STAKEHILL SWAMP, BALDIVIS

Boundary Definition: bushland/conservation wetland boundary (Areas of bushland within the boundaries of the Site are not accurately mapped; Boundary adjusted after negotiations with the land owner(s) in response to a submission to draft *Perth's Bushplan*.)

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 275
Area (ha): bushland 171.2 (Site also includes open water.)
Map no. 75
Map sheet series ref. no. 2033–II NW, 2033–II SW
Other Names: Submission Area 262
Local Authorities (Suburb): City of Rockingham (Baldivis)

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS
Spearwood Dunes
Sands derived from Tamala Limestone (Qts: S7)
Tamala Limestone (Qtl: LS1)
Wetlands (within the Spearwood Dunes)
Holocene Swamp Deposits (Qhw: Cs1)

VEGETATION AND FLORA
Vegetation Complexes
Spearwood Dunes
Karrakatta Complex — Central and South
Cottesloe Complex — Central and South
Wetlands
Herdsman Complex
Floristic Community Types: *not sampled, type inferred
Supergroup 2: Seasonal Wetlands
*17 *Melaleuca rhaphiophylla — Gahnia trifida* seasonal wetlands

WETLANDS
Wetland Types: sumpland, dampland
Natural Wetland Groups
Spearwood Dunes
Stakehill (S.4)
Wetland Management Objectives: Conservation (166.1ha)
Swan Coastal Plain Lakes EPP: 89ha + 1.9ha + 2.1ha + 30.4ha = 123.4ha (total)

THREATENED ECOLOGICAL COMMUNITIES
Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: open water, vegetated wetland
Vegetation and Flora: limited survey (DEP 1998 roadside observations, EPA and WAWA 1990, Semeniuk, V&C Research Group 1991b)
Structural Units: mapping (EPA and WAWA 1990, Semeniuk, V&C Research Group 1991b)
Wetlands: *Melaleuca rhaphiophylla* Open to Closed Forest sometimes over *Juncus kraussii* Sedgeland; *Melaleuca teretifolia* Closed Heath; Sedgeland of either *Baumea articulata* or *B. juncea*
Scattered Native Plants: not assessed
Vegetation Condition: wetland — >90% Excellent to Very Good, <10% Good to Degraded, with areas of severe localised disturbance (Semeniuk, V&C Research Group 1991b)
Total Flora: not known
Significant Flora: none recorded
Fauna: Significant mammal species: Quenda (Friend 1996 D)
Linkage: no adjacent bushland; part of Greenways 84, 85 (Tingay, Alan & Associates 1998a)
Other Special Attributes: Wetland of 'regional significance' (Semeniuk, V&C Research Group 1991b, 1991e)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Indicative place (AHC 2000 D)

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Rarity, General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation

Recommendation: Proposed Parks and Recreation Reservation (see Table 3, Volume 1).

STAKEHILL SWAMP, BALDIVIS

Boundary Definition: bushland/conservation wetland boundary (Areas of bushland within the boundaries of the Bushplan Site are not accurately mapped.)

SECTION 1: CADASTRAL INFORMATION

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

Bushplan Site no. 275 **Map no.** 93, 99 **Map sheet series ref. no.** 2033–II NW, 2033–II SW

Other Names
Submission Area 262

Local Authorities (Suburb)
City of Rockingham (Baldivis)

Ownership Categories
Private (including commercial organisation)

Area (ha): total 186.3 (includes open water); bushland 176.8

Zoning
MRS: Rural
TPS: Rural, Local Roads

Lot/Location/Reserve numbers (Purpose), Street name
596, 599, 786, 787, 788, 789, 803 Stakehill Rd; 155, 156, 593, 594, 595, 597, 598, 755, 756, 778, 782 Jarvis Rd; 101, 733, 759, 760, 763, 775 Mandurah Rd; 7, 8, 9, 732 Sixty Eight Rd; 154, 592, 754, 779, 849, 919 Eighty Rd

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS

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

Wetlands (within the Spearwood Dunes)
Holocene Swamp Deposits (Qhw: Cs1)

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Vegetation Complexes

Spearwood Dunes
Karrakatta Complex — Central and South
Cottesloe Complex — Central and South

Wetlands
Herdsman Complex

Floristic Community Types: *not sampled, type inferred

Supergroup 2: Seasonal Wetlands
*17 *Melaleuca rhaphiophylla — Gahnia trifida* seasonal wetlands

WETLANDS

Wetland Types: sumpland, dampland

Natural Wetland Groups

Spearwood Dunes
Stakehill (S.4)

Wetland Management Objectives: Conservation (166.1ha)

Swan Coastal Plain Lakes EPP: 89ha + 1.9ha + 2.1ha + 30.4ha = 123.4ha (total)

THREATENED ECOLOGICAL COMMUNITIES

Not assessed

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: open water, vegetated wetland

Vegetation and Flora: limited survey (DEP 1998 roadside observations, EPA and WAWA 1990, Semeniuk, V&C Research Group 1991b)

Structural Units: mapping (EPA and WAWA 1990, Semeniuk, V&C Research Group 1991b)
Wetlands: *Melaleuca rhaphiophylla* Open to Closed Forest sometimes over *Juncus kraussii* Sedgeland; *Melaleuca teretifolia* Closed Heath; Sedgeland of either *Baumea articulata* or *B. juncea*

Scattered Native Plants: not assessed

Vegetation Condition: wetland — >90% Excellent to Very Good, 10% Good to Degraded, with areas of severe localised disturbance (Semeniuk, V&C Research Group 1991b)

Total Flora: not known

Significant Flora: none recorded

Fauna: no systematic survey. Significant mammal species: Quenda (Friend 1996 D)

Linkage: adjacent bushland to the north

Other Special Attributes: Wetland of 'regional significance' (Semeniuk, V&C Research Group 1991b, 1991e)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, Rarity, General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation

Opportunities and/or Constraints

Opportunities: Bushplan Site/part Bushplan Site subject to Swan Coastal Plain Lakes EPP; location of conservation category wetlands

Constraints: private land; under General Mineral Resource Area (limestone)

Recommendation: The most appropriate mechanism for the protection of this Bushplan Site be considered through the public comment period in consultation with the land owner(s).

LEGEND

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

2033 - II NW

IV | I
2033
III | NW 93 // NE | SW | SE

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

PERTH'S BUSHPLAN MAP INDEX

N

SCALE

0 500 1000
Metres

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

ntw-map17//environ/bushplan//bushv2_93.dgn

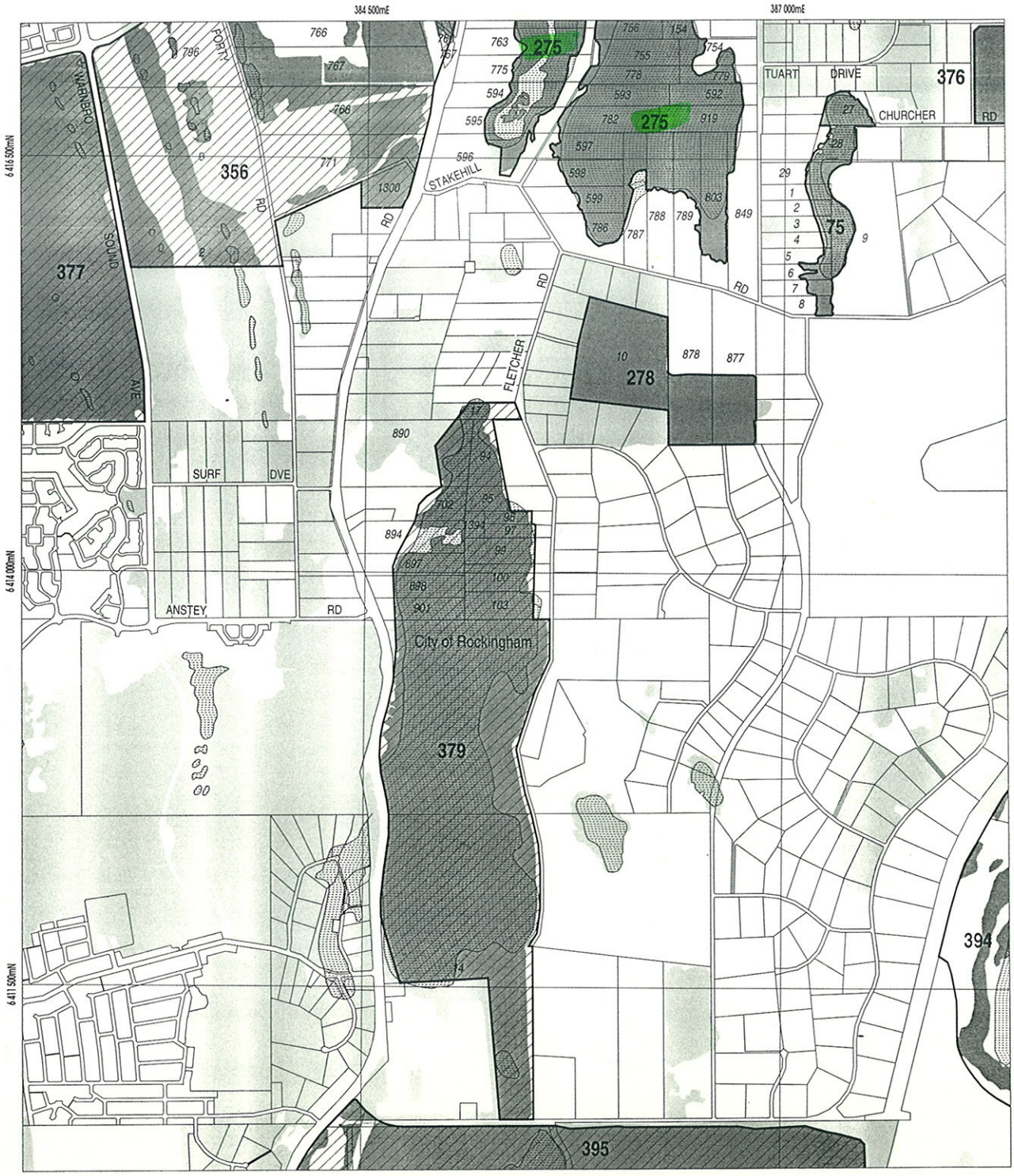
Cadastral Data supplied by Department of Land Administration, W.A.

Wetlands Data supplied by Water and Rivers Commission

Native Vegetation Extent for Study Area supplied by Agriculture Western Australia

Bushplan Site Map

Map 93



LEGEND

- 472 — Bushplan Sites With Regionally Significant Bushland
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- Channel Wetlands
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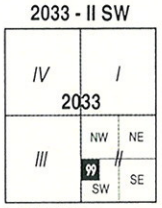
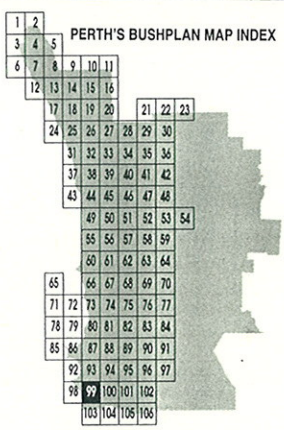
2033 - II SW



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

PERTH'S BUSHPLAN MAP INDEX



N

SCALE

0 500 1000

Metres

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

ntw-map17//environ/bushplan//bushv2_99.dgn

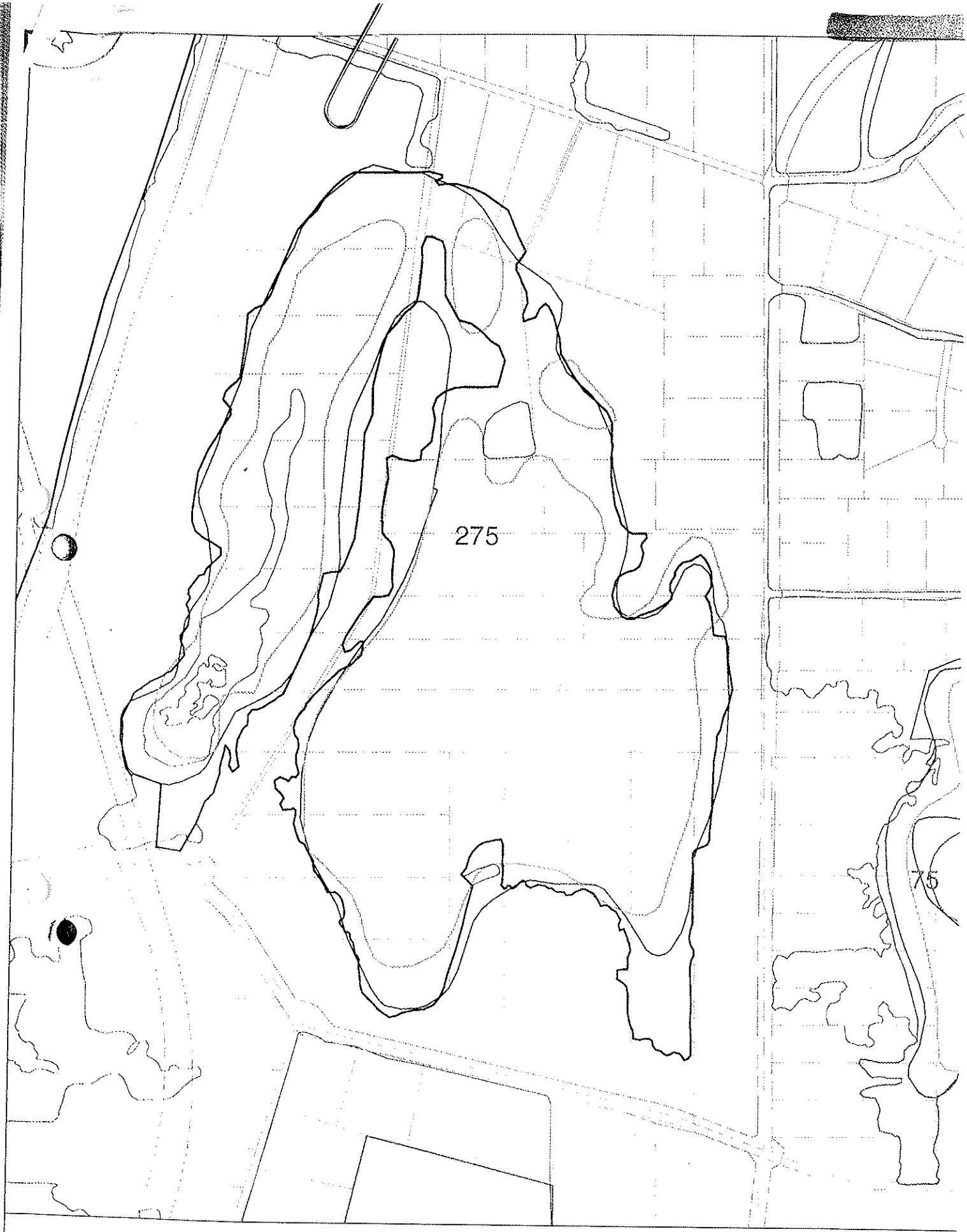
Cadastral Data supplied by Department of Land Administration, W.A.

Wetlands Data supplied by Water and Rivers Commission

Native Vegetation Extent for Study Area supplied by Agriculture Western Australia

Bushplan Site Map

Map 99



BUSHPLAN SITES CORRECTED

THE GOVERNMENT OF WESTERN AUSTRALIA

WESTERN AUSTRALIAN PLANNING COMMISSION

CUSTOMER FOCUS WESTERN AUSTRALIA

B 28/10/97

N

Stakehill Swamp

- ~~Site 275 ... why is 262 on file??~~ Submission
- ~~wetlands in the city of Rockingham want~~
- ~~caution evident~~
- ~~Arnold ... didn't make ... made ref to.~~
- ~~Reference in library (at Steyne:~~

711.3 - 113 (941) WES ✓

gst

262 do

SYSTEM 6 BUSHLAND SUBMISSION FORM
FOR CONSIDERATION IN THE UPDATE PROGRAMME

If you wish to submit more than one area for consideration in the System 6 update, please use a separate form for each area.

Please fill in each section giving as much information as possible.

LOCATION, OWNERSHIP AND ZONING OF THE AREA

1. Location Stakehill Swamp

Please give as accurate and detailed a description as possible of the site location

Please include either a hand drawn or copied map showing the area of the area

a) Bordering Roads: Jarnia / Eighty / Stakehill / Sixty eight Roads, Baldinis

b) Nearest Corner: .....

c) Lot Number: ..... Street Number: .....

d) Town/Suburb/Location: Baldinis

e) Local Council: Rockingham

f) Site Name (if any): See above.

g) Approximate size of the area (ha): 350 ha

h) Please locate the area on a map and give us map references if possible:

.....

i) Map: ..... Streetsmart /UBD/Other: .....

j) Map no.: .....

k) Grid Ref: .....

l) Please give any other information that may help us to find the location:

See "South-West Corridor Structure Plan Review" 11
Jan 1993, Figure 11, Page 21, Region Open Space also Figure 10.
Working Paper No. 3

m) Are you aware of any development proposals that are likely to affect the area?

Rapid Transit Route - undecided as to Mandurah Rd

NOTE: Areas that have already been given development APPROVAL should not be nominated

Please fill out those questions that you can answer

2. Who owns the area? (If owned by the person/s making the nomination please indicate) .....

.....

3. If you own the area, and may be interested in participating in conservation on private land initiatives please indicate (and leave your name and address at the end of this submission form) .....

4 .What is the area zoned? (please indicate whether zoning is Town Planning Scheme or Metropolitan Region Scheme) ..Reserved.....

CAN YOU TELL US A LITTLE ABOUT THE PHYSICAL CHARACTERISTICS OF THE AREA

5. Why do you consider this area important? (Refer to Guiding Issues paper)
(1). Significant wetland values (See WRMA Report (unpublished) 'Wetlands in the City of Rockingham', recognised in MRS amendment Stage B.

6. What is/are the soil type/s and colours ? (2) Cleared parent and swamp

Type: Sand/Clay/Gravel/Loam/Silt
Colour: White/Grey/Brown/Orange/Yellow/Red/Black (2) Part of tract proposed Rockingham Lakes Regional Park

7. Does the area have any special features such as unusual landforms / landscapes that still retain their natural vegetation? Yes/No

If yes, what are they? .....

.....

.....

8. Is the area a wetland or does it include a wetland? .....

If yes, what kind of a wetlands is it?

a) lake

b) river

c) stream

d) swamp

e) estuary

f) seasonally wet

g) other

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

CAN YOU TELL US A LITTLE ABOUT THE VEGETATION /FAUNA ON THE NOMINATED AREA.

10. What percentage of the area is indigenous vegetation? .....

11. If the area includes regions cleared of native bushland please indicate reasons for the inclusion. .....

.....

12. Has any previous flora or fauna survey work been done on the area?
.....See. PEP/MFP/ Environmental audit, SWest/Semenuk study - City of Rockingham.
If yes, please give details of the work .....

.....

.....

13. How would you rate the condition of the native bushland? (see attached table)

a) pristine
b) excellent
c) very good
d) good
e) degraded
f) completely degraded
g) don't know

14. Please indicate the disturbances affecting the area and where appropriate the percentage of the area disturbed.

a) Partial clearing
b) fragmentation
c) Selective removal of species: timber cutting, wildflower picking, mowing dieback and other plant diseases
d) Fire regime, including intensity, season and frequency
e) 'Enrichment plantings' that is plantings of species not found in that community
f) Weed invasion
g) Animal impact: horses, foxes, rabbits, cats, dogs, camels, goats etc
h) Soil movement, both removal and dumping
i) Changes in water regimes; flooding, drainage and watering
j) Salinity
k) Fertiliser drift and along waterways nutrient influx
l) Mining, including that for road works

m) Grazing: stock, overgrazing by feral or native mammals

n) Proliferation of tracks, fire breaks and walk trails

o) Off-road vehicle use

p) Use as service corridors by the SEC, Main Roads, Water Authority.

(Source: B Keighery. Bushland Plant Survey, September 1994)

15. Does the area contain any plant species of special interest that you know of? (eg. declared rare flora, priority taxa, outlier populations) .....

Do you know what they are? .....

.....

16. Do you know of any native animals that use the area? ..... Emus .....

Can you list those you know of? (birds, mammals, reptiles, amphibians etc)

.....

17. Is the area used by any native animals of special interest? (eg. endangered species, large/important populations).....

If yes, please name them and indicate source of information

.....

.....

CAN YOU TELL US A LITTLE ABOUT THE SURROUNDING AREA

18. Are there any bushland areas (including wetlands) near to this area?

.....

If yes, how close are they ? .....

.....

.....

Are they already conservation reserves? .....

What is their approximate size? .....

19. Does the submitted area link other bushland areas? .....

.....

.....

Please attach any additional information about the area which may be of use when assessing it.

