LYON ROAD BUSHLAND, BANJUP

Boundary Definition: bushland (taken to cadastre) boundary

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 492 **Area (ha):** bushland 25.0
Map no. 59 **Map sheet series ref. no.** 2033–1 SW
Other Names: draft *Perth's Bushplan* Submission no.s – 225, 417
Local Authorities (Suburb): City of Cockburn (Banjup)

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS
Bassendean Dunes
Bassendean Sands (Qpb: S8)
Bassendean Dunes/Pinjarra Plain
Bassendean Sands over Guildford Formation (Qpb/Qpa:S10)
Wetlands (within the Bassendean Dunes/Pinjarra Plain)
Holocene Swamp Deposits (Qhw: Ms5) (Qrw: Sp1)

VEGETATION AND FLORA
Vegetation Complexes
Bassendean Dunes
Bassendean Complex — Central and South
Floristic Community Types: *not sampled, types inferred
Supergroup 2: Seasonal Wetlands
*4 *Melaleuca preissiana* damplands
*5 Mixed shrub damplands
Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
*21a Central *Banksia attenuata – Eucalyptus marginata* woodlands
*21c Low–lying *Banksia attenuata* woodlands or shrublands
*23a Central *Banksia attenuata — B. menziesii* woodlands

WETLANDS
Wetland Types: dampland
Natural Wetland Groups
Bassendean Dunes
Jandakot (B.3)
Wetland Management Objectives: Conservation (11.1Ha)
Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES
Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated wetland, vegetated uplands (prominent north–south ridge)

Vegetation and Flora: limited survey (Keighery, BJ, and Clarke 2000a, Regeneration Technology Pty Ltd 1999, Tingay, Alan & Associates 1994, 1999)

Structural Units: mapping (Tingay, Alan & Associates 1994)
Uplands: *Eucalyptus marginata* Open Woodland over *Banksia attenuata* and *B. menziesii* Low Open Woodland to Low Closed Forest; *Eucalyptus todtiana* and *Banksia ilicifolia* Low Open Woodland to Low Closed Forest; *Banksia attenuata* and *B. ilicifolia menziesii* Low Open Woodland to Low Closed Forest
Wetlands: *Eucalyptus rudis* Tall Open Woodland; *Kunzea ericifolia* Closed Tall Scrub; *Melaleuca preissiana* Scattered to Low Woodland over Closed to Closed Low Heaths dominated by *Astartea* aff. *fascicularis*, *Hypocalymma angustifolia, Pericalymma ellipticum, Euchilopsis linearis* and *Calothamnus lateralis* and combinations of these; *Restio stenostachyus* Sedgeland.
Vegetation Condition: Excellent to Very Good (Keighery, BJ, and Clarke 2000a)
Total Flora: not known (estimated >200 native taxa, Keighery, BJ, and Clarke 2000a)
Significant Flora: *Anthotium junciforme* (4)

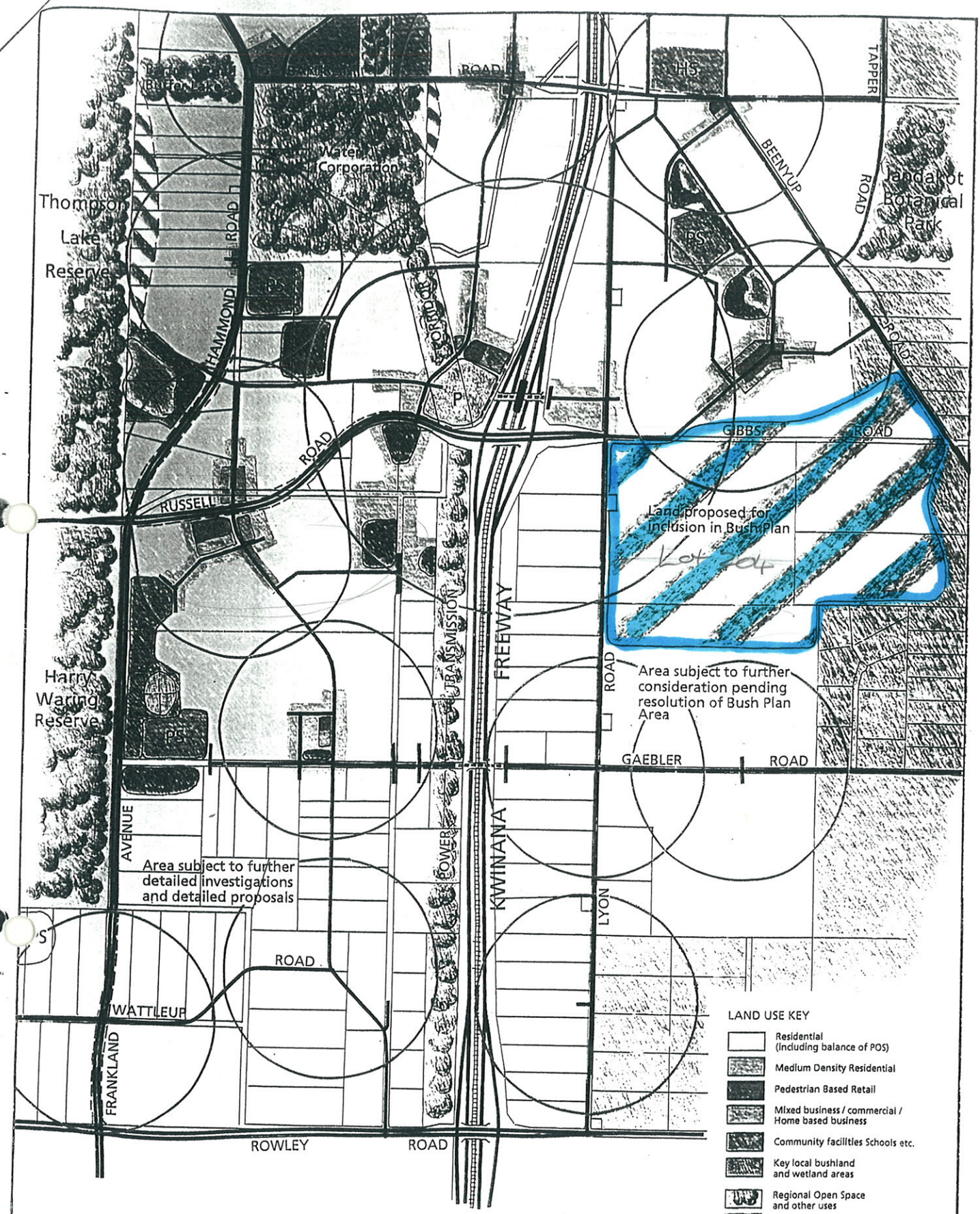
Total Flora: not known (estimated >200 native taxa, Keighery, BJ, and Clarke 2000a)
Significant Flora: *Anthotium junciforme* (4)
Fauna: Significant mammal species: Quenda (Keighery, BJ, and Clarke 2000a)
Linkage: adjacent bushland to the south, east and west; part of Greenway 120 (Tingay, Alan & Associates 1998a)
Other Special Attributes: Site Category One Area, Middle Canning Catchment Study (Evangelisti & Associates *et al.* 1995)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Directory of Important Wetlands in Australia (Regeneration Technology Pty Ltd 1999)

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Diversity, Rarity, General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation
Recommendation: Urban Negotiated Planning Solution (see Table 3, Volume 1).

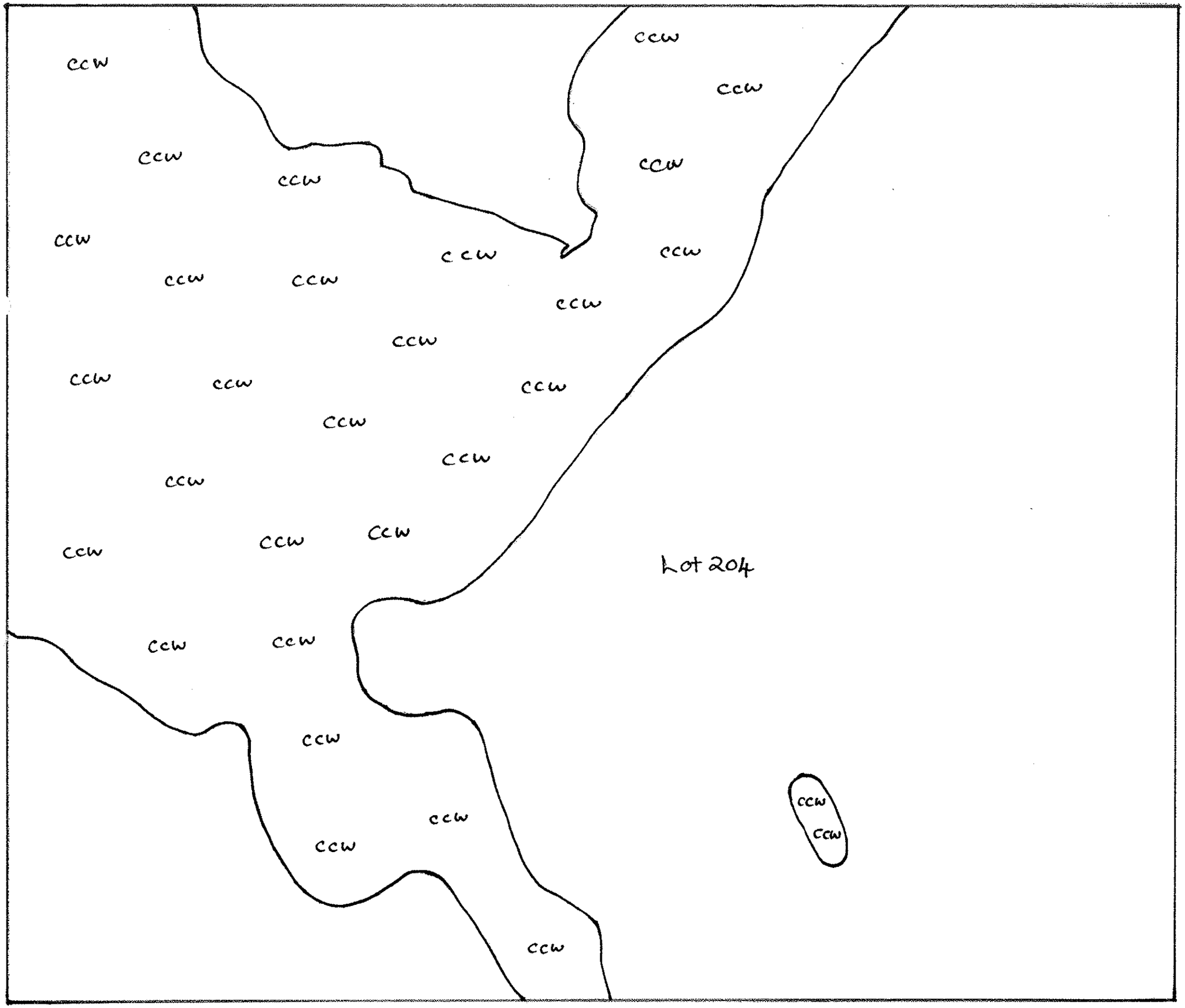


SOUTHERN SUBURBS DISTRICT STRUCTURE PLAN

DRAFT – JUNE 1999

City of Cockburn

Map 1: Bush For
Boundary for Con
Wetlands on Lot 204



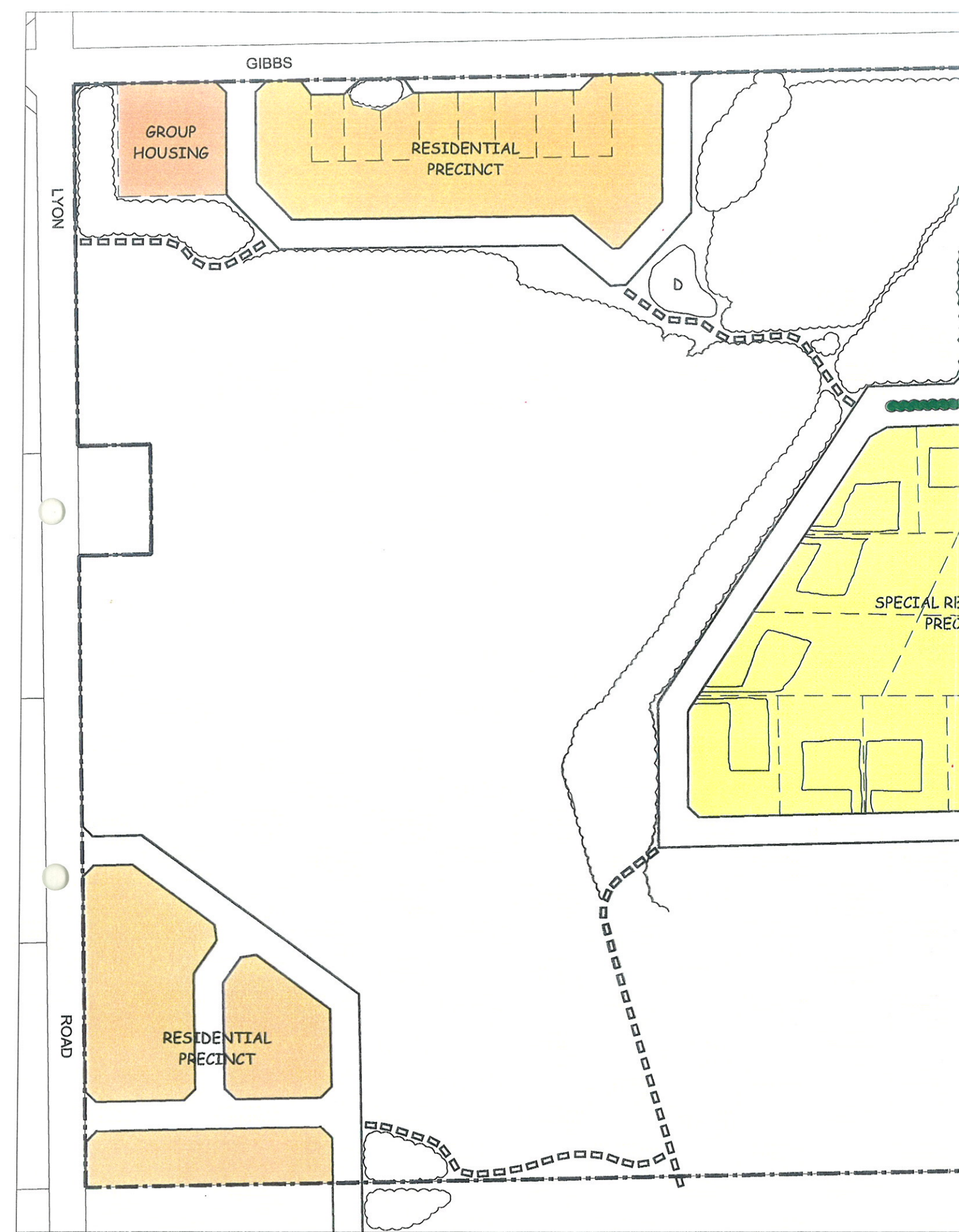
Lyon Road Bushland
City of Cockburn
Wetland Details

- Bushplan Sites (boundaries)
- Cadastre with Lot Numbers
- EPP Lakes Policy
- Conservation Category Wetlands - Boundaries
- Contours - 1m & 2m (WAWA)
- CONSERVATION
- SUSTAINABLE USE - MULTIPLE USE
- RESOURCE ENHANCEMENT

GIBBS RD
COFFEY RD
GAEBLER RD
BARFIELD RD
LYON RD

Map Ident:	plot991027_4
Prepared By:	Sean Collingwood
Prepared For:	SPC
Date:	27 Oct 1999
Scale	1:10000
0	250 m

MFP INTERNAL USE ONLY



City of Cockburn

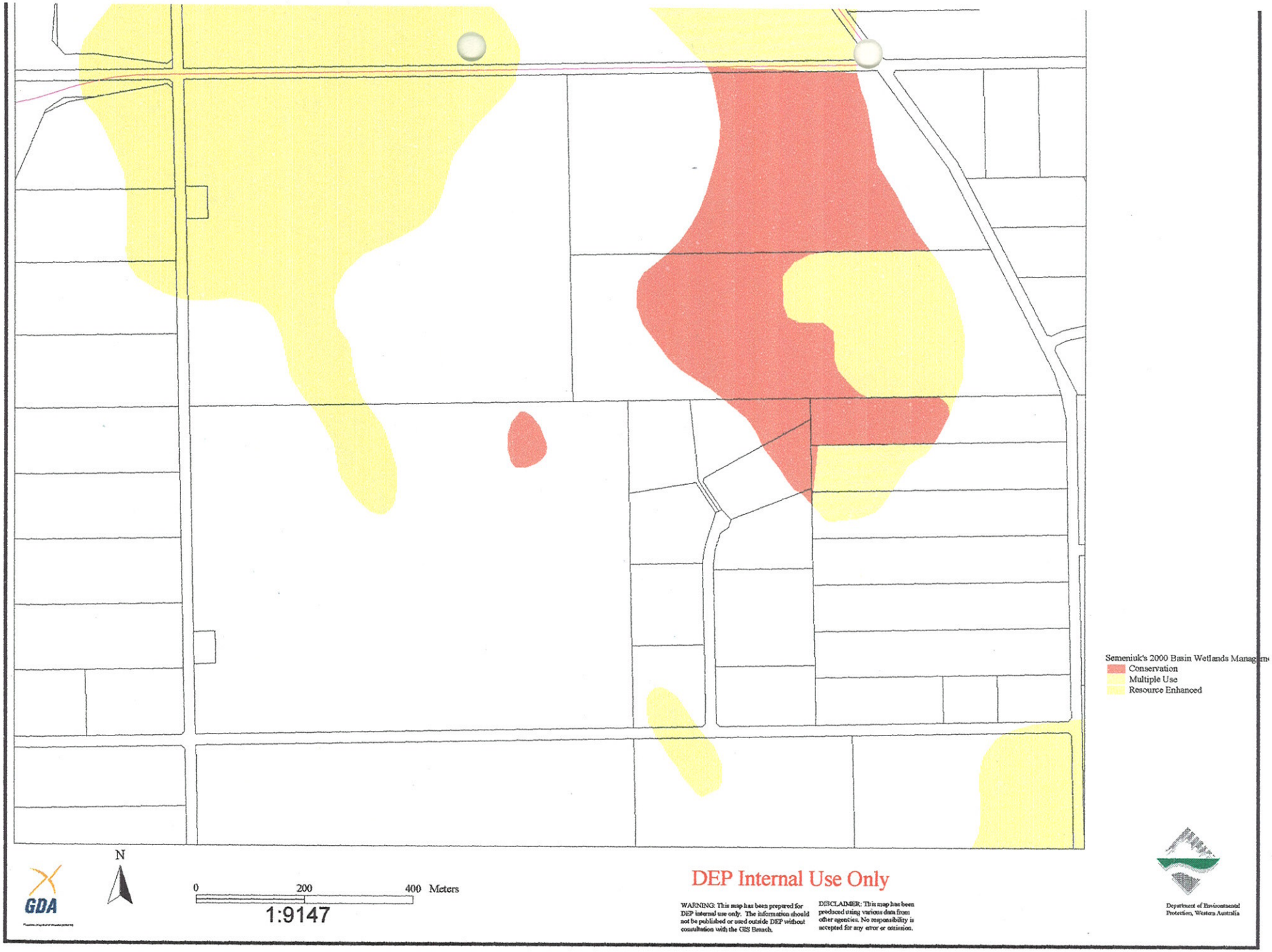
GNA 12/00

0 50m

SCALE 1:2500

ALTERNAT

JAA LOT 204, Pt


Semeniuk's 2000 Basin Wetlands Manag
Conservation
Multiple Use
Resource Enhanced
N
0
200
400 Meters
1:9147
GDA
DEP Internal Use Only
WARNING: This map has been prepared for DEP internal use only. The information should not be published or used outside DEP without consultation with the GIS Branch.
DISCLAIMER: This map has been produced using various data from other agencies. No responsibility is accepted for any error or omission.
Department of Environmental Protection, Western Australia

Lyon Road Bushland
City of Cockburn
Site Details

- Bushplan Sites (boundaries)
- Cadastre with Lot Numbers
- Bassendean Complex-Central And South
- EPP Lakes Policy
- PROPOSED GREENWAYS
- Conservation Category Wetlands - Boundaries
- Contours - 1m & 2m (WAWA)
- CALM Rare Flora

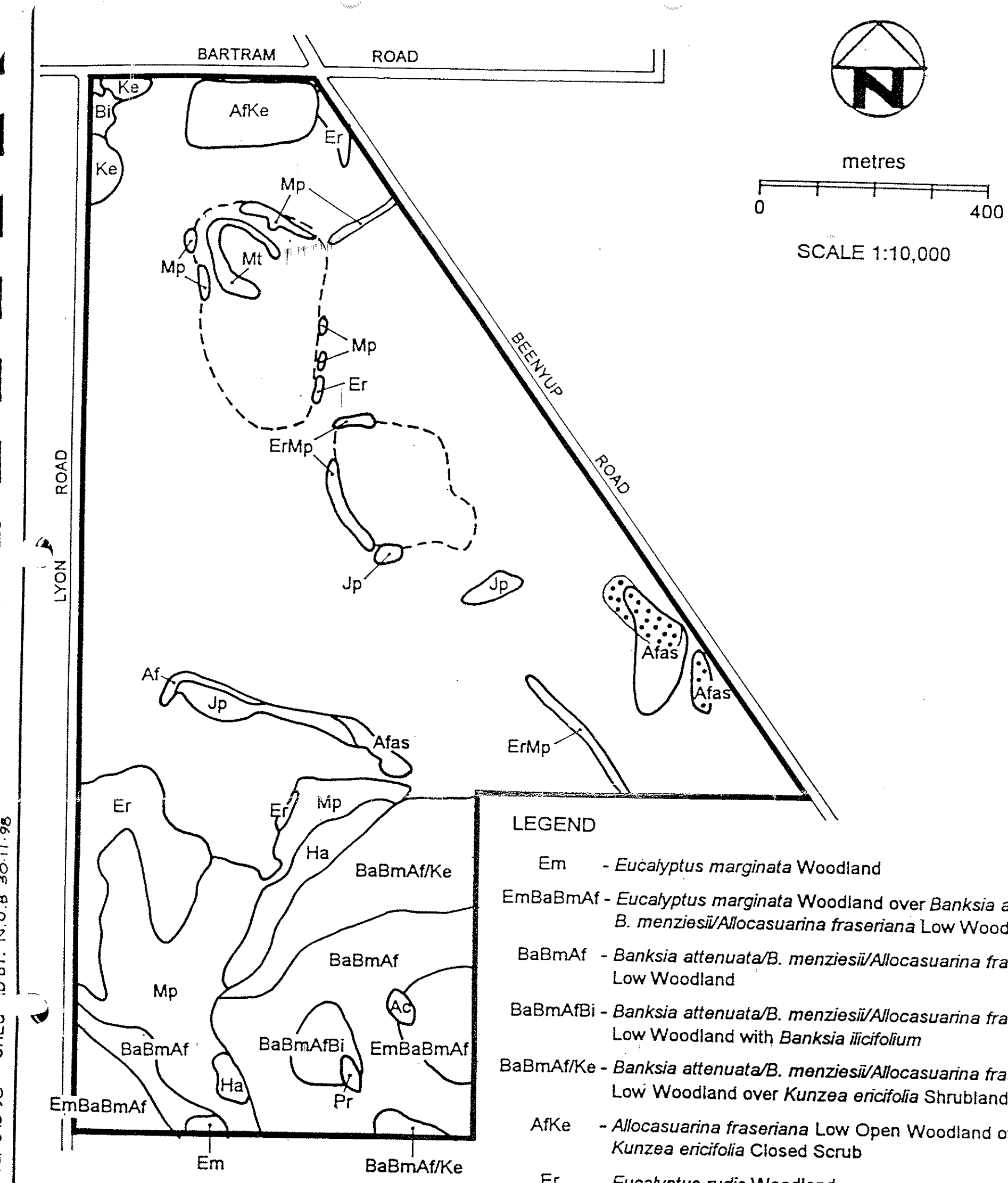
MAP4 - GREENWAYS
LINKAGES TO
LOT 204 LYON RD

Greenway 35

LYON RD

COFFEY RD

Map Ident: plot991027_3
Prepared By: Sean Collingwood
Prepared For: SPC
Date: 27 Oct 1999
Scale 1:10000
0 250 m
MFP INTERNAL USE ONLY



LEGEND

Em - *Eucalyptus marginata* Woodland

EmBaBmAf - *Eucalyptus marginata* Woodland over *Banksia attenuata/ B. menziesii/Allocasuarina fraseriana* Low Woodland

BaBmAf - *Banksia attenuata/B. menziesii/Allocasuarina fraseriana* Low Woodland

BaBmAfBi - *Banksia attenuata/B. menziesii/Allocasuarina fraseriana* Low Woodland with *Banksia ilicifolium*

BaBmAf/Ke - *Banksia attenuata/B. menziesii/Allocasuarina fraseriana* Low Woodland over *Kunzea ericifolia* Shrubland

AfKe - *Allocasuarina fraseriana* Low Open Woodland over *Kunzea ericifolia* Closed Scrub

Er - *Eucalyptus rudis* Woodland

ErMp *Eucalyptus rudis* Woodland over *Melaleuca preissiana* Low Woodland

Bi - *Banksia ilicifolium* Low Woodland

Mp - *Melaleuca preissiana* Low Open Woodland

Ac - *Adenanthos cygnorum* High Open Shrubland

Ke - *Kunzea ericifolia* Closed Scrub

Mt - *Melaleuca teretifolia* Open Scrub

Ha - *Hypocalymma angustifolium* Closed Heath

Afas - *Astartea fascicularis* Closed Heath

Pr - *Pultenaea reticulata* Closed Heath

Jp - *Juncus pallidus* Sedgeland

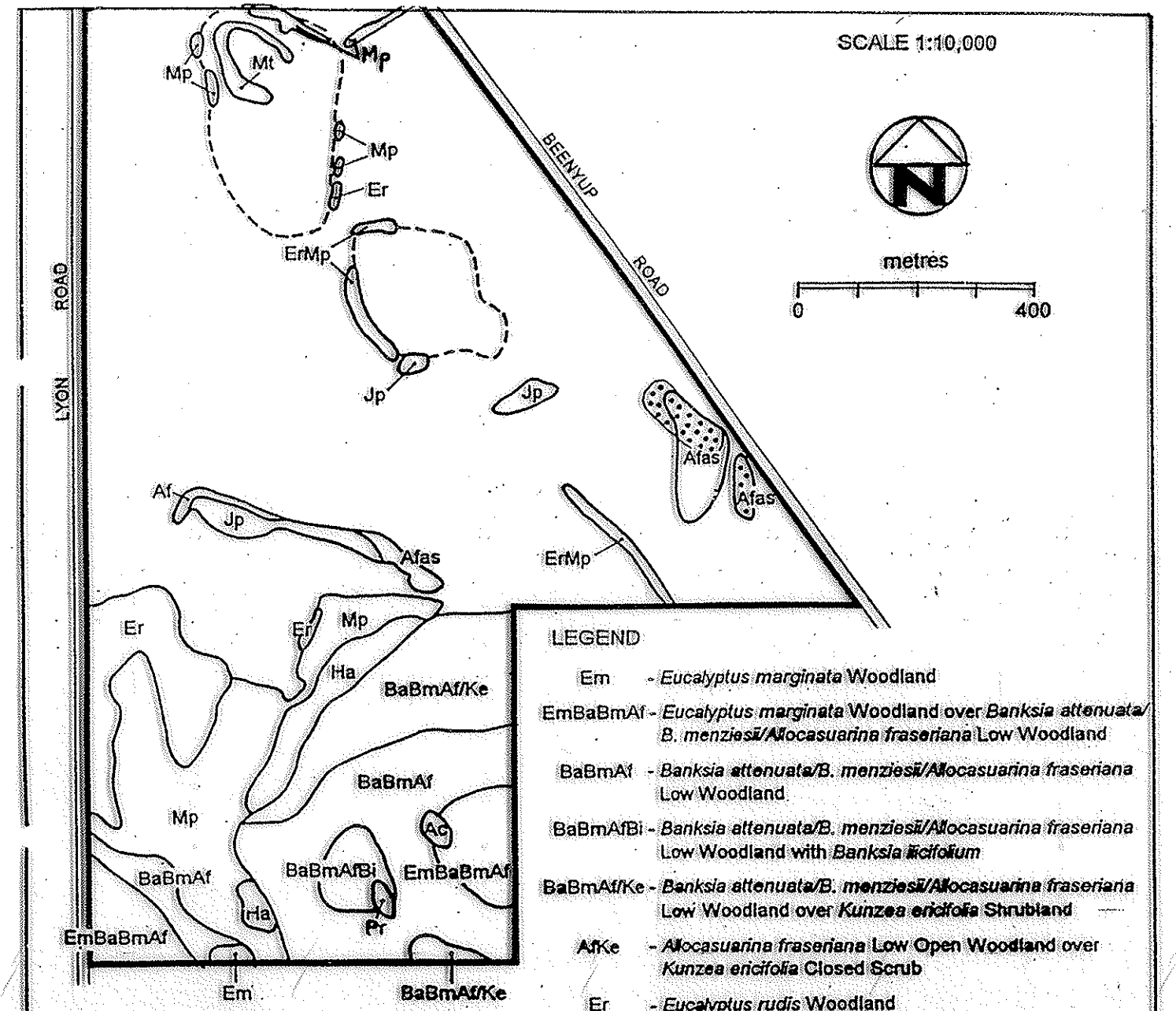
Cleared

Wetland Boundary

Declared Rare Flora

ALAN TINGAY & ASSOCIATES

LOTS 210, 211 & 204 LYON ROAD, ATWELL SOUTH
VEGETATION MAP
FIGURE 6



LEGEND

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Ha	- *Hypocalymma angustifolium* Closed Heath
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Pr	- *Pultenaea reticulata* Closed Heath
Jp	- *Juncus pallidus* Sedgeland

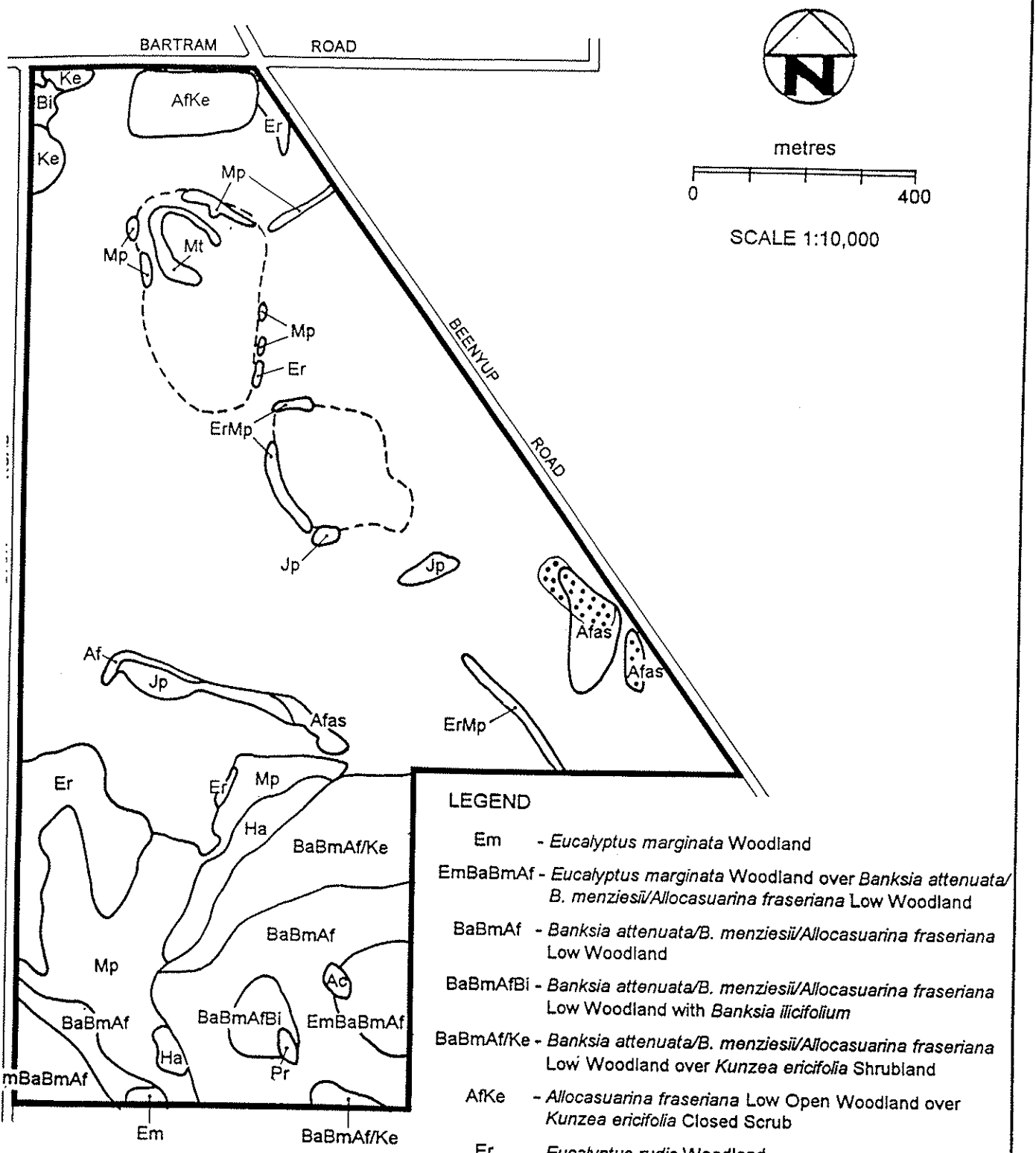
Cleared

Wetland Boundary

Declared Rare Flora

ALAN TINGAY & ASSOCIATES

LOTS 210, 211 & 204 LYON ROAD, ATWELL SOUTH
VEGETATION MAP
FIGURE 6



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Ha - *Hypocalymma angustifolium* Closed Heath

