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ENVIRONMENTAL REVIEW



Alkimos-Eglinton Structure Plan

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- 1** ENVIRONMENTAL REVIEW

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 - 4** TRANSPORT & ENGINEERING INFRASTRUCTURE

 - 5** COASTAL PLANNING STRATEGY



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FOR MORE INFORMATION on the Alkimos Eglinton project, contact the Alkimos Eglinton Information Line on 9449 3991 or visit www.alkimoseglinton.com.au.

AN INVITATION TO COMMENT ON THIS ENVIRONMENTAL REVIEW

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

The Environmental Review (ER) was prepared for Amendment 1029/33 to the Metropolitan Region Scheme (MRS) for the proposed rezoning of parts of Alkimos-Eglinton.

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

The ER is available for public review in accordance with the advertising period determined by the Minister for Planning and Infrastructure from **26 September 2003 to 23 January 2004**.

After receipt of comments from Government agencies and from the public the WAPC will forward submissions to the EPA. The EPA will prepare an Assessment Report with recommendations to the Government, taking into account issues raised in public submissions.

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 EPA will be acknowledged. Submissions will be treated as public documents and may be quoted in full or in part in each report unless specifically marked confidential.

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 general issues discussed in the ER or the specific 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 ER.
- If you discuss different sections of the ER, 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.

Remember to include:

- your name,
- your address,
- the date, and
- whether you want your submission to be confidential.

The closing date for submissions is: **23 January 2004**

Submissions should be addressed to:

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

Attention: **Angela Clare**

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EXECUTIVE SUMMARY

This Environmental Review has been prepared to accompany a proposed Amendment to the Metropolitan Region Scheme (MRS) Amendment 1029/33 for changes to Zonings and Reservations of land in the Alkimos-Eglinton area. The proposed amendment to the MRS proposes the following changes to reflect a revised Structure Plan for the subject land:

- Rationalising and increasing the 'Parks and Recreation' reserves by 25.3ha to reflect greater protection of regionally significant areas, including a reduction in foreshore reserve over parts of the southern sector, and a new 'Parks and Recreation' reservation over Lot M1482 and Lot 102.
- 'Urban' zoning over the balance of Lot 101, parts of Swan Location 16, Lots M1503, 11, Pt 6, M1482 and 102.
- Relocating the Alkimos WWTP on Lot 101 700m further east with a revised odour buffer of 450m within Public Purposes and additional land to 600m in Urban Deferred zoning. This will allow the flexibility to alter the buffer area as further scientific work proceeds through to mid 2005 and is considered and accepted by the Water Corporation and the EPA.
- Relocating the Groundwater Treatment Plant (GWTP) to within the north-eastern corner of Lot 102.
- Removing Private Recreation and Urban Deferred zonings around the WWTP.
- Reducing the 'Central City Area' zoning over Lot 102 to rationalise the size of the regional centre.
- Making changes to 'Other Regional Road' reservations to reflect the revised alignment of Marmion Avenue and other district distributor roads.

The Amendment is proposed by the Western Australian Planning Commission as the next phase of the planning process for the area following development of the Alkimos-Eglinton Structure Plan. An Amendment to the City of Wanneroo DPS subsequently will be required to ensure consistency with zonings and reservations reflected in the revised Metropolitan Region Scheme (MRS).

The Environmental Protection Authority (EPA) identified that the Amendment raises a number of environmental issues and required the preparation of an Environmental Review document for assessment under Section 48A of the *Environmental Protection Act*, 1986.

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 S1.

The commitments made for managing the environment will be implemented through the provisions of the MRS. Table S2 contains the statutory basis for the proposed management measures.

The Amendment area forms part of the Perth North West Corridor within the City of Wanneroo and occupies 2660ha. The Amendment Area presently comprises predominantly 'Urban' and 'Central City Area' zones and 'Parks and Recreation' reservations under the existing MRS. Land to the east of the Amendment area is either reserved for Parks and Recreation or included in the Rural zone.

The proposed MRS Amendment will result in an increase of up to 25.3ha of significant bushland to be reserved as Regional Open Space (ROS), including increases in areas of Banksia Woodland and Quindalup Heath. Areas to be reserved as ROS also include the retention of some populations of two Priority 3 flora species identified on the site. The Amended MRS retains a larger area of significant fauna habitats, particularly areas of *Banksia* Woodland than currently exists in the MRS for this area.

The proposed MRS Amendment retains landforms which have been identified as having conservation significance as ROS or in Special Development Precincts, including the undulating dunal landscape of the Young Quindalup Dunes, the parabolic dunes and the shore parallel ridges of the Spearwood Dunes. The prominent east-west parabolic dune formation is proposed for special development under the proposed MRS Amendment.

The Amended MRS will not have any significant impacts on the water levels in any of the nearby wetlands. The use of groundwater in the area is not expected to affect the forecast requirements for future water supply of the Water Corporation.

The Coastal ROS Reserve is not proposed to be altered for most of the study area in the Amended MRS. It has, however, been reduced in the southern sector of Alkimos from the proposed Alkimos coastal node ('Alkimos by the Sea') to the southern boundary of the Amendment Area. The reduction in area of the foreshore reserve is compensated by additions to the proposed ROS in the Amended MRS.

The future WWTP at Alkimos has been relocated approximately 700m to the east. The WWTP in its proposed relocated position aims to reduce the impact of the plant and its associated odour buffer on the urban development proposals for the area. In particular, the relocation aims to maximise the development potential of the land surrounding the regional beach adjacent to Lot 101. The Water Corporation has indicated its intention to develop a more compact plant, incorporating advanced technology treatment processes and odour control facilities.

To accommodate the ultimate buffer alignment the proposed amendment reflects a 450m Public Purpose reservation with a surrounding reservation of 150m of Urban Deferred. The Corporation are currently scientifically determining a "distinct" odour level criteria for the future facility inline with the March 2002 EPA Guidance Statement No 47.

The program for determination by mid 2005 of the final buffer area will include sophisticated onsite climatic monitoring and modeling, investigation of the "speciation" of waste water odour (understanding the relationship of the basic compounds in odour as

measured by dynamic olfactory) and determine the actual odour control performance of the Subiaco and Beenyup facility upgrades. It is envisaged that by mid 2005 the Corporation will make a final recommendation to the EPA and WAPC on the buffer size and area.

The GWTP and associated 300m chlorine buffer are proposed to be relocated to a 21ha site north east of the Central City Area and included in the Public Purposes reservation. An additional 24ha to provide for a 500m evacuation buffer for operational purposes it is proposed to be included in the Parks and Recreation reservation in this location.

The proposed MRS Amendment incorporates revised alignments and reservation widths of a number of Other Regional Roads (ORR). The revised layout and design of the ORRs has been based on the objectives of the Department for Planning and Infrastructure's Liveable Neighbourhoods trial Policy. This promotes the integration of these roads with frontage land uses and the adoption of appropriate design criteria.

TABLE S1
SUMMARY OF ENVIRONMENTAL FACTORS

Environmental Factor	Present State of the Environment	Proposal in Scheme which could Potentially Impact the Environment	Potential Impacts	Environmental Management Measures	Predicted Outcome
Biophysical					
Terrestrial Flora - Vegetation and Flora	Remnant native vegetation covers about 80% of the Alkimos-Eglinton area. The existing MRS incorporates vegetation in 256ha of Regional Open Space (ROS).	Amended MRS includes major changes in ROS location, size and configuration. Urban development adjacent to Parks and Recreation reservations	Overall increase of 25.3ha of good to excellent quality vegetation in ROS. Potential degradation of ROS from adjacent development.	Environmental Management Plans and Implementation Strategies will be prepared for Regional Open Space (and immediate interface).	Positive moderate impact through significant increase in high quality bushland and representative vegetation types reserved in ROS compared to existing MRS
Terrestrial Flora - Declared Rare and Priority Flora and other significant flora	No Rare and Endangered flora has been recorded within the Amendment area. Two Priority 3 species have been recorded in the Amendment Area within existing ROS. In addition, a number of significant flora are known to occur in the Amendment Areas.	Amended MRS includes changes in ROS location, size and configuration. Urban development adjacent to Parks and Recreation reservations	Overall increase of 25.3ha of good to excellent quality vegetation in ROS, including vegetation types known to support Priority Flora species and other significant flora. Recorded populations of P3 species <i>Hibbertia spicata</i> ssp. <i>leptothea</i> and <i>Conostylis pauciflora</i> ssp. <i>euryhipis</i> will be lost through the deletion of Area 5 at Alkimos. Potential degradation of ROS from adjacent development.	Populations of Priority Flora will be retained in reserved areas of ROS and will be protected through Environmental Management Plans and Implementation Strategies which will be prepared for Regional Open Space (and immediate interface).	Positive minor impact as Priority Flora will be protected within expanded ROS compared to existing MRS
Terrestrial Fauna	Vertebrate fauna within the Amendment area are generally typical of the region and will be protected within the existing ROS.	Amended MRS includes changes in ROS location, size and configuration. Urban development adjacent to Parks and Recreation reservations	Overall increase of 25.3ha of good to excellent quality vegetation of important habitat to native fauna to be protected in ROS. Potential degradation of ROS from adjacent development	Environmental Management Plans and Implementation Strategies will be prepared for Regional Open Space (and immediate interface).	Positive moderate impact through increase in ROS compared to existing MRS

Environmental Factor	Present State of the Environment	Proposal in Scheme which could Potentially Impact the Environment	Potential Impacts	Environmental Management Measures	Predicted Outcome
Specially Protected (Threatened) Fauna	One species of Threatened fauna, the Short-billed Black Cockatoo (Schedule 1), has been recorded within the Amendment area. The Peregrine Falcon (<i>Falco peregrinus</i>) [Schedule 4], Southern Carpet Python (<i>Morelia spilota</i>) [Schedule 4] and the Southern Brown Bandicoot (<i>Isodon obesulus</i>) [Priority 4], although not identified at the site during the survey, could potentially occur within habitats of the Alkimos-Eglinton area.	Amended MRS includes changes in ROS location, size and configuration. Urban development adjacent to Parks and Recreation reservations	Overall increase of 25.3ha of good to excellent quality vegetation in ROS. Potential degradation of ROS from adjacent development	Environmental Management Plans and Implementation Strategies for Regional Open Space (and immediate interface) will be prepared. Significant and representative areas of habitat suitable for the identified Specially Protected (Threatened) Fauna including an increase in the area of <i>Banksia</i> and Tuart Woodland to be retained in ROS. The increased reservation of Old Quindalup Heath in ROS will result in greater protection of habitat of the Priority Fauna species; the Keeled Legless Lizard (P2) and the Western Slender Blue Tongue (P4).	Positive minor impact through increase in the protection of habitat known to support important species of fauna in ROS compared to existing MRS
Coastal Environment – Dunes	A Foreshore Reserve exists along the coastline. Public access to the regional beach is limited by proximity of proposed WWTP	Amended MRS includes a proposed reduction to the southern region of the Foreshore Reserve.	The coastal environment (dunes) is already severely compromised by the existing land use zonings at Alkimos-Eglinton. Amendments to the MRS propose to reduce the area of coastal dunes reserved at Alkimos.	Foreshore Management Plans and Implementation Strategies will be prepared for the foreshore reserves of Alkimos (including Lot 102 and Karli Spring) and Eglinton.	
Coastal Environment – Foreshore	A Foreshore Reserve exists along the coastline. Public access to the regional beach is limited by proximity of proposed WWTP	Amended MRS includes proposed changes to the central (increased) and southern (reduced) part of the Foreshore Reserve. WWTP location moved further inland.	A coastal node is proposed at the southern regional beach location. The southern node is located in an area which experiences fluctuations in erosion and accretion. Increased public use of foreshore reserve at proposed coastal node.	Foreshore Management Plans and Implementation Strategies will be prepared for the foreshore reserves of Alkimos (including Lot 102 and Karli Spring) and Eglinton.	Reduced coastal foreshore reserve width compared to existing MRS to allow coastal node. Increase in width of coastal reserve in central area to provide better interface to approved golf course /resort /marina development.
Pollution					
Air-Odour	The present odour buffer is shown on the existing MRS (modified in 1997) and comprises a distance of approximately 1000m to the north and northeast and 750m to the southeast and 650m to the south of the WWTP. This was based on the provision of some odour control at the plant as it	The amended MRS will involve the relocation of the WWTP and reduction of the buffer to 600m and the relocation of the GWTP to a separate site.	Potential for off-site odour impacts associated with the operation of the WWTP and GWTP and reduced buffer of the WWTP.	An Odour and Noise Management Plan and Implementation Strategy will be prepared for the Waste Water and Ground Water Treatment Plants. Prior to the lifting of 'Urban Deferralment' an Odour Study is to be prepared and endorsed by the WAPC and EPA to demonstrate that odour levels in this area are acceptable and that the land is suitable for urban development.	Odours emanating from the WWTP and GWTP will be maintained and managed within the designated buffers.