1a 2 DESCRIPTION updated

DEP SYSTEM 6/BUSHPLAN – SURVEY SHEET B.J. KEIGHERY 6/97

BUSHLAND AREA 65 275 SITES YES/NO

DATE 9/1/98 RECORDERS BJK CR

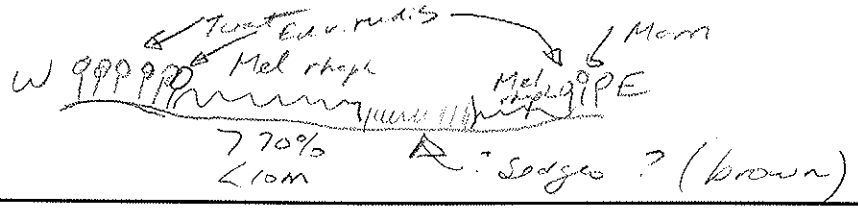
Observations edge Eighty rd inspection transects

Geographic Location	Latitude	S Longitude	E
Reference Map			

Photograph	Photographer's Name	Photo No

Transect of landscape units (draw in transect incorporating features listed and any other relevant unit)

dunes
dry/wet flats
sumplands
uplands
type



Soil - surface			sub -soil
Exposed rock	type	% area	

FLORA/VEGETATION (list dominant and significant plants below, see over for vege association descriptions)

Eucalypts	*E. calophylla*	*E. wandoo*	*E. marginata*	*E. todtianna*	*E. rudis*	
	E. decipiens	*E. drummondii*	*E. haematoxylon*	*E. lanepoolei*	*E. gomphocephala*	
	E. accedens	*E. patens*	*E. laeliae*	*E. megacarpa*		
Sheoaks	*Allocasuarina fraserana*		*Casuarina obesa*			
Banksia	*B.attenuata*	*B. menziesii*	*B. prionotes*	*B. illicifolia*	*B. grandis*	*B. littoralis*
Melaleuca	*M. preissii*	*M. rhaphiophylla*	*M. lanceolata*		*M. cuticularis*	
Others	*Callitris preissii.*					
Mallees	Eucalypts	*E. argutifolia*	*E. petrensis*	*E. decurva*	*E. foecunda*	*E. latens*
SIGNIFICANT SPECIES / DOMINANT SPECIES						
(see over for vegetaion descriptions)						

Vegetation Condition - Keighery 1994 (Trudgen 1993) (show range and indicate predominant class)

1 = 'Pristine' (Excellent)
2 = Excellent (Very Good)
3 = Very Good (Good)
4 = Good (Poor)
5 = Degraded (Very Poor)
6 = Completely Degraded

Specific aspects of disturbance

partial clearing

weeds (list):

selective removal of species: timber cutting mowing fire grazing dieback %area

fire frequency:

'enrichment plantings' (list)

animal impact: horse foxes rabbits cats dogs goats pigs overgrazing by native mammals

soil movement: mining dumping rubbish dumping roadworks

changes in water regimes: flooding drainage watering nutrient influx

Tracks: fire breaks walk trails off road vehicle use animal tracks

Service corridors: SEC Main Roads Water Authority. Telecom

Other

VEGETATION (describe each unit of vegetation using dominants and life form/height class and canopy cover according to the Muir/Keith codes above)

Fauna comments

Adjacent bushland (refer to aerial photograph)

OTHER COMMENTS

bp site 275

Map Ident: plot980527_1	DATE: 27 May 98
Prepared By: Andrea Zappacosta	Prepared For:
Scale 1:AUTO	MFP INTERNAL USE ONLY

0 — 500 m

- AG VEG 1998 BOUNDARY THEME
- Cadastre
- Bushplan sites refno 1-500 SCP BOUNDARY THEME
- cons category wetlands

STAKEHILL SWAMP

BJK - CONFIRM CLEARED AREAS AS CHANGES FOR AGWA ET

- VERIFY THAT CONDITION OF ADDITIONAL VEG MEETS REGSIN CRITERIA ET

BushSite 275: Stakehill Swamp, Baldivis

10.10 LEDA SWAMPS

10.10(a) GENERAL INFORMATION

LOCAL AUTHORITY: Town of Kwinana
MRS ZONE: Parks and Recreation
RESERVE: †33581, vacant Crown land
MANAGEMENT: Town of Kwinana
SYSTEM 6 RECOMMENDATION: M104
WAC CLASSIFICATION: Le.f.s.se.c

10.10(b) AREAS

Total wetland	approx 33 ha
Wetland within reserve	17.2 ha
Paperbark	21.6 ha
Sedgeland/heath	5.9 ha
Open water/low sedge	4.9 ha

10.10(c) DESCRIPTION

The Leda Swamps are relatively undisturbed. Their vegetation warrants careful description. The following account is based on a brief visit to the area.

The distribution of plant species across the swamps from east to west appears to follow a pattern common to the undisturbed wetlands of the region. On the eastern side of the swamp, presumably where seepage of groundwater from the unconfined aquifer is strongest, there is tall closed woodland of swamp banksia and swamp paperbark over a low shaded understorey. The tall saw sedge Gahnia trifida occurs in the understorey. West of the band of banksia and paperbark is tall jointed twig rush, suggesting that this part of the swamp remains well supplied with water throughout the year. Further west again, there is a change to a low wetland heath community (Figures 10.15 and 10.16).

10.11 TAMWORTH HILL SWAMP

LOCAL AUTHORITY: Shire of Rockingham
MRS ZONE: Rural
LAND OWNERSHIP: Freehold
MANAGEMENT: Private landowner
SYSTEM 6 RECOMMENDATION: n/a
WAC CLASSIFICATION: Le.f.m.se.c.

Notes: Jointed twig rush sedgeland with paperbark fringe and a small area of open water.

10.12 STAKEHILL SWAMP BS275

LOCAL AUTHORITY: Shire of Rockingham
MRS ZONE: Rural
LAND OWNERSHIP: Freehold
MANAGEMENT: Private landowner
SYSTEM 6 RECOMMENDATION: n/a
WAC CLASSIFICATION: Le.f.m.se.c.

X See Amendment Report in 096 file

REPORT FOR PUBLIC COMMENT

METROPOLITAN REGION SCHEME AMENDMENT 1050/33

STAKEHILL SWAMP, BALDIVIS ENVIRONMENTAL REVIEW

PREPARED FOR THE WESTERN AUSTRALIAN PLANNING COMMISSION

DECEMBER 2004

ATA Environmental
environmental scientists

REPORT FOR PUBLIC COMMENT

METROPOLITAN REGION SCHEME AMENDMENT 1050/33

STAKEHILL SWAMP, BALDIVIS ENVIRONMENTAL REVIEW

PREPARED FOR THE WESTERN AUSTRALIAN PLANNING COMMISSION

DECEMBER 2004

AN INVITATION TO COMMENT ON THIS ENVIRONMENTAL REVIEW

The Western Australian Planning Commission (WAPC) invites people to make a submission on this Environmental Review.

The Environmental Review was prepared for Amendment 1050/33 to the Metropolitan Region Scheme (MRS) for the proposed rezoning of Stakehill Swamp, Baldivis.

In accordance with the *Environmental Protection Act 1986* as amended, this Environmental Review has been prepared to describe the proposed Amendment and its likely impact on the environment.

The Environmental Review, along with the planning Amendment Report is available for public review in accordance with the advertising period determined by the Minister for Planning and Infrastructure from 14 December 2004

After receipt of comments from Government agencies and from the public, the WAPC will forward submissions to the Environmental Protection Authority (EPA). The EPA will prepare an Assessment Report with recommendations to the Government, taking into account issues raised in public submissions. Any environmental conditions, which may be set from this process, will be required to be incorporated into the MRS Amendment.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach.

It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the WAPC will be acknowledged. Submissions will be treated as public documents and may be quoted in full or in part in each report.

Submissions may be fully or partially utilised in compiling a summary of the issues raised or where complex or technical issues are raised, a confidential copy of the submission (or part of it) may be sent to the proponent.

The summary of issues is normally included in the EPA's Assessment Report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining a group or other groups interested in making a submission on similar issues.

Joint submissions may help to reduce the work for an individual or group, while increasing the pool of ideas and information.

If you form a small group (up to ten people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the issues discussed in the Environmental Review or the proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable.

When making comments on specific items in the review document:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- Attempt to list points so that the issues raised are clear. A summary of your submission is helpful.

- Refer each point to the appropriate section, chapter or recommendation in the reports.

- If you discuss different sections of the reports, keep them distinct and separate, so there is no confusion as to which section you are considering.

- Attach any factual information you wish to provide and give details of the source. Make sure your information is accurate.

Please present your comments on the WAPC submission form (6A) provided. It is attached to this report, the planning Amendment Report, and is also available from the display locations and the WAPC internet site www.wapc.wa.gov.au.

The closing date for submissions is: 1 April 2005

Written submissions should be addressed to:

Western Australian Planning Commission
Albert Facey House
469 Wellington Street
PERTH WA 6000

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An internal quality review process has been applied to each project task undertaken by us. Each document is carefully reviewed by core members of the consultancy team and signed off at Director level prior to issue to the client. Draft documents are submitted to the client for comment and acceptance prior to final production.

Document No: DPI-2004-003_004_sg_V6

Report No: 2004/75

Checked by: Signed: 

Name: Shaun Grein Date: 8 December 2004

Approved by: Signed: 

Name: Paul van der Moezel Date: 8 December 2004

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LIST OF FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY

The conservation value of Stakehill Swamp has long been recognised by the State's environmental and planning agencies and accordingly a number of proposals were initiated to progress the protection of the area. To formalise the protection of Stakehill Swamp in the long-term, the Western Australian Planning Commission (WAPC) has initiated a Major Amendment to the Metropolitan Region Scheme (MRS). The Amendment to the MRS would modify the regional planning framework for Stakehill Swamp while other proposed planning strategies would manage land use changes immediately around the lake. The principal purpose of MRS Amendment 1050/33 is to rezone the Stakehill Swamp area from its current 'Rural' zone to a 'Parks and Recreation' reserve to protect the regionally significant wetland.

The proposed amendment was referred to the Environmental Protection Authority (EPA) for assessment in accordance with the *Metropolitan Region Town Planning Scheme Act* and Section 48A of the *Environmental Protection Act 1986*. The EPA determined that the proposed Amendment should be formally assessed, and accordingly required that an Environmental Review (ER) be prepared.

The purpose of this Environmental Review is to provide information related to the proposed Amendment that will enable the EPA to evaluate the potential impacts on the environment. This report provides information on the key environmental issues relevant to the Scheme Amendment so that the potential impact of the proposed rezoning can be assessed. The relevant environmental factors and management strategies proposed are summarised in Table A and B.

The change in land use resulting from the proposed scheme amendment is likely to have a beneficial impact on the integrity, ecological functioning and environmental values of the wetland. With the implementation of appropriate environmental provisions and management associated with the future land use of the site, the conservation and ecological functions of the Stakehill Swamp wetland can be further protected and potentially enhanced. Therefore the EPA's preliminary objective of maintaining the integrity, ecological function and environmental values of the wetland can be met.

The proposed Amendment aims to meet the EPA objectives of maintaining the abundance, diversity, geographic distribution of vegetation, floristic communities, flora and fauna at the species and ecosystem level through the management of adverse impacts. This is to be achieved through the application of environmentally sensitive planning and principles of environmental best practice and implementation of specific management strategies and legislative capabilities.

TABLE A
SUMMARY OF ENVIRONMENTAL FACTORS

Environmental Factor	Preliminary EPA Objectives	Potential Impacts	Environmental Management Measures	Predicted Outcome
Regionally Significant Wetland	To maintain the integrity, ecological function and environmental values of the wetland and the environmental values of the Bush Forever Sites identified as having significant attributes.	The Amendment will result in 95% of the regionally significant wetland (total area protected in Bush Forever is 180.5ha), which is currently zoned 'Rural', being reserved as 'Parks and Recreation' under the MRS. The change in zoning and resultant introduction of management provisions will assist in: • Managing access within and adjacent to the wetland; • Managing impacts of disturbance of natural habitats; • Preventing fires; and • Managing potential changes in hydrology and pollutant loading.	Prepare Environmental Management Plans and Implementation Strategies Stakehill Swamp, Regional Open Space and the immediate interface	With the implementation of appropriate environmental provisions and management associated with the future land use of the site, the conservation and ecological functions of the Stakehill Swamp wetlands can be protected and possibly enhanced. The EPA's preliminary objective of maintaining the integrity, ecological function and environmental values of the wetland can be met.
Vegetation	To maintain the abundance, diversity, geographic distribution and productivity of vegetation, floristic communities and flora at the species and ecosystem level through the avoidance or management of adverse impacts and improvement in knowledge.	Currently there is 171.2 ha of remnant vegetation with the Stakehill Swamp wetland area, the majority (approximately 92%) of which is proposed for reservation as Park and Recreation.	Prepare Environmental Management Plans and Implementation Strategies Stakehill Swamp, Regional Open Spa and the immediate interface.	With the use of environmentally sensitive planning and development using the principles of environmental management practice, specific management strategies and legislative capabilities, there is an ability to meet the EPA objectives of maintaining the abundance, diversity, geographic distribution and productivity of vegetation, floristic communities and flora at the species and ecosystem levels through the avoidance or management of adverse impacts

Environmental Factor	Preliminary EPA Objectives	Potential Impacts	Environmental Management Measures	Predicted Outcome
				and improvement in knowledge can be achieved.
Fauna	To maintain the abundance, diversity, geographic distribution and productivity of special protection fauna at a species and ecosystem level through the avoidance or management of adverse impacts and improvement in knowledge.	The proposed reservation will protect the majority of Stakehill Swamp; however, the proposed reservation will substantially modify, destroy or isolate an area of important habitat of fauna species, or seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significantly proportion of the population of any of the listed fauna species. In addition to the removal of activities that have had a deleterious impact on fauna habitats, active management of the proposed Parks and Recreation zoning will result in the enhancement of the ecological attributes of the area through rehabilitation of degraded areas and the construction of facilities likely to minimise the impact of increased public use of the area.	• Prepare Environmental Management Plans and Implementation Strategies for Stakehill Swamp, Baldivis Regional Open Space and the immediate interface.	With the use of environmentally sensitive planning and development, adopting the principles of environmental best practice, specific management strategies and legislative capabilities, there is an ability to meet the EPA objectives of maintaining the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge can be achieved.

TABLE B
SUMMARY OF PROPOSED MANAGEMENT MEASURES

Environmental Factor	Site Specific Factor	Objective	Environmental Management Measures	Timing (Phase)	Whose Requirements
Regionally Significant Wetla7nd	Stakehill Swamp Conservation Category Wetland Environmental Protection (Swan Coastal Plain lakes) Policy 1992 *Bush Forever Site 275*	Appropriate buffer widths around the Stakehill Swamp wetland will be identified to protect the characteristics and conservation values of the wetland and the riparian vegetation.	A management plan to manage likely impacts on the wetland, riparian vegetation and fauna habitat. The management plan should be investigated in the preparation of a local town planning scheme amendment and rural concept plan.	TBA	EPA/WAPC
Vegetation	Vegetation Complexes & Vegetation Communities, Floristic and Threatened Ecological Communities and Declared Rare or Priority Flora	Identify the Vegetation Complex and Vegetation Community types as well as any Threatened Ecological Communities (TEC), Declared Rare or Priority Flora (DRF) species present and Floristic Communities and discuss their representation in existing conservation reserves and how they will be protected by the proposed Amendment.	Undertake appropriate field surveys to determine the existing type and representation of the vegetation on site, including TEC's & DRF. Prepare Environmental Management Plans and Implementation Strategies for Stakehill Swamp, Baldivis Regional Open Space and the immediate interface. Provide details of potential impacts from the proposal and how they will be addressed.	Surveys Undertaken in June 2004, Management Plans TBA	EPA/WAPC
Fauna	Specially Protected, Threatened or Priority Fauna Species	Assess the presence and distribution of fauna communities and significant bird species.	Undertake appropriate field surveys to determine the existing type and representation of the vegetation on site, including TEC's & DRF.	Surveys Undertaken in June 2004, Management Plans TBA	EPA/WAPC

1. INTRODUCTION

1.1 The Proposal

Stakehill Swamp is located to the southeast of the Rockingham City centre, to the east of Lake Cooloongup and Mandurah Road in the locality of Baldivis. For the purposes of this Environmental Review the study area is bounded by Stakehill Road to the south, Eighty Road to the east, Sixty Eight Road to the north and Mandurah Road to the west (Figure 1). Stakehill Swamp is located within this study area.

The study area consists of 34 properties currently in private ownership or owned by the Western Australian Planning Commission (WAPC) encompassing approximately 400ha (Figure 2). All the land in the study area is currently zoned Rural in the Metropolitan Region Scheme (MRS). The WAPC has initiated the MRS Amendment of Stakehill Swamp. The purpose of this Major Amendment to the MRS is to change the Stakehill Swamp area (approximately 202ha) of the South-West Corridor of the Perth Metropolitan Region from its current "Rural" zone to a "Parks and Recreation" reserve.

The following summary provides further background on the planning history preceding this amendment:

- In 1993, the draft South-West Corridor Structure Plan identified Stakehill Swamp for conservation, comprising 260ha. The conservation area included land either side of Jarvis Road, which runs up the central 'peninsula' of the subject area.

- Also in 1993, the WAPC proposed to reserve 173ha of Stakehill Swamp for 'Parks and Recreation' in the MRS to ensure its protection and management (as part of MRS Amendment 937/33). The Stakehill Rural Landowners Group (SRLAG) was formed to oppose this amendment and was successful in having this part of the amendment deleted.

- The permanently inundated portions of Stakehill Swamp were gazetted for protection under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*. The area of the swamp that is covered by the policy is around 120ha. The Draft *Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004* increases the area of Stakehill Swamp protected under the Policy, particularly in the northern region of the wetland.

- Stakehill Swamp was identified as a Conservation Category Wetland (CCW) in 1996. Ground-truthing in 2001 by the DoE (then the Water and Rivers Commission) supported the mapped CCW boundary. The CCW covers an area of approximately 180ha.

- MRS Amendment 1050/33, in its initial form, was assessed by the EPA as 'Scheme Not Assessed – Advice Given' on 17 December 2001. The advice referred to the following factors:

    - Conservation Category wetland;
    - Bush Forever Site 275; and

- Environmental Protection (Swan Coastal Plain Lakes) Policy, 1992.

The revised amendment was referred to the EPA in December 2003 and is the basis for this ER. The EPA determined that it is a significant modification to the 2001 proposal and therefore the EPA required assessment under Section 48 of the Environmental Protection Act.

1.2 Purpose and Scope

The conservation value of Stakehill Swamp has been recognised by the State's environmental and planning agencies and accordingly a number of proposals were initiated to progress the protection of the area. To formalise the protection of Stakehill Swamp in the long-term, the WAPC has initiated an individual Major Amendment to the MRS. The Amendment to the MRS would modify the regional planning framework for Stakehill Swamp while other proposed planning strategies would manage land use changes immediately around the lake. The principal purpose of MRS Amendment 1050/33 is to rezone the Stakehill Swamp area from its current 'Rural' zone to a 'Parks and Recreation' reserve.

The proposed Amendment was referred to the Environmental Protection Authority (EPA) for assessment in accordance with the *Metropolitan Region Town Planning Scheme Act, 1959* and Section 48A of the *Environmental Protection Act 1986*. The EPA determined that the proposed Amendment should be formally assessed and accordingly issued Environmental Review (ER) Instructions setting out the work required for the ER. A copy of these instructions is contained in Appendix 1.

The relevant environmental factors to be addressed in the ER have been defined by the EPA as follows:

Regionally Significant Wetland

- protection and management of the wetland; and
- delineation of an appropriate wetland buffer.

Vegetation

- value of vegetation complexes and communities in a local and regional context;
- representation and protection of Threatened Ecological Communities; and
- Declared Rare and Priority Flora.

Fauna

- the presence and distribution of fauna communities and significant bird species (identified in Bush Forever); and

- Specially Protected (Threatened) Fauna Species.

This ER documents the environmental condition of the Amendment Area and recommends environmental management measures that will form part of the

environmental assessment and approval to cater for environmental protection and environmental management of Stakehill Swamp and manage any development adjacent to the swamp. It is important to note that this ER addresses the area included in the proposed Parks and Recreation Reserve and the additional information outside this area is provided for context only.

For each factor, the EPA instructions are provided in terms of objectives and scope of work, followed by a description of the existing environment and relevant environmental policies, potential impacts, proposed management strategies and subsequent environmental outcomes.

A summary of the EPA's objectives, potential impacts and proposed management for each factor is provided in Table A.

1.3 Amendment Area

The Stakehill Swamp area is located in the City of Rockingham and is contained within the area bounded by Stakehill Road, Mandurah Road, Sixty Eight Road and Eighty Road. The study area is predominantly in private ownership with some land owned by the WAPC and is utilised for agriculture (market gardening, stock grazing) or rural living.

1.4 Environmental Review Process

Where a planning scheme, or a scheme amendment, is considered likely to have a significant environmental impact by the Environmental Protection Authority (EPA), the Environmental Protection Act (Division 3 of Part IV) requires that it be subject to an assessment by the EPA. The EPA has determined that Amendment 1050/33 to the Metropolitan Region Scheme (MRS) is being assessed because it raises significant environmental factors. The EPA requires the preparation of an ER to address the environmental issues relevant to the amendment, issued as Instructions by the EPA.

In accordance with Section 33E of the *Metropolitan Region Town Planning Scheme Act*, the proposed Amendment to the MRS was referred to the EPA. The EPA has determined that the proposed Amendment should be formally assessed under the *Environmental Protection Act 1986*. Accordingly, the Environmental Protection Authority (EPA) has issued Environmental Review (ER) Instructions which sets out the work requirements of the required ER. The ER requires an environmental impact assessment of the Stakehill Swamp area, focussing on the wetland area, wetland buffers, vegetation complexes and communities, Threatened Ecological Communities, Declared Rare or Priority Flora, and Threatened or Priority Fauna Species.

The purpose of this ER is to provide information to the EPA relating to the environmental factors associated with the proposed Amendment. This will enable it to evaluate the effect on the environment of the amendment and provide independent environmental advice to Government. An additional function of the ER is to clearly communicate details of the proposed MRS amendment and its future implications so that the EPA can obtain public comment on the possible environmental impacts of the

proposal. A secondary objective/output of the study is to investigate and report on land management controls for a wetland buffer and adjoining land to inform the anticipated local town planning scheme amendment process in the City of Rockingham's Stakehill Swamp precinct.

This ER has been structured in accordance with the EPA Instructions and describes the existing environmental characteristics of the area, the reservations proposed under the Scheme, the potential environmental impacts of the amendments proposed under the Scheme, and proposed environmental management measures to be implemented to prevent any impacts.

This Review is available for public comment for three months from 14 December 2004 concurrently with the draft Region Scheme map and text. Advice on how to make a submission on this ER is presented at the front of the document.

Submissions on environmental matters received from government agencies, private organisations and individuals during that period will be considered by the WAPC, which will prepare a response that may include:

- Clarification of parts of the Review to resolve misunderstandings.
- Modification of the Region Scheme as appropriate in response to environmental issues.
- Provision of additional information to support particular proposals.

The WAPC's response, together with the Review document and the Region Scheme itself, will then be assessed by the EPA, which will recommend to the Minister for the Environment under what conditions the Region Scheme should be approved. The EPA's advice will be published and will be open to public appeal for two weeks. The Minister for the Environment will then consult with the Minister for Planning and Infrastructure regarding the conditions of approval and any other relevant matters before the conditions are set.

1.5 Relevant Investigations

A number of planning and environmental studies have been conducted at Stakehill Swamp. These reports are summarised in the following section.

1.5.1 Stakehill Swamp Environmental Assessment (1993)

An environmental assessment of Stakehill Swamp was undertaken by ATA Environmental (formerly Alan Tingay & Associates) for the Department of Planning and Urban Development in 1993.

Purpose

The objective of this report was to define an appropriate boundary for the Stakehill Swamp conservation area having regard to the wetland, its fringing vegetation and an

adequate buffer zone according to the guidelines provided by the EPA. A boundary for Stakehill Swamp was also defined for reservation as Parks and Recreation under the Metropolitan Region Scheme.

Background

In January 1993 the Department of Planning and Urban Development (DPUD) released its South-West Corridor Structure Plan Review for public comment. The review consisted of a series of nine working papers. Working Paper Number 3, "A review of Open Space and Conservation 1980-1991" addressed conservation, recreation and open space issues. It also defined a number of areas designated for inclusion in the Regional Open Space system namely: Leda Regional Open Space, Rockingham Lakes Parks and Recreation reserve, Port Kennedy Area, Serpentine Regional Park and the Coastal Foreshore reserves, and Landscape Protection Areas.

Summary

Three options for defining a buffer zone to the wetland were presented which depended on the current and future zoning of the surrounding land. These options were as follows:

1. Rural zoning – No buffer zone was required due to the condition of the surrounding land and to the EPA Environmental Protection (Wetlands) Policy.

