PART XIV: FLORISTICS OF THE LAKE COOLOONGUP AND WALYUNGUP BUSHLAND.

B.J. Keighery, G.J. Keighery and N. Gibson.

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FLORISTICS OF RESERVES AND BUSHLAND AREAS IN THE PERTH REGION (SYSTEM 6) PART XIV: FLORISTICS OF THE LAKES COOLOONGUP AND WALYUNGUP BUSHLAND (PART M 103)

B.J. Keighery, G.J. Keighery and N. Gibson.

ABSTRACT

The diversity of structural formations and the combination of lakes, lakeside sedgelands, steep dunes and forested areas of Lakes Cooloongup and Walyungup and associated bushland presents a unique and diverse landscape. Ten principal plant communities are present in the area: Sedgelands dominated by *Baumea, Juncus* and *Gahnia*; seasonally wet Woodlands dominated by *Melaleuca rhaphiophylla, Banksia littoralis* and Tuart (*Eucalyptus gomphocephala*); dry Tuart Woodlands and Shrublands dominated by *Acacia rostellifera* and *Jacksonia furcellata* and *Acacia rostellifera*. Three regional floristic community types are represented in the Bushland: type 17 (*Melaleuca rhaphiophylla - Gahnia trifida* seasonal wetlands), type 19 (Sedgelands in Holocene dune swales) and type 24 (Northern Spearwood shrublands and woodlands). Community type 19 is highly restricted geographically and can be considered endangered. The Bushland contains a vascular flora of 256 taxa of which two taxa are non-flowering vascular plants, 104 are monocotyledons (76 natives and 28 weeds) and 150 are dicotyledons (96 natives and 54 weeds). The Lakes Bushland is part of a regionally significant larger natural area extending to the west and east.

INTRODUCTION

The Rockingham area contains a series of distinctive lakes: two coastal freshwater lakes, Lake Richmond and Point Becher Lake and two inland salt lakes, Lakes Cooloongup and Walyungup (Map 1).

Lakes Cooloongup and Walyungup have also been called "White Lakes" for the extensive salt banks exposed in summer. These two lakes are well known to many West Australians as they were a distinctive feature of the Perth to Mandurah Road before it was realigned to the west, closer to Rockingham. Many Perth to Mandurah travellers still choose to take the eastern road with its distinctive and pleasing views of the two lakes.

All four lakes were recognised as being significant conservation areas in the System 6 study (Department of Conservation and Environment 1983: M 102, Lake Richmond; M 106, Point Becher Lake and M 103, Lakes Cooloongup and Walyungup). The area of Lakes Cooloongup and Walyungup (M 103) was recommended to be included in a Regional Park "...because of its conservation value and because as a large, attractive area within the south - west corridor its recreational importance is likely to grow in the future." Thus the area is also known as the 'Lakes Regional Park' or 'Lakes Open Space'. Lakes Richmond, Cooloongup and Walyungup are also recognised as lakes in the context of the Swan Coastal Plain Lakes Environmental Protection Policy under the Environmental Protection Act and any action to modify the lakes is subject to environmental assessment.

The area of the Lakes Regional Park south of Dixon Road between Mandurah Road to the east and Ennis Avenue to the west is the subject of this study (Map 1).

SURVEY METHOD

Survey work was performed over four flowering seasons from 1992 to 1995.

Nine $100m^2$ study sites were located in the Lakes area to sample the range of plant communities identified using available vegetation mapping (Tingay and Tingay 1977), aerial photographs and limited field interpretation. The location of these sites is shown on Map 2 and the sites are described in Appendix 1. Of these nine sites, seven were permanently located using four steel pegs (sites COOL 1-4, 8, 9 and 11).

The seven permanent sites were located and described by groups of conservation volunteers from the Swan Coastal Plain Survey group, each led by a botanist. These groups recorded information in a set format on physical location, vegetation structure and density and the total flora of the permanent study sites (Keighery 1994; Keighery, Keighery and Gibson 1995). The sites were re - sampled by the botanists.

The seven permanent sites were included in a detailed floristic survey of the Swan Coastal Plain (Gibson *et al.* 1994) and the nine sites were included in the System 6 Update (Department of Environmental Protection 1994 - 1996).

Opportunistic plant collections, that is collections from outside the sites, were made during foot and vehicular transects of the bushland areas at various times of the year over the four years of survey. Identification of plant collections was made by the volunteers and the co-ordinators and verified at the W.A. Herbarium. A field herbarium has been prepared for the area. It is considered that approximately 90% of the flora have been documented.

GEOMORPHOLOGY AND SOILS

The Lakes lie between the coastal Quindalup Dunes and the near coastal Spearwood Dunes. Semeniuk (1987) places them in the Quindalup Dune Cooloongup Wetland Suite (Qu 1) with Lakes Richmond and the Point Becher Lake. These lakes are of a common origins having been formed .."as barred oceanic basins as part of the prograding shoreline...". While originally salty they are now of varying salinity as they are "..freshwater recharged.". Lakes Cooloongup and Walyungup are salt water lakes but there are freshwater discharge areas or seepages around the edges of the lakes.

These barred oceanic basins lie in a distinctive landscape of sand ridges, the Beach Ridge Plain (Searle, Semeniuk and Woods 1988). Between many of these ridges lie another suite of Quindalup Dune wetlands, the Becher Wetland Suite (Qu.2, Semeniuk 1987). These are a series of inter - ridge depressions which intersect the water table. Together the sand ridges, the Cooloongup Wetland Suite and the Becher Wetland Suite form a distinctive and unique landscape.

The majority of the soils of the study area are essentially calcareous sands of the Quindalup Dunes (mapped as S13 and Ls4, Gozzard 1983) with an element of the sands associated with the Spearwood Dunes (mapped as S7) to the east. Around the lakes and in the wet depressions between the dunes there is an accumulation of decayed organic matter and some soils are quite peaty, being mapped as Holocene swamp deposits (Cps and Cs1). Other areas are lagoonal deposits (M5) which are associated with deposits of calcium carbonate and salt.

VEGETATION

The Vegetation Map

The vegetation of the Lakes Cooloongup and Walyungup area was mapped in 1977 (Tingay and Tingay 1977) and this mapping has been used as a basis for the present vegetation map (Map 2). This shows the distribution of the principal vegetation associations identified in the area. The structural units described (Appendix 1) can be related to these units.

Lakes

An aquatic community is found in the waters of the lake. While algal species are the most common plants, larger vascular plants also occur in the lakes. These include *Lepilaena australis* (Zannichelliaceae), Common Watermilfoil (*Myriophyllum papillosum* = *M. propinquum*, Haloragaceae), Sago Pondweed (*Potamogeton pectinatus*, Potamogetonaceae) and Sea Tassel (*Ruppia maritima*, Potamogetonaceae). The abundance and distribution of these species depends on the relative salinity of the water body, some preferring brackish waters and others hypersaline waters (Sainty and Jacobs 1994).

Within the Lakes are a series of islands dominated by *Juncus kraussii*, Salt Water Couch (*Sporobolus virginicus*), *Schoenus nitens*, *Suaeda australis* and *Senecio lautus*. Less common are the grass *Polypogon tenellus* and the weeds *Juncus acutus* and *Melilotus indicus*.

Four broad communities can be distinguished on the areas around the Lakes: sedgelands, shrublands, wet woodlands and the drier upland woodlands.

Sedgelands

The edges of the Lakes are dominated by a series of sedges, principally *Baumea juncea*, *Gahnia*

trifida and *Juncus kraussii* forming closed to open sedgelands. Other important sedges (Cyperaceae and Juncaceae) in these communities are *Baumea articulata*, *B. vaginalis*, *Bolboschoenus caldwellii* and *Lepidosperma longitudinale*. The relative salinity of the areas influences the nature of the dominant species. In the areas of freshest water *Baumea articulata*, *B. vaginalis*, *Lepidosperma longitudinale* and *L. gladiatum* are the dominant species, while *Bolboschoenus caldwellii*, *Baumea juncea*, *Gahnia trifida* and *Juncus kraussii* are the dominants in the areas with increased salinity. The introduced sedge, *Juncus acutus*, replaces the native sedges in one area to the south of Safety Bay Road.