Environmental Factor	Present State of the Environment	Proposal in Scheme which could Potentially Impact the Environment	Potential Impacts	Environmental Management Measures	Predicted Outcome
	developed.				

Environmental Factor	Present State of the Environment	Proposal in Scheme which could Potentially Impact the Environment	Potential Impacts	Environmental Management Measures	Predicted Outcome
Risk	Chlorine buffer exists for the proposed GWTP and WWTP.	Reduced buffer and change in location of WWTP. Change in location of GWTP.	Potential for chlorine hazard in urban areas from the GWTP.	The proposed Amendment includes a buffer of not less than 300m around the GWTP chlorine storage facility 600m at the WWTP which adequately complies with the requirements and potential risk (individual) associated with the storage and handling of liquefied chlorine gas identified under EPA, 2000; DME, 1998 and AS 2927. The Water Corporation will implement best practice measures, including appropriate design of the storage building, testing and monitoring of mechanics and preparation of an Emergency Response Plan to prevent the potential risk to the public.	Public safety (individual risk) will not be compromised during the operation of the GWTP/WWTP and storage of chlorine at the plants.
Noise	Buffer exists for the WWTP	Change in location of WWTP and reduced buffer size.	Potential noise emissions associated with the reduced buffer to the WWTP	An Odour and Noise Management Plan and Implementation Strategy will be prepared for the Waste Water and Ground Water Treatment Plants. The Water Corporation will also implement measures to reduce potential sources of noise from the WWTP through the design of the treatment plant, particularly type of scrubbers to be installed and sensitive location of the WWTP access road.	The Water Corporation will operate the WWTP to ensure the Plant meets the requirements of the EPA Noise regulations.

TABLE S2
SUMMARY OF PROPOSED MANAGEMENT MEASURES

Issue	Objective	Environmental Management Measures	Timing (Phase)	Whose Requirements
Biophysical				
Vegetation and Flora	Maintain the abundance, species diversity and geographic distribution of vegetation and flora.	Environmental Management Plans and Implementation Strategies will be prepared for Regional Open Space and the immediate interface.	Plan preparation at the Local Structure Planning stage. Plan Implementation at subdivision stage.	Responsible Authority on advice from CALM
Declared Rare and Priority Flora	Protect Declared Rare and Priority Flora, consistent with the provisions of the <u>Wildlife Conservation Act, 1950</u> .	Populations of Priority Flora will be retained in reserved areas of ROS and will be protected through Environmental Management Plans and Implementation Strategies which will be prepared for Regional Open Space (and the immediate interface).	Plan preparation at the Local Structure Planning stage. Plan Implementation at subdivision stage.	As above.
Terrestrial Fauna	Maintain the abundance, species diversity and geographical distribution of terrestrial fauna.	Environmental Management Plans and Implementation Strategies will be prepared for Regional Open Space (and the immediate interface).	Plan preparation at the Local Structure Planning stage. Plan Implementation at subdivision stage.	As above.
Specially Protected (Threatened) Fauna	Protect Specially Protected (Threatened) Fauna, consistent with the provisions of the <u>Wildlife Conservation Act, 1950</u> .	Environmental Management Plans and Implementation Strategies for Region Open Space (and the immediate interface) will be prepared. Significant and representative areas of habitat suitable for the identified Specially Protected (Threatened) Fauna including an increase in the area of <i>Banksia</i> and Tuart Woodland to be retained in ROS.	Plan preparation at the Local Structure Planning stage. Plan Implementation at subdivision stage.	As above.
Coastal Environment	Maintain the integrity, function and environmental values of the dune system. Maintain the stability of the beaches and the integrity, function and environmental values of the foreshore area.	Foreshore Management Plans and Implementation Strategies will be prepared for the foreshore reserves of Alkimos (including Lot 102 and Karli Spring), and Eglinton.	Plan preparation at the Local Structure Planning stage. Plan Implementation at subdivision stage.	Responsible Authority on advice of the City of Wanneroo.
Pollution Management				
Odour	Odours emanating from the proposed WWTP and GWTP should not adversely affect the welfare and amenity of other land users.	An Odour and Noise Management Plan and Implementation Strategy will be prepared for the Waste Water and Ground Water Treatment Plants. Prior to the lifting of Urban Deferralment an Odour Study is to be prepared and endorsed by the WAPC and EPA to demonstrate that odour levels in this area are acceptable and that the land is suitable for urban development.	Prior to development. Prior to lifting of 'Urban Deferred Zoning.	DEP WAPC, DEP

Issue	Objective	Environmental Management Measures	Timing (Phase)	Whose Requirements
Pollution Continued				
Risk	Ensure that public risk associated with the operation of the Wastewater Treatment Plant and the storage of chlorine at the proposed Groundwater Treatment Plant is managed to meet the EPA's criteria for individual fatality risk off-site and the DME's requirements in respect of public safety	The chlorination plants will be operated and maintained in accordance with the Corporation's Chlorine Hazard and Safety Management System.	Prior to development.	DEP, DOPMR
Noise	Protect the amenity of nearby residents from noise impacts resulting from activities associated with the Wastewater Treatment Plant by ensuring noise levels meet statutory requirements and acceptable standards.	An Odour and Noise Management Plan and Implementation Strategy will be prepared for the Waste Water and Ground Water Treatment Plants. The Water Corporation will implement measures to reduce potential sources of noise from the WWTP through the design of the treatment plant, particularly type of scrubbers to be installed and sensitive location of the WWTP access road.	Prior to development.	DEP

1. INTRODUCTION

1.1 Purpose and Scope

This Environmental Review (ER) has been prepared in accordance with the EPA requirements to accompany Amendment 1029/33 to the Metropolitan Region Scheme (MRS) for the Alkimos-Eglinton area. The purpose of MRS Amendment 1029/33 is to review the Metropolitan Region Scheme (MRS) reservations and zonings for the Alkimos-Eglinton area to accord with a major review of development options for the site undertaken by the two major landowners, LandCorp and Eglinton Estates in 1997/98 while working closely with the Water Corporation. An Amendment to the MRS would modify the regional planning framework and facilitate land use changes within the Alkimos-Eglinton area to reflect the principles of the WAPC's 'Liveable Neighbourhoods' trial Policy.

The EPA has determined that the MRS Amendment raises significant environmental issues and requires assessment under Division 3 Part IV of the Environmental Protection Act. Where a scheme amendment is subject to an assessment by the EPA the responsible authority (WAPC) is required to prepare a report (referred to as an Environmental Review (ER)). The Environmental Review process is summarised in Figure 1.

The format of this ER is based on that recommended by the Environmental Protection Authority (EPA) in its instructions for this ER. A copy of these instructions is contained in Appendix 1.

The EPA has identified the key environmental factors relevant to the Alkimos-Eglinton MRS Amendment. The key factors include:

- Terrestrial flora including significance of flora and vegetation, presence of Declared Rare and Priority Flora and other significant flora.
- Terrestrial fauna including Specially Protected (Threatened) Fauna.
- Coastal stability and management.
- Odour, public risk and noise impacts resulting from the operation of the WWTP and GWTP.

In particular, the EPA has requested the ER investigate the environmental implications of the Scheme Amendment on:

- The regional representation of coastal vegetation communities on the Swan Coastal Plain through direct loss of vegetation from clearing for urban development.
- Coastal processes including beach profiles and dune stability through encroachment into an active area of coastal accretion and erosion.
- The amenity and safety of future residents near the WWTP and the GWTP through exposure to odour and risk associated with chlorine storage.

The ER documents the environmental management commitments which will form part of the environmental assessment and approval to cater for environmental protection and environmental management during the eventual development of Alkimos-Eglinton.

1.2 Amendment Area

The Amendment area encompasses approximately 2,660ha, with a coastline of some 7.5km, located in the City of Wanneroo (Figure 2). The Amendment area is bounded to the west by the Indian Ocean, to the east by the proposed Mitchell Freeway, to the south by the southern boundaries of Lot 3 (east) and Lot 102 (west), and to the north by the northern boundary of Lot M1503. The principal landowners are LandCorp, Eglinton Estates, Water Corporation and the Pentlands Bay Syndicate.

1.3 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 1029/33 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.

This ER has been structured in accordance with the EPA Instructions and describes the existing environmental characteristics of the area, the rezonings proposed under the Scheme, the potential environmental impacts of developments permitted under the Scheme, and proposed environmental management measures to be implemented as part of those developments.

This Review is available for public comment for three months from Friday 26 September 2003 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 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 regarding the conditions of approval and any other relevant matters before the conditions are set.

Advice on how to prepare a submission on this ER is provided at the beginning of this report.

1.4 Supporting Information

The Alkimos-Eglinton project was commenced in 1996 and has resulted in extensive background studies prior to the initiation of the MRS Amendment.

This Amendment is accompanied by a number of specialist reports prepared by consultants on behalf of the landowners. The accompanying specialist reports, available for public inspection with this Amendment, comprise:

1. Environmental Review (this Report)
2. Environmental Review Summary Document (ATA Environmental, 2003)
3. Planning Context Report (Development Planning Strategies, 2003)
4. Transport and Engineering Infrastructure (Sinclair Knight Merz and Cossill and Webley, 2003)
5. Coastal Strategy (ATA Environmental, 2003)

In the event of any conflict between this ER and the reports listed above, the ER prevails.

In addition to the above, the following historical reports are available on request, as listed in Table 1.

