavily infested with Lantana, Blackberry, Asparagus Fern, Wandering Jew, Morning Glory, Cassia, Passionfruit, Cotoneaster and Camphor Laurel. The eastern boundary is infested mainly with lantana. The northern edges are invaded by exotic plants from garden encroachments and garden escapees. The quarry has a low level of weed cover including Crofton Weed, Lantana, Camphor Laurel, Whisky Grass and Small-Leaved Privet.

There is no current formal volunteer or contract bush regeneration program at Alleyne Avenue Lookout. Some removal of Lantana and understorey weeds has occurred in the western corner.

Bush regeneration is needed to improve the viability of the remnant native vegetation and should follow the principles and priorities:

- 1) working from the intact good bush towards the more weed infested edges commencing from the quarry;
- 2) weed control, then planting indigenous species and mulching the areas adjacent to the northern boundary; and
- 3) weed control followed by planting indigenous species and mulching the areas along the eastern and southern boundary.

4.2 Stormwater Management

Stormwater drains off the end of Alleyne Avenue and into two drains which flow through the Reserve. The grassed road verges will be retained at this end of Alleyne Avenue to assist with infiltration of water and minimise stormwater runoff in the Reserve.

4.3 Fire Regime

The Reserve does not appear to have been burnt for a long period of time.

Management of the fire regime in the Reserve will be undertaken by the Warringah Pittwater Bushfire Management Committee in accordance with Circular C10 - Planning for Bush Fire Prone Areas. The Reserve will be regularly monitored for fuel loadings by Warringah Pittwater Bushfire Services and any hazard reductions required will be undertaken in accordance with the Draft Fuel Management Plan. Ecological considerations will be assessed by Council environmental staff to determine methods of hazard reduction.

Several species present are fire sensitive, including rainforest species which have grown in the drainage areas. It is not desirable to burn rainforest species. The Hawkesbury Sandstone Open Forest should not be burnt more often than once in ten years.

There needs to be follow-up weeding after fire as well as consideration of soil erosion issues.

4.4 Management of Native Flora and Fauna

The conservation of the bushland requires protection from further weed invasion and a bush regeneration program. An appropriate fire regime needs to be maintained within the Reserve to ensure the continued survival of the sandstone flora and to prevent burning of rainforest species.

Future planting and bush regeneration programs need to consider the habitat value of the Reserve for birds. Maintenance and enhancement of a nectar and pollen producing species such as *Angophora costata*, *Banksia integrifolia* and *Eucalyptus paniculata* is a priority.

4.5 Introduced Predators

A Pittwater wide public awareness campaign will address the value of the bushland as habitat for fauna and how residents can be responsible neighbours by ensuring that domestic cats and dogs do not roam in the Reserve. Fox predation is an issue which needs to be addressed through a Pittwater-wide control strategy.

4.6 Risk Management

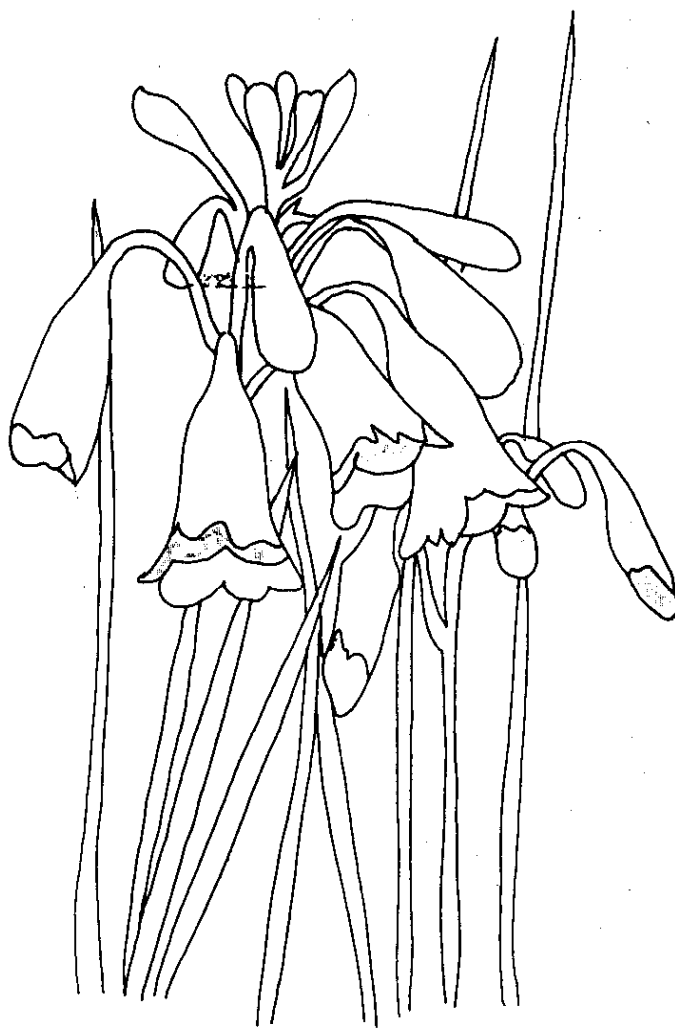
The step reserve is accessed by the public via a concrete path and steps. The regular monitoring and maintenance of the path will be carried out in conjunction with work required for fencing repairs. The rocky slope will be monitored yearly with regard to rockfall.

4.7 Signage and Recreational Opportunities

There needs to be a sign naming the Reserve. The lookout area and stairs are in serviceable condition. There is potential for the quarry to be used as an interpretive site demonstrating earlier industry of the area. Any increased use of the site would be subject to its assessment by an archaeologist and to any conservation works recommended in accordance with the Burra Charter.