2. Special Rural zoning – A 50 metre buffer was recommended to give additional protection to the wetland.

3. Urban zoning – A minimum 50 metre buffer zone was recommended along with no development between the western and eastern sections of the Swamp.

1.5.2 Bush Forever 2000

An environmental investigation of Stakehill Swamp was undertaken by Everall Consulting Biologist, Dave Everall for the Ministry for Planning in 1999.

Purpose

This report was commissioned by the Ministry for Planning to identify suitable implementation options and protection mechanisms through the public consultation process, in accordance with the implementation for Bushplan Site 275, Stakehill Swamp.

Background

Stakehill Swamp was identified in the draft *Perth's Bushplan* (Bushland Site 275) as an area containing regionally significant vegetation with associated wetland areas. However, at this time the land was zoned 'Rural' in the Metropolitan Region Scheme and most of the land surrounding the wetland had been extensively cleared for agriculture. The wetland was proposed for reservation as 'Parks and Recreation' in

the MRS as part of the *South West Corridor Omnibus Amendment, Stage B* in 1994, but this proposal was withdrawn following strong objections from both environmentalists and landowners.

Summary

Twenty five of the twenty six landowners were contacted and most were in agreement with a draft of this report. It was concluded that there was a significant potential for agreement to be reached on Bushplan between the landowners of Stakehill Swamp and the Government.

It was recommended by the landowners of Stakehill Swamp that:

1. The Western Australian Planning Commission to amend the Metropolitan Region Scheme from Rural to Parks and Recreation within the recommended Bushplan boundary.

2. Rockingham City Council be requested to enter into discussions with landowners with the view to amending its Local Rural Strategy so that the future land use and zoning potential of the Stakehill Swamp area can be resolved in the same time frame as the MRS amendment.

1.5.3 Stakehill Swamp Planning Study 2000

The Stakehill Swamp Planning Study was undertaken by O'Brien Planning Consultants for the City of Rockingham (2000).

Purpose

The purpose of this study was to progress a planning solution on Stakehill Swamp to a successful conclusion.

The main tasks of the project were as follows:

1. Using the Bushplan and the "Everall" boundaries as starting points, negotiate with the key Government agencies (Department of Environmental Protection, Water and Rives Commission and the Ministry for Planning) on what an appropriate wetland and buffer area boundary should be.

2. Identify those wetland and buffer areas that should be reserved as Parks and Recreation in the MRS and which areas, on a lot by lot basis, could be given up as part of open space requirements in future subdivisions.

3. Propose suitable land use controls and infrastructure requirements for future subdivsions.

4. In association with Council officers, consult with the affected landowners to ensure that their preferences and ideas are taken into consideration.

5. Produce an overall Indicative Development Plan for the area showing possible final subdivision layout.

6. Draft an amendment to the City's Town Planning Scheme which addresses the above, but only proposes to rezone those lots where there is intention to proceed with subdivision.

Background

The "Everall line" formulated in the Everall Report (June 1999) was widely accepted by Stakehill Swamp landowners but was not endorsed by the MfP, DEP or the WRC. It was also established that 25 of the 26 landowners held the view that the State Government should purchase the wetland area. The landowners opposed the concept of a buffer along the edge of the wetland but accepted that if subdivision were to proceed that there could be a condition requiring a suitable buffer to be conceded for public open space.

Summary

Based on the report's assessments the following conclusions were reached:

1. Stakehill Swamp is an environmentally significant wetland that should be reserved.

2. Subdivision may assist in the wetland reservation process.

3. Most of the landowners have come to accept that reservation of the wetland is the first step in resolving the conservation issue.

4. The CCW Line with an additional 10 metre buffer is a potential boundary line that will be acceptable to the State as a Parks and Reservation reserve.

5. The WAPC should budget funds for the purchase of the wetland portion from the landowners and should develop a program to assemble the wetland (Region Reserve) on a staged basis.

Based on the report's investigations and conclusions it was recommended that:

1. The MfP should proceed to reserve the Stakehill Swamp wetland, based on the CCW line plus 10 metres, for Parks and Recreation in the Metropolitan Region Scheme.

2. The MfP should budget sufficient funds to purchase the wetland from the landowners on a staged basis.

3. The City of Rockingham should approve the proposed amendments to its Rural Land Strategy for Precinct 4B and allow amendments to its Town Planning Scheme No 1 to be initiated to reflect these changes where landowners can show that the objectives of the Precinct can be achieved.

1.5.4 MRS Amendment 1050/33

In 1993, the draft South-West Corridor Structure Plan identified Stakehill Swamp, an area comprising 260 hectares, as suitable for conservation. The conservation area included land either side of Jarvis Road, which runs up the central portion of the subject area.

Also in 1993 as part of MRS Amendment 937/33, the WAPC proposed to reserve 173 hectares of Stakehill Swamp for "Parks and Recreation" in the MRS to ensure its protection and management. The Stakehill Rural Landowners Group (SRLAG) was formed to oppose this amendment and was successful in having this part of the amendment deleted.

In 2001, a new MRS Amendment (i.e.1050/33) was initiated with a proposal to amend the zoning of the Stakehill Swamp area of the South-West Corridor of the Perth Metropolitan Region from a "Rural" zone to a "Parks and Recreation" reserve.

The EPA considered the proposed amendment boundary to be acceptable and set the level of assessment at 'not assessed'. However, in view of the history of the site and landowners concerns, the Minister for Planning and Infrastructure did not agree to the release of the WAPC's proposed reserve boundary and identified a revised reserve boundary in 2003. This takes into account the views of the landowners and closer alignment with the Everall Line, the protection of the core wetland area and existing land uses. The WAPC considered the revised reserve boundary and, subsequently, initiated the revised amendment, which is shown in Figure 2 in this report.

2. METROPOLITAN REGION SCHEME AMENDMENT 1050/33

MRS Amendment 1050/33 proposes to change the Stakehill Swamp area of the South-West Corridor of the Perth Metropolitan Region from the current "Rural" zone to a "Parks and Recreation" reserve.

The Metropolitan Region Scheme (MRS) is a town planning scheme for land use in the Perth Metropolitan Region. This area stretches from south of Rockingham to north of Yanchep and east of Mundaring.

The Scheme defines the future use of land, dividing it into broad zones and reservations. It requires local government town planning schemes to provide detailed plans for their part of the region. These local schemes must be consistent with the Metropolitan Region Scheme.

The MRS uses a set of maps and a scheme text. The scheme text provides planning rules for zones and reservations which are presented on the figures in different colours and patterns.

The MRS has been in operation since 1963 and provides the legal basis for planning in the Perth Metropolitan Region. To plan for changing needs, the MRS is amended frequently.

An amendment to the MRS changes the zoning or reservation of land to allow for a different land use. When a rezoning or a new reservation is considered, an amendment to the MRS is advertised to seek comment from the wider community and all levels of government. The process allows for extensive community consultation and discussion in Parliament before a final decision is made.

Zones and Reservations

Zones and reservations in the MRS are broad categories. They are not precisely defined or limited. The following relate to the MRS Amendment 1050/33 proposal to change the Stakehill Swamp.

Parks and Recreation Reservation

Land reserved for Parks and Recreation is reserved for community purposes. It may be reserved to protect a resource or to provide areas for infrastructure or land of regional significance for ecological, recreation or landscape purposes.

Rural Zoning

Land that is zoned Rural is that in which a range of agricultural, extractive and conservation uses are undertaken.

3. KEY ENVIRONMENTAL FACTORS

3.1 Introduction

The Environmental Protection Authority (EPA), in its instructions for this Environmental Review, has defined several relevant factors which it considers are particularly important for its assessment of the proposed Amendment. Relevant environmental factors are defined as those which have the potential to have significant environmental impacts, and which the EPA may be required to provide advice to the Minister for the Environment. The key environmental factors identified by the EPA are a regionally significant wetland, vegetation and fauna.

The environmental implications of the Amendment are discussed in this section of the Environmental Review. For each factor, the EPA objective, a description of the relevant factor and analysis of the environmental implications associated with the Amendment is provided. This is followed by a description of how the Amendment will incorporate provisions for environmental management where appropriate.

3.2 Regionally Significant Wetlands

3.2.1 Preliminary EPA Objective

To maintain the integrity, ecological function and environmental values of wetlands.

3.2.2 EPA Scope of Work

How is the wetland identified in Bush Forever and the Environmental Protection (Swan Coastal Lakes) Policy 1992 going to be protected and managed by the proposed amendment using appropriate buffers and wetland management plans?

Appropriate buffer widths around the wetland area should be identified to protect the characteristics and conservation values of the wetland and the riparian vegetation.

The basis for the proposed buffer widths should be described with reference to existing policies and through liaison with the Bush Forever Office of DPI, WRC and DoE.

The Environmental Review should describe the contents and requirements of a wetland management plan to manage likely impacts on the wetland, riparian vegetation and fauna habitat.

In identifying an appropriate buffer to protect the wetland and riparian vegetation, attention should be given to what management measures are proposed to regulate adjacent land uses that may impact the values of the wetland.

3.2.3 Relevant Policies and Background

Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 (Lakes EPP) and Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004 (Wetlands EPP).

In 1999 a statutory review of the *Environmental Protection (Swan Coastal Plain Lakes) Policy, 1992* was required under Part 3 of the *Environmental Protection Act 1986*. As part of this statutory process a *Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy 1999* was released for public comment. Following consideration of comments, a *Revised Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy 1999* was then prepared by the EPA and transmitted to the Minister for the Environment for consideration.

The aim of the revised draft EPP was to declare and protect the environmental values of important wetlands on the Swan Coastal Plain by controlling activities that can degrade or destroy those environmental values (in summary, no filling, draining, mining, discharges or clearing without authorisation under the *Environmental Protection Act 1986*). It was proposed that important wetlands to be protected under the Policy would be identified on a Register of Protected Wetlands.

The revised draft EPP was remitted in October 2003 by the Minister for the Environment to the EPA, to reconsider the basis for protecting wetlands. Legal drafting has updated and improved the existing protection mechanisms of the *Environment Protection (Swan Coastal Plain Lakes) Policy 1992*.

The EPA released a new draft EPP for public comment in July 2004 for a period of ten weeks, which was subsequently extended by three weeks. The draft EPP protects wetlands of high ecological value on the Swan Coastal Plain. These wetlands were determined through an amalgamation of the datasets for the 1992 Swan Coastal Plain Lakes EPP and for Conservation Category Wetlands.

In summary, the proposed changes to the 1999 revised draft Wetlands EPP aim to achieve the protection of Conservation Category Wetlands by changing the new draft Wetlands EPP to include the immediate registration of Conservation Category Wetlands, as well as retaining the Swan Coastal Plain Lakes (from the 1992 Lakes EPP).

Bush Forever 2000

Prior to the development of the draft Wetlands EPP, Bush Forever has helped to protect some, but not all, of the Conservation Category Wetlands in the Perth metropolitan area. However, because Bush Forever addresses remnant vegetation and not specifically wetlands, many Conservation Category Wetlands have been left unprotected in both the metropolitan area and beyond it on the coastal plain. The Conservation Category Wetlands that are proposed to be registered under the Wetlands EPP constitute a small proportion of the total land area on the Swan Coastal Plain.

3.2.4 Wetland Description

Stakehill Swamp is an inverted U-shaped wetland that occupies an area of 180ha. The inverted U-shape consists of a western arm, a broader eastern arm and a narrow strip of dryland vegetation between the two arms.

The Swamp largely consists of wetland vegetation, with a few open areas of water, some areas filled in by previous earthworks and several access causeways constructed by landowners to facilitate movement across the wetland, particularly the western arm.

Semeniuk (1988) identified four different suites of wetlands within the City of Rockingham. Each suite contains wetlands that have similar geomorphic settings, soil types, water characteristics and histories. Stakehill Swamp belongs to the Stakehill Suite of wetlands which are a series of local sumplands in inter-dunal swales of the Spearwood Dune system. Stakehill Swamp is technically described as a sumpland type of wetland. Sumplands are seasonally inundated basins that only have water above ground for a part of the year and are dry for the remainder.

The Stakehill Suite of wetlands, including Stakehill Swamp, has been identified as providing an important ecological function due to the variety of habitats and their importance to fauna. In particular, the Stakehill Suite has been given a high significance for waterbirds (Semeniuk, 1991). Stakehill Swamp itself has a variety of habitats including open water, sedgelands and Paperbark Forests (see Section 4.3 for more detail on vegetation).

In 1993, Alan Tingay and Associates prepared a report to define an appropriate boundary for the Stakehill Swamp wetland area. The boundary was determined largely on the basis of vegetation types and ground contours. For the most part, the boundary mapped in 1993 was consistent with the outer edge of dense Paperbark trees. In a few areas that had been earthworked, the boundary was drawn to match as closely as possible the original boundary of the wetland rather than the modified area.

The 1993 boundary for Stakehill Swamp was largely supported by the mapping of the wetland in the Swan Coastal Plain Wetland Atlas (Hill *et al.*, 1996) and Bush Forever documentation (Government of Western Australia 2000).

The boundary of the Parks and Recreation reserve proposed in the MRS Amendment is not consistent with the boundary of the wetland as drawn by Alan Tingay & Associates (1993) or as depicted in the Wetland Atlas or the Bush Forever mapping. Major differences occur along the western and eastern sides of the western arm of the wetland where the boundary is outside of the wetland and includes dryland areas. In addition, the boundary of the proposed Parks and Recreation reservation along a portion of the western part of the eastern arm is well inside the mapped wetland boundary by up to 70m.

The Wetland Atlas also identifies appropriate management categories for wetlands. Management categories are based on a range of criteria including occurrence of threatened plant and animal species or communities, range of vegetation types and

fauna habitats, size of the wetland and surrounding reserved area (if any), degree of naturalness, and the human use of the wetland.

Stakehill Swamp is mapped in Swan Coastal Plain Wetland Atlas as a Conservation Category Wetland (sumplands) (i.e. WIN 17Sc 37Sc and 40Sc). Stakehill Swamp is also identified in Bush Forever (Government of Western Australia, 2000) as a Conservation Category Wetland.
The Water and Rivers Commission Position Statement on Wetlands (WRC, 1997) provides a general description and management objectives for each of the three different management categories for wetlands: Conservation (CCW), Resource Enhancement (REW) and Multiple Use (MU) (Table 1).

TABLE 1
WETLAND MANAGEMENT CATEGORIES & OBJECTIVES

Management Category	General Description of Wetlands	Management Objectives
Conservation Wetlands	Wetlands which support high levels of attributes and functions.	To preserve wetland attributes and functions through reservation in national parks, crown reserves, state owned land and protection under environmental protection policies.
Resource Enhancement wetlands	Wetlands that have been partly modified but still support substantial functions and attributes.	To restore wetlands through maintenance and enhancement of wetland functions and attributes by protection in crown reserves, state or local government owned land and by environmental protection policies, or in private property by sustainable management.
Multiple Use Wetlands.	Wetlands with few attributes, which still provide important wetland functions.	Use, development and management should be considered in the context of water (catchment/strategic drainage planning), town (land use) and environmental planning through landcare.

From *Wetlands of the Swan Coastal Plan Volume 2b* (Hill *et al.*, 1996)

A portion of Stakehill Swamp is also included in the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* commonly referred to as the EPP Lakes Policy. The areas of the Swamp that are protected by the EPP Lakes Policy encompasses approximately 120ha and includes most of the southeast portion and western section of the wetland and two isolated patches of the northern part of the wetland (Figure 4). The Lakes Policy area was defined by the EPA according to the area of wetland that contained above ground water on the 1st December 1992 and therefore does not include the whole wetland. The Lakes Policy was formulated to prevent further degradation of wetlands on the Swan Coastal Plain. Any plans to fill, drain, mine, or discharge into the wetlands protected by this Policy must be referred to the EPA for assessment and approval.

According to the *Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy* 2004, the majority of Stakehill Swamp is mapped as an EPP Wetland under the new draft EPP. The Draft Wetlands EPP 2004 increases the area of Stakehill Swamp protected under the Policy, particularly in the northern region of the wetland.

Wetlands that are nominated by Australia for inclusion in the List of Wetlands of International Importance under the *Ramsar Convention 1971* are considered to be internationally significant. Stakehill Swamp is not listed or known to be nominated for Ramsar listing.

Wetlands listed within the Department of Environment and Heritage's (formerly Australian Nature Conservation Agency) *Directory of Important Wetlands in Western Australia* and on the Australian Heritage Commission's *Register of the National Estate* list of wetlands are considered to be of national significance. Stakehill Swamp is not listed on either of these registers.

3.2.5 Potential Impacts

Wetlands may be adversely affected over time as a result of land use in the surrounding upland areas. Impacts can include clearing of wetland vegetation, uncontrolled access into the wetland areas, introduction or spread of weeds into the wetland area, dumping of rubbish, discharge of contaminated water, pollution of groundwater within the wetland catchment, abstraction of water for irrigation, as well as animal pest and disease issues.

Protection of wetlands can be achieved in a number of ways including fencing, the creation of buffer zones around wetlands and by the control of activities in the catchment of the wetland.

Under the current "Rural" zoning for Stakehill Swamp, a wide variety of rural land uses have taken place around Stakehill Swamp and within parts of the area proposed to be reserved as Parks and Recreation. These land uses include market gardening, goat farming, horse agistment, deer farming, poultry farming, lucerne cropping, plant nurseries and orchards. All these activities have the potential to adversely impact on the wetland if not managed appropriately.

Under the proposed MRS Amendment, new land uses that have the potential to degrade the area will not be permitted in the area reserved for Parks and Recreation. This will reduce the direct impact of rural activities on the wetland itself including grazing, nutrient addition to the groundwater, and the potential for clearing of the wetland vegetation. The Parks and Recreation reservation will also result in the enhancement of the ecological attributes of the area through rehabilitation of degraded areas. Under the proposed Scheme Amendment to area reserved and acquired by the WAPC will be managed for conservation. Once this area is acquired, the existing rural activities will cease. Existing land uses can continue until the area is acquired.

A portion of the wetland up to 70m wide east of Jarvis Road is not within the proposed Parks and Recreation reserve. However, the wetland vegetation in this area is in Excellent condition despite its Rural zoning. The condition of the wetland is an indication that the owners of the land in this area have managed the land use on

their property such that the wetland has been looked after and has not degraded. In fact, the overall condition of the wetland vegetation suggests that most landowners appreciate the environmental value of the wetland. Several earth working intrusions into the wetland, however, shows that the wetland is subject to impact from some landowners and that better protection of the wetland would be achieved by land use controls.

Buffer zones are usually recommended around wetlands to separate incompatible activities on the upland areas from the wetland habitats. In addition, vegetated buffer zones provide additional habitats for wildlife using the wetland.

The EPA (1997) has developed guidelines regarding adequate separation distances between wetlands and various land uses. Additionally the Water and Rivers Commission prepared a Position Statement (i.e. *Water and Rivers Commission Position Statement: Wetlands*) in 2001 for wetlands on the Swan Coastal Plain. The guidelines and the position statement recommend a minimum buffer of 50m, or 1mAHD higher than the furthermost extent of wetland dependant vegetation, which ever is the largest. These buffers are designed to protect wetlands from potential deleterious impacts while helping safeguard and maintain ecological processes and functions within the wetland and, where possible, within the actual buffer. At Stakehill Swamp a level of wetland protection already exists in the form of the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* which prohibits drainage into or out of, filling, mining and pollution of wetlands. While the current Lakes EPP does not protect the entire wetland, the revised EPP proposes this.

The recently released (for public comment) Draft Water Resources Statement of Planning Policy No. 2.9 (WAPC, 2004) provides guidance for the protection and management of wetlands and their buffers. The Draft Policy promotes adequate and appropriate buffering of wetlands to maintain or enhance the environmental attributes, functions and values of the water resource and minimise the impact of changes in land use. The Policy identifies a number of steps in determining an appropriate setback and recommends consideration of the biological and physical features associated with a water resource - its functions and values, together with the potential and existing pressures or impacts that may result from land use. This approach allows flexibility and 'outcome-based' decision-making by considering a range of criteria and negotiated outcomes rather than using a nominal 'setback' recommendation.

The creation of a buffer zone around Stakehill Swamp while the surrounding land use remains Rural would have no effect on existing activities in the buffer. As stated above, the Rural zoning has not greatly affected the ecological value of the wetland. Indeed, Stakehill Swamp is classified as a Conservation Category Wetland despite the surrounding rural activities, some of which are intensive horticulture.

3.2.6 Proposed Management

Future land use of the Stakehill Swamp area will be carried out and managed to maintain and enhance wetland ecological function through suitable location of land use and implementation of appropriate management measures.

For areas that are within the Department of Environment's standard 50m buffer of the Conservation Category Wetland boundary (as shown in the Wetland Atlas) land use controls are anticipated through a future amendment to the City of Rockingham's Town Planning Scheme. These controls would protect these areas from land uses that might be deleterious to the wetland values. Land use controls may permit Special Rural subdivision provided that residences, wastewater treatment units or any other potential pollution source are located outside the 50m zone.

The Parks and Recreation reservation of the area will mean that Stakehill Swamp will become public land rather than the predominantly private ownership that exists currently. The long-term viability of the ecological functioning of Stakehill Swamp may be threatened if public use of the area is not managed. Therefore public access of the area should be managed through provision of Dual Use Paths (DUPs), limited passive recreation areas and educational facilities. To facilitate and coordinate this, a Wetland and Public Open Space Management Plan will need to be prepared for Stakehill Swamp and the immediate interface to maintain water quality and wetland ecological attributes, including wildlife habitats.

The implementation and future management of the Parks and Recreation area of Stakehill Swamp will be a coordinated approach with Government agencies such as the Department of Conservation and Land Management (CALM) as well as the City of Rockingham and the Department for Planning and Infrastructure, as appropriate.

3.2.7 Proposed Outcome

The reservation and subsequent changes in land use resulting from the proposed MRS Amendment is likely to have a beneficial impact on the integrity, ecological functioning and environmental values of wetlands. With the implementation of appropriate environmental provisions and management associated with the future land use of the site, the conservation and ecological functions of the Stakehill Swamp wetlands can be further protected and possibly enhanced. Therefore the EPA's preliminary objective of maintaining the integrity, ecological function and environmental values of the wetland can be met.

3.3 Vegetation

3.3.1 Preliminary EPA Objective

To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

3.3.2 EPA Scope of Work

What are the values of the Vegetation Complexes and Vegetation Communities in a local and regional context?

Identify the Vegetation Complex and Vegetation Community types as well as any Threatened Ecological Communities (TEC's) and discuss their representation in

existing conservation reserves and how they will be protected by the proposed amendment.

Undertake appropriate field surveys to determine the existing type and representation of the vegetation on site, including TEC's, Declared Rare Flora.

Provide details of potential impacts from the proposal and how they will be addressed in accordance with the methodology and criteria used in Bush Forever.

