LINK BETWEEN YANCHEP AND NEERABUP NATIONAL PARKS

Boundary Definition: protected area/bushland boundary

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 130 **Area (ha):** bushland: 94.3
Map no. 13 **Map sheet series ref. no.** 2034–IV NE
Other Names: Part Submission Area 291 reserves between Yanchep and Neerabup National Parks
Local Authorities (Suburb): Shire of Wanneroo (Carabooda, Alkimos)

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS
Spearwood Dunes
Sands derived from Tamala Limestone (Qts: S7)
Tamala Limestone (Qtl: LS1, LS2)

VEGETATION AND FLORA
Vegetation Complexes
Spearwood Dunes
Cottesloe Complex — Central and South
Floristic Community Types: *not sampled, types inferred
Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes
*24 Northern Spearwood shrublands and woodlands
*28 Spearwood *Banksia attenuata* or *B. attenuata — Eucalyptus* woodlands

WETLANDS
No wetlands mapped

THREATENED ECOLOGICAL COMMUNITIES
Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: limestone ridge, vegetated uplands
Vegetation and Flora: limited survey (Submission No. 176e); detailed survey (part Site — *ecologia* 1997)
Structural Units: mapping (part Site — *ecologia* 1997)
Uplands — Sands derived from Tamala Limestone: Woodlands dominated by *Eucalyptus gomphocephala* and *E. marginata*; *Banksia attenuata* Low Woodlands
Uplands — Tamala Limestone: Heaths to Low Shrublands dominated by *Dryandra sessilis* var. *cygnorum*, *Xanthorrhoea preissii*, *Scaevola thesioides* and *Trymalium ledifolium* var. *ledifolium*
Vegetation Condition: >75% Very Good to Excellent, <25% Good, with areas of severe localised disturbance associated with track development
Total Flora: not known
Significant Flora: typical Tamala Limestone taxa — *Trymalium ledifolium* var. *ledifolium*
Fauna: limited survey for birds (41 species), native mammals (4 species), reptiles (17 species) and amphibians (3 species) (*ecologia* 1997). Significant bird species: category 1 (2), category 3 (16) and category 4 (13). Significant mammal species: Quenda (Friend 1996 D). Significant reptile species: a dragon (*Tympanocryptis adelaidensis*), Clawless Gecko (*Crenadactylus ocellatus*) and Black Monitor (*Varanus tristis*)
Linkage: adjacent bushland to the north-east (Site 129, across road) and west; part of Greenway 2 (Tingay, Alan & Associates 1998a); part of a regionally significant contiguous bushland/wetland linkage (Part A, Map 7)
Other Special Attributes: recommended for protection in study of City of Wanneroo bushland (Trudgen 1996)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Subject to protection under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Rarity, Maintaining ecological processes or natural systems
Recommendation: Site with Some Existing Protection; Existing Parks and Recreation Reserve, the purpose of the reserve should be amended to include conservation and appropriate mechanisms applied in consultation with the management body (see Table 3, Volume 1).

LINK BETWEEN YANCHEP AND NEERABUP NATIONAL PARKS

Boundary Definition: protected area/bushland boundary

SECTION 1: CADASTRAL INFORMATION

(Lots, locations and derived information to be updated in the public submission period)

Bushplan Site no. 130 **Map no.** 18 **Map sheet series ref. no.** 1034-IV NE

Other Names
Part Submission Area 291 reserves between Yanchep and Neerabup National Parks

Area (ha): total 94.5; bushland: 94.3

Local Authorities (Suburb)
Shire of Wanneroo (Carabooda, Alkimos)

Zoning
MRS: Parks and Recreation, Controlled Access Highways, Important Regional Roads, Other Major Highways
TPS: Landscape

Ownership Categories
State Government, Commonwealth Government, Private (commercial organisation)

Lot/Location/Reserve numbers (Purpose), Street name
102 Romeo Rd; M1482, 4144, 6282, 6283, 6284, 6285, 6286, 11989 Wanneroo Rd
Crown Reserve

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS

Spearwood Dunes
Sands derived from Tamala Limestone (Qts: S7)
Tamala Limestone (Qtl: LS1, LS2)

VEGETATION AND FLORA

Vegetation Complexes

Spearwood Dunes
Cottesloe Complex — Central and South

Floristic Community Types: *not sampled, type inferred

Supergroup 4: Uplands centred on Spearwood and Quindalup Dunes
*24 Northern Spearwood shrublands and woodlands
*28 Spearwood *Banksia attenuata* or *B. attenuata — Eucalyptus* woodlands

WETLANDS
No wetlands mapped

THREATENED ECOLOGICAL COMMUNITIES
Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: limestone ridge, vegetated uplands

Vegetation and Flora: detailed survey (part Bushplan Site — Ecologia 1997); limited survey (Submission No. 176e)

Structural Units: mapping (part Bushplan Site — Ecologia 1997)
Uplands - Sands derived from Tamala Limestone: Woodlands dominated by *Eucalyptus gomphocephala, E. marginata, Banksia attenuata* Low Woodlands
Uplands - Tamala Limestone: Heaths to Low Shrublands dominated by *Dryandra sessilis* var. *cygnorum, Xanthorrhoea preissii, Scaevola thesioides* and *Trymalium ledifolium* subsp. *ledifolium*

Vegetation Condition: >75% Very Good to Excellent, <25% Good, with areas of severe localised disturbance associated with track development

Total Flora: not known

Significant Flora: typical Tamala Limestone taxa - *Trymalium ledifolium* subsp. *ledifolium*

Fauna: limited survey by Ecologia (1997) recorded birds (41), native mammals (4), reptiles (17) and amphibians (3). Significant bird species: category 1 (2), category 3 (16) and category 4 (13). Significant mammal species: Quenda (Friend 1996 D). Significant reptile species: dragon (*Tympanocryptis adelaidensis*), Clawless Gecko (*Crenadactylus ocellatus*) and Black Monitor (*Varanus tristis*)

Linkage: adjacent bushland to the north-east (BS129, across road) and west; part of proposed Greenway 2 (Tingay, Alan & Associates 1997a); part of a regionally significant contiguous bushland/wetland linkage (Volume 2A, Map 8)

Other Special Attributes: recommended for protection in the study of City of Wanneroo bushland (Trudgen 1996)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Rarity, Maintaining ecological processes or natural systems

Opportunities and/or Constraints

Opportunities: Bushplan Site/part Bushplan Site location of Scheduled Fauna; under MRS Parks and Recreation Reservation and TPS Landscape Zoning, Crown Reserve

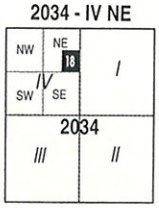
Constraints: private land; under MRD regional road requirements, General and Priority Mineral Resource Area (limestone)

Recommendation: The most appropriate mechanism for the protection of this Bushplan Site be considered through the public comment period in consultation with the land owner(s). This Bushplan Site is already reserved for Parks and Recreation in the Metropolitan Region Scheme — it should be made a reserve with a conservation purpose.

LEGEND

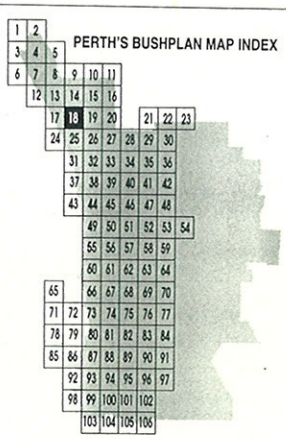
- 472 — Bushplan Sites With Regionally Significant Bushland
- Other Native Vegetation
- Conservation Category Wetlands
- Bushplan Sites With Some Existing Protection
- 696 — Lot Number, Location Number
- Channel Wetlands
- Local Government Boundary

2034 - IV NE



1 : 25 000 AMG Reference Grid showing Perth's Bushplan Map Sheet Breakdown

PERTH'S BUSHPLAN MAP INDEX



N

SCALE

0 500 1000

Metres

Produced by Project Mapping Section
Land Information Branch, Ministry for Planning, Perth W.A. November 1998

ntw-map7//environ/bushplan//bushv2_18.dgn

Cadastral Data supplied by Department of Land Administration, W.A.

Wetlands Data supplied by Water and Rivers Commission

Native Vegetation Extent for Study Area supplied by Agriculture Western Australia

Bushplan Site Map

(1-16)

Coalition for Wanneroo's Environment

31 August 1995

The System 6 Study Team
Department of Environmental Protection
141 St. George's Terrace
PERTH WA 6000

Dear Madam / Sir

SYSTEM 6 UPDATE

The Coalition for Wanneroo's Environment is a community based conservation body working in the city of Wanneroo. The protection of bushland and wetlands has been a focus of our work over the past six years.

We support the System 6 Update as a way of identifying and protecting natural areas of regional conservation value. It should aim to secure a system of conservation areas to protect biological and landscape diversity for the long-term. Following are our comments towards the update including nomination of local areas.

The 1983 System 6 report recognised many important areas, but several of the recommendations have not been implemented and many other significant areas were not included. Increased community concern for the environment, especially remnant bushland, and additional information on the ecosystems of the Swan Coastal Plain and their conservation status must be taken note of. The present system of reserves is inadequate; opportunities to add to the conservation estate and connect reserves diminish as land use decisions are made and development occurs.

The map of remnant vegetation within the Perth metropolitan region in the state government's Urban Bushland Strategy shows that the coastal plain has been extensively cleared. Much of that remaining is within the city of Wanneroo, which has about 46% of its bushland intact. This includes vegetation types and landforms which are poorly represented in reserves, for example Quindalup dune system, Karrakatta central and south vegetation complex and Pinjar vegetation complex.

The diversity, condition, size and location of remnant bushland in Wanneroo offers an opportunity to consolidate existing conservation reserves, set aside additional areas for protection and link reserves with bushland corridors. The importance of some areas has been recognised in the Swan Coastal Plain floristics survey, the East Wanneroo wetlands study and other studies.

However, population growth in Wanneroo is rapid and associated development, especially clearing of land for housing, rural-residential subdivisions and infrastructure, threatens the existence or condition of significant bushland and wetlands. Action is needed to protect these areas; in the interim to allow conservation assessment and in the long-term as part of the conservation estate.

We nominate the following areas for consideration in the System 6 Update. These areas include significant bushland and landscapes which warrant inclusion in a regional conservation network. The areas, shown on the attached maps, are noted below.

(a) • Moore River estuary and land to the south including Wilbinga and Caraban MPA. This covers vegetation and landforms of the Quindalup and Spearwood dunes and could be a large coastal conservation reserve forming a greenbelt north of the metropolitan region. It should link with Wabling MPA and Yeal Nature Reserve to form an east-west greenbelt across a number of soil and vegetation types on the coastal plain.

(b) • Bombing Range wetlands and Banksia woodlands north east of Pinjar, which includes RAAF Pearce Air Weapons Range and State Forest. Large, intact area of Banksia woodlands on Bassendean dunes with perched Paperbark damplands. Could form part of a major reserve network linking Yeal Nature Reserve and Melaleuca Park; the proposed Gnangara biological corridor. Situated on recharge area of the Gnangara groundwater mound.

✓(c) • Coastal bushland south of Yanchep townsite, in Yanchep/Eglinton. Quindalup dune vegetation that could link the coastal reserve and Yanchep National Park. An east-west belt of open space has been proposed in this area.

(d) • Limestone heathlands and Tuart-Banksia woodlands near Bernard Road, Carabooda. Cottesloe central and south complex vegetation in excellent to very good condition. Situated near Coogee Spring. Part of potential link between Yanchep National Park, western chain wetlands and Neerabup National Park. Historically important cave.

✓(e) • Remnant bushland between Yanchep and Neerabup National Parks; west of Wanneroo Road, north of Romeo Road. Includes Tuart, Jarrah and Banksia woodlands and limestone heathlands in excellent to very good condition. Forms a link between these conservation reserves. Limestone ridge is landscape feature.

✓(f) • Bushland between Wesco Road and Wattle Avenue including Shire View Hill. Diverse limestone heathlands including rare and uncommon mallee eucalypts (Yanchep Mallee, Rock Mallee and Fremantle Mallee). Limestone Marlock woodlands and merges to Marri-Banksia woodland. Number of vegetation types in very good condition. Carpet python seen near Shire View Hill, suggesting fauna habitat value. Includes high limestone ridges, important landscape feature.

(g) • Lake Neerabup and adjacent bushland. Linear sumpland including sedgelands; limestone ridge along eastern edge with Tuart and Cheesewood. Large, intact area of bushland to east including limestone heathlands and Tuart and Marri woodlands. Karst features include Orchestra Shell Cave; important Aboriginal heritage site. Adjacent Neerabup National Park and connects with Shire View Hill bushland.

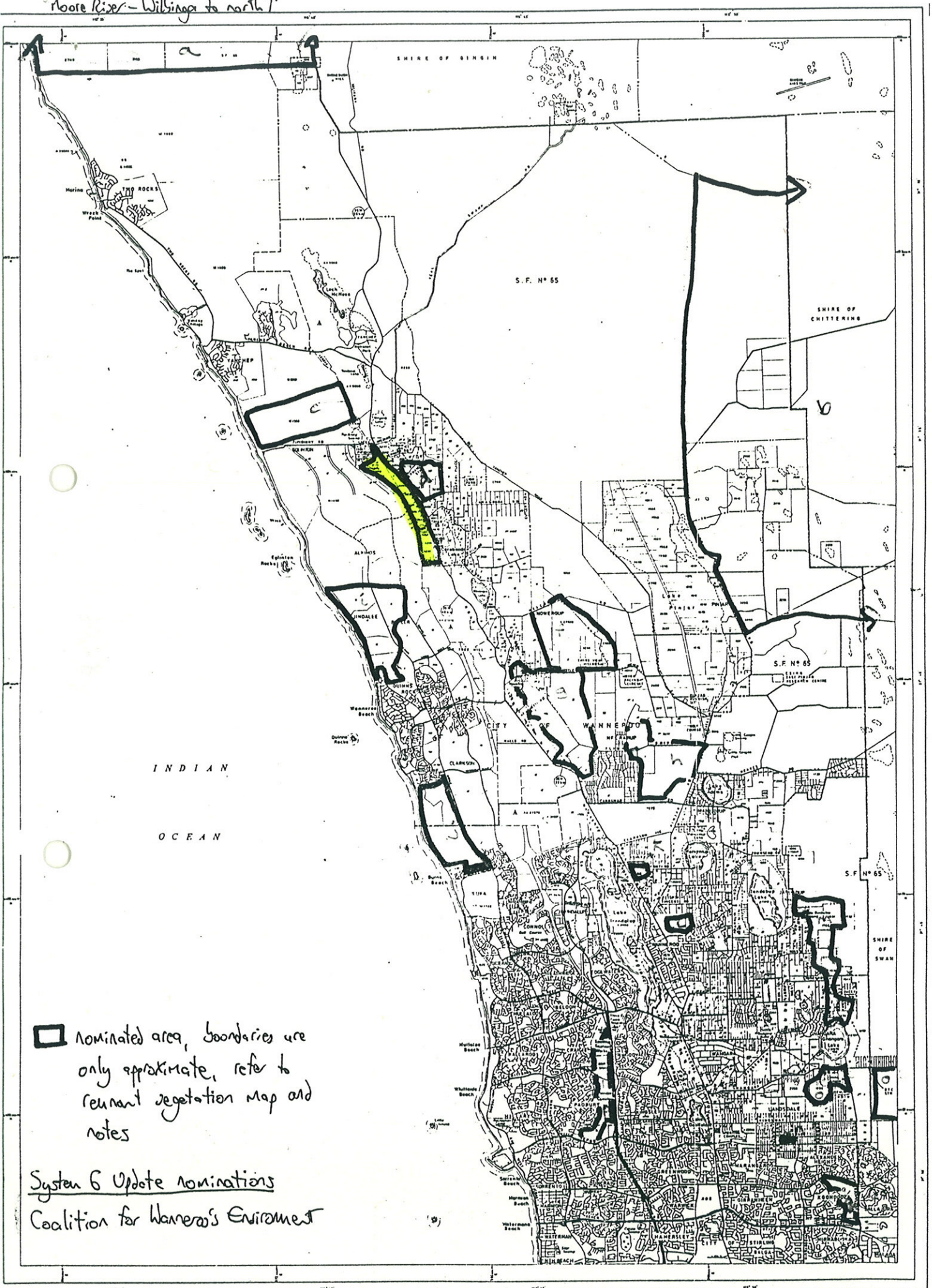
✓(h) • Flynn Drive bushland, Neerabup. Large, intact remnant of Karrakatta central and south complex vegetation. Includes Banksia woodlands in pristine-excellent condition. Occurs between Neerabup National Park and eastern wetland chain and State Forest.

✓(i) • Coastal bushland north of Quinns Rocks. Vegetation in excellent to very good condition, associated with series of parabolic Quindalup dunes. Parrotbush heathland and Banksia woodlands on Cottesloe soils in swales. Recognised in North West Corridor environmental audit.

✓(j) • Coastal bushland between Burns Beach and Mindarie Keys. Significant Quindalup dune landforms and vegetation, includes cuspate foreland, parabolic dune and sandsheets. Addition of land north and south would consolidate existing System 6 area and add to vegetation types represented. Part of link between coast and Neerabup National Park. Recognised in several studies as an important area.

✓(k) • Jarrah-Banksia woodland north of Wanneroo Road works depot. Bushland in fair to good condition, with adjoining land west of Wanneroo Road it covers a transect of remnant vegetation from Lake Joondalup inland. Includes mature trees with hollows for birds, adds to bushland habitat in Yellagonga Regional Park.