**TABLE 1
LIST OF REPORTS AVAILABLE ON REQUEST**

Environmental	<ul style="list-style-type: none"> ▪ A Report on the Flora and Vegetation of the Alkimos Area and Conservation Issues Affecting It (Trudgen and Keighery, 1990) (included as Appendix 2a) ▪ A Report on the Flora and Vegetation of the Ningana Area and Conservation Issues Affecting It (Trudgen and Keighery, 1990) (included as Appendix 2b) ▪ Vegetation Condition and Conservation Values – Lot 8 and 11 Eglinton. (P. Armstrong, 1996) (included as Appendix 2c) ▪ Alkimos-Eglinton Fauna Survey (Alan Tingay & Associates, 1996) ▪ Water Resources Management Plan (Woodward Clyde, 1996)
Coastal	<ul style="list-style-type: none"> ▪ Coastal Engineering Study (MP Rogers and Associates, 1998) ▪ Letter from MP Rogers & Associates to Woodsome Management dated 16 March 1999 re revised coastal setback distances (map attached).

2. EXISTING METROPOLITAN REGION SCHEME

2.1 Regional Context

2.1.1 North West Corridor Structure Plan

Within the framework established by *METROPLAN* (DPUD, 1990) and the *Urban Expansion Policy*, the *North West Corridor Structure Plan* was adopted by the Commission in 1992 as a regional planning framework for the development of one of Perth's major urban corridors.

The general aims and objectives of the *North West Corridor Structure Plan* were to provide:

- Timely provision of residential land to meet future housing needs and wide variety of housing types, price and location.
- For the creation of distinctive communities.
- Encouragement of local employment.
- For the creation of a hierarchy of retail and commercial centres with a diversity of facilities and ready accessibility to residents.
- Development of efficient public and private transport systems.
- Protection of areas of high scenic, environmental and recreational values and the use of natural features to provide regional open space networks.
- Cost effective and timely public and private infrastructure provision.
- Achievement of good quality, sustainable urban and natural environments.
- Accommodate compatible rural and rural-residential pursuits in appropriate locations.

While differing with some elements, the proposed Amendment to the MRS is considered to be consistent with the general aims and objectives of regional planning for the North West Corridor.

2.1.2 Current Zoning and Approvals

A program of major amendments to the MRS was undertaken through the 1990s to implement Metroplan, the Metropolitan Strategy for the Perth Region, and the Urban Expansion Policy (1990) which identified land for future development to meet forecast population growth to around 2020. On 17 August 1994, MRS Amendment 932/33 took effect to zone and reserve land for development at Alkimos-Eglinton. The current MRS, as shown in Figure 3 and described in detail in Section 2.2.3, includes:

- A 160ha Public Purposes site for the Waste Water and Groundwater Treatment Plants (WWTP/GWTP) and an ocean outfall on the coast.

- Land zoned Urban Deferred, Private Recreation and Parks and Recreation around the WWTP/GWTP sites, for buffer and parks and environmental protection purposes.
- Coastal foreshore reserves exceeding 300m in width in places.
- A Parks and Recreation (P&R) link at Eglinton connecting to P&R land at Yanchep.
- A large Central City Area zone inland at Alkimos.
- Regional road alignments for Marmion avenue, Romeo Road, Alkimos Drive and Eglinton Avenue.
- A railway alignment through the east of the district.
- Substantial Urban zonings.
- The Mitchell Freeway alignment.

The MRS Amendment was accompanied by a proposed District Structure Plan and supplementary consultants reports. The District Structure Plan was not however endorsed by the Commission.

In 1991, the EPA issued environmental approval for a marina, resort and golf course development at Eglinton subject to a number of commitments as contained in EPA Bulletin 500 (EPA, 1991). The zones and reservations of the 1994 MRS Amendment largely reflected the approved development particularly Urban zonings on the coast for a proposed golf course and resort facilities and reduced foreshore Parks and Recreation reserves. There are no proposals in this amendment that impact on the area of the environmental approval for the Eglinton Marina.

The current MRS zonings and reservations are discussed in the following sections and identified in Figure 3.

2.1.3 Parks and Recreation Reservations

Regional Open Space

The North West Corridor Structure Plan (1992) recommended a lateral wedge between Eglinton and Yanchep. This area was reserved for Parks and Recreation as part of the Alkimos-Eglinton Metropolitan Region Scheme Amendment No. 932/33 (1993) and St Andrews Metropolitan Region Scheme Amendment (1996).

The purpose of the wedge was to create a green corridor between areas of urban development and provide a link between Yanchep National Park and the coast. It was not intended to be exclusively for conservation purposes, but to contain a variety of uses such as major active and passive recreation, flora and fauna habitats, landscape areas, and other land uses requiring extensive areas of open space.

Coastal Foreshore Reserve

A Foreshore Reserve for Alkimos-Eglinton was proposed in 1993 and subsequently incorporated into the Metropolitan Region Scheme (Alan Tingay & Associates, 1993). The boundary of this reserve, was defined on the basis of the draft Guidelines for Coastal Protection at that time as published by the Department of Planning and Urban Development (DPUD), now the Department for Planning and Infrastructure (DPI). These Guidelines suggested a general boundary approximately 100m in-shore from the first line of permanent vegetation along the coast. This width was varied according to assessments of the erosion potential of the coast at each specific location, and the landforms and vegetation in the vicinity of the 100m setback. The reserve width was increased or reduced so that the boundary went around rather than through prominent features. However, where there was no evidence of limestone cliffs within 100m of the coast, either exposed or buried under more recent dunes, the reserve was made wider to provide a safety margin in case of increased coastal erosion associated with a rise in sea level.

The boundary of the foreshore reserve as delineated in the current MRS is shown in Figure 3. For historical reasons, this may not coincide with the High Water mark. In the southern section of Alkimos the foreshore reserve is currently up to 385m wide to incorporate Karli Spring (location shown on Figure 7d(i)), representative examples of the Quindalup Dunes and the buffer requirements of the WWTP at Lot 101. To the north of Alkimos, the boundary roughly parallels the coast and generally has a setback in excess of 100m. It narrows in the central portion of Lot 11 where it is defined by the approved golf course and marina developments.

Eglinton Beach Resort

The Eglinton Beach Resort, proposed by previous landowners, was approved by the Minister for the Environment in 1991 and subsequently rezoned in 1992 from 'Rural', 'Waterways Reservation' and 'Parks and Recreation' to 'Urban' and 'Parks and Recreation'. The proposal, located at Swan Location 1370, Lot 11, incorporated a residential estate, beach resort, large marina and a links-style golf course. The marina precinct encompasses more than 1km of the coast in the northern part of Eglinton South (Ocean Dunes), while the fifteenth, seventeenth, and eighteenth fairways of the golf course were proposed to lie immediately adjacent to the coastline and as such define the reserve in the southern parts of the property.

An alternative foreshore boundary along Lot 11 Eglinton, was determined by Alan Tingay and Associates (now ATA Environmental) in 1993 on behalf of the Department of Planning and Urban Development (DPUD), now DPI, in the event that the resort/golf course did not proceed and the land is developed for residential purposes instead.

2.1.4 Public Purposes Reservation

The Water Corporation is a major landowner in the Alkimos area, having purchased approximately 160ha (Lot 101) as part of their long term planning to service the metropolitan region of Perth with effluent treatment and water services. These services comprise the proposed Alkimos Waste Water Treatment Plant (WWTP) which will ultimately serve 300,000 to 500,000 persons and the Eglinton Ground Water Treatment Plant (GWTP) which will provide in the order of 120ML/day of potable water.

Based on the above planning the Water Corporation also required that an odour buffer be established beyond the limits of Lot 101 (into Lots 102 and M1482). The size and shape of the buffer varied to suit the topography and weather conditions and represented a modification of the nominal one kilometre radius buffer historically required by Water Corporation around permanent treatment facilities.

The location of the buffer in the current MRS has significant impacts on the foreshore reserve and nature of coastal activities within the buffer.

2.1.5 Major Traffic Corridors

The alignment for the extension of Marmion Avenue was included in the Important Regional Road reservation under the MRS Amendment 932. The alignment follows the lower valley areas in order to minimise earthworks and potential visual impacts of the road. The alignment also takes into account adjacent development areas and connects with road reserves already ceded in Lot 11, Eglinton (for the Eglinton Beach Resort), and east-west links defined by the Ministry for Planning and alignments proposed in the North-West Corridor Structure Plan and Alkimos-Eglinton District Structure Plan.

2.1.6 Railway

The alignment of the railway in the existing MRS follows the Freeway Reserve until the northern half of Alkimos whereupon it deviates to the west into the proposed Alkimos Regional Centre. The railway proceeds generally northwards to the Yanchep boundary. The railway reservation through Alkimos-Eglinton is currently being reviewed by the Department for Planning and Infrastructure to support better transport and landuse integration, and is likely to be the subject of a future MRS Amendment.

2.1.7 City Centre Zone - Alkimos Regional Centre

In accordance with the North-West Corridor Structure Plan the MRS identifies the location of a regional centre at Alkimos. The site is located between Joondalup and Yanchep and is situated to serve as a bus/train interchange on the extended suburban rail system. The centre is proposed to accommodate major retail and commercial facilities as well as civic, mixed business, residential uses and educational facilities.

3. METROPOLITAN REGION SCHEME AMENDMENT 1029/33

3.1 Introduction

The principal landowners, LandCorp and Eglinton Estates, in considering the District Structure Plan (1993) for Alkimos–Eglinton, determined that a revised plan could provide the basis for a more innovative and attractive urban development. It was considered that the development could incorporate the natural features of the area, and could provide for better conservation of representative components of the local environment within the urban context.

In summary, the proposed MRS Amendment (Figure 4) refines the Zonings and Reservations for portions of the subject land which when developed will provide for an extensive urban environment which will ultimately provide 17,000 dwellings to accommodate approximately 50,000 people. The major land use elements as reflected in the Alkimos-Eglinton Structure Plan (1998) include the following:

- The preservation of large areas of regional open space.
- Recognition of important natural features.
- Development of a series of urban villages each comprising a number of individual neighbourhoods designed according to the principles of Liveable Neighbourhoods.
- Provision of a strong public structure on the coast with retail and tourist facilities concentrated in a coastal village adjacent to the regional beach.
- Relocation of the wastewater treatment plant and groundwater treatment plant away from the regional beach area at Alkimos.
- Development of a regional centre at Alkimos.
- Extension of major traffic spines including the freeway and railway. Marmion Avenue will terminate to the west of the Alkimos regional centre.
- Development of a fully integrated public transport network including feeder bus services from the rail system and an integrated pedestrian/cycle way network.

The nature of the necessary amendments currently proposed to the Metropolitan Region Scheme are detailed below and presented in Figure 5:

- Move from the coast the Public Purposes reservation to accommodate the WWTP and GWTP, and relocate them to separate smaller sites (the ocean outfall site is to be retained).
- Include an Urban Deferred zoning between 450m and 600m surrounding the Alkimos WWTP inner plant boundary to allow flexibility in the definition of a final buffer after extensive odour modelling and other investigations have been undertaken.

- Remove Private Recreation and Urban Deferred zonings, originally put in place around the Public Purposes (WWTP and GWTP) site for buffer purposes.

- Reserve for Parks and Recreation an area adjacent to the Alkimos Regional Centre including a portion of the dunal ridge and portion of the buffer for the GWTP, for a town park.
- Reduce the coastal foreshore Parks and Recreation reservations, particularly immediately west of the Alkimos City Centre to provide better access to the prime regional beach and facilitate the establishment of a coastal village.
- Rationalise the area of the northern Parks and Recreation reservation to provide better representation of vegetation complexes.
- Introduce an area of Parks and Recreation reservation at Alkimos North adjacent to the proposed golf course development to provide a better environmental and topographic boundary to the proposed open space areas with the Environmental Approval for this development.
- Reduce the land zoned Central City Area for the Alkimos Regional Centre to better reflect likely future land requirements and topographical features, and to include additional land in the Urban zone.
- Realign and reduce the reservation width of Marmion Avenue, particularly through the Alkimos Regional Centre.
- Modify the reservation widths and alignments of Alkimos Drive and Eglinton Avenue.