fas - *Astartea fascicularis* Closed Heath

Pr - *Pultenaea reticulata* Closed Heath

Jp - *Juncus pallidus* Sedgeland

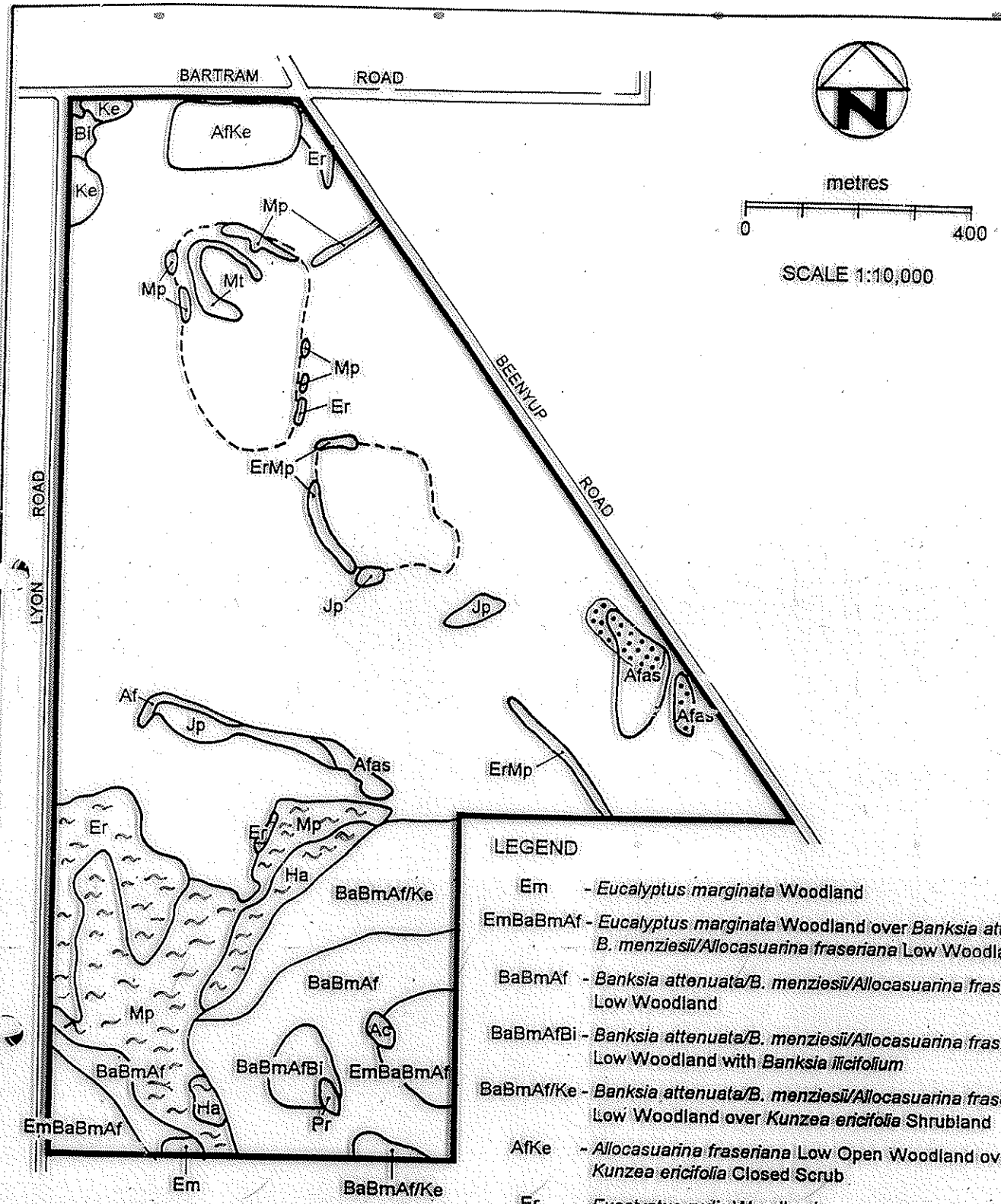
Cleared

Wetland Boundary

Declared Rare Flora

TINGAY & ASSOCIATES

LOTS 210, 211 & 204 LYON ROAD, ATWELL SOUTH
VEGETATION MAP
FIGURE 6



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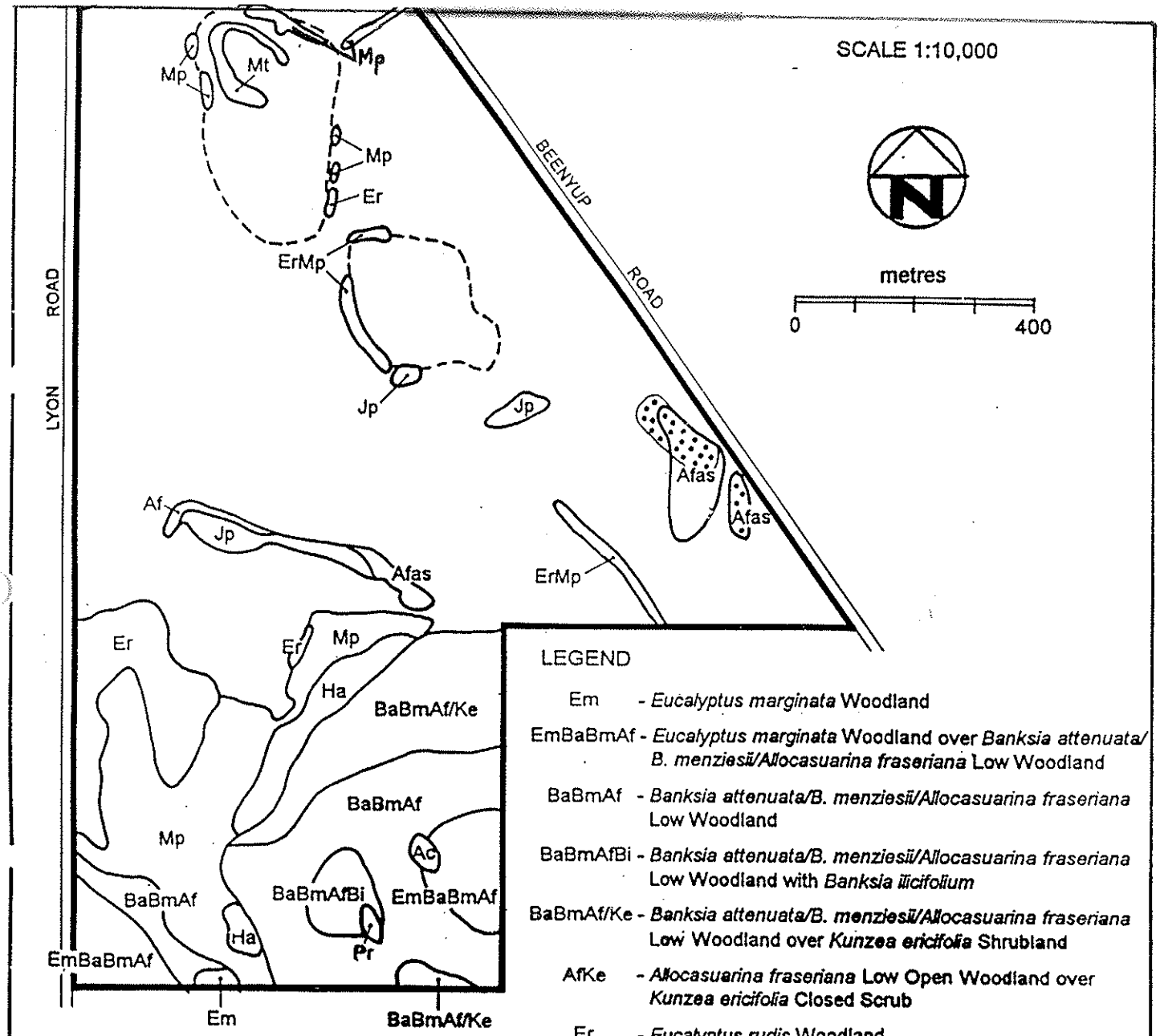
Cleared

Wetland Boundary

Declared Rare Flora

ALAN TINGAY & ASSOCIATES

LOTS 210, 211 & 204 LYON ROAD, ATWELL SOUTH
VEGETATION MAP
FIGURE 6



ALAN TINGAY & ASSOCIATES

LOTS 210, 211 & 204 LYON ROAD, ATWELL SOUTH
VEGETATION MAP
FIGURE 6

BS 692

GIBBS ROAD

GROUP HOUSING

RESIDENTIAL PRECINCT

RESIDENTIAL PRECINCT

SPECIAL RESIDENTIAL PRECINCT

STRATEGIC FIRE BREAK (LIMESTONE)

CONSERVATION CATEGORY WETLAND

LYON ROAD

RESIDENTIAL PRECINCT

Date of Photography: March 1999

GNA 12/00

0 50m

SCALE 1:2500

ALTERNATIVE DEVELOPMENT PLAN

JAA LOT 204, PT LOTS 11, 12 GIBBS ROAD, BANJUP

FACSIMILE

ALAN TINGAY & ASSOCIATES
environmental scientists
21 Howard Street
PERTH WA 6000
Ph: + 61 8 9481 3434
Fax: + 61 8 9481 3435

TO:	**Bronwyn Keighery**	**FAX NO:**	**9485 1187**
COMPANY:	Department of Environmental Protection	**DATE:**	1 December 1999
FROM:	Nicola O'Broin	**JOB NO:**	98085
SUBJECT:	Flora List Atwell South	**PAGE:**	1 of 3

Please check all sheets have been transmitted and are legible. If not, ring or send a fax immediately.

Bronwyn,

Please find attached the native flora list for Lots 210, 211 and 204 Atwell South, as requested. The list is from an environmental assessment report by Alan Tingay & Associates in 1994.

Kind regards,

Nicola O'Broin

Document No:98085_138_nob

01/12/99 09:23 ALAN TINGAY & ASSOC → 94851187 NO.664 001

KM (1997) cross referenced by BJK

LOTS 210, 211 AND 214 LYON ROAD, BANJUP
NATIVE FLORA LIST

GYMNOSPERMAE

CYCADACEAE
1 Macrozamia riedlei

MONOCOTYLEDONAE

ANTHERICACEAE
2 Laxmannia squarrosa
3 Thysanotus arenarius

COLCHICACEAE
4 Burchardia umbellata
5 Burch. baird. BJK.

CYPERACEAE
6 Lepidosperma angustatum
7 Lepidosperma leptostachyum
8 Lepidosperma longitudinale
9 ? Baumea articulata KM

DASYPOGONACEAE
12 Dasypogon bromeliifolius

HAEMODORACEAE
13 Anigozanthos manglesii
14 Conostylis aculeata
15 Conostylis juncea
16 Phlebocarya ciliata
17 Lomandra hern.
18 Lom. nigricans, Lom sp.

IRIDACEAE
20 Patersonia occidentalis

JUNCACEAE
Juncus pallidus

POACEAE
Stipa compressa
1 Amphipogon turbinatus
2 Danthonia caespitosa occidentalis
* Briza Ehrharta calycina

RESTIONACEAE
3 Hypolaena exsulca
4 Leptocarpus coangustatus
5 Loxocarya flexuosa
6 Loxocarya pubescens
7 Lyginia barbata
8 Restio sinuosus
9 Restio stenostachyus

XANTHORRHOEACEAE
30 Xanthorrhoea preissii

1 Meeboldina roycei KM
2 Meeboldina. Aphanos KM

DICOTYLEDONAE

APIACEAE
3 Platysace compressa

ASTERACEAE
4 Pithocarpa pulchella

CASUARINACEAE
5 Allocasuarina fraseriana
6 Allocasuarina humilis

DILLENIACEAE
7 Hibbertia hypericoides
8 Hibbertia racemosa
9 Hibbertia subvaginata

EPACRIDACEAE
40 Conostephium pendulum
1 Leucopogon polymorphus
2 Leucopogon propinquus
3 Leucopogon sprengelioides
4 Leuc. Conostephe BJK

GOODENIACEAE
5 Dampiera linearis
6 Dampiera Scaevola

LAURACEAE
7 Cassytha racemosa

LORANTHACEAE
8 Nuytsia floribunda

MIMOSACEAE
9 Acacia huegelii
50 Acacia pulchella
1 Acacia stenoptera
2 Acacia willdenowiana

MYRTACEAE
3 Astartea fascicularis
4 Calythrix flavescens
5 Calythrix fraseri
6 Eucalyptus marginata
7 Eucalyptus rudis
8 Eucalyptus todtiana
60 Hypocalymma angustifolium
1 Kunzea ericifolia
2 Melaleuca preissiana
3 Melaleuca scabra

01/12/99 09:23 ALAN TINGAY & ASSOC → 94851187 NO.664 D02

4 Melaleuca thymoides
5 Pericalymma ellipticum
6 Scholtzia involucrata

PAPILIONACEAE
7 Aotus gracillima
8 Aotus procumbens
9 Bossiaea eriocarpa
10 Daviesia triflora
11 Euchilopsis linearis
12 Eutaxia virgata
13 Gompholobium tomentosum
14 Hardenbergia comptoniana
15 Hovea trisperma
16 Jacksonia furcellata
17 Pultenaea reticulata

POLYGONACEAE
18 Muehlenbeckia adpressa

PROTEACEAE
19 Adenanthos cygnorum
20 Adenanthos obovatus
21 Banksia attenuata
22 Banksia grandis (one seedling)
23 Banksia ilicifolium
24 Banksia menziesii
25 Persoonia saccata
26 Petrophile linearis
27 Stirlingia latifolia

RUTACEAE
28 Eriostemon spicatus

SANTALACEAE
29 Leptomeria spinosa

STYLIDIACEAE
1 Stylidium brunonianum
2 Stylidium repens
3 Stylidium junceum

4 Melaleuca trichiloda KM
5 Pelo latifolia GJK
6 Agonis linearifolia KM

1 Hibbertia preissii GJK
8 Casuarina fraseriana KM

7 Xylomel. occid.

89 taxa

Species in descriptions not listed.

eg Mel. trichiloda

City of Cockburn

PO Box 1215, Bibra Lake
Western Australia 6965

Cnr Rockingham Road and
Coleville Crescent, Spearwood,
Western Australia 6163

Telephone (08) 9411 3444
Facsimile (08) 9411 3416

TO: DEP

ATTENTION: BRONWYN KEIGHERY

FAX NO: 9485 1187 **DATE:** 7/12/99

FROM: DARREN WALSH

NO. OF PAGES SENT: 2 **(including this cover sheet)**

MESSAGE:

BRONWYN,

DETAILS ON WETLAND FROM CARL SEMENIUK AS DISCUSSED.

REGARDS

DARREN

V. & C. SEMENIUK RESEARCH GROUP

RESEARCH AND EDUCATIONAL CONSULTANTS IN ENVIRONMENTAL AND NATURAL SCIENCES

PRINCIPAL POSTAL ADDRESS:
21 GLENMERE ROAD
WARWICK 6024
TELEPHONE (09) 447 3708

SUBSIDIARY ADDRESS:
123 FITZGERALD STREET
WEST PERTH 6005

22 FEB 1999
DLW

18th February 1999

Mr D Walsh
Environmental Services
City of Cockburn Administration Centre
9 Coleville Cr
Spearwood
WA, 6163

Dear Darren

Here is a brief response to your question, regarding Wetland 72 on map sheet 2033 I SW and its significance. The wetland is a vegetated dampland belonging to the Jandakot Suite. Jandakot Suite wetlands in general, have formed in undulating landscape that intersect the water table, and as such they are predominantly maintained by groundwater rise. However, Wetland 72 differs from the general pattern in that it has a shallow sub-surface clay lens which probably perches precipitation from the first winter rains, and this has the effect of making water available to plants prior to regional water table rise, an important factor for plant survival. It would also induce different pellicular water storage capacity, which may explain the different assemblage of plants colonising the dampland.

Regionally, the Wetland 72 dampland is important because there are very few vegetated damplands remaining in the Jandakot Suite. While there are some sumplands and damplands in the Jandakot Suite vested in Conservation Reserves, they are mostly sumplands, e.g., Bangamup Lake, and Gibbs Rd. wetland. The only damplands I am aware of that are vegetated is the un-named one in the Bangamup Reserve (which supports an assemblage of open shrubland *Melaleuca teretifolia*, open woodland *Melaleuca preissiana*), and Bosworth Reserve, which are representative of damplands in this area. Wetland 72, though vegetated, has an unusual wetland vegetation assemblage, probably because of the subsurface clay stratigraphy.

The conservation of this wetland would be important for several reasons. While there already are wetlands in the Conservation Estate within the Jandakot Suite, conservation of Wetland 72 would secure and increase wetland type diversity, wetland habitat diversity, wetland processes diversity, and biodiversity pertaining to the Jandakot Suite and also within the Jandakot region.

I hope this information is helpful to you.

Yours Sincerely
Chris Semeniuk

4/2/01 Meeting @ MRP with Kieran Bonar (DPI) & Sean Collingwood (MRP), Gary Whitson (DPI), Karen Clarke (MRP/DPI), Melissa Pratt (SWRC), Alan Blood & Kirsty (City of Cockburn)

Re Site 492 Lyon Rd, Banjup

Originally All Lot 204 City of Cockburn proposed as additional site + land to east & south.

Landcorp proposition (original) proposition of Lot 204 only

Landcorp plan is Bush Forever.

City of Cockburn.

Wetland buffer min 50m
road within this!

Lot 11 → 5 acre parcels ownership.
Wetland → private parcel?
MRS - Urban Deferred TPS - Rural?

Lot 199 - CCW to south → RO.
Show Subdivision Proposal.

23ha Tea Tree Close - deleted

21ha Lyon Rd Landcorp Prop.

Confirm CCW boundary & buffer

Landcorp got EPP wetland in Lots 211 & 210
Alan Blood to do calculation.

Upland Contour line to east.
→ Full Residential

Timing

New ~~TPS~~ Scheme 3 Aug / Sept Cockburn

→ Development Zone

Structure Plan ~~Process~~ → DEP comment

Then Subdivision Proposal EPA Assessment

Lake Coogee / Market Garden Swamp

Alan Wood, Requested Review

* Atlas - Hill et al 1996
Study/Mapping - 1986 - 1993/4 started Semenuik's trailing around Moore R.
from 1992? Moore Rd Standard

* Semenuik / updated Metro area 1997
for Bushplan - some site visits mostly aerial photog. (Bronwen's Maps)
1993 Regional Ass'n Perth - Bunbury study by WALIA
Semenuiks + crts
Murdoch Uni students + vists
outskirts aerial photography
Perth Metro ~ 80% visited

* 500 + wetlands
Peter Brown. Cooper Report
CCW outside BS Sites #500 onwards
Sites unlikely to be protected,
(Ray Stone thinks 500+ some were in Bushplan)

* Alan Tingay & Assoc did assessm. of 500+ wetlands to determine risk of no longer CCW - many aerial
1998 Low, Medium, High risk
Mainly land in private ownership

* Bushplan - aerial photo interp of CCW cleared, reduced, still there

2 sets of consultants - Alan Tingay & Ecologia
assessed Medium & High Risk CCW's
based on Site Visits & 686's

Mapping for Bush Forever.
Updated annually by WRC CIS to DEP, MRP

1/3/01

Cnr Lyon & Gibbes

10-15m edge degraded in E. rudis.

CONSERVATION BRANCH
DEPARTMENT of ENVIRONMENTAL PROTECTION

Memorandum

ATTENTION:	Melissa Patt
FROM:	Karen Clarke/Bronwen Keighery/Gary Whisson
DATE:	14 June 2001
SUBJECT:	BS 492 - Lot 204 Lyon Rd, Conservation Category Wetland Boundary
FILE NO:	PB237/1

Bush Forever Site 492 encompasses regionally significant bushland on Lot 204 Lyon Rd, Banjup. Appendix 1 attached documents the conservation values of this Site. The implementation mechanism for Lot 204 is an Urban/Urban Deferred Negotiated Planning Solution as the lot is currently zoned Urban Deferred under the MRS although it is still zoned Rural under the TPS (Government of Western Australia 2000a). Landcorp are proposing a residential subdivision on the lot and a review of wetland boundaries was requested to progress discussions over conservation of the regionally significant bushland on this Site.

A field inspection of Lot 204 Lyon Rd, Banjup was made by Karen Clarke (MfP) and Melissa Patt (WRC) on 1 March 2001 to review the wetland mapping for the Site and wetland management categories. Approximately 2 hours were spent traversing the bushland on foot and by vehicle. Being March there were relatively few plants flowering and annually renewed plants were dormant. Therefore, vegetation condition assessments are subject to revision on a mid/late spring inspection.

Map 1 attached shows the boundaries of the wetland dependant vegetation that is in Excellent to Very Good condition on Lot 204. There are two wetlands present; a large wetland occupies nearly half the Site, extending from the northwest corner to the east and south. There is also a small, previously unmapped wetland in the southeastern section of the Site. On the basis of vegetation type and condition the boundaries of the vegetated wetlands shown on Map 1 are proposed as those for Conservation Category Management status on Lot 204 Lyon Rd, Banjup.

REFERENCES

Government of Western Australia 2000a. *Bush Forever. Volume 1 Policies, Principles and Processes*. Western Australian Planning Commission, Perth, Western Australia.

Government of Western Australia 2000b. *Bush Forever. Volume 2 - Directory of Bush Forever Sites.* Department of Environmental Protection, Perth, Western Australia.

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Appendix 1: Site Description for Bush Forever Site 492 (Government of Western Australia 2000b, for maps see Government of Western Australia 2000a)

LYON ROAD BUSHLAND, BANJUP

Boundary Definition: bushland (taken to cadastre) boundary

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 492 **Area (ha):** bushland 25.0
Map no. 59 **Map sheet series ref. no.** 2033–1 SW
Other Names: draft *Perth's Bushplan* Submission no.s – 225, 417
Local Authorities (Suburb): City of Cockburn (Banjup)

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS
Bassendean Dunes
Bassendean Sands (Qpb: S8)
Bassendean Dunes/Pinjarra Plain
Bassendean Sands over Guildford Formation (Qpb/Qpa:S10)
Wetlands (within the Bassendean Dunes/Pinjarra Plain)
Holocene Swamp Deposits (Qhw: Ms5) (Qrw: Sp1)

VEGETATION AND FLORA
Vegetation Complexes
Bassendean Dunes
Bassendean Complex — Central and South
Floristic Community Types: *not sampled, types inferred
Supergroup 2: Seasonal Wetlands
*4 *Melaleuca preissiana* damplands
*5 Mixed shrub damplands
Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
*21a Central *Banksia attenuata – Eucalyptus marginata* woodlands
*21c Low–lying *Banksia attenuata* woodlands or shrublands
*23a Central *Banksia attenuata — B. menziesii* woodlands

WETLANDS
Wetland Types: dampland
Natural Wetland Groups
Bassendean Dunes
Jandakot (B.3)
Wetland Management Objectives: Conservation (11.1Ha)
Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES
Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated wetland, vegetated uplands (prominent north–south ridge)

Vegetation and Flora: limited survey (Keighery, BJ, and Clarke 2000a, Regeneration Technology Pty Ltd 1999, Tingay, Alan & Associates 1994, 1999)

Structural Units: mapping (Tingay, Alan & Associates 1994)
Uplands: *Eucalyptus marginata* Open Woodland over *Banksia attenuata* and *B. menziesii* Low Open Woodland to Low Closed Forest; *Eucalyptus todtiana* and *Banksia ilicifolia* Low Open Woodland to Low Closed Forest; *Banksia attenuata* and *B. ilicifolia menziesii* Low Open Woodland to Low Closed Forest
Wetlands: *Eucalyptus rudis* Tall Open Woodland; *Kunzea ericifolia* Closed Tall Scrub; *Melaleuca preissiana* Scattered to Low Woodland over Closed to Closed Low Heaths dominated by *Astartea* aff. *fascicularis, Hypocalymma angustifolia, Pericalymma ellipticum, Euchilopsis linearis* and *Calothamnus lateralis* and combinations of these; *Restio stenostachyus* Sedgeland.
Vegetation Condition: Excellent to Very Good (Keighery, BJ, and Clarke 2000a)
Total Flora: not known (estimated >200 native taxa, Keighery, BJ, and Clarke 2000a)
Significant Flora: *Anthotium junciforme* (4)

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Total Flora: not known (estimated >200 native taxa, Keighery, BJ, and Clarke 2000a)
Significant Flora: *Anthotium junciforme* (4)
Fauna: Significant mammal species: Quenda (Keighery, BJ, and Clarke 2000a)
Linkage: adjacent bushland to the south, east and west; part of Greenway 120 (Tingay, Alan & Associates 1998a)
Other Special Attributes: Site Category One Area, Middle Canning Catchment Study (Evangelisti & Associates *et al.* 1995)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Directory of Important Wetlands in Australia (Regeneration Technology Pty Ltd 1999)

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Diversity, Rarity, General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation
Recommendation: Urban Negotiated Planning Solution (see Table 3, Volume 1).

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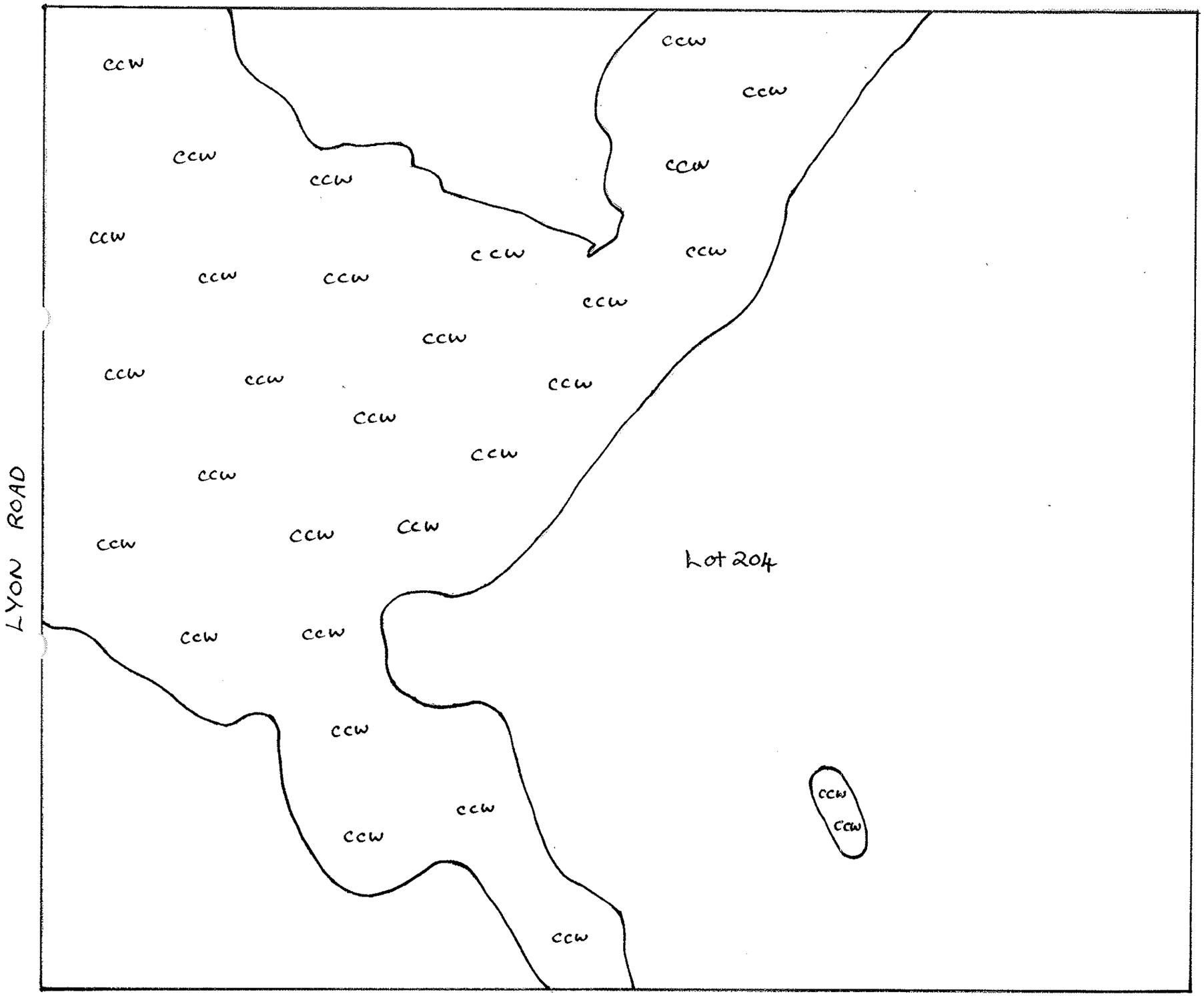
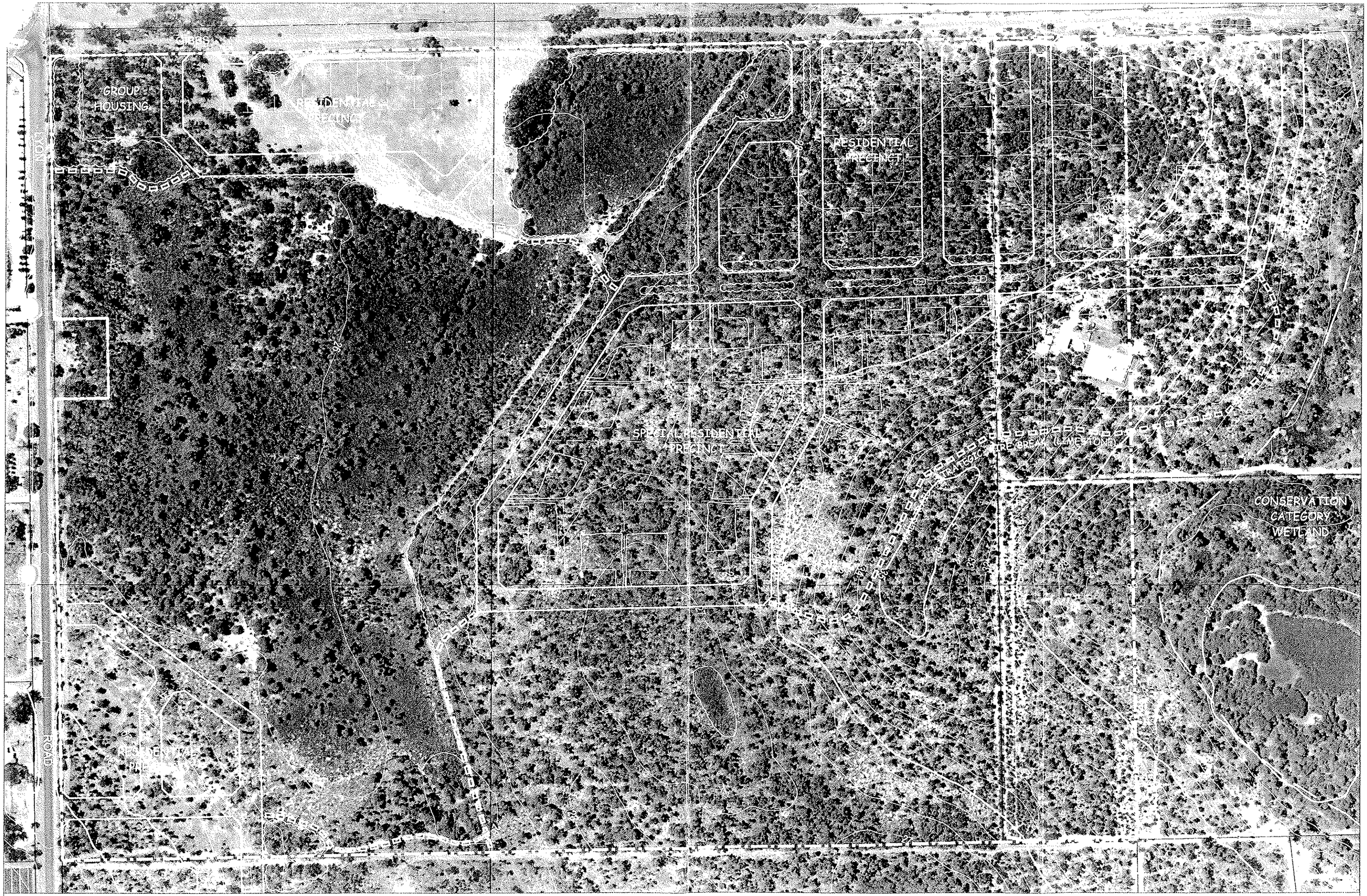


Map 1: Bush Forever Site 492 - Boundary for Conservation Category Wetlands on Lot 204 Lyon Rd, Banjup.



Date of Photography: March 1999

0 50m

SCALE 1:2500

GNA 12/00

ALTERNATIVE DEVELOPMENT PLAN

JAA LOT 204, PI LOTS 11, 12 GIBBS ROAD, BANJUP

ECOLOGICAL SYSTEMS BRANCH
(TERRESTRIAL SECTION)

DEPARTMENT of ENVIRONMENT, WATER & CATCHMENT PROTECTION

Memorandum

ATTENTION:	Emma Bamforth, Bush Forever Office, Department for Planning and Infrastructure
FROM:	Karen Clarke/John Dell/Gary Whisson
DATE:	17/1/02
SUBJECT:	Nominated Additional Bush Forever Area part DEP 74e/MfP 31 - Lot 199 Gaebler Rd, Jandakot
FILE NO.:	PB 1299/13 Vol 2

Thank you for referring the following report for comment:

> ATA Environmental (2001). Lot 199 Gaebler Road, Banjup Environmental Assessment. Version 2, December 2001, Report No. 2001/168.

During the public comment phase for Perth's Bushplan two submissions were received nominating a large area of bushland surrounding and including Lot 199 Gaebler Rd, Jandakot as an additional area to be considered for inclusion in Bush Forever.

Prior to the release of Bush Forever all nominated additional areas were subject to preliminary analysis which considered: aerial photographs, mapped information sets, field inspection (principally fence-line or edge inspection, with some more detailed survey work done after contact with the land owners and/or managers of the land), zoning/reservation and other known information. Beyond this, the level of assessment of these areas varied; those that were considered to have received adequate assessment against the criteria for identifying regionally significant vegetation (see Section 3.7, Part A, Government of WA 2000a) and other planning criteria (see Section 1.4, Part A, Government of WA 2000a), were listed in Bush Forever under three categories:

- additional Sites (see Appendix 6, Table 1.1, Government of WA 2000b)
- extensions to existing Sites (see Appendix 6, Table 1.2, Government of WA 2000b) and
- areas not considered suitable for inclusion in Bush Forever (see Appendix 6, Table 1.7, Government of WA 2000b).

The remainder of the nominated areas were still subject to consideration.

Lot 199 Gaebler Road is part of Nominated Additional Area 74e. To date only the north-western part of Area 74e, Lot 204 Lyon Rd, has been considered for inclusion through the Bushplan process and was included in Bush Forever as Site 492 to be implemented through a Negotiated Planning Solution. This occurred in direct response to land owner requests for assessment of this

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lot. The subsequent inclusion of part of Lot 204 as Bush Forever Site 492 (Government of Western Australia 2000a) does not imply that the remainder of Area 74e is not regionally significant and suitable for inclusion in Bush Forever.

Bush Forever does not include all of the bushland areas on the Swan Coastal Plain (SCP) portion of the Perth Metropolitan Region (PMR) that meet the scientific criteria for regional significance. The selection of areas for Bush Forever was based on both scientific criteria and planning criteria in an attempt to ensure there were real opportunities to conserve the areas selected. However, some of the Sites identified do not have an existing level of protection in the planning process and are subject to on-going negotiations that will reduce the amount of bushland remaining within these Sites. As a result, Bush Forever is subject to an on-going audit process to ensure conservation targets are being met.

The information on flora and vegetation documented by ATA Environmental (2001) clearly identifies that the bushland present on Lot 199 Gaebler Rd, Jandakot meets the scientific criteria for regional significance for the following reasons:

- The 48.3 hectare lot is almost fully vegetated with intact remnant bushland representative of the Bassendean – Central and South Vegetation Complex. The vegetation across most of the lot is in Excellent condition (Figure 4, ATA Environmental 2001) and contains a combination of vegetated wetlands and uplands.
- Bush Forever proposes protection of 13% of the Bassendean – Central and South Vegetation Complex but the proportion protected is likely to be significantly reduced, as it includes large areas of commonwealth airport lands, and may well fall below the "at least 10% target" through on-going negotiations as Bush Forever is implemented. Significantly this vegetation complex is very poorly protected outside the Perth metropolitan area. Hence achieving its effective protection in the Bush Forever area is of greater significance.
- The bushland present is contiguous with a much larger area of remnant bushland to the north (Lot 204 Lyon Rd), north-east (Lots 11 & 12), east (the 9 lots on Hausen Court) and south-east (Lots 50 & 51). It forms part of a large consolidated area of remnant bushland connected to Greenway 120 (Tingay , Alan and Associates 1998a) which links the central Cockburn wetland chain with the Jandakot Regional Botanic Park.
- Four wetlands are identified on the lot, two previously mapped by WRC (2001). The two additional wetlands identified are shown on Figure 2 of ATA Environmental (2001) as transitional dampland/dryland. ATA Environmental (2001) states that these two areas have "very limited wetland values" due to their "transitional wetland/dryland status". However, the vegetation types recorded for these two areas (Section 2.4 & Figure 3, ATA Environmental 2001) are wetland units typical of low lying areas in the Bassendean – Central and South Vegetation Complex. Based on the information in ATA Environmental (2001) these two wetlands plus the tongue of the large wetland on Lot 204 Lyon Rd that extends south into Lot 199, all contain vegetation of a type and quality that requires their classification as Conservation Category. Thus, the lot contains four Conservation Category wetlands, the boundaries of which need to be based on the vegetation mapping shown in Figure 3 of ATA Environmental (2001). This revises the boundaries of the two previously identified wetlands documented by WRC (2001). Figure 1 attached shows the revised Conservation Category wetland mapping for Lot 199 based on ATA Environmental (2001).
- The floristic community types (fct's) listed by ATA Environmental (2001) are inferred and have not been confirmed by analysis of plot based spring survey. Based on analysis of plots in areas surrounding Bush Forever Site 492, Government of Western Australia (2000a) inferred that fct's 4, 5, 21a, 21c and 23a are present in Lot 204 Lyon Rd immediately adjacent to Lot 199. While all of these five fct's were identified as "well reserved" in Gibson *et al.*

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(1994), the conservation status of fct 21c was listed as "susceptible". In addition, fct 23a is known to be restricted to the Bassendean Dune System of the Perth Metropolitan Region. The reservation status and conservation status listings in Gisbon *et al.* (1994) are a guide only and require updating to reflect current knowledge and conservation area status.