Moore River – Wilbinga to north ↑



nominated area, boundaries are only approximate, refer to remnant vegetation map and notes

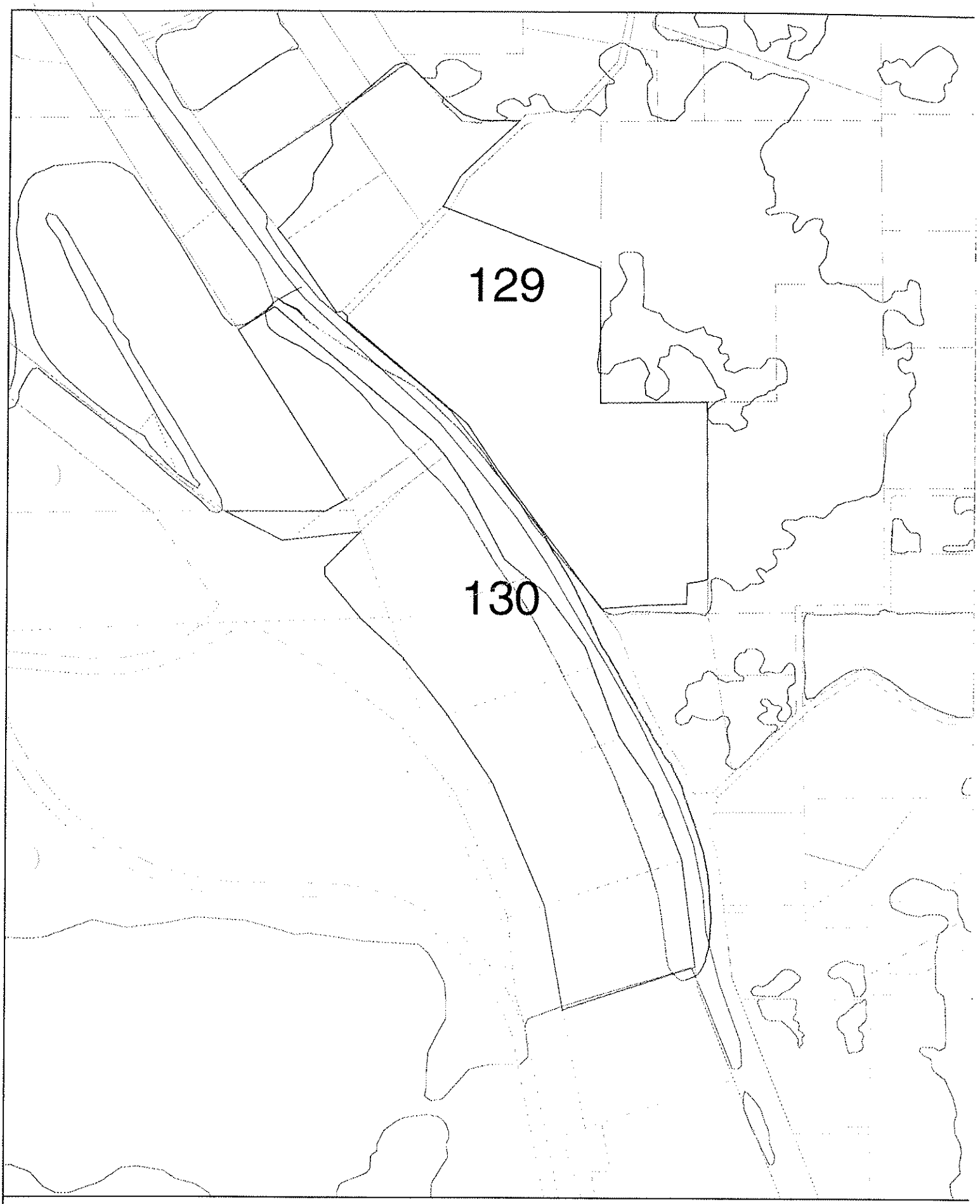
System 6 Update nominations

Coalition for Wanneroo's Environment

LEGEND
State Forest Bdy
Local Auth? Bdy
River/Course
Major Road
Minor Road
Road Reserve

Scale 1: 175 000

CITY OF WANNEROO
REGIONAL PLAN



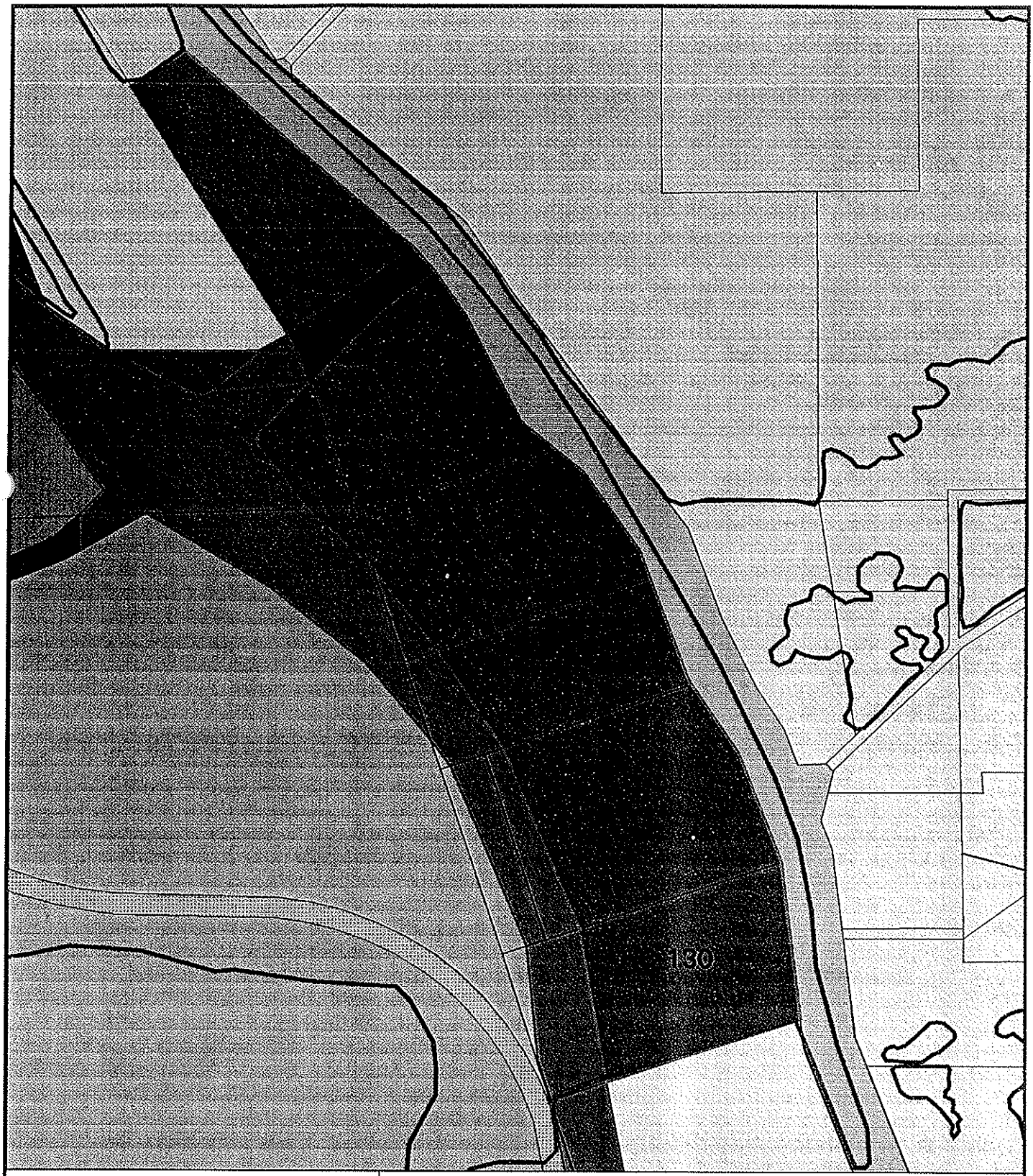
BUSHPLAN SITES CORRECTED

WESTERN AUSTRALIAN PLANNING COMMISSION

CUSTOMER FOCUS WESTERN AUSTRALIA

Road verge issue BJK 26/8

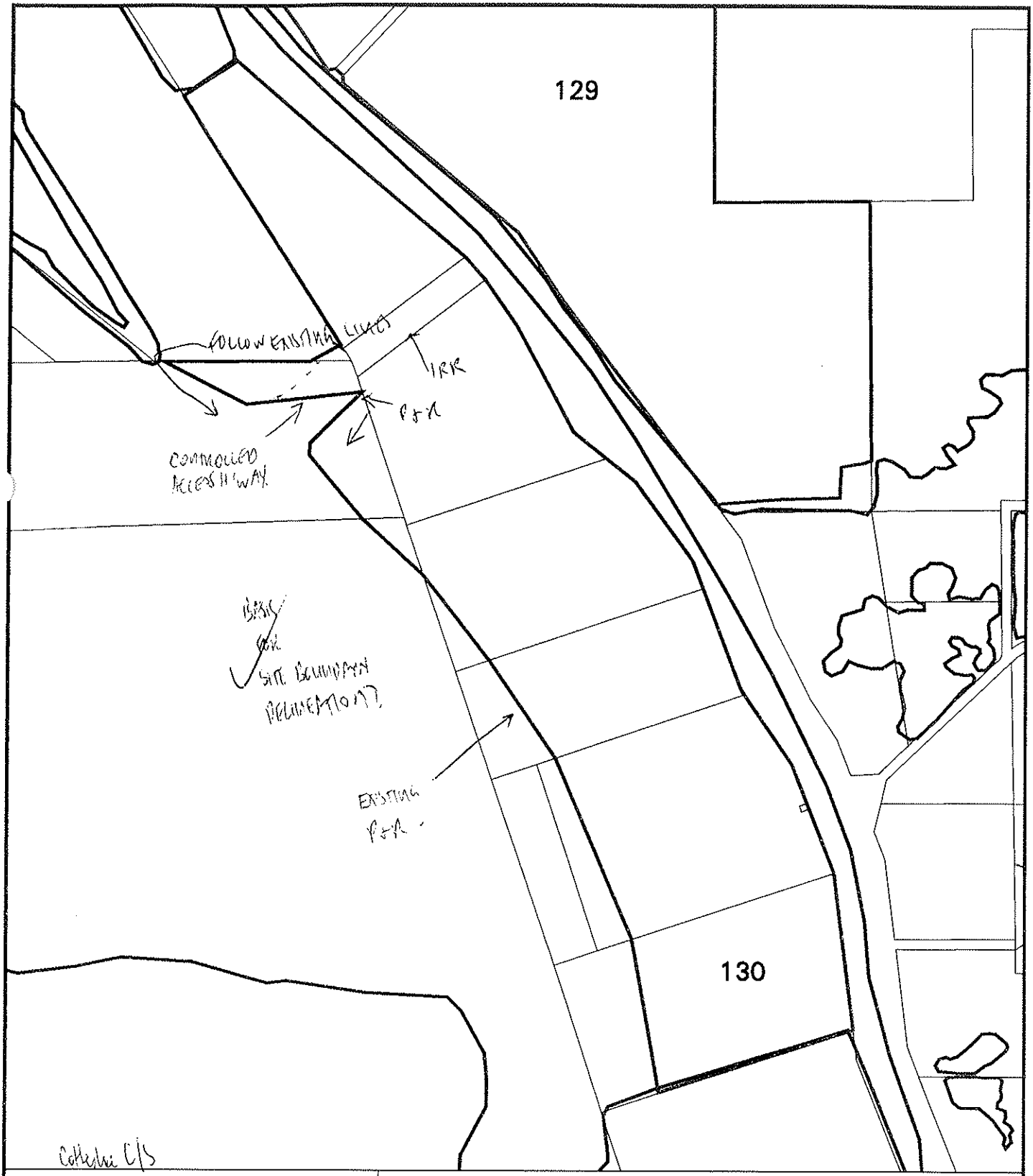
N



bp site 130

MFP INTERNAL USE ONLY	
Prepared By: Andrea Zappacosta	
Prepared For:	
Map Ident: plot980702_1	
Date: 02 Jul 98	
Scale 1:10604	

- Cadastre
- Bushplan sites refno 1-500 SCP BOUNDARY THEME
- AG VEG 1998 BOUNDARY THEME
- URBAN
- CENTRAL CITY AREA
- RURAL
- PARKS & RECREATION
- RAILWAYS
- CONTROLLED ACCES
- OTHER MAJOR HIGH
- IMPORTANT REGION



bp site 130

MFP INTERNAL USE ONLY
Prepared By: Andrea Zappacosta
Prepared For:
Map Ident: plot980526_1
Date: 26 May 98
Scale 1:10583

AG VEG 1998 BOUNDARY THEME

Cadastre

Bushplan sites refno 1-500 SCP BOUNDARY THEME

EXTENT OF
CHECK - CROWN RESERVES
- BASIC PLAN MATERIAL

LIMESTONE SITE. NEED MORE INFORMATION ABOUT VEGS.

ANDREA : WITH MRS PLEASE.

Spearwoods Subm 291 176e (190d)

SYSTEM 6 BUSHLAND SUBMISSION FORM
FOR CONSIDERATION IN THE UPDATE PROGRAMME

YANCHEP-NEERABUP CORRIDOR

LOCATION, OWNERSHIP AND ZONING OF THE AREA

1. Location

a) Bordering Roads: Wanneroo Road, Eglinton, Alkimos and Carabooda

b) Nearest Corner: Wanneroo Road and Romeo Road and Wanneroo Rd and Pipidinny Road.

c) Lot Number: Lots 1, 2, 6, 44, 79, 80, 82-89 Wanneroo Road and others

d) Suburb/Location: Alkimos, Eglinton and Carabooda

e) Local Council: City of Wanneroo

f) Site Name: Link between Yanchep National Park and Neerabup National Park.

g) Approximate size of area (ha): estimated area size 300 ha

h) Location on map: please see attached copy of aerial photo

i) Map: Streetsmart Street Directory, 1996

j) Map no.: 7 and 8

k) Grid Ref.: Map 7: 2E (top)
Map 8: 9C (bottom)

l) Other information to find location: please see attached copy of aerial photo.

m) Aware of any development proposals that are likely to affect the area?
No, proposed Mitchell Freeway extension west of area.

2. Who owns the area? Private owners and crown land

3. If you own the land? not applicable

4. What is the area zoned? Rural under MRS.

PHYSICAL CHARACTERISTICS

5. Why do you consider this area important? The area links Neerabup National Park and Yanchep National Park providing a wildlife corridor and open space connection between these two conservation reserves. It includes examples of limestone heathland and Banksia, Jarrah and Tuart woodlands. There is also a large stand of Fremantle mallee (*Eucalyptus foecunda*) in the area. The

importance of linking the National Parks was stated by V & C Semeniuk Research Group (1992) and Trudgen and Keighery (1990).
(Also refer to QRERG submission on Alkimos-Eglinton Metropolitan Region Scheme amendment pp 5-7).

6. What are the soil type/s and colours? Yellow and brown sands of Cottesloe soil types.

7. Any special features such as unusual landforms/landscapes? not applicable

8. Is the area a wetland or does it include a wetland? Yes, Beonaddy Swamp is nearby, this is in System Six area M3.

9. What percentage of the wetland is open water in summer? unsure

VEGETATION / FAUNA

10. What percentage of the area is indigenous vegetation? 75% or more

11. If the area includes regions of cleared native bushland please indicate reasons for the inclusion. Although some areas are cleared they should still be included in System Six as the area is a link from Neerabup National Park to Yanchep National Park. Degraded areas can be rehabilitated to enhance the ecological link between the National Parks.

12. Has any previous flora or fauna work been done on the area? No

13. The condition of the native bushland? Excellent to very good

14. Disturbances affecting the area?
a) partial clearing; for agriculture
d) Fire regime; Yanchep fire burnt out part on this area, 1992?
m) Grazing; some grazing
o) Off-road vehicle use; some tracks

15. Plant species of interest in the area? not aware of any, no flora survey made

16. Do you know of any animals that use the area? Studies should be done in this area to determine what animals use the area.