The proposed zoning and reservation changes to the MRS are discussed in the following sections.

3.2 Proposed Zoning Changes

3.2.1 Central City Area Zone

The *North West Corridor Structure Plan* identified regional centres at Joondalup, Alkimos and Yanchep to service future urban growth in the North West Corridor. The 1994 Alkimos-Eglinton MRS amendment put in place the Alkimos Regional Centre by including some 480 hectares of land in the Central City Area zone. This zone was intended to accommodate a wide range of land uses including major retail and commercial facilities, educational, civic, medical, mixed business and residential uses. It was envisaged that the specific zonings and land allocations for particular precincts would be determined following more detailed planning.

The current amendment proposes to reduce the land within Lot 102 included in the Central City area zone to 230 hectares. The Central City Area zone is proposed to be bounded to the north and south by a parabolic dunal ridge and to the east by the Mitchell Freeway alignment. To the west the Central City Area zone is proposed to be retained to 90m (notionally one street block) west of the Marmion Avenue alignment to establish building frontage along this arterial route.

It is intended that detailed structure planning for the Alkimos City Centre be undertaken at a later date, integrating major community infrastructure including a hospital, university, retail, commercial and office facilities, into a 'main street' town centre. Integrated public transport provision is also proposed, including a station located centrally within the Alkimos Regional Centre. Changes to the rail alignment and station locations will be put in place following the review of the Northern Suburbs Rail alignment discussed under 2.2 above.

3.2.2 Urban Zone

The amendment proposes to modify the MRS Urban zonings. The Urban zones are anticipated to accommodate most of the estimated 50,000 population. Provision is proposed to be made through the Structure Plan for development of a mix of housing types at a range of densities. Additional Urban zonings are proposed in three main locations as described below.

The northwestern and western portions of the land presently zoned Central City Area (portion lots 102 and M1482) are proposed to be rezoned to Urban to better reflect future land requirements for the Alkimos Regional Centre. The proposed revised Structure Plan indicates service/commercial land adjacent to the Mitchell Freeway at both Alkimos (within new Urban zonings) and Eglinton (within existing Urban zonings).

The relocation inland and reduction in size of the Waste Water and Groundwater Treatment Plants and associated buffers has enabled portions of the Public Purposes (WSD) reservation site and associated land around it currently either reserved for Parks and Recreation or zoned Private Recreation and Urban Deferred (see Sections 3.3 and 3.4 below), to be added to the Urban zone. This additional Urban zoned land will accommodate new residential neighbourhoods between the commercial, community and transport facilities of the Alkimos Regional Centre to the east, and the regional beach and proposed coastal village to the west.

Adjustments are proposed between the Urban zone and Parks and Recreation reservations at Lot M1503, Eglinton. Additions to the Urban zone are proposed to create a new neighbourhood either side of Marmion Avenue to the northeast of the proposed Eglinton Marina, in exchange for two additions to the Parks and Recreation reservation: on the coast at Eglinton north, and inland abutting the Yancheep Parks and Recreation reservation.

3.2.3 Private Recreation Zone

The 1994 MRS amendment included two portions of Lot 102 in a Private Recreation zone immediately south and west of the Public Purposes (Water Corporation) reserve. The Private Recreation zoned land was within the odour buffer area of the Waste Water Treatment Plant. This land is now proposed to be included in the Urban zone.

With the relocation of the Waste Water Treatment Plant to the east and the proposed adoption of current best practice approach for waste treatment which will reduce buffer requirements, this land is more appropriately included in the Urban zone. The relation of the plant will improve public amenity and will provide additional opportunities for residential development near the regional beach.

3.2.4 Urban Deferred Zone

The 1994 MRS amendment included land within Lots 102 and M1482 in the Urban Deferred zone. This site is located immediately north of the current Public Purposes (Water Corporation) reservation. As a result, it was included in the Urban Deferred zone, being within the 1km buffer of the Waste Water Treatment Plant.

With the proposed relocation of the Public Purposes (Water Corporation) site to the east, this land is now proposed to be included in the Urban zone.

Similar to the 1994 MRS amendment, it is proposed to put in place an Urban Deferred zone covering a portion of the buffer for the Alkimos wastewater treatment plant. The Urban Deferred zone will comprise a 150m ring of land surrounding the proposed 450m Public Purposes reserve around the plant out to 600m. This will allow flexibility in defining the buffer following scientific studies.

Urban development within the Urban Deferred zone will be prevented until the buffer has been defined. This will firstly be ensured by an EPA environmental condition requiring the buffer to be scientifically defined. Secondly the WAPC would need to specifically resolve to lift the area not included within the final determined buffer from Urban Deferred to Urban. Urban development would not be able to take place until both these actions had occurred.

3.3 Proposed Changes to Reservations

3.3.1 Public Purposes Reservations

Relocation of the Waste Water Treatment Plant (WWTP) and Groundwater Treatment Plant (GWTP).

Background

Following engineering investigations in the 1970 and 1980s, the Water Authority purchased Lot 101 at Alkimos, comprising 160ha, for a Wastewater and Groundwater Treatment Plant to service future growth, on the basis that this was the lowest point in the corridor to locate a gravity feed system. The property, purchased by the Corporation in 1987, included 500m of the required 1000m radius buffer area to mitigate any potential injurious effect on the surrounding land.

Lot 101 was located within a proposed green belt under the 1970 Corridor Plan for Perth however, in 1994, the green belt was relocated northwards to Eglinton as part of a Metropolitan Regional Scheme amendment. At this time Government requested advice on the possibility of relocating the plant away from prime beach front land to a location further inland from where it could be piped to an ocean outfall.

In November 1995 LandCorp separately began engineering investigations into the possible relocation of the Wastewater and Groundwater Treatment Plants (WWTP and GWTP) from Lot 101. The investigations were initiated as part of a master planning initiative seeking to constructively challenge convention to maximise planning opportunities and create better future communities for both residents and businesses in the Alkimos-Eglinton study area.

Negotiations with the Water Corporation from 1998 to 2001 resulted in an agreement to relocate the WWTP site to a valley area approximately 700m due east of its original location, and to reduce the plant buffer.. The relocation will necessitate land exchanges between the Water Corporation and LandCorp as the new site and buffer will not be wholly contained in the existing Water Corporation land holding. The dunes within the buffer area are to be generally retained in their natural state to further shield the plant from public view. Excavation will however be required to position the treatment plant to allow gravity wastewater inflow. The resultant site area is approximately 220ha, comprising 145ha 'Public Purposes' reservation and 75ha 'Urban Deferred' zoning. It is envisaged that the buffer area could be partly utilised for open space functions such as district level playing fields. A compatible land use study will be instigated by the Water Corporation to determine the best use of the land within the buffer.

The associated ocean outfall is to be retained in its current proposed location adjacent to the foreshore coastal reserve on a 8.65ha site. Should the outfall sewer require substantial groyne works it will create the opportunity for a public boat launching facility immediately north of the proposed coastal village, as happens elsewhere along the coast.

The GWTP and associated 300m chlorine buffer are proposed to be relocated to a 21ha site north east of the Central City Area and included in the Public Purposes reservation. An additional 24ha to provide for a 500m buffer is proposed to be included in the Parks and Recreation reservation.

The relocation of the proposed WWTP from its current position at Lot 101 and associated reduction in buffer requirements presents significant benefits to the Alkimos-Eglinton area including:

- Enables the development of an integrated coastal community with a coastal node on land which would have otherwise been constrained by the WWTP facilities and extensive odour buffers.
- Allows the Water Corporation to utilise more advanced treatment technology and odour control measures than originally proposed.
- The WWTP will be wholly contained within the dune valley so it is not visible from surrounding residential areas.
- The proposed site allows unrestricted access between the Alkimos Regional Centre and the regional coastal node.

Current Planning Status

The Alkimos WWTP facility is currently scheduled to commence operation in about 2005/06. A small temporary facility may be installed and operated for approximately 5 to 10 years. The startup date is totally dependent on new development in the catchment area. Current plans for the total catchment area for this plant cover the northern extremity of the North West corridor and North East urban corridor of Perth. Existing development in the north-west corridor is temporarily served by the Beenyup WWTP which currently has spare capacity as its catchment is not fully developed.

Wastewater from the relevant portion of the north-west corridor will be conveyed to the site by gravity fed main sewers, whereas the wastewater from the North East corridor will be pumped across to the main sewer system.

As with most new wastewater treatment facilities, the initial stages of the plant development may consist of temporary facilities. For the Alkimos WWTP it is being considered to initially have a temporary plant which will discharge the effluent to on-site soakage basins. The area required for on-site soakage is approximately 10ha. These systems are suitable for operating with the initial low flows.

The permanent plant would then be built in several stages with the final stage anticipated to be completed in 2043.

Effluent Disposal Options/Reuse Opportunities

The Water Corporation has examined disposal and reuse options for the effluent, and concluded that an ocean outlet will be required in each case. Some opportunity for reuse on surrounding open space area and/or horticulture areas may be economically feasible, however further studies and but will be required to determine the viability of such options.

The ocean outlet option will produce a treated effluent of the quality currently being achieved at the Corporation's Beenyup WWTP, with nitrogen levels of 35mg/L.

3.3.2 Parks and Recreation Reservations

The current Parks and Recreation reservations reflect the *North West Corridor Structure Plan* and comprise the coastal foreshore reserve, an east-west lateral wedge between Eglinton and Yanchep, and a coastal area north of the current Waste Water Treatment Plant site. The current coastal foreshore reserve is part of System 6 Recommendation M2. All existing Parks and Recreation reservations are included in Bush Forever, as shown in Figure 3.

The landowners consultants undertook an assessment of the environmental values of the entire district and proposed a number of changes including significant additions to the land reserved for Parks and Recreation. These proposals have however been modified, given the substantial changes to Parks and Recreation reservations that will occur elsewhere through Bush Forever.

Five major changes are proposed to the Parks and Recreation reservations:

- rationalisation and reductions to the coastal foreshore Parks and Recreation reservation;
- rationalisation of the northern Parks and Recreation reserve at Eglinton;
- the introduction of a town park immediately north of the Alkimos Regional Centre;
- deletion of a Parks and Recreation area in the buffer to the Waste Water Treatment Plant; and

- inclusion of an area adjacent to the coastal foreshore reserve on Lot M1482 to provide a better interface to the approved golf course/resort development.

Coastal Foreshore Reserve

The boundaries of the current coastal foreshore reserve were based on the Alkimos-Eglinton Coastal Planning Strategy prepared by Alan Tingay and Associates in 1993 on behalf of the then Department of Planning and Urban Development. The width of the current reserve varies but generally has a setback in excess of 100m from the high water mark (HWM), increasing to 300-400m south of the Water Corporation site (Lot 101) to accommodate Karli Spring (location shown on Figure 7d(i)) and representative Quindalup dunes.

The coastal foreshore Parks and Recreation reservation is proposed to be reduced in the western portion of Lot 102 to reflect the shifting of the WWTP and introduce a coastal village. The landowners have prepared the Coastal Planning Strategy Update in support of a reduction below the current coastal setback to accommodate a coastal node.