3.3.3 Relevant Policies and Background

A range of legislation is relevant to biodiversity conservation in Western Australia. These include the *Environmental Protection Act 1986* (EP Act), the *Conservation and Land Management Act, 1984* and *the Wildlife Conservation Act, 1950-1979* of which the latter Act is proposed for replacement with a new *Biodiversity Conservation Act.*

Conservation and Land Management Act

The Conservation and Land Management Act 1984 was created to make better provision for the use, protection and management of particular public lands and waters and the flora and fauna contained within, and to establish authorities to be responsible for the subject lands and related purposes.

Wildlife Conservation Act 1950-1979

The *Wildlife Conservation Act 1950-1979* provides for the 'conservation and protection of wildlife' and is administered by CALM.

Native flora and fauna are 'protected' under the provisions of Section 14 of the Act. The Act provides penalties for taking protected flora or fauna unlawfully. It also contains provisions for the declaration of species as "rare or likely to become extinct" (ie, endangered). "Fauna" is defined as meaning any animal indigenous to any State or Territory of the Commonwealth or the territorial waters thereof (ie, it includes fish), and "flora" as any plant, which is native to the State. Prior to passage of the *Conservation and Land Management Act* 1984, responsibility for wildlife management and management of nature reserves was held by the Fisheries and Wildlife Development Proposals (Part 8).

3.3.4 Vegetation Description

A flora and vegetation survey of the Stakehill Swamp proposed amendment area was conducted by ATA Environmental in 2004 using the *EPA Guidance Statement No. 51: Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004).

Prior to the survey a desktop search for the presence of rare flora was undertaken for the study area. This investigation encompassed a review of the following databases:

1. CALM's *'Threatened (Declared Rare) Flora'* database.

2. *'Western Australian Herbarium Specimen'* database for priority species opportunistically collected in the area of interest.

3. CALM's *'Declared Rare and Priority Flora List'* which contain species that area declared rare (Conservation code R or X for those presumed to be extinct) poorly known (Conservation codes 1, 2 or 3) or require monitoring (Conservation Code 4).

TABLE 2
SIGNIFICANT FLORA PREVIOUSLY RECORDED IN THE VICINITY OF THE STAKEHILL SWAMP AMENDMENT AREA

Species	Conservation Code	Flowering Time	Distribution
Acacia benthamii	P2	August–September	Baldivis
Cardamine paucijuga	P2	August-November	Baldivis
Dillwynia dillwynioides	P3	August-October	Karnup
Goodenia filiformis	P3	October-February	Karnup

A search of the Western Australian Threatened Species Units (WATSCU) Threatened Ecological Communities database was also obtained. Only one TEC, the Critically Threatened "Sedgelands in Holocene Dune Swales (SCP community type 19), was previously recorded within a 10km radius of the study area.

Prior to undertaking the field survey, previous flora and vegetation studies from the area were reviewed and recent aerial photography from the study area was examined to identify differences in vegetation types and structural units for the area.

Vegetation and Flora Survey Protocol

A vegetation and flora survey of the Stakehill Swamp Amendment area was conducted between 22 and 24 June 2004 (3 days in total). This is considered to be an appropriate survey period given the size of the area and complexity of the vegetation within the study area. The timing of the survey was not considered to be optimal for the identification of all herbaceous and ephemeral plant species, many of which are only identifiable when in flower following winter rains. The significant species identified on CALM's database however are all identifiable out of their flowering season.

Permission to access all properties within the study area was not obtained from all landowners. This prevented the study area from been comprehensively surveyed. The vegetation on properties where access was prohibited was mapped by comparison of aerial photography with areas that had been groundtruthed. The survey was undertaken through a combination of traversing the study area on foot and by 4 wheel drive vehicle, with vehicle access generally restricted to existing tracks and cleared tracks and roads that dissect and extend around the perimeter of the study area.

Aerial photography was used to identify and delineate major vegetation types, which were intensively sampled for all floristic plant species by way of fourteen 10m x 10m non-permanent quadrats, of which at least one was placed in each of the vegetation

types identified in the area. Within each quadrat the structure and floristic composition, along with the percentage cover of each species, species height and vegetation condition was recorded. For areas where vegetation had been cleared or the understorey had been completely removed, no quadrats were analysed. Additional plant species were recorded from opportunistic traverses of the site.

The locations of any plants positively identified in the field as CALM listed Declared Rare or Priority Flora were recorded using a handheld Global Positioning System (GPS) (Magellan Meridian Gold).

Significant Flora

CALM provided a list of Declared Rare and Priority listed Flora potentially occurring in the study area. These included *Acacia benthamii (*Priority 2*), Cardamine paucijuga* (Priority 2), Thread-leaved Goodenia (*Goodenia filiformis*) (Priority 3) and *Dillwynia dillwynioides* (Priority 3).

A total of 42 plants species (comprising 28 native and 14 introduced species) were recorded from the study area during the June 2004 survey undertaken by ATA Environmental (Appendix 2). None of these were CALM listed DRF or Priority taxa.

Bush Forever Sites

The Bush Forever (Government of Western Australia, 2000) report is the culmination of Perth's Bushplan Project, a long-running initiative which aimed to identify and protect areas of regionally significant bushland and associated wetlands on the Swan Coastal Plain in the Perth Metropolitan region.

The Stakehill Swamp Amendment area is associated with one Bush Forever site that encompasses virtually the entire amendment area. This site is Bush Forever Site 275 – Stakehill Swamp, Baldivis.

Vegetation Complexes

Heddle *et al.* (1980) identified and mapped large scale repeating patterns in native vegetation for the entire Darling System of the southwest of Western Australia. The vegetation was grouped into "complexes", that reflect the influence of landform, soil type and climate. This work shows the Stakehill Swamp Amendment area as supporting remnant vegetation belonging to the Karrakatta Complex – Central and South, the Cottesloe Complex – Central and South and the Herdsman Complex.

Vegetation of the Karrakatta Complex – Central and South is described by Heddle *et al.*, 1980 as an open forest of Tuart-Jarrah-Marri, with Jarrah and Marri replacing Tuart when progressing eastwards. *Banksia attenuata, B. menziesii, B. grandis* and *Allocasuarina fraseriana* are also common tree species associated with this complex. This Complex is associated with the eastern half of the western wetland and the southern portion of the eastern wetland of Stakehill Swamp. Approximately 18% of the Karrakatta Complex – Central and South remains on the Swan Coastal Plain portion of the Perth Metropolitan Region, however, only 8% of this Complex is

proposed for protection under Bush Forever which is below the 10% complex retention levels target.

The Cottesloe Complex – Central and South is characterised by a closed heath on limestone areas with shrubs such as *Melaleuca huegelii, Acacia* species, *Grevillea preissii* and *Trymalium ledifolium.* The deeper sands tend to support a mosaic of Tuart, Jarrah and Marri. This complex is associated with the western half of the western wetland of Stakehill Swamp. Approximately 36% of the Cottesloe Complex – Central and South remains on the Swan Coastal Plain portion of the Perth Metropolitan Region. Approximately 18% of the original extent of this complex is proposed for protection under Bush Forever, which is above the proposed 10% complex retention levels target.

The Herdsman Complex is characterised by sedgelands and a fringing woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla.* This Complex is associated with the majority of the eastern arm of the Stakehill Swamp wetland. Approximately 31% of the Herdsman Complex remains on the Swan Coastal Plain portion of the Perth Metropolitan Region, which is above the proposed 10% complex retention levels target.

Vegetation Community Types

Work undertaken by Gibson *et al.,* 1994 involved the classification of the vegetation on the southern Swan Coastal Plain using detailed surveys and numerical analysis of the floristic composition of the vegetation. These surveys and subsequent updates have delineated 66 Floristic Community Types (FCTs). The Gibson *et al.* (1994) study represents the most comprehensive analysis of vegetation on the Swan Coastal Plain and includes an assessment of the conservation and reservation status of the various Community Types.

Previous vegetation survey results from areas included in the Stakehill Swamp, Baldivis Bush Forever Site (No. 275), as reported in the Directory of Bush Forever Sites (WA Government, 2000) and quadrat data collected during floristic surveys for this Environmental review, allowed for the following inferences to be made:

- Wetland vegetation associated with the eastern and western wetland is probably representative of Community Type 17 – *Melaleuca rhaphiophylla-Gahnia trifida* seasonal wetlands. This community type is generally dominated by *Melaleuca rhaphiophylla,* with *Gahnia trifida* the usual dominant or co-dominant understorey species. The species diversity associated with this Community Type is generally very low.

- The dryland margins of the Stakehill Swamp Amendment area may belong to Community Type 28 – Spearwood *Banksia attenuata* or *Banksia attenuata – Eucalyptus* woodlands.

Threatened Ecological Communities

The Floristic Community Type (FCT) assessment of vegetation on the Swan Coastal Plain (SCP) was developed by Gibson *et al.* (1994) and is based on an underlying

concept that flora species occur in groups as a response to environmental factors and that defining such groups of species over the SCP would enable individual stands of vegetation to be assigned to a group of sites with similar flora composition. In general, floristic community types comprise groups of flora that consistently occur together (Trudgen, 1995). The identification of vegetation communities (and Floristic Community Types) can only be accurately and comprehensively undertaken using computer analysis of surveyed plot data collected over several seasons.

Ecological Communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat (Blyth and English, 1997). Threatened Ecological Communities (TECs) are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, ie Presumed Totally Destroyed, Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). Some TECs are protected under the *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999*. Although TECs are not protected under the *Wildlife Conservation Act 1950* or any other Western Australian legislation, some TECs trigger referral to the Commonwealth Environment Minister under the *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999*. In addition, the EPA's position on TECs as described in its Guidance Statement Number 10 (EPA, 2003), states that proposals that result in the direct loss of threatened ecological communities are likely to be formally assessed.

A search of the Stakehill Swamp area of the CALM's Threatened Ecological Communities database was undertaken in 2004. There were no known occurrences of Threatened Ecological communities recorded within the study area boundary. However CALM advised that there are numerous occurrences of a 'Critically Endangered' TEC - Sedgelands in Holocene dune swales (FCT community type 19) that occur nearby (within a 10 kilometre radius). Community type 19 is associated with Quindalup Dunes, a landform that does not occur within the Stakehill Swamp Amendment area.

No other inferred FCTs identified from the study area are listed on the CALM's list of Threatened Ecological Communities or the list of Threatened Communities under the EPBC Act.

Vegetation Associations

The natural vegetation on the upland areas surrounding the Stakehill Swamp has largely been cleared or disturbed to such an extent that only remnant Tuart (*Eucalyptus gomphocephala*) and some Marri (*Corymbia calophylla*) trees remain. Towards the margins of the wetland some Flooded Gum (*E. rudis*) also occur as either regrowth or intact. Lot 779 in the south-eastern part of the study area, off Eighty Road, contains some Open Woodland of *Banksia menziesii* to approximately 5m high with a degraded, weed infested understorey.

The western arm of Stakehill Swamp contains a narrow central section of open water surrounded by sedgelands. The remainder of this section of the wetland is covered by native vegetation, predominantly Paperbark (*Melaleuca rhaphiophylla*) over the sedge *Lepidosperma longitudinale*.

The wetland vegetation in the northern part of the swamp consists of Paperbarks (*Melaleuca rhaphiophylla*) which extend right across the width of the swamp. The Paperbarks are mostly in high densities and form a Low Closed Forest formation while in other areas they are more scattered in a Low Woodland Formation over a dense sedgeland of *Lepidosperma tenue.*

The vegetation of the eastern arm of the swamp consists of a large central sedgeland zone consisting of Jointed Twig Rush (*Baumea articulata*), *Gahnia trifida* and the smaller *Baumea juncea* with isolated stands of *Juncus pallidus.* Paperbark Forest mostly surrounds the central sedgeland area.

Acacia saligna is common as regrowth in the northern and western sections of the swamp in areas previously disturbed by clearing of Paperbarks.

The following vegetation associations were identified from the Stakehill Swamp project area by ATA Environmental during the June 2004 flora and vegetation survey.

Eucalyptus rudis Woodland Tall Woodland - This association is to 30m in height along the eastern and western fringes of each the two portions of the wetlands (Plate 1 and 2). The association varied from being grazed and relatively degraded with few native understorey species in the western wetland (Plate 1) to Excellent condition vegetation, with an intact understorey dominated by *Lepidosperma tenue* Sedgeland in the eastern wetland (Plate 2).

Eucalyptus rudis Open Woodland – This association, to 20m in height was recorded as fringing vegetation around the southern boundary of the western Stakehill Swamp wetland, north of Stakehill Rd (Plate 3). The understorey has been degraded through grazing with moderate levels of weed invasion (including Couch grass, Lupin and Bridle Creeper) and is in Good condition. Associated native understorey species included *Acacia saligna* and *Phyllanthus calycinus*.

Melaleuca rhaphiophylla Low Closed Forest – This is one of the dominant vegetation associations recorded from the study area (Plate 4). The association, to 5m in height, fringes the *Baumea articulata* dominated Closed Sedgeland of both sections (east and west) of the Stakehill Swamp wetland.

Baumea articulata Sedgeland – This association was recorded from a narrow strip (~40m wide) fringing the *Melaleuca rhaphiophylla* Low Closed Forest association in the western wetland and an area *Eucalyptus rudis* Tall Woodland (Plate 5). The area appeared to have been previously cleared and the vegetation is possibly regrowth. Numerous Flooded Gum saplings and a few juvenile Paperbarks interspersed this association. A larger area of lower, slightly more closed and better condition *Baumea articulata* Sedgeland occurs in the northern portion of the western wetland (Plate 6).

Baumea articulata Closed Sedgeland – This association was recorded in the interior of the large eastern Stakehill Swamp wetland that is fringed by *Melaleuca rhaphiophylla* Low Closed Forest and *Eucalyptus rudis* Woodland. The association was comprised virtually uniformly of *B. articulata* to 3m in height (Plate 7) with a few *Melaleuca rhaphiophylla* trees scattered throughout.

Melaleuca teretifolia and *Melaleuca lateritia* dominated Closed Low Heath - This association to 2 metres in height was recorded from the northern portion of the eastern Stakehill Swamp wetland (Plate 8). The association appears to have been previously cleared and has regrown.

Eucalyptus gomphocephala Tall Open Woodland – The association to 30m in height, was recorded from the southern portion of the amendment area, abutting the western wetland. The area has been and continues to be extensively grazed with no associated native understorey species present and a level of weed invasion (Plate 9).

Scattered *Eucalyptus gomphocephala* trees– This degraded vegetation association was recorded from the central area of the Amendment Area, to the east of the western wetland. No native species were recorded from this association.

Banksia menziesii Low Open Woodland – This association was recorded from a small area off Eight Rd along the eastern boundary of the Amendment Area (Plate 10).

Melaleuca teretifolia Open Shrubland - This vegetation association fringes the *Baumea articulata* Closed Sedgeland in the southern portion of the western wetland. Associated species included scattered *Melaleuca teretifolia* and *Melaleuca rhaphiophylla* (Plate 11).

Vegetation Condition

The majority of the wetland remnant vegetation within the study area has not been significantly altered in any way, whereas the dryland or "upland" vegetation has been previously "Parkland Cleared" for agricultural purposes. Vegetation condition was mapped by ATA Environmental using the scale adopted in Bush Forever (Government of Western Australia, 2000) for each area of vegetation assessment in the study area. This is shown in Figure 5. An explanation of condition categories is provided in Table 3.

TABLE 3
VEGETATION CONDITION RATING SCALE
(from Bush Forever, Government of Western Australia, 2000)

Scale	Descriptor	Explanation
1	Pristine	Pristine or nearly so, no obvious signs of disturbance
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive
3	Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some aggressive weeds, dieback, logging and grazing
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. 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
5	Degraded	Basic vegetation structure severely impacted by disturbance.

Scale	Descriptor	Explanation
		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
6	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as "parkland cleared" with the flora comprising weed or crop species with isolated native trees

The wetland vegetation associated with Stakehill Swamp ranges from Very Good to Pristine condition with very little evidence of stress in the Paperbarks or sedges. The perimeter of the wetland has a large amount of introduced Kikuyu grass, which thrives due to the moist soils throughout the year. However, there is negligible incursion of Kikuyu or any other weeds into the wetland itself due to the dense canopy of fringing Paperbarks, which inhibits growth of understorey species. Vegetation condition recorded at flora sampling sites (i.e quadrats) located within different vegetation associations is described in Appendix 3.

The wetland vegetation has been subject to periodic fires but does not appear to have sustained any long-term effects such as changes in tree density or weed invasion.

Physical damage has occurred to the wetland in the past including the construction of two causeways across the western section and various areas which have been filled in to create dry land for grazing or horticulture. In addition, some areas have been partially excavated on the margin of the Swamp for aesthetic reasons or to create a physical barrier to prevent animals wandering into the interior of the Swamp.

While the field observations confirmed that the overall condition of the upland vegetation (i.e Tuart woodland in central and southern portions of study area) has been parkland cleared and is degraded, there are also number of areas which have suffered severe disturbance and clearing around the fringes of the wetland. The upland areas have been subject to grazing and weed invasion in most places, while degraded wetland areas are limited mainly to the peripheral areas that have been affected by edge effects associated with adjacent land uses.

3.3.5 Potential Impacts

The majority of the vegetation within the project area was classified in the ATA Environmental Assessment as being in Very Good to Excellent condition, with some areas considered "Degraded", and a few of the *Melaleuca rhaphiophylla* Low Closed Forest areas considered to be in "Pristine" condition.

At present, the Stakehill Swamp wetland area encompasses 171.2ha of remnant vegetation. The proposed Amendment will result in approximately 92% of this remnant vegetation being protected in the Parks and Recreation Reserve. The areas of remnant vegetation that have been omitted include an area of wetland and dryland vegetation in Excellent condition on the eastern side of Jarvis Road and an area of dryland vegetation in Good condition in the southern portion of Lot 803 Stakehill

Road. In addition, there are parkland cleared stands of Tuarts at the periphery of the wetland which are not included in the Reserve.

The future land use associated with the proposal to reserve the Stakehill Swamp Amendment area to "Parks and Recreation" is likely to result in a beneficial impact on Stakehill Swamp. Under the proposed reservation, livestock, including sheep and cattle will no longer graze the site and the impacts and pressures on vegetation, flora, fauna and wetlands associated with previous grazing will be removed. Additionally, active management of the Parks and Recreation zoning will result in the enhancement of the ecological attributes of the area through rehabilitation of degraded areas and the construction of facilities likely to minimise the impact of increased public use of the area.

3.3.6 Proposed Management

The management of flora and vegetation issues within the Stakehill Swamp Amendment area will include the avoidance of deleterious impacts on the existing environment and to ensure the protection and enhancement of the ecological values of the area.

There is a requirement to consider the importance of possible ecological linkages and remnant vegetation during the planning for the future use of the area.

Environmental Management Plans and Implementation Strategies shall be prepared for Stakehill Swamp, Baldivis Regional Open Space and the immediate interface. These Plans shall be prepared and implemented in accordance with the provisions of the Plans, to the requirements of the Responsible Authority.

3.3.7 Proposed Outcome

With the use of environmentally sensitive planning and development using the principles of environmental management practice, specific management strategies and legislative capabilities, there is an ability to meet the EPA objectives of maintaining the abundance, diversity, geographic distribution of vegetation, floristic communities and flora at the species and ecosystem level through the avoidance or management of adverse impacts and improvement in knowledge can be achieved.

3.4 Fauna

3.4.1 Preliminary EPA Objective

To maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

3.4.2 EPA Scope of Work

What are the fauna values of the site and if fauna habitats are present, are Specially Protected (Threatened) Fauna present?

Assess the presence and distribution of fauna communities and significant bird species (as identified in Bush Forever).

Particular attention should be directed to the provision of adequate buffers around the wetland and surrounding riparian vegetation to protect the riparian vegetation and habitat values.

3.4.3 Relevant Policies and Background

A range of legislation is relevant to biodiversity conservation in Western Australia, including the *Environmental Protection Act 1986* (EP Act), the *Conservation and Land Management Act1984,* and the *Wildlife Conservation Act 1950,* of which the latter Act is proposed for replacement with a new *Biodiversity Conservation Act.*

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) applies to proposed "actions" that have the potential to significantly impact on a matter of national environmental importance. In such cases the proposed action is referred to the Commonwealth Minister for the Environment for a decision as to whether assessment is required under the Act.

The species *Calyptorhynchus latirostris* (Carnaby's Black-Cockatoo) which is listed by CALM as Specially Protected Fauna under the *Wildlife Conservation Act 1950* is also listed as an Endangered species of National significance under the *EPBC Act 1999.*

Background

A search of the Western Australian Museum on-line database (*FaunaBase*) was undertaken to develop a list of potential birds, reptiles, mammals and amphibians for the project area. The search was bounded by latitude 32° 00' to 32° 20'S, and longitude 115° 25' to 116° 00'E. This wide search area was used as there is little data in *FaunaBase* since records are only for vouchered specimens. Data from *FaunaBase* were supplemented with information from Tyler *et al.* (2000) for frogs, Storr *et al.* (1983, 1986, 1990 and 1999) for reptiles, Johnstone and Storr (1998) for birds and Strahan (1995) for mammals.

A search of the Department of Conservation and Land Management's Threatened and Priority Species database was undertaken to identify potential scheduled and threatened species in the region.

A search of the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* on-line database was also undertaken.

These sources of information were used to create lists of species expected to occur at the site. As far as possible, expected species are those that are likely to utilise the project area. Such lists often include species that have been recorded in the general region as vagrants or for which suitable habitat is absent. Particularly amongst the birds, for example, vagrants can be recorded almost anywhere.

Taxonomy and nomenclature for fauna species used in this report generally follow Aplin and Smith (2001) for amphibians and reptiles, How *et al.* (2001) for mammals and Johnstone (2001) for birds.

Survey Protocol

A four night fauna trapping program was conducted at Stakehill Swamp from 30 May – 3 June 2004. All fauna trapping was conducted under a licence issued by the Department of Conservation and Land Management (# SF 004547).

Fifteen separate trapping sites were set up within the areas that we had permission to survey (Figure 6) as some land owners would not grant permission for us to access their land. All sites consisted of two trapping arrays spread approximately 50 metres apart. Each trapping array consisted of one 150mm diameter stormwater pipe pit-trap (500mm deep), one 20L bucket pit-trap and four funnel traps alternating along a 10 m drift fence (300mm high). Funnel traps are approximately 800mm long and have a capture area of 200mm x 200mm at either end, with a funnel entrance of 5cm. Two 10m drift fences were constructed using the same pattern at each site. A cage trap and Elliott trap were set in the vicinity of each array. In addition 20 cages were spread throughout the areas that we had permission to survey. A total of 800 trap-nights were completed for this survey and the location of each trapping site is shown in Figure 6.

Pit-traps target small terrestrial reptiles and mammals, funnel traps target snakes and elongate lizards, and Elliott traps and cage traps target small mammal species.

Surveys for avifauna were conducted twice from sunrise for two hours. Sunrise and immediately after is the best time to survey for birds, as they are calling and more active at this time of the day. Two evenings of spotlight searches for frogs were conducted for two hours. Frogs are easily identified and located by their calls soon after dusk. In addition spotlighting targets a particular suite of fauna, such as nocturnal reptiles and mammals that do not readily get caught by other means (e.g. Pythons).