17. Is the area used by any native animals of special interest? No information available to be able to answer.

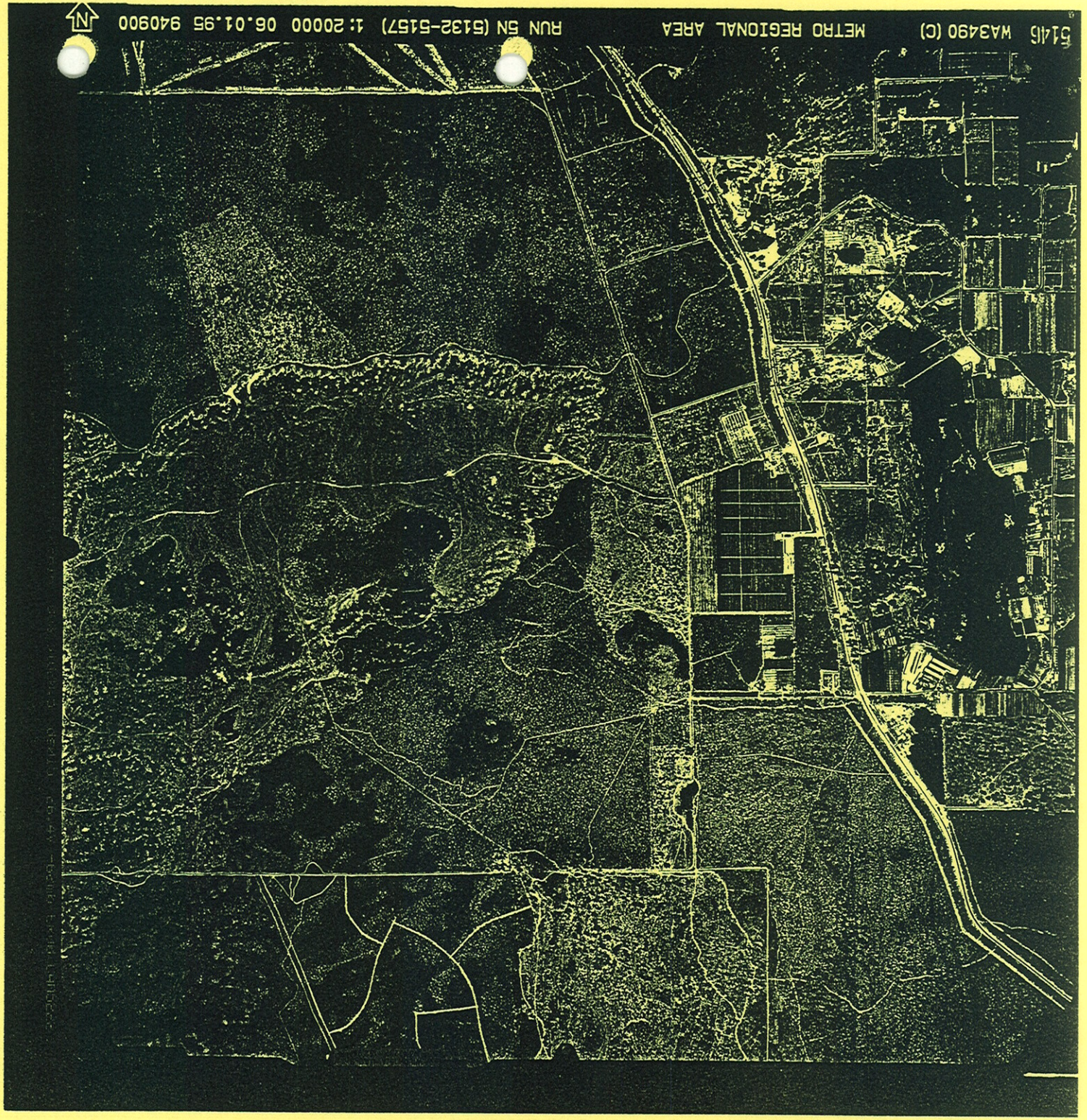
SURROUNDING AREA

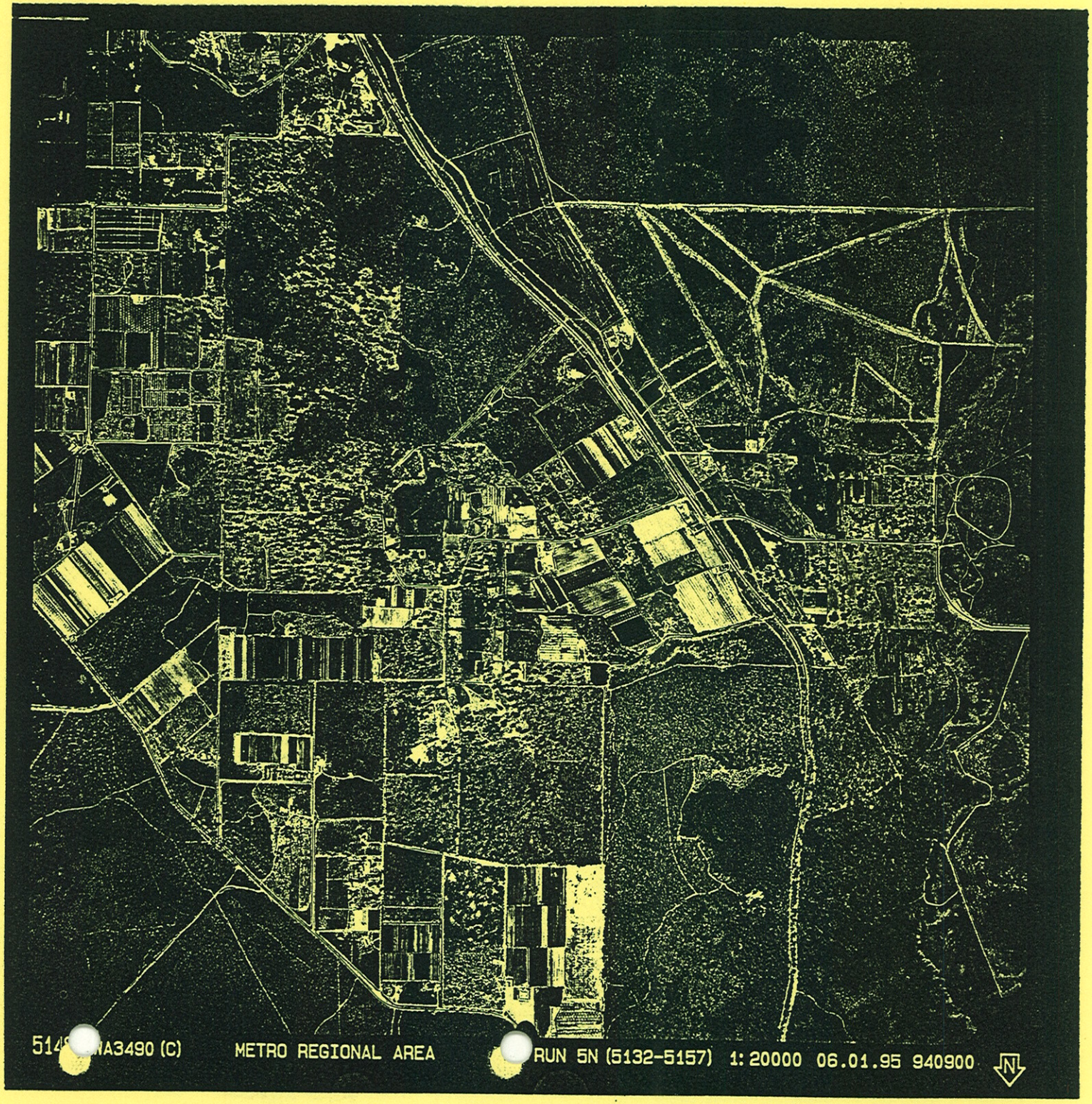
18. Are there any bushland areas (including wetlands) near this area? Yes, Yanchep National Park and Neerabup National Park are adjacent. There is also bushland opposite the submitted area, east of Wanneroo Road near Bernard Road. (This area should also be considered in updated System Six).

19. Does the submitted area link other bushland areas? Yes, the submitted area is a link from Neerabup National Park to Yanchep National Park. The importance of a link between the Parks has been noted by Trudgen and Keighery (1990) and V & C Semeniuk Research Group (1992). Also see QRERG submission on Alkimos-Eglinton Metropolitan Region Scheme amendment pp5-7).

Yanchep - Neerabup Corridor

This area continues on to attached photo.




514[illegible]NA3490 (C)
METRO REGIONAL AREA
RUN 5N (5132-5157) 1:20000 06.01.95 940900
N

REMNANT VEGETATION

IN THE QUINNS ROCKS AREA:

DESCRIPTION OF VEGETATION AND FLORA

AND

ITS CONSERVATION SIGNIFICANCE

by

Nicky Robinson

cartography by Keith Breheny

report for Quinns Rocks Environmental Group Inc.
August 1997

ACKNOWLEDGEMENTS

My thanks to Keith for help in fieldwork, advice on mapping, compiling the photo mosaic, reviewing the manuscript, and uncompromising support.

Thanks to David Wake and Renata Zelina of QREG, for the opportunity to tackle this project and for their advice and comments on the manuscript, and to Renata for taking the time to look up species common names.

I am grateful for the assistance provided by: Paul Holmes at the City of Wanneroo, who gave me access to original maps from the report by Trudgen (1996); and to the database staff at the WA Herbarium, who gave me with access to the WACENSUS and WAHERB databases.

LIST OF FIGURES

1. SUMMARY

Remnant vegetation and flora of the Quinns Rocks area, bounded by Pipidinny Road, Burns Beach Road and Wanneroo Road, are described, major vegetation communities are mapped, and their conservation significance is assessed.

Aerial photography was used to identify major vegetation communities, and ground truthing together with information from previous studies in small sections of the study area, were synthesised to formulate vegetation descriptions and maps. Vegetation communities include two Strand communities, six Quindalup communities, six Spearwood communities, and one Herdsman community .

A total of 473 species representing 255 genera and 77 families of vascular plants are recorded. At least one species of Declared Rare Flora, five priority species, and 23 other significant taxa occur in the study. Introduced species total 89. The flora list was compiled from previous studies in most representative sections of the study area, but as these studies do not cover the entire study area, the list is likely to be incomplete.

Large areas of remnant vegetation exist in the study area, which are representative of communities within the Quindalup and Cottesloe – Central and South vegetation complexes of Heddle (1980). The remnants have high conservation value due to the high level of clearing of these vegetation complexes and their lack of reservation for conservation throughout their original range, particularly in the Perth Metropolitan Area. Remnants in the study area represent an opportunity to add substantial areas to the conservation estate that have the potential to maintain sustainable ecosystems. They are generally in good to very good condition and are relatively large with low border to area ratios. They also provide linkages to other conservation areas adjacent to the study area.

Much is still unknown about the Swan Coastal Plain vegetation and flora. Integration of conservation with planning for urban development in the area is vital in order to preserve the natural values of the area for future generations.

the Indian Ocean in the west, Wanneroo Road in the east, Pipidinny Road in the north and Burns Beach Road in the south (see Figure 1).

Substantial areas of the remaining bush are planned for urban development (Department of Planning and Urban Development, 1992). Areas reserved for parks and recreation include Neerabup National Park, which runs north-south, west of Wanneroo Road, and the coastal strip, from the beach to up to 1km inland. The other major land use is urban. There are also several small holdings under market gardening along the eastern edge of the study area.

Apart from land reserved for public use, the tenure of the remainder is freehold with most areas of remnant vegetation owned by private developers, Landcorp or Homeswest.

The study area includes parts of the System 6 areas M2, M3 and M6, recommended for reservation for conservation and public amenity (Environmental Protection Authority, 1983). Approximately half of M2 (the coastal strip from Two Rocks to Burns Beach) is within the study area. Beonaddy Swamp in the north-east corner of the study area forms part of M3 (Yanchep National Park). M6 (Neerabup National Park) and proposed additions, lie almost entirely within the study area.

The condition of remnant bushland varies from poor to very good, although much is in good to very good condition (see Appendix 1 for Condition Rating Scale). Condition depends largely on the level of disturbance. Disturbances include grazing, use of four-wheel drive and off-road vehicles, rubbish dumping, fire, feral animals (particularly rabbits), clearing for urban development, agriculture and road building. Surrounding land uses also influence condition.

3. PHYSICAL ENVIRONMENT

Vegetation communities present at any site are greatly influenced by a range and combination of characteristics of the physical environment.

3.1 Geology, Geomorphology, Soils and Topography

The dominant geological/geomorphological features of the study area are the Quindalup Dune (Holocene Safety Bay Sand) system of the western side which overlies the older Spearwood Dune (Pleistocene Tamala Limestone) system exposed on the eastern side. Both systems are derived from aeolian deposits (Churchward & McArthur, 1980).

The Quindalup system forms a discontinuous strip of beach ridges and parabolic dunes along the south-west coast of Western Australia. In the study area its width varies. It extends inland up to 3.8km at one point in the north, but for 1.5km south of Quinns Rocks and at Burns Beach it discontinues, and here the Tamala limestone is exposed at the coast (Churchward & McArthur, 1980).

The dunes of the Quindalup system can be classified according to age: Q1 dunes are the oldest and generally occur furthest inland, followed by Q2 and Q3 dunes, with the youngest Q4 dunes occurring along the immediate coastline. The soils of the Quindalup dunes comprise white calcareous sands, and each age is differentiated by steepness, relief, organic matter accumulation in the upper layer, cementation in the lower layers, and vegetation associations. The Q1 dunes are the least steep with the lowest relief, have the greatest accumulation of organic matter, and greatest cementation. There is little differentiation of the coastal heath vegetation associations between Q1, Q2 and Q3 dunes, but Q4 dune vegetation is distinct and typified by pioneer species able to tolerate the harsh conditions closest to the coast (McArthur & Bartle, 1980).

The more extensive Spearwood system is found generally to the east of the Quindalup system. It is characterised by grey-brown surface sand over yellow sand over Tamala

limestone. Sand depth varies, with a maximum of 2m, and the limestone is often exposed at the surface. Where this system extends to the coast, exposed limestone forms low cliffs (McArthur & Bartle, 1980). The deeper soils of the Spearwood system support *Eucalyptus* and *Banksia* open forests and woodlands, and the shallower soils support heath communities.

The system is sub-divided into Karrakatta and Cottesloe soils with the former having deep yellow sands, and the latter shallower sands with much exposed limestone (Churchward & McArthur, 1980). In the study area Cottesloe soils dominate, and only a small area in the south-east corner is covered by the Karrakatta soil.

Other important features of the study area are three small wetlands. Beonaddy Swamp in the north-eastern corner of the study area, and the un-named wetland in the south-eastern corner (an extension of the Lake Joondalup wetland chain, identified as "Joondalup, North" by Arnold, 1990), are part of the Herdsman unit which are described by Churchward & McArthur (1980) as "peaty swamps". Hill et al. (1996) describes them as "sumplands" (seasonally inundated basins). Beonaddy Swamp is 45% undisturbed or vegetated, and the Joondalup North wetland is 86% undisturbed or vegetated (Hill et al., 1996). Karli Spring is a small wetland in the Quindalup Dune system approximately 100m from the beach in the northern section of the study area.

Topographically the study area ranges in height from sea level at the beach, to 75m in the south-eastern corner. Typically, the parallel dunes rise steeply from the beach to 10 or 20m, with the parabolic dune crests reaching up to 50m. Beyond the dunes the landscape is gently undulating, rising gradually from 15 to 20 m in the central-west to 45 to 55m in the east (Department of Land Administration, 1987).

3.2 Climate

The study area has a Mediterranean climate with hot dry summers and reliable winter rainfall. Annual rainfall is approximately 625 – 750mm. Strong south-westerly winds in

summer have the potential to cause blowouts of sparsely vegetated dunes (Trudgen & Keighery, 1990).

4. LITERATURE REVIEW

Heddle et al. (1980) mapped vegetation complexes in relation to landforms, soils and climatic conditions. Each complex is described in terms of projected foliage cover and height of dominant life-forms and species, and understorey species composition. The main vegetation complexes represented in the study area are Quindalup and Cottesloe – Central and South. Karrakatta – Central and South and Herdsman complexes are represented to a minor extent.

The Quindalup system extends from Dongara in the north to Geographe Bay in the south (Semeniuk et al., 1989). The original extent of the Cottesloe – Central and South complex was a discontinuous strip from 13km north of Lake Pinjar (west of the study area) to Lake Preston (south of Mandurah) (Trudgen, 1996).

The Quindalup system is by no means uniform in terms of geomorphology and vegetation throughout its range. Semeniuk et al. (1989) recognised variation from north to south, and divided the system into 5 sectors based on distinct associations of geomorphic units and vegetation habitats (due to different sedimentological, geomorphic, climatic and other edaphic factors). The sector within which our study area lies is Whitfords to Lancelin.

Griffin (1993), in a floristic study of the Quindalup dunes between the Swan and Irwin Rivers, recognised floristic variation north-south attributable to variation in Pleistocene deposits and on this basis he divided the system into sectors. The sector, within which our study area lies, coincides with that of Semeniuk et al. (1989). Within sectors, vegetation composition also varied which he related primarily to variation in landforms with other factors being proximity to the coast, time since colonisation, geology and soils.
In a later study, Griffin & Trudgen (1994) divided this sector into sub-sectors based on this within sector variation. Our study area lies within two of these sub-sectors, Moore River to Quinns Rocks, and Quinns Rocks to Whitfords.

Trudgen (1996) assessed the conservation values of remnant vegetation within the context of Heddle's classification for the whole of the City of Wanneroo. The City has extensive and significant remnants which are important for conservation in a regional context. Recommendations were based on vegetation condition, the conservation status of complexes (including extent of clearing and adequacy of representation in reserves), and potential to connect remnants and existing conservation areas.

Recommendations were made to reserve much of the remnant vegetation in our study area as representative examples of vegetation complexes and transitions between complexes. Linkages between the coast, Neerabup National Park and Yanchep National Park were also recommended for reservation.

Gibson et al. (1994) took a different approach in studying the vegetation of the Swan Coastal Plain. Their concept of floristic community types was highly correlated to seasonal moisture regimes and geomorphology, but poorly correlated to Heddle's vegetation complexes. It is difficult to determine precisely which floristic community types occur in our study area because of differences in methodology between the Swan Coastal Plain study and this study. Their descriptions are based on very detailed and site specific data, whereas this study, which takes a broader, generalised approach in describing the vegetation communities.