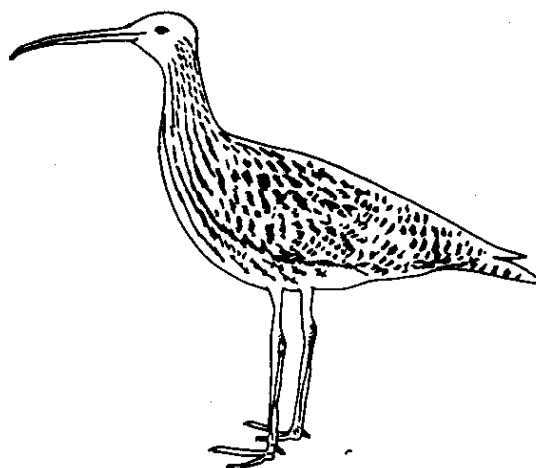
4.8 Boundaries and Neighbours

Alleyne Avenue Lookout has a number of private encroachments by adjoining residents on the northern boundary. There are areas of private garden, driveway access and retaining walls approximately 6 metres into the Reserve. All encroachments are illegal and threatening the integrity of this small bushland remnant.



5. Performance

Management objectives	Performance targets (Actions)	Responsibility	Completion date	Capital cost	Recurrent cost	Performance measures
Bush regeneration	Public appreciation and formation of a volunteer bush regeneration group	Nat Res	As public demand requires	Staff resources	\$1,000 p.a. and \$400 approx. materials	Volunteers commence work in the Reserve
Stormwater management	Maintain grass road verge at Alleyne Ave	Nat Res & Engineers	Ongoing monitoring		In kind staff time	Minimal impact of stormwater on bushland
Fire management	Maintain appropriate fire regime	Bushfire Services & Nat Res	Ongoing		In kind staff time	Safe fuel loads & conservation of bushland flora & fauna
Introduced Predators	Public awareness & feral animal control	Nat Res	Within Pittwater wide program as resources available		Staff time & resources	
Risk Management	Maintain steps and fences. Monitor slopes	Nat Res, Eng.	Ongoing		In kind Staff time	Safe access and fencing
Signage, recreation & interpretation	Install signs & picnic table & investigate quarry use	Building Services, Reserves & Nat Res	1997/98	As resources available	\$500 for signs	Public appreciation of reserve
Boundaries & neighbours	Public awareness & regain encroachments	Nat Res	As resources available	Seek detailed costings	Seek maintenance funds	Public appreciation to achieve viable bushland



Fauna Species List North Narrabeen

Key

Record

UBS -Urban Bushland Survey Summer; L=likely to occur

Status R=resident F=frequent visitor W=winter migrant

O=occasional or uncommon visitor S=summer migrant

Bold = regionally significant sp ***Bold Italic*** =Threatened species

Common Name	Scientific name	Record	Status
Birds			
Black-shouldered Kite	Elanus notatus	L	R
Whistling Kite	Haliastur sphenurus	L	O
Australian Kestrel	Falco cenchroides	L	R
Rallus pectoralis	Lewin's Rail	L	O
Eurasian Coot	Fulica atra	UBS	R
Dusky Moorhen	Gallinula tenebrosa	UBS	R
Purple Swampphen	Porphyrio porphyrio	UBS	R
Feral Pigeon	Columba livia	UBS	R
Spotted Turtle-dove	Streptopelia chinensis	UBS	R
Crested Pigeon	Ocyphaps lophotes	UBS	R
Sulphur-crested Cockatoo	Cacatua galerita	UBS	F
Galah	Cacatua roseicapilla	UBS	F
Australian King-Parrot	Alisterus scapularis	UBS	F
Crimson Rosella	Platycercus elegans	L	F
Eastern Rosella	Platycercus eximius	UBS	F
Rainbow Lorikeet	Trichoglossus haematodus	UBS	F
Fan-tailed Cuckoo	Cuculus pyrophanus	UBS	R
Common Koel	Eudynamys scolopacea	L	S
Southern Boobook	Ninox novaeseelandiae	L	R
Barn Owl	Tyto alba	L	R
Tawny Frogmouth	Podargus strigoides	L	R
Spine-tailed Swift	Hirundapus caudacutus	UBS	S
Azure Kingfisher	Ceyx azureus	L	S
Kookaburra	Dacelo novaeguinea	UBS	R
Sacred Kingfisher	Halcyon sancta	L	S
Dollarbird	Eurystomus orientalis	UBS	S
Welcome Swallow	Hirundo neoxena	UBS	F
Richard's Pipit	Anthus novaeseelandiae	L	R
Black-faced Cuckoo-shrike	Coracina novaehollandiae	UBS	R
Red-whiskered Bulbul	Pycnonotus jocosus	UBS	R
Eastern Yellow Robin	Eopsaltria australis	L	R
Grey Shrike-thrush	Colluricincla harmonica	L	R
Grey Fantail	Rhipidura fuliginosa	L	R
Willie Wagtail	Rhipidura leucophrys	UBS	R
Eastern Whipbird	Psophodes olivaceus	UBS	R
Clamorous Reed-warbler	Acrocephalus stentoreus	UBS	R
Little Grassbird	Megalurus gramineus	L	R
Tawny Grassbird	Megalurus timoriensis	L	R
Superb Fairy-wren	Malurus cyaneus	UBS	R
Yellow Thornbill	Acanthiza nana	L	F
Brown Thornbill	Acanthiza pusilla	L	R
Red Wattlebird	Anthochaera carunculatus	L	R
Little Wattlebird	Anthochaera chrysoptera	UBS	R
Yellow-faced Honeyeater	Lichenostomus chrysops	L	W
Noisy Miner	Manorina melanocephala	UBS	R
White-naped Honeyeater	Melithreptus lunatus	L	W
Spotted Pardalote	Pardalotus punctatus	UBS	R
Silvereye	Zosterops lateralis	UBS	W
Red-browed Finch	Emblema temporalis	UBS	R