Wetland Woodlands to Forests

On the seasonally inundated and waterlogged margins of the lakes are a series of woodlands to forests dominated by three principal tree species: Tuart (*Eucalyptus gomphocephala*), *Melaleuca rhaphiophylla* and *Banksia littoralis*. *Melaleuca preissiana*, is also relatively common but the areas in which it dominates are localised. The *Melaleuca rhaphiophylla* and *Banksia littoralis* Low Woodlands are principally associated with a sedge stratum of the same species that occur in the sedgelands. In some areas there is also a shrub layer, most commonly *Xanthorrhoea preissii*, *Melaleuca teretifolia* and more rarely *Calothamnus lateralis*. These shrublands are most common on the western side of Lake Cooloongup. At times the tree species are absent and the wetlands are dominated by *Xanthorrhoea*. Tuart is generally associated with an understorey of *Gahnia trifida* and a series of shrubs characteristic of the drier Tuart Woodlands such as *Templetonia retusa*. While Tingay and Tingay (1977) refers to this unit, it was not mapped by them.

Shrublands

On the well drained Quindalup and Spearwood Dunes of the area *Acacia rostellifera* Tall Open Scrub and *Jacksonia furcellata* and *Acacia rostellifera* Shrubland occur. Dominant shrub species include *Xanthorrhoea preissii*, *Acacia rostellifera*, *A. saligna* and *Leucopogon parviflorus*. On the Quindalup dunes other dominants are *Jacksonia furcellata* and *Acacia lasiocarpa*. The grass *Stipa flavescens* is also common as well as herbaceous species such as *Thysanotus arenarius*, *Tricoryne elatior* and *Conostylis aculeata*. These shrublands are the predominant vegetation formation on the taller Quindalup Dunes to the west of the Lakes.

The cover of *Acacia rostellifera* and *A. saligna* varies greatly depending on the time since the last fire and the exposure of the area to the westerly winds. In protected unburnt areas *Acacia rostellifera* grows to over 2 metres and forms areas of scrub as mapped by Tingay and Tingay (1977) while *A. saligna* can grow to a low tree. In protected areas and on the low dunes to the north of Lake Cooloongup *Xanthorrhoea* plants grow to over two metres in height.

Upland Woodlands to Forests

In the well drained dune swales and on the low dunes to the north of Lake Cooloongup, Tuart Forest to Open Woodland occurs. In these areas *Acacia saligna* is also dominant and may form a second tree layer as a Low Forest to Low Open Woodland. *Xanthorrhoea preissii*, *Phyllanthus*

calycinus and *Acanthocarpus preissii* are dominant understorey species. The herb layer is variable, the proportion of native and weed species varying depending on the level of disturbance in the community. In the most intact areas moss swards and Apiaceae and Portulacaceae species dominate the herb layer. From the Apiaceae these include *Daucus glochidiatus*, *Hydrocotyle* species (five species) and *Trachymene pilosa* and three *Calandrinia* species from the Portulacaceae. Rottnest Island Laceflower (*Trachymene coerulea*) forms a dense herb layer in many areas after fire. In the more disturbed areas various weeds, especially Scarlet Pimpernel (*Anagallis arvensis*), are dominant.

A small patch of emergent Tuart over *Banksia* Low woodland is found to the south east of Lake Cooloongup. This is part of the more extensive area of this community to the east of Mandurah Road.

Floristic Community Types

The regional study of the floristic variation of the Swan Coastal Plain by Gibson *et al.* (1994) identified three floristic community types in the area around Lakes Cooloongup and Walyungup (Table 1): type 17 (*Melaleuca rhaphiophylla - Gahnia trifida* seasonal wetlands), type 19 (Sedgelands in Holocene dune swales) and type 24 (Northern Spearwood shrublands and woodlands).

Table 1: Floristic Community Types in the Study Area.
The relationship between the structural units used for mapping and the floristic units determined in the regional survey (Gibson *et al.* 1994 and the Department of Environmental System 6 Update, indicated with a #).

Vegetation Mapping Unit	Sites	Floristic Community Type
Wet Woodlands to Forest		
Melaleuca rhaphiophylla Low Woodland to Forest	Sites 1 & 11	17 (*M. rhaphiophylla - Gahnia trifida* seasonal wetlands)
Tuart Closed Forest	Site 4	17 (*M. rhaphiophylla - Gahnia trifida* seasonal wetlands)
Banksia littoralis Woodland	Site 9	#19b (Woodlands over sedgelands in Holocene dune swales)
Tuart Closed Forest	Sites 12 & 13	#19b (Woodlands over sedgelands in Holocene dune swales)
Shrublands		
Acacia rostellifera Tall Open Scrub	Site 2	24 (Northern Spearwood shrublands and woodlands)
Jacksonia furcellata and *Acacia rostellifera* Shrubland		24 (Northern Spearwood shrublands and woodlands)
Dry Woodlands		
Tuart Woodland	Site 3	24 (Northern Spearwood shrublands and woodlands)

Further work for the Update of the System 6 and 1 sections of the Swan Coastal Plain

(Department of Environmental Protection 1994 - 1996) has identified two subgroups in type 19, 19a (Sedgelands in Holocene dune swales) and 19b (Woodlands over sedgelands in Holocene dune swales). Type 19b has been identified in the area of this study.

FLORA

The bushland contains a vascular flora of 256 taxa (Appendix 2). Of these 174 are natives and 82 weeds. Two of these taxa are non-flowering vascular plants, 104 are monocotyledons (76 natives and 28 exotics) and 150 are dicotyledons (96 natives and 54 weeds). The Cyperaceae (21 natives), Poaceae (15 natives, 19 weeds), Apiaceae (11 natives), Anthericaceae (9 natives), Mimosaceae (9 natives), Papilionaceae (7 natives, 6 weeds) and Asteraceae (4 natives, 9 weeds), are the most species rich families.

Significant Flora

Significant taxa of particular interest

Trachymene pilosa (Apiaceae)

A distinct form of this widespread species is found here and at Rottnest. This form is more compact with larger flower heads and only occurs prolifically on the dunes after fire. It has not been observed at Rottnest recently. In the past material from Rottnest was named as a separate species, *Dimetropia preissii* but the genus name *Trachymene* is an earlier name and would be used instead of *Dimetropia* . Also as the differences do not warrant recognition at the species level this is considered a distinct variant of *Trachymene pilosa*. Recognition of such variants is important as conservation areas should be designed to preserve the genetic diversity within a species as well as species and communities.

Sonchus hydrophilus Native Sow Thistle (Asteraceae)

This native Sow Thistle has often been mis - identified as the introduced Sow Thistle, *Sonchus asper*. On the Swan Coastal Plain *Sonchus hydrophilus* is found growing in calcareous seasonally inundated areas such as the margins of Lakes Cooloongup and Walyungup. Initially it was thought that this taxon was very rare (*Sonchus* aff. *asper* at Bold Park, Keighery, Harvey and Keighery 1990) but it has since been located in seasonally waterlogged areas across the Plain and elsewhere. However this taxon is still at risk as it has been observed to hybridise with *S. asper*, its habitat is not widespread and it is eaten by introduced snails.

Atriplex suberecta (Chenopodiaceae)

This widespread perennial has not previously been reported on the Swan Coastal Plain. This species is found along rivers and in salty areas from Carnamah to Esperance in the wheat belt. The closest record to Perth was from York on the Avon River.

Linum marginale Wild Flax (Linaceae)
This poorly collected perennial is inconspicuous until its pale blue flowers are produced in spring. Significant numbers of this taxon occur in the area. This species is rarely recorded on Quindalup Dunes.

Acacia lasiocarpa (Mimosaceae)
Two varieties of this taxon occur on the Swan Coastal Plain. *Acacia lasiocarpa* var. *lasiocarpa* is found in near coastal areas generally on Tamala surfaces near the coast but is also characteristic of the Beach Ridge Plain at Becher Point and south into the dunes on the west of Lakes Cooloongup and Walyungup. The other variety, *Acacia lasiocarpa* var. *bracteolata* (long peduncle), is confined to the seasonally waterlogged and inundated heavy soils of the Pinjarra Plain.

Acacia pulchella var. *goadbyi* (Mimosaceae)
This variety of Prickly Moses was found in one location in the area. This suckering form is normally found in the wheatbelt and this is the only known occurrence on the Swan Coastal Plain.

Eremophila glabra subsp. *albicans* (Myoporaceae)
A series of subspecies have recently been distinguished in *Eremophila glabra* (A. Chinnock pers. comm.). The form found along the west coast on calcareous dunes and sand overlying limestone is the widely cultivated grey leafed red - flowered spreading shrub form of the taxon. While relatively common along the west coast, this taxon is confined to the west coast of WA south of Exmouth.