The flora and vegetation of various sections of the study area have been mapped and/or described by several authors. Surveys by Keighery et al. (1996) and Mattiske (1990) covered Neerabup National Park and an adjacent Water Reserve in the eastern section. Other surveys were in the western section. Between Burns Beach and Mindarie surveys were conducted by Keighery (1991), Halpern Glick Maunsell (1995), and Kinhill Stearns (1983). Sections north of Quinns Rocks were surveyed by Robinson (1995), Trudgen & Keighery (1990), and LeProvost Environmental Consultants (1990). The coastal communities between Burns Beach and Jindalee were mapped by Hames Sharley Australia (1992). Flora of remnants in and near Quinns Rocks townsite have been surveyed by the Quinns Rocks Environmental Group (David Wake, QREG, pers. comm.)

Vegetation classifications used in these surveys differ in the level of detail of descriptions. They provide useful information on the flora and vegetation but are incomplete in their coverage of the study area.

Information on sites in the area could have been accessed and still could be - Trudgen 1996 does consider those in the City of Wanneroo

The sites are approximately as listed in next column

(Gibson et al sites are in
- Neerabup
- Yanchep
- Burns Beach (South)
- State Forest 65 E

DEP/System 6 Sites
- Wilbinga/1991
- Guttin 1993 Sites

While I would not suggest this be adopted at this late stage it would be useful to have the groups

5. MAPPING AND DESCRIPTION OF THE VEGETATION AND FLORA

5.1 Methods

5.1.1 Vegetation mapping and description

The vegetation maps were compiled from interpretation of aerial photography augmented with ground truthing and synthesis of information on vegetation maps from previous studies.

The aerial photographs used were 1 : 20,000 colour photographs taken for the Department of Land Administration on 6 January 1995 (WA3490 Metro Regional Area). A photo mosaic was compiled and the major vegetation communities were traced. Ground truthing was concentrated on easily accessible public land, and consequently assessment of the vegetation in large sections of the map relied on photo interpretation based on this ground truthing. The final maps produced here are reduced to approximately 1 : 22,500.

Some parts of the study area had been previously mapped by Halpern Glick Maunsell (1995); Hames Sharley Australia (1992); Keighery, Keighery and Gibson (1996); Kinhill Stearns (1983); LeProvost Environmental Consultants (1990); and Robinson (1995). These were used to aid photo interpretation.

The vegetation descriptions are based on observations made when ground truthing and synthesis of information from the above mentioned studies. The vegetation structural classification system used follows Keighery (1994) which was developed during floristic surveys on the Swan Coastal Plain (see Appendix 2).

5.1.2 Flora description

The flora list was compiled from previous flora surveys in various sections of the study area. These surveys were Keighery et al. (1996), Mattiske (1990), Keighery (1991), Robinson (1995), and Trudgen & Keighery (1990). No detailed surveys were found for the wetlands, but dominant species were given by Arnold (1990) for the two Herdsman complex wetlands.

5.2 Limitations of the study

5.2.1 Vegetation mapping and description

Due to limited resources and the large area covered by the project, some degree of generalisation is unavoidable in the vegetation maps and vegetation descriptions.

The scale of the maps (approximately 1 : 22,500) inevitably results in some loss of detail and precision in identifying communities. One consequence of scale limitations is that the narrow belt of coastal communities from the strand to the first stabilised dune, cannot be mapped, although the vegetation has been described in section 5.2. These communities are *Cakile maritima* Very Open Herbland, *Spinifex hirsutus/S. longifolius* Grassland, and *Scaevola crassifolia* Low Heath.

Small remnants (usually under 1 hectare) occur on some residential lots and public land, particularly in the Quinns Rocks townsite. These also were not mapped.

The use of aerial photography in composing a photo mosaic also results in some distortion. The vegetation maps should therefore be used with a degree of caution in this regard.

The aerial photographs were taken in 1995, two years before this study (in early 1997), and changes in land use and to remnant vegetation have since occurred. Some remnants

have been cleared for urban development and known changes have been incorporated into the vegetation maps. Other changes may have occurred due to the natural dynamic processes in remnants, or due to disturbances such as fire and grazing. These may affect the structure, floristics and condition of remnants. The maps have incorporated these changes where known.

5.2.2 Flora description

Previous studies from which the flora list is derived, do not cover the entire study area and therefore the list is likely to be incomplete. In particular, species occurring in the Herdsman Complex are likely to be under-represented as no previous detailed studies were found for these wetlands.

6. VEGETATION DESCRIPTION

6.1 General description of the study area

The coastal foredunes are very steep along the much of the study area. Outcrops of limestone, forming low cliffs, also occur at a few locations along the coast.

Beyond the foredunes the Quindalup communities occur on dunes of various ages with the older Q1, Q2 and Q3 dunes landward of the youngest Q4 dunes. There are some large blowouts and several smaller ones close to the coast.

The mosaic of Spearwood communities generally occur east of the Quindalup communities. These comprise mainly of Cottesloe - Central and South Vegetation Complexes. There is also a small area of Karrakatta - Central and South Complex in the south-eastern corner of the study area (Trudgen, 1996).

Two small areas of the Herdsman Vegetation Complex occur in the north-eastern corner, and the south-eastern corner (Trudgen, 1996).

6.2 Detailed description

Most of the following vegetation communities are mapped on Figures 3, 4 and 5 (a legend for these maps is given in Figure 2). Those communities not mapped (due to limitations of scale) are notated in the text.

Areas on the maps marked urban (U), pasture (P) or cleared (C) are generally devoid of any native vegetation. (Some small patches occur in places but because of scale limitations, these could not be mapped.) Those marked as highly disturbed (S7) are all within the Spearwood system and generally have some remnant native overstorey species.

6.2.1 Strand vegetation communities

Cakile maritima Very Open Herbland (not mapped)

This narrow belt of strand vegetation occurs on low foredunes or beachridges seaward of the first stabilised (or partly stabilised) dune. *Spinifex* spp. are also be found here.

Spinifex hirsutus/S. longifolius Grassland (not mapped)

Occurs on the beach side of the first stabilised dune. The introduced *Ammophila arenaria* is also found on the dunes.

6.2.2 Quindalup vegetation communities

Blowouts (Q1)

There are two large blowouts south of Mindarie and several other smaller ones. They are very sparsely vegetated by *Spinifex* sp. or *Lepidosperma gladiatum* with *Scaevola crassifolia, Isolepis nodosa, Carpobrotus* sp. and the introduced *Trachyandra divaricata* on the blowout ridges. In places *Olearia axillaris* and *Spyridium globulosum* occur.

Scaevola crassifolia Low Heath (Q2) (not mapped)

This community is found on the white sand of the youngest dunes (the foredunes and primary dunes, classified as Q4 dunes by McArthur & Bartle (1980)), and merges with *Spinifex* sp. Grassland at the top of the first dune system.

Apart from *O. axillaris*, other common species are *Lepidosperma gladiatum, Isolepis nodosa, Acrotriche cordata, Hemiandra pungens, Rhagodia baccata, Conostylis candicans, Leucophyta brownii, Acanthocarpus preissii, Leucopogon parviflorus,* and the introduced species *Tetragonia decumbens, Pelargonium capitatum, Trachyandra divaricata* and *Lagarus ovatus*. Larger shrubs (but usually less than 1m) are scattered in the swales: these include *Olearia axillaris, Exocarpus sparteus, Acacia lasiocarpa, Acacia cyclops,* and *Spyridium globulosum.*

Olearia axillaris Open Heath (Q3)

Occurs on the white to grey, calcareous sand of the older, steep to undulating Q1, Q2 and Q3 dunes.

There are significant amounts of other shrubs, particularly *Spyridium globulosum* which dominates in some areas. Other common shrub species are *Acacia saligna, A. rostellifera, A. cochlearis, A. cyclops, Santalum acuminatum, Calothamnus quadrifidus,* and *Myoporum insulare*. Many of the larger shrubs, particularly *Acacia* spp. are found on the deeper soils of sheltered swales. The lower layer is often dominated by *Lomandra maritima,* with other common species *Rhagodia baccata, Melaleuca acerosa, Acanthocarpus preissii, Desmocladus flexuosus,* and many others. Single trees of *Eucalyptus gomphocephala* (tuart) are found occasionally in the swales with several trees forming a small woodland very rarely.

Density of the vegetation is highly variable with total cover varying from 50% in exposed sites on dune ridges, and up to 100% in the sheltered sites.

Melaleuca acerosa/Acacia lasiocarpa Closed Low Heath over *Lomandra maritima* Herbland (Q4)

Occurs on the white to grey, calcareous sand of the older, steep to undulating Q1, Q2 and Q3 dunes.

This community varies in the mix of dominants present. *L. maritima* and *M. acerosa* are single dominants in some areas such as north of Burns Beach and north of Quinns Rocks, while *M. acerosa* and *A. lasiocarpa* are co-dominants south of Pipidinny Road.

Other common species are *Acanthocarpus preissii, Rhagodia baccata, Phyllanthus calycinus, Conostylis candicans, Hemiandra pungens, Desmocladus flexuosus, Lepidosperma squamatum* and the introduced *Pelargonium capitatum. Acacia saligna* is

also common in small stands or single shrubs. *Eucalyptus gomphocephala* is found occasionally on the lower dune slopes and in the swales.
The density of the vegetation is variable, often covering only 50% of the ground. There is much evidence of fire immediately south of Mindarie Keys. Indicators of this include the burnt remains of many shrubs, the fairly common occurrence of *Anthoceris littorea* ('fireweeds'), and low *Acacia saligna* shrubs (less than 0.5m). A high level of weed invasion in some areas may also be indicative of frequent fires.

Acacia rostellifera Heath and Scrub (Q5)
Occurs commonly in the shelter and deeper soils between dune ridges.

The structure of this community varies from Closed Heath and Tall Scrub to Open Heath. Where it occurs as Closed Heath and Tall Scrub there is little understorey in the dense thickets. Some stands show evidence of fire with the dead stems protruding above the shrubs that have apparently resprouted from suckers. It is expected that Low Heath would mature into Heath in the absence of fire.

Closed Sedgeland (Q6)
This community refers to Karli Spring, a small wetland behind the parallel dunes between Quinns Rocks and Pipidinny Road. The dominant species is *Lepidosperma gladiatum* (David Wake, QREG, pers. comm.). No other studies were found for the spring.

6.2.3 Spearwood vegetation communities

Banksia attenuata B. menziesii Low Woodland (S1)
Occurs in flat to undulating areas on grey over yellow sand.

B. attenuata is the dominant species with *B. menziesii* less common. *Nuytsia floribunda, Eucalyptus gomphocephala, E. todtiana* and *Allocasuarina fraseriana* are also found occasionally. The taller understorey dominants are *Xanthorrhoea preissii* and *Macrozamia riedlei*. The lower layer is very variable in species present, and in density of

cover. In some locations the layer is very dense, and in others, bare ground is dotted with rabbit burrows.

Eucalyptus marginata Open Forest and Woodland over *Banksia attenuata* Low Woodland (S2)
Occurs generally east of the Connolly Drive alignment on grey over yellow sand.
The presence and density of *E. marginata* and *B. attenuata* varies in this community. Other important overstorey species include *Corymbia calophylla* (previously *E. calophylla*), *E. todtiana* and *B. menziesii*. On higher ground, particularly along the western side of the Wanneroo Road alignment, *E. marginata/C. calophylla* Open Forest merges into *E. gomphocephala* Woodland.

Common species in the *Banksia* layer include *Allocasuarina fraseriana* and *B. grandis*, and *B. ilicifolia* and *B. littoralis* occur occasionally. The next layer is dominated by *Xanthorrhoea preissii* and *Macrozamia riedlei*. Common understorey species are *Hibbertia hypericoides, Petrophile* sp., *Hakea* spp., and *Mesomelaena stygia*.

Eucalyptus gomphocephala Woodland (S3)
Occurs on grey over yellow sand over limestone, usually on rises where the sand is shallow.

Between the Tamala Park Landfill Site and the Connolly Drive alignment, in the south of the study area, this community has an understorey of *Banksia attenuata, Xanthorrhoea preissii* and introduced grasses. This area has obviously been subject to grazing.

In the eastern portion of the study area *E. gomphocephala* Woodland is associated with *Dryandra sessilis* Heath on the higher ground, and merges with *E. marginata Corymbia calophylla* Forest/Woodland down the slopes. It is generally in much better condition although there are some degraded areas outside the boundary of Neerabup National Park, which have few native understorey species.

Limestone Heath (S4)

Occurs on limestone ridges on shallow grey over yellow sand, commonly with exposed rock.

This vegetation community is very variable. The most common dominant species is *Dryandra sessilis* which often occurs in dense monotypic stands, but other commonly occurring co-dominant species are *Xanthorrhoea preissii, Melaleuca huegelii, Acacia truncata* and *M. cardiophylla*. The latter two species also form dense stands with little or no *D. sessilis* present.

Known locations of substantial areas of *Melaleuca cardiophylla* Heath are: adjacent to the large blowout north of Burns Beach; in the large remnant near Mindarie Keys; and close to the coast approximately 1.5km north of Quinns Rocks.

In the eastern section of the study area, *D. sessilis* Heath is found in association with *Eucalyptus gomphocephala* which forms a woodland around the perimeter, and sometimes trees are scattered through the heath.

Other common species of this community are *Acacia saligna, A. pulchella, Calothamnus quadrifidus, Hakea trifurcata, H. prostrata, Hibbertia hypericoides* and *M. acerosa.*

A. pulchella occurs where *D. sessilis* is less than 1m. These areas have obviously been subject to a fairly recent fire. The structural classification of this association varies according to the time since the last fire. In some areas *D. sessilis* is less than 0.5m (Low Heath), and in others it is over 2m (Closed Tall Scrub). The latter is presumably the climax community. Height may also be determined by degree of exposure to winds from the ocean.

Xanthorrhoea preissii Shrubland (S5)

Occurs in the central eastern section of the study area on grey over yellow sand.

Common understorey shrubs include *Hibbertia hypericoides*. Keighery et al. (1996) recorded *Hakea trifurcata, Calothamnus quadrifidus, Melaleuca acerosa, Dryandra sessilis, Conostylis aculeata, Mesomelaena pseudostygia* and *Desmocladus flexuosus* for this vegetation association.

Eucalyptus foecunda/E. petrensis Closed Mallee (S6)

The only known area of this community large enough to be mapped occurs west of Marmion Avenue in the southern section of the study area. It is associated with a Limestone Heath community. There are other areas of this community, but due to the limitations of this study, their locations could not be confirmed.

Highly Disturbed Areas (S7)

These areas generally occur in the central section of the study area. They have been subject to grazing to the extent that the understorey consists almost entirely of introduced grasses, with very few or no native species. The trees and shrubs of the overstorey occur as either isolated or scattered individuals, or small to large stands. Species include *Eucalyptus marginata, E. todtiana, E. gomphocephala, Corymbia calophylla, Banksia* spp. and *Xanthorrhoea preissii.*

6.2.4 Herdsman vegetation communities

Melaleuca rhaphiophylla Low Open to Closed Forest (H1)

This is the dominant fringing community of Beonaddy Swamp in the north-east, and the Joondalup North wetland in the south-east. Other important species at both wetlands are *Eucalyptus rudis* with *Typha* sp. occurring in dense stands in disturbed areas. Some *Melaleuca lateritia* occurs at the Joondalup North wetland, and *M. preissiana*, a species

uncharacteristic of the Spearwood system, occurs to the south of the wetland (Arnold, 1990).