The proposed coastal village on Lot 102 will provide for the development of a range of public and private facilities including residential development in direct proximity to the district's best regional beach, directly serving the Alkimos Regional Centre. At the southern coastal village the proposed width of the Parks and Recreation reservation is 115m east of the line of permanent vegetation. The proposed setback is in excess of the 100m minimum of the WAPC's Coastal Planning Policy.

It is separately proposed in the southwestern portion of Lot 102 to reduce the reservation from its current width of 300 to 400m from the coast (line of permanent vegetation) to a width of 160 to 300m. This is to allow more direct access to the coast's regional beaches from the Urban zoned hinterland while retaining major topographic and vegetation features. The foreshore reserve remains wide in the southernmost extremity to accommodate and protect the catchment area of Karli Spring and surrounding representative examples of the Quindalup Dune System, but has been adjusted for better topographic fit. Karli Spring is registered as a site of Aboriginal significance and is said to be associated with the Waugal.

Provision has been made in the coastal foreshore reserve for amenity and parking areas, and concept plans indicating the possible form of development of the coastal village are included in the Coastal Planning Strategy (Report No. 5).

Northern Regional Open Space

The amendment proposes to alter the configuration of the northern Parks and Recreation reservation linking Eglinton to Yanchep. The principle of a lateral wedge as proposed by the North West Corridor Structure Plan is maintained. Two transfers from the Urban zone to the Parks and Recreation reservations are proposed: a coastal landform feature around an existing trig point on the coast, and an inland area of high quality Banksia Woodland abutting the Yanchep Regional Open Space. The transfer of an area of medium quality Quindalup Heath from the southern portion of the Parks and Recreation reservation to the Urban zone of approximately equal area is proposed to accommodate residential areas to the northeast of the proposed marina. The length of Marmion Avenue cutting through ROS is reduced, therefore protecting a more diverse range of vegetation types and fauna habitats. It is intended that this lateral wedge will accommodate regional and district recreation and other public functions consistent with reservation, in addition to conservation functions.

Proposed Alkimos Town Park

Parks and Recreation reservation is proposed for an area comprising very good quality Banksia and Tuart Woodland immediately north of the Central City Area zone to form a town park. The southern boundary of the reservation is proposed to include the northern edge of the parabolic dune, a significant landform feature which will provide a backdrop to the Alkimos Central City Area. The town park will abut the Public Purposes reservation for the Ground Water Treatment Plant. It is envisaged that much of the treatment plant buffer will be retained as bushland and managed with the town park. The total area proposed for reservation for Parks and Recreation in the 'town park' area is in excess of 60ha.

The balance of the northern parabolic dune (to the west) is to be included in a special development zone in the District Structure Plan to ensure protection of its landscape and visual qualities.

Coastal Land North of the WWTP

A 38ha area of land east of the coastal foreshore reservation and immediately north of the WWTP site, straddling Lots M1482 and Lot 102 and currently within the Parks and Recreation reservation is proposed to be included in the Urban zone. This land was reserved as part of the buffer around the WWTP and was identified as having conservation values.

An area of 20ha is proposed for reservation as Parks and Recreation on the northern boundary of Lot M1482 adjacent to the coast. The environmental approval for the proposed Eglinton marina and golf course includes the transfer to the crown of a foreshore and dune reserve on the southern boundary of Lot 11 and to provide an appropriate interface to this proposed reserve, an addition to the Parks and Recreation reservation is proposed adjacent on Lot M1482 (Figure 8).

3.4 Other Regional Road Reservations

The current MRS proposes Marmion Avenue as an Other Regional Road with a reservation width of 60m. The major east-west distributor roads – Romeo Road, Alkimos Drive and Eglinton Avenue were designated as Other Regional Roads, with 45m reservations. Connolly Drive is proposed as an additional 60m wide north-south road reserve but terminating at Romeo Road. Land for Other Regional Road reservations has been ceded through Lot 11.

This MRS Amendment proposes to modify the alignments and reservation widths of Eglinton Avenue, Alkimos Drive and Marmion Avenue. The western section of Romeo Road is no longer required as an Other Regional Road.

In general, the District Structure Plan proposes to ensure a long-term balance of regional traffic utilising the future freeway, with the district distributor road network to carrying inter-district traffic. It is intended that a network of district distributor (integrator) routes and neighbourhood connector streets will also be provided to carry and spread much of the district traffic requirements, through a more interconnected network than is provided in more conventional development elsewhere in the corridor.

3.4.1 Marmion Avenue

Marmion Avenue from south of Romeo Road to north of Eglinton Avenue, is proposed to be relocated 200 to 500m to the east of its current alignment. At Eglinton, Marmion Avenue forms a 'T' junction with Eglinton Avenue to provide a stronger east-west connection to the Freeway.

At Alkimos, the Structure Plan proposes a 'main street' running east-west through the Alkimos City Centre, with Marmion Avenue at its western end, and a rail line at its eastern ends. While the final location of the rail line through the Alkimos city centre is still the subject of review, Marmion Avenue has been relocated east to ensure a viable length for a main street. The relocation of the WWTP site to the east also necessitated relocation of Marmion Avenue to its more central alignment.

Marmion Avenue was initially proposed to discontinue through the Alkimos Regional Centre to direct traffic east to the freeway, and to ensure the function and design of Marmion Avenue responded to the urban environment of the Regional Centre. However, following reviews of the initial Structure Plan proposals an alternative approach was proposed.

The road reservation of Marmion Avenue through the Central City Area zone is now proposed to be reduced from the current 52m width to 36m to change the character of Marmion Avenue from a high speed route with development backing on, to a route better integrated with adjacent development and more compatible with a town centre. The reservation width will provide for two lanes of traffic in each direction, medians, verges and turn pockets within the Other Regional Road reservation. It is proposed that service roads and earthworks will be provided in the adjacent Central City Area zone. This provides for an appropriate balance of regional movements, local accessibility and land use in the town centre.

To the south of Romeo Road the alignment of Marmion Avenue swings west through Lot 3 Alkimos to connect with its current reservation at Jindalee.

The road reservation for Marmion Avenue through the Urban zone is proposed to be 52m wide. This will provide for two lanes of traffic in each direction, medians, verges and service roads within the road reserve. Earthworks are proposed to be accommodated in the adjacent land.

Through the Parks and Recreation reservations the reserve width varies, but is based on a minimum of 36m to accommodate two lanes of traffic in each direction, medians and verges, and widened where necessary to accommodate earthworks and drainage as designed. The reservation widths of connection points to land to the north (Yanchep) and to the south (Jindalee) are unchanged.

3.4.2 Connolly Drive

Connolly Drive was initially proposed to be included as a north-south Other Regional Road with a reservation parallel to a proposed relocation of the rail line. However, it is not included in this Amendment and is pending further investigation of alignment options for the Northern Suburbs Rail Line from Butler to Eglinton.

3.4.3 Eglinton Avenue

The alignment of Eglinton Avenue is proposed to be modified to provide a stronger connection to the freeway. The road reservation is proposed to be widened from 45m to 52m to join Marmion Avenue and provide a cross section with three lanes of traffic in each direction, medians and verges within the road reserve. Earthworks are proposed to be accommodated in the adjacent land.

3.4.4 Alkimos Drive

The alignment of Alkimos Drive has been modified slightly. The reservation is proposed to be widened to 48m to provide for two lanes of traffic in each direction, medians, verges and service roads within the road reserve, to facilitate frontage development. Earthworks are proposed to be accommodated in the adjacent land.

3.4.5 Romeo Road

Romeo Road terminates at Marmion Avenue, which is proposed to be to the east of its current alignment. Consequently the Other Regional Road reservation for Romeo Road has been shortened.

Traffic modelling has been prepared to support both long-term and staged development of the site and relevant reports are available for inspection with this Amendment. Traffic modelling should be considered in the context of the employment of self sufficiency objectives of the North West Corridor Structure Plan, other regional road and transport infrastructure including the Freeway, and the planning principles adopted for the development of this district.

4. KEY ENVIRONMENTAL FACTORS

4.1 Introduction

The Environmental Protection Authority (EPA), in its instructions for this ER, 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 include vegetation communities, coastal processes, and odour, risk and noise associated with the WWTP and GWTP.

The environmental implications of the Amendment, ie. those areas shown in Figure 5, 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, and in some instances a description of programs which will be required during the scheme amendment.

4.2 Vegetation and Flora

4.2.1 EPA Objective and Scope of Work

Vegetation and Flora	
EPA Objective: Maintain the abundance, species diversity and geographic distribution of vegetation and flora	
Instruction	Scope of Work:
i.	Undertake a detailed vegetation and flora survey of those areas within the Amendment proposed for rezoning from 'Parks and Recreation' to 'Urban', 'Private Recreation' to 'Urban', 'Urban' to 'Parks and Recreation', 'Central City Area' to 'Parks and Recreation' and 'Public Purposes' to 'Urban'.
ii.	Surveys shall be undertaken by appropriately trained and experienced persons under appropriate seasonal conditions to identify the diversity, distribution, and condition of the existing vegetation and flora which may be directly or indirectly impacted by zoning changes.
iii.	Map and describe the vegetation and relate these mapped units to soil/landform types.
iv.	Describe the area of each vegetation complex and floristic community type to be cleared.
v.	Undertake the assessment at a level that allows the Selection Criteria and the specific criteria for coastal reserves outlined in Bush Forever Volume 2 to be addressed in detail.
vi.	The survey should address all regional data sets outlined in Bush Forever, detail the site specific vegetation and flora attributes and take into consideration the EPA's current Position Statement on 'General Requirements for Terrestrial Biological Surveys for EIA in WA'.
vii.	Demonstrate how the proposed additions and deletions to the proposed and existing Parks and Recreation Reserve contribute to the conservation regionally (ie of Bush Forever sites in the same geomorphic units on the Swan Coastal Plain north of the Swan River) of vegetation communities and flora. This consideration should refer to all relevant regional studies listed in Bush Forever (eg. Griffin 1993; Griffin and Trudgen 1994) and should address the likely uses within the proposed Parks and Recreation reservations, ie Recreation (district playing fields, picnic areas) and bushland conservation.
viii.	Measures to ensure the protection of areas of bushland within the Parks and Recreation reservations from impacts associated with urban development and associated activities should be identified and documented.

4.2.2 Description of the Amendment Area and Assessment of Impacts

Background Information

Flora and Vegetation Surveys

The vegetation and flora of the Alkimos-Eglinton area has been surveyed by Trudgen and Keighery (1990a and b) and Armstrong (1996). These reports are included as Appendix 2a, 2b and 2c, respectively. Areas of Regional Open Space under the existing and proposed MRS were also surveyed by ATA Environmental in July 2002.

The surveys conducted by Trudgen and Keighery (1990) were carried out in late Spring and early summer in 1989 and included the southern and northern regions of the Amendment Area, including 'Alkimos' comprising Lots 101 and 102 (Trudgen and Keighery, 1990a) and 'Ningana' comprising Pt Lot M1503 (Trudgen and Keighery, 1990b), respectively.

Trudgen and Keighery considered that the timing and depth of survey was sufficient to determine the conservation value of the flora and vegetation in the Alkimos-Eglinton area to be identified. In particular, Trudgen and Keighery identified that it is likely that the results of the survey yielded at least 90% of the perennial flora and 80% of the geophyte and annual flora likely to occur in the specific study areas. A flora list for the Alkimos-Eglinton area is provided in Appendix 3.