Jacksonia furcellata (Papilionaceae)
While *Jacksonia furcellata* is typically a low tree to tall shrub, a floriferous shrub form to one metre is found on the dunes between Point Becher and Lakes Cooloongup and Walyungup. This taxon is often a co - dominant with *Acacia lasiocarpa* var. *lasiocarpa*

Kennedia coccinea Coral Vine (Papilionaceae)
While this brilliant flowered taxon is common on the Darling Plateau it is becoming increasingly uncommon on the western margins of the Plain. While it has been recorded recently in several coastal bushland areas (the Maidens near Bunbury, Tuart Forest National Park, Leschenault Peninsula, Yalgorup National Park, north of Naval Base and the study area) it is uncommon in these areas. The coastal populations of *Kennedia coccinea* have reticulate coriaceous leaves and larger, paler flowers than the flowers of the Plateau populations. Further study of this taxon may well result in it being recognised as taxonomically distinct as are many of the species that have disjunct distributions on the Plateau and the calcareous coastal areas (Keighery 1992).

VEGETATION CONDITION

General Condition

While the wetland communities (Lakeside Sedgelands and Wetland Woodlands) are generally in excellent condition, the drier uplands (Shrublands and Upland Woodlands) are generally in good to degraded condition with some areas of shrubland in very good condition.

Keighery and Keighery (1993) discussed the assessment of vegetation condition of Quindalup and Spearwood Dunes and identified four features of the vegetation of these near coastal areas that should be taken into consideration when assessing condition on these dunes:

" - the abundance and density of native species in the herb layer in the communities

- the presence of areas of bare sand, as these areas occur naturally and are important habitat areas (How and Dell, 1990)

- the occurrence of extensive moss swards in sheltered locations in shrublands, and

- the abundance and density of native grasses.

The drier upland areas in the study area have a reduced density of native grasses and herbs in the understorey and the moss swards and bare sand patches are invaded by weeds. Past grazing and frequent fires are considered to be the most likely cause of the reduced cover of the natives in the understorey. Most of the coastal Spearwood and Quindalup Dunes on the Swan Coastal Plain have been used for grazing. As recently as 1989 it was considered that regular yearly fires in coastal lands were desirable to increase the grazing value of these lands. Fires encouraged new growth on native shrubs and perennial grasses as well as favouring annual weedy grasses in the naturally bare areas characteristic of the Quindalup and Spearwood Dunes.

Tingay and Tingay (1977) in their discussion on vegetation quality (Section 2.1.4) identified this disturbance and defined the principal degrading factors as "...stock damage, fire, clearing, sand extraction, vehicle damage and rubbish dumping.". All of the vegetation was considered to be impacted by these factors. Present management of the area has excluded stock and vehicles and limited rubbish dumping. This management has resulted in substantial natural regeneration in all of the areas. Regeneration is particularly evident in the growth of many of the *Gahnia* clumps, particularly to the south of both Lakes Cooloongup and Walyungup. While the frequency of fires has decreased since the removal of grazing, periodic fires are still a feature of the area.

The cover of weeds is still significant in the dry shrublands and woodlands. Clearing, past stock grazing and frequent fires are considered to be the most likely cause of the reduced cover of the natives in the understorey. While the cover of native grasses and shrubs in these areas is increasing the cover of the native herbs has not increased significantly. The native herbs are present in the area (particularly species from the Apiaceae, Appendix 2) but their ability to compete with the weeds is poor.

However, it should be noted, that while some areas within the study area are considerably disturbed these areas are sufficiently intact to provide habitat for many species of fauna. Bushland in the best condition will provide the greatest diversity of habitat for all fauna, areas of vegetation in degraded or even completely degraded condition (Keighery 1994), provide habitat, especially for vertebrate fauna. Faunal studies indicate that bushland that is degraded but overall floristicaly representative of the unit to which it belongs can effectively provide habitat (R. How pers. comm.). Also the presence of degraded areas within larger areas provides protected migration routes for fauna between areas of bushland in better condition (J. Dell pers, comm.) and so raises the value of the bushland in better condition. These degraded bushland areas embedded in or surrounding areas of bushland in better condition also act to mitigate the disturbance of the bushland in better condition. Similar comments were made by Tingay and Tingay (1977):: "Vegetation quality is not necessarily an index of value as wildlife habitat. A single - species formation in excellent condition may support a less diverse fauna than a degraded formation with a number of ecological niches."

Weeds

Almost one third of the recorded flora for the study area are weeds. This is not unexpected as almost all of the area was once grazed and some areas completely cleared. Also some areas on the eastern side of the lakes were used for market gardens. As a consequence not only is a large percentage of the flora weeds but the cover of these weeds can be significant, especially in the wooded upland area which would have been preferred by the cattle. The principal weeds are annual species such as the herbs Scarlet Pimpernel (*Anagallis arvensis*), Clovers (*Trifolium* species), Cape Weed (*Arctotheca calendula*) and grassy weeds such as *Lagurus ovatus*, *Vulpia myuros* and *Bromus diandrus*.

Most perennial weed species are not as widespread but one species, Geraldton Carnation Weed (*Euphorbia terracina*), is of great concern. Over the last 10 years populations of this taxon have exploded in near coastal areas to such an extent that it can be the dominant species in the coastal heaths and grasslands and can form the principal understorey species in woodlands (for example as seen at Trigg Dune Reserve in Perth). Tingay and Tingay (1977) do not mention this taxon in their report, however areas to the west of the study area and the western margins of the study area are becoming dominated by it. Another perennial, Bamboo (*Arundo donax*), is of lesser concern as it does not spread rapidly but it should be removed as it forms impenetrable thickets if left undisturbed.

DISCUSSION

Vegetation

Gibson *et al.* (1994), the most recent regional study of the flora of the Swan Coastal Plain based

on detailed sampling of the plant communities of the Plain, identified three floristic community types in the study area (Table 1 and 2). These floristic community types are found in the wetlands 'super groups 2' and 'super group 4' which is typical of Spearwood and Quindalup Dunes. Type 24 is typical of the Spearwood Dunes but sometimes occurs on Quindalup Dunes adjacent to the mapped interface of the two dune systems. Floristic community type 24 has a restricted distribution on the Plain, being virtually confined to the Perth Metropolitan area, with a single atypical outlier to the north of the Perth Metropolitan Area (Map 3a, Department of Environmental Protection 1994 - 1996). The study area contains a significant area of this community type and is its most southern occurrence. The adjacent bushland to the east of Lake Cooloongup also supports this floristic community type.

Table 2:
Regional Conservation Status of the Floristic Community Types from Gibson *et al.* 1994 and the Department of Environmental Protection 1994 -1996 (#). Conservation status for type 19 (a & b) is considered endangered.

Floristic Community Type	Reservation Status*	Conservation Status
Wetlands		
17 (*M. rhaphiophylla* - *Gahnia trifida* seasonal wetlands)	Present in two or more Cons. Reserves	Low Risk
#19b (Woodlands over sedgelands in Holocene dune swales)	Present in one Cons. Reserves	Endangered
Shrublands and Woodlands to Forests		
24 (Northern Spearwood shrublands and woodlands)	Present in two or more Cons. Reserves	Susceptible

* Conservation Reserves are National Parks or Nature Reserves

The habitat diversity of the study area has resulted in the presence of a diverse suite of plant communities in the study area. While the species diversity of these communities is not high (see Flora section below), the communities have a diverse assemblage of vegetation structure, ranging from forests to sedgelands.

These communities complement those in the adjacent Becher Point area. The *Jacksonia furcellata* and *Acacia lasiocarpa* Low Heath (floristic community type 29b) on the parallel dunes of the Becher Point area gradually merging with the *Jacksonia furcellata* and *Acacia rostellifera* Shrubland (floristic community type 24) on the dunes to the east of Lakes Cooloongup and Walyungup. In addition the permanent lakes of the study area complement the distinctive series of linear wetlands found between many of the dunes of the Becher Point area. The communities associated with these wetlands are closely related. Gibson *et al.* (1994) identified both wetlands as community type 19 but further sampling and analysis for the System 6 Update further clarified type 19 identifying two subgroups (Department of Environmental Protection 1994 -1996). Floristic community type 19a (Sedgelands in Holocene dune swales) is presently known from the Point Becher and Lake Richmond area (Map 3b) while community type 19b (Woodlands over sedgelands in Holocene dune swales) is found further from the coast around Lakes Cooloongup and

Walyungup and to the west of Loch McNess in Yanchep National Park (Map 3c). Floristic community type 19 has been identified as an endangered community (Gibson *et al.* 1994) and both types 19a and 19b are considered endangered in this study.