House Sparrow	Passer domesticus	UBS	R
Common Mynah	Acridotheres tristis	UBS	R
Common Starling	Sturnus vulgaris	UBS	R
Australian Magpie Lark	Grallina cyanoleuca	UBS	R
Dusky Woodswallow	Artamus cyanopterus	L	S
Grey Butcherbird	Cracticus torquatus	UBS	R
Australian Magpie	Gymnorhina tibicen	UBS	R
Pied Currawong	Strepera graculina	UBS	R
Australian Raven	Corvus coronoides	UBS	R
Mammals			
Common Ringtail Possum	Pseudocheirus peregrinus	UBS	R
Common Brushtail Possum	Trichosurus vulpecula	L	R
Gould's Wattled Bat	Chalinolobus gouldii	L	R
Lesser Long-eared Bat	Nyctophilus geoffroyi	L	O
Fox	Vulpes vulpes	L	R
Rabbit	Oryctolagus cuniculus	UBS	R
Reptiles			
Red-bellied Black Snake	Pseudechis porphyriacus	L	R
Yellow-faced Whip Snake	Demansia psammophis	L	R
Brown Snake	Pseudonaja textilis	L	R
Eastern Water Skink	Eulamprus quoyii		R
Striped Skink	Ctenotus robustus	L	R
Copper-tailed Skink	Ctenotus taeniolatus	L	R
Grass Skink	Lampropholis delicata	UBS	R
Garden Skink	Lampropholis guichenoti	UBS	R
Weasel Skink	Saproscincus mustelina	L	R
Eastern Long-necked Tortoise	Chelodina longicollis	L	R
Blue-tongued Lizard	Tiliqua scincoides	L	R
Frogs			
Common Eastern Froglet	Crinia signifera	UBS	R
Brown-striped Frog	Limnodynastes peronii	UBS	R
Eastern banjo Frog	Limnodynastes dumerilli	L	R
Green and Golden Bell Frog	Litoria aurea	L	possible
Green Tree Frog	Litoria caerulea	L	R
Eastern Dwarf Tree Frog	Litoria fallax	UBS	R
Whistling Tree Frog	Litoria verreauxii	UBS	R



Boondah Reserve East, Warriewood

Reserve Number: 0143

Street Address: Corner Jackson, Boondah and Pittwater Roads, Warriewood.

1.0 Description & Category

1.1 Location and Description

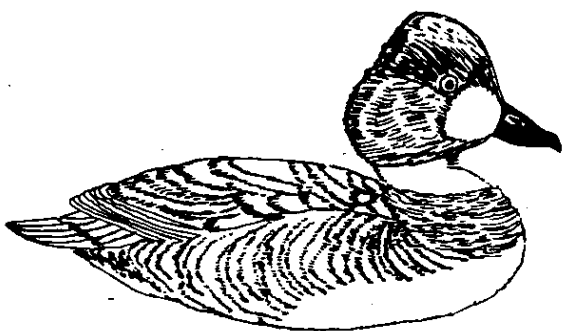
The reserve is approximately 5.8ha. The largest landuse in the reserve is developed sports grounds. It is located between Pittwater Road and Boondah Road in the suburb of Warriewood. Narrabeen Creek dissects the reserve with the associated riparian zone and floodplain making up approximately 30% of the reserve. This Plan of Management refers to this natural area of the reserve.

1.2 Land Tenure and Property Description

Boondah Reserve (east) is owned by Pittwater Council and is described as Lot B in DP 26902 and Lot 6 in DP 737137. It is zoned 6(a) Open Space existing recreation.

1.3 Category of Land

Boondah Reserve is community land and under the Local Government Act, 30% is categorised as a natural area further categorised as a watercourse, wetland and bushland. This part also meets the definition of bushland under State Environmental Planning Policy No. 19 - Bushland in Urban Areas.



2.0 Natural And Cultural Heritage

2.1 Topography, Geology and Soils

The underlying geology is stream alluvial and estuarine sediments. The level to gently undulating swales, depressions and infilled lagoons on Quaternary Sands naturally occurring have been affected by previous filling to create level sports grounds.

The soil landscape has been mapped as the colluvial Warriewood soil landscape. They range from deep, well sorted, sandy Humus Podzols and dark mottled Siliceous Sands overlying buried Acid Peats in depressions and deep Podzols and pale Siliceous Sands on sandy rises.

2.2 Hydrology

The reserve is within the Narrabeen Creek catchment with the creek meandering through the reserve. The landfilling associated with the construction of Warriewood Square and the sports fields has degraded the riparian zone structurally. The filling has restricted the flood retention capacity and channelled the flow to the main waterway. A weir is located at the Boondah Road boundary of the creek.

There is a sewer line running through a portion of the reserve which feeds into the upstream Warriewood Sewer Treatment Plant.

2.3 Vegetation

The vegetation in the natural area of the reserve is highly disturbed with weed infestation. It consists of remnant *Casuarina glauca* Swamp Oak Woodland with other native species including *Eucalyptus robusta*, *Melaleuca ericifolia*, *Cassythia pubescens*, and *Calochlaena dubia*. Aquatic species present include *Phagocytes australis*, *Ludwigia peploides montevidensis*, *Gahnia* spp., *Baumea* spp., *Juncus* spp., and *Persicaria strigosa*.

Casuarina glauca Swamp Oak Woodland in the Pittwater area is considered regionally significant.

The understorey consists of weeds which cover most of the remnant vegetation. They include Lantana, Small-leaved Privet, Crofton Weed, Morning Glory, Coastal Morning Glory, Castor Oil Plant, Honeysuckle, Turkey Rhubarb, Tradescantia albiflora, Cape Ivy and Green Cestrum.