The fauna investigations were undertaken within the proposed time frame of the project. This timing is not ideal for recording vertebrates and the capture list reflects this survey timing. Reptiles are generally inactive during cooler weather and mammals and some bird species are inactive during rainy cooler periods. In addition, some species of wading birds are only found in the region during summer months, as they are migrants.

Avifauna

Bird species that may occur at the site are listed in Appendix 4. Based on the results of the database searches, a total of 135 species of birds may potentially occur at the site. However it is unlikely all 135 species would occur at the site due to an absence of specific microhabitat requirements or the seasonal nature of the species. The disadvantage of lists of predicted species is that, in the process of covering all eventualities, an area can appear to have a more diverse fauna than is actually the case. Forty-two species were recorded during the survey (Appendix 4).

Amphibians, Reptiles and Mammals

Amphibian, reptile and mammal species expected to occur at Stakehill Swamp are listed in Appendix 5, 6 and 7 respectively.
The regional desktop search of the Western Australian Museum database identified 13 species of amphibian, 57 species of reptile and 28 species of mammal (6 introduced or feral) that may be present at Stake Hill Swamp, Baldivis. However, not all of these species will be necessarily present on site because of the absence of specific microhabitat requirements.

One species of amphibian, one species of reptile and five species (2 introduced) of mammal were recorded on site.

Significant Vertebrate Species Recorded or Predicted to Occur near Stakehill Swamp, Baldivis

The fauna species listed in Table 4 below have either been previously recorded or have the potential to occur in the vicinity of Stakehill Swamp, Baldivis.

TABLE 4
SIGNIFICANT VERTEBRATE SPECIES PREDICTED TO OCCUR NEAR STAKEHILL SWAMP, BALDIVIS

Species	Status under Wildlife Conservation Act Schedule (S) / Priority (P)	Status under Commonwealth Environment Protection and Biodiversity Act	Recorded (R) / Predicted (P)	Comment
Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo (*Calyptorhynchus latirostris*)	Schedule	Endangered	R	Species or species habitat likely to occur within area
Baudin's Black Cockatoo (*Calyptorhynchus baudinii*)	Schedule	Vulnerable	R	Species or species habitat likely to occur within area
Chuditch (*Dasyurus geoffroii*)	Schedule	Vulnerable	R	Species or species habitat unlikely to occur within area
Southern Brown Bandicoot (*Isoodon obesulus fusciventer*)	Priority		R	Species found on site
Eastern Curlew (*Numenius madagascariensis*)	Priority		R	Species or species habitat likely to occur within area
Bush Stonecurlew (*Burhinus grallarius*)	Priority		R	Species or species habitat likely to occur within area
Peregrine Falcon (*Falco peregrinus*)	Schedule		P	Species or species habitat likely to occur within area
Quokka (*Setonix brachyurus*)		Vulnerable	P	Species or species habitat unlikely to occur within area

Species	Status under Wildlife Conservation Act Schedule (S) / Priority (P)	Status under Commonwealth Environment Protection and Biodiversity Act	Recorded (R) / Predicted (P)	Comment
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)		Migratory	P	Species or species habitat unlikely to occur within area

Significant Fauna under the WA Wildlife Conservation Act 1950-1979

In Western Australia, all native fauna species are protected under the *WA Wildlife Conservation Act 1950-1979*. Fauna species that are considered rare, threatened with extinction or have a high conservation value are specially protected under the Act. In addition, some species of fauna are covered under the 1991 ANZECC convention, while certain birds are listed under the Japan and Australian Migratory Bird Agreement (JAMBA) and the China and Australian Migratory Bird Agreement (CAMBA).

Classification of rare and endangered fauna under the Wildlife Conservation (Specially Protected Fauna) Notice 1998 recognises four schedules of taxa. These are:

Schedule 1 – fauna which are rare or likely to become extinct and are declared to be fauna in need of special protection.

Schedule 2 – fauna which are presumed to be extinct and are declared to be fauna in need of special protection.

Schedule 3 – birds which are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction which are declared to be fauna in need of special protection; and

Schedule 4 – fauna that are in need of special protection, otherwise than for the reasons mentioned in Schedule 1, 2 or 3.

In addition to the above classification, CALM also classify fauna under four different Priority codes:

Priority one – Taxa with few, poorly known populations on threatened lands. Taxa which are known from few specimens or sight records from one of a few localities on lands not managed for conservation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened species.

Priority two – Taxa with few, poorly known populations on conservation lands, or taxa with several, poorly known populations not on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands no under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority three – Taxa with several, poorly known populations, some on conservation lands. Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority four – Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed or for which sufficient knowledge is available and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands. Taxa which are declining significantly but are not yet threatened.

Species Listed as Threatened or Priority Species under WA Wildlife Conservation Act 1950 Potentially Occurring at Stakehill Swamp, Baldivis

Threatened and priority species listed under the *WA Wildlife Conservation Act* that may potentially occur at Stakehill Swamp, Baldivis are listed in Table 4.

Descriptions of Species Listed as Schedule 1 – Fauna that are Rare or likely to become Extinct

Chuditch (*Dasyurus geoffroii*) –The Chuditch is unlikely to be found at Stakehill Swamp due to unsuitable habitat and habitat fragmentation in the region.

Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) – Carnaby's Cockatoo inhabits the southwest of WA. Its preferred habitat is the woodland where it preferentially feeds on plants of the Proteaceae family. It may utilise the Jarrah and Banksia woodlands of the site for feeding but is not known to breed in the area. Carnaby's Cockatoo is likely to occur in the area in question because of suitable habitat and recent sightings in the area.

Baudin's Cockatoo (*Calyptorhynchus baudinii*) – Baudin's Cockatoo is most common in the far southwest of WA where it breeds. Breeding records come from the southern forests north to Collie and east to near Kojonup. Baudin's Cockatoo is typically found in vagrant flocks and utilises the taller, more open Jarrah and Marri woodlands, where it feeds mainly on Marri seeds. Baudin's Cockatoo is likely to occur in the area in question because of suitable habitat and recent sightings in the area.

Descriptions of Species listed as Schedule 4 – Fauna that are in need of special protection

Peregrine Falcon (*Falco peregrinus*) – This species is found across most of Australia, but only occurs in low densities and has a wide and patchy distribution. It favours hilly or mountainous country and open woodlands and may be an occasional visitor to the study area.

Descriptions of Species Listed as Priority 4– Taxa in Need of Monitoring

Quenda or Southern Brown Bandicoot (*Isoodon obesulus fusciventer*) – The Southern Brown Bandicoot prefers dense scrub (up to one metre high), with swampy vegetation. They will often feed in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and crop land lying close to dense cover. Major threats to Quenda include habitat fragmentation and loss of habitat on the coastal plain, fire in fragmented habitat, predation by foxes, predation of young by cats and predation around residential areas by dogs. The Southern Brown Bandicoot was recorded at Stakehill Swamp during this assessment.

Eastern Curlew (*Numenius madagascariensis*) – The Eastern Curlew breeds in eastern Russia, but has been recorded as a non-breeding visitor to Japan, North Korea, South Korea, mainland China, Hong Kong, Taiwan, Bangladesh, Thailand, Vietnam, Philippines, Malaysia, Singapore, Brunei, Indonesia, Papua New Guinea, Australia and New Zealand. In the non-breeding season it is essentially coastal, occurring at estuaries, mangrove swamps, saltmarshes and intertidal flats, particularly those with extensive seagrass meadows. The main threats are habitat loss, hunting and a decrease in the availability of food because of pollution, and a potential threat may be that females probably tend to migrate further south, to the more threatened south Australian wetlands. The Eastern Curlew is potentially found in the Stakehill Swamp area.

Bush Stone-curlew (*Burhinus grallarius*) – The Bush Stone-curlew is regarded as uncommon or rare throughout the region having declined as a result of feral cats and foxes. It can be found in open wooded country or scrubs, among many other habitats. It is possibly found in the study area because suitable habitat is present.

Species Listed under the Commonwealth Environment Biodiversity Conservation Act 1999 Potentially Occurring at Stakehill Swamp

Four threatened species of fauna and one migratory species of bird potentially occurring at Stakehill Swamp was highlighted as having national environmental significance under the *Environment Protection and Biodiversity Conservation* Act 1999 including the Carnaby's Cockatoo, Baudin's Cockatoo and the Chuditch, as described in the previous Section, as well as the Quokka. Quokkas are unlikely to be found at Stakehill Swamp even though suitable habitat is present.

Migratory Species Listed under the Environment Protection and Biodiversity Conservation Act 1999

The White-bellied Sea Eagle is a migratory bird species listed under the *Environment Protection and Biodiversity Conservation Act* 1999 but not listed under the WA Wildlife Act. White-bellied Sea-Eagles are observed soaring overhead in near-coastal areas, however, it is unlikely to inhabit Stakehill Swamp due to unsuitable habitat.

3.4.4 Potential Impacts

It is unlikely that the proposed MRS Amendment will substantially modify, destroy or isolate an area of important habitat of these species, or seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significantly proportion of the population of any of the listed fauna species.

In addition to the removal of activities that have had a deleterious impact on fauna habitats, active management of the proposed Parks and Recreation zoning will result in the enhancement of the ecological attributes of the area through rehabilitation of degraded areas and the construction of facilities likely to minimise the impact of increased public use of the area.

3.4.5 Proposed Management

It is important that the management of fauna issues associated with the study area addresses the issues of avoidance of deleterious impacts on the existing environment and to ensure the protection of and enhancement of the ecological values of the area.

A number of Schedule or Priority Species listed under the *WA Wildlife Act* 1950 or listed as Vulnerable, Endangered or Migratory species under the *Environment Protection and Biodiversity Conservation Act 1999*, including Quenda, Carnaby's Black Cockatoo and Baudin's Cockatoo were predicted or recorded in the study area.

The wetland vegetation as identified in Figure 5, should be left undisturbed to maintain Scheduled, Priority, Threatened and Vulnerable species at Stakehill Swamp.

Environmental Management Plans and Implementation Strategies for Stakehill Swamp, Baldivis Regional Open Space and the immediate interface are recommended. Vegetation, native fauna and recreation management objectives will be implemented in the environmental management plans. The above Environmental Management Plans shall be prepared and implemented in accordance with the provisions of the Plans, to the requirements of the Responsible Authority.

3.4.6 Proposed Outcome

With the use of environmentally sensitive planning and development adopting the principles of environmental best practice, specific management strategies and legislative capabilities, there is an ability to meet the EPA objectives of maintaining the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge can be achieved.

4. DEFERRED ENVIRONMENTAL FACTORS

The EPA will often identify environmental factors that it considers relevant to the scheme but which are likely to be best addressed at a later level of planning. These factors are considered to be significant enough to warrant attention as part of the environmental review of this scheme, to the extent that the Responsible Authority should show how these factors could be addressed at a later level of planning. These factors are called "deferred environmental factors". There have been no deferred factors identified for this amendment.

5. IMPLEMENTATION

5.1 General

5.1.1 Introduction

With the environmental attributes and management requirements of the Stakehill Swamp Amendment area defined, it is necessary to implement the most appropriate mechanisms in which those attributes can be protected outside of the proposed Parks and Recreation reserve. This section discusses the planning considerations that could apply to protect those attributes.

5.2 Land Use Considerations

MRS Amendment 1050 proposes the boundary in which land is intended to be placed within a regional Parks and Recreation reserve (see Section 1.1).

This defines, in a statutory way, those areas with the most significant environmental attributes warranting a high level of protection. However, the environmental assessment has also defined other areas adjacent to the proposed MRS reservation where the importance of these attributes is able to be potentially managed through other mechanisms other than reservation. These areas are defined in Figure 4 and summarised in Figure 7 as the identified Wetland Protection Area. It also includes the balance of the areas outside of the Wetland Protection Area which are currently zoned for Rural purposes.

The Wetland Protection Area has been derived following the detailed site examination undertaken as part of this assessment and is a combination of the Conservation Category Wetland buffer and the Bush Forever Site 275 boundary identifying significant bushland vegetation adjacent to Stakehill Swamp. For the most part, the Wetland Protection Area is contained outside of those areas included within the Parks and Recreation reserve. Where it is outside of the proposed reserve, it is necessary to ensure that appropriate planning controls are in place to protect the environmental attributes intended to be protected by the Reservation.

The Wetland Protection Area is the next most environmentally significant area outside of that reserved for Parks and Recreation purposes whose specific environmental attributes warrant specific protection through management controls.

However, consideration also needs to be given to the balance of the study area which is presently zoned Rural under Council's Town Planning Scheme No. 1. The current Rural zoning enables a number of land uses which, if not managed appropriately, have the potential to adversely impact on the wetland and other associated environmental attributes intended to be protected by the proposed reservation.

Considering the need to protect the environmental attributes of the Wetland Protection Area and the need to review the appropriateness of the current planning controls in the balance of the study area, an amendment to the City of Rockingham's TPS 2 is one

mechanism that could ensure that the use of the land outside of the proposed Parks and Recreation Reservation does not adversely impact on those environmental attributes.

In this respect, the land use, development and rural residential subdivision options for the land outside of the proposed Parks and Recreation Reservation will be examined by the City of Rockingham, the Department for Planning and Infrastructure and the Department of Environment, in collaboration with the landowners. Important matters that will need to be considered in the planning investigation include rural residential lot size and pattern, land capability, effluent disposal, landscape attributes, fencing, fire management, accommodation of existing land uses, the identification of building envelopes, access arrangements, setbacks and management requirements for the Wetland Protection Area.

Planning options should be examined and the following provides a guide for more detailed investigation. In the interim, while planning options are being examined and finalised, proposals from landowners for land use, development and subdivision should be treated on their merits by the City of Rockingham and the WAPC.

5.3 Planning Considerations for Future Zoning over Study Area

As noted above, the designation of an appropriate zoning over the balance of the land (outside of the proposed MRS reserve) is subject to further planning consideration by the Department for Planning and Infrastructure, Council and Department of Environment in consultation with landowners.

Possible land use designations have previously been considered in a number of planning studies, as discussed in Section 1.

At the local level, Council's Rural Land Strategy, defines its view as to the potential use and development of land at Stakehill Swamp. The Strategy was adopted by Council in December 2003, but is subject to consideration by the WAPC. The Strategy includes the land within Planning Unit 4, which provides a series of recommendations to incorporate landholdings within the area for Rural Residential and Special Residential purposes. The Study Area itself is included within *Precinct 4B – Stakehill* of Planning Unit 4.

The Strategy describes possible future land uses for the Precinct in the following terms:

> *'Precinct 4B has been the subject of a separate planning study and concept plan which when finalised will be incorporated as an addendum to this Strategy.'*
>
> and
>
> *Subdivision/development of the Stakehill Swamp precinct will be dealt with on its merits following analysis of the proposed Rural Concept Plan.*

With the completion of the environmental assessment through this Amendment and the identification of an appropriate Wetland Protection Area, it is appropriate to define the balance areas for consideration of possible future land use and development potential having regard to Council's Rural Land Strategy and the further planning consideration by the Department for Planning and Infrastructure, Council and Department of Environment following consultation.

With the Parks and Recreation Reserve protecting the most environmentally significant elements of Stakehill Swamp, the primary consideration in a future amendment, is the need to specifically consider specific planning controls for the:

- Wetland Protection Area outside of the proposed MRS reserve; and
- Balance Rural areas in the study area.

The Wetland Protection Area represents a direct buffer to the Stakehill Swamp Reserve and needs to be protected from incompatible land uses. Because of the environmental sensitivities associated with the Area and its wetland buffer function, it warrants a high degree of land use and planning control to ensure that the use and management of this area is compatible with the protection of the MRS reserve area.

It is therefore important that the amendment specifically identifies and incorporates appropriate controls for the Wetland Protection Area. If the land in the study area is to proceed for rural residential purposes, this may occur by way of being incorporated as part of a future Subdivision and Development Guide Plan, which is incorporated into the Scheme as part of a rural residential rezoning. The latter approach is presently utilised by the City of Rockingham in other Rural Residential subdivisions in the locality. The Subdivision and Development Guide Plan is intended to replace the reference to Rural Concept Plan under Council's Rural Land Strategy, and be developed as part of proposed changes to the zoning of the land. The specific measures and methodology are subject to further consideration but is likely to entail consideration of such management measures as development of land, drainage and filling, use of bores, grazing of animals, clearing controls and use of chemicals.

Consideration will also be required for land which is either wholly or substantially contained within the proposed MRS reservation and Wetland Protection Area, east of the Jarvis Road. This environmental assessment has reaffirmed the environmental sensitivity associated with this land. Accordingly, it is necessary in the absence of reservation of these landholdings, to provide further consideration as to the availability or otherwise of reasonable economic uses on these properties, given the high degree of environmental constraint.

Similarly, consideration will also need to be given for land east of the Jarvis Road that is not wholly or substantially contained within the Wetland Protection Area. This land is located at the northern end of Jarvis Road and will be effectively surrounded by reservation and management areas on all of its boundaries. Accordingly, specific consideration of uses for this area will also need to consider the appropriateness of access and fire control depending on the nature of uses allowable.

For the balance areas outside of the proposed MRS reserve and Wetland Protection Area, consideration will need to be given to ensure that future uses are compatible with the objective of protecting the environmental attributes of the proposed reservation. As noted previously, the present Rural zoning permits a range of land uses that have the potential to adversely impact the area under reservation. Should the area proceed to a Rural Residential or similar zoning, such changes in land use should be subject to the inclusion of appropriate management and land use controls within an amendment to the City of Rockingham's Town Planning Scheme.

The specific provisions will need further planning consideration but should include the important matters mentioned earlier including rural residential lot size and pattern, land capability, effluent disposal, landscape attributes, fencing, fire management, accommodation of existing land uses, the identification of building envelopes, access arrangements, setbacks and management requirements for the Wetland Protection Area.

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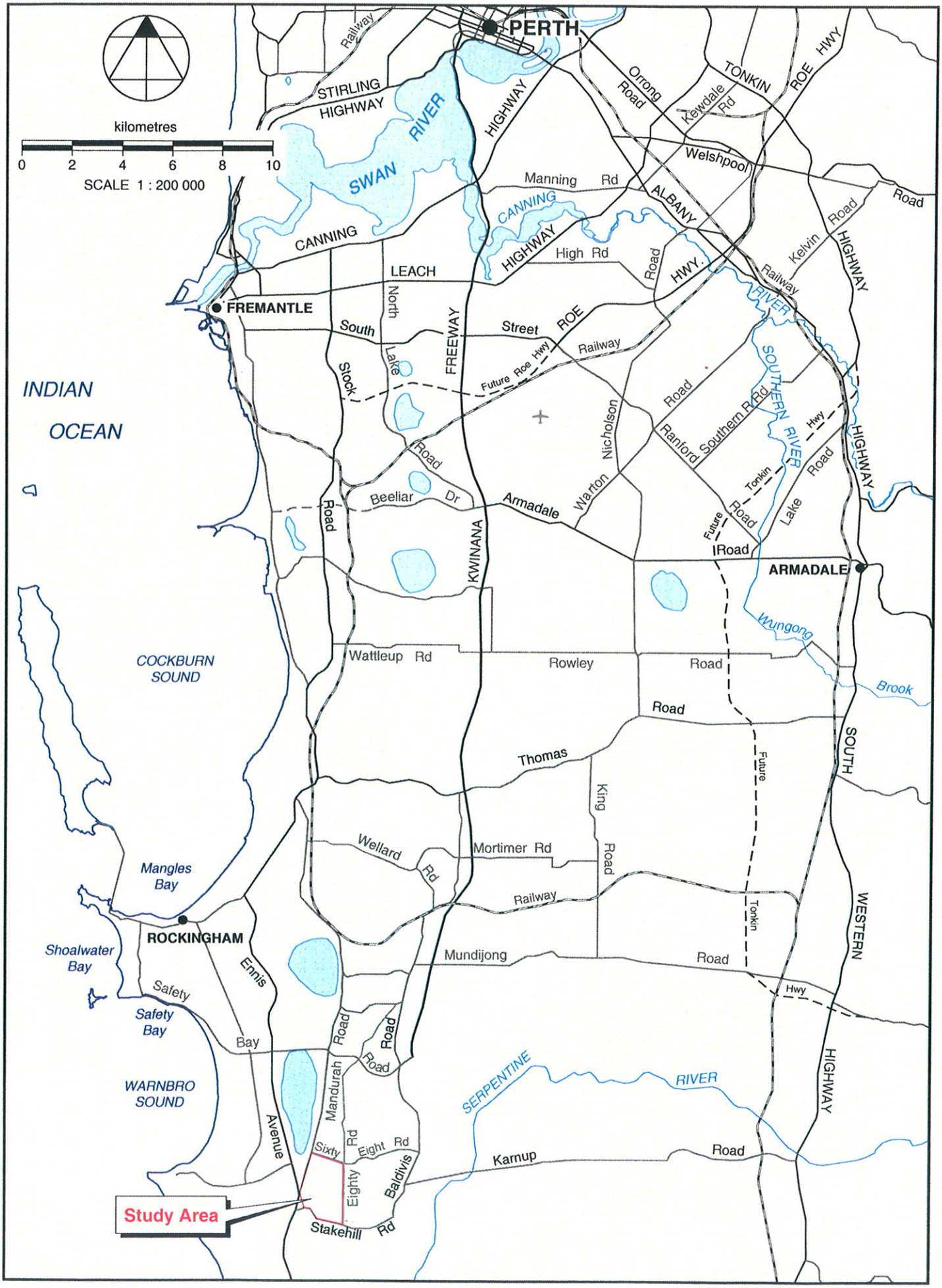
FIGURES