Within the area between Becher Point and the Lakes, the Tuart Woodlands to Forest is naturally confined to the protected swales adjacent to the Lakes and then to the east of the Lakes. The mature Tuart trees with their white trunks and grey - green foliage form a distinctive landscape in this area well illustrating why these trees have been called White Gums. However Tuarts are absent from the lands to the west of the study area. This is probably due to proximity to the coast as Tuarts planted in the Becher Point area are stunted. The areas to the west of Rockingham Road are naturally sedgelands, shrublands and grassland. Unfortunately these distinctive natural landscapes are not complemented by landscaping in adjacent areas. Areas of heathland in the parks to the west are being planted with Tuarts while to the east of the Lakes Plane trees (*Plantanus* x *acerifolia*) have been planted at the Safety Bay Road roundabout. It is inappropriate to plant Tuarts in the heath communities to the west and equally insensitive to be planting Plane trees to the east. Also the Planes are a threat to the substantive natural values of the area as Planes are known to escape into wetlands adjacent to plantings (Keighery 1995). The planting of Planes where groves of Tuart trees normally grow grossly fragments this distinctive landscape. Planting grassed areas with groves of Tuarts would maintain this landscape as well as providing some additional habitat for native fauna.

At present the study area, the Becher Point area and bushland to the east have bushland connections (Map 1) and form a regionally significant bushland area encompassing a series of unique landforms and their associated communities.

The condition of the overall area is variable. However the substantial regeneration of some of the Lakes area as a result of restricting access by fencing indicates that the condition of degraded areas can be improved with appropriate management. In general the condition of the Becher Point area is "...in excellent to very good condition as there are bare sand areas and moss swards, the herb layer is composed of predominantly native species.." also,"...grasses are widespread, forming a grass stratum in most communities and, at times, are the dominant species forming a grassland in their own right. " (Keighery and Keighery 1993).
The protection of this area by maintenance of the fencing established by the Port Kennedy Land Conservation District group should aid this area in maintaining its condition. Similar protection of the bushland connection to the Lakes should contribute to the preservation of the entire area.

Flora

The diversity of flora in the area is not high but this is to be expected as the area is predominantly Quindalup Dunes and the flora of these dunes is not diverse (Griffin 1994). Also the floristic community types present in the area have medium to relatively low species diversity across the region, ranging from 41.8 in $100m^2$ for community type 24 to 13.6 in $100m^2$ for community type

17. However the diversity compares favourably (Table 3) with that of other areas of Quindalup Dunes within close proximity to the study area (Keighery and Keighery 1993).

The flora of the study area is most similar to the Becher Point area (M106), sharing 168 taxa. This is not surprising since both areas have similar habitat diversity. Both areas have a significantly different flora and increased diversity when compared with the Mount Claremont Bushland (M46) as both of these contain wetland areas which are absent from the Mount Claremont Bushland. Species such as *Baumea acuta*, *Baumea articulata*, *Baumea juncea*, *Bolboschoenus caldwellii*, *Lepidosperma effusum*, *Schoenus nitens*, *Loxocarya pubescens*, *Juncus kraussii*, *Triglochin procera*, *Typha domingensis*, *Centella cordifolia*, *Cotula coronopifolia*, *Sonchus hydrophilus*, *Lobelia alata*, *Melaleuca rhaphiophylla* and *Melaleuca teretifolia* are typical of the wetland areas. The diversity of these areas is also enhanced by the presence of several taxa that are generally associated with outcropping Tamala limestone, such as *Acacia lasiocarpa* subsp. *lasiocarpa*, *Trymalium ledifolium* subsp. *ledifolium* and *Cryptandra mutila*.

The major differences in the floras of the two areas are the presence of fore-dune and beach taxa at Becher Point (such as *Spinifex* species) and aquatic and fringing salt lake species (such as *Wilsonia backhousei* and *Gahnia trifida*) in the study area.

Table 3
A Comparison of the Floras of Mount Claremont Bushland (M 46), Lake Cooloongup and Walyungup Bushland (part M103) and Becher Point area (M 106).

Bushland Area	Total Taxa	Native Taxa	Non - Native Taxa (%)
M 46	177	117	58 (33%)
M 103	256	174	82 (32%)
M 106	240	172	68 (28%)

CONCLUSION

The diversity of structural formations and the combination of lakes, lakeside sedgelands, steep dunes and forested areas of Lakes Cooloongup and Walyungup and associated bushland presents a unique and diverse landscape. The presence of rare wetland communities contributes to this uniqueness. Together with bushland areas to the west and a lesser extent to the east the Lakes area is part of a regionally significant larger natural area.

This landscape is of great heritage value and this area should be managed to maintain these values. The presence of such distinctive natural areas in an increasingly urban area does much to give the area a distinctive and unique character, especially if the surrounding areas are landscaped in harmony with the natural landscape. However this appears to be rarely followed in this area.

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Appendix 1: Vegetation Descriptions and Condition

General Information

Broad mapping units are used for the vegetation mapping (Map 2). The determination of these units is based on vegetation descriptions from the sites. The actual location of the sites is indicated on the map. The vegetation descriptions for each of the mapped units are from the areas considered to best illustrate these units, being 'typical' and in the best condition.

Sites are grouped on the basis of the mapping units and the floristic community type. An * indicates that the floristic community type for the unit and/or site has been inferred from the floristics.

Keys to the terminology used for the vegetation descriptions and specific condition ratings are given in Keighery (1994).

SEDGELANDS (Floristic community type not determined)

Mapping Unit: - *Baumea juncea* Sedgeland

Baumea juncea Sedgeland
Condition Rating Excellent
Soil: black peaty sand
Drainage: poor Aspect: flat

Mapping Unit: - *Gahnia trifida* Sedgeland

Gahnia trifida Tall Sedgeland
Condition Rating Excellent
Soil: black peaty sand
Drainage: poor Aspect: flat

WET WOODLANDS TO FORESTS

Floristic Community Type 17

Mapping Unit: - *Melaleuca rhaphiophylla* Low Woodland to Forest

Site COOL 1 (Gibson *et al.* 1994)
Melaleuca rhaphiophylla Low Open Forest over Open Vines *Cassytha racemosa* over *Gahnia trifida, Baumea juncea* and *Juncus kraussii* Closed Sedgeland.
Condition Rating Excellent
Soil: black peaty sand
Drainage: poor Aspect: flat

Site COOL 11 (Gibson *et al.* 1994)
Melaleuca rhaphiophylla Low Forest over *Cassytha racemosa* Open Vines over *Gahnia trifida* and *Baumea vaginalis* Closed Sedgeland.
Condition Rating Pristine to excellent
Soil: brown sand
Drainage: poor Aspect: S, slope gentle

Mapping Unit: - Wet Tuart Woodland to Forest

Site COOL 4 (Gibson *et al.* 1994)
Tuart Closed Forest over *Melaleuca rhaphiophylla* Low Woodland over *Templetonia retusa* over Tall Open Shrubland over *Gahnia trifida* and *Baumea juncea* Closed Sedgeland.
Condition Rating Excellent
Soil: black/brown loam sand
Drainage: moderate Aspect: flat

Floristic Community Type 19b

Mapping Unit - *Banksia littoralis* Woodland

Site COOL 9 (Gibson *et al.* 1994)
Banksia littoralis Low Woodland over *Acacia saligna* Low woodland over *Xanthorrhoea preissii* Open Heath over *Lepidosperma gladiatum* Sedgeland
Condition Rating Excellent
Soil: sandy clay
Drainage: poor, waterlogged Aspect: flat

Mapping Unit - Wet Tuart Woodland to Forest

Site COOL 12
Tuart Closed Forest over *Gahnia trifida* and *Baumea juncea* Closed Sedgeland.
Condition Rating Excellent
Soil: sandy peat
Drainage: poor, waterlogged Aspect: flat

Site COOL 13
Tuart Closed Forest over *Melaleuca rhaphiophylla* Low Woodland over *Gahnia trifida* and *Baumea juncea* Closed Sedgeland.
Condition Rating Excellent
Soil: sandy peat
Drainage: poor, waterlogged Aspect: flat