The central region of the Amendment Area (Lot 8 and 11) was surveyed by Armstrong in late spring (October and November) 1996 (Armstrong, 1996). This survey focused on determining the condition and conservation values of the vegetation on Lot 8 and 11 Eglinton. In particular, Armstrong's investigation determined the quality of the plant communities (based on Trudgen and Keighery's 1990 surveys); identified and located significant flora; surveyed the vegetation condition and provided a discussion of the plant community types and the flora in a regional conservation context.

The surveys conducted by Trudgen and Keighery (1990) and Armstrong (1996) provided a description of the vegetation types at the level of vegetation association, however vegetation mapping has been prepared at a higher level for the Amendment Areas as part of this ER:

Quindalup Dunes:

- Old Quindalup Dune Heath - Q1, Q2 and Q3 area dunes including old stabilised sand dunes with heath vegetation.
- Young Quindalup Dune Heath - Q4 age dunes including younger or reworked sand dunes with heath vegetation

Spearwood Dunes:

- Limestone Heath – shallow soils or exposed limestone
- Banksia Woodlands – deeper sandy soils
- Tuart Woodlands – deeper sandy soils close to stable Quindalup dune soils

The vegetation association mapping Figure 7(i) was compiled prior to the completion of Bush Forever and therefore there may be discrepancies with the remnant bushland mapping prepared by the then Ministry for Planning in 1996. In some instances vegetation boundaries have been modified to align with the extent of remnant vegetation in the study area, however for the purposes of this Amendment reference to vegetation mapping prepared for each Amendment Area is recommended.

To ensure adequate assessment of the impact of the proposed MRS amendments to the values of the MRS Regional Open Space areas, ATA Environmental conducted a survey in July 2002 to allow the preparation of mapping at the vegetation association level.

The Vegetation Association maps have been prepared for the existing Parks and Recreation Reserve as well as each area proposed to be added to the MRS Parks and Recreation Reserve (Figure 7a(i) – 7d(i)).

Flora and Vegetation of the Amendment Area – An Overview

Flora surveys of the Eglinton and Alkimos by Trudgen and Keighery (1990 a & b) identified flora representative of up to 12 different plant families of monocotyledons and 39 families of dicotyledonous plants. The families most represented in the study area in terms of monocotyledons included Cyperaceae, Poaceae, Haemodoraceae and Anthericaceae. The most abundant dicotyledons families were Proteaceae, Asteraceae, Myrtaceae, Papilionaceae, Mimosaceae and Epacridaceae. During the survey of the study area more species were recorded at Alkimos, probably because of the larger area at Alkimos and the fact that it supports a larger area of Banksia Woodland, the most species rich of the vegetation types present in the area (Trudgen and Keighery, 1990b).

According to Trudgen and Keighery (1990a & b), the family makeup of the native flora recorded from Eglinton and Alkimos is relatively typical of the flora of the south-west of WA and is comparable with that of previous studies of coastal and near coastal areas on the Swan Coastal Plain.

Native vegetation covers about 80% of the Alkimos-Eglinton area, as shown in Figure 3, and according to the broad vegetation mapping prepared by Trudgen and Keighery (1990a & b) and Armstrong (1996) the distribution of vegetation types strongly reflects the underlying Quindalup and Spearwood dune soils and landforms. In general, the western region of the Amendment Area comprises vegetation representative of the Quindalup Vegetation Complex, with the eastern portion supporting vegetation of the Cottesloe-Central and South Vegetation Complex on the Spearwood Dunes.

Quindalup Dune Vegetation

Floristically, the Quindalup dunes support a low diversity of plants due to reduced soil development and more extreme climatic conditions when compared to inland dunes. The development of plant communities on the Quindalup dunes begins at the strand which is dominated by a *Spinifex* Grassland, backed by younger dunes comprised of an Open to Closed Heath or Shrubland of *Scaevola crassifolia*, *Olearia axillaris*, *Acanthocarpus preissii*, *Hemiandra pungens* and *Acacia rostellifera*. Further inland on the older Quindalup dunes and plains, the vegetation types are more variable in structure and height. Heaths and shrublands predominate with areas of scrub and localised herblands and woodlands. Several

of the vegetation types feature *Acacia rostellifera* as the dominant species. *Acacia lasiocarpa* is also dominant in low heaths and dwarf scrubs in combination with various other species, and *Melaleuca systena* (formerly *Melaleuca acerosa*) is dominant in some areas of low heaths and shrublands. Various dominant species which occur on the younger dunes closer to the coast are also present, including *Olearia axillaris* and *Scaevola nitida* as dominant in open shrubland, and *Lomandra maritima* and *Melaleuca systena* as dominant in low heath.

Spearwood Dune Vegetation

The Spearwood dunes vary floristically depending on the presence of limestone, sands derived from limestone and the topography of the inland area. In general, the limestone outcrops at Eglinton support Open to Closed Low Heaths dominated by *Dryandra sessilis*, *Hakea trifurcata*, *Calothamnus quadrifidus*, *Scaevola nitida*, *Acacia truncata* and *Allocasuarina humilis*. Occasional Shrublands of *Xanthorrhoea preissii* occur within the Heath.

On the deeper soils of the Spearwood Dune System, generally in the eastern half of the Amendment Area, taller shrublands, woodlands and forests occur. *Banksia* woodlands and forests are the most extensive of these vegetation types, and feature *B. attenuata* and *B. menziesii* in places, in association with *Allocasuarina fraseriana*, *Eucalyptus todtiana* and *E. marginata* (Jarrah). A small area of *Eucalyptus gomphocephala* (Tuart) Woodland is found at the northern boundary of the site at Eglinton.

Vegetation Associations

The vegetation associations recorded in the Alkimos-Eglinton area are described in detail in Trudgen and Keighery (1990a and b) and Armstrong (1996) and are summarised below. Additional Vegetation Associations were identified by ATA Environmental in July 2002 and are identified with an asterisk in the following table. The additional vegetation associations are described in more detail in succeeding sections according to where they were recorded in the ROS Amendment Areas.

The corresponding Floristic Community Type for each of the Vegetation Associations has been inferred from the descriptions of the vegetation associations provided in these reports and with reference to the FCT descriptions in Gibson *et al.* (1994) and Bush Forever (Government of WA, 2000). The surveys conducted by ATA Environmental (2002) have also assist in verifying the appropriate FCT for Vegetation Associations recorded in the existing and proposed ROS areas.

TABLE 2
Vegetation Associations Recorded in the Study area by Trudgen and Keighery (1990),
Armstrong (1996) and ATA Environmental (2002) and Corresponding
Floristic Community Types

	Vegetation Associations	Vegetation Assoc. Mapping Unit	Floristic Community Type (inferred)
QUINDALUP DUNES			
S	Vegetation of the Strand	S	S14
Q4	Vegetation of the Q4 Age Dune		
	Open to Low Closed Heaths to Shrublands dominated by <i>Scaevola crassifolia</i> and <i>Olearia axillaris</i> ; <i>Scaevola nitida</i> , <i>Acanthocarpus preissii</i> and <i>Hemiandra pungens</i> or <i>Acacia rostellifera</i> . The strand area is dominated by a grassland of <i>Spinifex longifolius</i> and <i>S. hirsutus</i> .		
	▪ <i>Scaevola crassifolia</i> , <i>Acacia truncata</i> Low Open Heath	ScAt	S13
	▪ <i>Scaevola crassifolia</i> , <i>Olearia axillaris</i> Open to Closed Heath	ScOa	S13
	▪ <i>Scaevola nitida</i> , <i>Olearia axillaris</i> Dense Low Heath	SnOa	S13
	▪ <i>Myoporum insulare</i> , <i>Spyridium globulosum</i> Shrubland	MiSg	29a
	▪ <i>Spyridium globulosum</i> , <i>Melaleuca systema</i> , <i>Lomandra maritima</i> Low Open Heath *	SgMsLm	29a
	▪ <i>Lomandra maritima</i> Herbland with <i>Acacia truncata</i> , <i>Olearia axillaris</i> Low Heath	Lm (Q4)	29a
	▪ <i>Allocasuarina lehmaniana</i> , <i>Melaleuca systema</i> Closed Heath *	AlMs	29a
▪ <i>Allocasuarina lehmaniana</i> Closed Heath *	Al	29a	
▪ <i>Lepidosperma gladiatum</i> Sedgeland *	Lg	29a	
Q4b	Vegetation of the Q4 Age Stabilised Blowout		
	The stabilised blowout at Ningana (Pt Lot M1503) comprises a Low Closed Heath of <i>Scaevola nitida</i> on the swales and dune slopes; <i>Acacia truncata</i> , <i>Melaleuca systema</i> Low Shrubland on the dune crest; and Low Open Heaths of <i>Acanthocarpus preissii</i> and <i>Hemiandra pungens</i> at the landward extent of the blowout.		
	▪ <i>Scaevola nitida</i> Low Closed Heath to Closed Heath	Sn	29b
	▪ <i>Acacia truncata</i> , <i>Acrotriche cordata</i> , <i>Melaleuca systema</i> , <i>Pimelea ferruginea</i> Low Open Shrubland to Low Shrubland	At	29b
▪ <i>Acanthocarpus preissii</i> , <i>Hemiandra pungens</i> Low Open Heath	Ap	29b	
Q	Vegetation of the Q1, Q2 and Q3 Age Quindalup Dunes		
	Low Open Heaths of <i>Melaleuca systema</i> , <i>Acacia rostellifera</i> , <i>Acacia lasiocarpa</i> and <i>Hibbertia racemosa</i> over Herblands dominated by <i>Lomandra maritima</i> .		
	▪ <i>Olearia axillaris</i> , <i>Scaevola nitida</i> Open Shrubland	OaSn	S13
	▪ <i>Scaevola nitida</i> , <i>Acacia truncata</i> Closed Heath *	SnAt	29b
	▪ <i>Acacia rostellifera</i> Closed Scrub / Heath	Ar (Q)	S11
	▪ <i>Acacia rostellifera</i> , <i>Spyridium globulosum</i> Closed Heath	ArSg	S11
	▪ <i>Acacia rostellifera</i> , <i>Melaleuca systema</i> Low Open Heath	ArMs	S11
	▪ <i>Acacia rostellifera</i> , <i>Melaleuca systema</i> , <i>Lomandra maritima</i> Low Open Heath	ArMsLm	29b
	▪ <i>Melaleuca systema</i> Low Shrubland to Shrubland	Ms	S11
	▪ <i>Melaleuca systema</i> , <i>Lysinema ciliatum</i> Low Closed Heath *	MsLc	29b
	▪ <i>Melaleuca systema</i> , <i>Lomandra maritima</i> Low Open Heath *	MsLm	29b
	▪ <i>Brachyloma preissii</i> , <i>Melaleuca systema</i> , <i>Lomandra maritima</i> Low Open Heath *	BpMsLm	29b
	▪ <i>Lomandra maritima</i> Herbland	Lm (Q)	29b
	▪ <i>Acacia cochlearis</i> Closed Heath *	Ac	29b
	▪ <i>Acacia cochlearis</i> , <i>Olearia axillaris</i> , <i>Melaleuca systema</i> Open Heath *	AcOaMs	29b
	▪ <i>Acacia lasiocarpa</i> , <i>Scaevola nitida</i> Low Heath with <i>Lomandra maritima</i>	AlSn	29b
	▪ <i>Santalum acuminatum</i> Heath	Sa	29b
▪ <i>Trymalium albicans</i> , <i>Acacia lasiocarpa</i> , <i>Oxylobium reticulatum</i> , <i>Melaleuca systema</i> Low Open Heath	Ta	29b	
▪ <i>Nuytsia floribunda</i> Low Woodland	Nf	24	