- There has been no site specific assessment for fauna nor examination of the area for its regional conservation value for fauna. There has been no assessment to determine whether any of the CALM listed fauna species outlined in Section 2.7.1 actually occur on the lot. The fauna habitats described in ATA Environmental (2001) indicate that the area is likely to have high conservation values for fauna. The presence of at least one significant mammal species, the Quenda (Southern Brown Bandicoot), has been confirmed on Lot 204 Lyon Rd (Government of Western Australia 2000a) in bushland directly linked with Lot 199. Vertebrate fauna on the Coastal Plain have undergone major declines as a consequence of habitat reduction, disturbance and other factors. Much of the fauna now has fragmented distributions and only survives on larger remnant areas of bushland such as on this lot.
- In particular, the bushland on Lot 199 is likely to support populations of a high number of those bird species of conservation significance on the Swan Coastal Plain which were listed in Conservation Category 1 and 2 in Bush Forever. These are either habitat specialists with a reduced distribution on the Swan Coastal Plain or they are wide-ranging species with reduced populations on the Swan Coastal Plain. As this lot is part of a large consolidated area of bushland with linkage east-west and south it is likely to have significant value in facilitating the seasonal migration of small Passerine birds. A number of species move northwards at the beginning of winter and move southwards in spring. These require native vegetation for food, shelter and roosting sites while in transit.
- Due to the high linkage value of Lot 199 it is also likely to have long-term value in helping maintain the genetic movement of flora and fauna between different areas and thus play a significant role in the conservation of biological diversity.
- Due to the combination of vegetated uplands and wetlands and diversity of vegetation types identified on Lot 199 by ATA Environmental (2001), a flora of >200 native taxa is likely to be present on the site as documented for the adjacent Lot 204 Lyon Rd (Government of Western Australia 2000a).
- To date these has not been sufficient survey of Lot 199 in appropriate seasons to determine whether the site supports populations of significant flora. Significant flora include Declared Rare Flora, Priority Flora and additional taxa documented in Bush Forever (Table 13, Government of Western Australia 2000a) due to geographical variation or regional ecological preferences. Given the Excellent condition of the vegetation present on Lot 199 and the range of vegetation types present it is highly likely that significant flora are present.

In summary, Lot 199 Gaebler Rd, Jandakot meets four of the five scientific criteria for regional significance:

1. representation of ecological communities: part of a large consolidated area of Bassendean - Central and South Vegetation Complex in generally Excellent condition with existing linkage to other consolidated bushland areas
2. diversity - vegetated uplands and wetlands, range of vegetation types, 200+ native plant taxa expected, diverse fauna expected
3. rarity - Quenda present in wetland contiguous with Lot 199, other significant flora and fauna taxa highly likely to be present
4. general criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation - four Conservation Category wetlands present.

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Lot 199 Gaebler Rd, Jandakot is currently zoned Urban Deferred and an MRS amendment would be required before residential development could be considered. In addition, the City of Cockburn Draft TPS No. 3, that proposes Lot 199 be included in a "Development Zone", has not yet been finalised. Therefore, the opportunity exists to conserve the regionally significant bushland on Lot 199 and include it as an extension to Bush Forever Site 492 to ensure conservation targets for the Bassendean - Central and South Vegetation Complex are met. Due to the linkage value, intactness and condition of the bushland on Lot 199 its conservation is an important part of meeting the State's obligations under the National Strategy for the Conservation of Australia's Biological Diversity (Commonwealth of Australia 1996) and the recently agreed National Objectives and Targets for Biodiversity Conservation 2001 - 2005 (Commonwealth of Australia 2001).

It is recognised that Lot 199 is a constrained Site due to its Urban Deferred Zoning, it is none the less considered that the area has values that warrant its inclusion in Bush Forever. If the bushland on Lot 199 cannot be protected in its entirety, then the minimum area that would be recognised is the core area of vegetation in Excellent condition (Figure 4, ATA Environmental 2001) plus the four Conservation Category wetlands each with their required 50m buffer. The latter are effectively non-developable areas in any event.

Given the constraints associated with its Urban Deferred Zoning and its site characteristics it is anticipated that the site may most appropriately be treated as an Urban Negotiated Planning Solution that would serve to consolidate this area with the adjoining protected area on Lot 204 to the north.

Alternatively, an opportunity may present itself to more fully protect this area as a replacement area for bushland in Bush Forever Sites with the same vegetation complex that are not able to be protected, or in exchange for other existing sites with lower overall value.

References

(References not listed below can be found in Bush Forever Volume 2)

Commonwealth of Australia (2001). National Objectives and Targets for Biodiversity Conservation 2001 - 2005. Published by Environment Australia, Canberra.

Government of WA (2000a) *Bush Forever - Volume 2 Directory of Bush Forever Sites.* Published by the Department of Environmental Protection, Perth.

Government of WA (2000b) *Bush Forever - Summary of Submissions on the Draft Perth's Bushplan 1998.* Published by the Western Australian Planning Commission, Perth.

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Recommendation

Lot 199 contains vegetation from the Bassendean complex central and south, which currently has 13% proposed for protection. The site does not contain any threatened ecological communities. The site may contain threatened orchids, however this would need to be confirmed during a spring survey and can be considered through further detailed planning. The site may also provide habitat for several scheduled and priority fauna species, including one listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*.

Much of the vegetation on site is considered to be in a Very Good to Excellent condition.

The site contains one wetland that has been classified by the WRC as conservation category and one as resource enhanced as well as two additional areas which have not been identified by the WRC. From the site inspection, the resourced enhanced wetland area is considered to meet CCW status.

The site is however zoned Urban Deferred under the MRS and Rural under the TPS. The site has been earmarked for development in the City of Cockburns Draft TPS No. 3 and is privately owned.

Although the site contains vegetation primarily in an excellent condition, it does not contain any TEC's or is of a vegetation complex which is currently below the 10% target for protection. The mapped wetlands and their associated buffers will be retained on site through the normal planning process, and would not be considered as developable land. As a result, the Bush Forever Office recommends that the site not be included as a Bush Forever Site. However, advice will be provided which indicates that any subdivision design for the Lot will be required to show that the native vegetation in the northern section of Lot 199, adjacent to the wetland areas, to be retained.

To be approved by (tick appropriate boxes)

DPI ❑ DEP ❑ WRC ❑ CALM ❑

Approval

DPI

Emma Bamforth _____ Date _____

Kieron Beardmore _____ Date _____

DEP

Gary Whisson _____ Date _____

WRC

Melissa Patt _____ Date _____

CALM

Paul Brown _____ Date _____

PRINTED: Thu 13 Dec 01

DRAWN: EDS/TE 13-12-01 CHECKED: SM 13-12-01

21098SI/21_168F3.dgn

Legend

- Site Boundary
- Cadastral Boundary
- Vegetation Type Boundary

metres

0 50 100 150 200

SCALE 1 : 4 000

Lyon Road

Gaebler Road

EmBAf

MpBaKe

KeDb

KeAf

KeAf

BAf

BBi

AfHa

BaBm

Lb

Ke

MpKe

Bi

BaBm

PoDb

BaBmAf

BEc

BaBmAf

199

416

204

1

2

3

4

5

10

11

19

50

AERIAL SOURCE: DOLA, Panairama South, 2000.

Vegetation Types Legend

Upland Areas & Ridge

EmBAf — Jarrah (*Eucalyptus marginata*), *Banksia attenuata*, *B. menziesii*, *B. ilicifolia*, Sheoak (*Allocasuarina fraseriana*) Low Woodland over Balga (*Xanthorrhoea preissii*), *Stirlingia latifolia*, *Hibbertia hypericoides*, *Dasypogon bromeliifolius*, *Petrophile linearis*.

BaBmAf — *B. attenuata*, *B.menziesii* and Sheoak Low Open Woodland to Low Woodland with occasional Jarrah (usually stunted) over a Shrubland of Balga, *Allocasuarina humilis*, *Jacksonia furcellata*, *S. latifolia* and *H. hypericoides*.

Flats & Low-lying Areas

BaBm — *B. attenuata*, *B. menzeisii* Low Woodland to Low Open Forest with occasional Sheoak and Jarrah over a Low Closed Heath to Closed Heath of *X. preissii*, *D. bromeliifolius*, *Hibbertia subvaginata* and *Xanthorrhoea brunonis*.

BAf — *B. attenuata*, *B.menziesii* and Sheoak Low Woodland with occasional Jarrah and Woolly Bush (*Adenanthos cygnorum*) over a Low Open Heath of *D. bromeliifolius*, *S. latifolia*, *H. hypericoides* and *Amphipogon turbinatus*.

BEc — *B. attenuata* and *B.menziesii* Low Open Woodland over Perennial Veldt Grass (*Ehrharta calycina*), Blowfly Grass (*Briza minor*), Geranium (*Pelargonium capitatum*) and Pigface (*Carpobrotus edulis*).

PoDb — Purple Flag (*Patersonia occidentalis*), *D. bromeliifolius*, *Hibbertia subvaginata* and *Lyginia barbarta* Low Closed Heath with scattered dead or dying Banksia and Sheoak (dieback affected).

Lb — *Lyginia barbarta* Sedgeland with *D. bromeliifolius*, *X. preissii*, Purple Flag and *Lepidosperma angustatum*.

Fringing Wetland

BBi — *B. attenuata*, *B.menziesii* and Holly-leaf Banksia (*B. ilicifolia*) Low Open Forest over a Low Closed Heath of *D. bromeliifolius*, *Desmocladus flexuosus*, *Gompholobium tomentosum*, *Scholtzia involucrata*, *Hypocalymma angustifolium* and *Adenanthos obovatus*.

Sumpland Vegetation - Seasonally Inundated Areas

MpBaKe — Paperbark (*Melaleuca preissiana*), *B. attenuata*, WA Christmas Tree (*Nuytsia floribunda*) Low Woodland over Spearwood (*Kunzea ericifolia*) and *X. preissii*.

KeDb — Spearwood, *D. bromeliifolius*, *Astartea fascicularis* Low Closed Heath with occasional Paperbark.

KeAf — Spearwood, *Astartea fasicularis* Closed Heath to Closed Scrub with scattered Paperbarks.

AfHa — *A. fascicularis*, *H. angustifolium* Low Closed Heath to Closed Heath with *D. bromeliifolius* and *Boronia racemosa* with occasional stands of Paperbark, Spearwood and Holly-leaf Banksia.

To — Bulrush (*Typha orientalis*) Sedgeland with *Juncus pallidus* over introduced grasses and herbs.

Dampland - Seasonally Waterlogged Areas

Bi — Holly-leaf Banksia Low Open Woodland over Open to Closed Heath of *A. obovatus*, *D. bromeliifolius*, *Astartea fascicularis* and *Pericalymma ellipticum*.

MpKe — Paperbark Low Woodland over a Closed to Open Scrub of Spearwood over *Hypocalymma angustifolium* with occasional *B. attenuata*, Holly-leaf Banksia, Woolly Bush and WA Christmas Tree.

Ke — Spearwood Open Scrub

Figure 1: Conservation Category Wetlands (CCW)

ATA Environmental

LOT 199 GAEBLER ROAD, BANJUP

ENVIRONMENTAL ASSESSMENT

VEGETATION TYPES

CCW

FIGURE 3

FORM 1 BUSH FOREVER SITE ASSESSMENT

Form Completed By: Emma Bamforth
From: DPI
Date: 20th December 2001

Table 1: Bush Forever Site Assessment for Additional Nominated Areas

ISSUE	COMMENT
General Information	
DPI Site Number	31
DEP Site Number	74e
Site Name	Atwell Landcorp Site – Lyon Rd/Gaebler Woodland
Location	Lot 199 Gaebler Road, Banjup (other lots included as part of this nominated area but not assessed on this form include Lot 11 & 12 Beenyup Rd, 50 and 51 Gaebler Rd and Lot 204 which is now included in BF Site 492)
Local Government Area	Cockburn
Size	48.4 hectares – almost all of which is vegetated
Environmental Considerations	
Vegetation Complex	Bassendean Complex Central and South (13% but areas are within the Jandakot airport and under mining proposals where future is uncertain)
Flora Survey Undertaken?	Undertaken by ATA consultants on 5th December 2001. ATA Report No 2001/168 18th December 2001 (a copy of the report is attached). The remainder of the information provided in this proforma has been taken from the ATA report. Sally Madden and Emma Bamforth met ATA onsite on 5th December to check ATA survey methodology and to familiarise ourselves with the site.
Floristic Community Types	ATA inferred that the site contained the following FCT's. FCT 4 *Melaleuca preissiana* Damplands FCT 5 Mixed Shrub Damplands FCT 21a Central *Banksia attenuata – Eucalyptus marginata* Woodlands FCT 21c Low-lying *Banksia attenuata* Woodlands or Shrublands
Vegetation Condition	Emma and Sally assessed veg type in northern section to be Very Good to Excellent, southern section was Good to Very Good. ATA identified the vegetation condition as predominately Excellent with small areas on the periphery of the site as Good to Degraded depending on the extent of weed invasion (see vegetation condition map in ATA report).
Floristic diversity	A total of 109 vascular plant species were recorded during the December 2001 survey. 92 species were natives and 17 introduced. Results from survey will be limited due to timing of survey. ATA indicated that they expected an additional 20-30 species may be recorded in a spring survey.

Scientific importance	Not considered important for the preservation of evolutionary processes nor does it contain any unusual or important geomorphological or geological sites. The site is not recognised as an area of scientific or educational interest or as an example of an important environmental process.
Threatened Ecological Communities (TECs)/Declared Rare Flora (DRF)	No TEC's or DRF were identified as occurring within the site according to CALM's database records. Species likely to occur include: • *Caladenia huegelii* • *Diuris micrantha* • *Diuris purdiei* • *Drakaea elastica* • *Drakaea micranthus ms* No TEC's or DRF were recorded within the study area during the December 2001 flora survey, however it was acknowledged by ATA that the DRF orchids which are known from the region may occur on site but that the timing of the survey was not suitable for their detection.
Rare Fauna	No rare fauna were identified as occurring within the site according to CALM's database records. Species likely to occur include: • Numbat *Mymecobius fasciatus* • Carnaby's Cockatoo *Calyptorhynchus latirostris (also listed under the Commonwealth EPBC Act)* • Native Bees *Leioproctus douglasiellus, Leioproctus contraries* and *Neopasiphe simplicior* • Peregrine Falcon *Falco peregrinus* • Carpet Python *Morelia spilota imbricata* • Southern Brown Bandicoot *Isoodon obseulus* • Western Brush Wallaby *Macropus irma* None of these species were recorded during the site visit however no detailed survey has been undertaken.
Linkage	Lot 199 lies immediately south of and abuts BF Site 492. The lot is not identified as one of Perth's Greenways.
Wetland Management Objectives and/or Type	Two wetland areas identified by WRC mapping (one CCW, the other RE) lie within the northern section of Lot 199. Two additional dampland areas were located in the southern section of the site during the site inspection. These areas could possibly be considered as a RE category. From the site inspection, the wetland mapped as RE (WRC mapping) appeared to be of a CCW quality and consideration should be given to upgrading the management category of this wetland area. ATA has mapped all 4 wetland/dampland areas. The quality of the vegetation in all 4 areas was identified as Good to Excellent.
Groundwater Source Protection Areas	The site lies within a Priority 3 Drinking Water Source Protection Area.

Planning Considerations	
MRS zone	Urban Deferred
TPS zone	Rural. Included in a "Development Zone" in the City of Cockburn's Draft TPS No 3.
Ownership	Private
State Planning Policies (SPPs)/Planning Control Areas (PCA's)/Other Planning Considerations	None Identified
Environmental Protection Policies (EPP's)	None identified.
Previous Planning Approvals	
Mineral Extraction	N/A
Relevant Structure Plans etc:	The Southern Suburbs District Structure Plan (adopted in October 1999) lies to the north of Gibbs Road and to the west of Lyon Road. Council is however planning to extend the structure plan to incorporate the land south of Gibbs road, including Lot 199. As part of the structure planning process and environmental audit, the City of Cockburn nominated the northern portion of Lot 199 and all of Lot 204 for inclusion into Bush Forever. As a prerequisite to the design phase, the City of Cockburn has commissioned a detailed engineering study of servicing and infrastructure requirements for Lot 199.
Previous recommendation by the Bush Forever Inter-Agency Co-ordination Group following first pass over the nominated additional sites (July, 2000)	On the basis of the above work by Cockburn and the existing constraints for Lot 199, Lot 204 was successfully negotiated with Landcorp and was included as a BF Site (No. 492). Lot 199 was not considered suitable due to zoning, ownership and structure plan.
Landowners Views	
Other information	A contract for purchase of this property is currently being upheld due to the uncertainly regarding the sites identification as a nominated Bush Forever area. No liaison with the land owner has been undertaken. Consultation has been primarily been with the prospective buyers and their consultants ATA and Development Planning Strategies. The prospective buyers have indicated that should it be determined that the site meets the Bush Forever criteria and be pursued for inclusion into Bush Forever, they will not pursue the purchase of the property.

DRAFT PERTH'S BUSHPLAN -

ASSESSMENT OF PROPOSED ADDITIONAL BUSHPLAN AREAS

Lot 204 Lyon Road, Banjup

18/1/2000

Department of Environmental Protection
B. Keighery and K. Clarke
January 2000

LOT 204, LYON ROAD, BANJUP

Department of Environmental Protection
Conservation Branch - B. Keighery and K. Clarke, January 2000

SUMMARY

The bushland in Lot 204 Lyon Road is *Banksia attenuata* and *B. menziesii* Low Woodland, *Banksia attenuata* and *B. ilicifolia* Low Woodland and *Melaleuca preissiana* Very Open Woodland generally in Very Good to Excellent condition typical of the Bassendean Complex - Central and South vegetation complex to the south of Perth. Five floristic community types typical of the Bassendean Dunes are considered to be found in the area. The bushland in Lot 204 Lyon Road meets three of the criteria for identifying regionally significant bushland and as a consequence is worthy of inclusion in Perth's Bushplan. As part of the larger Lyon Road Bushland, Lot 204 has additional values related to size and diversity. As an example of the Bassendean Complex - Central and South in the area to the south of Thompsons Lake the bushland in Lot 204 Lyon Road is a suitable substitute for Bushplan Site 458 which is proposed to be excluded from the final Perth's Bushplan. Lot 204 is constrained by its urban zoning and a series of boundaries for encompassing the values of the area are suggested. Boundary C encompasses the smallest area that includes the described attributes.

BACKGROUND

Lot 204 Lyon Road is predominantly bushland and is in the north-western corner of the larger Lyon Road Bushland area identified in the Southern Suburbs District Structure Plan Environmental Audit (City of Cockburn 1999). The Lyon Road Bushland is bounded by Lyon Road to the west, Beenyup Road to the east, Gibbs Road to the north and Gaebler Road to the south (see Map 1). While the size and condition of this bushland could have identified the area as a possible Bushplan Site the urban zoning of much of the area would have curtailed any detailed investigation. Two issues have led to the more detailed consideration of Lot 204 Lyon Road for inclusion in the final Perth's Bushplan. These are:

(1) City of Cockburn's Submission to Perth's Bushplan
The Lyon Road Bushland is one of the bushland areas submitted to MfP as being suitable for inclusion in Perth's Bushplan. The area was considered as part of the Southern Suburbs District Structure Plan Environmental Audit undertaken in the week of 18 January 1999 coordinated by the City of Cockburn. The four key Perth's Bushplan government agencies - DEP (Adrian Vlok and Bronwen Keighery), MfP, CALM and WRC participated in this audit as well as the V & C Semeniuk Research Group on behalf of the City of Cockburn.

(2) Proposed deletion of Bushplan Site 458
Bushplan Site 458 is immediately to the north of the Lyon Road Bushland. Both areas are in the Bassendean Complex - Central and South to the east of Thompsons Lake. Even though Bushplan Site 458 is in Parks and Recreation Reservation and, in terms of Perth's Bushplan was considered protected it is proposed to be entirely excluded from the final Perth's Bushplan as there is advanced planning to use the area for a regional centre. While the values of Bushplan Site 458 as a regional centre have been recognised by the Bushplan Coordination group and the EPA it is considered that a substitute site must be proposed as part of the deletion process. As LandCorp is involved with the development of Bushplan Site 458 and Lot 204 Lyon Road, Lot 204 Lyon Road is considered an appropriate substitute if the areas have comparable value.

Lot 204 Lyon Road has been surveyed by Alan Tingay and Associates (1994, 1998a) for LandCorp and by Regeneration Technology Pty Ltd (1999) for the City of Cockburn.

LOT 204, LYON ROAD, BANJUP

Department of Environmental Protection
Conservation Branch - B. Keighery and K. Clarke, January 2000

A field inspection of the area under consideration for inclusion Perth's Bushplan was made by Bronwen Keighery (DEP) and Kieron Beardmore, Sean Collingwood and Karen Clarke (MfP) and Mike Allen and Melissa Patt (WRC) on 9/11/99. This field inspection focused on Lot 204 Lyon Road. Approximately two hours was spent traversing the bushland by foot and vehicle. Being November many plants had finished flowering. Bronwen Keighery (DEP) had previously visited the area as part of the Southern Suburbs District Structure Plan Environmental Audit.

AREA COMMENTS

The bushland in Lot 204 Lyon Road is an area of *Banksia attenuata* and *B. menziesii* Low Woodland, *Banksia attenuata* and *B. ilicifolia* Low Woodland and *Melaleuca preissiana* Very Open Woodland generally in Very Good to Excellent condition typical of the Bassendean Complex - Central and South vegetation complex. Five floristic community types typical of the Bassendean Dunes are considered to be found in the area.

The Lyon Road Bushland meets three of the criteria for identifying regionally significant bushland (representation of ecological communities, rarity, general criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation) and as a consequence is worthy of inclusion in Perth's Bushplan (Map 2). The area is constrained by its urban zoning and a series of boundaries for encompassing the values of the area are suggested. Option C encompasses the smallest area that includes the described attributes (see Map 3).

DETAIL of the SELECTION CRITERIA

Representation of ecological communities:

Vegetation Complexes

This area lies within the Bassendean Complex - Central and South vegetation complex (Heddle *et al.* 1980).

Floristic Community Types

The floristic composition of this bushland area indicates that it is typical of the following floristic community types

Supergroup 2: Seasonal Wetlands

*4 *Melaleuca preissiana* damplands
*5 Mixed shrub damplands

Supergroup 3: Uplands centred on Bassendean Dunes

*21a Central *Banksia attenuata — Eucalyptus marginata* woodlands
*21c Low lying *Banksia attenuata* woodlands or shrublands
*23a Central *Banksia attenuata — B. menziesii* woodlands

It is a good example of wetlands and uplands of the Bassendean Complex - Central and South.

Description of Lot 204 Lyon Road (after layout for Bushplan Site descriptions)
Landscape Features: vegetated wetland, vegetated upland (prominent NS ridge)
Vegetation and Flora: limited survey (DEP 1999, Regeneration Technology Pty Ltd 1999, Tingay, Alan & Associates 1994, 1998a)

Structural Units: mapping (Tingay, Alan & Associates 1994)

Uplands (Map 1 - 11.4 and part 11.1, Map 2 - BaBmAf/Ke, BaBmAf, BaBmAfBi, EmBaBmAf, Em, Ac, Pr, Er): On the ridge is *Eucalyptus marginata* Open Woodland over *Banksia attenuata* and *B. menziesii* Low Open Woodland to Low Closed Forest

over *Hibbertia subvaginata* and *Leucopogon conostephioides* Open Low Heath over *Phlebocarya ciliata, Dasypogon bromeliifolius* and *Conostylis aculeata* Herbland, *Amphipogon turbinatus* Open Grassland and *Lyginia barbata* Open Sedgeland. Towards the base of the ridge, moving towards the wetland, *Eucalyptus todtiana* and *Banksia ilicifolia* appear as dominants.
Wetlands (Map 1 - 11.1, Map 2 - Mp, Ha): At the margins *Kunzea ericifolia* Closed Tall Scrub is found, surrounding wet flats dominated by scattered to Low Woodland of *Melaleuca preissiana* over Closed Heaths to Closed Low Heaths dominated by *Astartea* aff. *fascicularis, Hypocalymma angustifolia, Pericalymma ellipticum, Euchilopsis linearis* and *Calothamnus lateralis* and combinations of these over *Restio stenostachyus* Sedgeland and *Eucalyptus rudis* Woodland.
Vegetation Condition: Very Good to Excellent.
There are mixed age stands of *Banksia* as well as seedlings. The bushland is relatively intact being generally in Very Good to Excellent condition. Weed diversity and frequency increases towards the west of Lot 204. The edge in this area is highly disturbed with patches of veldt grass and other weeds. Frequent fire and partial clearing has contributed to the lower quality of the vegetation in this area.
Total Flora: 89 native taxa (> 60% of expected taxa; DEP 1999, Regeneration Technology Pty Ltd 1999, Tingay, Alan & Associates 1994, 1998a)
Significant Flora: *Anthotium junciforme* (4)*; *Burchardia bairdii, Restio stenostachyus* (endemic to the Swan Coastal Plain)
* in adjacent bushland, expected to found in wetland

Rarity

The bushland is excellent habitat for the Quenda, runnels and diggings were observed in the area (DEP 1999).

General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation

The vegetated area of the mapped dampland (see Map 2) is generally in Excellent to Very Good condition. While the dampland vegetation described in Lot 204 is found in the Bassendean Dunes the relatively high clay content of the wetland soils support vegetation more typical of wetlands of the Southern River Complex than the Bassendean Complex. The presence of the wetland taxa - *Burchardia bairdii* and *Restio stenostachyus*, more often found on the eastern side of the Bassendean Dunes system illustrate this. The extent, type and condition of this wetland vegetation warrant the recognition of this portion of the dampland as a Conservation Category Wetland (see Appendix 1).

Criteria not relevant to determination of conservation value, but which may be applied when evaluating areas having similar values

The area was considered as part of the Southern Suburbs District Structure Plan Environmental Audit and was part of the area given the highest priority for protection. Structure Planning in the area allows for the 'trade off' of the protection of part of Lot 204 for partial development of the EPP Lakes to the north.

OTHER ISSUES

Lot 204 Lyon Road as part of a larger area

The bushland in Lot 204 Lyon Road is part of a larger area of bushland, the Lyon Road Bushland, an area bounded by Lyon Road to the west, Beenyup Road to the east, Gibbs Road to the north and Gaebler Road to the south. The larger area of Lyon Road Bushland

meets four of the criteria for identifying regionally significant bushland (representation of ecological communities, rarity, diversity, general criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation) and as a consequence is also worthy of inclusion in Perth's Bushplan. Again sections of this area are constrained by its urban zoning. As part of the Lyon Road Bushland, Lot 204 has additional values related to size and diversity.

Lot 204 is also an important component of the proposed greenways for Perth (Tingay & Associates 1998b). Greenway 120, the extension of the Russell Road-Thomsons Lake-Woodman Pt Regional Park Greenway, passes through the northern section of Lot 204 (see Map 4) forming part of a major east-west linkage across the Swan Coastal Plain. Just to the north-east of Lot 204 this Greenway links with Greenway 81, the Forrestdale Lake-Thomsons Lake Greenway, linking wetlands and uplands in the north-west to the site.

Issues raised in relation to the LandCorp response (23rd November 1999)
The response from Alan Tingay & Associates for LandCorp (2nd November 1999, attached to LandCorp letter of 2nd November) raises a series of issues related to process and aspects of the various conservation assessments. While many of these issues are addressed in the preceding assessment of conservation value (in relation to Perth's Bushplan), those relating to this and other conservation assessments are itemised below.

Some of the issues raised are not directly addressed. These relate to the fundamental lack of recognition by Alan Tingay & Associates (2nd November 1999) of the core issue in the recognition of regionally significant bushland - that is that the bushland is a good representative of its type on a regional level.

Omission of Lot 204 Lyon Road from previous regional conservation planning

- System 6: It is well established that there were significant omissions from System 6, Perth's Bushplan is an update of System 6.
- Jandakot Botanic Park: There is no known record of this area being subject to detailed assessment for inclusion in the Park. The draft Perth's Bushplan proposes a series of additional areas in the area of the Park.
- Perth's Bushplan: See Background, this report. The response by Alan Tingay & Associates (2nd November 1999) does not address the natural values of the area in relation to the criteria for the identification of regionally significant bushland.
- Identification of Conservation Category Wetlands: Over 4,700 wetlands have been identified in the studies of the wetlands of the Swan Coastal Plain (Hill and Del Marco 1996, Hill *et al.* 1996b). It is not unexpected that when a wetland is considered on a lot by lot basis that the assessment of a wetland's Management Category may need to be reassessed. The wetland in Lot 204 is a part of the larger Wetland 72 as identified in Hill *et al.* (1996b). The part of the wetland in Lot 204 has been reassessed (see above and Appendix 1) and determined to be Conservation Category. The response by Alan Tingay & Associates (2nd November 1999) does not address a reassessment even though their 1994 report describes a high degree of naturalness for the portion of the wetland in Lot 204.
- Southern Suburbs District Structure Plan Environmental Audit: This process was the result of recognition that there were high quality vegetated wetlands and uplands in the Southern Suburbs that had not been identified in previous planning of the area. A core issue in this Audit was allowing for partial development of the EPP Lakes (for use as

compensation basins) and recognition and protection of some of the high quality vegetated wetlands and uplands.

Declared Rare Flora
There is a deal of confusion associated with the identification of DRF in Lot 204. In past years *Anthotium junciforme* has been gazetted as DRF. This is no longer the case and the most recent CALM listing (Atkins 1998) places *Anthotium junciforme* as a Priority 4 species. Lot 204 contains suitable habitat for *Anthotium junciforme* and there are records of this species to the east of Lot 204. This species is most common after fire and even though searches by Alan Tingay & Associates have not located the species it may well occur in the area.

Detail of the assessments of conservation value
A series of assessments have been made of Lot 204, all have been done over a limited time period, generally outside the peak flowering time for species in the area. However the combination of the information describing the flora and vegetation contained in each of these assessments clearly indicates that the area contains vegetation of a quality and type that meets the requirement for determination as regionally significant bushland (see above). **Any detailed assessment of the area will add to the values identified.** For example, the brief survey of vegetation condition for this report identified a population of *Burchardia bairdii* in the wetland. This is recognised as a significant species in Perth's Bushplan and is the most western known population of this species.

Inclusion of wetland and upland areas
The Bassendean - Central and South Vegetation Complex is typified by a combination of upland and wetland areas. The presence of high quality upland and wetland areas in Lot 204 is fundamental to the areas recognition as containing bushland of regional significance.

Wetland Values
Several wetland specialists have attributed particular values to this wetland (Regeneration Technology Pty Ltd 1999, Semeniuk 1999). The identification of these values is related to expert opinion. Any critique of these values requires a detailed assessment of wetlands in relation to the degree of perching, vegetation and flora of similar wetlands of the Jandakot Wetlands Suite. Such an assessment is beyond the scope of this report, simply disputing the issues as is done by Alan Tingay & Associates (2nd November 1999) is not adequate.

Protection of Bassendean Central and South Vegetation Complex
While the draft Perth's Bushplan recognised more than 10% (13%) of the Bassendean Central and South Vegetation Complex many of these areas are subject to negotiated planning solutions (basic raw material sites, previous planning decisions, urban and industrial zoning, commonwealth land) and only portions of the Sites are able to be protected. The incremental loss of this complex in the implementation of Bushplan is of concern and the identification of alternative areas is a priority.

While Bushplan proposes to look for alternatives outside the PMR this is not suitable in the case of this complex as.

- this complex is already a high priority for protection as less than 1% of this complex is currently considered to be protected outside of the Perth Metropolitan Region (PMR) and;
- the Perth Metropolitan Region is a key area for the conservation of the Bassendean Central and South Vegetation Complex as it lies central to its distribution and floristic community type 23a (Central *Banksia attenuata — B. menziesii* woodlands), the most

species rich of the Bassendean Dune floristic community types, is a key component of this vegetation complex and is confined to the PMR.

Diversity
Diversity has not been used as a criterion in this assessment for the identification of regionally significant bushland as it is difficult to use diversity in this case as comparisons of diversity can only be made between similar areas containing the same suite of communities. While the work done by Regeneration Technology Pty Ltd (1999) gives a measure of the diversity of the units sampled it cannot be compared with other differently acquired measures (eg Gibson *et al.* 1994 mean species richness per plot). However on a broad scale the area has a diversity of structural units; 10 units are mapped (see Map 2, Tingay, A & Assoc 1994), a diversity of species and floristic community types (see above).

Previous correspondence from DEP
The identification of Lot 204 as containing regionally significant bushland is supported by DEP. The memo from Adrian Vlok attached to the response by Alan Tingay & Associates (2nd November 1999) is quoted out of context and is incorrectly attributed to 1999 (Memo date is 6th November 1998). The Memo has been superseded by the Southern Suburbs District Structure Plan Environmental Audit. An integral part of this audit was the ranking of natural areas within the area of the audit. As Lot 204 was identified as having regional value the focus was better protection of this area in the Southern Suburbs District Structure Plan in preference to complete protection of the EPP Lakes.

Comments on possible boundaries

A series of boundaries for proposed protected areas in Lots 204 Lyon Road and are shown on Map 3.

Option A - Protection of the majority of the bushland

Rationale: As outlined above this bushland meets a number of the criteria for regional significance. Therefore, Option A is to retain all of the bushland. The boundary drawn includes all the bushland of conservation value and forms a consolidated area linking through to the larger Lyon Road Bushland area (Map 1) to the south and east of Lot 204. The only area on Lot 204 that does not contain vegetation of regional significance is the cleared area along the northern boundary (see Maps 2 and 3).

If it is not possible to protect the entirety of the vegetated areas on Lot 204 there are a series of other options that take into consideration

- protection of the highest priority area,
- identification of consolidated development and conservation areas
- linkage and
- wetland configuration.

Option B

Rationale: There are some areas that are more disturbed than the majority of the site. These include the north-western and south-western corners where weed invasion has had a major impact on the understorey. Therefore, the proposed boundary for Option B excludes these areas from the core conservation area. However, if these corners are removed this will expose the inner higher value conservation area to greater weed invasion from the newly

created boundary. The retention of more disturbed boundary areas around higher quality core bushland create an effective weed break to protect the inner areas.

Option C
Rationale: Weed invasion, particularly veld grass is a particular problem towards the western edge of the site. Option C proposes a new western boundary along the edge of the *Melaleuca preissiana* wetland including half of the *Eucalyptus rudis* Woodland in the north-western corner of the site and the band of *Banksia attenuata/ Banksia menziesii/ Allocasuarina fraseriana* Woodland in the south-western corner. The areas excluded encompass the worst of the weed invasion. The north-eastern corner of the site is also somewhat disturbed due to the adjacent clearing, frequent fire and weed invasion. Therefore, in Option C it is also excluded. However, as for Option B, retention of these disturbed areas would protect the inner higher conservation areas from weed invasion and other disturbance factors.