2.4 Fauna

The *Casuarina glauca* vegetation community has high habitat value (Australian Museum, 1994). Even though the reserve has a high level of disturbance, the dense weed understorey does provide habitat and protection from predation for many faunal species, particularly birds. Possums are expected to occur in the reserve and bandicoot diggings have been sighted. It is likely that herpetofauna would also be present. The many bird species seen in the reserve include Superb Blue Wren, the Swamp Hen, and the regionally significant Pheasant Coucal. Casuarinas are also the food source for the Glossy Black-cockatoo, a vulnerable species in NSW. Aquatic fauna features a number of pest species including the introduced Mosquito Fish in the creek which predares on native species. The reserve has been identified as a Co2 corridor within Pittwater's Council's Habitat and Wildlife Corridor Strategy.

2.5 Aboriginal and Non-aboriginal sites

There are no recorded aboriginal sites within this reserve and due to the topography and levels of past disturbance, none are expected to occur.

There are no recorded sites of European or cultural significance.

3.0 Classification, Significance And Objectives

3.1 Statement of Significance

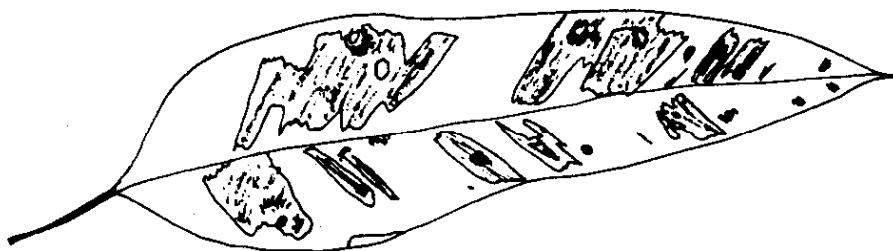
Boondah Reserve (east) is significant because:

- ❖ it contains remnant *Casuarina glauca* Swamp Oak Woodland which has been identified as a regionally significant vegetation community
- ❖ the *Casuarina glauca* has been identified as important fauna habitat.
- ❖ it contains Narrabeen Creek with valuable flood plain and wetland pockets.
- ❖ it provides additional wetland and riparian habitat to the adjacent Warriewood Wetlands and has been identified as a wildlife corridor Co 2.

3.2 Management Objectives:

The management objectives for Boondah Reserve (east) are:

- ❖ to protect the floodplain and wetland components of the reserve
- ❖ to improve health of waterway and decrease the water weed infestation
- ❖ to adequately manage the weed infestation in the understorey
- ❖ to create a landscape edge to define the natural area and the playing fields
- ❖ to restore and regenerate the vegetation community
- ❖ to conserve and improve the habitat values of the reserve.



4.0 Management Issues

4.1 Weed Invasion and Bush Regeneration

The reserve is severely degraded by weed infestation. The introduction of fill material and the floodplain nature of the area makes weed control difficult. The remnant trees are threatened by the mass of weed vines and climbers. Any control methods used in this reserve must take into account the rapid re-infestation of weeds along the riparian zones.

Due to the scale of weed infestation and past disturbances, a restoration approach could be used in this reserve and should be undertaken following these principles:

1. Primary removal of weeds should be undertaken in sectors to ensure habitat value is maintained and specialist treatment for the creek embankment would be required.
2. Mechanical removal techniques would initially be the most appropriate and cost effective means with follow up spraying, mulching, and planting due to the nature of the site.
3. More sensitive weed removal techniques are required for the creek banks to ensure no erosion of the embankment.
4. Follow up hand removal and maintenance for primary treated areas would be required.

The creek is infested with water weed species including *Salvinia* and *Brazilian Milfoil*. A combination of biological and mechanical weed control should be undertaken.

4.2 Stormwater

Stormwater in Narrabeen Creek which flows through the reserve and subsequently flows through drains under Warriewood Square into the estuarine section of Mullet Creek. The reserve has some small low floodplain areas remaining which assist in flood times by allowing water storage in the swelled creek.

The natural reeds and aquatic plants assist in filtering the water flow, however many of the water weeds detain flow and reduce the amount of dissolved oxygen in the creek. The water weeds are indicative of elevated nutrient levels and generally poor water quality.

No further filling should occur in the reserve's floodplain areas. Restoration of the zone with native wetland plants would assist the water quality of the creek and enhance the habitat value of the reserve.

4.3 Management of Native Fauna and Introduced Predators

Boondah Reserve (east) provides good bird habitat and an extension of habitat and wildlife corridor for fauna using the Warriewood Wetlands. Foxes and feral cats would move through the Reserve, however the thick weed understorey may provide protection from predation.

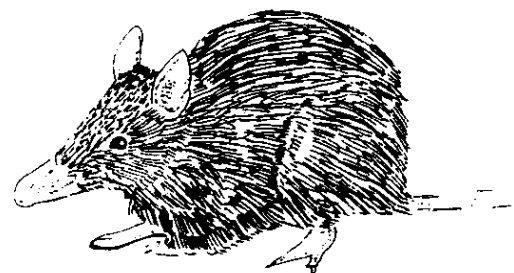
A Pittwater wide public awareness campaign regarding responsible pet ownership and feral animals will assist the habitat value of these small bushland pockets. A Pittwater wide fox control program needs to address fox predation in the reserve.

4.4 Access, walking tracks and recreation

The playing fields are important recreational facilities. The surrounding natural areas should be delineated from the active recreational areas. Restoration of the reserve should include a landscaped edge to discourage access into the natural area. Access throughout the remnant bush and creek should be restricted to only where a footbridge formally links footpaths. One such bridge is present linking the end of Vuko Place and Boondah Road.

4.5 Boundaries and neighbours

The reserve lies between Pittwater Road and Boondah Road with a fence forming the boundary between the reserve and the Department of Main Roads depot. The playing fields to the east join the Warriewood Community Centre.