SHRUBLANDS

Floristic Community Type 24

Mapping Unit - *Acacia rostellifera* Tall Open Scrub

Site COOL 2 (Gibson *et al.* 1994)
Xanthorrhoea preissii, Acacia rostellifera, A. saligna and *Leucopogon parviflorus* Low Shrubland over *Conostylis aculeata* Open Herbland.
Condition Rating Good
Comments: The cover of *Acacia rostellifera* varies greatly depending on the time since the last fire and the exposure of the area to the westerly winds. In protected unburnt areas *Acacia rostellifera* grows to over 2 metres and forms areas of scrub as mapped by Tingay and Tingay (1977). Some *Xanthorrhoea* plants are over 2 metres in height. Past grazing and frequent fires are considered to be the most likely cause of the reduced cover of the natives in the understorey. This has led to a significant cover of grassy weeds such as *Lagurus ovatus, Bromus diandrus* and *Vulpia myuros.*
Soil: grey sand
Drainage: well Aspect: flat

Mapping Unit - *Jacksonia furcellata* and *Acacia rostellifera* Shrubland

Site COOL 8 (Gibson *et al.* 1994)
Jacksonia furcellata and *Acacia rostellifera* Shrubland over *Leucopogon parviflorus, Acacia lasiocarpa* and *Phyllanthus calycinus* Open Low Heath over *Stipa flavescens* Grassland and *Thysanotus arenarius, Tricoryne elatior* and *Conostylis aculeata* Open Herbland.
Condition Rating Good to very good
Comments: Past grazing and frequent fires are considered to be the most likely cause of the reduced cover of the natives in the understorey. This has led to a significant cover of the herbaceous weed *Anagallis arvensis* and numerous other herbaceous weeds . Grassy weeds are *Lagurus ovatus* and *Bromus diandrus.*
Soil: white sand
Drainage: well Aspect: west, slope gentle

UPLAND WOODLANDS TO FORESTS

Floristic Community Type 24

Mapping Unit - Tuart Woodland to Forest

Site COOL 3 (Gibson *et al.* 1994)
Tuart Woodland to open Woodland over *Acacia saligna* Low Forest to Low Open Woodland over *Phyllanthus calycinus* and *Acanthocarpus preissii* Open Low Heath over **Anagallis arvensis* Herbland.
Condition Rating Good to degraded.
Comments: Past grazing and frequent fires are considered to be the most likely cause of the reduced cover of the natives in the understorey. This has led to a significant cover of the herbaceous weed *Anagallis arvensis* . Grassy weeds are *Lagurus ovatus* and *Bromus diandrus*. In places (see Map 2) the vegetation has virtually been cleared and the Tuart occurs at medium to low density.
Soil: black sand
Drainage: well Aspect: flat to gentle

Appendix 2: Flora List

Key

Column 1: Family

Column 2: Taxon

Names follow Gibson *et al.* (1994) unless indicated otherwise. Taxa yet to be named have an attached reference collection number from the relevant collector. A * preceding the name indicates a weed. An "ms" after the name indicates that this is a manuscript name which is yet to be published.

Columns 3 - 12: Plant Communities (mapping units, Map 2)

Lake

w Ephemeral Algae Formation (Map 2: Ephemeral Algae Formation)

Wetlands

s Sedgelands (Map 2: various sedgelands)

x wetland areas dominated by *Xanthorrhoea preissii* (Map 2: a subunit in all Wetland Woodlands to Forests)

mr wetland areas dominated by *Melaleuca rhaphiophylla* and *Banksia littoralis* (Map 2: *Melaleuca rhaphiophylla* Low Woodland to Forest and *Banksia littoralis* Low Woodland)

mp wetland areas dominated by *Melaleuca preissiana* (Map 2: not mapped within other wetland Woodlands)

Shrublands

ar *Acacia rostellifera* Tall Open Scrub (Map 2: same name)

h *Jacksonia furcellata* and *Acacia rostellifera* Shrubland (Map 2: same name)

Woodlands

T Tuart Woodland to Forest (Map 2: same name)

b Tuart over *Banksia* Low Woodland (Map 2: same name)

D Degraded areas (Map 2: same name)

		ar	h	mr	T	x	b	w	s	D	mp
Aizoaceae											
*	Carpobrotus edulis				•					•	
	Carpobrotus virescens		•								
Anacardiaceae											
*	Schinus terebinthifolia			•							
Anthericaceae											
	Arthropodium capillipes				•						
	Chamaescilla corymbosa				•		•				
	Corynotheca micrantha				•		•				
	Sowerbaea laxiflora			•							•
	Thysanotus arenarius		•								
	Thysanotus manglesianus			•							
	Thysanotus patersonii	•	•								
	Thysanotus sparteus				•						
	Tricoryne elatior	•	•		•						
Apiaceae											
	Apium prostratum			•							
	Centella cordifolia			•	•				•		
	Daucus glochidiatus				•						
	Homalosciadium homalocarpum			•						•	
	Hydrocotyle alata			•					•		
	Hydrocotyle blepharocarpa		•								
	Hydrocotyle diantha			•	•	•					
	Hydrocotyle hispidula		•								
	Hydrocotyle tetragonocarpa		•								
	Trachymene coerulea				•						
	Trachymene pilosa		•								
Apocynaceae											
	Alyxia buxifolia		•								
Asclepiadaceae											
*	Gomphocarpus fruticosus			•	•						
Asparagaceae											
*	Myrsiphyllum asparagoides				•						
Asphodelaceae											
*	Asphodelus fistulosus		•							•	
*	Trachyandra divaricata		•							•	
Asteraceae											
*	Arctotheca calendula	•								•	
*	Aster subulatus					•					
*	Carduus pycnocephalus			•	•						
*	Cirsium vulgare			•		•			•		
*	Conyza albida			•	•						
*	Dittrichia graveolens					•			•		
*	Hypochaeris glabra	•	•		•						
	Ixiolaena viscosa			•		•					
	Olearia axillaris		•								
	Senecio lautus		•		•						
*	Sonchus asper					•	•				
	Sonchus hydrophilus					•			•		
*	Sonchus oleraceus			•	•						

		ar	h	mr	T	x	b	w	s	D	mp
Brassicaceae											
*	Brassica tournefortii		•		•						
*	Heliophila pusilla		•	•							
Caryophyllaceae											
*	Arenaria serpyllifolia		•	•							
*	Cerastium glomeratum	•	•	•	•				•		
*	Minuartia hybrida		•			•					
*	Petrorhagia velutina		•	•	•						
*	Sagina apetala					•					
*	Silene gallica				•						
*	Silene nocturna		•								
*	Stellaria media				•						
Casuarinaceae											
	Casuarina obesa								•		
Chenopodiaceae											
*	Atriplex prostrata								•		
	Atriplex suberecta								•		
*	Chenopodium macrospermum								•		
*	Chenopodium murale								•		
	Rhagodia baccata		•	•	•						
	Suaeda australis								•		
	Threlkeldia diffusa								•		
Colchicaceae											
	Wurmbea monantha					•					
Convolvulaceae											
	Wilsonia backhousei								•		
Crassulaceae											
	Crassula colorata	•	•			•					
*	Crassula glomerata		•	•		•					
*	Crassula natans					•					
Cuscutaceae											
*	Cuscuta epithymum		•						•		
Cyperaceae											
	Baumea articulata					•			•		
	Baumea juncea			•	•	•			•		
	Baumea vaginalis			•		•					
	Bolboschoenus caldwellii					•					
	Carex preissii	•			•	•					
	Cyperus polystachyos					•					
	Gahnia trifida			•	•	•	•				
	Isolepis cernua				•						
	Isolepis marginata		•		•						•
	Isolepis nodosa			•		•			•		
	Isolepis setiformis			•							
	Lepidosperma angustatum	•	•		•						
	Lepidosperma gladiatum	•			•	•					
	Lepidosperma leptostachyum					•			•		
	Lepidosperma longitudinale			•		•					
	Schoenoplectus validus					•		•			
	Schoenus asperocarpus			•							
	Schoenus grandiflorus				•						
	Schoenus nitens			•		•			•		