Option D
Rationale: The Lot adjoining Lot 204 to the south has been subject to grazing in the past and its vegetation is more disturbed than most areas of Lot 204. The southern boundary of Lot 204 is slightly lower quality vegetation than the core inner area due to the edge effects of the adjacent grazing activities. Option D proposes creating a new southern boundary just in from the existing Lot boundary to remove this lower quality vegetation. However, this option must be considered in conjunction with decisions about the conservation of the larger Lyon Rd Bushland area. Adopting Option D will sever the linkage of Lot 204 to the area identified for conservation to the south of the site, Lot 199 (see Maps 1 and 2).
The south-west corner of Lot 204 is not included in Option D again due to disturbance in this area. However, Option D retains the north-west corner of the site so that all of the *Eucalyptus rudis* Woodland present on the site is retained consolidating the full range of habitats available for the fauna of the uplands and wetlands.

LOT 204, LYON ROAD, BANJUP
Department of Environmental Protection
Conservation Branch - B. Keighery and K. Clarke, January 2000

REFERENCES

(Unlisted references can be found in Draft Perth's Bushplan Volume 2B)

DEP 1999. Perth's Bushplan Survey 1999. Unpublished bushland plot and area records. Department of Environmental Protection, Perth Western Australia

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Tingay, Alan & Associates 1994. Environmental Assessment. Unpublished report for LandCorp, Perth Western Australia

Tingay, Alan & Associates 1998a. Atwell South Environmental Assessment. Unpublished report for Landcorp, Perth Western Australia

Tingay, Alan & Associates 1998b. A Strategic plan for Perth's Greenways - Final Report. Prepared for Environment Australia, Ministry for Planning, Department of Conservation and Land Management, WA Municipial Association, Department of Environmental Protection, Water and Rivers Commission, Main Roads WA, swan Catchment Centre, Conservation Council, Greening WA and the Australian Trust for Conservation Volunteers.

Tingay, Alan & Associates 1999. Letter to Ken Haustead, LandCorp, dated 2 November 1999.

V. & C. Semeniuk Research Group 1999. Letter to Darren Walsh, City of Cockburn, dated 18 February 1999.

APPENDIX 1

WATER AND RIVERS COMMISSION

YOUR REF
OUR REF 12123
ENQUIRIES Melissa Patt
DIRECT TEL (08) 9278 0451

DEPARTMENT OF ENVIRONMENTAL PROTECTION
02 DEC 1999
File No 1 P6087 Name B Keighery
File No 2 _____ Name (BKE)
File No 3 _____ Name _____

9

Bronwen Keighery
Department of Environmental Protection
Westralia Square
141 St Georges Terrace
PERTH WA 6000

Dear Bronwen

Re: LOT 204 LYON RD, BANJUP

Thankyou for allowing the Water and Rivers Commission the opportunity to comment on the potential inclusion of Lot 204 Lyon Rd, Banjup into Bushplan.

Officers of the Commission undertook a site visit on the 9th November 1999 with yourself and officers from the Ministry for Planning. The visit was to assess the site for suitability for inclusion into Bushplan. Having completed the site assessment, the Commission feels that the extent, type and condition of the vegetation would warrant the site having Conservation Category status.

The Commission would support a recommendation for the inclusion of Lot 204 Lyon Rd, Banjup in Bushplan.

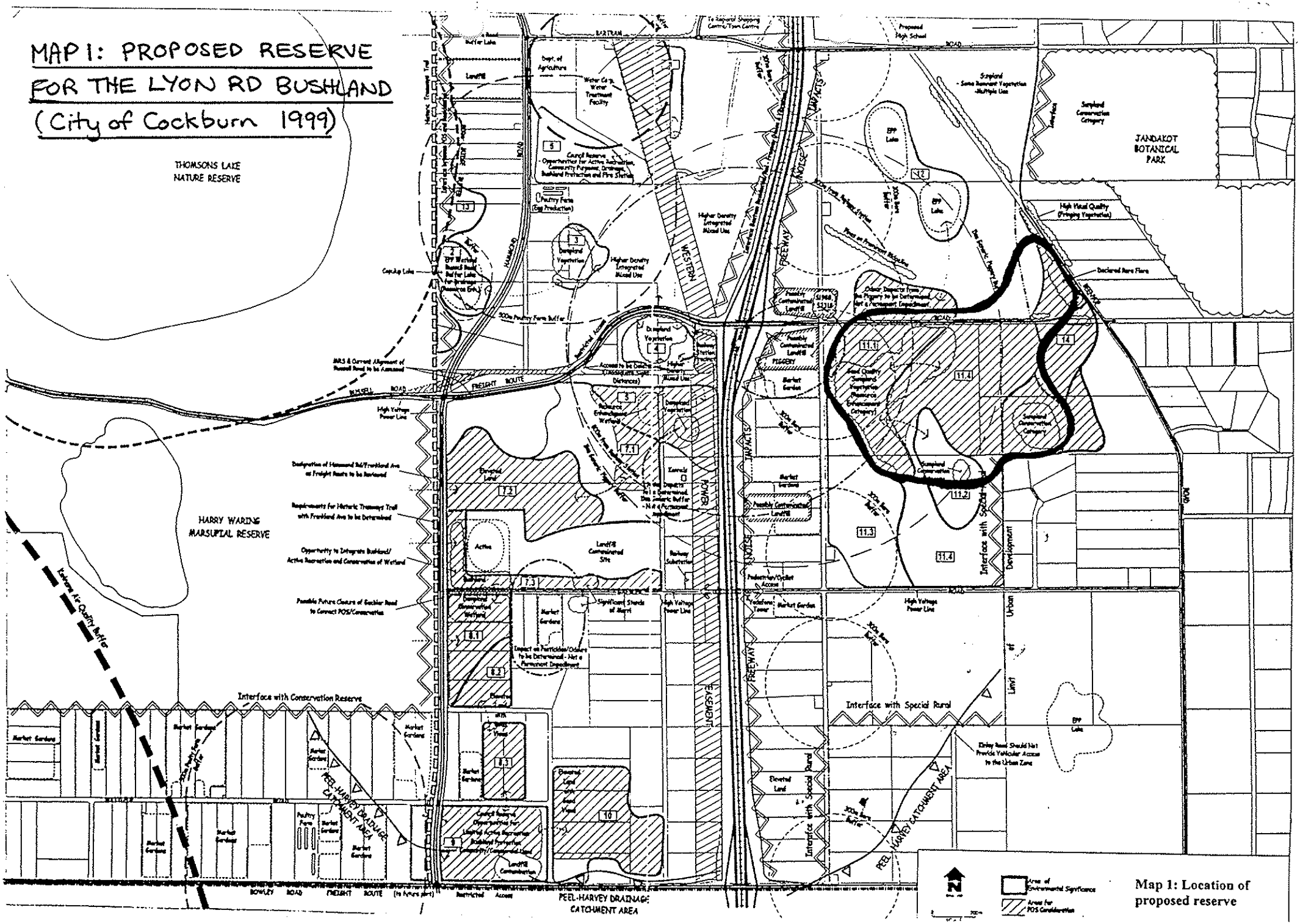
Yours sincerely

Tim McAuliffe
DIRECTOR
POLICY AND PLANNING
30th November 1999

HYATT CENTRE 3 PLAIN STREET EAST PERTH WA 6004
PO BOX 6740 HAY STREET EAST PERTH WA 6892 TEL (08) 9278 0300 FAX (08) 9278 0301
EMAIL ADDRESS correspondence@wrc.wa.gov.au

1183Ex

MAP 1: PROPOSED RESERVE FOR THE LYON RD BUSHLAND (City of Cockburn 1999)



Map 1: Location of proposed reserve

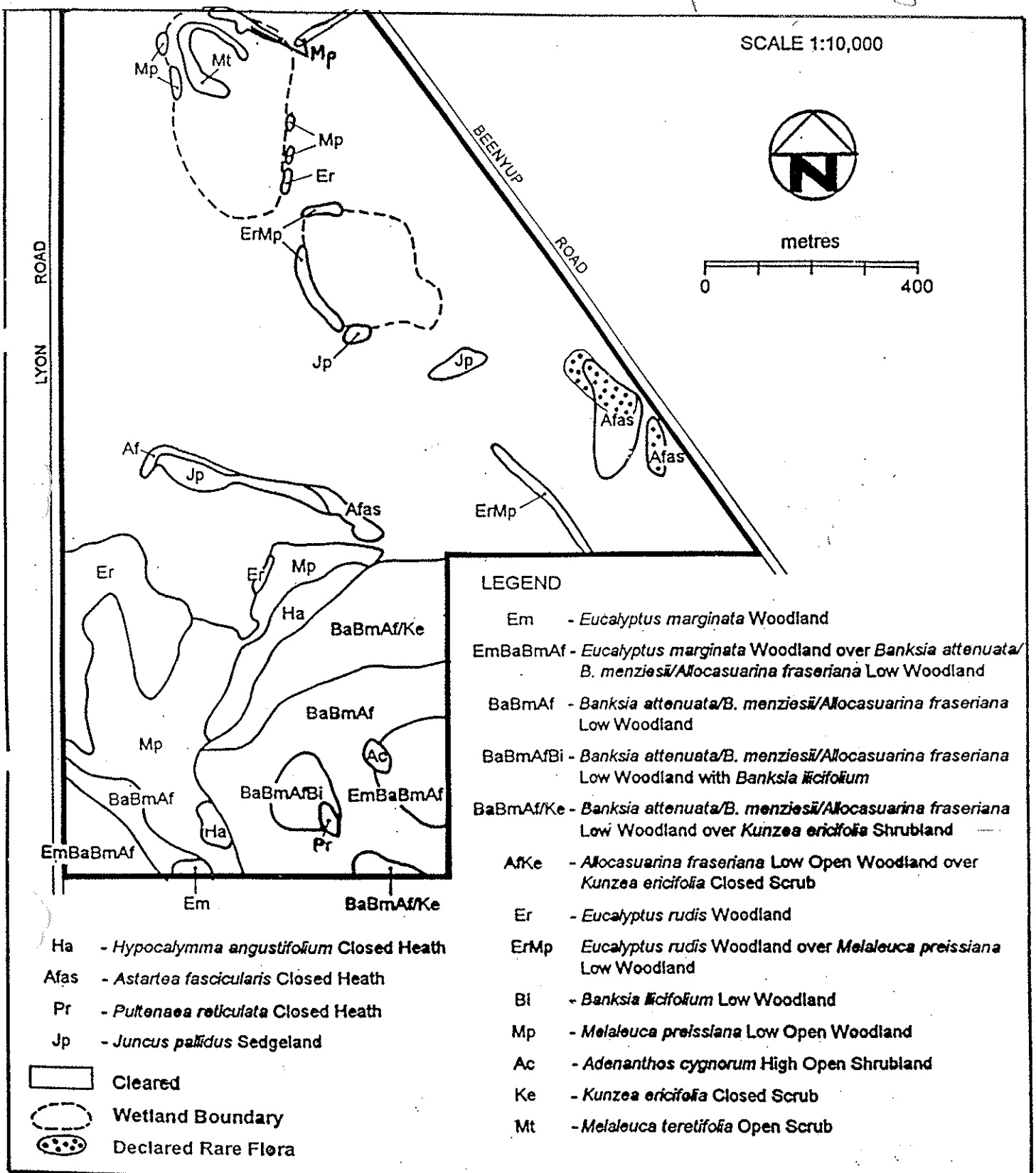
Lyon Road Bushland
City of Cockburn
Aerial 1999

- Bushplan Sites (boundaries)
- Cadastre with Lot Numbers Blue - Overlay Image
- Conservation Category Wetlands - Boundaries
- Contours - 1m & 2m (WAWA)

MAP 2: VEGETATION ASSOCIATIONS (overlay)
(Alan Tingay & Assoc 1994)

Map Ident: plot991027_2
Prepared By: Sean Collingwood
Prepared For: SPC
Date: 27 Oct 1999
Scale 1:10000
0 250 m
MFP INTERNAL USE ONLY

Map 2 - Overlay



LEGEND

Em	- *Eucalyptus marginata* Woodland
EmBaBmAf	- *Eucalyptus marginata* Woodland over *Banksia attenuata/ B. menziesii/Allocasuarina fraseriana* Low Woodland
BaBmAf	- *Banksia attenuata/B. menziesii/Allocasuarina fraseriana* Low Woodland
BaBmAfBi	- *Banksia attenuata/B. menziesii/Allocasuarina fraseriana* Low Woodland with *Banksia ilicifolium*
BaBmAf/Ke	- *Banksia attenuata/B. menziesii/Allocasuarina fraseriana* Low Woodland over *Kunzea ericifolia* Shrubland
AfKe	- *Allocasuarina fraseriana* Low Open Woodland over *Kunzea ericifolia* Closed Scrub
Er	- *Eucalyptus rudis* Woodland
ErMp	*Eucalyptus rudis* Woodland over *Melaleuca preissiana* Low Woodland
Bi	- *Banksia ilicifolium* Low Woodland
Mp	- *Melaleuca preissiana* Low Open Woodland
Ac	- *Adenanthos cygnorum* High Open Shrubland
Ke	- *Kunzea ericifolia* Closed Scrub
Mt	- *Melaleuca teretifolia* Open Scrub

Ha	- *Hypocalymma angustifolium* Closed Heath
Afas	- *Astartea fascicularis* Closed Heath
Pr	- *Pultenaea reticulata* Closed Heath
Jp	- *Juncus pallidus* Sedgeland

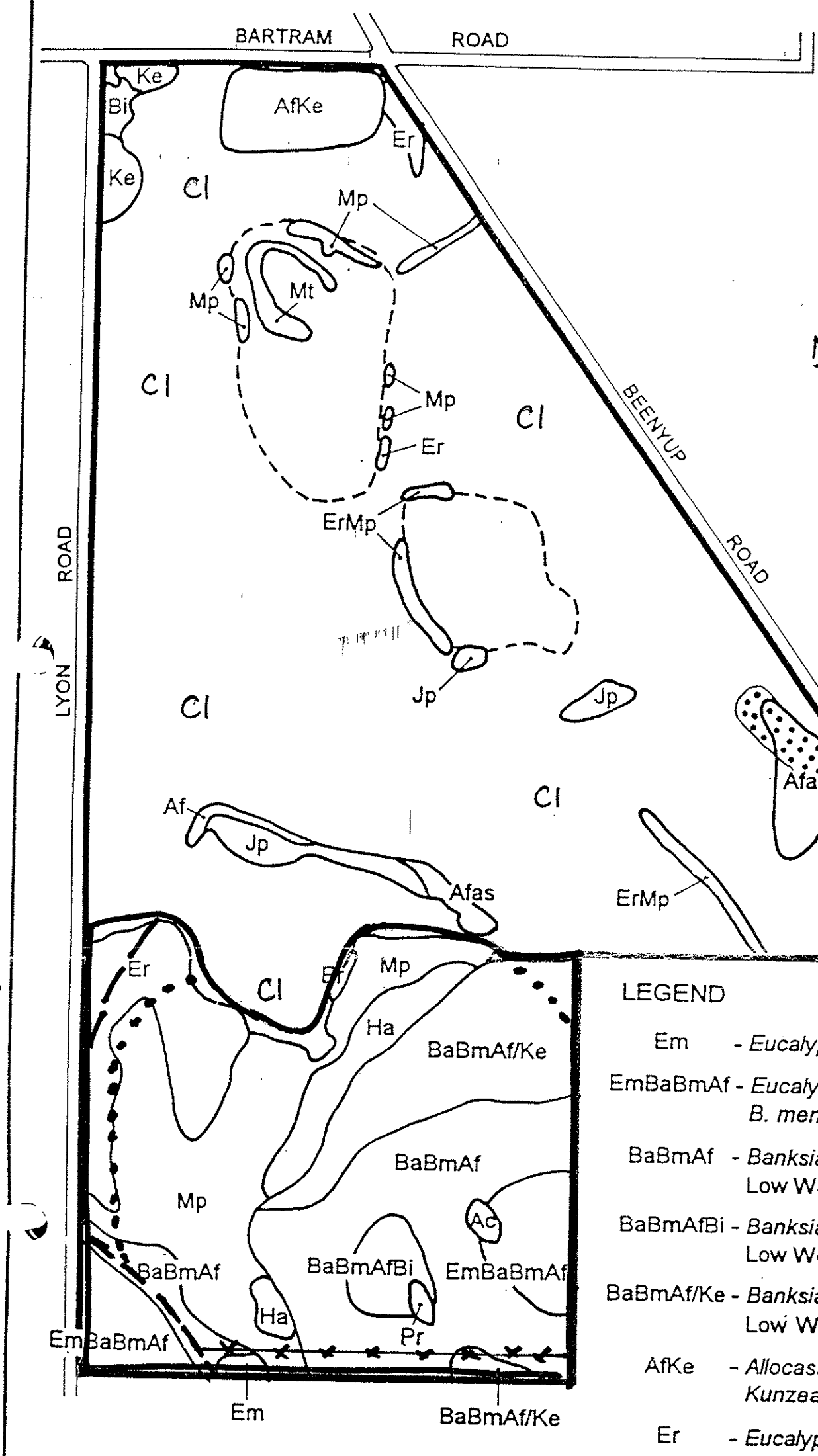
Cleared

Wetland Boundary

Declared Rare Flora

ALAN TINGAY & ASSOCIATES

LOTS 210, 211 & 204 LYON ROAD, ATWELL SOUTH
VEGETATION MAP
FIGURE 6



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SCALE 1:10,000

MAP 3 : BOUNDARY OPTIONS FOR PROPOSED BUSHPLAN SITE, LOT 204 LYON ROAD

——— Option A
– – – Option B
····· Option C
×-×-×- Option D

LEGEND

Em - *Eucalyptus marginata* Woodland

EmBaBmAf - *Eucalyptus marginata* Woodland over *Banksia attenuata/ B. menziesii/Allocasuarina fraseriana* Low Woodland

BaBmAf - *Banksia attenuata/B. menziesii/Allocasuarina fraseriana* Low Woodland

BaBmAfBi - *Banksia attenuata/B. menziesii/Allocasuarina fraseriana* Low Woodland with *Banksia ilicifolium*

BaBmAf/Ke - *Banksia attenuata/B. menziesii/Allocasuarina fraseriana* Low Woodland over *Kunzea ericifolia* Shrubland

AfKe - *Allocasuarina fraseriana* Low Open Woodland over *Kunzea ericifolia* Closed Scrub

Er - *Eucalyptus rudis* Woodland

ErMp *Eucalyptus rudis* Woodland over *Melaleuca preissiana* Low Woodland

Bi - *Banksia ilicifolium* Low Woodland

Mp - *Melaleuca preissiana* Low Open Woodland

Ac - *Adenanthos cygnorum* High Open Shrubland

Ke - *Kunzea ericifolia* Closed Scrub

Mt - *Melaleuca teretifolia* Open Scrub

Ha - *Hypocalymma angustifolium* Closed Heath

Afas - *Astartea fascicularis* Closed Heath

Pr - *Pultenaea reticulata* Closed Heath

Jp - *Juncus pallidus* Sedgeland

Cl Cleared

Wetland Boundary

Declared Rare Flora

DRAWN BY: N.E. 6/10/98 CHEC D BY: N.O'B 30-11-98

98085

ALAN TINGAY & ASSOCIATES

LOTS 210, 211 & 204 LYON ROAD, ATWELL SOUTH
VEGETATION MAP
FIGURE 6

Lyon Road Bushland
City of Cockburn
Site Details

- Bushplan Sites (boundaries)
- Cadastre with Lot Numbers
- Bassendean Complex-Central And South
- EPP Lakes Policy
- PROPOSED GREENWAYS
- Conservation Category Wetlands - Boundaries
- Contours - 1m & 2m (WAWA)
- CALM Rare Flora

MAP4 - GREENWAYS
LINKAGES TO
LOT 204 LYON RD

Greenway 87

LYON RD

HAEFLIGER RD

COFFEY RD

Map Ident: plot991027_3
Prepared By: Sean Collingwood
Prepared For: SPC
Date: 27 Oct 1999
Scale 1:10000
0 250 m
MFP INTERNAL USE ONLY

Figure 1: Site inspection of Lot 204 on 9/11/99 showing northern section of *Hypocalymma angustifolium* Closed Heath with the *Eucalyptus rudis* Woodland visible in the background on the left hand side behind a fringing band of *Melaleuce preissiana* Low Open Woodland. Left to Right: Karen Clarke (Consultant), Kieron Beardmore (MfP), Melissa Patt and Mike Allen (WRC), Sean Collingwood (MfP).

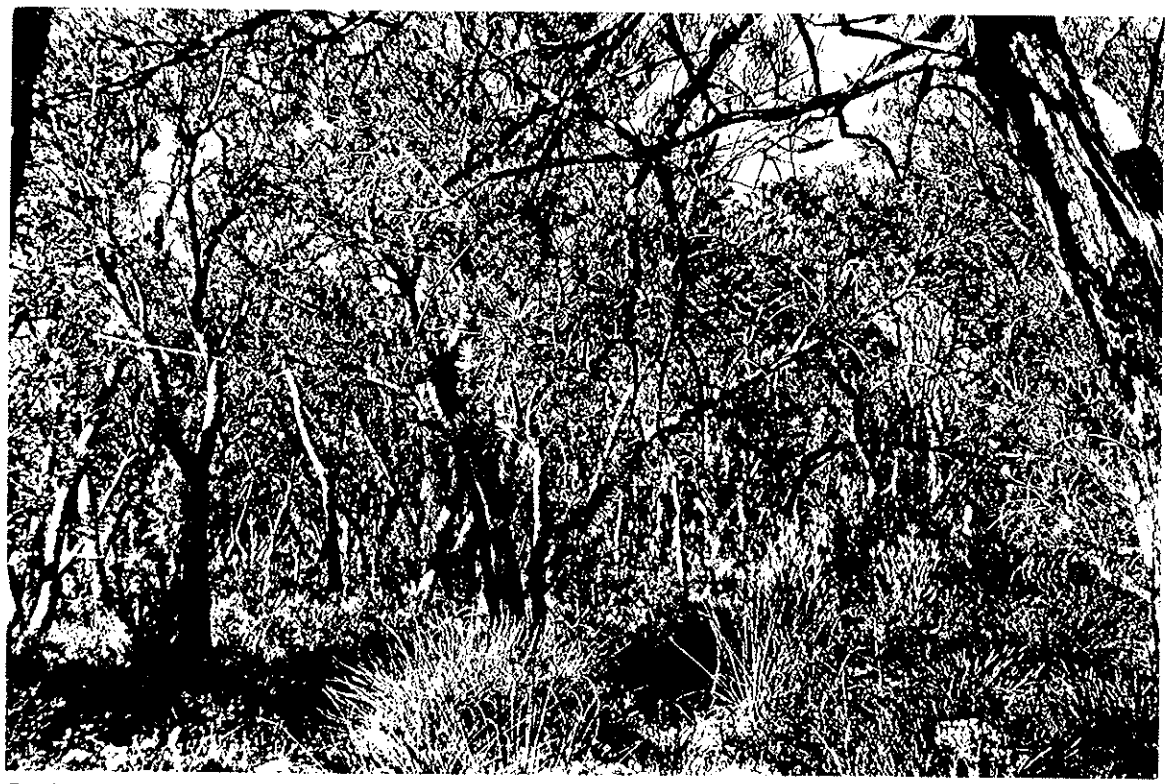

Figure 2: *Banksia attenuata/B. menziesii/Allocasuarina fraseriana* Low Woodland on the eastern side of Lot 204, 9/11/99.

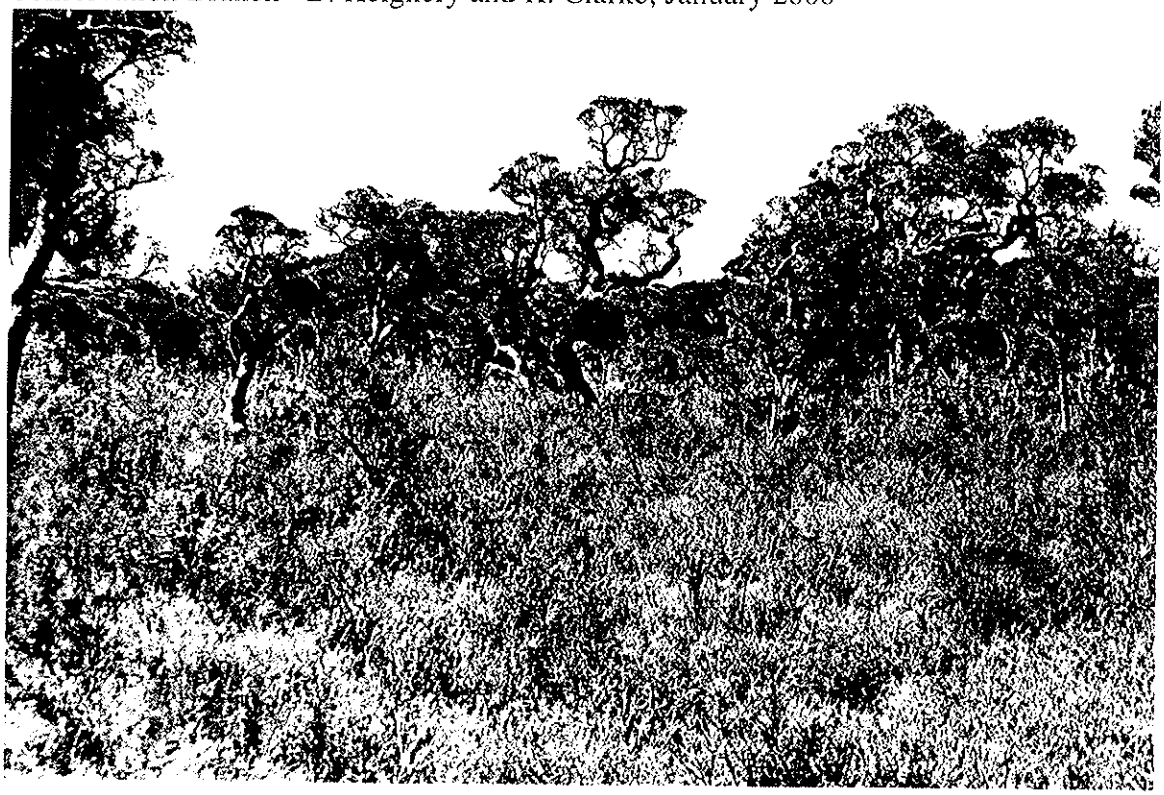

Figure 3: Close-up of *Melaleuca preissiana* Low Open Woodland and *Hypocalymma angustifolim* Closed Heath communities in the centre of Lot 204, 9/11/99.

Figure 4: *Eucalyptus marginata* Woodland over *Banksia attenuata/B. menziesii/ Allocasuarina fraseriana* Low Woodland on the eastern boundary ridge, 9/11/99.

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Conservation Assessment Banjup Bushland for the City Of Cockburn

March 1999

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Table of contents

Table of contents 2
1.0 Introduction 2
1.1 Objectives: 2
1.2 Location and Size of the Proposed Area 2
1.3 Geomorphology 3
1.4 Wetlands 3
2.0 Methodology 3
3.0 Results 4
3.1 Floristics 4
4.0 Assessment Criteria for the Determination of Regional Significance of Bushland (Perths Bushplan, 1998) 7
4.1 Criteria 1, Representation of Ecological Communities: 7
4.2 Criteria 2, Diversity: 8
4.3 Criteria 3, Rarity: 9
4.4 Criteria 4, Maintenance ecological processes or natural systems: 9
4.5 Criteria 5, Scientific or Evolutionary importance: 10
4.6 Criteria 6, General criteria for the Protection of Wetland, Streamline, and Estuarine Fringing Vegetation and Coastal Vegetation: 11
5.0 Conclusion & Recommendations 11

1.0 Introduction

1.1 Objectives:

In a recent Environmental Audit conducted as part of the Southern Suburbs District Structure Plan (City of Cockburn, DEP, Ministry of Planning, WRC and an independent consultant, V & C Semeniuk Research Group), it was identified that Bushland Area 11 in Jandakot was of significant conservation and recreation value. The report suggested that this area in conjunction with a small area on the northern side of side Gibbs Road (Area 14), identified as supporting a DRF species, should be considered for Public Open Space as they represented areas of very high environmental value. A large proportion of the proposed area is currently owned by LandCorp, Area 14 is zoned Urban deferred, while various sections of Area 11 are zoned for urban deferred and Rural Water Protection.

This conservation assessment was commissioned to provide a rapid evaluation of the regional conservation significance of the area in question, in relation to the Perth Bushplan criteria.

1.2 Location and Size of the Proposed Area

The proposed reserve is expected to incorporate approximately 75ha of land comprised of sections 11.1 and sections 11.2, 11.4 and 14 (see attached map). This

area would encompass three seasonal wetlands (two of which are currently zoned conservation category wetlands by Waters and Rivers Commission: WRC), an unusual geomorphological feature known as a star dune and the part of Area 14 that currently supports a small population of the DRF, *Anthotium junciforme*. The reserve is bounded to the north-east by Beenyup Road, and to the south by development and a small section of Area 11 (incorporating Area 11.3 and parts of 11.2 and 11.4) that has been heavily impacted by human disturbance. To the west is Lyon Road, while the northern section incorporates a small section north of Gibbs Road, which is bounded by cleared agricultural land.

1.3 Geomorphology

The proposed reserve is located within the Bassendean soil system on the western side of the Swan Coastal Plain. The area is characterised by low hills and leached siliceous sands, interspersed with damp interdunal depressions.

The soils on the ridges are composed of light grey sand over yellow sand, while interdunal areas are composed of silty sands. Peaty clay dominates the substrate of wetland 54 (map sheet 2033 I SW; Hill *et al.*, 1996). Semeniuk (1999) evaluates the geomorphology of this area as unique.

1.4 Wetlands

Three wetlands will be encompassed within the proposed reserve, these include wetlands 54, 61 and 83 as identified on map sheet 2033 I SW (Hill *et al.*, 1996). Wetlands 61 and 83 are currently categorised by the WRC as conservation wetlands representing areas of high conservation value. Wetland 61 was recently burnt and has in the past been disturbed by grazing, however it has been identified that the naturalness of the adjacent vegetation and the associated damplands are high, incorporating a range of quality habitats (City of Cockburn, 1999). Wetland 83 is ranked within the top one percent of wetlands in its category, indicating it is one of the best examples of that suite grouping of wetlands on the Swan Coastal Plain (Hill *et al.*, 1996). This wetland has received recognition in *A Directory of Important Wetlands in Australia* (ANCA, 1993).

The third wetland, wetland 54 (the focus wetland for this study) is a large perched dampland, with unique plant assemblage. This wetland is considered to have a high level of naturalness, with stratigraphy and habitat uncommon to the region (City of Cockburn, 1999).

2.0 Methodology

A site visit made as part of the environmental audit for the City of Cockburn's Structure Plan (1999), provided descriptions of the vegetation associations found in the proposed reserve area, identified conservation values within each sector of the proposed reserve and listed features unique to the area.

This report gives some initial data on species composition, cover, abundance and richness for the two dominant vegetation/ geomorphic units (Dampland & Uplands). It should be cautioned that limitations to the scope of this work means results do not reflect an adequate sample number or spatial design for the area and are therefore only indicative.

Ten 2x2m plots were randomly sampled within three of the vegetation communities located within the proposed reserve, two within the Dampland (representing the *Eucalyptus rudis* woodland community and the *Melaleuca preissiana* woodland community) and one in the Upland (*Banksia* woodland). Each plot was randomly selected within each community. Within each of these plots, species, abundance and percentage cover were recorded in addition to canopy cover. A vegetation condition index was assigned to each plot based on the condition index developed by Trudgen (1991). The five-point scale accords a score of one for least disturbed sites and five for highly disturbed sites with significant weed invasion.

In addition to these plots, the numbers of trees occurring within a 5m radius from the corner of each were recorded in the Upland. This was considered necessary to capture the dominant overstorey species that were under-represented within the sample plots.

The survey was conducted on the 11 March 1999.

3.0 Results

3.1 Floristics

Table 1: Dominant species in each complex based on plant densities and frequency of occurrence in sample and canopy plots.

Veg. complex	Dampland (*E. rudis*)	Dampland (*M. preissiana*)	Upland
Canopy	*Eucalyptus rudis*	*Melaleuca preissiana*	*Banksia attenuata* *Xylomelum sp.* *Banksia menziesii*
Shrubs	*Astartea fascicularis*	*A. fascicularis* *Hypocalymma angustifolium*	*Kunzea ericifolia* *Hypocalymma robustum* *Scholtzia involucrata*
Herbs	*Dielsia stenostachya**	*Hypolaena exsulca*	*Desmocladus flexuosa*** *Dasypogon bromeliifolius* *Lyginia barbata*

* previously *Restio stenostachya*
**previously *Loxocarya flexuosa*

3.1.1 Community types

Three community types were intercepted as part of the sampling these being *Melaleuca preissiana* damplands, *Eucalyptus rudis* damplands and Low lying *Banksia attenuata* woodlands. These fit broadly into the *M. preissiana* dampland (community type 4) and Low lying *Banksia attenuata* woodlands or shrublands (community type 21c) of the Gibson *et al*, (1994) scheme. The *E. rudis* community identified in this report is considered a subcommunity of the broader *M. preissiana* dampland community.

3.1.2 Species richness

A species richness of 10, 23 and 44 was recorded for the three vegetation communities (i.e. *E.rudis* community, *M. preissiana* community and the *Banksia* woodland community respectively). Figure 1 illustrates the species area curve for these three areas and indicates that more comprehensive sampling is needed to capture the true richness of the areas. However, comparison of mean species richness recorded for the identified community types shows that richness for the upland area already exceeds that recorded for community type 21c (mean richness = 40.5), despite the richness value for the previous study being recorded in more than twice the sample area ($100m^2$ compared to $40m^2$, this study). The combined species richness of the two dampland areas (27) is approaching the mean recorded for community type 4 (richness = 36.9: Gibson *et al.*, 1994).

The timing of the survey meant that certain species such as orchids and annuals were not present or were unidentifiable.

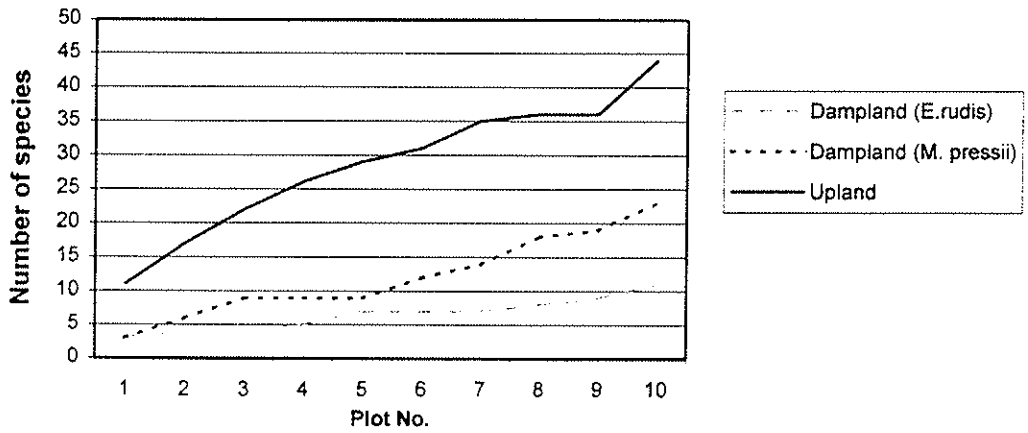

Figure 1: Cumulative species area curves for each of the Vegetation Complexes sampled at the Banjup Bushland.