4.6 Fire Regime

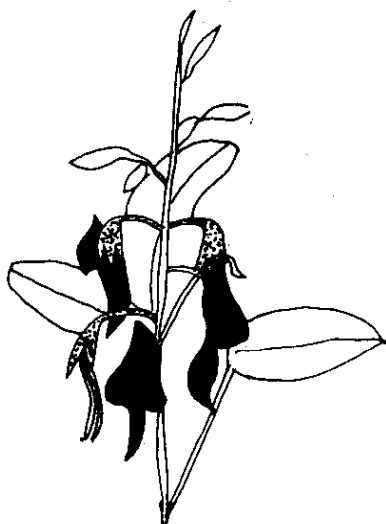
Management of the fire regime in the Reserve will be undertaken by the Warringah Pittwater Bushfire Management Committee in accordance with Circular C10 - Planning for Bush Fire Prone Areas. The Park will be regularly monitored for fuel loadings by Warringah Pittwater Bushfire Services and any hazard reductions required will be undertaken in accordance with the draft Fuel Management Plan. Ecological considerations will be assessed by Council's environmental staff to determine methods of hazard reduction.

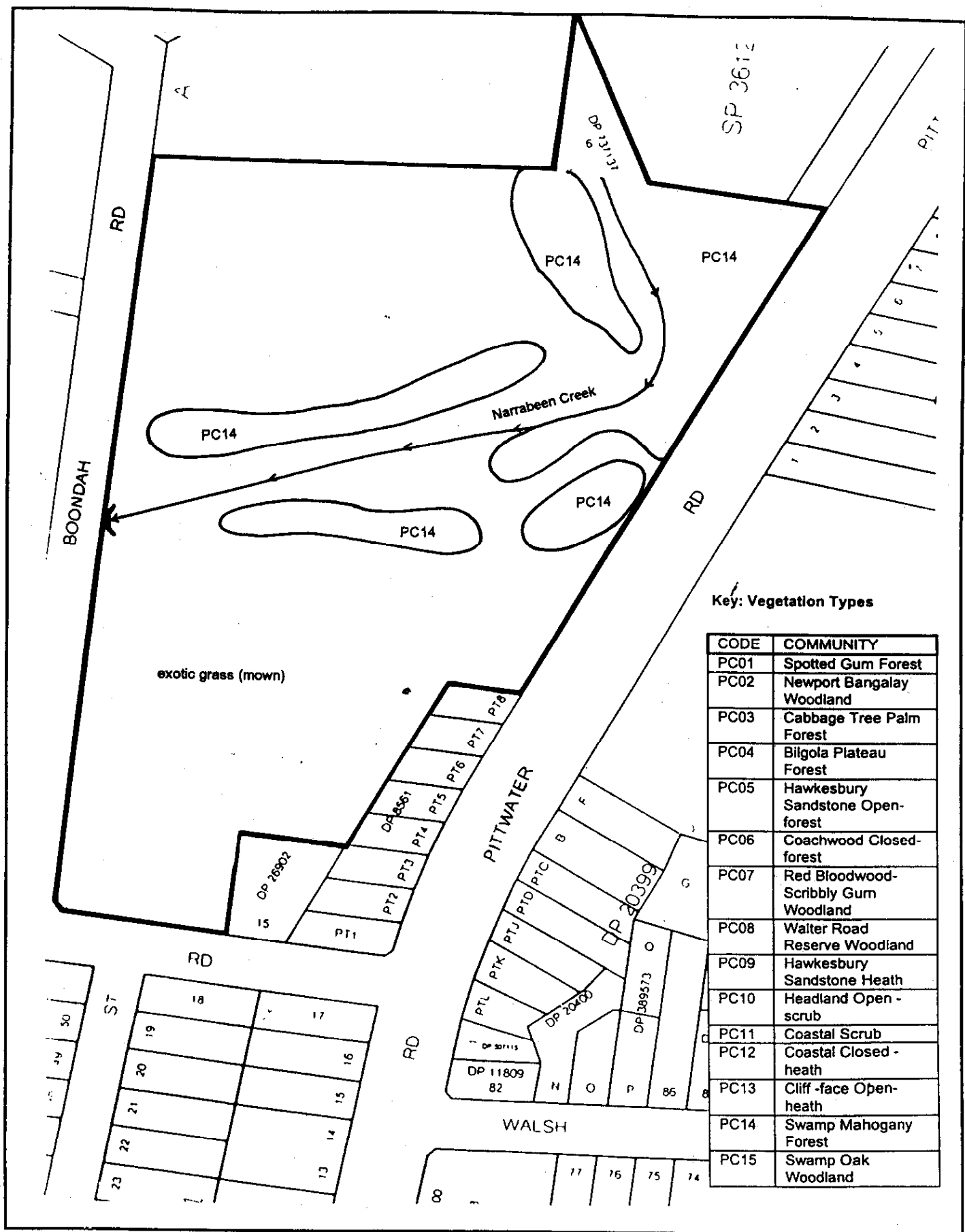
There needs to be follow-up weeding after fire as well as consideration of soil erosion issues.