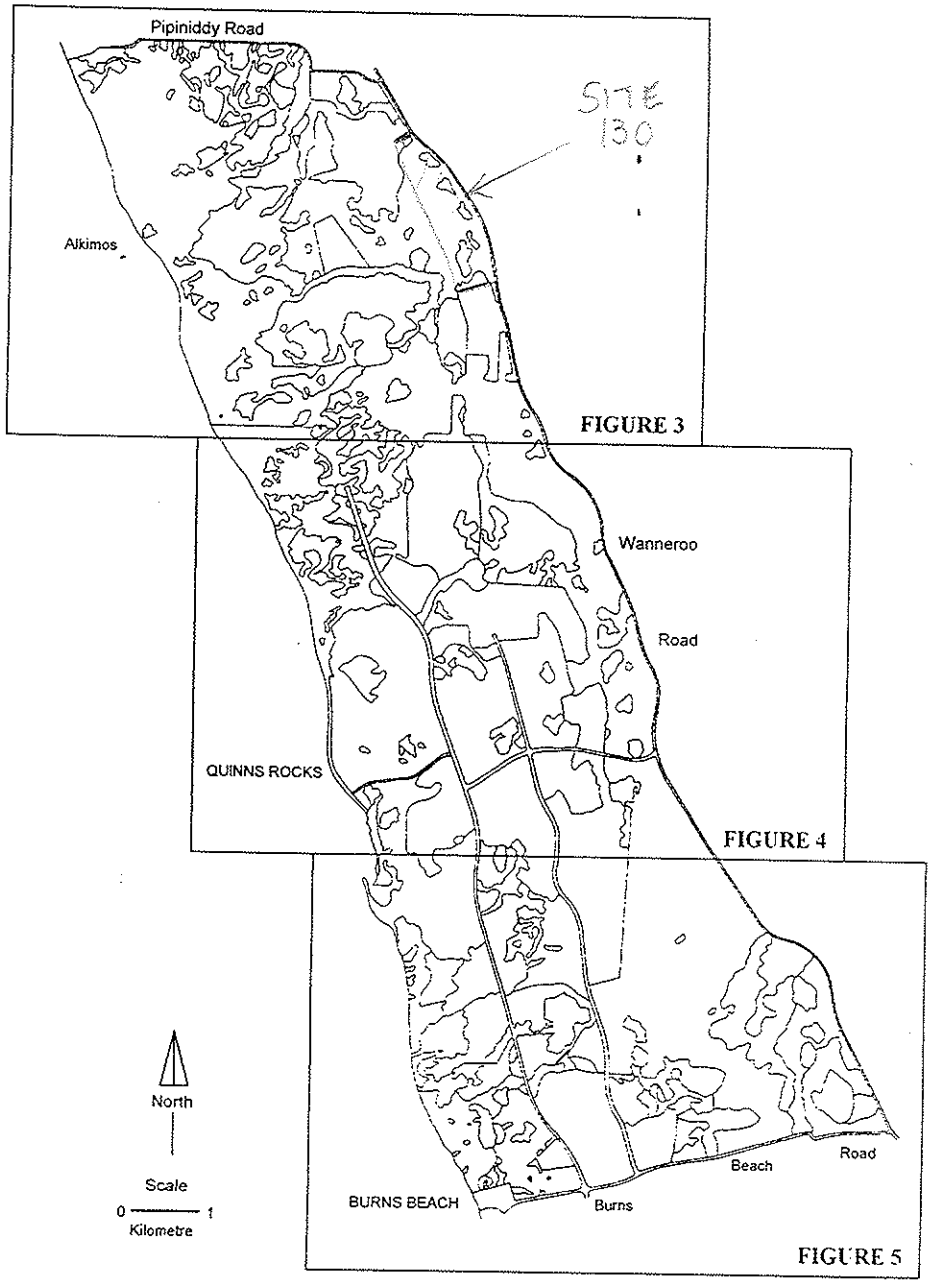


Figure 2. Legend showing layout of vegetation map coverage

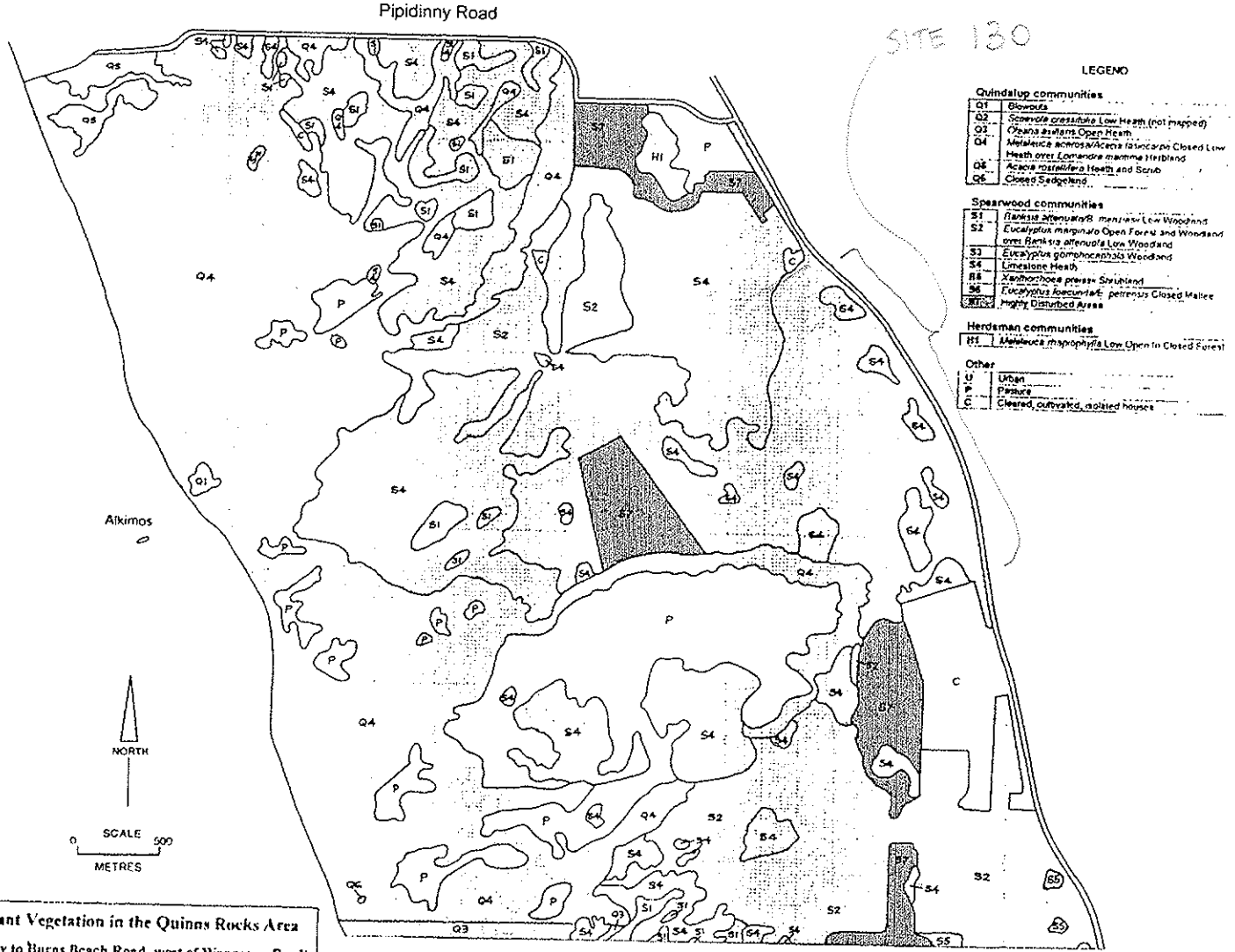


Figure 3. Remnant Vegetation in the Quinns Rocks Area
(Pipidinny to Burns Beach Road, west of Wanneroo Road)
- Northern Section

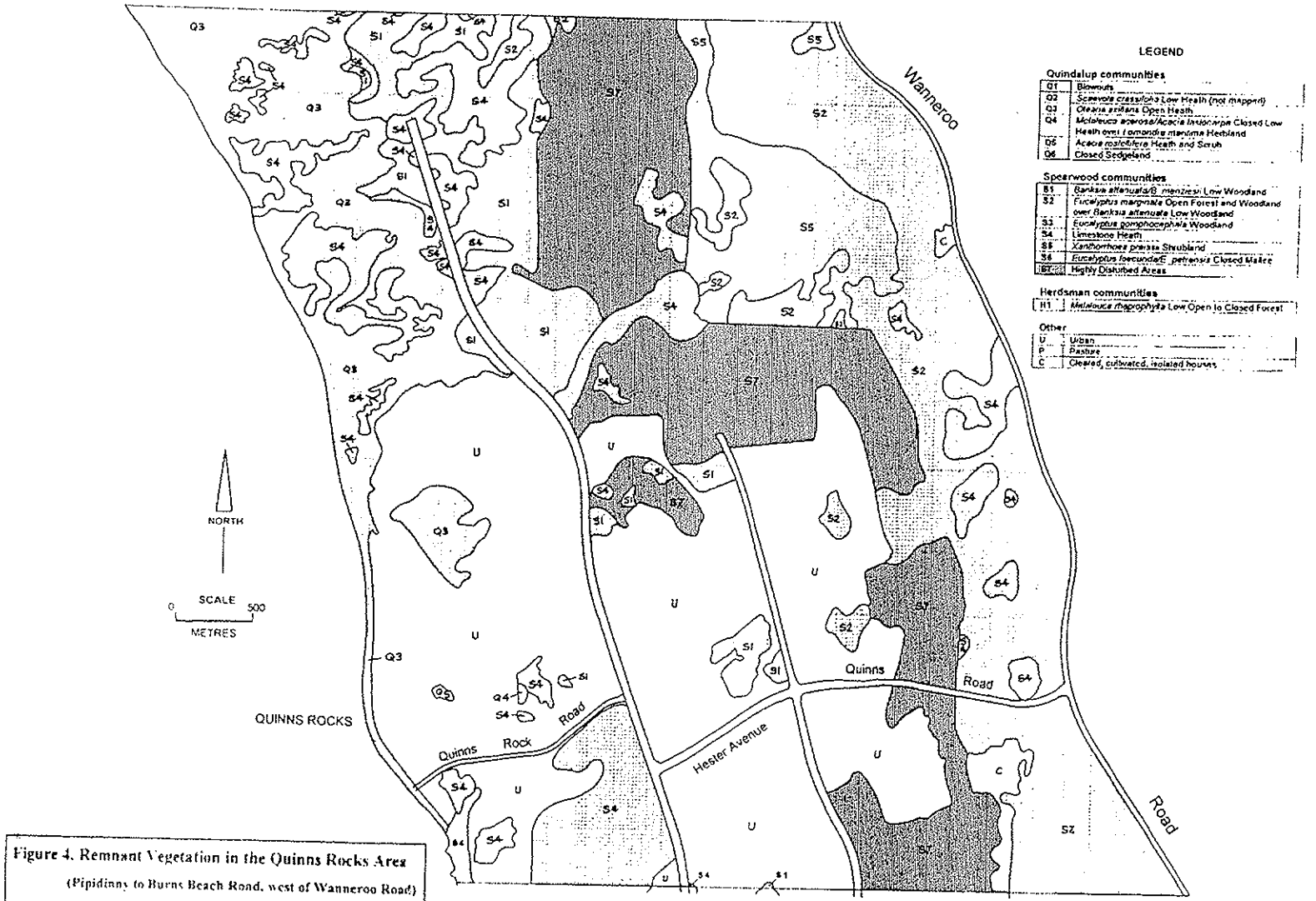


Figure 4. Remnant Vegetation in the Quinns Rocks Area
(Pipidinny to Burns Beach Road, west of Wanneroo Road)
- Central Section

7. FLORA DESCRIPTION

7.1 General description

A total of 473 species representing 255 genera and 77 families of vascular plants were recorded. Introduced (weed) species total 89. A flora list is given in Appendix 3.

The most species rich families are Proteaceae (29 natives), Myrtaceae (27 natives), Asteraceae (27 native and 12 weed species), Cyperaceae (25 natives), Orchidaceae (25 natives), Papilionaceae (23 natives, 12 weeds), Epacridaceae (16 natives), and Poaceae (15 natives, 22 weeds).

Families with the most weed species are Poaceae (22 species), Asteraceae (12), and Papilionaceae (12).

7.2 Significant Taxa

7.2.1 Declared Rare and Priority Taxa

At least one species of Declared Rare Flora (DRF) and five priority (poorly known) species listed by Atkins (1996), occur in the study area. DRF have special protection under the *Wildlife Conservation Act 1950* and cannot be harvested, injured in any way, or destroyed without written permission from the Minister for CALM. Priority (P) species are taxa that are poorly known and require further survey to determine their conservation status, or are rare but not threatened and require monitoring.

Eucalyptus argutifolia (Myrtaceae) - DRF
Small stands of this rare mallee species occur at the southern end of its range in the study area. It extends north only as far as Seabird (Keighery, 1992).

Gyrostemon ramulosus (Gyrostemonaceae)

This small tree is widespread in drier parts of Australia but it is uncommon in the Metropolitan Region and Perth is the southern end of its range on the Swan Coastal Plain (Powell, 1990).

Conostylis teretifolia subsp. *planescens* (Haemodoraceae)

This uncommon *Banksia* Woodland species is at the southern end of its range in the study area (Trudgen & Keighery, 1990).

Hemiandra pungens (Lamiaceae)

A dune form of this widespread species found in the study area, only occurs from Wanneroo to Seabird (Keighery et al., 1996).

Baeckea robusta (Myrtaceae)

The southern end of this species' range is close to the study area (Gibson et al., 1994).

Leptospermum spinescens (Myrtaceae)

This shrub is at the southern end of its coastal range at Perth. Outside the Perth Region its leaves are often shorter and broader (Marchant et al., 1987).

Melaleuca cardiophylla (Myrtaceae)

Low dense shrublands of this species are not well conserved on the Swan Coastal Plain (Keighery, 1992), and the southern end of its range is at Bold Park (Gibson et al., 1994).

Jacksonia stricta (Papilionaceae)

This near coastal shrub it at the southern end of its range in or close to the study area. It extends north to Eneabba (Marchant et al., 1987).

Nemcia reticulata (Papilionaceae)

The coastal form of this species extends from the study area (Burns Beach) to Northampton and is not known in any conservation reserves south of Nambung (Gibson et al., 1994).

Billardiera variifolia (Pittosporaceae)

This twining shrub occurs only occasionally on the Swan Coastal Plain and the northern end of its range is close to the study area (Marchant et al., 1987).

Persoonia comata (Proteaceae)

This is at the southern end of its range in the north of the study area (Trudgen & Keighery, 1990).

Petrophile aff. *brevifolia* (Proteaceae)

This undescribed species occurs only on the Swan Coastal Plain (Trudgen & Keighery, 1990).

Petrophile aff. *serruriae* (Proteaceae)

An undescribed species of the Swan Coastal Plain between Perth and Geraldton (Trudgen & Keighery, 1990).

Veronica aff. *calycina* (Scrophulariaceae)

This Quindalup dune species is known only from Alkimos and Yalgorup. Its favoured habitat type has mostly been degraded by grazing or cleared, and consequently it is uncommon and may be rare. It is probably *V. stolonifera* described from Fremantle (Gibson et al., 1994).

Stylidium aff. *repens* (Stylidiaceae)

The southern most locality of this undescribed species occurs near the coast in the north of the study area (Trudgen & Keighery, 1990).

Pimelea rosea (Thymelaeaceae)

This shrub occurs near the coast (Marchant et al., 1987), and is at the northern end of its range close to the study area at Lake Pinjar (Gibson et al., 1994).

confusing

8. CONSERVATION SIGNIFICANCE

8.1 The values of remnant vegetation

The values attached to remnant vegetation, or bushland, are many.

The conservation value of bushland lies in the need to conserve representative samples of all species and communities both common and rare, and to preserve natural processes that maintain the biosphere in which we live. Such processes are outline in the State Planning Strategy Discussion Paper on Environmental Issues (in Keighery & Gray, 1993). These include maintaining water cycles, regulating climate, protecting soil, nutrient cycling, regulating insect populations, providing renewable resources, protecting species and genetic diversity, and providing habitat for pollinators of agricultural crops.

All bushland has an intrinsic value. Whether species are common or rare, they are part of the unique and diverse flora of Western Australia which is part of our heritage. The aesthetic values of bushland provide us with a source of artistic inspiration and a sense of place and of well-being. Bushland also provides places for active and passive recreation.

Bushland is an educational resource enabling students to observe and understand how organisms function and how natural processes work and contribute to our own survival. There is still many aspects of our natural environment to be studied and documented. Remnant bushland provides an opportunity to increase our scientific knowledge at all levels of study and gain a greater understanding of how to manage our natural resources for the benefit of present and future generations.

The economic value of bushland includes its' potential to attract tourists who come to see Western Australia's famous wildflowers. Other economic benefits are protection from land and water supply degradation associated with clearing native vegetation, and as a potential genetic resource for agricultural crops, the cut flower and nursery industries, or chemical compounds with medicinal or other industrial uses.

By conserving remnant bush, we are not only preserving biodiversity and natural processes (which also implies conserving fauna and their habitats, and geomorphological features and processes), but by default are also preserving all other values. Assessment of conservation value or significance will therefore will focus on the biological values of the vegetation.

8.2 Criteria for assessing conservation value

Criteria adopted here for assessing conservation value are similar to those used by other authors, such as Trudgen (1996). They are as follows:

1. The value of vegetation in a regional context.

This refers to where the remnant occurs in the overall distribution of the vegetation type, how it varies throughout its range and how well this variation is represented in reserves.

2. The potential for maintaining sustainable ecosystems.

This refers to the conditions required to allow ecosystem processes to continue functioning in the long-term in order to retain the integrity of the remnant. Factors to be considered include the size and shape of reserves, external influences, connectivity, duplication of reserves, and the condition of the vegetation.

3. The significance of flora present.

This refers to the diversity of flora, and the presence of Declared Rare Flora (DRF), Priority species (poorly known and geographically restricted taxa), species at their range ends, and isolated populations of species.

8.3 Assessment of conservation value

The map of remnant vegetation in the study area (Figure 6) shows relatively large areas on both the Quindalup and Spearwood systems remaining.

8.3.1 Value of vegetation in a regional context

8.3.1.1 Extent, variation and reservation of the Quindalup system

The Quindalup system extends from Dongara to Geographe Bay. Semeniuk et al. (1989), Griffin (1993), and Griffin & Trudgen (1994) discuss the reservation status of the Quindalup system and draw the same conclusion: that the variation within the system is inadequately represented in reserves between Lancelin and Whitfords. The narrow coastal reserves of the sector in the Perth Metropolitan Area, only preserves the seaward parts of the system.

Given that very little of the Quindalup system is reserved in this sector, and that the entire width of the system is still largely intact in the study area, the remnant vegetation has a very significant conservation value.

Karli Spring is currently under review by CALM as a possible "Critically Endangered Ecological Community" (Val English, CALM, pers. comm.).

8.3.1.2 Extent, variation and reservation of the Spearwood system

The variation found within the Quindalup system is also likely to occur in the Spearwood system (Trudgen, 1996). The diverse flora of this system was once extensive and escaped clearing because the poor sandy soils were little use for agriculture. However as urbanisation expands plant communities, such as *Banksia* Woodlands, are fast disappearing (Keighery & Gray, 1993).