		ar	h	mr	T	x	b	w	s	D	mp
	Tetraria capillaris								•		
	Tetraria octandra				•		•				
Dasypogonaceae											
	Acanthocarpus preissii	•	•								
	Lomandra maritima		•		•						
Dennstaedtiaceae											
	Pteridium esculentum			•	•						
Dilleniaceae											
	Hibbertia racemosa		•								
Epacridaceae											
	Leucopogon parviflorus		•								
Euphorbiaceae											
	Adriana quadripartita	•		•	•	•					
*	Euphorbia peplus				•					•	
*	Euphorbia terracina	•	•							•	
	Phyllanthus calycinus	•	•		•						
Fumariaceae											
*	Fumaria capreolata				•						
Gentianaceae											
*	Centaurium erythraea	•	•		•						
Geraniaceae											
*	Erodium cicutarium		•							•	
	Geranium solanderi			•							
*	Pelargonium capitatum		•	•							
	Pelargonium littorale				•						
Goodeniaceae											
	Scaevola crassifolia		•								
	Scaevola globulifera		•								
Haemodoraceae											
	Anigozanthos humilis		•								
	Conostylis aculeata	•	•		•						
	Conostylis candicans		•								
Haloragaceae											
	Haloragis brownii					•					
	Myriophyllum papillosum (= M. propinquum)							•	•		
Iridaceae											
*	Homeria flaccida									•	
*	Romulea rosea		•		•	•				•	
Juncaceae											
*	Juncus acutus								•	•	
*	Juncus bufonius					•					
*	Juncus capitatus								•		
	Juncus kraussii			•					•		
Juncaginaceae											
	Triglochin procerum			•							
	Triglochin striatum			•					•		

		ar	h	mr	T	x	b	w	s	D	mp
Lamiaceae											
	Hemiandra pungens		•								
Lauraceae											
	Cassytha flava			•							
	Cassytha racemosa			•	•						
Linaceae											
	Linum marginale					•					
Lobeliaceae											
	Lobelia alata			•		•					
Loganiaceae											
	Logania vaginalis			•	•	•					
Loranthaceae											
	Amyema miquelii				•						
Malvaceae											
*	Lagunaria patersoniana								•		
Mimosaceae											
	Acacia cochlearis		•		•						
	Acacia cyclops		•		•						
	Acacia lasiocarpa		•								
	Acacia pulchella var. glaberrima				•						
	Acacia pulchella var. goadbyi		•								
	Acacia rostellifera	•	•			•	•				
	Acacia saligna	•	•	•	•	•					
	Acacia truncata				•						
	Acacia willdenowiana				•						
Moraceae											
*	Ficus carica			•							
Myoporaceae											
	Eremophila glabra subsp. albicans		•								
	Myoporum caprarioides			•	•						
	Myoporum insulare	•									
Myrtaceae											
	Astartea fascicularis			•							
	Calothamnus lateralis								•		
	Eucalyptus gomphocephala				•						
	Eucalyptus rudis			•							
	Melaleuca cuticularis								•		
	Melaleuca preissiana			•	•						•
	Melaleuca rhaphiophylla			•	•						
	Melaleuca teretifolia			•	•						
Olacaceae											
	Olax benthamiana		•								
Onagraceae											
	Epilobium billardierianum subsp. billardierianum			•							
Orchidaceae											
	Acianthus reniformis				•						
	Caladenia latifolia	•			•						

		ar	h	mr	T	x	b	w	s	D	mp
	Microtis media			•							
	Prasophyllum calcicola ms						•				
	Prasophyllum elatum						•				
Orobanchaceae											
*	Orobanche minor				•						
Oxalidaceae											
	Oxalis perennans			•	•						
Papilionaceae											
	Gompholobium tomentosum		•								
	Hardenbergia comptoniana		•		•		•				
	Jacksonia furcellata	•	•								
	Kennedia coccinea		•		•		•				
	Kennedia prostrata		•								
*	Lotus angustissimus			•							
*	Melilotus indicus								•		
*	Ornithopus compressus	•		•							
	Sphaerolobium medium			•							
	Templetonia retusa	•	•		•	•					
*	Trifolium campestre				•						
*	Trifolium cernuum			•							
*	Trifolium glomeratum									•	
Phormiaceae											
	Dianella divaricata	•	•	•							
Poaceae											
	Agrostis avenacea			•							
*	Aira cupaniana			•							
*	Arundo donax									•	
*	Avena barbata	•	•								
*	Briza maxima		•		•						
*	Briza minor		•	•		•					
	Bromus arenarius		•								
*	Bromus diandrus	•	•		•						
*	Cynodon dactylon			•	•						
*	Cynosurus echinatus				•						
	Danthonia caespitosa		•								
*	Ehrharta calycina		•							•	
*	Ehrharta longiflora		•								
*	Eragrostis curvula									•	
	Eragrostis elongata		•								
	Hemarthria uncinata					•					
*	Lagurus ovatus	•	•	•	•	•					
*	Lolium perenne		•		•						
*	Lolium rigidum		•			•				•	
	Microlaena stipoides				•						
*	Parapholis incurva								•		
	Paspalidium distans				•						
*	Pennisetum clandestinum			•	•						
	Poa drummondiana		•								
	Poa poiformis			•							
	Poa porphyroclados	•	•		•						
*	Polypogon monospeliensis					•			•		
	Polypogon tenellus					•			•		
	Sporobolus virginicus				•	•			•		
*	Stenotaphrum secundatum				•						
	Stipa flavescens	•	•	•							
	Stipa pycnostachya				•						

		ar	h	mr	T	x	b	w	s	D	mp
*	Vulpia bromoides								•		
*	Vulpia myuros				•		•				
Polygalaceae											
	Comesperma virgatum				•						
Polygonaceae											
	Muehlenbeckia adpressa	•		•	•		•				
Portulacaceae											
	Calandrinia calyptrata		•								
	Calandrinia granulifera		•								
	Calandrinia liniflora	•									
Potamogetonaceae											
	Potamogeton pectinatus							•			
	Ruppia maritima							•			
Primulaceae											
*	Anagallis arvensis var. foemina	•	•	•	•						
*	Anagallis arvensis var. arvensis				•	•	•				
	Samolus junceus								•		
	Samolus repens			•	•						
Proteaceae											
	Banksia littoralis						•				
	Dryandra sessilis				•						
	Grevillea vestita				•						
	Hakea prostrata	•		•			•				
Ranunculaceae											
	Clematis aristata	•									
	Clematis microphylla				•						
Restionaceae											
	Loxocarya flexuosa	•	•								
	Loxocarya pubescens			•					•		
Rhamnaceae											
	Cryptandra mutila		•								
	Spyridium globulosum	•									
	Trymalium albicans				•						
Rubiaceae											
*	Galium murale				•						
	Opercularia hispidula				•						
	Opercularia vaginata		•								
Santalaceae											
	Exocarpos sparteus	•	•								
Scrophulariaceae											
*	Bellardia trixago			•	•	•					
*	Dischisma arenarium		•		•						
*	Parentucellia latifolia					•					
*	Parentucellia viscosa					•					
*	Verbascum virgatum					•					
Solanaceae											
	Anthocercis littorea		•		•						
*	Physalis peruviana			•							

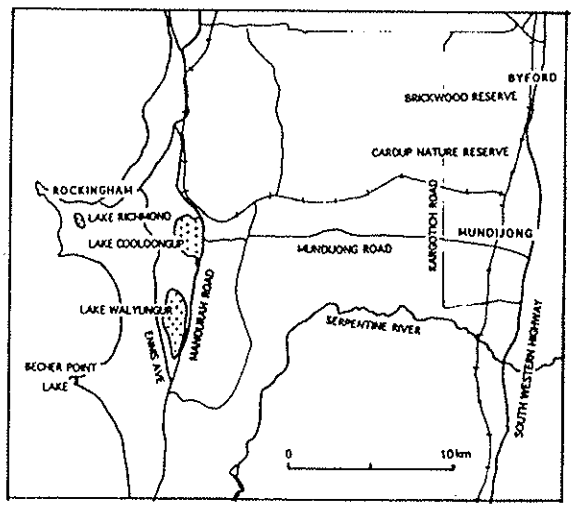
		ar	h	mr	T	x	b	w	s	D	mp
*	Solanum nigrum				•						
	Solanum symonii			•	•						
Stackhousiaceae											
	Stackhousia huegelii					•					
Sterculiaceae											
	Thomasia cognata				•						
Typhaceae											
	Typha domingensis					•					
*	Typha orientalis					•					
Urticaceae											
	Parietaria debilis	•		•							
Verbenaceae											
*	Phyla nodiflora var. nodiflora			•		•					
Violaceae											
	Hybanthus calycinus		•		•						
Xanthorrhoeaceae											
	Xanthorrhoea preissii		•		•	•	•				
Zamiaceae											
	Macrozamia riedlei				•						
Zannichellaceae											
	Lepilaena australis								•		