5. Performance

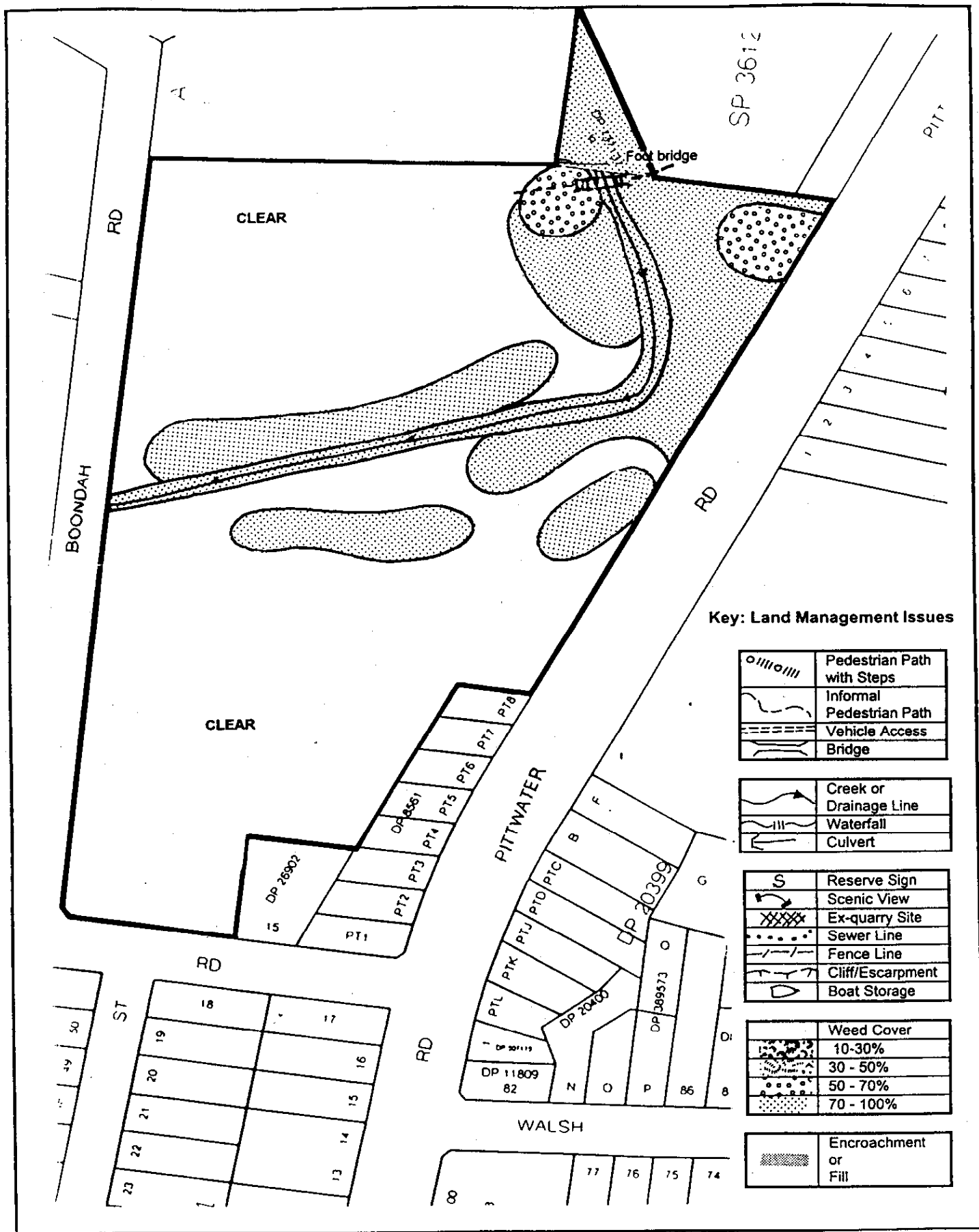
Management objectives	Performance targets (Actions)	Responsibility	Completion date	Capital cost	Recurrent cost	Performance measures
Bush regeneration & weed control	Initiate a riparian and wetland restoration program	Natural Resources	When funds secured	Seek detailed costs of contract program	As required	Restoration program commenced
Stormwater control & drainage	Restoration program to include water quality priorities for Narrabeen Creek	Natural Resources/ Works & Services	When funds available	Seek detailed design and costing	Integrate costing into works & existing maint. programs	Improved water quality
Management of fauna & introduced predators	Include reserve in a Pittwater Wide Feral animal control program. Consider habitat value in any restoration program	Natural Resources & Compliance	Feral animal control when funds available	Seek detailed costings	Costed within a Pittwater wide feral animal control program	Fauna populations extant Public understanding & responsible pet ownership
Access walking track and recreation	Delineate active recreational area and natural areas. Formalise walking track and upgrade bridge	Reserves & Natural Resources	Within available funding or current works programs	Within maintenance program for the reserve		Pleasant edge to natural area with appropriate public access in the reserve
Fire Management	Maintain appropriate fire regime	Bushfire Services & Natural Resources	Ongoing		Staff time	Hazard reduction





Urban Bushland Plan of Management		
Map: Vegetation Communities	Scale: 1:2000	Date: APRIL 1997
Locality: Boondah Reserve (east) Warriewood		

Pittwater Council



Urban Bushland Plan of Management

Map: Management Issues

Scale: 1:2000

Date: APRIL 1997

Locality: Boondah Reserve (east) Warriewood



Pittwater Council

Appendix 1
Floristic List for Plant Communities
Pittwater Council Bushland Reserves

Notes	
* Introduced Species or Native Species not Indigenous to Area	
? Uncertain Identification	
1 Spotted Gum Forest	
2 Newport Bangalay Woodland	
3 Cabbage Tree Palm Forest	
4 Bilgola Plateau Forest	
5 Hawkesbury Sandstone Open-forest	
6 Coachwood Closed-forest	
7 Red Bloodwood-Scribbly Gum Woodland	
8 Walter Road Reserve Woodland	
9 Hawkesbury Sandstone Heath	
10 Headland Open-scrub	
11 Coastal Scrub	
12 Coastal Closed-heath	
13 Cliff-face Open-heath	
14 Swamp Mahogany Forest	
15 Swamp Oak Woodland	