Table 2: Density, richness and % cover of native species and vegetation condition in each vegetation complex of Bushland Area 11 (plot size 2 x 2m).

Vegetation complex	No. plants (mean ± SE) per plot	Species richness	Native vegetation cover (mean±SE)/plot	Canopy cover (mean ± SE)/plot	Vegetation condition (mean ± SE)/plot	Status
Dampland: *E. rudis*	5 ± 1.387	10	64.8 ± 12.06	49.5 ± 13.03	2.7 ± 0.4175	Very good
Dampland: *M. preissiana*	14.7 ± 2.48	23	96.8 ± 15.75	59.0 ± 11.52	2.25 ± 0.32	Very good
Upland: *Banksia* woodland	32.1 ± 9.86	44	99.6 ± 6.132	31.0 ± 9.86	1.95 ± 0.145	Very good

3.1.3 Vegetation condition

Habitat condition of all areas sampled was very good with minimal human disturbance and weed invasion. This is particularly evident in the Upland unit with the mean condition index being better (1.95) than that recorded in this community type across the Swan Coastal Plain (3.6: Gibson *et al.*, 1994). The condition ratings of the Dampland communities were slightly higher than the mean recorded for similar community types throughout the Swan Coastal Plain indicating slight levels of disturbance. However, these areas still lie within the "very good" condition category.

Overall, it appears that the level of human disturbance has been minimal and this is reflected in the high vegetation condition levels recorded during this rapid sampling exercise. The most significant disturbance impact relates to area 14 where a degraded area of sumpland, containing the DRF species *Anthotium junciforme*, exists. The sumpland area and its fringing vegetation has been impacted by grazing and clearing, with quality vegetation limited to ridge sides in the area, where the *Banksia* woodland has been reported to be in good condition (City of Cockburn, 1999). The northern proportion of area 11.1 has also been partly cleared.

Overall vegetation condition is very good to excellent across the proposed reserve.

3.1.4 Weed Types and Frequency

In the sampled areas, weed frequency did not appear to be significant given the very good to excellent native vegetation cover (99.6% ± 6.132 in the Upland samples) and there was little evidence of dead annual weed biomass in the survey plots. Observed weeds included *Briza maxima, B. minor*, *Aira caryophyllea*, and *Ehrharta calycina* (veldt grass). Veldt grass extent was extremely limited in the sampled area, occurring in only one of the sampled plots in the Dampland (*M. preissiana*) complex. The

predominant weeds were therefore the *Briza* spp. which occurred most frequently in the Dampland (*E. rudis*) complex occurring in six plots, while only four plots contained these species in the Dampland (*M. preissiana*) complex and only two plots in the Upland.

Weed encroachment at present is minimal, however increased fire frequency and other human disturbances such as clearing will almost certainly result in rapid spread of veldt grass and other pasture weeds from adjacent farming areas.

4.0 Assessment Criteria for the Determination of Regional Significance of Bushland (Perths Bushplan, 1998).

Banjup Bushland (City of Cockburn) meets the following Bushplan criteria:

4.1 Criteria 1, Representation of Ecological Communities:

A number of areas selected to represent the range of ecological communities and the places in which these communities range

4.1.1 Inclusion guidelines

An example of regional vegetation type, which is threatened or poorly reserved or a site with special value for flora or fauna conservation.

Areas contributing to at least 10% or 400ha of each vegetation complex, whichever is the largest, in at least five separate areas is to be protected in accordance with guidelines set by the IUCN (1991).

Best available examples of each natural wetland group and wetland types within each group, where the wetland has a direct relationship with bushland or regional significance.

4.1.2 Bushland Area 11/14, Compliance

- The proposed area represents approximately 75ha of excellent to very good quality vegetation. It has been identified by the Southern Suburbs District Structure Plan Environmental Audit that Bushland area 11 represents an area of Very High Value. It was also identified that area 14 reported to contain declared rare flora, represents an area of high value currently limited by a degraded area of sumpland (City of Cockburn, 1999). It was recommended that units 11.1, 11.4 and 14 should have high priority for conservation as Public Open Space (POS).

- It has been identified that within the Jandakot Suite only two damplands are currently known to be vested in conservation reserves, these being the damplands

of the Bangamup and Bosworth reserves (Semeniuk, 1999). In order to ensure adequate representation of damplands in the Jandakot suite it will be essential to conserve the damplands within Area 11 and its associated fringing vegetation and upland vegetation.

- The dampland within Area 11 represents an unusual suite of vegetation communities. This is most likely associated with its perched nature arising as a consequence of a subsurface clay lens. This has the effect of providing water to plants earlier in the season than that received by most other wetlands in the region and consequently the dampland has encouraged the development of an unusual vegetation assemblage (Semeniuk, 1999).

- Wetlands 61 and 83 are currently categorised by the WRC as conservation wetlands representing areas of high conservation value.

4.2 Criteria 2, Diversity:

Areas with a high diversity or flora and/or fauna species or communities in close association

4.2.1 Inclusion guidelines

Areas having considerable biological diversity at the community, species or genetic level

Areas having a high diversity of plant associations, assemblages or communities relative to the area

Areas with high diversity of faunal assemblages.

4.2.2 Bushland Area 11/14, Compliance

- Area 11.1 encompasses the perched dampland, which currently supports a vegetation complex that has been identified as being atypical of damplands in the region, the diversity of which is considered high with uncommon stratigraphy and habitat (Semeniuk, 1999; City of Cockburn, 1999). The naturalness in the undisturbed sections is high (City of Cockburn, 1999). Species richness (27) was high, even considering the limited amount of sampling conducted.

- Area 11.4 incorporates the eastern portion of the star dune ridge. The vegetation condition within this zone is very good, with a species richness recorded from this study of 44. This exceeds the average for this community type (Gibson, *et al.*, 1994), even given the inadequate sampling frequency.

- Although no official faunal surveys have been conducted, faunal diversity is expected to be high, given the variety of habitats/vegetation complexes associated with the area.

4.3 Criteria 3, Rarity:

Areas that contain rare or threatened communities or species, or species of restricted distribution.

4.3.1 Inclusion guidelines

Areas supporting a population of Declared Rare Flora, Priority Flora, Threatened Fauna or ecological community.

Areas supporting rare, uncommon or restricted communities and/or communities outside or at the limit of their normal range.

4.3.2 Bushland Area 11/14, Compliance

- Area 14 has been identified as containing a species of declared rare Flora (*Anthotium junciforme*) of high conservation priority.

- The dampland supports an extensive population of *Dielsia stenostachya* (Restionaceae), a Priority 4 taxon, in addition to small populations of *Meeboldina tephrinus* (Restionaceae), a taxon uncommon in the Perth region (Meney, unpubl.)

- Area 11 (11.4) contains a unique star dune formation on leached grey sands, identified as having high geomorphologic significance (Semeniuk, pers. com.). Similar geomorphic features are poorly represented in reserves on the Swan Coastal Plain and conservation of this feature and its associated vegetation complex is considered to be of high priority. The feature supports an open *Banksia* woodland interspersed with *Eucalyptus todtiana* (City of Cockburn, 1999).

4.4 Criteria 4, Maintenance ecological processes or natural systems:

Maintenance of ecological processes or natural systems at a regional or national scale

4.4.1 Inclusion guidelines

Vegetation in good condition or better (Connell 1995) but threatened vegetation types may be regionally significant even if in poor condition.

Usually greater than 20ha but may be smaller in the case of threatened or poorly reserved vegetation types or areas with special significance for other purposes.

Fauna habitats providing specific requirements for feeding/breeding/nursery functions.

Substantial wildlife corridors connecting bushland areas.

Habitat for significant populations of migratory birds.

4.4.2 Bushland Area 11/14, Compliance

- The survey conducted in this study has revealed that the vegetation complexes within area 11 are in excellent to very good condition with low weed invasion and minimal human disturbance.

- The proposed reserve currently represents approximately 75ha of high quality bushland that may act as a wildlife link between nearby reserves and wetlands. This area would currently provide a partial link between habitat provided in the Jandakot Botanical Park, Thomsons Lake Nature Reserve and Harry Waring Marsupial Reserve.

- The perched dampland will provide valuable resources to amphibian and waterbirds early in the season, reducing pressure on nearby larger wetlands such as Thomson's Lake.

4.5 Criteria 5, Scientific or Evolutionary importance:

Areas containing evidence of evolutionary processes either as fossilised material or as relict species and areas unusual or important geomorphological or geological sites.

Areas of recognised scientific and educational interest as reference sites or as examples of the important environmental processes at work.

4.5.1 Inclusion guidelines

Long term scientific/educational monitoring sites or study areas.

4.5.2 Bushland Area 11/14, Compliance

- The star dune formation represents an area of unusual geomorphologic significance.

4.6 Criteria 6, General criteria for the Protection of Wetland, Streamline, and Estuarine Fringing Vegetation and Coastal Vegetation:

Conservation category wetland areas including fringing vegetation and associated upland vegetation. Coastal vegetation within the accepted coastal management zone.

4.6.1 Inclusion guidelines

Conservation category wetlands associated with regionally significant bushland, their fringing vegetation and associated upland vegetation.

Coastal vegetation within the accepted coastal management zone.

4.6.2 Bushland Area 11/14, Compliance

- Dampland of high local significance given its perched nature and the unusual vegetation complexes associated with its uncommon water regime and soil types.
- Two additional wetlands zoned as conservation category by the Waters and Rivers Commission. One of these has been ranked within the top 1 percent of wetlands within its suite-group, indicating a wetland of high conservation value.

5.0 Conclusion & Recommendations

Overall, Area11/14 is of very high conservation value, containing a variety of communities and geomorphic features which are unique in the Perth region. The condition of the habitats in the area is exceptional considering the level of disturbance in adjacent areas. Maximum effort should be made to ensure impacts to the area are not further increased and the areas ecological processes are conserved. The Banjup bushland meets 5 out of 5 criteria for identifying areas of regional significance (Perth Bushplan, 1999). The area has a high priority for conservation, emphasised by the presence of a number of important taxa including a declared rare flora species, a priority 4 taxa and a species uncommonly found in the Perth region. These features in combination with the areas size, and the rareness of the dampland community and the star dune formation, stress the areas compliance to the criteria for inclusion in the Perth Bushplan (1999).

It is recommended that this area be included in the Bushplan as a regionally significant bushland and be conserved accordingly. This would ensure that wetland type diversity, wetland process diversity, habitat diversity, geomorphological diversity and the overall biodiversity that pertains to the Jandakot region will be maintained. It is also recommended that a comprehensive management and conservation plan be undertaken, incorporating a comprehensive survey of flora and fauna.

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Hill, A.L., Semeniuk, C.A., Semeniuk, V., & Del Marco, A., (1996) *Wetlands of the Swan Coastal plain, Volume 2B: Wetland Mapping, Classification and Evaluation. Wetland Atlas.* Waters and Rivers Commission and the Department of Environmental Protection, Perth.

Semeniuk, V & C Research Group, (1999) unpublished correspondence to City of Cockburn. VCSRG Pty Ltd.

Appendix 1. ***Species list for each vegetation community at Banjup bushland.***

DAMPLAND
***Eucalyptus rudis* Community**

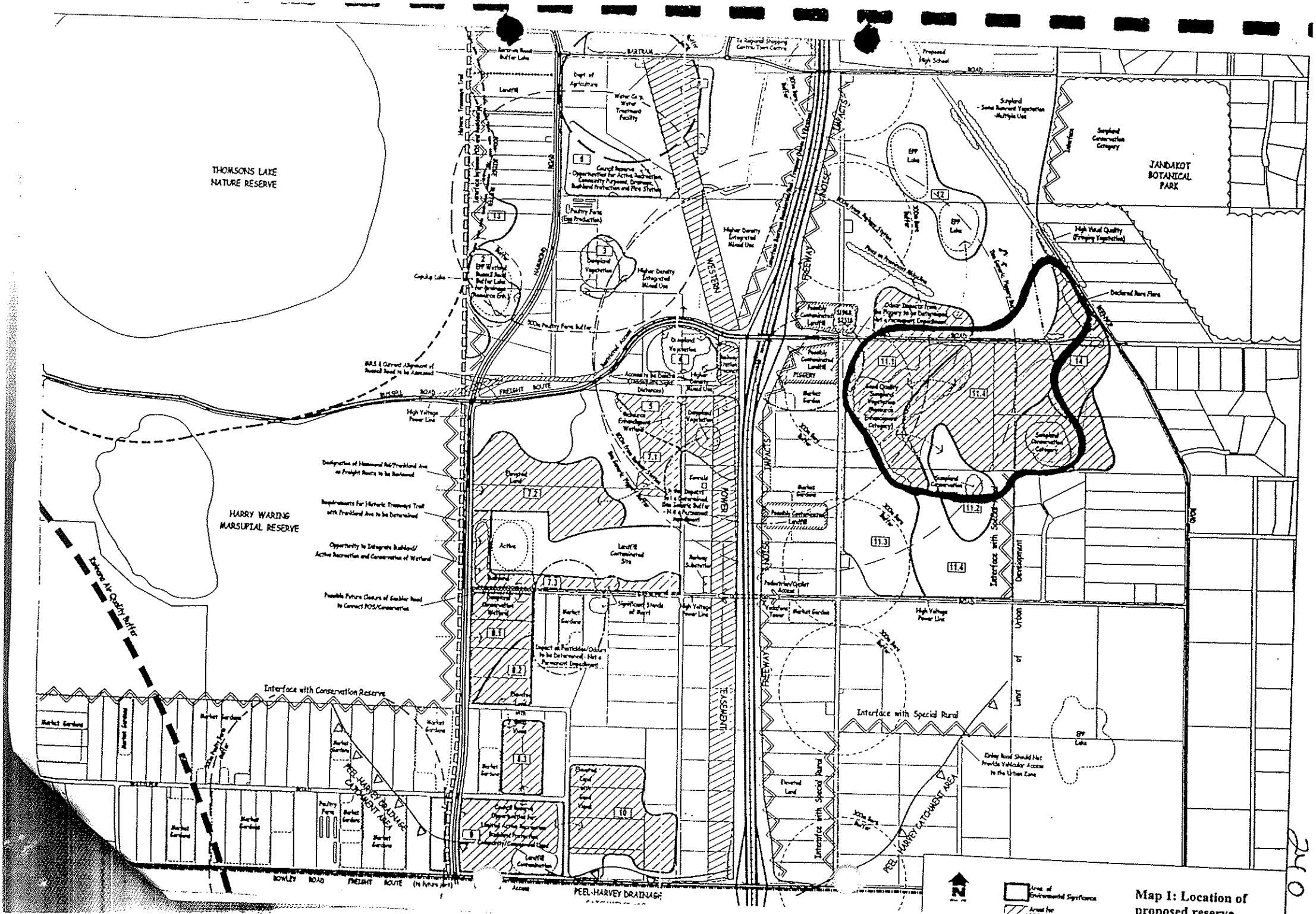
Astartea fascicularis
*Briza minor**
Cassytha racemosa
Dampiera linearis
Dielsia stenostachya
Eucalyptus rudis
Hypocalymma angustifolium
Melaleuca preissiana
Melaleuca teretifolia
Patersonia rudis

***Melaleuca preissiana* Community**
Acacia pulchella
Agonis linearifolia
*Aira caryophyllea**
Astartea fascicularis
Baumea articulata
*Briza minor**
Cassytha racemosa
Dielsia stenostachya
*Ehrharta calycina**
Eucalyptus rudis
Gompholobium ~~aristatum~~ tomentosum
Hypocalymma angustifolium
Hypolaena exsulca
Jacksonia furcellata
Lepidosperma angustatum
Lepidosperma longitudinale
Lyginia imberbis
Meeboldina roycei
Meeboldina tephrinus
Melaleuca preissiana
Melaleuca teretifolia
Nuytsia floribunda
Patersonia rudis
Schoenus rodwayanus
Stylidium repens
Unknown legume
Viminaria juncea

UPLAND

***Banksia* Woodland Community**

Acacia pulchella
Adenanthos cygnorum
*Aira caryophyllea**
Allocasuarina fraseriana
Astartea fascicularis
Banksia attenuata
Banksia ilicifolia
Banksia menziesii
Bossiaea eriocarpa
*Briza maxima**
Calytrix flavescens
Calytrix fraseri
Conostylis aculeata
Corynotheca micrantha
Dampiera alata
Dampiera linearis
Dasypogon bromeliifolius
Desmocladus flexuosa
Eucalyptus marginata
Eucalyptus todtiana
Gompholobium aristatum
Gonocarpus sp.
Hibbertia subvaginata
Hypocalymma angustifolium
Hypocalymma robustum
Hypolaena exsulca
Jacksonia furcellata
Kunzea ericifolia
Lepidosperma aff. gracilis
Leucopogon conostephioides
Lomandra hermaphrodita
Lomandra nigricans
Lomandra preissii
Lomandra sp.
Lyginia barbata
Lyginia imberbis
Macrozamia riedlei
Melaleuca preissiana
Melaleuca teretifolia
Melaleuca thymoides
Nuytsia floribunda
Patersonia rudis
Petrophile linearis
Platysace compressa
Pultenaea reticulata
Schoenus curvifolius
Scholtzia involucrata
Stipa compressa
Stylidium repens
Stylidium sp
Xanthorrhoea preissii
Xylomelum occidentale


THOMSONS LAKE NATURE RESERVE
HARRY WARING MARSUPIAL RESERVE
JANDAKOT BOTANICAL PARK
BARTRAM ROAD
BRIGGS & Garratt Alignment of Russell Road to be Assessed
BUSSELL ROAD
FREIGHT ROUTE
HAMMOND ROAD
WESTERN POWER
FREEWAY
NOISE
IMPACTS
KENTUCKY ROAD
ROWLEY ROAD
PEEL-HARVEY DRAINAGE
PEEL-HARVEY CATCHMENT AREA
Interface with Conservation Reserve
Interface with Special Rural
Interface with Special Rural Development
Interface with Urban Land
Entrance Air Quality Buffer
Proposed High School
Proposed Shopping Centre Town Centre
Water Corp. Water Treatment Facility
Dept of Agriculture
Landfill
Poultry Farm (Egg Production)
Council Reserve - Opportunities for Active Recreation, Community Purposes, Drainage, Bushland Protection and Fire Station
Conjuka Lake
EPP Wetland & Buffer Lake for Groundwater Recharge (Ph.)
EPP Lake
Swampland - Some Remnant Vegetation - Multiple Use
Swampland Conservation Category
High Visual Quality (Fringing Vegetation)
Declared Rare Flora
Odour Impacts from the Piggery to be Determined - Not a Permanent Impediment
Possible Contaminated Landfill SUMA #3218
PISGERY
Higher Density Integrated Mixed Use
Drainage Access
Access to be Built to Standard (Distances to be Determined)
Residence Embedding Wetland
Drainage Lake
Active Recreation
Landfill Contaminated Site
Railway Substation
Pedestrian/Cyclist Access
Significant Stands of Marri
Impact on Pesticides/Odours to be Determined - Not a Permanent Impediment
Electricity Tower
Market Gardens
Poultry Farm
Designation of Hammond Rd/Frankland Ave as Freight Routes to be Reviewed
Requirements for Historic Tramways Trail with Frankland Ave to be Determined
Opportunity to Integrate Bushland/ Active Recreation and Conservation of Wetland
Possible Future Closure of Gwalker Road to Connect POS/Conservation
Delay Road Should Not Provide Vehicular Access to the Urban Zone
Area of Environmental Significance
Areas for
Map 1: Location of proposed reserve

LANDCORP

ATWELL SOUTH

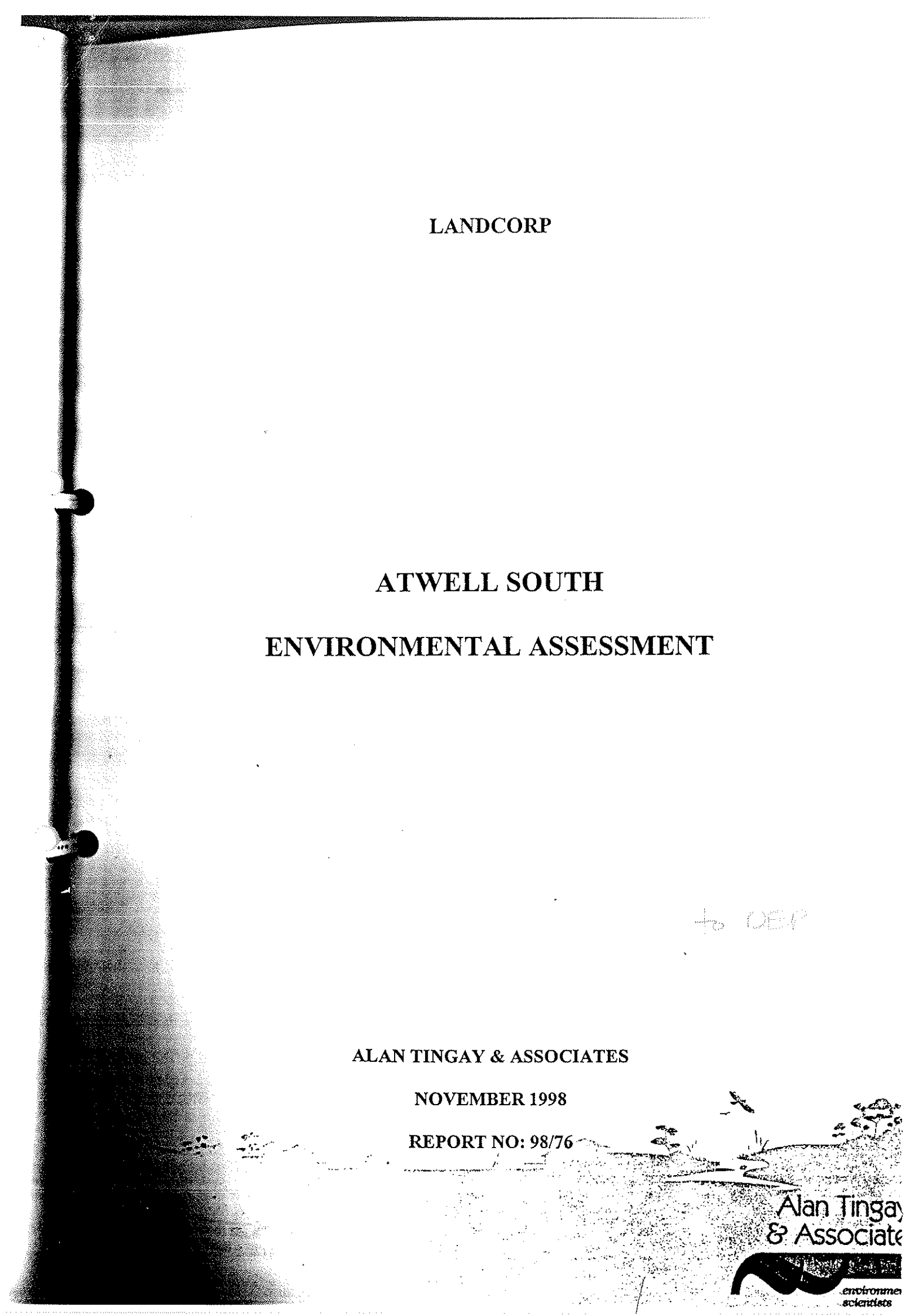
ENVIRONMENTAL ASSESSMENT

to DEP

ALAN TINGAY & ASSOCIATES

NOVEMBER 1998

REPORT NO: 98/76



According to a previous assessment in the Jandakot area conducted by Bowman Bishaw Gorham (1990), the two EPP lakes were identified as having no natural cover, low landscape value, low recreational potential, medium-high degree of disturbance, low biological condition and an overall apparent conservation value rated as medium.

In 1996 the Water & Rivers Commission (WRC), in conjunction with the DEP, published the Wetland Atlas which mapped wetlands on the Swan Coastal Plain, identified wetland types, classified wetland management categories and recommended buffer zones. The Wetland Atlas identifies two sumplands (seasonally inundated basins) in the study area (Figure 5). The boundaries of these wetlands are not consistent with the EPP wetland mapping. This is due to different criteria used for defining wetlands in the Wetland Atlas compared to that used for defining EPP wetlands which only identified areas of standing water of 1000m^2 or more as at 1 December 1991.

One of the sumplands is located in the northern half of the study area and covers the eastern half of Lots 210 and 211, including the area of EPP lakes. The northern wetland is classified with a management category of Multiple Use. According to the EPA (1993) Multiple use wetlands have few attributes but still provide important wetland functions. Their use, development and management should be considered in the context of water, town and environmental planning through landcare.

The second sumpland is located in the southern half of the study area, mainly on the western half of Lot 204 and extending into the south west portion of Lot 211. This wetland has a Resource Enhancement management category which means that the wetland has been partly modified but still supports substantial functions and attributes. Management priorities should aim at wetland restoration through the maintenance and enhancement of wetland functions and attributes. Therefore, the Wetland Atlas identifies the southern sumpland as having higher environmental values than the northern sumpland that includes the area of EPP lakes.

2.5 Vegetation

2.5.1 Vegetation Associations

Most of Lots 210 and 211 have been cleared of native vegetation. Some degraded remnants occur along the northern boundary and isolated trees remain throughout the pasture. In contrast, most of the native vegetation on Lot 204 has been retained (Figure 6).

The following description of the vegetation on Lot 204 is based on a survey undertaken by Alan Tingay and Associates in May 1994.

The vegetation belongs to the Bassendean Complex-Central and South. The upland sandy ridges consist of a Low Woodland of Jarrah *(Eucalyptus marginata), Allocasuarina fraserriana, Banksia attenuata* and *Banksia menziesii* trees from 6-10m tall over an understorey with *Jacksonia furcellata, Gompholobium tomentosum* and *Bossiaea eriocarpa* as dominant shrubs. A low ground layer is also present with *Dasypogon bromeliifolius* and *Hypolaena exsulca* being common. *Jacksonia furcellata* is not present

in areas which contain *Stirlingia latifolia* which is common after fire, indicating that fire frequency may explain variations in the understorey in this area.

The vegetation on mid slopes consists of *Banksia attenuata, B. menziesii* and *Allocasuarina fraseriana* Low Woodland. *Banksia ilicifolia* is also common in the overstorey. The understorey is generally low, up to 0.3m in height, with dominant species *Scholtzia involucrata, Dasypogon bromeliifolius* and *Loxocarya flexuosa*. The presence of these species and *B. ilicifolium* indicates that the water table in winter is within a few metres of the surface.

The low-lying areas are subject to waterlogging and support a vegetation type consiting of scattered Paperbark trees *(Melaleuca preissiana)* up to 6-8m tall over a Low Closed Heath and Sedgeland dominated by *Hypocalymma angustifolium* and *Leptocarpus coangustatus* from 0.3m and 0.6m tall. Dense stands of *Astartea fascicularis* up to 1.2m tall also occur on the flats.

In some area the *Melaleuca preissiana* trees form a Woodland with 10-20% cover while in others they are more scattered in an Open Woodland formation over a Closed Heath. *Hypocalymma angustifolium* Closed Heaths and Low Closed Heath/Sedgelands occur where the *M. preissiana* trees are scarce or totally absent.

Fringing the flats in the north-eastern section are stands of *Kunzea ericifolia* (Spearwood) Closed Scrub. Dense stands are up to 5m tall and with a dense canopy that does not allow the development of an understorey apart from scattered *Dasypogon bromeliifolius* sub-shrubs.

Kunzea ericifolia shrubs are also common as a sub-canopy under *Banksia* Low Woodlands in the lower slopes of the north-east corner.

The north-west corner of Lot 204 contains a Flooded Gum *(Eucalyptus rudis)* Woodland 10-12m tall over occasional *Melaleuca preissiana* trees 6m tall. The understorey of the Flooded Gum Woodland is open and dominated by *Hypocalymma angustifolium* and *Astartea fascicularis*. This area is flat and sandy and is prone to waterlogging and inundation in winter. The sedge *Lepidosperma longitudinale* and the rush species *Restio stenostachyus* are also common under the Flooded Gum Woodlands.

One isolated stand of *Pultenaea reticulata* Closed Scrub occurs in a small depression within *Banksia* Low Woodland in the southeastern area. This stand is about 600m² in size and contains a dense clump of *P. reticulata* shrubs 1.5-2m tall, over *Dasypogon bromeliifolius*. *Kunzea ericifolia* is also present in the shrub layer up to 3m tall. *Pultenaea reticulata* is common in winter-wet depressions in the swan Coastal Plain but is rarely the dominant species in a Closed Scrub association.

2.5.2 Vegetation Significance

Perth's Bushplan is a "whole of Government" report that builds on the System 6 Update and the findings of the Perth Environment Project. Prepared jointly by the Ministry for Planning (MFP), DEP, CALM and the Water & Rivers Commission, it identifies areas of land worthy of protection to conserve the biodiversity of the Swan Coastal Plain portion

of the Perth Metropolitan Region. Perth's Bushplan was released for public comment on 28 November 1998. The site is not included in the draft Bushplan.

The main criteria used by government agencies to determine regional significance of vegetation has been to protect a minimum 10% of each vegetation complex remaining in the Perth Metropolitan Area (PMA). Currently there is 22% of the Bassendean Complex Central and South remaining in the Perth Metropolitan Area, of this 6% is currently protected, and an additional 7% is proposed for reservation in Bushplan.

In addition to this main criteria, the Urban Bushland Strategy (1995), established the following criteria for determining locally and regionally significant bushland:

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.
...ying 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 is 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 in 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.

O... the basis of these criteria, the exclusion of the land from the draft Bushplan, and the presence of larger remnants within the nearby Jandakot Botanical Park, it could be argued that the vegetation on the lots is of local significance only and is not vital to meet the government's objective for urban bushland conservation.

2.5.3 Vegetation Condition

The condition of the native vegetation on Lot 204 is quite variable. The majority of the swampy vegetation and the vegetation on the eastern ridge is in good condition with a low amount of human disturbance. The vegetation on the western ridge areas adjacent to Lyon Road is in poor condition with a high density of invasive weeds such as Veldtgrass *(Ehrharta calycina)* and *Gladiolus caryophyllaceus*. The density of trees and shrubs in this area also appears to have been reduced markedly by past clearing practices.

The area has a large population of rabbits throughout the native bush.

In 1994, the understorey in the dry upland areas contained a large number of dead and stressed low shrubs. This appears to be a drought-induced effect due to the lack of rain

experienced in the six months prior to the survey. The understorey should regenerate after the onset of winter rains.

There are also many dead *Banksia* trees scattered throughout the area. These have most likely been killed by past fires as there is no apparent indications of dieback disease which can lead to *Banksia* deaths.

2.6 Flora

A survey of native flora, including identification of any rare or priority flora or unusual species found on site, was conducted by Alan Tingay & Associates in May 1994. The timing of the survey meant that ephemeral species which may be present in spring, ie. orchids and annuals, were not recorded.

A total of 79 native species were recorded during the survey. This includes 1 non-flowering plant *(Macrozamia riedlei)*, 23 Monocotyledons and 55 Dicotyledons. The plant families containing the most number of species were the Myrtaceae (13 species), Papilionaceae (11 species), Proteaceae (9 species) and Restionaceae (7 species).

The Department of Conservation and Land Management (CALM) maintains a list of Rare or Priority Flora. Five species which may occur in the study area were listed as DRF. These include:

- *Caladenia huegelii*
- *Diuris micrantha*
- *Diuris purdiei*
- *Drakaea elastica*
- *Drakaea micrantha*

← not visible.

None of these species found in the 1994 survey were a gazetted Declared Rare Flora (DRF). A recent search of the CALM database identified that the DRF species, *Anthotium junciforme* has been found on the site in swampy land on Lot 211 adjacent to Beenyup Road (Figure 6). This species usually grows at the edges of swamps, often under *Melaleuca preissiana* or *Hypocalymma angustifolium* but can also be found in *Banksia ilicifolia* flats. These habitats occur extensively and in good condition on Lot 204. LandCorp has committed to conducting a thorough survey for this species during the summer flowering months to determine its presence in the study area.

2.7 Fauna

The study area contains a number of fauna habitat types, however no survey of native fauna in the study area has been carried out. The range of species which utilise these types of habitats is likely to be similar to that which occurs in nearby areas within the Jandakot Botanical Park.

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236

Vegetation Survey of Frankland Reserve for City of Cockburn

22/10/95

Dr Kathy Meney
Consultant Botanist

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SUMMARY

• Frankland Reserve represents a floristic composition and vegetation structure typical of *Banksia attenuata-Banksia menziesii* woodland on Bassendean sands in the Perth Coastal Plain.

• No rare or priority flora were recorded in the reserve.

• Species richness was high (67 native species at the site) and the floristics are representative of 'Group 3' and Community type 20 flora categories for vegetation of the Swan Coastal Plain (Gibson *et al*)

• The Banksia community type at Frankland Reserve is considered poorly reserved and of vulnerable conservation status on the Swan Coastal Plain (Gibson *et al*).

• Vegetation condition is average, affected mainly by frequent fires which have diminished the seed banks of seeder species and resulted in a high proportion of denuded ground, particularly on the dune ridge.

• The number of weed species at the reserve and weed frequency in surveyed plots was average for Banksia woodlands but low in terms of overall cover and competitive threat.

• Frankland Reserve is a species rich reserve of high conservation value. The current vegetation condition, which is average for urban reserves on the Swan Coastal Plain, will improve with fire exclusion and weed management along perimeter roads and internal tracks. The reserve represents a Banksia woodland community type which is poorly reserved and vulnerable and should be retained for conservation purposes.

1.0 METHODS

1.1 Location and Size of Reserve

Frankland Reserve is located in the City of Cockburn and is bounded by Frankland Road, Wattleup Road and private land. It is approxim tely 10 ha and incorporates a mid-dune and upper dune crest on porous Bassendean sands.

1.2 Survey

A series of three 20m^2 plots were established along a transect line to incorporate lowland (Plot 1, near Wattleup Rd), mid-dune (Plot 2) and the dune ridge (Plot 3). The site was assessed on a single occasion in September 1995, while most annual species were in full flowering phase.
Vegetation structure was recorded using Muir's classification (Muir 1977). Vegetation condition was scored using the five point scale developed by Trudgen (1991) and used by Gibson et al (1994) for a floristic survey of the Swan Coastal Plain. This system accords a score of one for least disturbed sites and five indicating highly disturbed sites with significant weed invasion. Species richness and weed frequency were also recorded. Vegetation type is used to refer to structural vegetation units and community type/s classified according to Gibson et al (1994).

2.0 RESULTS AND DISCUSSION

2.1 Vegetation Structure

Structurally, the vegetation type at Frankland Reserve is uniform open low woodland dominated by *Banksia attenuata* and *Banksia menziesii*. Scattered *Eucalyptus marginata* occurs on the dune ridge and *Banksia ilicifolia* and *Nuytsia floribunda* are very occasional on the lower slopes.

2.2 Floristics

The floristic composition of Frankland Reserve belongs to the 'Group 3' classification of Gibson *et al* (1994), ie. typical of Bassendean Dunes. This vegetation group has the highest species richness (mean 60.4 native species per site) and lowest weed frequency (mean 3.4 species per site) of major vegetation types on the Swan Coastal Plain and this broad floristic 'supergroup' has high conservation value. Within this vegetation class are four distinct community types, with Frankland Reserve most typical of Community Type 20 (Table 1).

A species richness of 67 taxa was recorded for Frankland Reserve. This compares favourably with Group 3 Banksia woodlands indicating it is typical of this floristic group. It is of high species richness compared to Banksia woodland communities in general on the Swan Coastal Plain, which average a species richness of 7 to 86 per 100m^2 (Gibson *et al*).

Weed species and frequency was slightly higher than average for better condition Banksia woodlands, with a total of nine weed species averaging 5.7 per $20m^2$ plot. The higher weed frequency and density reflects the recent fire through the reserve which favours a initial predominance of pioneering species. Percentage weed cover was relatively low in surveyed plots (<3%), but was considerably higher in denuded, fire-scarred upper dune ridge and along the reserve perimeter.