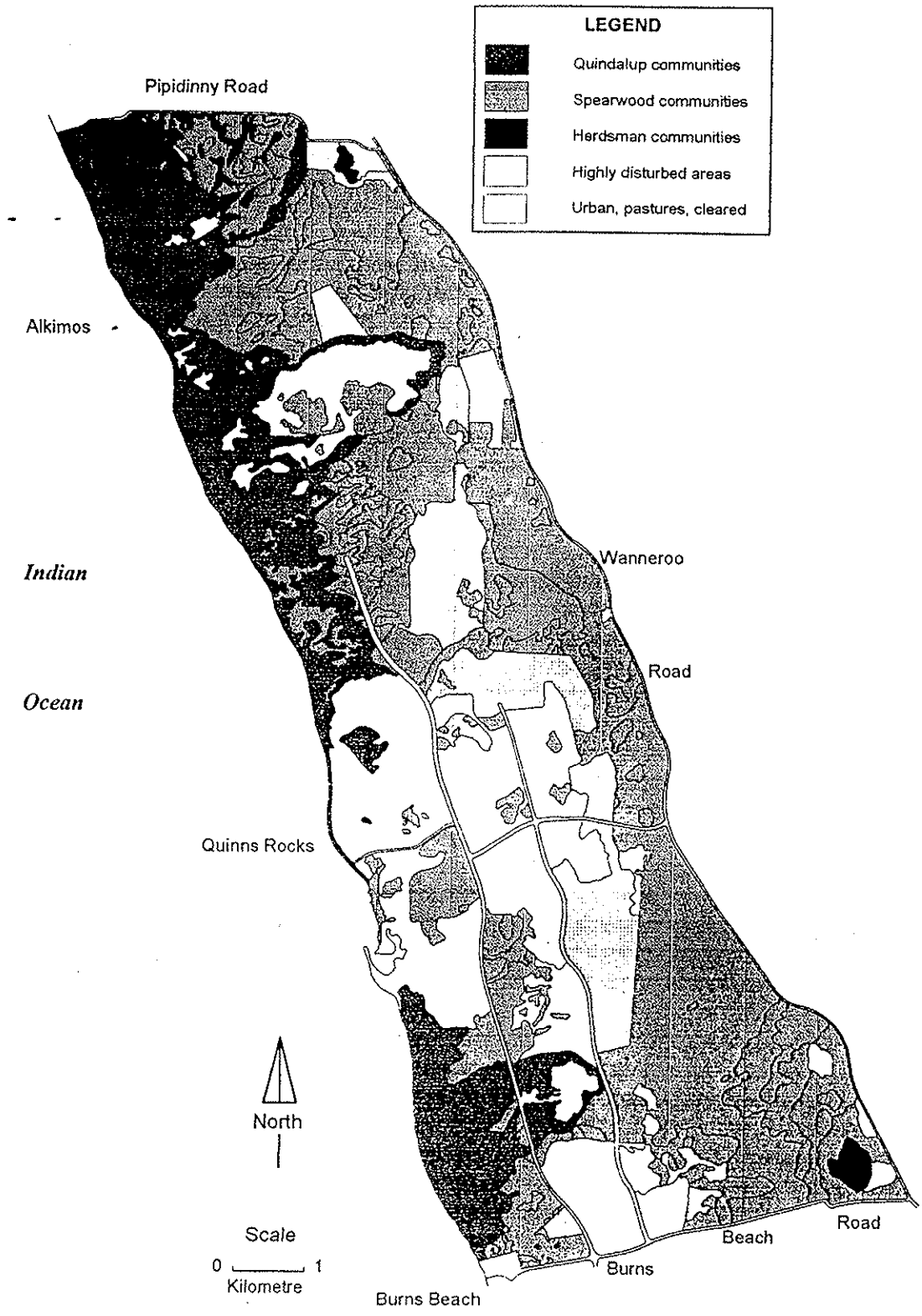


Figure 6. Remnant vegetation in the Quinns Rocks Area
(Pipidinny to Burns Beach Road, west of Wanneroo Road)

With only 20-30% of the original area of Cottesloe – Central and South remaining (the largest portion being north of the Swan River), and only 8% represented in reserves (Trudgen, 1996), the section found in the study area has a very significant conservation value.

This view is supported by Keighery et al. (1996, p.81) in a study of the floristics of Neerabup National Park. They conclude that the Park is a "... very significant regional conservation area" due in part to its "... relatively large areas of the regional floristic community types typical of the Spearwood Dunes."

8.3.1.3 Extent and reservation of the Herdsman unit

Trudgen (1996) estimates that only 20-30% of this unit is extant in the Perth Metropolitan Area, and of the original distribution only 5-10% is represented in reserves. Both wetlands in the study area therefore have significant conservation value because of the high level of clearing of this unit despite being in only poor to good condition. The Joondalup North wetland in the south-east has particularly significant value because it occurs in a transition zone between Cottesloe – Central and South and Karrakatta – Central and South vegetation complexes. It is subject to the Environmental Protection (Swan Coastal Plain Lakes) Policy (Hill et al., 1996).

8.3.1.4 Vegetation transitions and combination of vegetation complexes

The ecotones or transition areas between the Quindalup and Spearwood communities are also important for conservation, and in the study area they are well represented. Ecotones are often areas of greater diversity than within discrete communities. At the boundary, suites of species from each habitat may be found together with those that utilise both habitats, and those that thrive under conditions provided by the boundary (Smith, 1990).

Trudgen (1996) states that these transitions have significant conservation value, and the combined area increases the total value. Conserving interfaces also conserves the sequence of these systems (Griffin & Trudgen, 1994).

8.3.2 Potential for maintaining sustainable ecosystems

In assessing conservation value of an area, the potential for maintaining viable and sustainable ecosystems is an important factor. A review of the principles of reserve design for preserving long-term conservation values is useful in this assessment.

In an ideal situation reserves should be as large as possible with a minimum border length (Lunney & Recher, 1986). If reserves are compact in shape then the border/area ratio, and consequently external influences, are minimised. External influences include different physical conditions at the edge, such as levels of solar radiation, wind, water and nutrients, all of which can have a profound effect on the biota (Saunders et al., 1991). Other impacts on reserves with large borders, or on small reserves, particularly in urban areas, are vulnerability to weed infestation, frequent fires, invasion by feral animals, and increased accessibility and disturbance by human activity (Lunney & Recher, 1986). These factors lead to a cycle of disturbance, which in turn leads to degradation of the natural values of the reserve.

Other design principles include providing connections or corridors of natural habitat between reserves to facilitate the movement of flora propagules and fauna. The capacity for movement aids in preservation of species and genetic diversity. If connection is not possible, movement is more likely between closely clustered reserves than between those that are isolated by large tracts of land devoid of native vegetation (Lunney & Recher, 1986).

Reserves should also be duplicated so that outbreaks of disease or natural catastrophes in one reserve do not lead to extinction of species which are dependent on specific habitats (Lunney & Recher, 1986).

The condition of reserves is also important. If they are in good condition initially they are more likely to retain integrity in the long-term.

While it is unlikely that an ideal situation will ever exist (particularly in areas close to urban centres which historically have been subject to some form of disturbance, such as is the case in the study area), these principles are still useful in assessing conservation value and in reserve design.

Substantial areas of remnant vegetation with minimum border length/area ratios, and which are in very good condition (according to Trudgen, 1996), exist in the study area. The largest area is in the northern section, north of Quinns Rocks (see Figure 6). Although there are sections of highly disturbed, pasture, and cleared land, the remnant vegetation is interconnected in this area. It also links to Neerabup National Park in the south and east of the study area.

Other substantial, well-shaped areas in very good condition (Trudgen, 1996) are the Quindalup and Spearwood communities west of Marmion Avenue in the southern section, and the southern part of Neerabup National Park and proposed additions (see Figures 5 and 6). These two areas are linked by the land surrounding the Tamala Park landfill site which is in poor to good condition (Trudgen, 1996), and which was recommended for reservation in the System 6 report (EPA, 1983). The value of this connection is reduced to some degree by Marmion Avenue and Connolly Drive (two fairly major roads which dissect it north-south).

The smaller remnants in the central, urban areas of Quinns Rocks, Mindarie and Merriwa are in good to very good condition (Trudgen, 1996). The clustered nature of these remnants and their close proximity to larger remnants helps facilitate some exchange of biota, which consequently helps protect their long-term viability.

The Herdsman unit wetlands and Karli Spring are also relatively small but they adjoin larger remnants, and the former act as links to remnants outside the study area.

The highly disturbed sections of the study area are concentrated along the western boundary of Neerabup National Park. These areas can have a negative impact on adjoining bush by providing a source of weeds. However the scattered native trees and shrubs, while they cannot be described as remnant vegetation, still have some value as a part of the natural landscape (Keighery & Gray, 1993) and can provide important habitats. Tuart (*Eucalyptus gomphocephala*), the largest tree of the coastal plain, is particularly important as "one of the most biologically valuable trees of Perth" (Powell, 1990). Hollows are used by nesting birds and other fauna, virtually every part of the tree is utilised by insects which are also a food source for larger fauna, the bark shelters lizards, and large fungi growing on the trunk are in turn inhabited by thousands of insects.

The study area is also linked to adjoining bushland. In the north it is linked or closely connected, to bushland at Eglinton and to Yanchep National Park. In the east it has some linkage to a north-south chain of wetlands and remnant bushland east of Wanneroo Road. In the south-east Neerabup National Park and surrounding bushland (proposed for addition to the Park), is connected to Yellagonga Regional Park by the Joondalup North wetland. In the south-west bushland forms a continuum with that at Iluka and with the coastal reserve. These linkages, despite some dissection by roads of various widths, may well contribute to the long-term preservation of conservation values of the study area and it's surrounding bushland and wetlands.

This assessment has not considered proposed land uses. Development is planned for much of the study area, including large parts of what is remnant vegetation (DPUD, 1992). The conservation values described here would be affected by such development and should be considered in land use planning for the area.

8.3.3 Significance of flora

No definitive assessment can be made of flora diversity in the study area due to the limitations of this study in compiling the flora list. However some general comments can

be made based on previous studies. Trudgen (1996, p.46) described the flora of the City of Wanneroo as "diverse". Keighery et al. (1996, p.81) recognised that the Spearwood dunes have a "diverse flora". Griffin (1993) found species richness in the Quindalup dunes relatively low but this was in comparison to the particularly rich kwongan flora.

The presence of one species of Declared Rare Flora, six Priority species, and at least twenty-three other significant taxa, attests to the area's conservation significance. It is not only these taxa that add to the conservation significance of the area, but also locally common species that do not occur, or are not common elsewhere. Trudgen & Keighery (1990) give the examples of *Lomandra maritima* and *Pimelea ferruginea* which only occur on the Quindalup dunes: if communities found on this inadequately reserved complex are not protected, common species such as these may also become rare.

Gibson et al. can be used to consider species richness ie diversity associated with lack of floristic surveys

9. DISCUSSION AND CONCLUSION

The study area has large remnants of native vegetation on the Quindalup and Spearwood systems, and many of these are in good to very good condition. The vegetation communities and flora found in the study area are inadequately represented in reserves, as outlined in the previous section. An opportunity exists here to preserve conservation values in the long-term by the addition of significant areas to the conservation estate.

The area has high conservation value, and this view is supported by other authors:

- "the Alkimos area and adjoining uncleared areas have considerable conservation value for flora, vegetation and geomorphological types" (Trudgen & Keighery, 1990, p.45);
- The area between Burns Beach and Mindarie has "... a mixture of very important and important areas for conservation of vegetation with lesser, but still significant value for flora" (Griffin & Trudgen, 1994, p.1-2);
- "Neerabup National Park is a very significant regional conservation area ..." (Keighery et al., 1996, p.81);
- The entire area has "significant", "high" or "very high" conservation value (Trudgen, 1996).

Many remnants in the study area clearly fulfills the Western Australian Government's Urban Bushland Strategy definition of regionally significant bushland (see Appendix 4), and others have high local significance.

The presence of many poorly known species highlights the fact that, despite the study area being readily accessible in terms of distance from our main urban centre, there is still much we don't know about its flora. Gibson et al. (1994, p.1) found "... significant gaps in our knowledge of the distribution of flora and floristic communities ..." of the Swan Coastal Plain. With the gradual encroachment of urban development in the study area, "Availability of such knowledge is vital if conservation of our unique flora and plant

communities is to be integrated with urban and industrial growth" (Gibson et al., 1994, p.1). Scarce complex plant communities cannot be restored once land is cleared for development – they are gone forever (Keighery & Gray, 1993).

Fragmentation of bushland into small reserves does not ensure long-term preservation of conservation values. A comparative study between a section of the coastal reserve in the study area surrounded by large tracts of relatively undisturbed bushland, and a section of coastal reserve surrounded by long established urban development at City Beach, showed dramatic differences. The undisturbed reserve had a statistically significant higher diversity and significantly lower weed cover that the urban reserve (Robinson, 1995).

Only by conserving large areas of remnant vegetation can we hope to gain a better knowledge of our vegetation and flora, and preserve them for future generations.

REFERENCES

Arnold, J. *Perth Wetlands Resource Book.* Bulletin 266. Environmental Protection Authority and the Water Authority of Western Australia.

Atkins, KJ. (1996) *Declared Rare and Priority List for Western Australia.* Department of Conservation and Land Management, WA.

Bennett, EM. (1988) *The Bushland Plants of Kings Park, Western Australia.*

Churchward, HM & McArthur, WM. (1980) Landforms and soils of the Darling System, Western Australia. In: *Atlas of Natural Resources, Darling System, Western Australia.* Department of Conservation and Environment, Western Australia.

Department of Land Administration. (1987) *Australia 1:25,000 Topographic Survey, Sheets: Yanchep 2034-IV NE; Yanchep 2034-IV SE; and Muchea 2034-I SW (Edition 1 LAWA – Series R812).* Department of Land Administration, Perth.

Department of Planning and Urban Development. (1992) *North West Corridor Structure Plan.* Department of Planning and Urban Development, Perth.

Environmental Protection Authority. (1983) *Conservation Reserves for Western Australia as recommended by the Environmental Protection Authority – 1983. The Darling System – System 6. Part II: Recommendations for Specific Localities. Report 13.* Department of Conservation and Environment, Western Australia.

Gibson, N, Keighery, BJ, Keighery, GJ, Burbidge, AH & Lyons, MN. (1994) *A Floristic survey of the southern Swan Coastal Plain.* Unpublished Report for the Australian Heritage Commission prepared by Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).

Government of Western Australia. (1995) *Urban Bushland Strategy. Final.* Ministry for Planning, Perth.

Griffin, EA. (1993) *Flora of the Quindalup Dunes between the Swan and Irwin Rivers, Western Australia.* Unpublished Report to Coastal Planning Branch, Department of Planning and Urban Development and the Heritage Council of WA.

Griffin, EA & Trudgen, M. (1994) *Variation in the floristic composition of the vegetation growing on the Holocene dunes between Whitfords and Lancelin, south-western Australia, and recommendations for reservation to conserve the variation present.* Prepared for Bowman Bishaw Gorham, Environmental Management Consultants, Perth.

Halpern Glick Maunsell. (1995) *Public Environmental Review for Proposed Residential Development of the Western Cell, Lot 2 Burns Beach.* Burns Beach Property Trust, Perth.

Hames Sharley Australia. (1992) *Coastal Planning Study, Burns Beach to Jindalee. Summary Report.* Department of Planning and Urban Development and the City of Wanneroo, Perth.

Heddle, EM, Loneragan, OW and Havel, JJ. (1980) Vegetation Complexes of the Darling System, Western Australia. In: *Atlas of Natural Resources, Darling System, Western Australia.* Department of Conservation and Environment, Western Australia.

Hill, AL, Semeniuk, CA, Semeniuk, V & Del Marco, A. (1996) *Wetlands of the Swan Coastal Plain. Volume 2b. Wetland Mapping, Classification and Evaluation, Wetland Atlas.* Water and Rivers Commission and Department of Environmental Protection, Western Australia.

Keighery, GJ. (1991) *Flora and vegetation of the Mindarie Cusp Area.* Report to DPUD, North-West Corridor Environmental Audit.

Keighery, GJ. (1992) *Significant Species of Flora of the Coastal Belt (Quindalup and Spearwood Systems) of the Swan Coastal Plain.* Department of Conservation and Land Management, WA.

Keighery, GJ & Keighery, BJ. (1992) Plant Communities of the Northern Swan Coastal Plain – with special reference to uncommon and potentially rare plant communities. In: *Bushland in Our Backyard. Proceedings of a workshop held by the Wildflower Society of Western Australia.* Eds. Gibson, N & Keighery, BJ. Wildflower Society of WA, Perth.

Keighery, BJ & Gray, CM. (1993) *Towards an Urban Bushland Policy for The National Trust of Australia (WA). A Discussion Paper.* National Trust of Australia (WA), Perth.

Keighery, BJ. (1994) *Bushland Plant Survey. A Guide to Plant Community Survey for the Community.* Wildflower Society of WA, Perth.

Keighery, BJ, Keighery, GJ, and Gibson, N. (1996) Floristics of Neerabup National Park. In: *Floristics of Reserves and Bushland Areas of the Perth Region (System 6). Parts XI – XV.* Wildflower Society of WA, Perth.

Kinhill Stearns. (1983) *Proposed Refuse Disposal Facility at Mindarie. Environmental Review and Management Programme.* City of Perth, City of Stirling and Shire of Wanneroo.