Floristic List for Pittwater Council Urban Bushland Reserves															
COMMUNITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FERNS															
ADIANTACEAE															
Adiantum aethiopicum	1										11				
ASPLENIACEAE															
Asplenium flabellifolium	1														
BLECHNACEAE															
Blechnum cartilagineum	1				5	6					11			14	
Blechnum indicum	1		3								11				
Doodia aspera															
CYATHEACEAE															
* Cyathea cooperi	1				5									14	
DAVALLIACEAE															
Davallia pyxidata					5										
DENNSTAEDTIACEAE															
Hypolepis muelleri			3								11				
Pteridium esculentum	1			4	5	6	7				11			14	15
DICKSONIACEAE															
Calochlaena dubia	1		3		5	6								14	15
GLEICHENIACEAE															
Gleichenia dicarpa					5										
Sticherus flabellatus					5										

[illegible]

* Conyza bonariensis	1				5	7	10	11	12	14
* Coreopsis lanceolata					5					14
* Crassocephalum crepidioides										
* Delairea odorata		4						11		
* Dimorphotheca pluvialis									12	13
Euchiton sphaericum								11		
* Gazania rigens							10		12	
* Gnaphalium americanum	1									
* Hypochaeris radicata	1				5	7	10	11		14
Lagenifera stipitata	1				5					
Olearia tomentosa					5					
Ozothamnus diosmifolius	1				5					
* Roldana petasitis	1									
* Senecio madagascariensis	1				5		10	11		
* Sonchus oleraceus	1				5		10	11	12	
* Taraxacum officinale	1						10			14
* Xanthium occidentale					5					
BALSAMINACEAE										
* Impatiens walleriana					5					14
BIGNONIACEAE										
Pandorea pandorana	1				5	6	10	11		
BRASSICACEAE										
* Rorippa nasturtium-aquaticum					4	7				14
CAPRIFOLIACEAE										
* Lonicera japonica	1									
CARYOPHYLLACEAE									12	
* Stellaria media										
CASUARINACEAE										

Allocasuarina distyla	1				5	7	7	10				15
Allocasuarina littoralis	1				5	7	8	10				
Allocasuarina torulosa		3	4		5			10				
Allocasuarina verticillata					5							
Casuarina glauca												
CELASTRACEAE												
Cassine australis	1				5				11			
Maytenus silvestris												
CHENOPODIACEAE									11			
Einadia hastata												
CONVOLVULACEAE												
Convolvulus erubescens	1							10	11	12		15
Dichondra repens								10	11			
* Ipomoea cairica	1								11			
* Ipomoea indica												
CRASSULACEAE												
* Kalanchoe tubiflora						7						
CUNONIACEAE												
Ceratopetalum apetalum					5	6	8					
Ceratopetalum gummiferum			4									
DILLENIACEAE												
Hibbertia aspera	1				5	6			10			
Hibbertia dentata	1				5				10			
Hibbertia empetrifolia	1		4		5					11		
Hibbertia fasciculata					5							
Hibbertia linearis	1					7		10				
Hibbertia scandens	1							10	11	12		

ELAEOCARPACEAE	1	4	5	6	7	10	12	14
Elaeocarpus reticulatus	1							
EPACRIDACEAE								
Acrotriche divaricata	1							
Astroloma humifusum	1							
Astroloma pinifolium	1					10		
Dracophyllum secundum			5					
Epacris longiflora			5					
Epacris microphylla								
Epacris pulchella			5		7			
Leucopogon juniperinus	1							
Leucopogon lanceolatus	1					10		
Leucopogon microphyllus								
Monotoca elliptica			5				8	
Monotoca scoparia			5					
Styphelia tubiflora			5					
Trochocarpa laurina	1			6				
Woolisia pungens			5					
EUPHORBIACEAE								
Amperea xiphoclada			5					
Breynia oblongifolia	1	3	4		7	10	11	12
Claoxylon australe	1							
Euphorbia peplus								
Glochidion ferdinandi	1		4	6	7	10	11	14
Micrantheum ericoides					7	10		14
Omalanthus populifolius	1			6	7	10	11	14
Phyllanthus gasstroemii	1		5			10		14
Phyllanthus hirtellus								
Poranthera microphylla			5		7	10		
Ricinocarpus pinifolius			5			10	11	
EUPOMATIACEAE								

[illegible]

[illegible]

	1	2	3	4	5	6	7	8		
Cassytha pubescens	1				5					
* Cinnamomum camphora	1				5		7			
Endiandra sieberi					5	6				15
LOBELIACEAE										
Lobelia trigonocaulis					5					
Pratia purpurascens	1	2			5		7		10 11	
LOGANIACEAE										
Mitrasacme polymorpha					5		7		10	
MALACEAE										
* Eriobotrya japonica	1									
* Raphiolepis indica	1				5					
MALVACEAE										
* Pavonia hastata	1				5				10	14
* Sida rhombifolia										14
MELIACEAE										
Synoum glandulosum	1		3		5	6	7			
MENISPERMACEAE										
Sarcopetalum harveyanum	1		3		5				11	
Stephania japonica	1				5					14
MONIMIACEAE										
Wilkiea huegeliana	1		3		5					
MORACEAE										
Ficus rubiginosa					5					
MUSACEAE										
* Ravenala madagascariensis							7			

[illegible]

* Ochna serrulata	1	3	5	7	10	11	
OLEACEAE							
* Ligustrum lucidum	1				10		
* Ligustrum sinense	1	4	5	6	7		
Notelaea longifolia	1	3	5	7	10	11	
* Olea europaea ssp. africana			5		10		14
OXALIDACEAE							
Oxalis corniculata	1						
* Oxalis purpurea	1		5		10		
Oxalis sp.							
PASSIFLORACEAE							
* Passiflora edulis	1	3	4	5			
Passiflora herbertiana	1		5				
PHYTOLACCACEAE							
* Phytolacca octandra			5	7		11	
PITTOSPORACEAE							
Billardiera scandens	1		5	7	10	11	
Bursaria spinosa	1	4	5	6		11	
Pittosporum revolutum	1		5		10	11	
Pittosporum undulatum	1	3	5	7			
PLANTAGINACEAE							
* Plantago lanceolata			5		10	11	
* Plantago major	1						
POLYGALACEAE							
Comesperma ericinum		4					
POLYGONACEAE							