Overall vegetation condition was average, ranging from poor on areas of the dune ridge and adjacent to Wattleup Road where weed impact and total proportion of denuded ground was high, to excellent in mid-slope zones. The site had been recently burnt and use by wildflower pickers and 4WD users has had localised affect on weed spread and soil de-stabilisation along existing tracks.

Table 1. Parameters used to assess conservation value of Frankland Reserve.

PARAMETER	VALUE	STATUS
Species richness (no. at site)	67	high
% Similarity to most similar community type (Gibson *et al*)	80	typical
Weed frequency (mean species no./plot)	5.7	average
% Weed cover	2.3	low
Vegetation condition	3	average

Table 2. Dominant species based on plant densities in plots.

Shrubs	Herbs
Stirlingia latifolia	*Mesomelaena pseudostygia*
Hibbertia hypericoides	*Burchardia umbellata*
Calytrix flavescens	*Amphipogon turbinatus*
Melaleuca acerosa	*Lomandra hermaphrodita*
Gompholobium tomentosum	*Conostylis setigera*
	Schoenus curvifolius
	Trachymene pilosa
	Crassula colorata

Table 3. Frequent species based on presence in all plots.

232

Shrubs	Herbs
Allocasuarina humilis	*Amphipogon turbinatus*
Conostephium pendulum	*Burchardia umbellata*
Melaleuca acerosa	*Conostylis setigera*
Petrophile linearis	*Crassula colorata*
Stirlingia latifolia	**Gladiolus caryophyllaceous*
	**Hypochaeris glabra*
	Lomandra hermaphrodita
	Lomandra sericea
	Lyginia barbata
	Stylidium adpressum
	Trachymene pilosa

Table 4. Density of native and weed species in $20m^2$ survey plots at Frankland Reserve.

	Natives mean no. ± standard error	**Weeds** mean no. ± standard error
Plot 1	19.4 ± 7.9	129.8 ± 82.8
Plot 2	8.8 ± 2.5	35.2 ± 26.9
Plot 3	8.8 ± 2.2	17.0 ± 7.0
TOTAL	12.3 ± 2.9	60.7 ± 29.7

2.3 Conservation Status

The reserve is typical of Banksia woodland Community type 20 (Gibson *et al*). This community type typically comprises *Banksia attenuata* woodlands, *Eucalyptus marginata-Banksia attenuata* woodlands or shrublands, and extends from Koondoola in the northern coastal plain to Yarloop in the south. This community type is characterised by high species richness and is considered poorly reserved on the Swan Coastal Plain and of vulnerable conservation status. Floristically, Frankland Reserve is closest to subcommunity types 20a and 20b and further and more comprehensive survey work would be required at a later stage of fire recovery to fully determine floristic classification. Subcommunity type 20a is considered endangered on the Swan Coastal Plain.

No rare or priority flora were recorded on the site.

RECOMMENDATIONS

1. Retain Frankland Reserve as a conservation reserve for flora and fauna and exclude all activities not compatible with such a purpose (wildflower picking, mining, 4WD use etc).
2. Undertake weed and fire management program to protect and enhance the conservation values of the reserve.

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APPENDIX 1. SPECIES DENSITIES AND ABUNDANCE AT FRANKLAND RESERVE, COCKBURN.

230

SPECIES	NUMBER PER 20M^2 PLOT mean ± standard error	PRESENCE/ABSENCE DATA[1] downslope	midslope	upslope
AIZOACEAE				
**Carpobrotus edulis*	0.3 ± 0.3	-	+	-
ANTHERICACEAE				
Laxmannia squarrosa	6.7 ± 6.7	-	-	+
APIACEAE				
Trachymene pilosa	131.7 ± 85.6	+	+	+
ASTERACEAE				
**Hypochaeris glabra*	57.7 ± 25.5	+	+	+
Podolepis gracilis	18.7 ± 18.7	-	-	+
Podotheca angustifolia	-	-	-	-
Rhodanthe sp.	-	-	-	-
**Ursinia anthemoides*	327.0 ± 192.1			
CASUARINACEAE				
Allocasuarina humilis	4.7 ± 2.2	+	+	+
Allocasuarina fraseriana	-	-	-	-
COLCHICACEAE				
Burchardia umbellata	32.7 ± 7.3	+	+	+
CRASSULACEAE				
Crassula colorata	96.7 ± 55.5	+	+	+
CYPERACEAE				
Lepidosperma angustatum	5.7 ± 3.8	+	-	+
Lepidosperma leptostachyum	-	-	-	-
Mesomelaena pseudostygia	37.3 ± 21.1	-	+	+
Schoenus aff. *brevisetis*	7.3 ± 5.4	-	+	+
Schoenus curvifolius	14.7 ± 9.7	+	+	-
Tetraria octandra	-	-	-	-
DASYPOGONACEAE				
Dasypogon hookeri	6.0 ± 6.0	+	-	-
Lomandra hermaphrodita	25.7 ± 11.3	+	+	+
Lomandra sericea	10.7 ± 2.3	+	+	+
DILLENIACEAE				
Hibbertia hypericoides	15.0 ± 8.7	-	+	+
Hibbertia racemosa	-	-	-	-

Appendix 1 cont.

SPECIES	NUMBER PER 20M^2 PLOT mean ± standard error	PRESENCE/ABSENCE DATA[1] downslope	midslope	upslope
DROSERACEAE				
Drosera menziesii	1.7 ± 1.2	+	+	-
Drosera erythrorhiza	-	-	-	-
EPACRIDACEAE				
Conostephium pendulum	0.7 ± 0.3	+	+	+
Leucopogon conostephioides	-	-	-	-
Leucopogon propinquis	3.3 ± 3.3	-	-	+
GOODENIACEAE				
Dampiera linearis	5.3 ± 4.8	+	-	+
Scaevola canescens	-	-	-	-
HAEMODORACEAE				
Anigozanthus humilis	5.3 ± 1.2	+	+	+
Conostylis aculeata	4.3 ± 4.3	+	-	-
Conostylis setigera	14.0 ± 3.0	+	+	+
IRIDACEAE				
**Gladiolus caryophyllaceus*	25.3 ± 13.4	+	+	+
Patersonia occidentalis	2.7 ± 2.7	+	-	-
JUNCACEAE				
**Juncus bufonius*	42.3 ± 35.1	+	-	+
LAMIACEAE				
Hemiandra pungens	0.3 ± 0.3	+	-	-
LORANTHACEAE				
Nuytsia floribunda	-	-	-	-
MIMOSACEAE				
Acacia huegelii	1.3 ± 0.7	-	+	+
MYRTACEAE				
Calytrix flavescens	11.0 ± 6.3	+	-	+
Eucalyptus marginata	-	-	-	-
Hypocalymma robustum	-	-	-	-
Melaleuca acerosa	5.7 ± 2.9	+	+	+
Scholtzia involucrata	0.3 ± 0.3	+	-	-
ORCHIDACEAE				
Caladenia flava	3.3 ± 1.8	+	+	+
Caladenia varians	-	-	-	-
Thelymitra sp.	-	-	-	-

Appendix 1 cont.

SPECIES	NUMBER PER 20M^2 PLOT mean ± standard error	PRESENCE/ABSENCE DATA[1] downslope	midslope	upslope
PAPILIONACEAE				
Bossiaea eriocarpa	1.3 ± 1.3	+	-	-
Bossiaea ornata	3.3 ± 3.3	-	+	-
Daviesia nudiflora	-	-	-	-
Daviesia triflora	1.7 ± 0.9	+	+	-
Gompholobium tomentosum	3.7 ± 3.7	-	-	+
Jacksonia furcellata	-	-	-	-
Nemcia reticulata	-	-	-	-
POACEAE				
**Aira caryophyllea*	13.3 ± 6.7	+	-	+
Amphipogon turbinatus	29.0 ± 11.0	+	+	+
**Briza maxima*	0.3 ± 0.3	-	-	+
**Ehrharta calycina*	2.7 ± 2.7	+	-	-
Neurachne alopecuroides	0.7 ± 0.7	-	-	+
**Vulpia* sp.	16.7 ± 12.0	+	+	+
PROTEACEAE				
Banksia attenuata	1.7 ± 1.2	-	+	+
Banksia ilicifolia	-	-	-	-
Banksia menziesii	1.7 ± 0.3	+	+	+
Petrophile linearis	1.3 ± 0.9	+	+	-
Stirlingia latifolia	15.3 ± 5.5	+	+	+
RESTIONACEAE				
Alexgeorgea nitens	-	-	-	-
'Desmocladus' flexuosus ined (ex *Loxocarya flexuosus*)	4.0 ± 4.0	+	-	-
Lyginia barbata	4.7 ± 1.8	+	+	+
RUTACEAE				
Boronia ramosa	-	-	-	-
Eriostemon spicatus	-	-	-	-
STYLIDIACEAE				
Stylidium adpressum	6.7 ± 2.3	+	+	+
Stylidium brunonianum	-	-	-	-
Stylidium piliferum	4.3 ± 4.3	-	-	+
VIOLACEAE				
Hybanthus calycinus	-	-	-	-
XANTHORRHOEACEAE				
Xanthorrhoea brunonis	0.3 ± 0.3	-	+	-
Xanthorrhoea preissii	1.0 ± 1.0	-	+	-

[1]Species not represented in plots were observed during general survey.

STOCKLAND

THE SANCTUARY - LOT 199 GAEBLER ROAD, BANJUP

ENVIRONMENTAL MANAGEMENT PLAN

ATA ENVIRONMENTAL
in association with
MCNALLY NEWTON LANDSCAPE ARCHITECTS

VERSION 2

AUGUST 2003

REPORT NO: 2003/83

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LANDSCAPE ARCHITECTS

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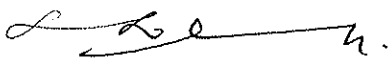
Checked by: Signed: 

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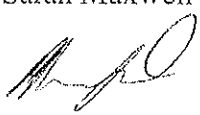
Approved by: Signed: 

Name: Paul van der Moezel Date: 22 August 2003

TABLE OF CONTENTS

1. INTRODUCTION 1

1.1 Purpose and Scope 1
1.2 Background 1
1.2.1 Bush Forever 1
1.2.2 Planning Approval 2

2. SUBDIVISION DEVELOPMENT 3

2.1 Timing 3
2.2 Pre-Construction Management Requirements 3
2.2.1 Bandicoot Trapping and Relocation 3
2.2.2 Installation of Temporary Fencing 4
2.2.3 Native Vegetation Clearing 4
2.2.4 Bush Harvesting 4
2.2.5 Protection of Locally Significant Trees 5

3. DESCRIPTION OF THE CONSERVATION AND RECREATION RESERVE 6

3.1 Topography 6
3.2 Geology & Soils 6
3.3 Vegetation Types and Condition 6
3.4 Flora 7
3.5 Wetlands 7

4. MANAGEMENT OF THE CONSERVATION AND RECREATION RESERVE 8

4.1 Treatment of Interface between the Reserve and Surrounding Development 8
4.1.1 Landscape Treatment 8
4.1.2 Roads and Kerbing 9
4.1.3 Drainage 9
4.1.4 Car Parking 9
4.2 Access Management 9
4.2.1 Pedestrian Access Paths 10
4.2.2 Gates 10
4.2.3 Boardwalk 10
4.2.4 Emergency Vehicle Access 11
4.3 Fencing 11
4.3.1 Boundary Fencing 11
4.3.2 Internal Fencing 11
4.4 Interpretative Signage 11
4.5 Vegetation Management 12
4.5.1 Weed Control 12
4.5.2 Revegetation 15
4.5.3 Timing for Rehabilitation Works 16
4.5.4 Control of Feral Animals and Domestic Pets 17
4.5.5 Fire Control 17
4.5.6 Prevention of Dieback Invasion 17

5. IMPLEMENTATION, TIMING AND RESPONSIBILITIES 18

5.1 Prioritisation of Management Proposals 18
5.2 Allocation of Responsibilities 20
5.3 Monitoring and Review 20
5.3.1 Performance Monitoring 20

LIST OF FIGURES

1. Subdivision Design and Location of Conservation and Recreation Reserve

2. Vegetation Types of the Reserve

3. Vegetation Condition and Distribution of Invasive Weeds

4. Location of Wetlands in the Reserve

5. Fire Management Plan

LIST OF PLANS

A. Indicative Path Linkages to Adjacent Regional Open Space

Ba. Conservation Reserve Interface with Parking Embayment
Bb. Detail Plan - Conservation Reserve Interface with Parking Embayment

C1. Conservation Reserve Interface – Road with No Car Bay
C2. Conservation Reserve Interface – Road with Parking Embayment

D3. Conservation Reserve Interface – Road with Parking Embayment and Extended Verge
D4. Conservation Reserve Interface – Bushland Retention

E1. Permanent Fencing to Conservation Reserve
E2. Conservation Reserve Path with Local Fencing at Intersections
E3. Typical Conservation Reserve Path Cross Section
E4. Cross Section – Timber Boardwalk
E5. Indicative Interpretive Signage

LIST OF APPENDICES

1. Lot 199 Gaebler Road, Banjup – Flora List

1. INTRODUCTION

1.1 Purpose and Scope

This Environmental Management Plan has been prepared to guide the management of the Conservation and Recreation Reserve to be retained for conservation and passive recreation purposes following the development of the approved subdivision area at The Sanctuary – Lot 199 Gaebler Road, Banjup.

Specifically, this Plan has been prepared to fulfil Condition 23 of subdivision approval set by the Western Australian Planning Commission (WAPC) which states:

Before any site works commence, the subdivider shall prepare, submit for approval and once approved implement an Environmental Management Plan for the proposed Conservation and Recreation Reserve the subject of Condition 22, to the satisfaction of the WAPC. The Plan shall provide, but not limited to:

- *The details of the treatment of the interface between the Reserve and surrounding roads and development;*
- *Paths;*
- *Fencing;*
- *Interpretive signage;*
- *Weed control;*
- *Revegetation;*
- *Enhancement of wetlands and bushland;*
- *Fire management; and*
- *Boardwalks.*

so the Reserve area provides recreational value to the future local community. The Plan shall respect the conservation values of the Reserve by ensuring that no native vegetation is removed except in accordance with the approved Environmental Management Plan. The subdivider shall enter into suitable arrangements to maintain the implemented enhancements within the Reserve for 2 years.

According to Condition 23, the EMP is to be prepared and implemented to the satisfaction of the City of Cockburn, Bush Forever Office (Department of Planning and Infrastructure) and the Water and Rivers Commission (WRC).

1.2 Background

1.2.1 Bush Forever

Lot 199 Gaebler Road was not considered to comprise attributes of regional significance and was therefore not included as part of the draft Perth's Bushplan or the published Bush Forever. However, the whole of Lot 199 was nominated by the City of Cockburn as an additional area as part of the public comment period of Perth's Bushplan. Forming part of 'Nominated Additional Area 74e' further assessment was required to determine the site's significance at a regional level.

Subsequent to extensive liaison with the Bush Forever office and the Department of Environmental Protection (DEP) and site inspections, including flora surveys and fauna assessments undertaken by ATA Environmental, it was agreed that the protection of a minimum of 25% of the site represented an acceptable Negotiated Planning Solution. The project team in consultation with the relevant agencies determined that 25% of the site along the northern boundary was the most appropriate area to be conserved as it enabled:

- consolidation of upland and wetland vegetation with the adjoining Bush Forever Site 492 located to the north; and
- an appropriate management boundary that also included Conservation and Resource Enhancement category wetlands and their associated 50m buffers.

1.2.2 Planning Approval

The development area of Lot 199 was defined through the Bush Forever Negotiated Planning Solution as that part of Lot 199 not required for protection of bushland. Lot 199 has a total area of 48.3ha, the Conservation and Recreation Reserve encompasses 12.08ha (25% of the landholding), leaving the balance 36.2ha for future development.

An application for the subdivision of Lot 199 was submitted to the WAPC in January 2003 and was approved by the WAPC in May 2003 subject to a number of Conditions.

The approved subdivision provides for the creation of 394 residential lots and one neighbourhood shopping site. Lots range in size from 330m^2 to 787m^2 with an average lot size of 590m^2. A significant portion of the lots within the estate front east-west aligned roads and therefore orientate north-south in accordance with current recommendations to maximise energy efficiency in residential design.

Smaller cottage lots are located in areas of high amenity including adjacent to parkland areas. To enhance the streetscape and residential amenity, most small lots will be serviced by rear laneways.

Three distinct parks are proposed in addition to the Conservation and Recreation Reserve addressed in this Management Plan. In total, 32% of Lot 199 will convert to public ownership as conservation and/or open space. The design philosophy for open space provides for two green corridors extending from the Conservation and Recreation Reserve to the south of the estate. These corridors will be a transition from the conservation priority of the Reserve in the north to landscaped open space in the south which provides opportunities for passive and active recreation. Two ornamental lakes are proposed to be constructed in the western POS and will provide an irrigation and drainage function for the development area. The design specifications of the lakes are curently being discussed with the relevant government agencies.

The subdivision plan is currently subject to minor revision to achieve better solar orientation of home sites. The revision does not impact on the Conservation and Recreation Reserve boundary.

2.2.5 Protection of Locally Significant Trees

The City of Cockburn has previously identified the requirement to conserve as many Holly-leaf Banksia (*Banksia ilicifolia*) trees as possible within the development area. A tree survey was undertaken by McMullen Nolan and Partners to locate the Banksias. A large number of Holly-leaf Banksia trees were found to occur within the Conservation and Recreation Reserve. Nevertheless, the southern boundary of the Conservation Reserve was extended to maximise further retention in the Reserve.

3. DESCRIPTION OF THE CONSERVATION AND RECREATION RESERVE

3.1 Topography

The landform at the Conservation and Recreation Reserve is generally flat with a low rises in the eastern corner and south-central portion of the site and two small depressions (wetlands) along the northern boundary. Elevation ranges from 26m AHD at the wetlands to 30m AHD in the surrounding area. The low rises are up to an elevation of 34m AHD.

3.2 Geology & Soils

Lot 199 Gaebler Road is located on the central part of the Swan Coastal Plain within the Bassendean Dune System. The Bassendean Dunes consists of low hills of leached siliceous sand interspersed with sand flats and seasonal swamps.

According to regional soil mapping prepared by Gozzard (1983), the upland areas comprise deep Bassendean sands, generally light grey at the surface and yellow at depth which are well drained and of aeolian origin. The low lying areas consist of shallow Bassendean sands over silts and clays of the Guildford formation of variable thickness.

3.3 Vegetation Types and Condition

The Conservation and Recreation Reserve comprises vegetation representative of the Bassendean Vegetation Complex – Central and South. Vegetation in this Complex is described as ranging from Woodlands of Jarrah-Sheoak-Banksia on the sand dunes to a low woodland of *Melaleuca* species and sedgelands on the low-lying depressions and swamps (Heddle *et al.*, 1980).

This complex includes upland and flat areas dominated by a mixed *Banksia* Woodland including *B. attenuata, B. menziesii, B. ilicifolia,* with scattered Jarrah (*Eucalyptus marginata*), Sheoak (*Allocasuarina fraseriana*) and WA Christmas trees (*Nuytsia floribunda*) over *Xanthorrhoea preissii, Dasypogon bromeliifolius, Patersonia occidentalis, Stirlingia latifolia, Lyginia barbarta, Hibbertia subvaginata, Petrophile linearis* and *Acacia pulchella.*

The low-lying areas support typical sumpland vegetation as described in Section 3.2.

The vegetation types of the Reserve are shown in Figure 2.

The vegetation in the Reserve has remained intact with minimal weed invasion, and as a result is in excellent condition. Some regions of the Reserve, particularly at the periphery along the firebreaks have a higher density of weeds, including more aggressive species such as Perennial Veldt Grass (*Ehrharta calycina*), Gladiolus (*Gladiolus caryophyllaceus*), Blowfly Grass (*Briza minor, B. maxima*), Pigface (*Carpobrotus edulis*), and Rose Pelargonium (*Pelargonium capitatum*).

In addition, the eastern wetland has been invaded by a number of weeds tolerant of seasonal inundation and typical of disturbed areas, including Introduced Bulrush (*Typha orientalis*), Fleabane, Thistle and Cotton Bush. The margin and informal access track to the wetland is

also significantly disturbed with large areas of Pigface (*Carpobrotus edulis*) and scattered stands of Arum Lily (*Zantedeshia aethiopica*).

The condition of the vegetation and distribution of invasive weeds in the Reserve is shown in Figure 3.

3.4 Flora

ATA Environmental conducted flora and vegetation surveys of Lot 199 on 5 December 2001 and a spring survey on 20 and 23 September 2002. The timing of the surveys optimised the potential identification of annual and ephemeral species such as orchids, grasses and any significant species listed by CALM.

The December 2001 survey yielded a total of 109 plant species including 91 native species and 18 introduced species. A further 20 species including 19 native and one introduced species were recorded during the spring 2002 survey. While several species of orchid were identified, no species of significance as listed by CALM were recorded. The total flora list for Lot 199 is now 129 species including 110 native and 19 introduced species, as presented in Appendix 1. It is anticipated that most of these species occur in the Conservation and Recreation Reserve, due to the representation of upland and lowland vegetation types represented in the Reserve.

3.5 Wetlands

The Reserve includes two wetlands identified as sumplands, or seasonally inundated basins, under the Wetland Atlas (Hill *et al.*, 1996), as shown in Figure 4.

The wetland in the western part of the Reserve forms the southern extent of a large sumpland located to the north of the property on Lot 204. The portion of the wetland in he Reserve includes a seasonally inundated area comprising a Low Woodland of Paperbarks (*Melaleuca preissiana*) with scattered *Banksia attenuata, Nuytsia floribunda* over *Kunzea ericifolia* and *Xanthorrhoea priessii* surrounded by a Low Closed Heath with common species *Hypocalymma angustifolium, Adenanthos obovatus, Dasypogon bromeliifolius* and *Patersonia occidentalis*. The sumpland is identified as a Resource Enhancement (RE) wetland in the Wetland Atlas. The portion of this wetland on Lot 204 to the north is classified as a Conservation Category (CC) wetland.

The sumpland located in the eastern portion of the Reserve includes a central small depression which appears to be regularly inundated. This area, which was inundated in August 2001 and dry in December 2001, supports a stand of Bulrushes (*Typha orientalis*) with fringing *Juncus pallidus*. The central area is surrounded by a narrow band of *Astartea fascicularis* Low Heath with a Low Woodland of Paperbarks (*M. preissiana*) over a Closed Scrub of *Hypocalymma angustifolium* and *Astartea fascicularis* to the west and a Closed Heath dominated by *H. angustifolium* and *Astartea fascicularis* further to the east. This wetland is identified as Conservation Category in the Wetland Atlas as it supports a high level of natural attributes and functions.

4. MANAGEMENT OF THE CONSERVATION AND RECREATION RESERVE

The retention of the bushland in an urban setting provides an important function of improving the community's appreciation and understanding of the bushland flora, vegetation and associated fauna. In this way, while conservation of the flora and fauna values of the bushland will be the management priority, the bushland will also function as an educational resource for the local and broader community.

On this basis, the objectives of the Conservation and Recreation Reserve will be to:

- Ensure the native flora, vegetation, fauna habitat values and wetland functions are maintained and protected through appropriate management of the site.
- Provide appropriate access within the Conservation and Recreation Reserve to promote community ownership and appreciation for bushland values.
- Maintain linkage with other nearby bushland areas.

The purpose of this section is to identify the key environmental strategies required to maintain the values of the Conservation and Recreation Reserve following development of the adjacent land for residential purposes.

4.1 Treatment of Interface between the Reserve and Surrounding Development

4.1.1 Landscape Treatment

It is proposed to landscape a narrow section of the southern boundary of the Conservation and Recreation Reserve.

The principal purpose of the landscaped verge is to provide a soft edge between the Reserve and the residential area which is aesthetically pleasing to local residents and visitors to the area. The landscaped verge will act as an additional separation in the event of a fire in the Reserve and will also provide an important drainage function in keeping with the current water sensitive urban design principles.

The verge will be landscaped, mostly as lawn, to a width of between 6m and 9.7m. The width of the verge will vary to allow for a drainage swale (refer to Plans C & D), the retention of native trees where possible (refer to Plan D4) and to provide parking embayments in some locations (refer to Plan C2 and Plan D3). The location of the landscaped verge is illustrated in Plan B.

A Dual Use Path located along the entire length of the landscaped verge will provide access around the outside of the bushland section of the Reserve and will link with paths in the POS areas. The location of the DUP is shown in Plan B(a).

The lot located immediately adjacent to the south-eastern boundary of the Reserve will be separated from the Reserve by the installation of development style fencing (up to 1.8m high) which will connect to the 1.2m high fencing around the periphery of the bushland. A

firebreak will be installed between the fence and the bushland and will link to the existing firebreak along the eastern boundary.

4.1.2 Roads and Kerbing

Roads adjacent to the Conservation and Recreation Reserve will be constructed with flush kerbing to promote drainage of stormwater directly into the drainage swale located in the landscaped verge, as shown in Plans C & D. The flush kerb comprising a 1:6 to 1:4 fall shoulder will prevent the build-up of particulate matter and associated flooding of the road surface.

4.1.3 Drainage

Most of the stormwater drainage from the residential development of Lot 199 will be directed into the Public Open Space areas. However, to promote infiltration of stormwater throughout the drainage treatment system it is proposed to direct drainage from the road abutting the Conservation and Recreation Reserve into a shallow, narrow grassy swale constructed around the perimeter of the Reserve.

4.1.4 Car Parking

Up to 10 parallel car parking bays are proposed to be installed at the boundary of the Conservation and Recreation Reserve in the landscaped verge. The provision of parking will be primarily for the use of visitors and non-local residents who are interested in visiting the Conservation and Recreation Reserve. For this reason, the bays have been located adjacent to Reserve access points, as shown in Plan B.

4.2 Access Management

The management of the Conservation and Recreation Reserve aims to promote pedestrian and disabled access while preventing access to vehicles, motorcycles and bicycles so that the conservation values are protected and maintained. The installation of paths in bushland areas requires careful consideration as too many paths can cause problems such as fragmentation of bushland, promotion of weed invasion and disease.

On this basis, the objectives to manage access within the Reserve are to:

- promote pedestrian access while maintaining the conservation values of the bushland;
- facilitate disabled access; and
- restrict access to vehicles and bicycles which result in degradation of the bushland.

The provision of access in the Reserve to meet the above objectives is discussed in the following sections.

The paths within the Reserve will link to the bushland area north of Lot 199. However, regional pedestrian and cycle networks will be catered for on dual use paths outside the Reserve. A concept plan showing potential access linkages to the north of the Reserve through adjacent areas of regional bushland and to local infrastructure is shown in Plan A.

4.2.1 Pedestrian Access Paths

The future use of the Conservation and Recreation Reserve by local residents and the broader community will require the provision of appropriately aligned access paths through the bushland area.

The general procedure for the alignment and installation of paths in bushland areas is to formalise existing tracks which are appropriately aligned and rehabilitate others. However, existing tracks are currently limited to the northern firebreak. Therefore additional paths have been aligned within the Reserve. These paths avoid wetland areas and minimise the clearing of native vegetation. The path system within the Reserve includes a pedestrian access path which provides access between the wetlands via access from the southern and western boundary of the Reserve.

The City of Cockburn has identified that paths within the Reserve should be wide enough to allow passage of maintenance and/or fire control vehicles and to act as a fire break. The paths are to be constructed with concrete to a width of 2.1m with a 1m crushed limestone edging for a total width of 4.1m.

The dual use path proposed to be installed adjacent to the southern boundary of the Reserve which will also facilitate fence maintenance and repair, when required.

The indicative location of paths within the Reserve and at the periphery is shown in Plan B(a). The final alignment of the internal path will be determined on-site in consultation with the City of Cockburn.

4.2.2 Gates

The style and location of gates at the periphery of the Reserve has been explored to ensure that access to the Reserve is maximised for appropriate user groups. Pedestrian, disabled and pram access will be provided at the southern and western boundary via a zig-zag fence which will be constructed to prevent access to vehicles, motorcycles and bicycles. A standard farm gate will be installed adjacent to the zigzag fences to provide access to maintenance and emergency vehicles. The farm style gates will be locked at all times.

The type of vehicle access gate proposed to be installed at the periphery of the Reserve is shown in Plan E1.

4.2.3 Boardwalk

A boardwalk is proposed to be installed which will provide a viewing platform over the seasonally inundated wetland in the eastern region of the Reserve. The boardwalk (and access path) will be located to utilise an existing access track and open area at the wetland. The boardwalk will be constructed with galvanised steel with either timber decking or timber chequer plate/mesh to minimise repair costs in the event of fire or vandalism.

The location of the boardwalk, as shown in Plan B(a), has been confirmed on site with the City of Cockburn (Paddy Strano, Chris Beaton) and Water & Rivers Commission (Bob Pond, Jane Sturgess). The detail design plan for the boardwalk is shown in Plan E4.

4.2.4 Emergency Vehicle Access

The dual use paths located within and at the periphery of the Conservation and Recreation Reserve will be constructed to a width to 3m to allow vehicle access in the event of an emergency. Vehicle access gates will also installed at the boundary fencing to provide access to the pathways.

4.3 Fencing

4.3.1 Boundary Fencing

To ensure that the conservation values of the bushland area are maintained in the long-term a 1.2m high pine post and wire mesh fence will be installed at the boundary of the landscaped verge and native bushland around the southern and western boundary of the Conservation and Recreation Reserve. The construction materials have been selected to ensure that the fence is aesthetically pleasing and reduces uncontrolled access, yet allows movement of native fauna in the event of a fire.

The boundary fence will be installed prior to the commencement of any development works and will be located along the southern boundary of bushland to be conserved in the Reserve.

The location and type of fencing to be installed at the boundary of the Reserve is shown in Plan B(a) and E1, respectively.

The existing fencing at the eastern boundary of the Reserve will be retained and will link to fencing proposed as part of this Management Plan.

4.3.2 Internal Fencing

ATA Environmental propose that internal fencing along internal pathways may not be necessary as they are often ineffective, require constant maintenance and repair and reduce the bushland experience. This initiative has been supported by the City of Cockburn.

To avoid the development of informal paths particularly where pedestrians may attempt to take a shortcut, pine post and wire mesh fencing will be installed. This may be necessary where two paths intersect at right angles, as shown in Plan B(a).

4.4 Interpretative Signage

Interpretive signage will be installed in the Conservation and Recreation Reserve to provide the local community and visitors with information relating to the bushland environment, orientation and to advise of user restrictions.

Interpretive signage will be an important mechanism in influencing the level of interest and involvement of the community in enhancing the value of the Reserve.

Interesting and informative signage may be installed which provides straight forward information and diagrams describing native fauna, the attributes of native flora, flora and fauna interactions and vegetation patterns.

The indicative interpretative signage to be installed in the Reserve is shown in Plan E5.

4.5 Vegetation Management

The location and shape of the Conservation and Recreation Reserve was selected to conserve a representative portion of the bushland and wetland areas in good or better condition, with high floristic diversity and which provides habitat value to native fauna.

The Conservation and Recreation Reserve comprises low-lying areas intersected by a minor ridge dominated by a mixed *Banksia* Woodland with scattered Jarrah, Sheoak and WA Christmas trees over a mixed heath. The wetland in the north-western region of the Reserve forms the southern extent of a large sumpland located to the north of Lot 199. This wetland includes a seasonally inundated area comprising a Low Woodland of Paperbarks (*Melaleuca preissiana*) with scattered *Banksia attenuata, Nuytsia floribunda* over Spearwood (*Kunzea ericifolia*) and Grass Trees surrounded by a Low Closed Heath.

The smaller sumpland located in the north-eastern region of the Reserve includes a small depression which appears to be regularly inundated. This area was inundated at the time of the survey and supports a stand of introduced Bulrushes (*Typha orientalis*) with fringing *Juncus pallidus*. This area is surrounded by a Low Woodland of Paperbarks over heath.

In order to maintain the Conservation and Recreation Reserve in its current condition following development of the surrounding land, the following existing and potential issues will requirement management:

- controlling the introduction and spread of weed species;
- maintaining the existing native plant composition and structure;
- controlling access to feral animals and domestic pets; and
- fire prevention and control.

4.5.1 Weed Control

The introduction and spread of weeds in bushland areas presents a major threat to biodiversity including the loss of native floristic diversity, vegetation structure and native fauna habitat. In addition, the prevalence of weeds in bushland areas increases the threat of fire.

In general, the condition of the bushland in the Reserve is very good with limited weed invasion, as shown in Figure 3. However, some control and monitoring of potentially invasive weeds such as Perennial Veldt Grass (*Ehrharta calycina*), Gladiolus (*Gladiolus caryophyllaceus*), and Blowfly Grass (*Briza minor, B. maxima*) will need to be implemented along fire breaks and degraded areas of the bushland.

Control of the Introduced Bulrush, Fleabane, Thistle, Cotton Bush, Pigface and Arum Lily will be implemented in the inundated sections and surrounding the eastern wetland. The distribution of invasive weeds in the Reserve is shown in Figure 3.

The most effective method of keeping weeds out of the Conservation and Recreation Reserve will be to control and prevent the source of invasion. For example, prevent dumping of garden refuse, keep irrigated lawns away from the bushland and minimise

disturbance by installing fewer tracks and fire breaks. The following section provides the basic principles of bush regeneration irrespective of the method employed to remove a particular species of weed.

In most instances it is not possible, nor desirable, to remove all weeds during one site visit as the factors contributing to weed invasion will be continually operating. Therefore, for a successful weed control program it will be important to re-weed the site on a regular basis. The program should focus on implementing the following principles:

- work from areas in good condition towards weed infested areas;
- ensure minimal disturbance to soil and vegetation;
- let the rate of regeneration of native plants determine the rate of weed removal (as appropriate); and
- implement a long term maintenance program to monitor weed control methods and native flora regeneration.

The following management recommendations are proposed for the Conservation and Recreation Reserve:

- The control of invasive weeds should be a priority in the management of the Reserve.
- Grassed areas adjacent to the Conservation and Recreation Reserve should be reticulated in such a manner that water does not impinge on the bushland area.

Weed control programs should not be undertaken in isolation but as a component of a vegetation rehabilitation program. Guidelines to control weeds within the Reserve are provided in the following table.

TABLE 1
CONTROL GUIDELINES FOR WEEDS IN THE CONSERVATION AND RECREATION RESERVE

Species	Common Name	Treatment Method				Control Notes
		Manual removal	Herbicide wipe, stem injection, cut stump	Spot Spray	Blanket Spray	
Briza maxima,	Blowfly Grass			✓		Sertin or other similar herbicides at 2L ha.
Briza minor	Shivery Grass					
Carpobrotus edulis	Pigface	✓				No specific information on control using herbicides. Pull up and destroy.
Cirsium vulgare	Thistle	✓				No specific information on control using herbicides. Pull up and destroy.
Conyza bonariensis	Fleabane	✓				No specific information on control using herbicides. Pull up and destroy.
Ehrharta calycina	Perennial Veldt Grass	✓		✓		Easy to control with Fusilade at 4L per hectare or with similar herbicides such as Sertin, Targa. Spot spray at 2L per hectare. Heavy infestation smay require follow-up spray the next year. Remove small infestation by hand.