LeProvost Environmental Consultants. (1990) *Eglinton Beach Resort Public Environmental Review. Volume 1 of 2.* Eglinton Resort Development Pty Ltd.

Lunney, D & Recher, HF. (1986) The Living Landscape: An Ecological View of National Parks and Nature Conservation. In: *A Natural Legacy. Ecology in Australia.* Second Edition. Eds.: HF Recher, D Lunney & I Dunn. Pergamon Press, Sydney.

Marchant, NG, Wheeler, JR, Rye, BL, Bennett, EM, Lander, NS, and Macfarlane, TD. (1987) *Flora of the Perth Region.* Western Australian Herbarium, Department of Agriculture, WA.

Mattiske, EM & Associates. (1990) *Botanical studies in Neerabup National Park (A^27575) and Water Supply Reserve (^34537, 9538).* Prepared for Water Authority of Western Australia.

McArthur, WM & Bartle, GA. (1980) *Landforms and Soils as an Aid to Urban Planning in the Perth Metropolitan Northwest Corridor, Western Australia.* Land Resources Management Series No. 5, CSIRO, Australia.

Powell, R. (1990) *Leaf and Branch. Trees and Tall Shrubs of Perth.* Department of Conservation and Land Management, Perth.

Powell, R & Emberson, J. (1996) *Growing Locals. Gardening with Local Plants in Perth.* Western Australian Naturalists' Club (Inc.), Perth.

Rippey, E & Rowland, B. (1995) *Plants of the Perth Coast and Islands.* University of Western Australia Press, Perth.

Robinson, N. (1995) *A survey of the flora and vegetation of coastal reserves north of Quinns Rocks, Western Australia.* Unpublished dissertation.

Saunders, DA, Hobbs, RJ & Margules, CR. (1991) Biological Consequences of Ecosystem Fragmentation: A Review. *Conservation Biology, 5(1)* : 18-32

Semeniuk, V, Cresswell, ID & Wurm, PAS. (1989) The Quindalup Dunes: the regional system, physical framework and vegetation habitats. *Journal of the Royal Society of Western Australia, V 71, Parts 2 & 3* : 23-47.

Smith, RL. (1990) *Ecology and Field Biology.* Fourth Edition. Harper and Row, New York.

Trudgen, M & Keighery, BJ. (1990) *A Report on the Flora and Vegetation of the Alkimos area and Conservation Issues affecting it.* Prepared for LandCorp, Perth.

Trudgen, M. (1996) *An assessment of the conservation values of the remnant vegetation in the City of Wanneroo with recommendations for appropriate reserves for the City.* Report for the City of Wanneroo.

APPENDIX 1 - VEGETATION CONDITION SCALE

The scale follows that of the Ministry for Planning's Perth Environment Project, as used by Trudgen (1996).

Description	Very Poor	Poor	Good	Very Good
High level disturbance	> 50%	25-50%	< 25%	0
Low level disturbance	> 75%	50-75%	25-50%	< 25%
Species recruitment	absent	local	general	general
Population structure	senescent	senescent	good	good
Vertical strata	> 75% lost	25-75% lost	< 25% lost	intact
Community diversity	> 75% lost	25-75% lost	< 25% lost	intact

APPENDIX 2 - VEGETATION STRUCTURAL CLASSIFICATION

The vegetation structural classification system in the table below follows Keighery (1994).

	Canopy Cover (percentage)			
Life form /Height class	100 - 70	70 - 30	30 - 10	10 - 2
Trees over 30m	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland
Trees 10-30m	Closed Forest	Open Forest	Woodland	Open Woodland
Trees under 10m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Tree Mallee	Closed Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Shrub Mallee	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs over 2m	Closed Tall Scrub	Tall Open Scrub	Tall Shrubland	Tall Open Shrubland
Shrubs 1-2m	Closed Heath	Open Heath	Shrubland	Open Shrubland
Shrubs under 1m	Closed Low Heath	Open Low Heath	Low Shrubland	Low Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

APPENDIX 3 - FLORA LIST

The following list is compiled from previous flora surveys in various parts of the study area. These surveys are Keighery (1991) and species recorded are denoted by 'K', Trudgen & Keighery (1990) denoted by 'TK', Robinson (1995) denoted by 'R', Mattiske (1990) denoted by 'M', Keighery, Keighery & Gibson (1996) denoted by 'KG', and Arnold (1990) denoted by 'A'.

'K', 'TK' and 'R' are surveys from the western section of the study area, while 'M', 'KG' and 'A' are from the eastern section.

Common names are taken from Powel & Emberson (199), Marchant et al. (1987), Bennett (1988), and Rippey & Rowland (1995).

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
AIZOACEAE							
* Carpobrotus edulis	Pigface; Hottentot Fig	+	+	+	+	+	
Carpobrotus virescens	Native Pigface	+	+	+			
Carpobrotus modestus						+	
* Tetragonia decumbens		+	+	+			
AMARANTHACEAE							
Ptilotus drumondii	Narrow Leaf Mulla Mulla					+	
Ptilotus manglesii	Pom-Poms	+			+	+	
Ptilotus polystachyus	Prince Of Wales Feathers	+	+			+	
Ptilotus stirlingii	Stirling's Mulla Mulla		+			+	
ANTHERICACEAE							
Caesia micrantha	Pale Grass Lily	+				+	
Chamaescilla corymbosa	Blue Squill					+	
Corynotheca micrantha	Sand Lily	+	+			+	
Dichopogon capillipes		+			+	+	
Laxmannia sessiliflora ssp. australis	Nodding Lily		+				
Sowerbaea laxiflora	Purple Tassels		+		+	+	
Thysanotus arenarius		+	+			+	
Thysanotus manglesianus	Fringed Lily					+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
Thysanotus multiflorus	Many-Flowered Fringe Lily					+	
Thysanotus patersonii	Twining Fringe Lily	+	+	+	+	+	
Thysanotus sparteus						+	
Thysanotus triandrus			+				
Tricoryne elatior	Yellow Autumn Lily	+	+	+		+	
APIACEAE							
Daucus glochidiatus	Native Carrot	+	+	+		+	
Eryngium pinnatifidum	Blue Devils				+	+	
Homalosciadum homalocarpum			+			+	
Hydrocotyle blepharocarpa						+	
Hydrocotyle callicarpa	Small Pennywort					+	
Hydrocotyle diantha				+		+	
Hydrocotyle hispidula						+	
Trachymene coerulea	Blue Lace Flower	+				+	
Trachymene pilosa	Small Lace Flower	+	+	+	+	+	
Xanthosia huegelii		+	+			+	
ASPARAGACEAE							
* Myrsiphyllum asparagoides						+	
ASPHODELACEAE							
* Asphodelus fistulosus	Wild Onion; Onion Weed			+			
* Trachyandra divaricata		+	+	+			
ASTERACEAE							
Actites megalocarpa		+					
* Arctotheca calendula	Capeweed			+	+	+	
* Arctotheca populifolia	Dune Arctotheca; Dune Cabbage	+					
Asteridea pulverulenta	Common Bristle Daisy					+	
Brachyscome iberidifolia	Swan River Daisy				+	+	
* Carduus pycnocephalus						+	
* Centaurea melitensis	Maltese Cockspur					+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
* Cirsium vulgare						+	
* Conyza albida	Tall Fleabane	+				+	
Euchiton sphaericus			+			+	
* Hedypnois rhagadioloides	Cretan Weed					+	
Hyalosperma cotula					+	+	
* Hypochaeris glabra	Flat Weed	+	+	+	+	+	
Lagenifera huegelii	Coarse Lagenifera	+	+			+	
Lagenifera sp. Should not be listed, would be ours					+		
Leptorhyncuos scabrus			+				
Leucophyta brownii				+			
Millotia myosotidifolia					+	+	
Millotia tenuifolia	Soft Millotia	+	+				
Olearia axillaris	Coast Daisy Bush	+	+	+	+	+	
Olearia rudis	Azure Daisy Bush	+	+			+	
Ozothamnus cordatus	Tangle Daisy	+	+	+	+	+	
Podolepis canescens	Bright Podolepis		+				
Podolepis gracilis	Slender Podolepis	+	+		+	+	
Podolepis lessonii					+		
Podotheca angustifolia	Sticky Longheads	+	+			+	
Podotheca chrysantha	Yellow Podotheca					+	
Podotheca gnaphalioides	Golden Long Heads		+				
Pterochaeta paniculata						+	
Quinetia urvillei		+	+			+	
Rhodanthe citrina						+	
Senecia lautus	Coastal Groundsel	+	+	+		+	
Siloxerus humifusus	Siloxerus	+	+			+	
* Sonchus asper				+	+	+	
Sonchus hydrophilus	Native Sowthistle					+	
* Sonchus oleraceus	Common Sowthistle			+		+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
* Urospermum picroides	False Hawkbit					+	
* Ursinia anthemoides	Ursinia	+	+		+	+	
Waitzia suaveolens	Fragrant Waitzia	+	+		+	+	
BRASSICACEAE							
* Brassica barrelieri subsp. oxyrrhina	Smooth-Stem Turnip			+			
* Brassica tournefortii	Mediterranean Turnip					+	
* Cakile maritima	Sea Rocket	+	+	+			
* Heliophila pusilla		+	+	+		+	
Lepidium pseudohyssopifolium						+	
Lepidium rotundum	Veined Peppercress					+	
* Raphanus raphanistrum	Wild Radish					+	
Stenopetalum gracile						+	
CAMPANULACEAE							
* Wahlenbergia capensis	Cape Bluebell		+			+	
Wahlenbergia preissii						+	
CARYOPHYLLACEAE							
* Cerastium glomeratum	Mouse Ear Chickweed	+		+		+	
* Minuartia mediterranea						+	
* Petrorhagia velutina	Velvet Pink		+			+	
* Petrorhagia sp.					+		
* Sagina apetala	Annual Pearlwort					+	
* Silene gallica	French Catchfly	+		+		+	
CASUARINACEAE							
Allocasuarina fraseriana	Common Sheok	+	+		+	+	
Allocasuarina humilis	Dwarf Sheok	+	+		+	+	
Allocasuarina lehmanniana	Dune Sheok	+	+				
Casuarina obesa	Salt Sheok		+				
CENTROLEPIDACEAE							
Centrolepis aristata	Pointed Centrolepis			+		+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
Centrolepis drummondiana		+				+	
CHENOPODIACEAE							
Atriplex cinerea	Grey Saltbush	+					
Halosarcia indica ssp. bidens				+			
Rhagodia baccata	Berry Saltbush	+	+	+	+	+	
Salsola kali	Prickly Saltbush	+					
Threlkeldia diffusa	Wallaby Saltbush	+	+	+			
COLCHICACEAE							
Burchardia congesta		+	+		+	+	
Wurmbea monantha						+	
CONVOLVULACEAE							
Dichondra repens	Kidney Weed					+	
CRASSULACEAE							
Crassula colorata	Dense Stonecrop	+	+	+		+	
Crassula exserta		+	+				
* Crassula glomerata		+	+	+			
Crassula pedicellosa						+	
CUSCUTACEAE							
* Cuscuta epithymum	Lesser Dodder					+	
CYPERACEAE							
Carex preissii		+				+	
Cyatochaeta avenacea Not likely, should be checked prob. misid.					+		
Isolepis cernua	Nodding Club-Rush		+			+	
Isolepis cyperoides						+	
Isolepis marginata	Coarse Club-Rush			+		+	
Isolepis nodosa	Knotted Club-Rush	+	+	+	+	+	
Lepidosperma costale			+				
Lepidosperma gladiatum	Sword Sedge	+	+	+			
Lepidosperma leptostachyum						+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
Lepidosperma longditudinale	Pithy Sword-Sedge	+					
Lepidosperma scabrum			+				
Lepidosperma squamatum		+	+	+	+	+	
Lepidosperma tenue					+		
Lepidosperma 'coastal terete' (BJK & NG 231)						+	
Mesomelaena pseudostygia					+	+	
Mesomelaena stygia	Telegraph Sedge	+	+				
Schoenus brevisetis						+	
Schoenus clandestinus		+	+			+	
Schoenus curvifolius		+	+			+	
Schoenus discifer						+	
Schoenus grandiflorus	Large Flowered Bog-Rush	+	+			+	
Schoenus lanatus	Woolly Bog-Rush					+	
Schoenus latitans					+		
Schoenus subbarbatus	Bearded Bog-Rush		+				
Tetraria octandra					+	+	
DASYPOGONACEAE							
Acanthocarpus preissii	Prickle Lily	+	+	+	+	+	
Calectasia cyanea	Blue Tinsel Lily					+	
Dasypogon bromeliifolius	Pinapple Bush					+	
Lomandra caespitosa	Tufted Mat-Rush	+	+			+	
Lomandra hermaphrodita					+	+	
Lomandra maritima	Coast Mat-Rush	+	+	+		+	
Lomandra preissii		+				+	
Lomandra sericea	Silky Mat-Rush					+	
Lomandra sonderi					+		
Lomandra suavocolens		+	+			+	
DILLENIACEAE							
Hibbertia aurea						+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
Hibbertia hypericoides	Common Buttercups	+	+		+	+	
Hibbertia racemosa	Stalked Guinea-Flower	+	+	+	+	+	
Hibbertia spicata ssp. leptotheca		+	+			+	
Hibbertia subvaginata						+	
DROSERACEAE							
Drosera erythrorhiza	Red-Ink Sundew				+	+	
Drosera glandulifera	Pimpernel Sundew					+	
Drosera macrantha	Bridal Rainbow					+	
Drosera menziesii subsp. penicillaris	Pink Rainbow					+	
Drosera pallida	Pale Sundew		+			+	
Drosera stolonifera	Leafy Sundew					+	
Drosera sp. (climbing)					+		
EPACRIDACEAE							
Acrotriche cordata	Coast Ground-Berry	+	+	+			
Andersonia lehmanniana						+	
Astroloma ciliatum	Moss-Leaved Cranberry					+	
Astroloma microcalyx	Native Cranberry					+	
Astroloma pallidum	Kick Cranberry	+	+		+	+	
Conostephium pendulum	Pearl-Flower	+	+		+	+	
Conostephium preissii		+					
Leucopogon australis	Spiked Beard-Heath					+	
Leucopogon insularis			+				
Leucopogon aff. nutans (GJK 11159)	Nodding Beard-Heath					+	
Leucopogon parviflorus		+	+	+	+	+	
Leucopogon polymorphus			+			+	
Leucopogon aff. polymorphus			+				
Leucopogon propinquus		+	+	+	+	+	
Leucopogon sprengeloides		+				+	
Lysinema ciliatum	Curry Flower					+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
EUPHORBIACEAE							
Adriana quadripartita	Bitter Bush	+	+				
* Euphorbia peplus	Pretty Spurge					+	
* Euphorbia terracina	Geraldton Carnation Weed; False Caper	+				+	
Phyllanthus calycinus	Phyllanthus; False Boronia	+	+	+	+	+	
Poranthera microphylla	Small Microphylla					+	
Ricinocarpus glaucus	Wedding Bush		+			+	
FUMARIACEAE							
* Fumaria capreolata	Whiteflower Fumitory					+	
FRANKENIACEAE							
Frankenia pauciflora	Seaheath			+			
GENTIANACEAE							
* Centaurium erythraea	Common Centaury		+			+	
GERANIACEAE							
* Erodium cicutarium	Common Crowfoot; Common Storksbill			+		+	
* Geranium molle	Dove's Foot Cranesbill				+	+	
Geranium retrorsum				+		+	
Geranium solanderi	Native Geranium		+				
Pelargonium australe						+	
* Pelargonium capitatum	Rose Pelargonium	+	+	+	+	+	
Pelargonium littorale			+			+	
GOODENIACEAE							
Lechenaultia linarioides	Fountain Leschenaultia	+	+	+	+	+	
Scaevola canescens	Grey Flower		+			+	
Scaevola crassifolia	Thick-Leaved Fanflower	+	+	+			
Scaevola nitida	Shining Fanflower		+				
Scaevola paludosa			+				
Scaevola repens var. repens						+	
Scaevola thesioides	Rats' Tails		+			+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
Verreauxia reinwardtii			+				
GYROSTEMONACEAE							
Gyrostemon ramulosus	Corkybark					+	
Tersonia cyathifolia	Button Runner	+				+	
HAEMODORACEAE							
Anigozanthos humilis	Cats Paw		+		+	+	
Anigozanthos manglesii	Kangaroo Paw		+			+	
Conostylis aculeata	Spring Cottonheads	+	+	+	+	+	
Conostylis aculeata x candicans						+	
Conostylis candicans	Grey Cottonheads	+	+	+	+	+	
Conostylis pauciflora ssp. euryhipis	Dawesville Cottonheads		+				
Conostylis setigera	Bristly Cottonheads					+	
Conostylis stylidioides		+					
Conostylis teretifolia subsp. planescens			+				
Haemodorum laxum			+			+	
Haemodorum paniculatum	Mardja	+	+		+	+	
Haemodorum spicatum	Mardja	+	+			+	
Phlebocarya ciliata						+	
HALORAGACEAE							
Glischrocaryon aureum	Common Popflower					+	
IRIDACEAE							
* Gladiolus caryophyllaceus	Wild Gladiolus		+		+	+	
* Homeria flaccida	One Leaf Cape Tulip	+			+	+	
Orthrosanthos laxus	Morning Iris		+			+	
Patersonia occidentalis	Purple Flag				+	+	
* Romulea rosea	Guildford Grass	+	+	+		+	
* Sparaxis bulbifera	Harlequin Flower					+	
JUNCACEAE							
Luzula meridionalis	Field Woodrush	+					