* Acetosa sagittata	1			5					14	
* Persicaria capitata				5						
Persicaria decipiens									14	15
PROTEACEAE										
Banksia ericifolia				5			7	8	9	10
Banksia integrifolia	1		3	4	5		7			11
Banksia oblongifolia							7		10	
Banksia serrata	1				5		7	8		
Banksia spinulosa					5		7			
Conospermum longifolium					5		7			
Grevillea buxifolia					5		7	8		
Grevillea sericea					5		7	8	10	
Hakea dactyloides							7		10	
Hakea gibbosa							7	8	10	
Hakea salicifolia							7		10	
Hakea sericea							7			
Hakea teretifolia				4			7	8		
Isopogon anemonifolius				5			7		11	
Isopogon anethifolius									10	
Lambertia formosa				4			7		10	
Lomatia myricoides				5						
Lomatia silaifolia				5			7			
Persoonia levis	1			5			7		10	
Persoonia linearis	1			5			7		10	
Persoonia pinifolia				5			7			
Petrophile pedunculata								8		
Petrophile pulchella				5						
Telopea speciosissima										
Xylomelum pyriforme				4			7			
				4						
RANUNCULACEAE										
Clematis aristata	1			5					10	11

[illegible]

Dodonaea triquetra	1				5	7	10	14
SOLANACEAE								
* Cestrum parqui							10	14
* Physalis peruviana								14
* Solanum mauritianum								14
* Solanum nigrum	1				5		10	14
Solanum prinophyllum	1						11	12
STERCULIACEAE								
* Brachychiton acerifolius	1				5			
Lasiopetalum ferrugineum					5	7	10	11
THYMELAEACEAE								
Pimelea latifolia ssp. hirsuta	1							
Pimelea linifolia				4	5	7	11	
Wikstroemia indica	1						10	
ULMACEAE								
Trema aspera	1				6			14
URTICACEAE								
* Parietaria judaica							11	
VERBENACEAE								
Clerodendrum tomentosum	1		3		5			
* Lantana camara	1	2	3	4	5	6	10	14
* Verbena bonariensis				4			11	12
VIOLACEAE								
Hybanthus monopetalus								
Viola hederacea	1					7	10	14
VITACEAE							11	15

Cayratia clematidea	1	3						10	11			
Cissus antarctica	1	3			5	6	7		11			
Cissus hypoglauca	1	3										
Monocotyledons												
AGAVACEAE												
* Agave americana												
ARACEAE												
Gymnostachys anceps	1	3					7					
* Monstera deliciosa												
ARECACEAE												
Livistona australis	1	3			5		7				14	
* Phoenix canariensis	1	4						10	11			
CANNACEAE												
* Canna indica					5		7					
COMMELINACEAE												
Commelina cyanea	1			4			7	10	11			
* Tradescantia albiflora		3		4	5	6					14	
CYPERACEAE												
Carex appressa					5						14	15
Carex breviculmis					5							
Caustis flexuosa					5				8			
Cyathochaeta diandra					5		7		8			
* Cyperus difformis	1							10				
Gahnia aspera												
Gahnia clarkei											14	
Gahnia melanocarpa					5			10	11			
Gahnia sieberana	1				5			10				15

Lepidosperma laterale	1		4	5	7	10			
Ptilanthelium deustum				5		10			
Schoenus sp.					8				
HAEMODORACEAE									
Haemodorum planifolium				5	7	8			
IRIDACEAE									
Patersonia longifolia					8				
Patersonia sericea				5	7				
* Watsonia angusta	1					10			
JUNCACEAE									14
Juncus usitatus									
LILIACEAE									
Dianella caerulea var. caerulea	1		4	5	7	10	11		14
Dianella caerulea var. producta					8				
Dianella revoluta	1			5	7	10			
Laxmannia gracilis	1				7				
* Lilium formosanum							11		
* Protasparagus aethiopicus	1			5					
Schelhammera undulata	1	3		5	7	10	11	12	
Thysanotus tuberosus	1	3		5	6				
LOMANDRACEAE									
Lomandra confertifolia	1			5	7				
Lomandra filiformis				5	7				
Lomandra glauca				5	7	8			
Lomandra gracilis	1			5	7		10	11	
Lomandra longifolia	1	3		5	7	8	10	11	
Lomandra multiflora	1			5			10	11	

Lomandra obliqua	1			5	7	10			
ORCHIDACEAE									
Acianthus fornicatus	1			5	7	10			
Cryptostylis erecta	1		4	5					
Cryptostylis subulata	1			5		10			
Pterostylis sp.	1				8				
Thelymitra ixioides									
PHILESIACEAE									14
Eustrephus latifolius	1	3		5	6	7	11		
Geitonoplesium cymosum	1	3	4	5	7		11		
POACEAE									
• Andropogon virginicus				5	7				
Anisopogon avenaceus	1			5	7				
Aristida vagans				5					
• Axonopus affinis				5	7				
• Briza minor							11		
• Bromus unioloides	1			5			11		
• Cortadiera selloana									
Cymbopogon refractus	1				7	10			
• Cynodon dactylon				5	7				
Danthonia sp.				5					
Deyeuxia quadriseta					7				
Dichelachne micrantha	1			5	7	10			
Digitaria parviflora	1			5					
Echinopogon caespitosus	1			5		10	11		
Echinopogon ovatus	1			5		10	11	12	
• Ehrharta erecta				5					
• Ehrharta longifolia	1			5		10			14
Entolasia marginata	1			5		10	11		15
Entolasia stricta	1		4	5	7	8			
Eragrostis brownii					8				

[illegible]

Appendix 2
Map of Rare or Threatened and Significant Plant Species
Pittwater Council Bushland Reserves