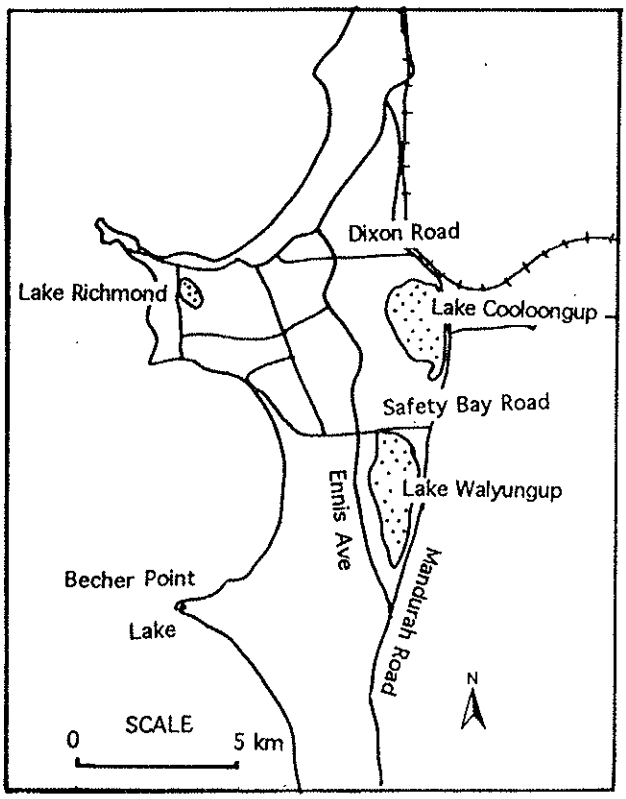
Map 1: Location Lakes Cooloongup and Walyungup

Key

Major and secondary roads

Lakes





Map 2: Vegetation Map

Key

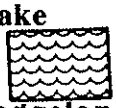
Plant communities are adjusted from Tingay and Tingay (1977). Community names have been adjusted to conform with descriptions of vegetation used in this series of publications. The names for each unit used by Tingay and Tingay are given in brackets. Plant names have been matched with present nomenclature as indicated in Appendix 1 and the Vegetation section.

plant community boundary

Site location (see Appendix 1)

Plant Communities

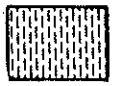
Lake



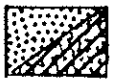
Ephemeral Algae Formation (same)

Sedgelands

Baumea Sedgeland (*Cladium* Sedgeland)



**Juncus acutus* Sedgeland (same)



Gahnia trifida Sedgeland (Open *Gahnia trifida* Sedgeland)
Melalaeuca rhaphiophylla Low Woodland over *Gahnia trifida* Sedgeland (Regrowth)

Wetland Woodlands to Forest

Melalaeuca rhaphiophylla Low Woodland to Forest

Banksia littoralis Low Woodland (Low *Banksia littoralis* Woodland)

Wet Tuart Woodland to Forest (additional unit)

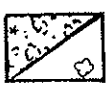
Shrublands

Acacia rostellifera Tall Open Scrub (*Acacia* Scrub and Tall Open Mixed Scrub)

Jacksonia furcellata and *Acacia rostellifera* Shrubland
(Tall Open Mixed Shrubland & Open *Acacia* Heath)

Upland Woodlands to Forest

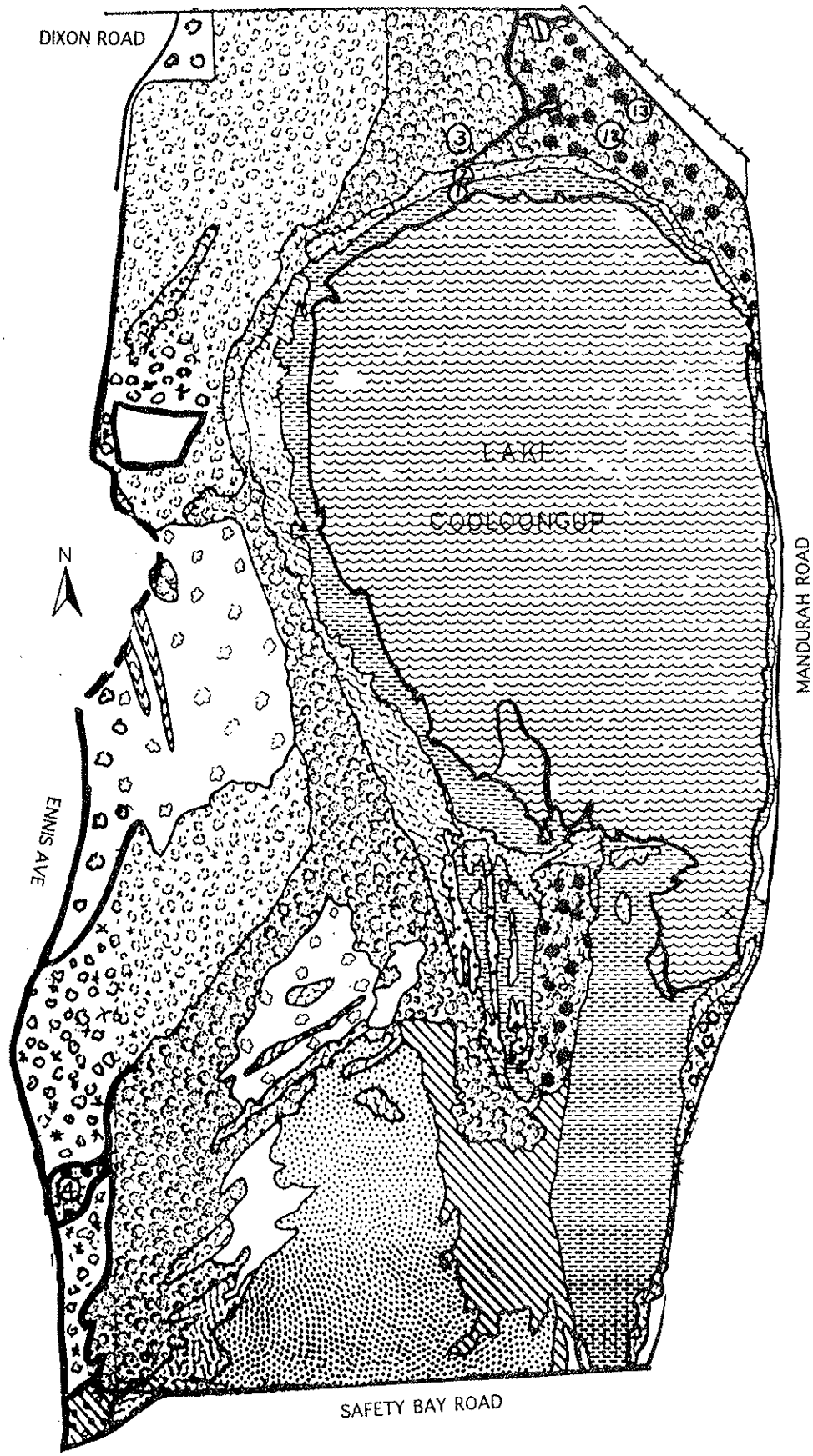
Tuart Woodland to Forest (Tall Open Tuart Forest)
Scattered emergent Tuart over *Banksia* Low Woodland (Tall Open Tuart Forest)