Species	Common Name	Treatment Method				Control Notes
		Manual removal	Herbicide wipe, stem injection, cut stump	Spot Spray	Blanket Spray	
Ehrharta longiflora	Annual Veldt Grass	✓		✓		Remove small populations by hand. Fusilade or similar herbicide at 2L/ha, before flowering.
Gladiolus caryophyllaceus	Gladiolus	✓	✓			Remove old flower heads to prevent seeding. In sandy soils pull straight out the ground in Aug-Sept. Glyphosate 1 in 100 at flowering time just wipe one leaf.
Gomphocarpus fruticosus	Cotton Bush, Swan Plant	✓		✓		Glyph/Rndup 1 in 100, knap- sack plus wetting agent, Sept- Dec, before fruit forms. Pull out small populations. Cut at or slightly below ground level, rarely regrows. Remove any seed heads. Make sure you wear gloves to protect your skin from the sap.
Opuntia stricta	Prickly Pear	✓	✓			No control mechanisms identified. However removing manually or mechanically followed by cut stem application of herbicide.
Pelargonium capitatum	Rose Geranium	✓		✓		Difficult to control. Pull plants in autumn/winter when soil is damp. Plant will reshoot if stem is broken at or below ground level. Secondary weeding is important but good control can be achieved. No specific data for herbicide control. Suggest Ally/Brush 5g ha. Glyph. 1 in 100 in early Sept, add wetting agent. Try with wick applicator. Repeat applications may be necessary.
Typha orientalis	Introduced Bulrush		✓	✓		Difficult to dig out even small populations and reinfestation can be rapid. Remove flowers, seed source. Cut stems below water level in summer or just prior to recharge of wetland, plants then rot. Repeated cuttings in growing season (summer) will kill plants. Remove cut material. Hard to get at to wipe but try wiping with a high rate of Roundup.
Zantedeshia aethiopica	Arum Lily	✓		✓		Glyph. 1 in 100 June to Oct. Several applications may be necessary. Can also use Glean Ally/Brushoff. Difficult to dig out in most sites. On dry sites use a Peter lever. Glean 20g ha (1g in 50 L water) plus wetter. Spot spray from April to Nov. In wetland areas use Glyphosate without a surfacant to avoid problems with frogs and tapoles etc. The herbicide will form a pool at the leaf base and be absorbed into the plant.

General weed control works by herbicide application will be implemented in the Reserve in Winter 2003 with control of Introduced Bulrush by slashing to commence in summer 2003. Control works will be monitored in Spring 2004 with follow-up control implemented in Winter/Summer 2004, where required. These works will then be monitored in Spring 2005 to determine if further remediation work is required before the management of the Reserve becomes the responsibility of the City of Cockburn. The timing for works, including weed control, in the Reserve is summarised in Table 3.

4.5.2 Revegetation

Enhancement of Wetlands and Bushland

Degraded areas within the Conservation and Recreation Reserve are generally restricted to the periphery of the bushland. The principal objective of the rehabilitation strategy will be to maintain a bushland ecosystem in which natural regeneration can occur. This will be achieved by encouraging natural regeneration by reducing or eliminating disturbance factors such as weed invasion, fire, pests, and disease.

While it is anticipated that the bushland may change over time as a result of subtle changes in climatic conditions and natural events such as fire, the natural plant community will regenerate naturally and will be resilient if managed properly.

The rehabilitation and restoration of degraded areas will involve two main processes:

1. removal and prevention of the disturbances that lead to the deterioration of the bushland such as weed control, control of access, fires; and

2. implementation of revegetation techniques such as direct seeding and tube or seedling planting.

When undertaking revegetation works, seedlings will be used where ever possible and planted to take full advantage of winter rainfall and in densities consistent with the surrounding vegetation. For example, care will be taken to avoid evenly spacing seedlings or planting in rows so that a random effect is achieved.

The key focus of revegetation works in the Conservation and Recreation Reserve will be the sandy open area at the periphery of the eastern wetland. The open area surrounds the inundated region of the wetland which supports a stand of introduced Bulrush (*Typha orientalis*). The open area will be replanted with species consistent with the surrounding vegetation and those which are tolerant of potential inundation, ie species from column 'C' in Table 1 below.

It is unlikely that the stand of *Typha orientalis* will increase beyond its current distribution in the inundated section of the eastern wetland as its growth is dependent on the presence of surface water for most of the year. However, control measures will be implemented and will include manually slashing/cutting the base of stems in summer followed by herbicide application by stem wipe. The stand will be monitored annually for a period of two years and controlled areas within the wetland will be replanted with native sedges such as *Juncus pallidus* and *Baumea articulata*.

The native species to be used in any revegetation works within the Reserve are listed in the following table according to location at the site.

TABLE 2
RECOMMENDED SPECIES FOR REVEGETATION IN CONSERVATION AND RECREATION RESERVE

	Common Name	Botanical Name	Species A Upland Areas	Species B Transitional	Species C Wetland & Low-lying Areas
Trees	Jarrah	*Eucalyptus marginata*	✓		
	Candle Banksia	*Banksia attenuata*	✓		
	Firewood Banksia	*B. menziesii*	✓		
	Holly-leaf Banksia	*B. ilicifolia*	✓	✓	
	Sheoak	*Allocasuarina fraseriana*	✓		
	Paperbark	*Melaleuca preissiana*			✓
	WA Christmas Tree	*Nuytsia floribunda*		✓	
Shrubs	Grass Tree	*Xanthorrhoea preissii*	✓		
	Spearwood	*Kunzea ericifolia*		✓	
	Buttercups	*Petrophile linearis*	✓		
	Pixiemop	*Allocasuarina humilis*	✓		
	Dwarf Sheoak	*Jacksonia furcellata*	✓		
	Stinkwood	*Scholtzia involucrata*		✓	
		Davesia triflora	✓		
		Acacia pulchella	✓		
		Astartea fascicularis	✓	✓	
		Hypocalymma angustifolium		✓	✓
		Adenanthos obovatus		✓	
		Astartea fascicularis			✓
		Boronia racemosa			✓
		Melaleuca thymoides		✓	
		Scholtzia involucrata		✓	
		Pericalymma ellipticum			✓
Herbs and Groundcover	Blueboy	*Patersonia occidentalis*	✓		
	Pineapple Bush	*Juncus pallidus*			✓
	Purple Flag	*Lepidosperma angustatum*	✓		
		Baumea articulata			✓
		Mesomelaena pseudostygia	✓		
		Conostylis aculeata	✓		

4.5.3 Timing for Rehabilitation Works

The following table summarises the timing for rehabilitation works proposed in the Conservation Reserve.

TABLE 3
TIMING OF MANAGEMENT WORKS

	2003				2004				2005		
Item	winter	spring	summer	autumn	winter	spring	summer	autumn	winter	spring	summer
Install Temporary Fence											City of Cockburn to takeover responsibility for the management of the Reserve
Weed Control											
- Typha cutting/slashing											
- herbicide application											
Revegetation											
Monitoring											
- weed control											
- revegetation											

4.5.4 Control of Feral Animals and Domestic Pets

The control of introduced and domestic animals in the bushland will reduce the potential for destruction to the native vegetation and death or distress to native fauna.

Evidence of introduced animals such as rabbits and rodents has been identified at Lot 199, during previous site investigations. In addition, cats may frequent the bushland from nearby residential areas.

While the installation of conservation fencing at the periphery of the Reserve may assist in preventing access to dogs and other feral animals, it will not allow for the movement of native fauna in the event of a fire. For this reason, other methods of preventing impacts on the bushland by feral and domestic animals need to be implemented. For example, Stockland, in consultation with the City of Cockburn, may implement cat curfews or advise prospective purchasers that cats are not permitted within The Sanctuary.

4.5.5 Fire Control

The protection of life, property and environmental and community values in the bushland will be the important components of fire management within the development area.

The incidence and impact of potential unplanned fires in the Reserve will be reduced through maintaining a strategic fire access system and implementing measures to control weeds which contribute to a high fuel load (such as Grass species – Veldt Grass, particular along existing fire breaks to be retained). The pedestrian access path through the Reserve and around the periphery in the landscaped verge will form the strategic fire access system. In addition, the existing firebreak at the northern and eastern boundary will be maintained.

In addition, early detection of fires and rapid attack will play an important role in fire control in the Reserve. Importantly, no burning for fuel reduction purposes will be undertaken in the bushland area.

The fire management measures proposed in the Reserves are shown in Figure 5 and include access paths and fire breaks to be used for emergency vehicle access. The location of vehicle access gates is also shown.

4.5.6 Prevention of Dieback Invasion

Evidence of the invasion of dieback at Lot 199 has not been recorded, however the proposed development of the site and associated activities has the potential to facilitate its invasion, therefore a number of management measures will be implemented, including:

- all imported soil, topsoil, vegetation and path construction material is to be sourced from a dieback free source; and

- vehicle movement is to be restricted to outside the Conservation and Recreation Reserve (a permanent fence will be installed prior to construction works).

5. IMPLEMENTATION, TIMING AND RESPONSIBILITIES

5.1 Prioritisation of Management Proposals

The following table prioritises the management proposals for the Conservation and Recreation Reserve and identifies the maintenance requirements according to the management categories outlined in Section 3.

TABLE 4
PRIORITISATION AND RESPONSIBILITY FOR MANAGEMENT PROPOSALS

Strategy	Specification	Timing	Priority	Responsibility
Pre-Construction Management				
Bandicoots	Implement bandicoot trapping and relocation program	At least two weeks prior to bushland clearing	High	Stockland
Fencing	Install a temporary fencing at the periphery of the bushland to be conserved in the Conservation and Recreation Reserve	Immediately following bandicoot relocation program and immediately prior to bushland clearing	High	Stockland
	Install a temporary fence around any areas of vegetation to be retained as part of the landscaped verge surrounding the bushland in the Reserve.	Immediately following bandicoot relocation program and immediately prior to bushland clearing	High	Stockland
	Replace temporary fence with permanent conservation fence at periphery of bushland.	During works associated with landscaped edge	Medium - High	Stockland
Vegetation Clearing	Native vegetation to be mulched immediately following clearing and stockpiled in locations to be determined in consultation with the City of Cockburn	Immediately following clearing	High	Stockland, in consultation with City of Cockburn
Bush Harvesting	Any native vegetation not used within the development area and Conservation and Recreation Reserve will be made available to the City of Cockburn	Following clearing and as appropriate	Medium-High	Stockland, City of Cockburn
	Stockland to advise the City of the project timing so that the collection of resources (such as native seed, plants etc) can be collected or taken from the subdivision area prior to development	Immediately	High	City of Cockburn
Treatment of Interface				
Drainage Swales / Landscaping	Construct swale drains in the landscaped verge of the Reserve	During establishment of landscaped interface	High	Stockland
Roads	Install flush kerbing on roads adjacent to the Reserve	During road construction	-	Stockland
Car Parking	Install up to 10 car bays at the periphery of the Reserve as shown in Plan B.	During establishment of landscaped interface	Medium	Stockland

Strategy	Specification	Timing	Priority	Responsibility
Access Management				
Pedestrian Access Paths	Install a pedestrian access path of concrete (or other appropriate material) to a width of 2.5m (with limestone edging to a total width of 3m). The final alignment is to be determined on-site to the satisfaction of the City of Cockburn.	Prior to commencement of works	High	Stockland
Dual Use Path	Install a DUP path of concrete (or other appropriate material) to a width of 2.5m outside the boundary of the bushland within the Reserve shown in Plan B(a).	Prior to commencement of works	High	Stockland
Gates	Install pedestrian access and vehicle access gates at access points to Reserve.	Prior to commencement of works and during construction of perimeter fence	High	Stockland
Boardwalks	Construct boardwalks, as shown in Plan E4, with galvanised steel with either timber decking or timber chequer plate/mesh	During construction of pedestrian access path within Reserve	Medium-High	Stockland
Emergency Vehicle Access	Emergency vehicle access within the Reserve will be available via the pedestrian access path	As per pedestrian access path		
Fencing				
Perimeter Fencing	A 1.2m high pine post and wire mesh permanent fencing will be installed at the perimeter of the Reserve.	Immediately following bandicoot relocation program and immediately prior to bushland clearing	High	Stockland
Internal fencing	Install fencing at intersections of paths.	During construction of paths	Medium – High	Stockland
Interpretative Signage	Install signage as shown in Plan E5, at appropriate locations within locations within the Reserve.	Following construction of paths	Medium	Stockland
Vegetation Management				
Weed Control	Implement weed control for those species identified in Table 1.	Following completion of construction works in the Reserve	Medium – High	Stockland
Revegetation	Rehabilitate degraded areas by direct seeding / planting using local native species where possible.	Following completion of construction works in the Reserve	Medium - High	Stockland
Control of Pests	Consider the implementation of curfews for pets or alternatively, a total ban on allowing cats within the development area		High	Stockland
Fire Management	Liaise with the FESA and the City of Cockburn to determine responsibilities for fire control in the Reserve.		Medium	Stockland & City of Cockburn

Strategy	Specification	Timing	Priority	Responsibility
Dieback Management	All imported soil, topsoil and vegetation is to be sourced from a dieback free source. Vehicle movement is to be restricted to outside the Conservation and Recreation Reserve (a permanent fence will be installed prior to construction works).	During Construction	High	Stockland
Maintenance and Monitoring				
General	Inspect areas where management strategies have been implemented. Assess if further works or general repairs are required.		As Required	Stockland for a period of 2yrs, followed by the CoC on satisf-actory completion of works.

5.2 Allocation of Responsibilities

Stockland will be responsible for the implementation of the recommendations presented in this Management Plan, as well as the ongoing management and maintenance of the Conservation and Recreation Reserve to the satisfaction of the City of Cockburn over a period of two years from commencement of site works. Following this period, the City of Cockburn will adopt responsibility for the management of the Conservation and Recreation Reserve.

5.3 Monitoring and Review

The implementation of management strategies identified in this Plan will be an on-going process which should be flexible in responding to changes in the natural environment, the recreational use of the environmental and community values. As such, a program of monitoring the success of the strategies proposed in this Plan will be essential for the purposes of reviewing and updating the Plan by the City of Cockburn in five years time. This will ensure that the aims and objectives of the Plan have been achieved and that any new developments in management techniques can be utilised.

5.3.1 Performance Monitoring

Stockland will implement monitoring in the Reserve to assess the success of rehabilitation works including weed control activities and revegetation up to two years from the time of implementation of the works. This will allow identification of areas requiring augmentation or remedial works to be identified early and appropriately planned. In addition, the monitoring will ensure that an adequate representation of species and plant density is achieved.

During the two year period, Stockland will also be responsible for ensuring the general maintenance of facilities within the Reserve and will implement repairs where necessary to maintain the upkeep of paths, fences, signage and other infrastructure proposed as part of this Management Plan.

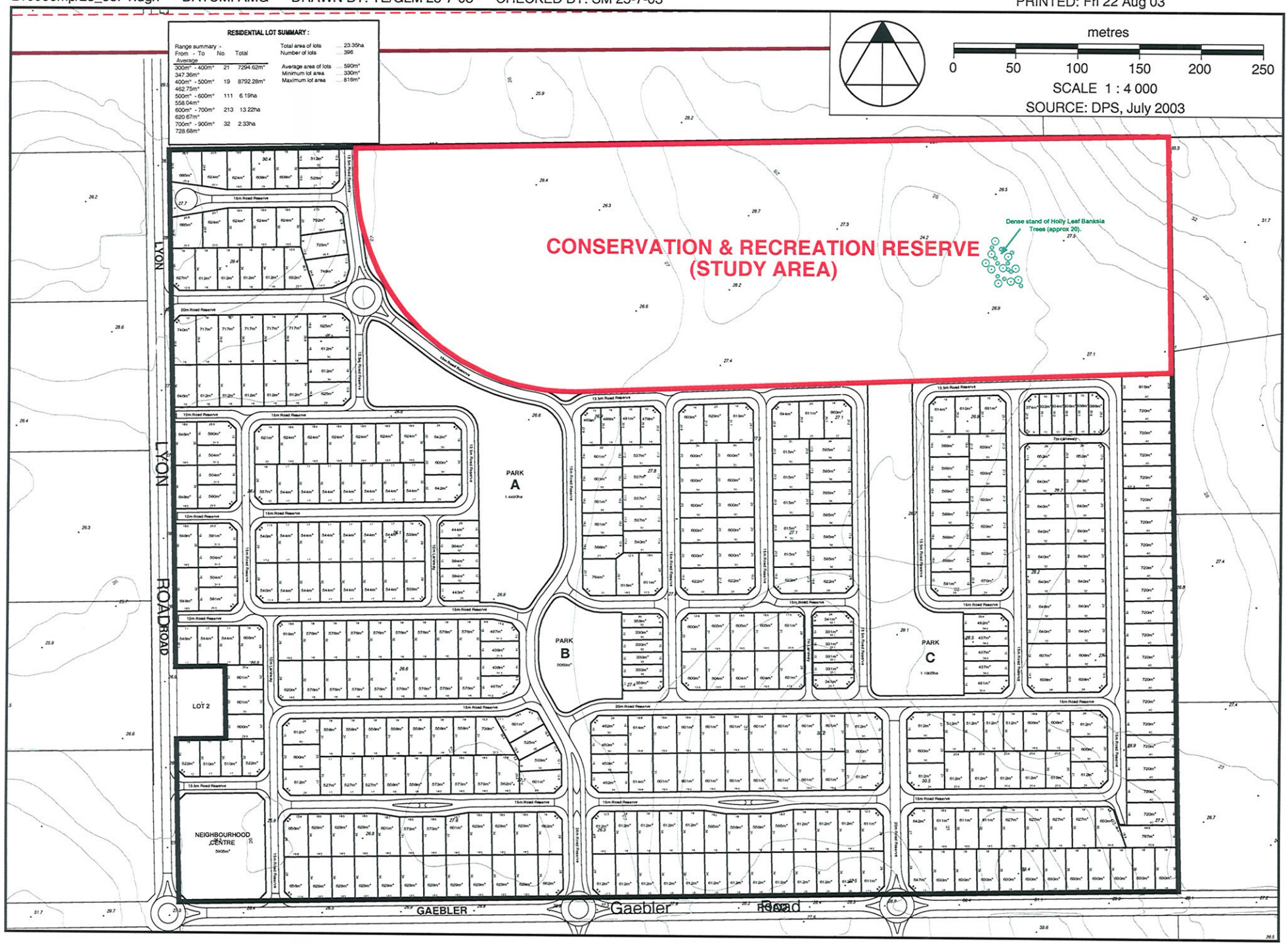
ATA Environmental does not propose to implement monitoring of surface water /groundwater quality or levels as the area of influence on the wetlands at Lot 199 extends beyond the boundaries of the study area.

FIGURES

21098emp/23_83F1.dgn DATUM: AMG DRAWN BY: TE/GLM 25-7-03 CHECKED BY: SM 25-7-03 PRINTED: Fri 22 Aug 03

ATA Environmental
environmental scientists

THE SANCTUARY - LOT 199 GAEBLER ROAD, BANJUP
ENVIRONMENTAL MANAGEMENT PLAN
WAPC APPROVED SUBDIVISION PLAN
FIGURE 1



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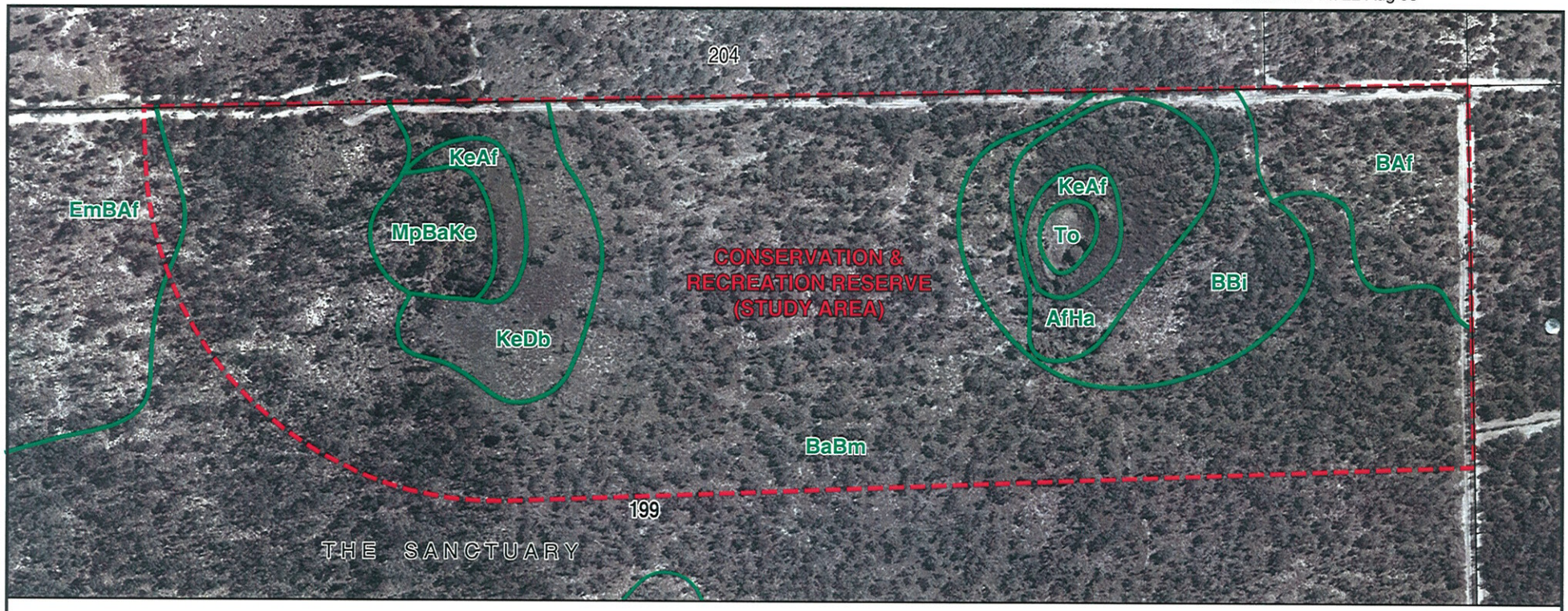
ENVIRONMENTAL MANAGEMENT PLAN

VEGETATION TYPES OF THE RESERVE

FIGURE 2



VEGETATION TYPES LEGEND

Upland Areas & Ridge

EmBAf Jarrah (*Eucalyptus marginata*), *Banksia attenuata*, *B. menziesii*, *B. ilicifolia*, Sheoak (*Allocasuarina fraseriana*) Low Woodland over Balga (*Xanthorrhoea preissii*), *Stirlingia latifolia*, *Hibbertia hypericoides*, *Dasypogon bromeliifolius*, *Petrophile linearis*.

Flats & Low-lying Areas

BaBm *B. attenuata*, *B. menzeisii* Low Woodland to Low Open Forest with occasional Sheoak and Jarrah over a Low Closed Heath to Closed Heath of *X. preissii*, *D. bromeliifolius*, *Hibbertia subvaginata* and *Xanthorrhoea brunonis*.

BAf *B. attenuata*, *B.menziesii* and Sheoak Low Woodland with occasional Jarrah and Woolly Bush (*Adenanthos cygnorum*) over a Low Open Heath of *D. bromeliifolius*, *S. latifolia*, *H. hypericoides* and *Amphipogon turbinatus*.

Fringing Wetland

BBi *B. attenuata*, *B.menziesii* and Holly-leaf Banksia (*B. ilicifolia*) Low Open Forest over a Low Closed Heath of *D. bromeliifolius*, *Desmocaludus flexuosus*, *Gompholobium tomentosum*, *Scholtzia involucrata*, *Hypocalymma angustifolium* and *Adenanthos obovatus*.

Sumpland Vegetation - Seasonally Inundated Areas

MpBaKe Paperbark (*Melaleuca preissiana*), *B. attenuata*, WA Christmas Tree (*Nuytsia floribunda*) Low Woodland over Spearwood (*Kunzea ericifolia*) and *X. preissii*.

KeDb Spearwood, *D. bromeliifolius*, *Astartea fascicularis* Low Closed Heath with occasional Paperbark.

KeAf Spearwood, *Astartea fasicularis* Closed Heath to Closed Scrub with scattered Paperbarks.

AfHa *A. fascicularis*, *H. angustifolium* Low Closed Heath to Closed Heath with *D. bromeliifolius* and *Boronia racemosa* with occasional stands of Paperbark, Spearwood and Holly-leaf Banksia.

To Bulrush (*Typha orientalis*) Sedgeland with *Juncus pallidus* over introduced grasses and herbs.

LEGEND

- Conservation and Recreation Reserve Boundary
- The Sanctuary Boundary
- 199 Cadastral Boundary, Lot Number
- Vegetation Type Boundary

metres

0 20 40 60 80 100

SCALE 1 : 3 000

BASE SOURCE: DPS, July 2003
AERIALPHOTO SOURCE: McMULLEN NOLAN, July 2003

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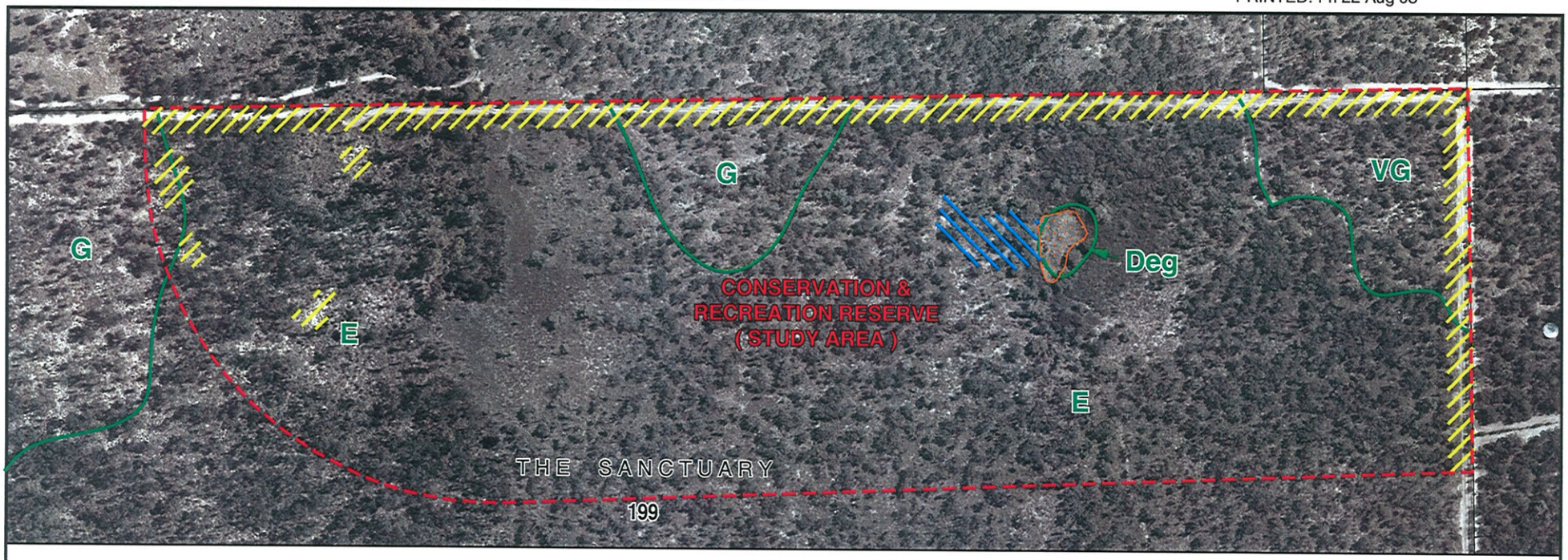

THE SANCTUARY - LOT 199 GAEBLER ROAD, BANJUP
ENVIRONMENTAL MANAGEMENT PLAN

VEGETATION CONDITION AND DISTRIBUTION OF INVASIVE WEEDS

FIGURE 3

LEGEND

Veldt Grass (Perennial & Annual), Annual Grasses, Gladiolus

Typha orientalis (with Cotton Bush, Thistle, Fleabane and Annual Grasses)

Pigface *(Carpobrotus edulis)* and Arum Lily *(Zantedeshia aethiopica)*

metres
0 20 40 60 80 100
SCALE 1 : 3 000

BASE SOURCE: DPS, July 2003
AERIALPHOTO SOURCE: McMULLEN NOLAN, July 2003

Vegetation Condition Legend

P **Pristine**
Pristine or nearly so, no obvious signs of disturbance

E **Excellent**
Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive

VG **Very Good**
Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

G **Good**
Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Deg **Degraded**
Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

CD **Completely Degraded**
The structure of the vegetation is no longer intact and the areas is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora composing weed or crop species with isolated native trees or shrubs.

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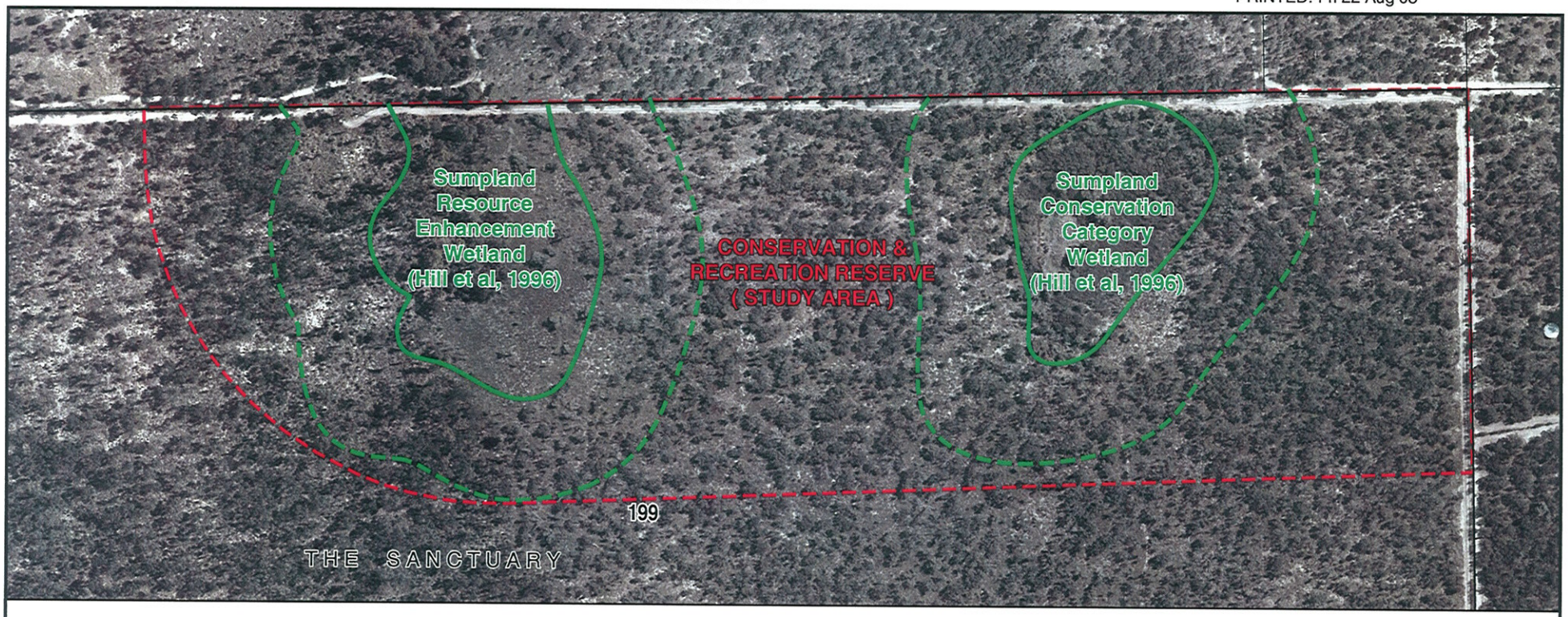

LEGEND

- Conservation and Recreation Reserve Boundary
- The Sanctuary Boundary
- 199 Cadastral Boundary, Lot Number
- Wetland Deliniation Boundary
- Extent of 50m Wetland Buffer

metres
0 20 40 60 80 100
SCALE 1 : 3 000

BASE SOURCE: DPS, July 2003
AERIALPHOTO SOURCE: McMULLEN NOLAN, July 2003

THE SANCTUARY - LOT 199 GAEBLER ROAD, BANJUP
ENVIRONMENTAL MANAGEMENT PLAN

LOCATION OF WETLANDS IN THE RESERVE

FIGURE 4

21098emp/23_83F5.dgn DATUM: AMG DRAWN BY: TE 21-8-03 CHECKED BY: SM 21-8-03 PRINTED: Fri 22 Aug 03

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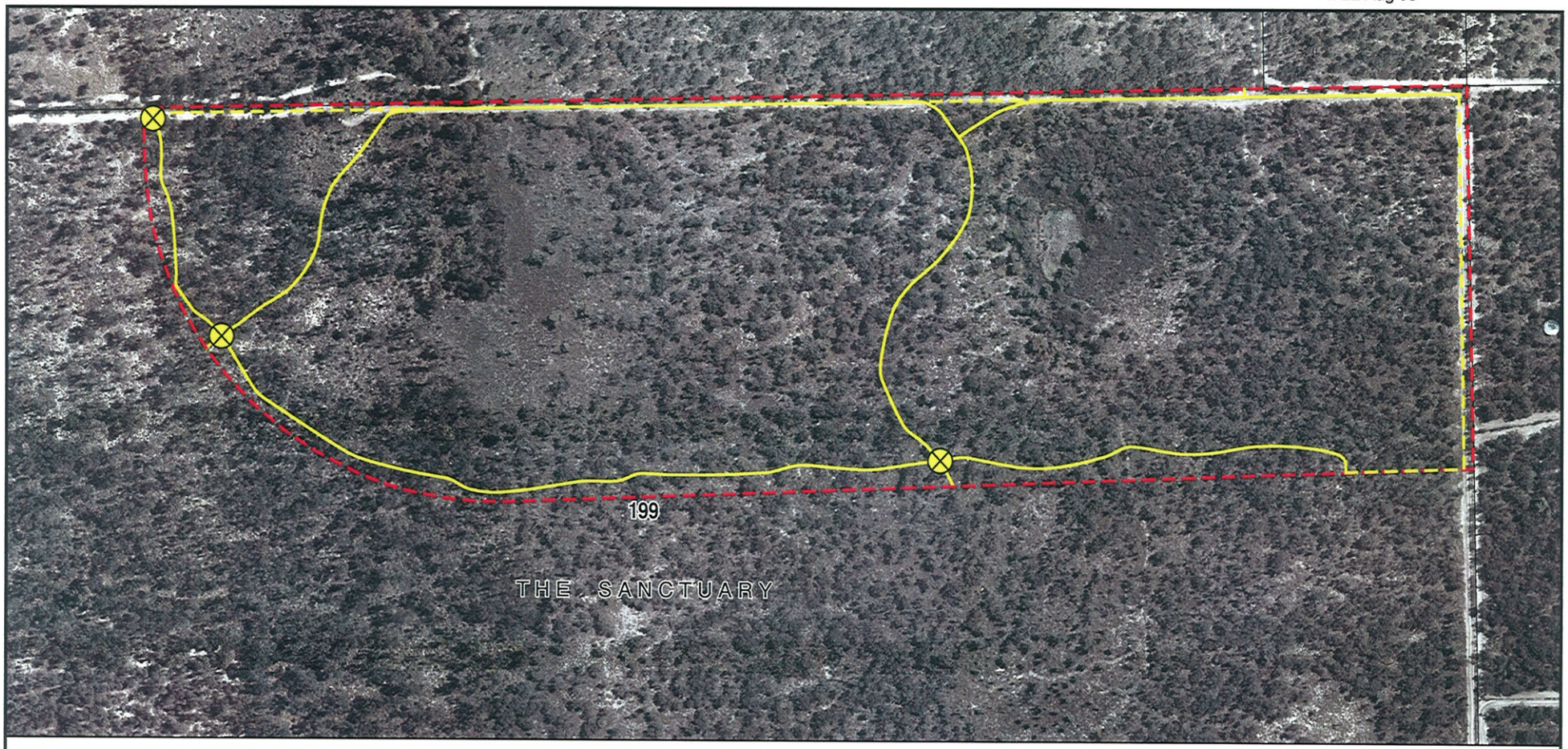
ATA



THE SANCTUARY - LOT 199 GAEBLER ROAD, BANJUP
ENVIRONMENTAL MANAGEMENT PLAN

FIRE MANAGEMENT PLAN

FIGURE 5

LEGEND

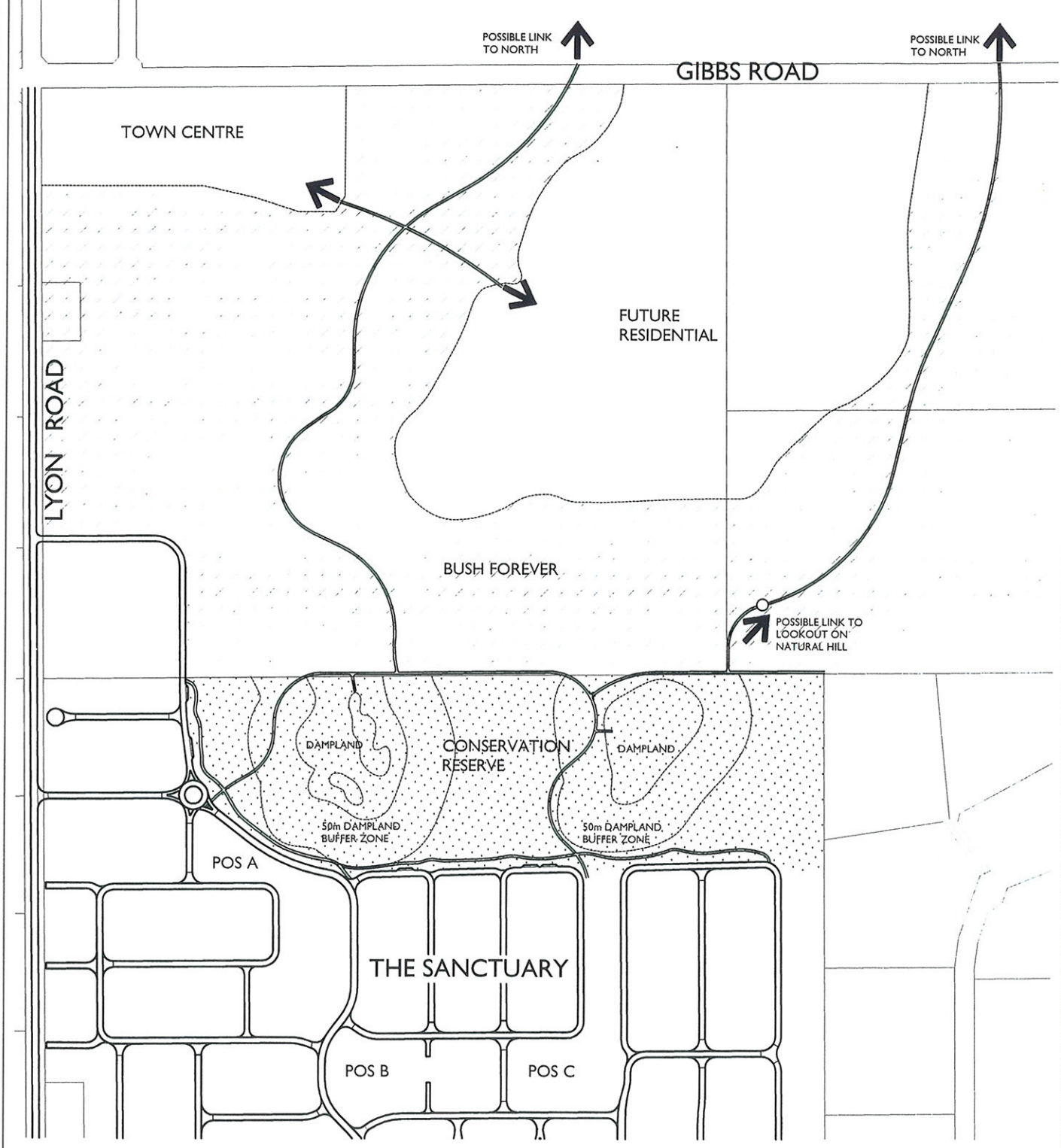
- Conservation and Recreation Reserve Boundary
- 199 Cadastral Boundary, Lot Number
- Pathways / Existing fire breaks for emergency access
- Vehicle access gates

metres
0 20 40 60 80 100
SCALE 1 : 3 000

BASE SOURCE: DPS, July 2003
AERIALPHOTO SOURCE: McMULLEN NOLAN, July 2003

PLANS

PLAN A



NOTE:
PATH LOCATIONS ARE INDICATIVE ONLY AND REQUIRE CONSULTATION WITH OTHER LANDOWNERS AND STAKEHOLDERS AND SENSITIVE LOCATION WITHIN BUSHLAND AREAS FOLLOWING APPROPRIATE APPROVALS.