	Vegetation Associations	Vegetation Assoc. Mapping Unit	Floristic Community Type (inferred)
SPEARWOOD DUNES			
BaBm	Sand Surface of the Spearwood Dunes		
	<i>Banksia attenuata</i> and <i>B. menziesii</i> Low Woodland over <i>Allocasuarina humilis</i> , <i>Hibbertia hypericoides</i> , <i>Xanthorrhoea preissii</i> and <i>Hakea ruscifolia</i> over a sedge/herb layer of <i>Mesomelaena pseudostygia</i> and <i>Desmodcladus flexuosus</i>		
	▪ <i>Banksia attenuata</i> , <i>B. menziesii</i> Low Woodland	BaBm	28
	▪ <i>Banksia attenuata</i> , <i>Allocasuarina fraseriana</i> Low Open Forest over <i>Jacksonia sternbergiana</i> High Shrubland	BaAfJs	28
	▪ <i>Eucalyptus tottiana</i> , <i>Banksia attenuata</i> , <i>B. menziesii</i> Low Open Woodland	EtBaBm	28
	▪ <i>Eucalyptus marginata</i> , <i>Banksia attenuata</i> , <i>B. menziesii</i> , <i>Allocasuarina fraseriana</i> Low Woodland over <i>Jacksonia sternbergiana</i> High Shrubland *	EmBAfJs	28
	▪ <i>Acacia rostellifera</i> Low Closed Forest	Ar (S)	S11
	▪ <i>Xanthorrhoea preissii</i> Shrubland	Xp	24
	▪ <i>Xanthorrhoea preissii</i> , <i>Dryandra sessilis</i> , <i>Hakea trifurcata</i> Closed Heath *	XpDsHt	24
	▪ <i>Xanthorrhoea preissii</i> , <i>Hibbertia hypericoides</i> Open Heath *	XpHh	24
▪ <i>Allocasuarina fraseriana</i> , <i>Banksia</i> spp., <i>E. tottiana</i> Low Open Forest to Open Forest	Af	28	
Eg	▪ Tuart (<i>Eucalyptus gomphocephala</i>) Open Woodland to Woodland over <i>Banksia attenuata</i> , <i>Acacia saligna</i> and <i>Xanthorrhoea preissii</i> .	Eg	28
Ar	▪ <i>Acacia rostellifera</i> Low Closed Woodland includes a small admixture of <i>Banksia attenuata</i> , <i>Hardenbergia comptoniana</i> with a very open understorey.	ArBa	S11
LH	Limestone Surface of the Spearwood Dunes		
	Open to Closed Heaths on Limestone dominated by a mixture of <i>Dryandra sessilis</i> , <i>Hakea trifurcata</i> , <i>Calothamnus quadrifidus</i> , <i>Allocasuarina humilis</i> , <i>Melaleuca cardiophylla</i> and <i>Xanthorrhoea preissii</i> with <i>Melaleuca huegelii</i> where limestone outcrops strongly		
	▪ <i>Dryandra sessilis</i> Open to Closed Heath	Ds	24
	▪ <i>Dryandra sessilis</i> , <i>Hakea trifurcata</i> Open to Closed Heath *	DsHt	24
	▪ <i>Dryandra sessilis</i> with <i>Melaleuca huegelii</i> or <i>Acacia truncata</i> Closed Heath	DsMh/At	24 or 29a
	▪ <i>Melaleuca huegelii</i> , <i>Acacia truncata</i> , <i>Thomasia triphylla</i> Low Open Heath *	MhAt	24 or 29a
	▪ <i>Melaleuca huegelii</i> , <i>Acacia truncata</i> , <i>Melaleuca cardiophylla</i> Low Open Heath to Low Closed Heath *	MhAtMc	24 or 29a
	▪ <i>Melaleuca huegelii</i> , <i>Melaleuca systema</i> Low Open Heath *	MhMs	26a
	▪ <i>Melaleuca huegelii</i> , <i>Melaleuca systema</i> , <i>Acacia truncata</i> Low Open Heath *	MhMsAt	26a
	▪ <i>Melaleuca huegelii</i> , <i>Thomasia triphylla</i> , <i>Brachyloma preissii</i> Low Open Heath *	MhTt	24 or 29a
	▪ <i>Melaleuca huegelii</i> , <i>Dryandra sessilis</i> Open Heath to Heath	MhDs	24
	▪ <i>Hakea trifurcata</i> Open to Closed Heath	Ht	24
	▪ <i>Hakea trifurcata</i> , <i>Dryandra sessilis</i> Open Heath to Closed Heath *	HtDs	24
	▪ <i>Calothamnus quadrifidus</i> Open Heath to Closed Heath	Cq	24
	▪ <i>Calothamnus quadrifidus</i> , <i>Dryandra sessilis</i> Open Heath to Closed Heath *	CqDs	24
	▪ <i>Melaleuca cardiophylla</i> Closed Heath	Mc	24
	▪ <i>Melaleuca cardiophylla</i> , <i>Dryandra sessilis</i> Closed Heath	McDs	24
	▪ <i>Melaleuca cardiophylla</i> , <i>Dryandra sessilis</i> , <i>Acacia truncata</i> Low Closed Heath	McDsAt	24
	▪ <i>Acacia rostellifera</i> , <i>Melaleuca cardiophylla</i> Closed Heath *	ArMc	29a
	▪ <i>Allocasuarina humilis</i> Low Open Heath	Ah	24
	▪ <i>Acacia saligna</i> and <i>Jacksonia furcellata</i> Open Scrub	AsJf	24
	▪ <i>Scaevola nitida</i> , <i>Acacia truncata</i> Open to Closed Heath	SnAt	24
▪ <i>Lomandra maritima</i> Low Heath	Lm (S)	29a	

Note: * indicates vegetation types recorded by ATA Environmental (2002) not previously identified by Trudgen and Keighery (1990) or Armstrong (1996)

Vegetation Condition

The condition of the vegetation within the Alkimos-Eglinton Area varies from excellent to completely degraded, as shown in Figure 7(ii). Vegetation considered to be in excellent condition includes the area of *Banksia* and Sheoak (*Allocasuarina fraseriana*) Low Woodland in the central northern portion of Lot M1503. The cleared to degraded areas are largely found along the coastal regions of Alkimos-Eglinton, within the large parabolic dune on Lot 102, in the central southern portion of Lot 11 and in the east, south and north west of Lot M1503. The degraded areas appear to be the result of a number of factors including clearing for stock grazing, the impact of rabbits and fire. However, the most significant contributor to vegetation degradation in the primary dunes has been uncontrolled vehicular access. The site, particularly, on Lot 8 and 11, is characterised by a network of intersecting tracks.

Existing MRS ROS Reservations and Bushplan/Bush Forever

The current MRS Regional Open Space Reservations reflect the *North West Corridor Structure Plan* and comprise the coastal foreshore reserve, an east-west lateral wedge between Eglinton and Yanchep, and a coastal area north of the current Waste Water Treatment Plant site. The current coastal foreshore reserve is part of System 6 Recommendation M2. All existing Parks and Recreation reservations are identified as Bush Forever Sites (BF Site 289 and 397).

Bush Forever has been prepared jointly by the Department for Planning and Infrastructure, Department of Environmental Protection (DEP), Department of Conservation and Land Management (CALM) and the Water & Rivers Commission. It builds on the System 6 Update and the findings of the Perth Environment Project and identifies areas of regional significance worthy of protection to conserve the biodiversity of the vegetation on the Swan Coastal Plain portion of the Perth Metropolitan Region. The principal objective of Bush Forever is to protect at least 10% or 400ha, whichever is the largest, of each vegetation complex in at least five separate areas in the Perth Metropolitan Region. Other key criteria for the identification of regionally significant areas include the protection of threatened ecological communities, floristic communities and verified conservation category wetlands associated with bushland. In addition, elements such as size, vegetation condition, relationship with other areas and land use zoning constraints were also considered during the selection process.

The identification of regionally significant vegetation in the Amendment Area was constrained by the existing MRS Parks and Recreation zonings, therefore providing limited opportunity to consider other areas more appropriate in terms of conservation value. In particular, the existing boundaries of the Bush Forever Sites have not been assessed as part of the formal Bushplan/Bush Forever assessment process.

Under the current MRS, the Amendment Area comprises two Bush Forever Sites, Site 397 which spans the coastline between Wilbinga and Mindarie, and Site 289 which extends into the study area from Yanchep National Park. The site information for Bush Forever Site 289 and 397 is contained in Appendix 4. The boundary of the Bush Forever Sites are identified in Figure 3 and described as follows:

Bush Forever Site 289

The area at Eglinton designated as 'Parks and Recreation' under the current MRS forms the western portion (185ha) of the area identified as Bush Forever Site 289 (total area 616.9ha). This area supports vegetation characteristic of the Quindalup Dune Systems and Spearwood Dune Systems (Cottesloe-Central and South Complex) adjacent to the coastal foreshore reserve. A significant component of BF Site 289 comprises cleared or degraded land.

According to Bush Forever (Government of WA, 2000) the current values of BF Site 289 include:

- Site protects vegetation of the Quindalup Dunes mostly Q2 or Q3 in age, Q4 limited to area close to coastline, associated blowouts; well separated dunes perched on undulating Spearwood (Tamala) Limestone surface.
- Provides for the continuation of natural processes comprising 196ha of vegetation of the Quindalup Dunes extending 3.9km inland and linking the coast and other regionally significant vegetation in Yanchep National Park.
- Protects the Quindalup/ Spearwood Dune interface.
- Protects vegetation and fauna habitat typical of the Quindalup / Spearwood units.
- Protects the Alkimos Dune Complex, a system of parabolic beach dunes of Holocene age containing a chronological sequence (Lemmon *et al.* 1979 in Government of WA, 2000).
- Protects populations of Priority 3 Flora, *Conostylis pauciflora* ssp. *euryhipis* and *Stylidium maritimum*.

Bush Forever Site 397

Bush Forever Site 397 encompasses a semi-contiguous north-south vegetated coastal strip and extends inland approximately 0.8km to include an area of 'Parks and Recreation' adjacent to Lot 101 at Alkimos.

Following engineering investigations in the 1970s, the Water Authority purchased 160ha of land, Lot 101, at Alkimos for a Wastewater and Groundwater Treatment Plant to service future growth. The lot was located within a proposed green belt under the 1970 Corridor Plan for Perth. A portion of this greenbelt (approximately 38ha) was reserved as 'Parks and Recreation' under the MRS Amendment 932/33 (1993) to form part of the buffer around the WWTP and to protect near-coastal limestone heath vegetation. This buffer also forms part of Bush Forever Site 397.

According to Bush Forever (Government of WA, 2000) the current values of BF Site 397- ie the coastal strip and area of vegetation adjacent to Lot 101 are constrained in meeting the specific coastal reserve criteria. In summary the values of this Site are as follows:

- The Site protects vegetation of the younger Quindalup Dune types.