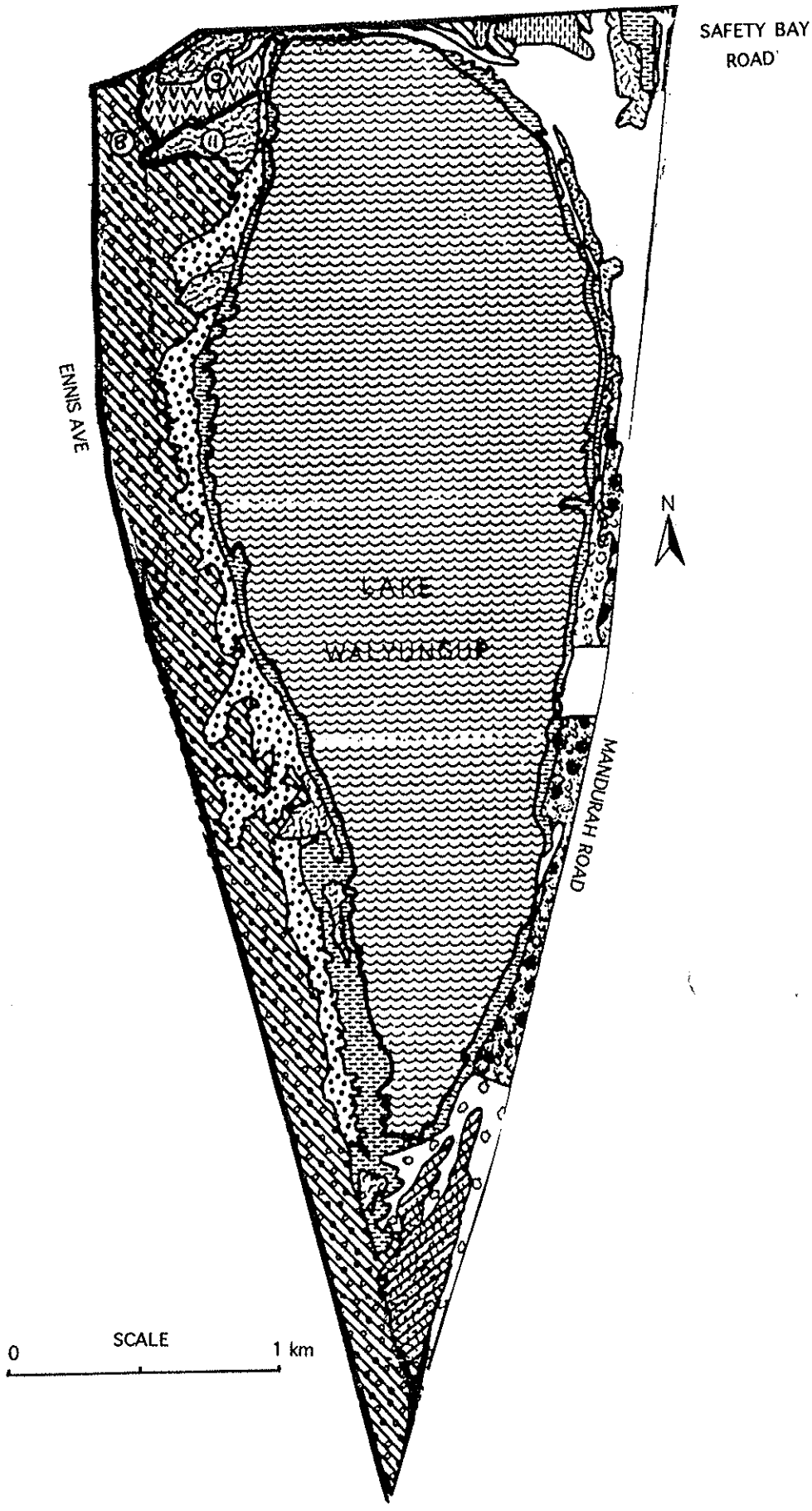
Tuart Woodland over exotic grasses - both units
(Grassland with emergent Tuarts - low density, - medium density)

Degraded areas (Grassland)

Map 2: Vegetation Map

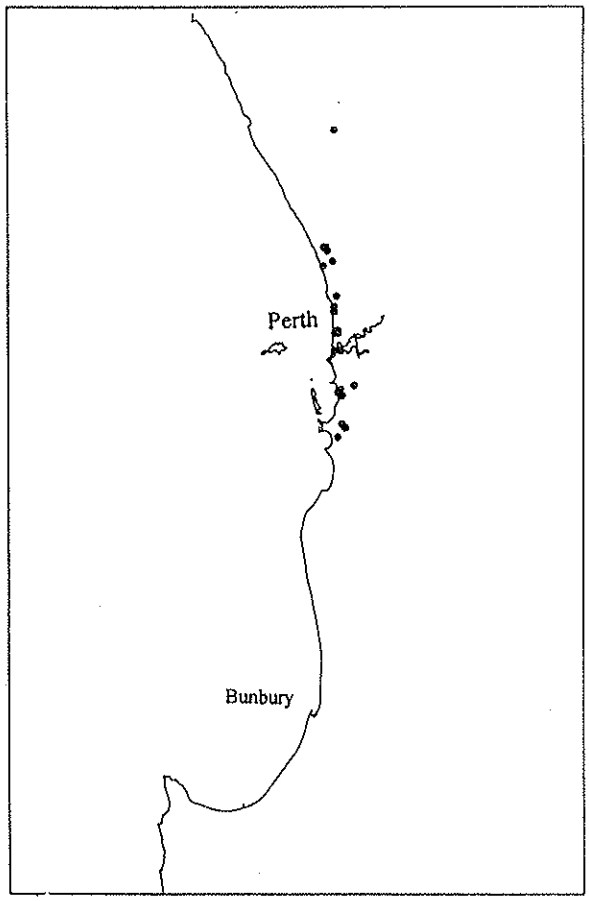


Map 2: Vegetation Map



Map 3: Distribution of the Floristic Community Types
(from Gibson *et al.* 1994 and Department of Environmental Protection 1994 - 1996)

A Distribution of Floristic Community Type 24



Department of Environmental Protection Western Australia

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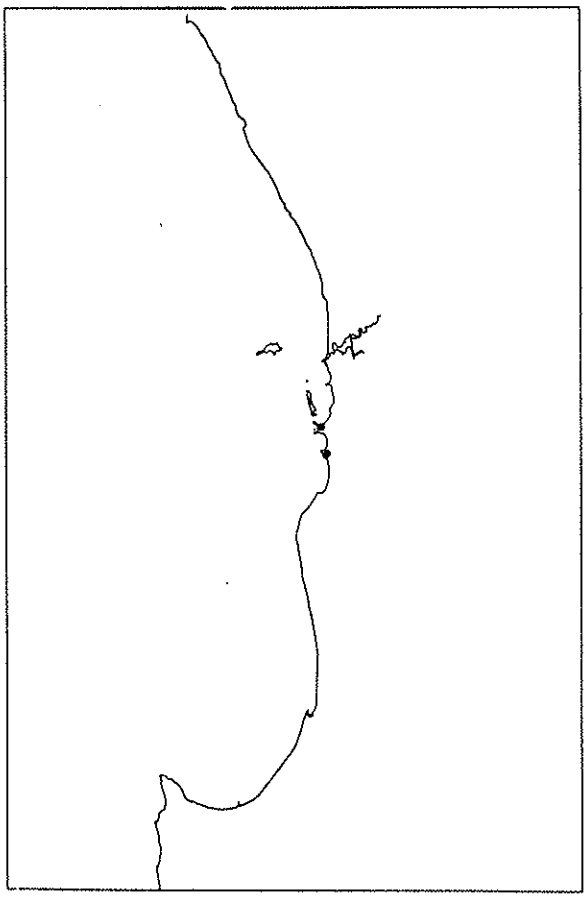
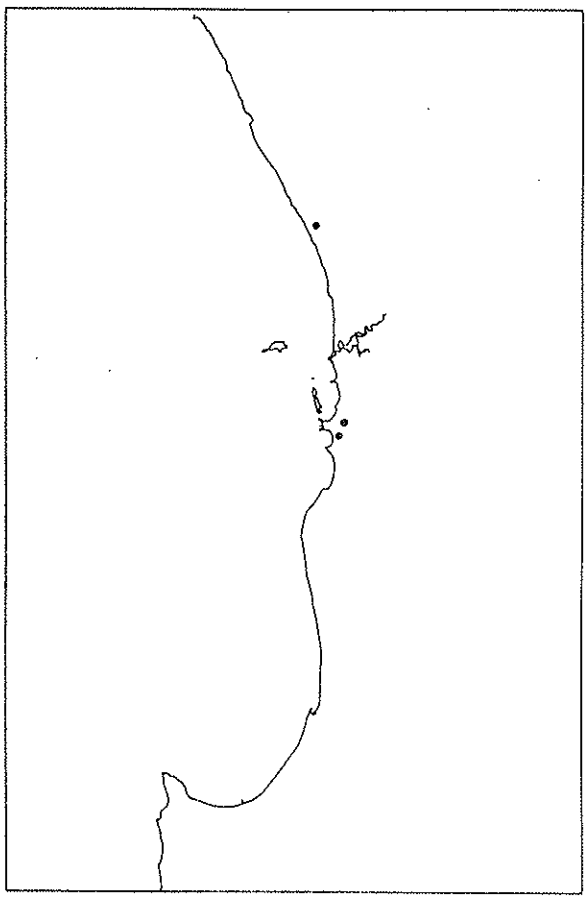
Kilometers

B Distribution of Floristic Community Type 19a



C Distribution of Floristic Community Type 19b



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FLORISTICS of RESERVES and BUSHLAND AREAS

of the

PERTH REGION (SYSTEM 6)

PARTS XI - XV

by

Keighery, B.J.[1], Keighery, G.J.[2] and Gibson, N.[2]

February 1997

1. 224 Hamersley Road SUBIACO WA 6008
2. Department of Conservation and Land Management PO Box 51 WANNEROO WA 6065

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