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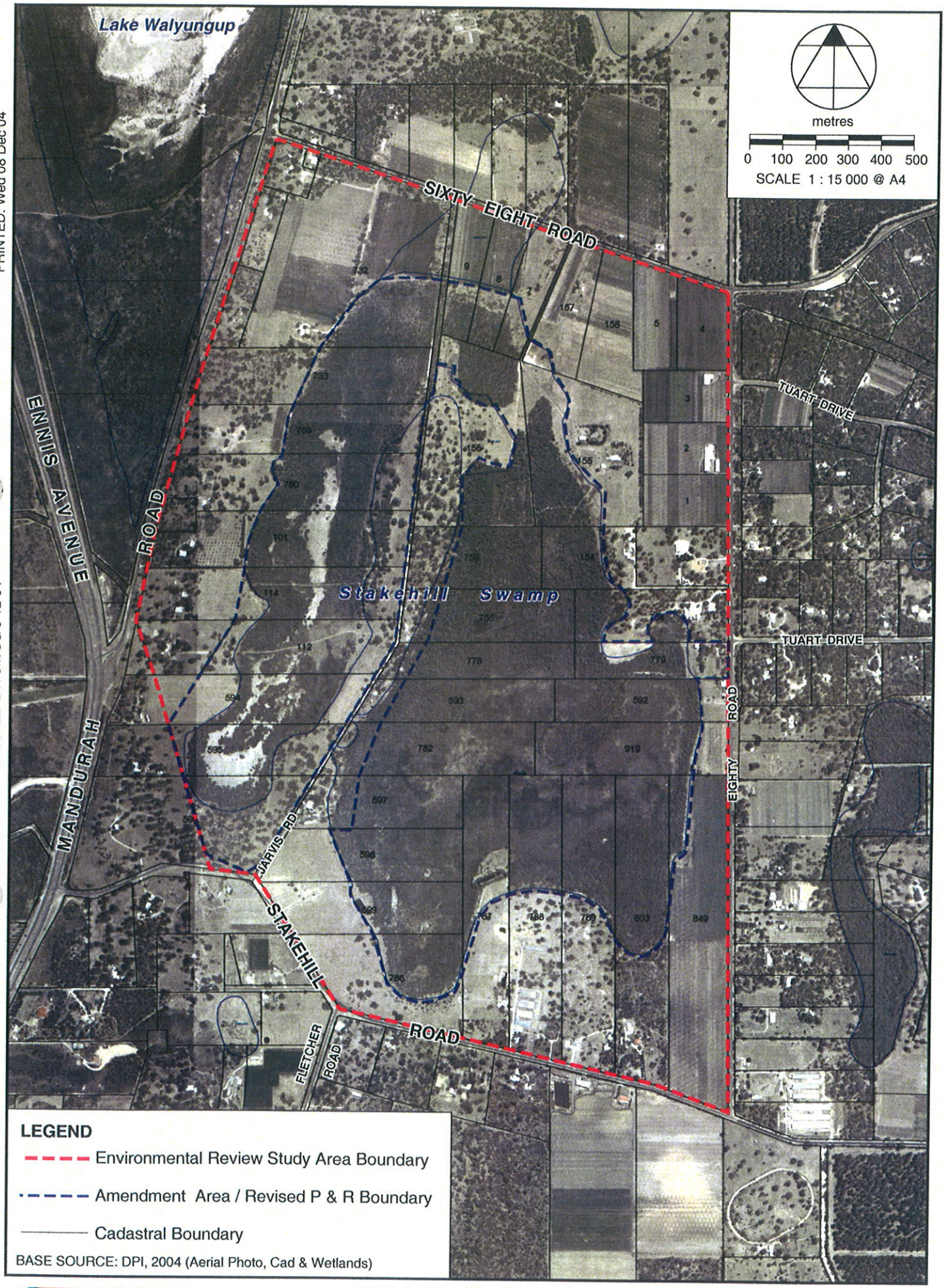
MRS AMENDMENT 1050/33, STAKEHILL SWAMP, BALDIVIS
ENVIRONMENTAL REVIEW

REGIONAL LOCATION

FIGURE 1



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MRS AMENDMENT 1050/33, STAKEHILL SWAMP, BALDIVIS
ENVIRONMENTAL REVIEW

AMENDMENT AREA

FIGURE 2

PRINTED: Wed 08 Dec 04
CHECKED BY:: SM/SG 8-12-04
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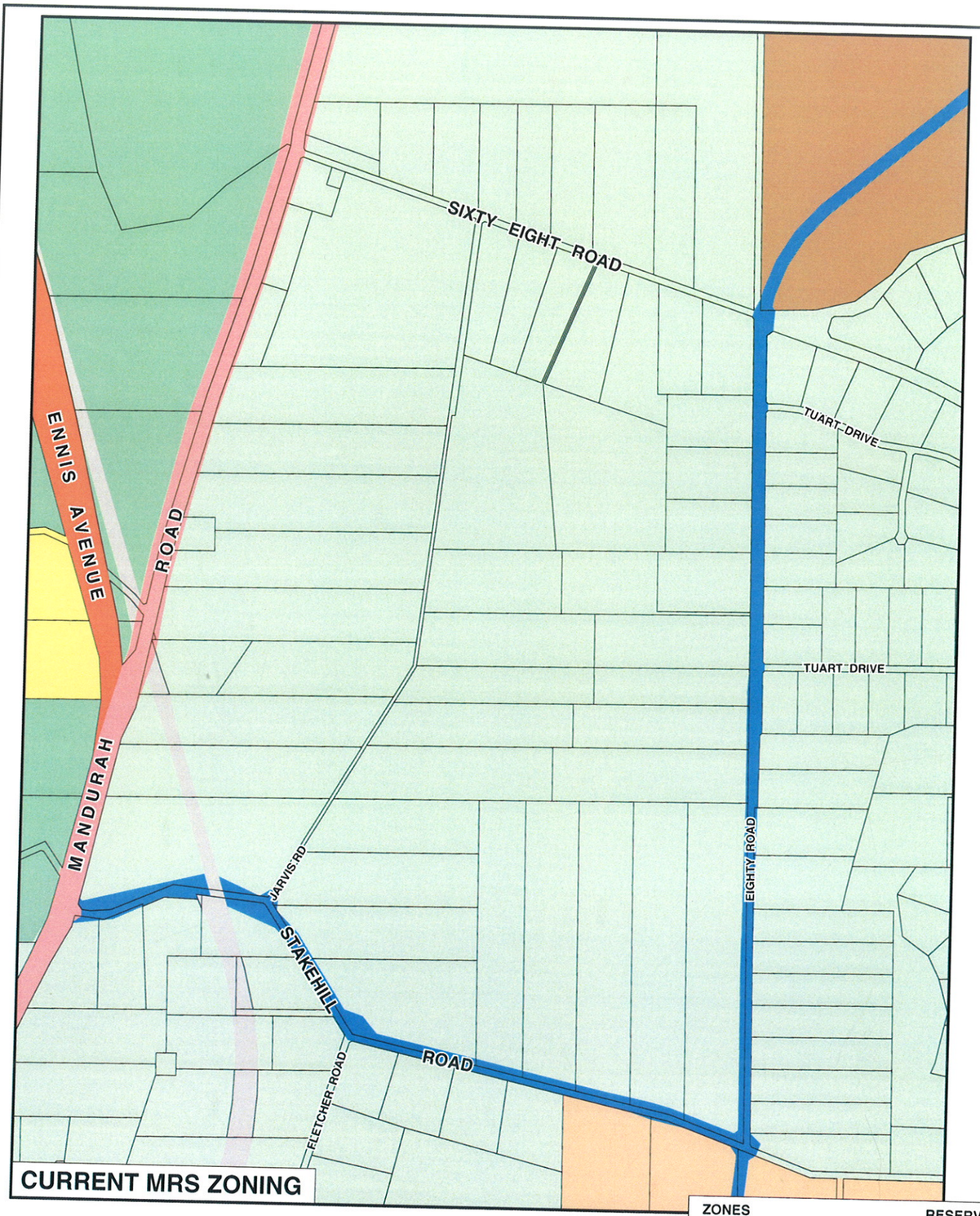
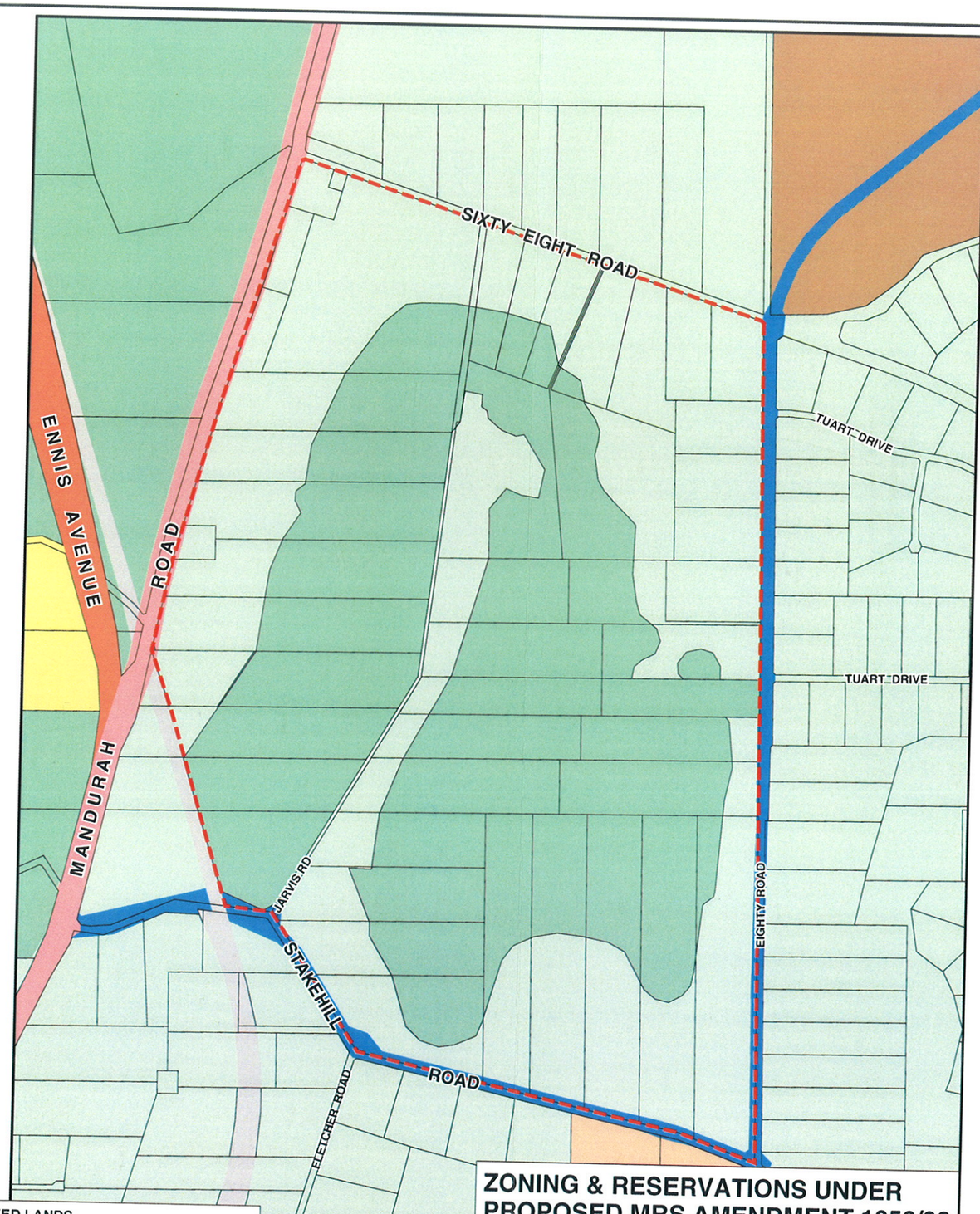
DATUM: MGA (Current Map only)
DPI-2004-003/24_75F3.dgn



CURRENT MRS ZONING



ZONING & RESERVATIONS UNDER PROPOSED MRS AMENDMENT 1050/33

Environmental Review Study Area Boundary

metres
0 100 200 300 400 500
SCALE 1 : 15 000 @ A3

MRS SOURCE: DPI, 2000

ZONES
- URBAN
- URBAN DEFERRED
- RURAL

RESERVED LANDS
- PARKS & RECREATION
- PUBLIC PURPOSES
- RAILWAYS

ROADS
- CONTROLLED ACCESS HIGHWAYS
- OTHER MAJOR HIGHWAYS
- IMPORTANT REGIONAL ROADS

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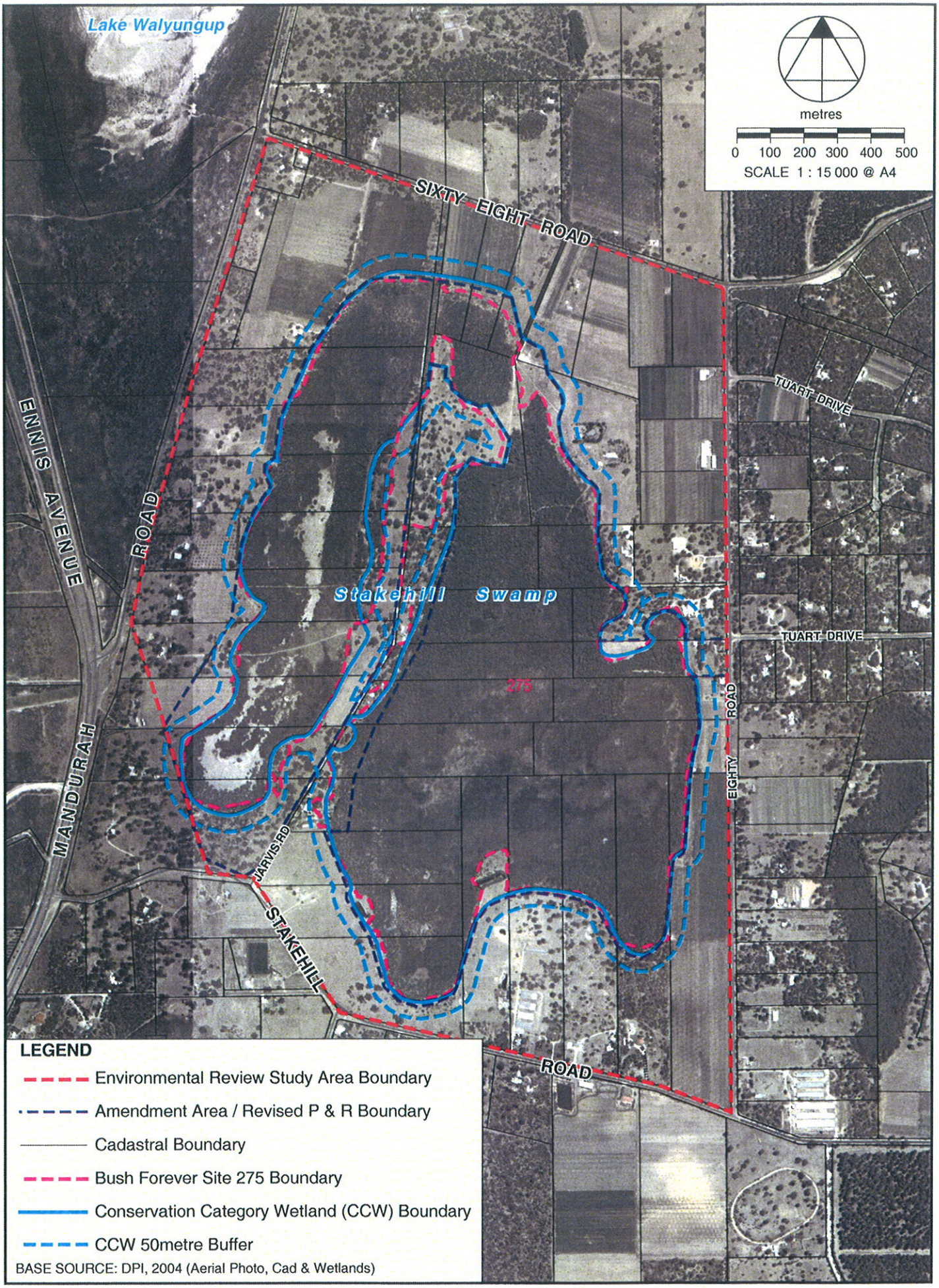
MRS AMENDMENT 1050/33, STAKEHILL SWAMP, BALDIVIS
ENVIRONMENTAL REVIEW

CURRENT MRS & ZONINGS & RESERVATIONS UNDER PROPOSED MRS AMENDMENT1050/33

FIGURE 3



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MRS AMENDMENT 1050/33, STAKEHILL SWAMP, BALDIVIS
ENVIRONMENTAL REVIEW
CONSERVATION SIGNIFICANCE OF AMENDMENT AREA
FIGURE 4

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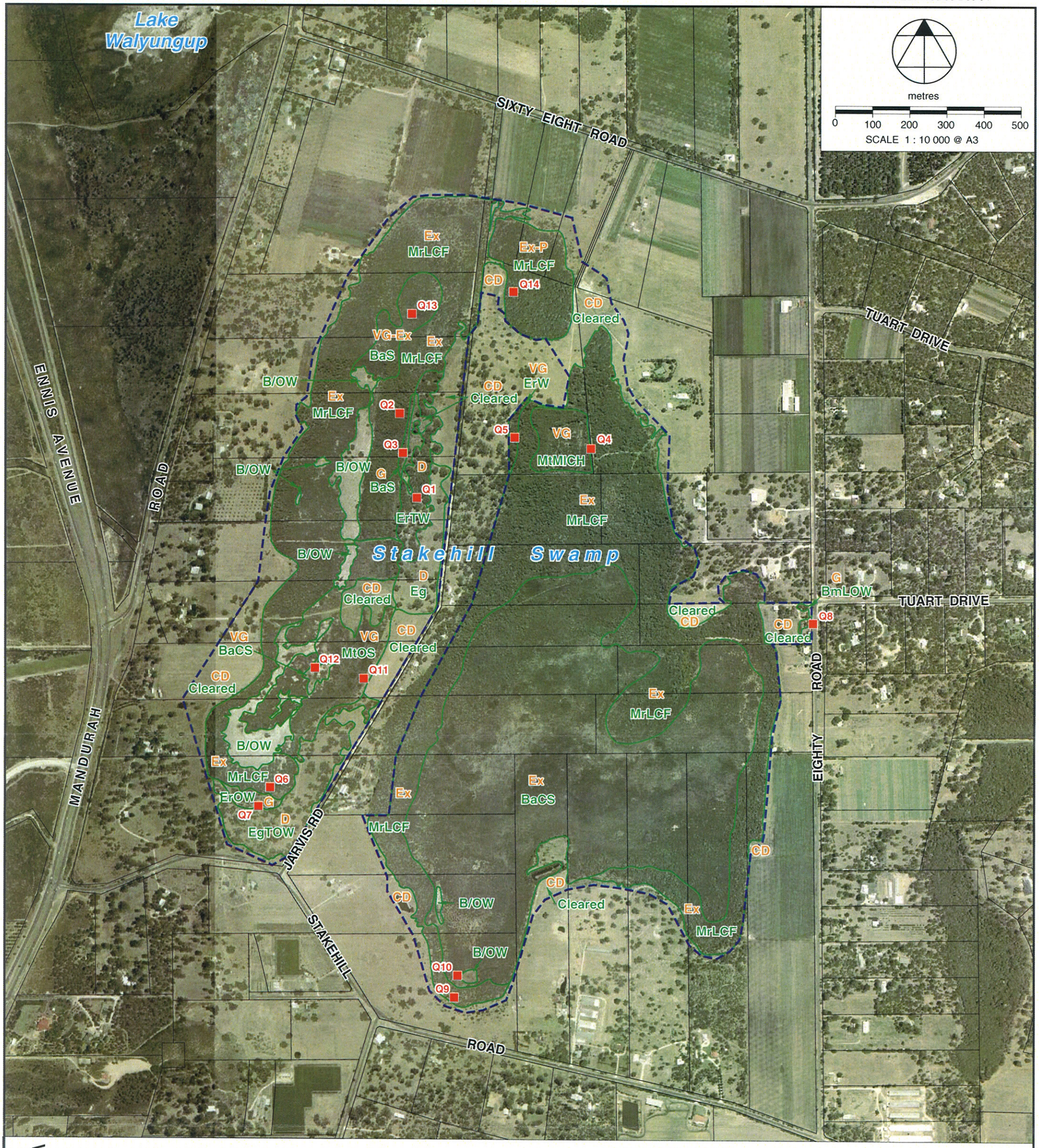

VEGETATION ASSOCIATIONS & CONDITION
FIGURE 5

MRS AMENDMENT 1050/33
STAKEHILL SWAMP, BALDIVIS
ENVIRONMENTAL REVIEW

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LEGEND

- Amendment Area / Revised P & R Boundary
- Cadastral Boundary
- Vegetation Association Boundary
- Q1 Flora Sampling Quadrat (10 x 10m)

VEGETATION ASSOCIATIONS

MrlCF	*Melaleuca rhaphiophylla* Low Closed Forest
ErTW	*Eucalyptus rudis* Tall Woodland
EgTOW	*Eucalyptus gomphocephala* Tall Open Woodland
ErW	*Eucalyptus rudis* Woodland
ErOW	*Eucalyptus rudis* Open Woodland
BmLOW	*Banksia menziesii* Low Open Woodland
Eg	Scattered *Eucalyptus gomphocephala*
MtOS	*Melaleuca teretifolia* Open Shrubland
MtmICH	*Melaleuca teretifolia* & *Melaleuca lateritia* dominated Closed Heath
BaCS	*Baumea articulata* Closed Sedgeland
BaS	*Baumea articulata* Sedgeland
B/OW	Bare ground with open water during portion of the year

BASE SOURCE: DP1, 2004 (Aerial photo, Cadastra)

VEGETATION CONDITION (SOURCE: BUSH FOREVER Govt. of W.A., 2000)

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

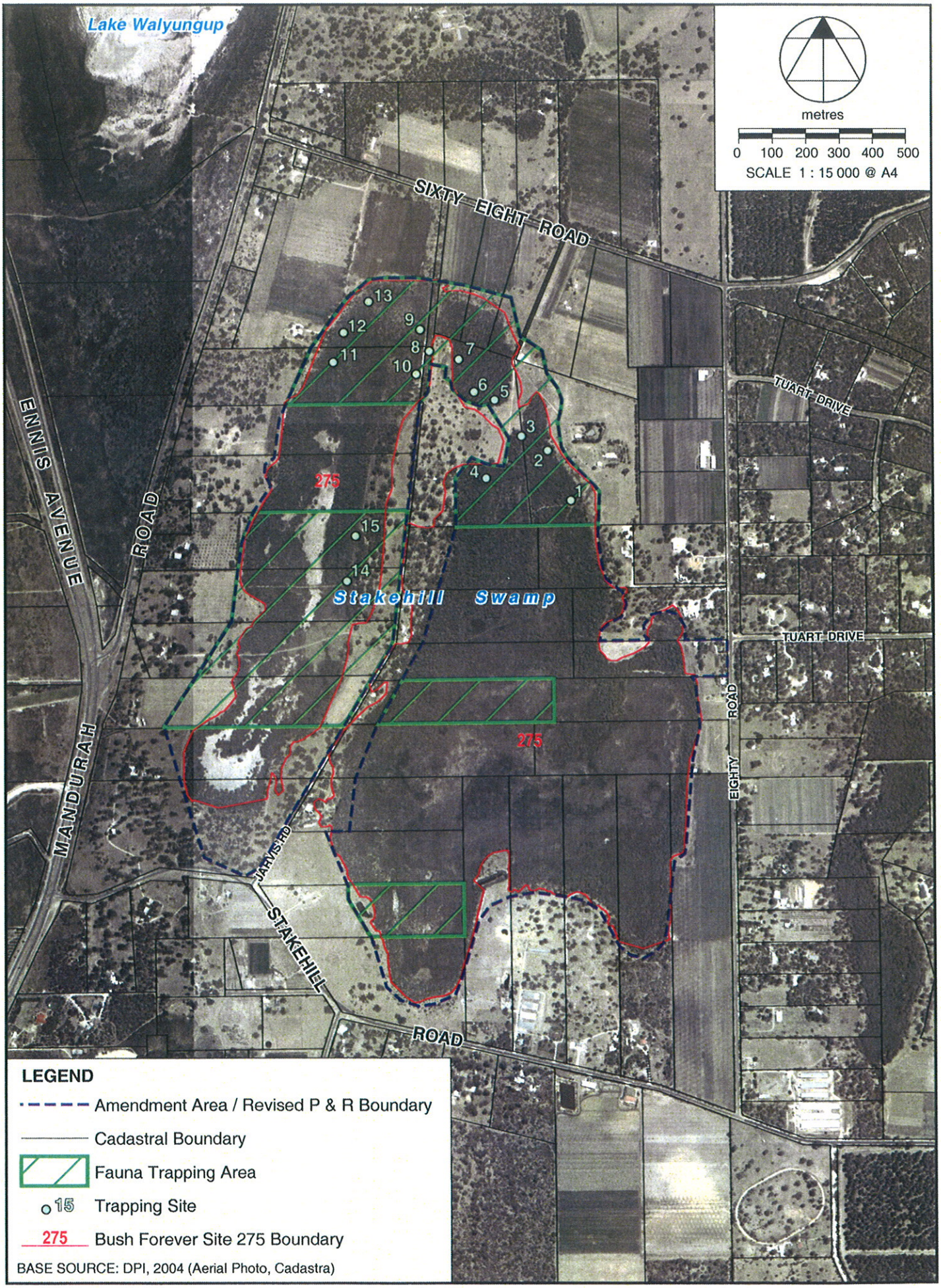
Ex Excellant
Vegetation structure intact, disturbance affecting individual species and weeds are non aggressive species.