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
JUNCAGINACEAE							
Triglochin calcitrapum	Spurred Arrowgrass					+	
Triglochin centrocarpum	Dwarf Arrowgrass					+	
Triglochin trichophorum						+	
LAMIACEAE							
Hemiandra pungens	Snake Bush	+	+	+		+	
LAURACEAE							
Cassytha flava	Dodder-Laurel	+	+	+		+	
Cassytha glabella	Tangled Dodder-Laurel	+				+	
Cassytha racemosa	Dodder-Laurel	+	+			+	
LOBELIACEAE							
Isotoma hypocrateriformis	Woodbridge Poison		+			+	
Lobelia gibbosa	Tall Lobelia					+	
Lobelia tenuior	Slender Lobelia		+			+	
LOGANIACEAE							
Logania vaginalis		+				+	
LORANTHACEAE							
Amyema miquelii	Stalked Mistletoe; Broad-Leaved Mistletoe					+	
Nuytsia floribunda	Christmas Tree		+			+	
MALVACEAE							
Alyogyne huegelii	Lilac Hybiscus	+				+	
MIMOSACEAE							
Acacia cochlearis	Rigid Wattle	+	+	+	+	+	
Acacia cyclops	Red-Eyed Wattle	+	+	+		+	
Acacia huegelii		+	+			+	
Acacia lasiocarpa	Dune Moses	+	+	+		+	
Acacia pulchella	Prickly Moses	+	+		+	+	
Acacia rostellifera	Summer-Scented Wattle	+	+	+	+	+	
Acacia rostellifera x saligna			+				

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
Acacia saligna	Coojong; Golden-Wreath Wattle	+	+	+	+	+	
Acacia truncata		+	+	+		+	
Acacia willdenowiana	Grass Wattle					+	
MYOPORACEAE							
Eremophila glabra	Tarbush	+		+		+	
Myoporum insulare	Boobialla	+	+	+			
MYRTACEAE							
Baeckea robusta						+	
Calothamnus quadrifidus	One-Sided Bottlebrush	+	+		+	+	
Calothamnus sanguineus	Pindak; Silky-Leaved Blood-Flower				+	+	
Calytrix angulata	Yellow Starflower		+				
Calytrix flavescens	Summer Starflower					+	
Corymbia calophylla					+	+	
Eremaea asterocarpa subsp. asterocarpa	Star-Fruited Eremaea					+	
Eremaea pauciflora	Orange-Flowered Eremaea		+			+	
Eucalyptus argutifolia	Yanchep Mallee	+					
Eucalyptus decipiens	Limestone Marlock		+			+	
Eucalyptus foecunda	Fremantle Mallee	+				+	
Eucalyptus gomphocephala	Tuart	+	+		+	+	
Eucalyptus marginata	Jarrah		+		+	+	
Eucalyptus petrensis	Rock Mallee	+					
Eucalyptus rudis	Flooded Gum						+
Eucalyptus todtiana	Pricklybark		+			+	
Hypocalymma robustum	Pink Myrtle	+			+	+	
Leptospermum spinescens		+	+			+	
Melaleuca acerosa	Coast Honey-Myrtle	+	+	+	+	+	
Melaleuca cardiophylla	Tangling Honey-Myrtle	+	+	+			
Melaleuca huegelii	Chenille Honey-Myrtle	+	+	+	+	+	
Melaleuca lateritia							+

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
Melaleuca preissiana							+
Melaleuca rhaphiophylla	Freshwater Paperbark						+
Melaleuca trichophylla			+				
Scholtzia involucrata	Spiked Scholtzia					+	
Scholtzia laxiflora		+					
OLACACEAE							
Olax benthamiana	Olax	+		+		+	
ORCHIDACEAE							
Caladenia arenicola	Carousel Spider Orchid					+	
Caladenia flava	Cowslip Orchid			+		+	
Caladenia georgei	Tuart Spider Orchid					+	
Caladenia latifolia	Pink Fairy Orchid	+		+		+	
Caladenia longicauda subsp. calcigena ms	White Spider Orchid					+	
Caladenia reptans	Little Pink Fairy Orchid					+	
Cyanicula gemmata	Blue China Orchid					+	
Cyrtostylis reniformis ms						+	
Diuris corymbosa	Common Donkey Orchid					+	
Elythranthera brunonis	Purple Enamel Orchid					+	
Eriochilus dilatatus	White Bunny Orchid					+	
Leporella fimbriata	Hare Orchid					+	
Leptoceras menziesii	Rabbit Orchid					+	
Microtis media	Common Mignonette Orchid		+	+			
Prasophyllum fimbria	Fringed Leek Orchid					+	
Prasophyllum parvifolium	Autumn Leek Orchid					+	
Pterostylis aspera	Brown-Veined Shell Orchid					+	
Pterostylis brevisepala						+	
Pterostylis pyramidalis	Tall Snail Orchid					+	
Pterostylis recurva	Jug Orchid					+	
Pterostylis sanguinea	Dark Banded Greenhood					+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
Pterostylis vittata	Banded Greenhood				+	+	
Pyrorchis nigricans	Red Beaks	+				+	
Thelymitra campanulata	Shirt Orchid					+	
Thelymitra sp.					+		
OROBANCHACEAE							
* Orobanche minor	Lesser Broomrape	+		+	+	+	
OXALIDACEAE							
Oxalis perennans						+	
* Oxalis pes-caprae	Soursos					+	
PAPILIONACEAE							
Bossiaea eriocarpa	Common Brown Pea	+	+		+	+	
Daviesia decurrens	Winged Bitter-Pea	+			+	+	
Daviesia divaricata	Marno	+				+	
Daviesia nudiflora		+			+	+	
Daviesia triflora		+			+	+	
Gompholobium aristatum	Yellow Pea	+				+	
Gompholobium knightianum						+	
Gompholobium marginatum						+	
Gompholobium tomentosum	Hairy Yellow Pea		+	+	+	+	
Hardenbergia comptoniana	Hardenbergia; Native Wisteria	+	+	+	+	+	
Hovea pungens	Devil's Pins					+	
Hovea trisperma	Common Hovea	+	+		+	+	
Isotropis cuneifolia	Granny's Bonned; Common Lamb-Poison	+	+			+	
Jacksonia furcellata			+			+	
Jacksonia sericea	Waldjumi	+			+	+	
Jacksonia sternbergiana			+		+	+	
Jacksonia stricta			+	+		+	
Kennedia prostrata	Running Postman	+	+	+	+	+	
* Lupinus cosentinii	Sandplain Lupin			+		+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
* Lupinus sp.					+		
* Medicago polymorpha	Burr Medic		+				
* Medicago sp.					+		
* Meliotis indica	King Island Melitot; Hexham Scent		+				
Mirbelia trichcalyx						+	
Nemcia capitata	Bacon-And-Eggs				+	+	
Nemcia reticulata		+	+	+		+	
* Ornithopus compressus	Yellow Serradella					+	
Sphaerolobium medium						+	
Templetonia retusa	Cockie's Tongue	+	+	+		+	
* Trifolium arvense	Hare's Foot Clover					+	
* Trifolium campestre	Hop Clover		+			+	
* Trifolium cernuum	Drooping Flower Clover					+	
* Trifolium glomeratum	Cluster Clover					+	
* Trifolium scabrum	Rough Clover					+	
* Vicia sativa	Common Vetch					+	
PHORMIACEAE							
Dianella revoluta	Flax Lily	+	+	+	+	+	
PHYTOLACCACEAE							
* Phytolacca octandra	Pink Ink Plant; Inkweed					+	
PITTOSPORACEAE							
Billardiera variifolia						+	
PLANTAGINACEAE							
Plantago exilis						+	
POACEAE							
* Agropyron racemosum		+	+				
* Aira caryophyllea	Silvery Hairgrass	+				+	
* Aira cupaniana			+				
* Ammophila arenaria	Marram Grass		+				

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
Amphipogon turbinatus							
* Avena barbata	Bearded Oat; One-Sided Oat	+	+		+	+	
* Avena fatua	Wild Oats	+				+	
* Briza maxima	Blowfly Grass		+				
* Briza minor	Shivery Grass	+	+		+	+	
* Bromus diandrus	Great Brome		+		+	+	
* Bromus madritensis	Madrid Brome	+	+	+	+	+	
* Bromus rubens		+			+		
* Cynodon dactylon	Couch				+		
Danthonia acerosa						+	
Danthonia caespitosa	Common Wallaby-Grass		+				
Danthonia occidentalis		+	+		+		
* Desmazeria rigida			+			+	
Dichelachne crinata	Plumegrass		+			+	
* Ehrharta calycina	Perennial Veldtgrass				+	+	
* Ehrharta longiflora			+		+	+	
* Holcus setiger		+	+	+		+	
* Lagurus ovatus	Hare's Tail Grass				+	+	
* Lolium perenne	Perennial Ryegrass	+		+		+	
* Lolium rigidum	Annual Ryegrass			+			
Microlaena stipoides	Weeping Grass	+				+	
Neurachne alopecuroidea	Foxtail Mulga-Grass					+	
* Pentaschistis airoides		+				+	
Poa drummondiana	Shaking Grass					+	
Poa porphyroclados		+	+	+		+	
Spinifex hirsutus	Satin-Leaved Spinifex	+	+	+		+	
Spinifex longifolius	Long-Leaved Spinifex	+	+				
Sporobolus virginicus	Salt Couch	+	+	+			
Stipa compressa		+		+			
		+	+	+		+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
Stipa elegantissima	Feather Grass					+	
Stipa flavescens	Tall Speargrass	+	+			+	
* Vulpia bromoides	Squirrel Tail Fescue					+	
* Vulpia myuros	Rat's Tail Fescue				+	+	
POLYGALACEAE							
Comesperma calymega	Blue-Spike Milkwort	+	+			+	
Comesperma confertum						+	
Comesperma integerrimum		+	+				
Comesperma volubile			+				
POLYGONACEAE							
Muehlenbeckia adpressa						+	
PORTULACCACEAE							
Calandrinia brevipedata	Short-Stalked Purslane					+	
Calandrinia corrigioloides	Strap Purslane	+				+	
Calandrinia liniflora	Parakeelya		+	+		+	
PRIMULACEAE							
* Anagallis arvensis	Pimpernel	+	+	+		+	
PROTEACEAE							
Adenanthos cygorum	Woolly Bush					+	
Banksia attenuata	Candle Banksia	+	+		+	+	
Banksia grandis	Bull Banksia		+		+	+	
Banksia ilicifolia	Holly-Leaf Banksia	+					+
Banksia littoralis	Swamp Banksia						
Banksia menziesii	Firewood Banksia	+	+		+	+	
Banksia prionotes	Saw-Tooth Banksia	+					
Conospermum triplinervum	Tree Smokebush	+	+			+	
Dryandra lindleyana		+	+	+	+	+	
Dryandra sessilis	Parrotbush	+	+	+	+	+	
Grevillea crithmifolia		+				+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
Grevillea preissii	Spider-Net Grevillea	+	+	+		+	
Grevillea vestita			+		+	+	
Hakea candolleana						+	
Hakea costata	Ribbed Hakea		+			+	
Hakea lissocarpha	Honey Bush	+	+	+	+	+	
Hakea prostrata	Harsh Hakea		+		+	+	
Hakea ruscifolia	Candle Hakea		+			+	
Hakea trifurcata	Two-Leaf Hakea	+	+		+	+	
Persoonia comata			+			+	
Persoonia saccata	Thread-Leaf Snottygobble				+	+	
Petrophile brevifolia		+	+		+	+	
Petrophile aff. brevifolia			+				
Petrophile linearis	Pixie Mops	+	+		+	+	
Petrophile macrostachya		+	+		+	+	
Petrophile serruriae		+	+		+	+	
Petrophile aff. serruiae			+				
Stirlingia latifolia	Blueboy	+	+		+	+	
Synaphea spinulosa						+	
RANUNCULACEAE							
Clematis linearifolia	Old Man's Beard; Small Leaved Clematis	+	+	+		+	
Ranunculus colonorum	Buttercup				+		
Ranunculus pumilio	Small-Flowered Buttercup					+	
RESTIONACEAE							
Alexgeorgia nitens		+	+			+	
Desmocladus flexuosus		+	+	+	+	+	
Hypolaena exsulca			+			+	
Loxocarya cinerea						+	
Loxocarya fasicularis		+		+			
Lyginia barbata		+	+		+	+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
RHAMNACEAE							
Cryptandra glabriflora						+	
Cryptandra mutila						+	
Cryptandra pungens			+			+	
Spyridium globulosum	Basket Bush	+	+	+		+	
Stenanthemum tridentatum		+	+			+	
Trymalium ledifolium		+	+	+		+	
Trymalium floribundum					+		
ROSACEAE							
* Acaena ?echinata	Sheep's Burr				+		
RUBIACEAE							
* Galium murale						+	
Opercularia vaginata	Dog Weed	+	+	+	+	+	
RUTACEAE							
Eriostemon spicatus	Pepper-And-Salt	+				+	
SANTALACEAE							
Exocarpus sparteus	Broom Ballart	+	+	+		+	
Leptomeria empetriformis		+				+	
Leptomeria priessiana				+		+	
Leptomeria spinosa	Spiny Currant Bush					+	
Santalum acuminatum	Quandong	+		+		+	
SAPINDACEAE							
Diplopeltis huegelii		+		+		+	
Dodonaea aptera			+			+	
SCROPHULARIACEAE							
* Bartsia trixago						+	
* Dischisma arenarium			+	+		+	
* Verbascum virgatum						+	
Veronica aff. calycina	Cup Speedwell		+				

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
SOLANACEAE							
Anthoceris littorea	Yellow Tailflower	+	+			+	
Anthoceris ilicifolia	Yellow Tailflower					+	
* Solanum nigrum	Black Berry Nightshade	+	+		+	+	
* Solanum linnaeanum		+	+			+	
STACKHOUSIACEAE							
Stackhousia monogyna			+			+	
Tripterococcus brunonis	Winged Stackhousia					+	
STERCULIACEAE							
Thomasia cognata		+	+			+	
Thomasia triphylla			+	+		+	
STYLIDIACEAE							
Levenhookia pusilla	Midget Stylewort					+	
Levenhookia stipitata	Common Stylewort		+			+	
Stylidium brunonianum	Pink Fountain Triggerplant		+		+	+	
Stylidium calcaratum	Book Triggerplant		+		+	+	
Stylidium diuroides	Donkey Triggerplant					+	
Stylidium junceum	Reed Triggerplant	+	+		+	+	
Stylidium maritima ms			+			+	
Stylidium macrocarpum	Flagon Triggerplant					+	
Stylidium piliferum	Common Butterfly Triggerplant		+			+	
Stylidium repens	Matted Triggerplant					+	
Stylidium aff. repens			+				
Stylidium schoenoides	Cow-Kicks				+	+	
THYMELAEACEAE							
Pimelea argentea		+			+	+	
Pimelea calcicola		+	+			+	
Pimelea ferruginea	Coast Banjine		+	+			
Pimelea rosea	Rose Banjine					+	

FAMILY/Taxon	Common Name	K	TK	R	M	KG	A
TYPHACEAE							
* Typha sp.							+
URTICACEAE							
Parietaria debilis	Native Pellitory		+	+		+	
VIOLACEAE							
Hybanthus calycinus	Native Violet		+	+	+	+	
XANTHORRHOEACEAE							
Xanthorrhoea preissii	Blackboy; Grasstree; Balga	+	+		+	+	
ZAMIACEAE							
Macrozamia riedlei	Zamia		+		+	+	

APPENDIX 4

DEFINITIONS OF REGIONALLY AND LOCALLY SIGNIFICANT

These definitions are from the Urban Bushland Strategy (Government of Western Australia, 1995.

REGIONALLY SIGNIFICANT	LOCALLY SIGNIFICANT
* Example of a regional vegetation type which is threatened or poorly reserved or a site with special value for flora or fauna conservation.	One of the better examples of a local vegetation type.
* Having considerable biodiversity or supports a population of Declared Rare Flora, priority listed flora, or threatened fauna.	Having biodiversity value but unlikely to include Declared Rare Flora. May include geographically significant species at the limit of their range.
* Vegetation in good condition or better. Threatened vegetation types may be regionally significant even if in poor condition.	Vegetation may be in poor condition but if poor, capable of regeneration.
* Usually greater than 20 hectares but may be smaller in the case of threatened or poorly reserved vegetation types, or areas with special significance for other purposes.	Ideally greater than 4 hectares but smaller areas may be of significance depending on how much remains in the locality.
Suitable for passive recreation by people from both within and beyond the locality.	Suitable for passive recreation by the local community.
Region wide use or potential for scientific or educational study.	Use or potential for use by local schools.
Having cultural heritage values of a regional or greater significance.	Having local heritage value.
Regular shape is desirable unless the area functions as a significant corridor linking other remnants.	Shape not critical but remnant should be capable of ongoing management.

* Essential criteria for bushland to be regarded as regionally significant.

MAIN ROADS
WESTERN AUSTRALIA

MITCHELL FREEWAY: ROMEO ROAD TO PERTH-LANCELIN ROAD

BIOLOGICAL ASSESSMENT

Draft Version 2.2

MARCH 1997

Prepared by

ecologi
ENVIRONMENTAL CON

SITES

130 /129

SITES
129/130