INDICATIVE DUAL USE PATH LINKS
THE SANCTUARY BANJUP WA

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Northbridge, WA 6865
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e: admin@mnla.com.au

PLAN B

existing fire break. Not approved.

existing firebreak

ALL PEDESTRIAN PATHS SENSITIVELY LOCATED THROUGH EXISTIG BUSHLAND. CURRENT LOCATIONS ARE INDICATIVE AND SUBJECT TO ON SITE SURVEY AND DETAILED LOCATION TO AVOID DAMAGE AND CLEARING

ELEVATED METAL FRAME BOARDWALK SKIRTS AROUND WETLAND AREA

RETAIN & PROTECT EXISTING WETLAND AREA

POSSIBLE FUTURE LINK TO ADJOINING LAND HOLDINGS

PEDESTRIAN PATH TO BE CONSTRUCTED PARTLY ON EXISTING TRACK TO MINIMISE DISTURBANCE

LOCAL FENCING TO PEDESTRIAN INTERSECTIONS ONLY TO CONTROL ACCESS

ELEVATED METAL FRAME BOARDWALK VIEWS WETLAND AREA

RETAIN & PROTECT EXISTING TYPHA & WETLAND SPECIES

EXISTING BARE INUNDATION ZONE TO BE REVEGETATED WITH APPROVED LOCAL DAMPLAND SPECIES. REMOVE EXISTING WEEDS

POSSIBLE FUTURE LINK TO ADJOINING LAND HOLDINGS

POSSIBLE FUTURE LINK TO ADJOINING LAND HOLDINGS

TREES TO CONSERVATION RESERVE & ROAD INTERFACE

MIN 4m, MAX 6m WIDE GRASSED SWALE

2.5m WIDE DUAL USE FOOTPATH

REFER SECTION DWG NO BJ-01-02

FENCE TO PERIMETER OF CONSERVATION RESERVE

GATE TO ALLOW PEDESTRIAN ACCESS

EXTENT OF 50m BUFFER ZONE

EXTENT OF 50m BUFFER ZONE

+26.4

+26.3

+28.7

+27.3

DAMPLAND

WETLAND

CONSERVATION RESERVE

WETLAND

WETLAND

DAMPLAND

+28.2

+26.6

EXISTING HOLLY LEAF BANKSIA AS SURVEYED.

50m WETLAND BUFFER ZONE

50m WETLAND BUFFER ZONE

+27.1

PATH LINK TO PUBLIC OPEN SPACE

REFER SECTION DWG NO BJ-01-02

2.1m WIDE FOOTPATH

6m WIDE GRASSED SWALE

FENCE TO PERIMETER OF CONSERVATION RESERVE

GATE TO ALLOW PEDESTRIAN ACCESS

EXISTING FIREBREAK

FIREBREAK TO BE INSTALLED

GATE TO ALLOW PEDESTRIAN/ EMERGENCY ACCESS

2.5m WIDE DUAL USE PATH LINK INTO SUBDIVISION

PUBLIC OPEN SPACE A

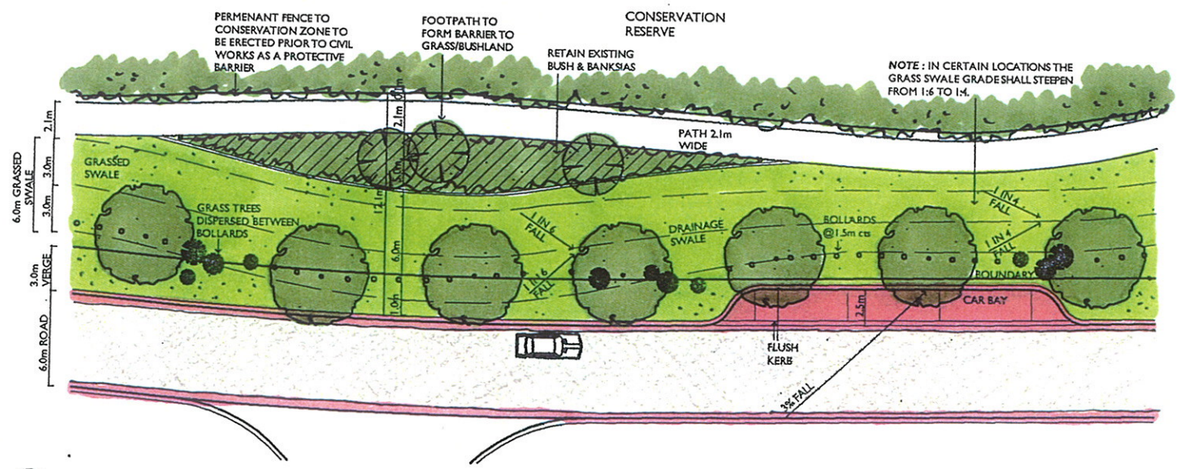
REFER SECTION DWG NO BJ-01-02

PATH LINK TO PUBLIC OPEN SPACE

PUBLIC OPEN SPACE C

A CONSERVATION RESERVE INTERFACE WITH PARKING EMBAYMENT

SCALE 1:1000



B DETAIL PLAN: CONSERVATION RESERVE INTERFACE WITH PARKING EMBAYMENT

SCALE 1: 200

LEGEND

- EXTENT OF SURVEYED WETLAND
- DAMPLAND
- 50m WIDE BUFFER ZONE TO WETLAND
- PROPOSED REVEGETATION AREA
- ROLL ON TURF
- PROPOSED TREE PLANTING TO CONSERVATION RESERVE INTERFACE
- GRASS TREES LOCATED TO MINIMISE BOLLARDS
- BOLLARDS AT 1.5m cts

REVISION	DATE	AMENDMENT	CHECKED
C	24.7.03	ISSUE FOR EMP REPORT	CN
B	10.07.03	ISSUE FOR COUNCIL REVIEW	CN
A	11.07.03	ISSUE FOR CLIENT REVIEW	CN

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DRAWING TITLE
CONSERVATION RESERVE INTERFACE LANDSCAPE CONCEPT PLAN

PROJECT
THE SANCTUARY
BANJUP WA

CLIENT
STOCKLAND

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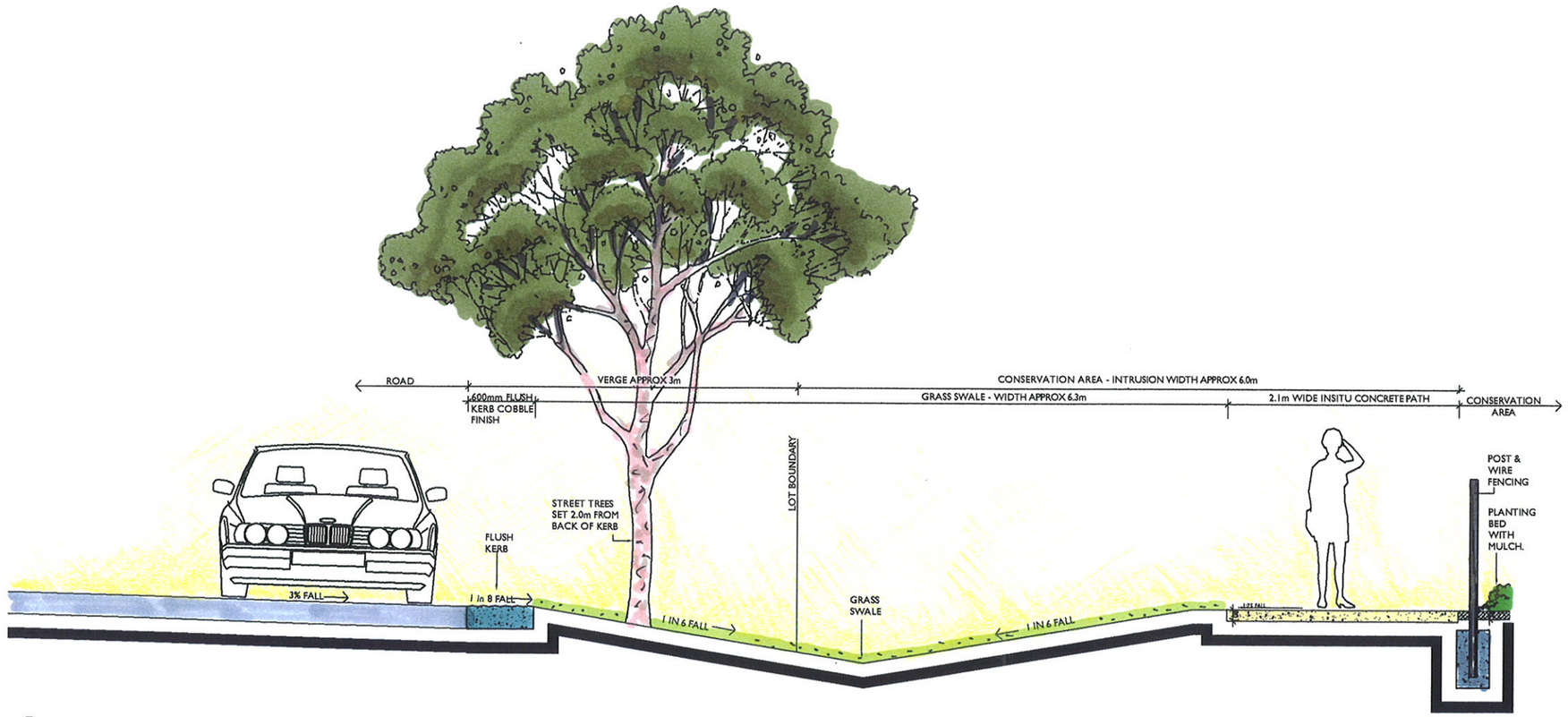
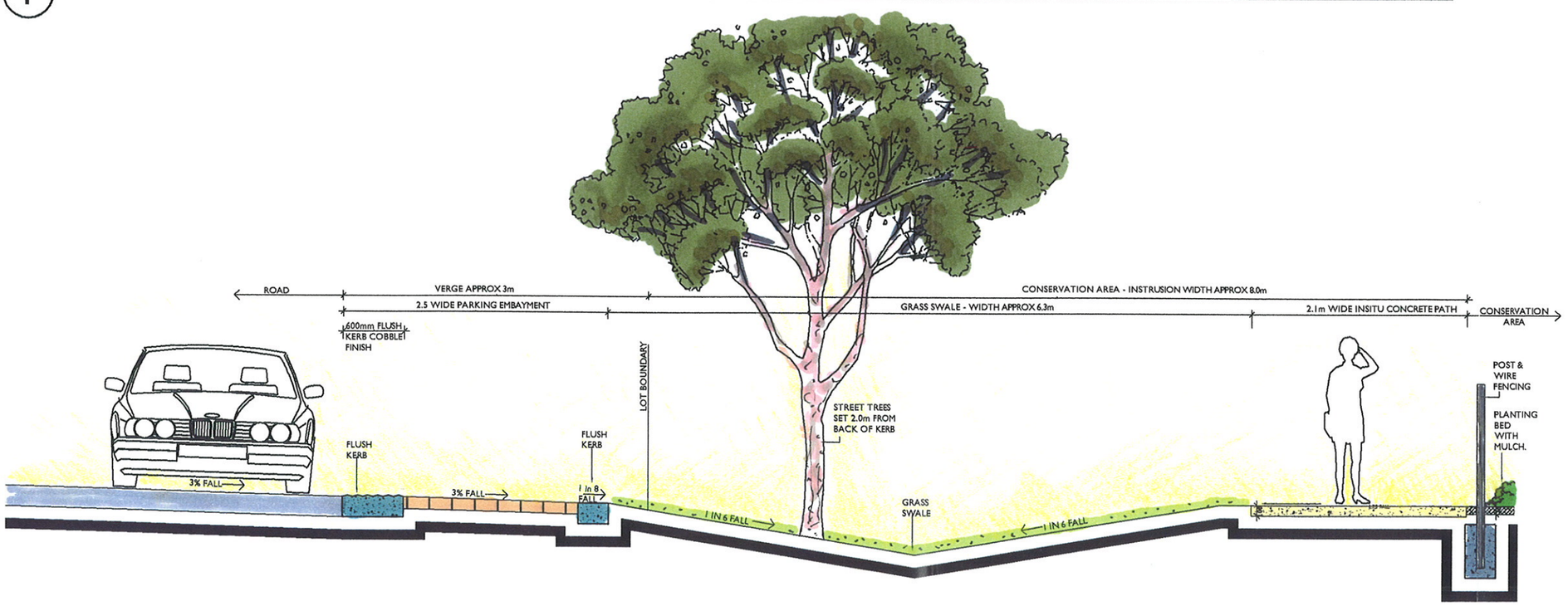
PLAN C



1 CONSERVATION AREA INTERFACE: ROAD WITH NO CAR BAY

SCALE 1:50



2 CONSERVATION AREA INTERFACE: ROAD WITH PARKING EMBAYMENT

SCALE 1:50

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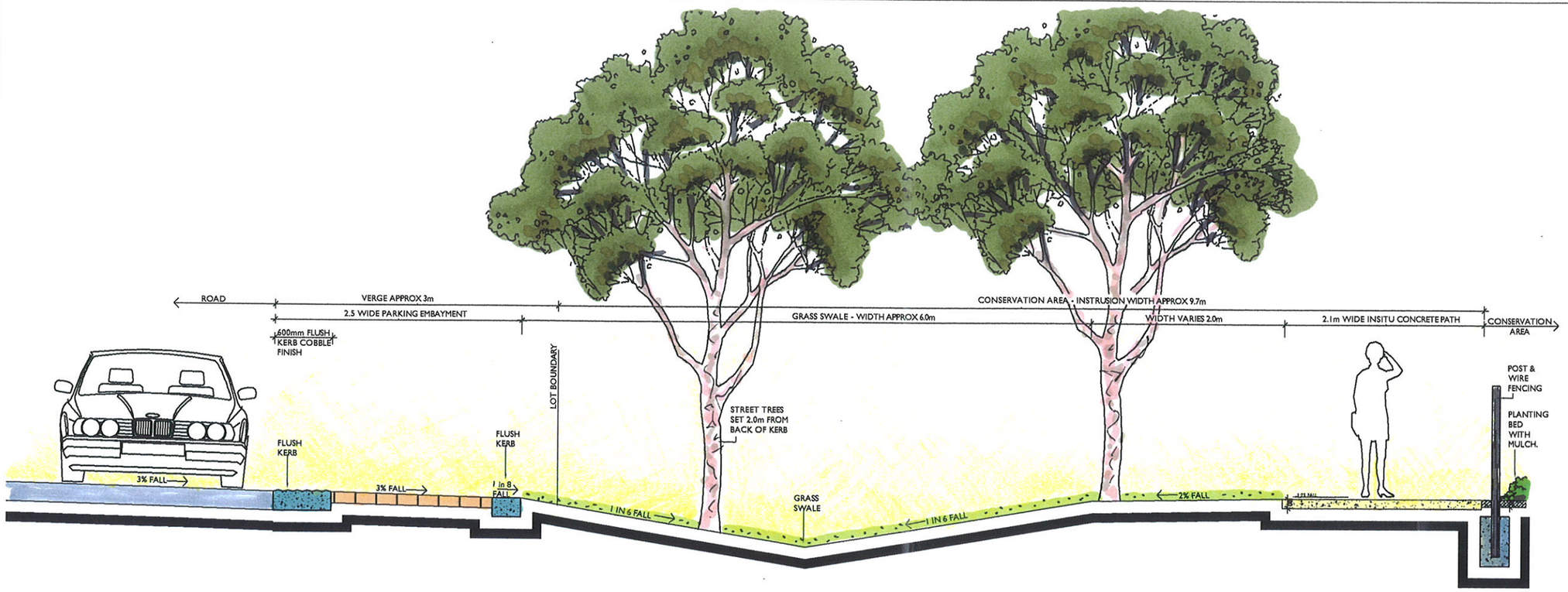
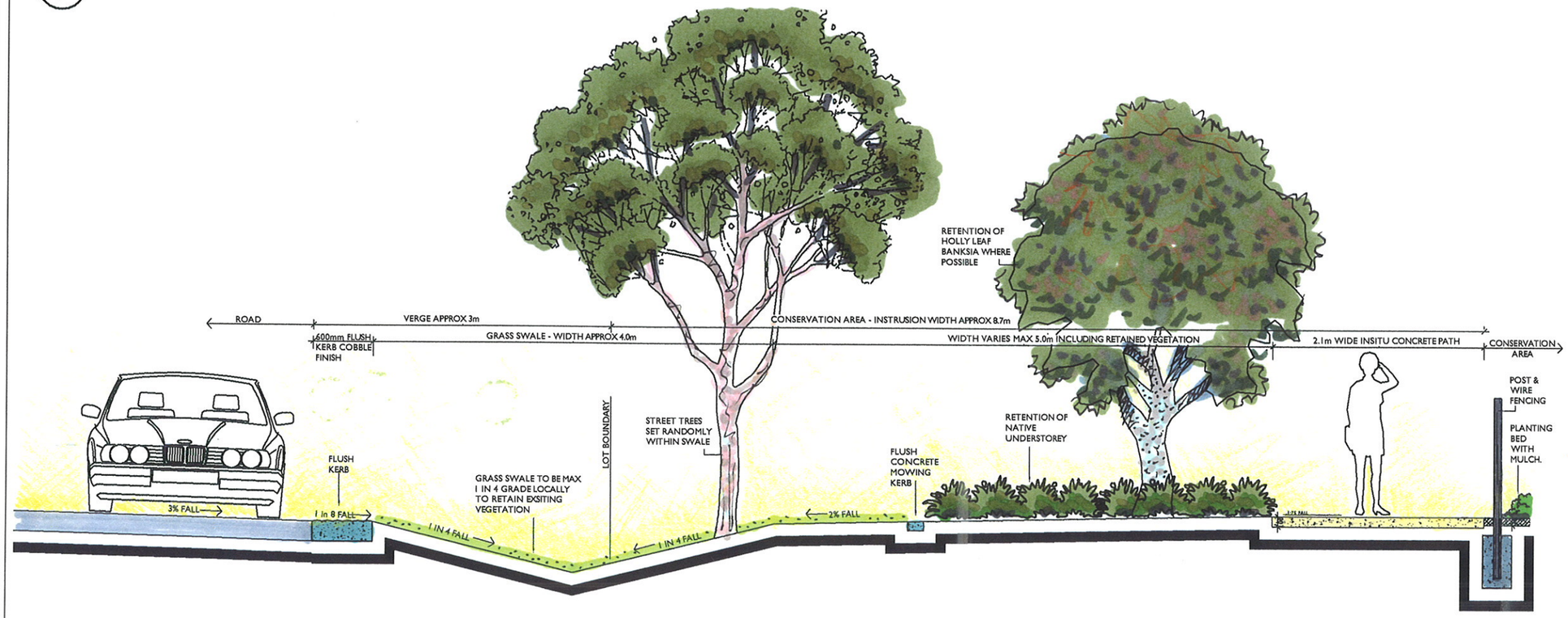
PLAN D



3 CONSERVATION AREA INTERFACE: ROAD WITH PARKING EMBAYMENT & EXTENDED VERGE

SCALE 1:50



4 CONSERVATION AREA INTERFACE: BUSHLAND RETENTION

SCALE 1:50

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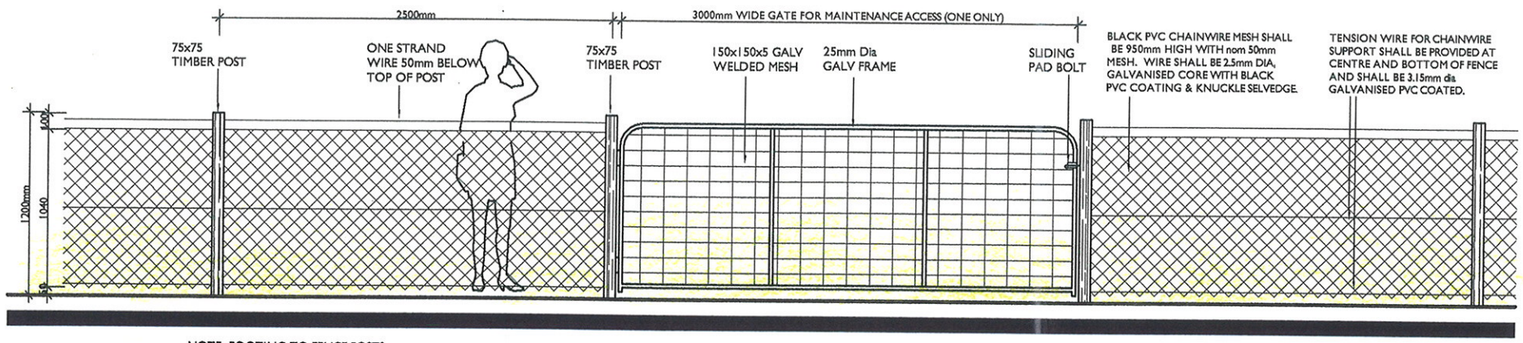
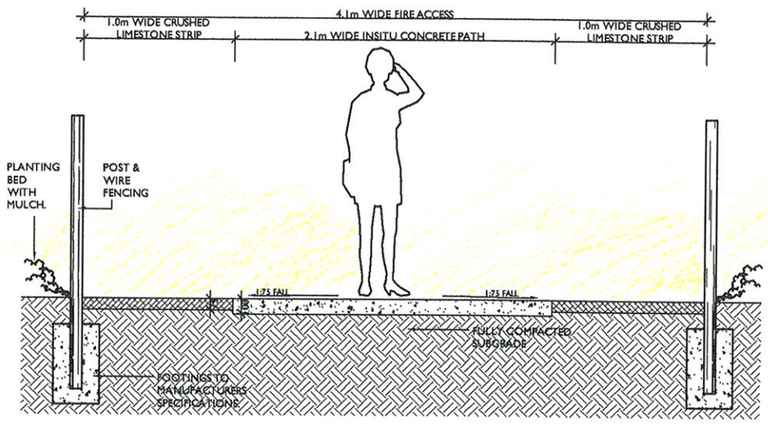
REVISION:	B

PLAN E

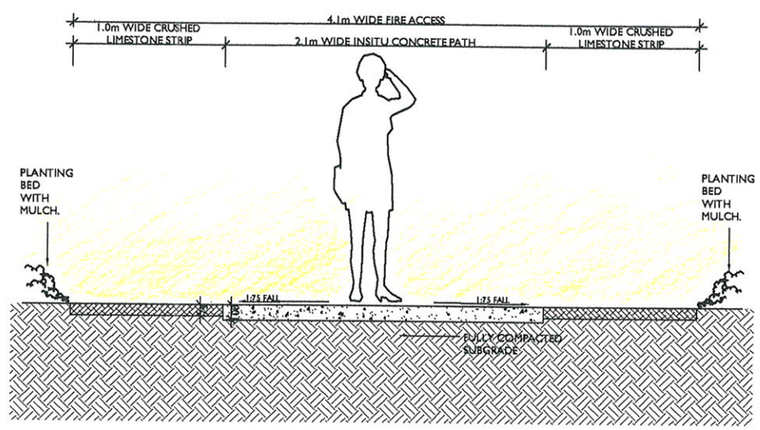


NOTE: FOOTING TO FENCE POSTS TO APPROVED STRUCTURAL DETAIL BY CONTRACTOR.

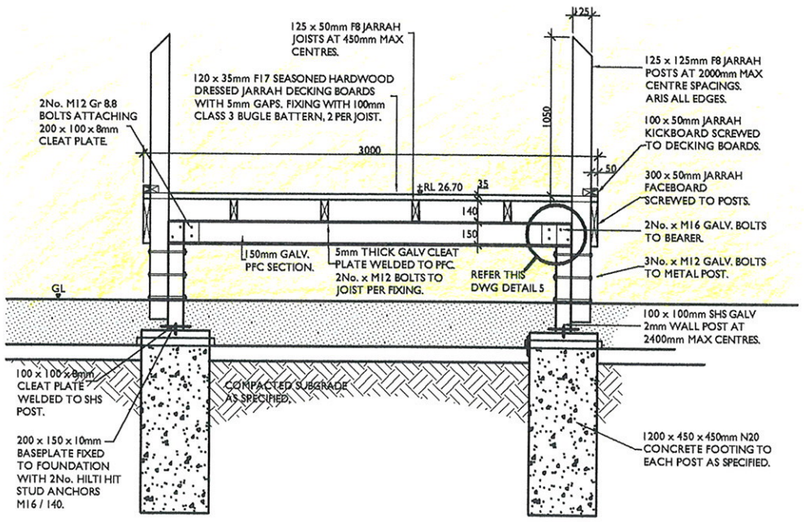
1 PERMENANT FENCING TO CONSERVATION AREA — SCALE 1:50



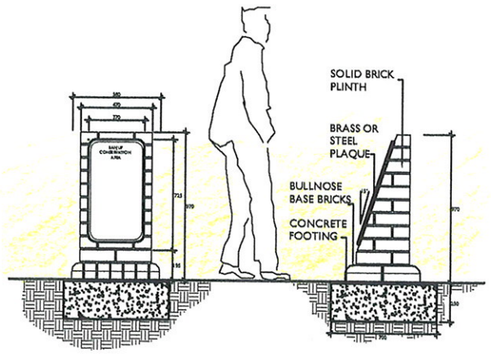
2 CONSERVATION RESERVE PATH WITH LOCAL FENCING AT INTERSECTIONS — SCALE 1:40



3 TYPICAL CONSERVATION RESERVE PATH CROSSSECTION — SCALE 1:40



4 SECTION: TIMBER BOARDWALK — SCALE 1:40



5 INDICATIVE INTERPRETATIVE SIGNAGE — SCALE 1:40

REVISION	DATE	AMENDMENT	CHECKED
B	18/07/03	ISSUE FOR COUNCIL REVIEW	CN
A	11/07/03	ISSUE FOR CLIENT REVIEW	CN

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CONSTRUCTION DETAILS

PROJECT
THE SANCTUARY
BANJUP, WA

CLIENT
STOCKLAND

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DRAWING CHECKED BY:	CN
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THIS PLAN IS NOT TO BE USED FOR CONSTRUCTION UNLESS THE ISSUE IS REVISION 1 AND THE DRAWING IS SIGNED BELOW

SIGNED

PRINT
DIRECTOR FOR McNALLY-NEWTON

CAD REF: BJ-01-03
DATE: July 2003
SCALE: AS SHOWN at A3

DRAWING NUMBER: BJ-01-05
REVISION: B

APPENDIX 1

LOT 199 GAEBLER ROAD, BANJUP
FLORA LIST

APPENDIX 1
LOT 199 GAEBLER ROAD – COMPLETE FLORA LIST
(*denotes introduced species)

GYMNOSPERMAE	
CYCADACEAE	Macrozamia fraseri
MONOCOTYLEDONAE	
ANTHERICACEAE	Agrostocrinum scabrum
	Chamaescilla corymbosa
	Laxmannia squarrosa
	Sowerbaea laxiflora
	Thysanotus arenarius
	Thysanotus patersonii
	Thysanotus thrysoideus
	Thysanotus triandrus
ARACEAE	*Zantedeschia aethiopica
COLCHICACEAE	Burchardia umbellata
CYPERACEAE	Lepidosperma angustatum
	Mesomelaena pseudostygia
	Schoenus curvifolius
DASYPOGONACEAE	Dasypogon bromeliifolius
HAEMODORACEAE	Anigozanthus humilis
	Anigozanthos manglesii
	Conostylis aculeata
	Conostylis juncea
	Conostylis setigera
	Phlebocarya ciliata
IRIDACEAE	*Gladiolus caryophyllaceus
	Patersonia occidentalis
JUNCACEAE	Juncus pallidus
ORCHIDACEAE	Caladenia arenicola
	Caladenia flava
	Caladenia longicauda ssp. longicauda
	Caladenia macrostylis
	Caladenia reptans ssp. reptans
	Diuris corymbosa
	Elythranthera brunonsis
	Leporella fimbriata
	Pterostylis vittata

	Pyrorchis nigricans
POACEAE	*Aira caryophyllea
	Amphipogon turbinatus
	*Briza maxima
	*Briza minor
	*Ehrharta calycina
	*Pentaschistis thunbergii
RESTIONACEAE	Hypolaena exsulca
	Desmocladus flexuosus
	Lyginia barbata
TYPHACEAE	*Typha orientalis
XANTHORRHOEACEAE	Xanthorrhoea brunonis
	Xanthorrhoea preissii
DICOTYLEDONAE	
APIACEAE	Platysace compressa
	Trachymene pilosa
	Xanthosia huegelii
ASTERACEAE	*Conyza bonariensis
	*Cotula coronopifolia
	Helipterum cotula
	*Hypochaeris glabra
	Pithocarpa pulchella
	Podotheca angustifolium
	*Pseudognaphalium luteoalbum
	*Sonchus oleraceus
	*Ursinia anthemoides
	Waitzia suaveolens
AIZOACEAE	*Carpobrotus edulis
CASUARINACEAE	Allocasuarina fraseriana
	Allocasuarina humilis
CACTACEAE	*Opuntia stricta
COMMELINACEAE	Cartonema philydroides
CRASSULACEAE	Crassula colorata
DILLENIACEAE	Hibbertia hypericoides
	Hibbertia racemosa
	Hibbertia subvaginata

DROSERACEAE	Drosera erythrorhiza
EPACRIDACEAE	Conostephium pendulum
	Leucopogon sp.
GERANIACEAE	*Pelargonium capitatum
GOODENIACEAE	Dampiera linearis
	Lechenaultia floribundus
	Scaevola canescens
HALORAGACEAE	Gonocarpus pithyoides
LAMIACEAE	Hemiandra pungens
LAURACEAE	Cassytha racemosa
LOBELIACEAE	Lobelia tenuior
LORANTHACEAE	Nuytsia floribunda
MIMOSACEAE	Acacia huegelii
	Acacia pulchella
	Acacia stenoptera
MOLLUGINACEAE	Macarthuria australis
MYRTACEAE	Astartea fascicularis
	Calytrix fraseri
	Calytrix sp. (unmapped wetland)
	Eremaea sp.
	Eucalyptus marginata
	Hypocalymma angustifolium
	Hpocalymma robustum
	Kunzea ericifolia
	Melaleuca preissiana
	Melaleuca thymoides
	Pericalymma ellipticum
	Scholtzia involucrata
PAPILIONACEAE	Aotus procumbens
	Bossiaea eriocarpa
	Burtonia conferta
	Daviesia triflora
	Euchilopsis linearis
	Gompholobium tomentosum
	Jacksonia furcellata

	Kennedia prostrata
	*Lotus uliginosus
	*Trifolium sp.
POLYGALACEAE	Comesperma calymega
PROTEACEAE	Adenanthos cygnorum
	Adenanthos obovatus
	Banksia attenuata
	Banksia grandis (one seedling)
	Banksia ilicifolium
	Banksia menziesii
	Persoonia saccata
	Petrophile linearis
	Stirlingia latifolia
	Synaphea polymorpha
	Xylomelum occidentale
RUBIACEAE	Opercularia vaginata
RUTACEAE	Boronia crenulata
	Boronia sp.
STYLIDIACEAE	Levenhookia stipitata
	Stylidium brunonianum
	Stylidium carnosum
	Stylidium junceum
	Stylidium piliferum
	Stylidium repens
	Stylidium schoenoides
TREMANDRACEAE	Platytheca galioides