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 it. 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.

D 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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MRS AMENDMENT 1050/33, STAKEHILL SWAMP, BALDIVIS
ENVIRONMENTAL REVIEW

LOCATION OF FAUNA SAMPLE SITES

FIGURE 6

DPI-2004-003/24_75f7.dgn DATUM: MGA DRAWN BY: TE/GLM 8-12-04 CHECKED BY: SM/SG 8-12-04

PRINTED: Wed 08 Dec 04

metres

0 100 200 300 400 500

SCALE 1 : 10 000 @ A3

Lake Walyungup

SIXTY EIGHT ROAD

TUART DRIVE

ENNIS AVENUE

MANDURAH ROAD

Stakehill Swamp

275

JARVIS ROAD

STAKEHILL ROAD

EIGHTY ROAD

TUART DRIVE

LEGEND

- Amendment Area / Revised P & R Boundary
- Cadastral Boundary
- Bush Forever Site 275 Boundary
- Conservation Category Wetland (CCW) Boundary
- CCW 50metre Buffer
- Wetland Protection Area

BASE SOURCE: DPI, 2004 (Aerial Photo, Cad & Wetlands)

ATA Environmental
environmental scientists

MRS AMENDMENT 1050/33
STAKEHILL SWAMP, BALDIVIS
ENVIRONMENTAL REVIEW

WETLAND PROTECTION AREA

FIGURE 7

PLATES

Plate 1 - *Eucalyptus rudis* Tall Woodland

Plate 2 - *Eucalyptus rudis* Woodland

ATA Environmental
environmental scientists

Plate 3 - *Eucalyptus rudis* Open Woodland

Plate 4 - *Melaleuca rhaphiophylla* Low Closed Forest

ATA Environmental
environmental scientists

Plate 5 - *Baumea articulata* Sedgeland

Plate 6 - *Baumea articulata* Sedgeland

ATA Environmental
environmental scientists

Plate 7 - *Baumea articulata* Closed Sedgeland

Plate 8 - *Melaleuca teretifolia* and *Melaleuca lateritia* dominated Closed Low Heath

Plate 9 - *Eucalyptus gomphocephala* Tall Open Woodland

Plate 10 - *Banksia menziesii* Low Open Woodland

Plate 11 - *Melaleuca teretifolia* Open Shrubland

APPENDICES

APPENDIX 1

ENVIRONMENTAL PROTECTION AUTHORITY
ENVIRONMENTAL REVIEW INSTRUCTIONS

ENVIRONMENTAL ASSESSMENT OF PLANNING SCHEMES AND THEIR AMENDMENTS

Metropolitan Region Scheme Amendment 1050/33

Stakehill Swamp Baldivis

ENVIRONMENTAL REVIEW INSTRUCTIONS

1. Introduction

The *Environmental Protection Act 1986* sets out that where a planning scheme, or an amendment to a scheme, is judged to have a significant environmental impact it will be subject to an assessment by the Environmental Protection Authority (EPA) under Section 48A of the Act. These schemes/amendments are being assessed because they raise significant environmental factors.

Where a scheme/amendment is subject to an assessment by the EPA, the Responsible Authority is required to produce an Environmental Review addressing the environmental factors relevant to the scheme/amendment. The EPA issues instructions for the scope and content of the Environmental Review. Below are the instructions for the above Metropolitan Region Scheme (MRS) amendment.

The Environmental Review is then made publicly available with the amendment document to enable members of the public and relevant agencies to comment on the possible environmental impacts of the scheme/amendment. Additional information on the purpose and functions of environmental assessment of a scheme amendment is given in Attachment 1.

The scheme that is the subject of this assessment is called **MRS Amendment 1050/33 Stakehill Swamp, Baldivis**.

A map showing the location of the amendment is shown as Attachment 2.

2. Instructions

2.1 Status of the instructions

The EPA, in its formulation of the instructions, endeavours to come to an agreement with the Responsible Authority and any other involved agency about the scope and content of the Environmental Review document. The EPA Service Unit provides services and facilities for the EPA. In many cases the EPA Service Unit will act for the EPA.

Other parties may also have a view about the contents of the instructions. To accommodate this additional input the instructions are subject to appeal to the Minister for the Environment.

Where an appeal is lodged and upheld the Chairman of the EPA will issue the final instructions, consistent with the appeal decision. Where no appeals are received or all appeals are dismissed, this document is the final instructions for the preparation of the Environmental Review.

2.2 General information

The fundamental requirements of the Environmental Review document are to:

a) describe the state of the environment affected by the scheme, indicating at least the scheme area and its immediate surroundings;

b) describe the purpose of any zoning or reservation;

c) identify those environmental factors which should be considered in relation not only to the scheme being assessed but also to later levels of planning, such as subdivision and development;

d) identify those environmental factors which require alternative procedures or processes to address any requirements for on-going long-term management;

e) for those environmental factors not relevant to the scheme being assessed, describe the process (approvals and the like) necessary to address those factors later, including likely referral to the EPA; and

f) for those factors relevant to the scheme being assessed, describe the extent to which the environment could be protected from both direct and indirect impacts, including:

- identifying the portions of the environment of highest conservation value and describing how the scheme plans to protect them;
- listing those land-uses that will be permitted without further environmental approval being required under proposed zoning;
- predicting the potential environmental impacts of these land uses;
- describing the scheme provisions which will allow management of those impacts to ensure the environment is protected to an acceptable level in the best manner possible; and
- identifying potential conflicts of land uses having environmental implications and how the environmental impacts are to be managed.

The Environmental Review document should consist of sections that deal with the above requirements. The recommended format for the Environmental Review document is enclosed as Attachment 3.

An important aspect of the environmental impact assessment process is the review by the public. The EPA wants to receive public input into the possible environmental impacts of this scheme and its implementation. To facilitate adequate public input, the Environmental Review should be made available as widely as possible and at a reasonable cost.

Attachment 4 contains:

1. a list of agencies and persons who should receive free copies of the Environmental Review (including EPA members);
2. a list of places where the Environmental Review should be made available for public viewing;
3. recommended cost of the Environmental Review; and
4. methods for advertising the availability of the Environmental Review.

2.3 Environmental factors relevant to this scheme and deferred environmental factors

The EPA, following consideration of the factors related to the scheme, is likely to identify some key factors which need to be given special attention and which should form the principal basis of the EPA assessment report to the Minister for the Environment. These key factors are termed the "environmental factors relevant to the scheme".

The EPA has also identified other environmental factors which it considers to be relevant to the scheme but are likely to be best addressed at a later level of planning. These factors are considered to be significant enough to warrant attention as part of the environmental review of this scheme to the extent that the Responsible Authority should show how these factors could be addressed at a later level of planning. These factors are called "deferred environmental factors". *Note: no deferred factors have been identified for this amendment.*

The EPA, in consultation with the Responsible Authority and the relevant agencies, has identified a list of factors likely to be found to be the "environmental factors relevant to the scheme" and those likely to be found to be "deferred environmental factors". This list is provided to assist with the preparation of the Environmental Review document, but during the course of the preparation of the document other factors may be found also to be relevant, and they should be included in the detailed discussion.

A copy of the form used to identify the environmental factors (the "filtering form") is included as Attachment 5.

2.4 General Scope of the Environmental Review - Limit of the Environmental Review

The scheme amendment has been initiated to:

- rezone Stakehill Swamp, Baldivis to *Parks and Recreation* in the MRS.

Environmental factors relevant to the scheme

The EPA has identified some environmental factors which are relevant to the scheme area and should be addressed in the Environmental Review document. These factors are listed below (see Table 1).

Table 1: Environmental factors relevant to the scheme

CONTENT		SCOPE OF WORK	
Factors	**Site specific factor**	**Work required for the environmental review**	**Additional comments**
Regionally significant wetland	Stakehill Swamp Conservation Category Wetland *Environmental Protection (Swan Coastal Plain lakes) Policy 1992* Bush Forever site 275	*How is the wetland identified in Bush Forever and the Environmental Protection (Swan Coastal Lakes) Policy 1992 going to be protected and managed by the proposed amendment using appropriate buffers and wetland management plans?* Appropriate buffer widths around the wetland area should be identified to protect the characteristics and conservation values of the wetland and the riparian vegetation. The basis for the proposed buffer widths should be described with reference to existing policies and through liaison with the Bush Forever Office of DPI, WRC and DoE. The Environmental Review should describe the contents and requirements of a wetland management plan to manage likely impacts on the wetland, riparian vegetation and fauna habitat.	In identifying an appropriate buffer to protect the wetland and riparian vegetation, attention should be given to what management measures are proposed to regulate adjacent land uses that may impact the values of the wetland.

Vegetation	Vegetation Complexes & Vegetation Communities, Floristic and Threatened Ecological Communities and Declared Rare or Priority Flora	*What are the values of the Vegetation Complexes and Vegetation Communities in a local and regional context?* Identify the Vegetation Complex and Vegetation Community types as well as any Threatened Ecological Communities (TEC), Declared Rare or Priority Flora (DRF) species present and Floristic Communities and discuss their representation in existing conservation reserves and how they will be protected by the proposed amendment.	Undertake appropriate field surveys to determine the existing type and representation of the vegetation on site, including TEC's & DRF. Provide details of potential impacts from the proposal and how they will be addressed. *In accordance with the methodology and criteria used in Bush Forever.*
Fauna	Specially Protected, Threatened or Priority Fauna Species	*What are the fauna values of the site?. If fauna habitats are present, are Specially Protected (Threatened) Fauna present?* Assess the presence and distribution of fauna communities and significant bird species (as identified in *Bush Forever*). As mentioned above particular attention should be directed to the provision of adequate buffers around the wetland and surrounding riparian vegetation to protect the riparian vegetation and habitat values.	Undertake a suitable field survey to determine the existing abundance, species diversity and geographic distribution of terrestrial fauna, including Specially Protected (Threatened) Fauna. Provide details of potential impacts from the proposal and how they will be addressed. *In accordance with the methodology and criteria used in Bush Forever.*

2.6 Deferred environmental factors

None identified.

Attachment 1

Information on the purposes and functions of the environmental assessment of schemes and their amendments

Purpose of the environmental assessment

The purpose of an environmental assessment is to ensure that the scheme takes proper account of the relevant environmental factors. To do this the EPA reports to the Minister for the Environment on the environmental factors relevant to the scheme, recommends environmental conditions under which the scheme may operate and provides other recommendations as it sees fit.

Functions of an Environmental Review

The primary function of the Environmental Review is to provide information about the environmental factors related to the proposed scheme to the EPA to enable it to evaluate the significant effect on the environment of the scheme and provide independent environmental advice to Government.

An additional function of the document is to clearly communicate details of the proposed scheme and its future implications to the public so that the EPA can obtain informed public comment on relevant environmental factors and their areas. Effective public information and involvement is an essential part of environmental impact assessment.

These instructions are issued to assist in identifying matters that should be addressed within the Environmental Review document. However, other relevant matters may arise during the preparation of the environmental review document and these should also be included.

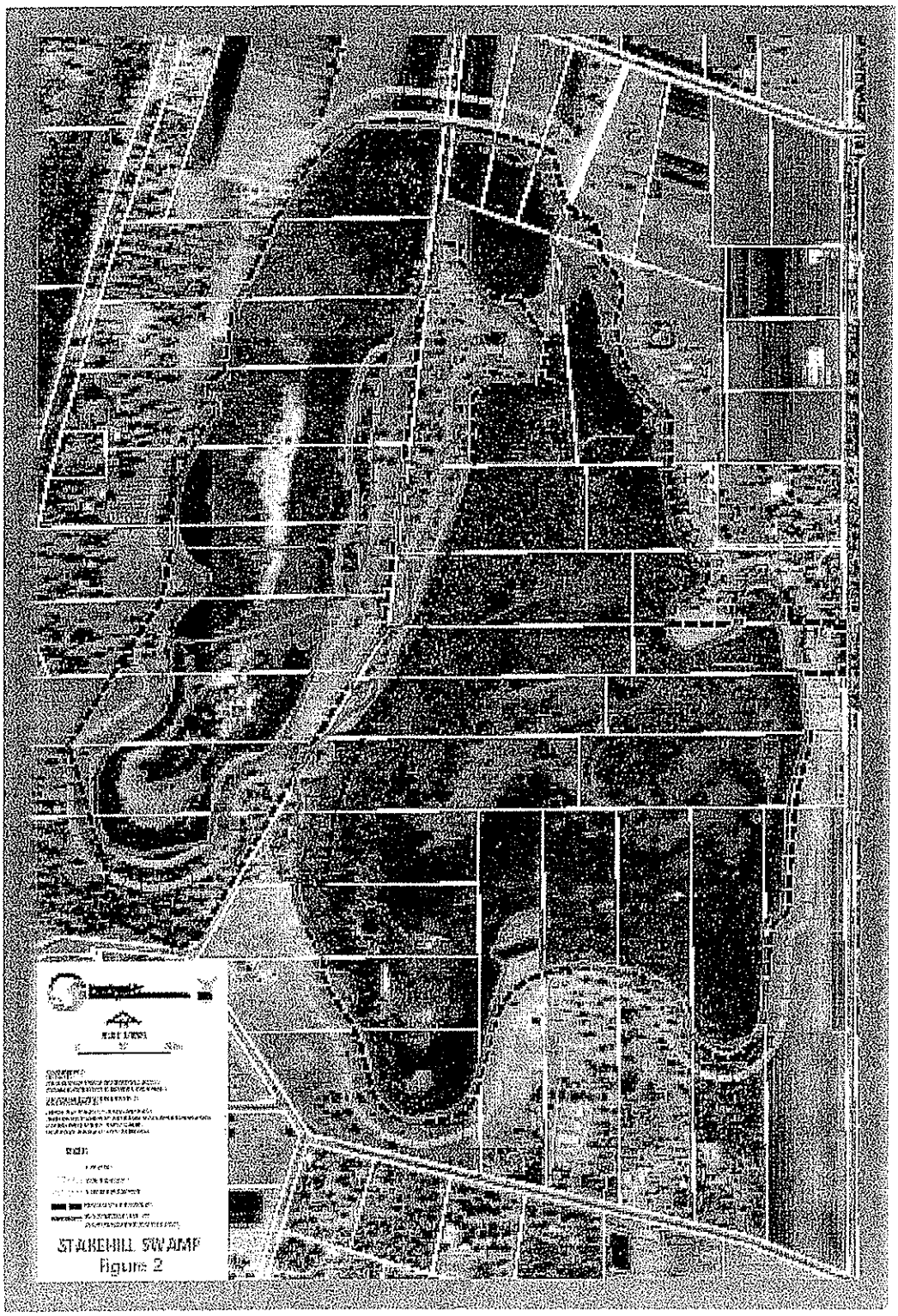
The Environmental Review document will be made publicly available during the advertised period for the scheme and submissions from other agencies and the public will be sought. The Responsible Authority is required to forward submissions relating to the Environmental Review to the EPA and respond to the EPA on environmental factors or conditions and procedures which may apply should the proposal be implemented that are raised in those submissions. Based on the information in the Environmental Review document, the response to submissions and its own investigations the EPA will then report to the Minister for the Environment.

Please note:

Statements of fact, conclusions or theories used to justify arguments should be substantiated and supported by technical work undertaken to prepare the Environmental Review. In addition, statements of fact, conclusions and arguments should be based on information that has a high degree of scientific certainty. Where these are not met the EPA will provide advice consistent with the precautionary principle.

Attachment 2

Location of Scheme/amendment



Attachment 3

Environmental Review Document Structure

The legislation requires that the Environmental Review Document be part of the amendment documentation. For our purposes it would be useful for it to be a separate volume, perhaps an appendix to the amendment document.

The following structure is suggested:

1. How to make a submission

- Include a standard sheet to guide the reader how to make a submission.

2. Introduction

- Clarify who is the Responsible Authority.
- Provide a paragraph or two to explain the background to the Environmental Review document and the process to date (see recent examples of Environmental Reviews) eg the Environmental Review Document is prepared in accordance with S48A of the *Environmental Protection Act 1986*; the Environmental Review Document should be read in conjunction with the amendment document.
- Refer the reader to a process flow chart, probably from the *Planning for People* document, which could be Appendix A1.

3. Summary of Amendment

- Should include a brief description of scheme / amendment and its purpose.
- Cross reference to the amendment document, particularly the scheme text / provisions, wherever possible.
- Include a clear location map and any other figures to describe the amendment.

4. Environmental Factors Relevant to the Scheme

These factors will be specified by the EPA in the final instructions. Each factor should be addressed using the following format:

4.1 Environmental factor:

- Provide background on the current state of the environment.
- Discuss any polices relevant to the environmental factor.

Preliminary EPA objective / proposed alternative objective

- The EPA objectives for each environmental factor will be provided to the Responsible Authority following the issuing of the final instructions.

Potential impacts

- This section should outline the potential impacts that could result from the implementation of the scheme / amendment.

Proposed management

- How the scheme / amendment, provisions or zoning pattern address the impacts on environment.
- How scheme provisions will be implemented and how subsequent planning stages will address the impacts on the environment.

Proposed outcome

- Given the proposed management, can the EPA objective be met?
- On evaluation of the above (4.1.1 to 4.1.4) if it appears the EPA objective cannot be met this section provides the opportunity to offer an alternative objective and justify why the EPA should accept the alternative objective.

5. Deferred Environmental Factors (if applicable)

- These will have been identified in the instructions
- Alternatively, the document may argue why an environmental factor relevant to the scheme, as determined by the EPA, is considered to be a deferred factor.
- This section should largely follow the same format as Section 4.

6. Summary of scheme provisions

- This Section should reiterate the proposed management of the environmental factors (from section 4).

7. References

8. Glossary (if necessary)

Appendices

A1 Flow chart of process

A2 Instructions and objectives

A3 Other information

Attachment 4

Availability of Environmental Review

1. Copies for distribution free of charge

Supplied to DEP:

- Library / Information Centre 9
- EPA members and Executive Officer 6
- Officers of the DEP (Perth) 5

Distributed by the responsible authority to:

Libraries	• J S Battye Library ..... 3 • City of Rockingham Public Library ..... 4 (at least)
Government departments	• Department for Planning and Infrastructure ..... 4 • Water and Rivers Commission (Perth) ..... 2 • CALM 2
Other	• Conservation Council of WA ..... 1 • Stakehill Rural Landowner Action Group ..... 3 • As Responsible Authority thinks fit .....

2. Recommended cost

In general, Environmental Reviews for scheme amendments can be charged at $10 for the main document and $10 for appendices including postage. The EPA encourages the preparation of cd versions of Environmental Reviews to be made available free of charge on request.

3. Advertising

The responsibility for advertising the release and availability of an Environmental Review resides with the responsible authority and is done at their expense under the following guidelines:

Format and content
The format and content of the advertisement should be approved by the DEP before appearing in the media. The advertisement should be compatible with the model advertisement below.

Size
As a guide, the size of the advertisement should be 2 newspaper columns (approximately 10 cm) wide by approximately 14 cm long. Dimensions less than these would be difficult to read.

Location

For Town Planning Schemes the approved advertisement should appear in the news section of the main local newspaper.

Model advertisement

Scheme Title

Environmental Review
(Public Review Period: *date* to *date*)

The WAPC have resolved to initiate *Scheme Title* for the purposes of...

An Environmental Review (ER) has been prepared by *the proponent* to examine the environmental impacts associated with the implementation of the proposed scheme/amendment, in accordance with Western Australian Government procedures. The ER describes the scheme/amendment, examines the likely environmental impacts if implemented and the puts forward proposed environmental management procedures.

The proponent has prepared a project summary which is available free of charge from Responsible Authority Name and Contact Details

Copies of the Environmental Review may be purchased for $X from: Responsible Authority Name and Contact Details

Copies of the complete Environmental Review will be available for examination at:

- Department of Environment
  Library Information Centre
  8th Floor, Westralia Square
  141 St Georges Tce
  PERTH WA 6000
- LGA Council Office
- LGA Library

Submissions on this scheme/amendment are invited by the closing date, especially in electronic format where they can be emailed to: project.officer@dpi.wa.gov.au
OR addressed and posted to:
Responsible Authority
Address 1
Attention:

If you have any questions on how to make a submission, please ring the EPA Service Unit project officer Rachael Mercy on (08)9222 7086, or Responsible Authority Name on (08) 9XXX XXXX.

Attachment 5

Form used to Identify the Environmental Factors (The "Filtering From")

A copy can be obtained from:

Brett Knight
Department for Planning and Infrastructure
Marine House
1 Essex Street
Fremantle, WA 6160
Ph: (08) 9216 8905
Fx: (08) 9216 8995

APPENDIX 2

FLORA LIST
STAKEHILL SWAMP, BALDIVIS

APPENDIX 2
FLORA LIST – STAKEHILL SWAMP

FAMILY	SPECIES
GYMNOSPERMA	
CYCADACEAE	*Macrozamia fraseri*
MONOCOTYLEDONS	
ASPARAGACEAE	**Myrsiphyllum asparagoides*
CYPERACEAE	*Baumea articulata* *Baumea juncea* **Gahnia trifida* *Lepidosperma longitudinale* *Lepidosperma gracile* *Lepidosperma tenue*
DASYPOGONACEAE	*Acanthocarpus preissii*
JUNCACEAE	*Juncus kraussii*
POACEAE	**Cortaderia selloana* **Ehrharta calycina* **Cynodon dactylon* **Poa annua* **Pennisetum clandestinum*
RESTIONACEAE	*Desmocladus flexuosus*
XANTHORRHOEACEAE	*Xanthorrhoea preissii*
DICOTYLEDONS	
ASTERACEAE	**Hypochaeris glabra* **Senecio vulgaris* **Sonchus oleraceus* **Taraxacum officinale*
ASCLEPIADACEAE	**Gomphocarpus fruticosus*
CASUARINACEAE	*Allocasuarina fraseriana*
EUPHORBIACEAE	*Phyllanthus calycinus*
LAURACEAE	*Cassytha racemosa*
MIMOSACEAE	*Acacia saligna*

FAMILY	SPECIES
MYRTACEAE	*Eucalyptus gomphocephala* *Eucalyptus rudis* *Melaleuca lateritia* *Melaleuca rhaphiophylla* *Melaleuca preissiana* *Melaleuca teretifolia*
OLEACEAE	**Olea europaea*
PAPILIONACEAE	*Jacksonia furcellata* **Lupinus cosentinii* **Trifolium campestre* *Viminaria juncea*
PRIMULACEAE	**Anagallis arvensis*
PROTEACEAE	*Banksia attenuata* *Banksia menziesii*
RANUNCULACEAE	*Clematis pubescens*
RHAMNACEAE	*Spyridium globulosum*

* Introduced species

APPENDIX 3

STAKEHILL SWAMP FLORA QUADRAT DATA

QUADRAT Q1

Flooded Gum (*Eucalyptus rudis*) Tall Woodland. Degraded Condition

QUADRAT 1Q (10x10m)

SPECIES	% COVER	HEIGHT (M)
Eucalyptus rudis	60	20
Xanthorrhoea preissii	20	0.6
Macrozamia fraseri	<1	0.5
Pennisetum clandestinum	20	grass
Senecio vulgaris	<1	0.6

QUADRAT Q2

Paperbark (*Melaleuca rhaphiophylla*) Low Closed Forest over B*aumea **juncea*** Open Sedgeland. Excellent Condition

QUADRAT Q2 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Melaleuca rhaphiophylla	70	5
Baumea juncea	25	1
Baumea articulata	5	2
Eucalyptus rudis	<1	2
Lepidosperma tenue	<1	1
Clematis pubescens	<1	creeper

QUADRAT Q3

Baumea articulata Sedgeland. Good Condition

QUADRAT Q3 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Baumea articulata	70	0.6
Melaleuca rhaphiophylla	10	2
Eucalyptus rudis	10	2
Baumea juncea	5	0.6
**Pennisetum clandestinum*	5	grass

QUADRAT Q4

Melaleuca teretifolia/Melaleuca lateritia Closed Heath over *Baumea articulata* Sedgeland. Very Good Condition

QUADRAT Q4 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Melaleuca teretifolia	30	2
Melaleuca lateritia	20	2
Baumea articulata	40	2
Lepidosperma longitudinale	10	1.5

QUADRAT Q5
Eucalyptus rudis Woodland. Very Good Condition

QUADRAT Q5 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Eucalyptus rudis	40	20
Baumea articulata	50	1
**Asparagus asparagoides*	5	Creeper
Viminaria juncea	0.5	3
**Olea eurpaea*	2	1
Poa annua	Grass	1

QUADRAT Q6

Melaleuca rhaphiophylla Low Closed Forest. Excellent Condition

QUADRAT Q6 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Melaleuca rhaphiophylla	60	5
Gahnia trifida	40	1
**Asparagus asparagoides*	<1	Creeper

QUADRAT Q7

Eucalyptus rudis Open Woodland. Good Condition

QUADRAT 7 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Eucalyptus rudis	40	20
Acacia saligna	30	1.5
**Asparagus asparagoides*	5	Creeper
**Poa annua*	10	Grass
**Cynadon dactylon*	10	Grass
**Ehrharta calycina*	2	Grass
**Lupinus consentii*	2	10

QUADRAT Q8

Banksia menziesii Low Open Woodland. Good Condition

QUADRAT 8 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Banksia menziesii	60	5
Allocasuarina fraseriana	2	1.5
Jacksonia furcellata	3	1.5
Ehrharta calycina	35	Grass
Lupinus consentii	<1	10

QUADRAT Q9

Melaleuca rhaphiophylla Low Closed Forest. Excellent Condition

QUADRAT 9 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Melaleuca rhaphiophylla	90	5
Baumea articulata	10	1

QUADRAT Q10

Baumea articulata Closed Sedgeland. Excellent Condition

QUADRAT 10 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Baumea articulata	100	2

QUADRAT Q11

Melaleuca teretifolia Open Shrubland. Very Good Condition

QUADRAT 11 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Melaleuca teretifolia	60	5
Viminaria juncea	5	3
Lepidosperma tenue	25	0.5
Gahnia trifida	25	1
Poa annua	25	grass

QUADRAT Q12

Baumea articulata Closed Sedgeland. Very Good Condition

QUADRAT 12 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Baumea articulata	80	1.5
**Senecio vulgaris*	10	1.5
Lepidosperma tenue	4	01
**Gomphocarpus fruticocus*	5	1.5
**Poa annua*	1	grass

QUADRAT Q13

Baumea articulata Sedgeland. Very Good to Excellent

QUADRAT 13 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Baumea articulata	80	0.5
Melaleuca teretifolia	5	2
**Sonchus oleraceus*	10	1
**Hypochaeris glabra*	<1	0.1
Melaleuca rhaphiophylla	5	4

QUADRAT Q14

Melaleuca rhaphiophylla Low Closed Forest. Excellent to Pristine Condition

QUADRAT 14 (10x10m)

SPECIES	% COVER	HEIGHT (M)
Melaleuca rhaphiophylla	70	10
Gahnia trifida	10	1.5
Lepidosperma tenue	15	1
Baumea articulata	5	1
Cassytha sp.	<1	creeper

APPENDIX 4

SPECIES OF BIRD PREDICTED AND RECORDED AT STAKEHILL SWAMP, BALDIVIS

APPENDIX 4
SPECIES OF BIRD PREDICTED AND RECORDED AT STAKEHILL SWAMP, BALDIVIS

X represents birds that were present during the survey period.
* represents an introduced species.
E represents species listed under the *Environment Protection and Biodiversity Conservation Act* 1999.
EM represents migratory bird species listed under the *Environment Protection and Biodiversity Conservation Act* 1999.
S represents species listed on the Department of Conservation and Land Management's Scheduled Fauna list.
P represents species listed on the Department of Conservation and Land Management's Priority Fauna list.
BF1 represents species identified by Bushforever as being habitat specialists with a reduced distribution on the Swan Coastal Plain.
BF2 represents species identifed by Bushforever as wide-ranging species with reduced populations on the Swan Coastal Plain.

Acanthizidae (Thornbills, Gerygones, Whitefaces, Wrens)		
Broad-tailed Thornbill	*Acanthiza apicalis* BF1	X
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa* BF1	
Western Thornbill	*Acanthiza inornata* BF1	X
Western Warbler	*Gerygone fusca*	X
White-browed Shrubwren	*Sericornis frontalis* BF1	X
Weebill	*Smicrornis brevirostris* BF1	X
Accipitridae (Kites, hawks and eagles)		
Collared Sparrowhawk	*Accipiter cirrocephalus*BF2	X
Brown Goshawk	*Accipiter fasciatus fasciatus* BF2	X
Wedge-tailed Eagle	*Aquila audax* BF2	
Little Eagle	*Aquila morphnoides* BF2	
Swamp Harrier	*Circus approximans*	
Black-shouldered Kite	*Elanus caeruleus*	
Whistling Kite	*Haliastur sphenurus* BF2	X
Square-tailed Kite	*Hamirostra isura* BF2	
Aegothelidae (Frogmouths)		
Australian Owlet Nightjar	*Aegotheles cristatus*	
Anatidae (Ducks, geese and swans)		
Chestnut Teal	*Anas castanea*	
Grey Teal	*Anas gracilis*	
Blue-winged Shoveller	*Anas rhynchotis rhynchotis* BF1	
Pacific Black Duck	*Anas superciliosa*	
White-eyed Duck	*Aythya australis*	
Muck Duck	*Biziura lobata* BF1	
Australian Wood Duck	*Chenonetta jubata*	
Black Swan	*Cygnus atratus*	
Pink-eared Duck	*Malacorhynchus membranaceus* BF1	
Blue-billed Duck	*Oxyura australis* BF1	
Freckled Duck	*Stictonetta naevosa* BF2	
Australian Shelduck	*Tadorna tadornoides*	
Anhingidae (Darter)		
	Anhinga melanogaster novaehollandiae	
Apodidae (Swifts)		
Fork-tailed Swift	*Apus pacificus pacificus*	
Ardeidae (Herons, Egrets, Bitterns)		
Great Egret	*Ardea alba modesta*	
Cattle Egret	*Ardea ibis coromanda*	
White-faced Heron	*Ardea novaehollandiae*	X
White-necked Heron	*Ardea pacifica*	X
Australian Bittern	*Botaurus poiciloptilus*	
Little Egret	*Egretta garzetta*	
Rufous Night Heron	*Nycticorax caledonicus* BF2	
Artamidae (Woodswallows)		
Black-faced Woodswallow	*Artamus cinereus* BF2	
Dusky Woodswallow	*Artamus cyanopterus* BF2	

Masked Woodswallow	*Artamus personatus*	
Campephagidae (Cuckoo-shrikes)		
White-winged Triller	*Lalage tricolor*	
Caprimulgidae (Nightjars)		
Spotted Nightjar	*Eurostopodus argus*	
Casuariidae (Emu, Cassowaries)		
Emu	*Dromaius novaehollandiae*	
Charadriidae (Lapwings and plovers)		
Black-fronted Dotterel	*Charadrius melanops*	
Red-kneed Dotterel	*Erythrogonys cinctus*	
Banded Lapwing	*Vanellus tricolor*	
Climacteridae (Treecreepers)		
Rufous Treecreeper	*Climacteris rufa* BF1	
Columbidae (Pigeons and doves)		
Domestic Pigeon	*Columba livia*	X
Common Bronzewing	*Phaps chalcoptera* BF1	X
	Streptopelia chinensis tigrina	X
Senegal Turtle-dove	*Streptopelia senegalensis*	X
Corvidae (Crows, Ravens)		
Australian Raven	*Corvus coronoidesi*	
Cracticidae (Magpies, Currawongs, Butcherbirds)		
Magpie	*Cracticus tibicen*	X
Grey Butcherbird	*Cracticus torquatus*	
Grey Currawong	*Strepera versicolor* BF2	
Cuculidae (Cuckoos)		
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	
Horsfield's Bronze Cuckoo	*Chrysococcyx basalis*	
	Chrysococcyx lucidus	
Pallid Cuckoo	*Cuculus pallidus*	
Dicaeidae (Flower-peckers)		
Mistletoebird	*Dicaeum hirundinaceum*	
Dicruridae (Flycatchers)		
Magpie-lark	*Grallina cyanoleuca*	X
Restless Flycatcher	*Myiagra inquieta* BF1	
Grey Fantail	*Rhipidura fuliginosa*	X
Willie Wagtail	*Rhipidura leucophrys*	X
Falconidae (Falcons)		
Brown Falcon	*Falco berigora* BF2	
Nankeen Kestrel	*Falco cenchroides*	X
Australian Hobby	*Falco longipennis*	X
Peregrine Falcon	*Falco peregrinus* S1 BF2	
Halcyonidae (Forest kingfishers)		
Laughing Kookaburra	*Dacelo novaeguineae* *	X
Sacred Kingfisher	*Todiramphus sanctus*	
Hirundinidae (Swallows)		
Welcome Swallow	*Hirundo neoxena*	X
Tree Martin	*Hirundo nigricans*	X
Maluridae (Fairy-wrens)		
Red-winged Fairy Wren	*Malurus elegans*	X
Variegated Fairy-wren	*Malurus lamberti* BF1	
	Malurus lamberti assimilis	
White-winged Fairy-wren	*Malurus leucopterus* BF1	
Splendid Wren	*Malurus splendens* BF1	X
	Stipiturus malachurus westernensis	
Meliphagidae (Honeyeaters)		
Western Spinebill	*Acanthorhynchus superciliosus*	X
Red Wattlebird	*Anthochaera carunculata*	X
Western Wattlebird	*Anthochaera lunulata* BF2	X
Singing Honeyeater	*Lichenostomus virescens*	X
Brown Honeyeater	*Lichmera indistincta indistincta*	X

Western White-naped Honeyeater	*Melithreptus chloropsis* BF2	X
White-cheeked Honeyeater	*Phylidonyris nigra* BF2	X
New Holland Honeyeater	*Phylidonyris novaehollandiae* BF2	X
Meropidae (Bee-eaters)		
Rainbow Bee-eater	*Merops ornatus*	
Motacillidae (Pipits and true wagtails)		
Richards Pipit	*Anthus australis australis*	
Neosittidae (Sittellas)		
Varied Sittella	*Daphoenositta chrysoptera* BF1	
Pachycephalidae (Whistlers)		
Rufous Whistler	*Colluricincla harmonica rufiventris*	X
Shriketit	*Falcunculus frontatus*	
Pardalotidae (Pardalotes)		
Spotted Pardalote	*Pardalotus punctatus*	
Striated Pardolote	*Pardalotus striatus*	X
Pelecanidae (Pelicans)		
Australian Pelican	*Pelecanus conspicillatus*	
Petroicidae (Flycatchers, Robins)		
Western Yellow Robin	*Eopsaltria australis griseogularis* BF1	
Scarlet Robin	*Petroica multicolor campbelli* BF1	
Phasianidae (Pheasants and quails)		
Stubble Quail	*Coturnix pectoralis*	
Brown Quail	*Coturnix ypsilophora*	
Podargidae (Frogmouths)		
Tawny Frogmouth	*Podargus strigoides*	
Podicipedidae (Grebes)		
Australian Grebe	*Tachybaptus novaehollandiae novaehollandiae*	
Psittacidae (Pittas)		
Galah	*Cacatua roseicapilla*	X
Long-billed Corella	*Cacatua tenuirostris*	X
Forest Red-tailed Black Cockatoo	*Calyptorhynchus banksii naso* E P3 BF2	
Carnaby's Cockatoo	*Calyptorhynchus latirostris* E S1 BF2	X
Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	
Elegant Parrot	*Neophema elegans*	
Western Rosella	*Platycercus icterotis* BF1	
Red-capped Parrot	*Platycercus spurius*	X
Australian Ringneck Parrot	*Platycercus zonarius*	X
Rainbow Lorikeet	*Trichoglossus haematodus*	X
Rallidae (Coots, Crakes, Moorhens)		
Coot	*Fulica atra australis*	
Dusky Moorhen	*Gallinula tenebrosa tenebrosa* BF1	
Purple Swamphen	*Porphyrio porphyrio bellus*	
Ballions Crake	*Porzana pusilla palustris*	
Spotless Crake	*Porzana tabuensis*	
Recurvirostridae (Avocets, Stilts)		
Banded Stilt	*Cladorhynchus leucocephalus*	
Black-winged Stilt	*Himantopus himantopus*	
Red-necked Avocet	*Recurvirostra novaehollandiae*	
Scolopacidae (Curlews, Godwits, Knots, Sandpipers, Stints)		
Long-toed Stint	*Calidris subminuta*	
Eastern Curlew	*Numenius madagascariensis* P4	
Wood Sandpiper	*Tringa glareola*	
Common Sandpiper	*Tringa hypoleucos*	
Marsh Sandpiper	*Tringa stagnatilis*	
Strigidae (Hawk-owls)		
Barking Owl	*Ninox connivens*	
Southern Boobook Owl	*Ninox novaeseelandiae*	
Sylviidae (Cristicolas, Grassbirds, Songlarks, Warblers)		
Australian Reed Warbler	*Acrocephalus australis*	
Brown Songlark	*Cincloramphus cruralis*	

Rufous Songlark	*Cincloramphus mathewsi*	
Little Grassbird	*Megalurus gramineus gramineus*	
Threskiornithidae (Ibis, Spoonbills)		
Yellow-billed Spoonbill	*Platalea flavipes*	
Royal Spoonbill	*Platalea regia*	
Glossy Ibis	*Plegadis falcinellus*	
Straw-necked Ibis	*Threskiornis spinicollis*	
Tytonidae (Barn owls)		
Barn Owl	*Tyto alba*	
Masked Owl	*Tyto novaehollandiae*	
Zosteropidae (White-eyes)		
Silver-eye	*Zosterops lateralis gouldi*	X

APPENDIX 5

SPECIES OF AMPHIBIAN PREDICTED AND RECORDED AT STAKEHILL SWAMP, BALDIVIS

APPENDIX 5
SPECIES OF AMPHIBIAN PREDICTED AND RECORDED AT STAKEHILL SWAMP, BALDIVIS

Hylidae	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15
Litoria adelaidensis															
Litoria moorei															
Myobatrachidae															
Crinia georgiana															
Crinia glauerti															
Crinia insignifera															
Crinia pseudinsignifera															
Geocrinia leai															
Heleioporus eyrei	5	1		4	2		2	1			2	2	1	1	1
Heleioporus psammophilus															
Limnodynastes dorsalis															
Myobatrachus gouldii															
Neobatrachus pelobatoides															
Pseudophryne guentheri															

APPENDIX 6

SPECIES OF REPTILE PREDICTED AND RECORDED AT STAKEHILL SWAMP, BALDIVIS

APPENDIX 6
SPECIES OF REPTILE PREDICTED AND RECORDED AT STAKEHILL SWAMP, BALDIVIS

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15
Agamidae (Dragons)															
Pogona minor															
Rankinia adelaidensis															
Boidae (Pythons)															
Morelia spilota imbricata															
Cheluidae (Tortoises)															
Chelodina oblonga															
Elapidae (Elapid Snakes)															
Brachyurophis fasciolata fasciolata															
Brachyurophis semifasciata															
Demansia psammophis reticulata															
Echiopsis curta															
Elapognathus coronatus															
Neelaps bimaculatus															
Neelaps calonotos															
Notechis scutatus															
Parasuta gouldii															
Parasuta nigriceps															
Pseudechis australis															
Pseudonaja affinis affinis															
Pseudonaja modesta															
Pseudonaja nuchalis															
Simoselaps bertholdi															
Simoselaps semifasciatus															
Gekkonidae (Geckoes)															
Christinus marmoratus															
Gehyra variegata															
Heteronotia binoei															
Strophurus spinigerus															
Underwoodisaurus milii															
Pygopodidae (Legless lizards)															
Aprasia pulchella															
Aprasia repens															

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15
Delma fraseri															
Delma grayii															
Lialis burtonis															
Pygopus lepidopodus															
Scincidae (Skinks)															
Acritoscincus trilineatum		1	1					1					1	1	
Cryptoblepharus plagiocephalus															
Ctenotus fallens															
Ctenotus gemmula															
Ctenotus impar															
Ctenotus labillardieri															
Cyclodomorphus celatus															
Egernia kingii															
Egernia napoleonis															
Hemiergis initialis initialis															
Hemiergis quadrilineata															
Lerista christinae															
Lerista distinguenda															
Lerista elegans															
Lerista lineopunctulata															
Menetia greyii															
Morethia lineoocellata															
Morethia obscura															
Tiliqua occipitalis															
Tiliqua rugosa															
Typhlopidae (Blind Snakes)															
Ramphotyphlops australis															
Ramphotyphlops pinguis															
Ramphotyphlops waitii															
Varanidae (Goannas and Monitors)															
Varanus gouldii															
Varanus rosenbergi															
Varanus tristis															

APPENDIX 7

SPECIES OF MAMMAL PREDICTED AND RECORDED AT STAKEHILL SWAMP, BALDIVIS

APPENDIX 7
SPECIES OF MAMMAL PREDICTED AND RECORDED AT STAKEHILL SWAMP, BALDIVIS

X represents birds that were present during the survey period.
* represents an introduced species.
E represents species listed under the *Environment Protection and Biodiversity Conservation Act* 1999.
EM represents migratory bird species listed under the *Environment Protection and Biodiversity Conservation Act* 1999.
S represents species listed on the Department of Conservation and Land Management's Scheduled Fauna list.
P represents species listed on the Department of Conservation and Land Management's Priority Fauna list.

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15
Bovidae (Cattle)															
Cow *Bos taurus* *															
Canidae (Dogs, Dingoes)															
Dog *Canis lupus familiaris* *															
Dasyuridae (Dunnarts, Quoll, Mardo, Wambengers)															
Mardo *Antechinus flavipes leucogaster* Brush-tailed Phascogale *Phascogale tapoatafa tapoatafa* Gilbert's Dunnart *Sminthopsis gilberti* Grey-bellied Dunnart *Sminthopsis griseoventer griseoventer* Common Dunnart *Sminthopsis murina*															
Felidae (Cats)															
Feral Cat *Felis catus* *															
Leporidae (Rabbits and Hares)															
Rabbit *Oryctolagus cuniculus* *	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Macropodidae (Kangaroos and Wallabies)															
Western Grey Kangaroo *Macropus fuliginosus* Western Brush Wallaby *Macropus irma*	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Molossidae (Free-tail Bats)															
White-striped Free-tail Bat *Tadarida australis*															
Muridae (Rodents)															
Water Rat *Hydromys chrysogaster* House Mouse *Mus musculus* * Brown Rat *Rattus norvegicus* Black Rat *Rattus rattus*	2 1		3 1			4 1	11 4	3	4	 1	3 1	7 1	7	4	1
Mustelidae (Ferrets)															

		Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15
Ferret	*Mustela putorius*															
Myrmecobiidae (Numbat)																
Numbat	*Myrmecobius fasciatus*															
Peramelidae (Bandicoots)																
Southern Brown Bandicoot	*Isoodon obesulus fusciventer* P4	1		2				3								
Phalangeridae																
Common Brushtail Possum	*Trichosurus vulpecula vulpecula*															
Suidae (Pig)																
Feral Pig	*Sus scrofa* *															
Tachyglossidae (Echidna)																
Echidna	*Tachyglossus aculeatus*															
Tarsipedidae (Honey Possums)																
Honey Possum	*Tarsipes rostratus*															
Vespertilionidae (Evening Bats)																
Gould's Wattled Bat	*Chalinolobus gouldii*															
Chocolate Wattled Bat	*Chalinolobus morio*															
Lesser Long-eared Bat	*Nyctophilus geoffroyi*															
Greater Long-eared Bat	*Nyctophilus timoriensis timoriensis*															
Southern Forest Bat	*Vespadelus regulus*															


WILD 15/4 UAGA-F
No.13037 152.72
4084
No bd changes
5230 WA3663(C) METRO REGIONAL AREA RUN 6 (5174-5266) 1:20000 2/01/96 950000
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stereo pair to South - photo filed in BFS 75

5188 WA 3165 (C) METRO REGIONAL AREA & EXT. RUN 9 (5161-5244) 1:20000 11-DEC-92 920676