- Provides for the protection of continuing natural processes by protecting 302ha of bushland of the Quindalup Dunes extending to a maximum of 0.8km inland but generally less.
- Forms a semi-contiguous north-south vegetated linkage along the coast.
- Protects the only wetland in the Quindalup Dunes north of Perth in the Perth Metropolitan Region, ie. Karli Spring.
- Protects populations of Priority 3 Flora, *Conostylis pauciflora* ssp. *euryhipis* and *Stylidium maritimum*.

MRS Amendment 1029/33 proposes a number of changes to the boundaries of Bush Forever Site 289 and 397. The implications of these changes in terms of the conservation of flora and vegetation are discussed in the following sections and summarised in Appendix 5.

Assessment of the Proposed ROS Amendments

The landowner's consultants undertook an assessment of the environmental values of the entire district and proposed a number of changes including a number of modifications to the boundary alignments of land reserved for Parks and Recreation. These proposals have however been modified, given the substantial changes to Parks and Recreation reservations that will occur elsewhere through Bush Forever.

Five major changes are proposed to the Parks and Recreation reservations (as shown in Figure 6:

- Boundary changes to the northern Parks and Recreation reserve at Eglinton (Areas 1, 2 and 3);
- inclusion of an area adjacent to the coastal foreshore reserve on Lot M1482 to provide a better interface to the approved golf course/resort development (Area 4);
- deletion of a Parks and Recreation area in the buffer to the Waste Water Treatment Plant (Area 5);
- The introduction of a town park immediately north of the Alkimos Regional Centre (Area 6); and
- Rationalisation and reductions to the coastal foreshore Parks and Recreation reservation (Area 7a-d);

The selected changes proposed to the boundaries of the MRS Parks and Recreation / Bush Forever Sites and Public Purposes Area as part of this Amendment, are summarised in the following table:

TABLE 3
Summary of Proposed ROS and Other Amendments

Location	Specific Amendment Area (Refer to Figure 6)	Modification
Bush Forever Site 289 - Ningana (Eglinton ROS)	1	Addition
	2	Addition
	3	Deletion
Alkimos - Lot M1482	4	Addition
Alkimos - WWTP buffer	5	Deletion
Alkimos – GWTP buffer	6	Addition
Alkimos Foreshore Reserve (area surrounding proposed coastal node)	7	Deletion
Alkimos – Public Purposes Area / Urban Deferred	8	Relocation

The following sections provide a description of each Amendment Area. The vegetation types and condition of the areas are mapped in Figure 7a(i) – 7d(i) and 7a(ii) – 7d(ii), respectively.

Area 1 – Addition to Bush Forever Site 289

Amendment Area 1 proposes to increase the connectivity of the ROS to the coast by expanding the width of the corridor at this point. This Area encompasses 11.2ha of predominantly Old Quindalup (Q1, Q2 and Q3) Dune vegetation and a small area of Young Quindalup Heath (Q4 age dunes) adjacent to the coast.

Based on vegetation surveys of the Ningana area (Trudgen and Keighery, 1990) and recent mapping by ATA Environmental (2002), the vegetation of Amendment Area 1 includes Shrublands of *Myoporum insulare* and *Spyridium globulosum* (MiSg) adjacent to the coast; Closed Heaths of *Scaevola nitida* and *Acacia truncata* (SnAt) on the protected dune slopes and swales; *Melaleuca systema* and *Lomandra maritima* Low Open Heath on the dune crests and upper slopes; small, dense stands of *Acacia rostellifera* (Ar) in protected areas; and Closed Heaths of *Acacia cochlearis* (Ac) over a significant portion of Area 1 on dune slopes, crests and swales.

The vegetation of this area is in good to very good condition with some degradation to the dunes caused by off-road vehicle and motorbike use. A small portion (3%) of Amendment Area 1 is cleared or degraded as a result of these activities.

A number of species of interest have been recorded in the Quindalup Dunes by Trudgen and Keighery (1990) including two species of Priority 3 Flora, *Conostylis pauciflora* ssp. *euryhipis* and *Stylidium maritimum*. *Conostylis pauciflora* ssp. *euryhipis* is locally common but restricted in distribution and generally confined to the consolidated dunes within 10km of the coast between Cervantes and Yanchep. This species has been recorded in the Q2 age dunes in *Scaevola nitida* Low Closed Heath; *Acacia rostellifera*, *Melaleuca systema* Low Open Heath; *Acacia rostellifera* Closed Scrub/Heath, all of which occur in Amendment Area 1.

During the detailed investigations of the ROS areas by ATA Environmental (2002) the Priority 3 Flora, *Conostylis pauciflora* ssp. *euryhipis*, was found to be widespread in the

Alkimos-Eglinton area. In Amendment Area 1 it was recorded throughout the vegetation type MsLm.

Several populations of *Stylidium maritimum* were recorded in the Alkimos-Eglinton area by Trudgen and Keighery (1990). This species generally occurs in the *Xanthorrhoea preissii* Shrublands where the Spearwood System abuts the Quindalup Dunes (Q1 age), particularly where this interface is in a swale. The preferred habitat of *Stylidium maritimum* does not occur in Amendment Area 1, therefore the addition of Area 1 will not have any impact on the protection of this species.

The Floristic Community Types present in Amendment Area 1 include FCT 29a (Coastal Shrublands on shallow sands); 29b (*Acacia* Shrublands on taller dunes); S11 (Northern *Acacia rostellifera* – *Melaleuca systema* Shrublands); S13 (Northern *Olearia axillaris* – *Scaevola crassifolia* Shrublands); and S14 (*Spinifex longifolius* Grasslands and Low Shrublands).

None of the Floristic Community Types identified above are listed as a Threatened Ecological Community at the state or national level. FCTs 29a and 29b have been recommended for listing as Threatened due to their poor reservation status (English and Blyth, 1997) however, they are not listed on CALM's Threatened Ecological Community list of 4 December 2001 or the Commonwealth Threatened Ecological Community list. These communities occur as small areas within the Amendment Area and are expected to be present also within the surrounding areas of proposed or existing Regional Open Space. According to Gibson *et al.*, (1994) FCT 29a and 29b are currently protected in Vacant Crown Land south of Seabird, Bush Forever Site 346 (M91), Trigg Reserve (BF Site 308/M36), Port Kennedy (BF Site 377), Garden Island (BF Site 63), Bush Beach Reserve (Part of BF Site 397), and Vacant Crown Land west of the Caraban Nature Reserve.

Area 2 – Addition to Bush Forever Site 289

Amendment Area 2 proposes to increase the corridor linkage between the coast and inland ROS at Yanchep by up to 450m. The addition of this area increases the reservation of the Spearwood Dunes to be included in the Ningana ROS by approximately 38.2ha.

Amendment Area 2 supports two main vegetation units; Limestone Heaths and *Banksia* Woodlands. The Heath vegetation is found on the upland regions of the Amendment Area where limestone is outcropping or very close to the ground surface. The *Banksia* Woodland occurs in fragmented patches between the ridges where limestone occurs at depth. Most of the vegetation in Amendment Area 2 is in very good to excellent condition. Pockets of vegetation at the western periphery where the Amendment Area abuts the existing Parks and Recreation Reservation have been cleared or are degraded from past land use activities.

The vegetation of the Limestone Heath area is dominated by large areas of *Dryandra sessilis* Open to Closed Heath (Ds). Smaller pockets of *Dryandra sessilis* and *Hakea trifurcata* Open to Closed Heaths (DsHt); *Calothamnus quadrifidus* Open to Closed Heaths (Cq); and *Calothamnus quadrifidus* and *Dryandra sessilis* Open to Closed Heaths (CqDs/DsCq) were identified mainly in the western region of Area 1. Within Amendment Area 1 the area of Limestone Heath vegetation to be protected encompasses approximately 17.9ha.

On the deeper soil surfaces *Banksia attenuata* and *B. menziesii* Low Woodlands (BaBm) dominate over a shrub layer of *Allocasuarina humilis*, *Hibbertia hypericoides*, *Xanthorrhoea priessii* and *Hakea ruscifolia* and a sedge/herb layer of *Mesomelaena pseudostygia* and *Desmocladius flexuosus*. The reservation of a small pocket of Tuart Open Woodland to Woodland (Eg) will be increased under the proposed MRS. The unit is dominated by an overstorey of Tuart with an open layer of *Banksia attenuata* over a shrub layer of *Acacia slaigna*, *Xanthorrhoea preissii*, *Jacksonia furcellata*, *Dryandra sessilis* and *Olearia axillaris*.

The vegetation in Amendment Area 2 corresponds to FCT 24 (Northern Spearwood Shrublands and Woodlands) and 28 (Spearwood *Banksia attenuata* or *Banksia attenuata* – *Eucalyptus* Woodlands).

FCTs 24 and 28 are currently well reserved and low risk in terms of their conservation status, however FCT 24 is confined to the Perth Metropolitan Region.

Area 3 – Deletion to Bush Forever Site 289

Amendment Area 3 proposes the deletion of 56.7ha of Quindalup and Spearwood Dune Vegetation comprising Old Quindalup Heath (Q1, 2, 3), Limestone Heath and small parcels of Banksia Woodland from the existing MRS.

The vegetation of the Quindalup Dune System occurs in the western portion of Area 3 and comprises large areas of *Acacia rostellifera* Closed Scrub/Heath with *Spyridium globulosum* (ArSg) as the co-dominant species in some areas. The Ar / ArSg vegetation types are generally restricted to the swales and leeward slopes of the dunes. Low Open Heaths of *Melaleuca systema* and *Lomandra maritima* (MsLm) dominate the dune crests and windward slopes in the western region of Amendment Area 3.

The Limestone Heath in Amendment Area 3 comprises dense areas dominated by *Dryandra sessilis* Open to Closed Heaths in the northern region and mixed Open to Closed Heaths of *Dryandra sessilis* and *Hakea trifurcata* (DsHt) in the south-eastern region of Area 3. An area of *Calothamnus quadrifidus* Closed Heath (Cq) occurs in the central region of Area 3.

Small pockets of *Banksia* Woodland (BaBm) are scattered through the eastern region of Area 3 which are dominated by a mixture of *Banksia attenuata*, *Banksia menziesii* over a shrub layer dominated by *Allocasuarina humilis*, *Hibbertia hypericoides*, *Xanthorrhoea preissii* and *Hakea ruscifolia*. In most cases a thin band of Cq interspersed with *Dryandra sessilis* and *Allocasuarina humilis* occurs at the interface of the BaBm Woodlands and limestone heaths of Ds and DsHt.

The eastern portion of Amendment Area 3 (ie east of Marmion Avenue) comprises vegetation types which are consistent with the types proposed for protection in Amendment Area 2 (ie. BaBm, Ds, DsHt/HtDs, Cq, CqDs). The western portion of Amendment Area 3 (ie west of Marmion Avenue) contains vegetation associations that all occur in the balance of the ROS area at Eglinton.

The vegetation of Amendment Area 3 is in good to very good condition with the central region of the Area dissected north to south by a degraded cleared area.

According to the vegetation mapping for Amendment Area 3, the Old Quindalup Heath vegetation corresponds to FCT 29a (Coastal Shrublands on shallow sands) and 29b (*Acacia* Shrublands on taller dunes). The Limestone Heath vegetation in this area corresponds to FCT 24 (Northern Spearwood Shrublands and Woodlands) and the Banksia Woodlands to FCT 28 (Spearwood *Banksia attenuata* or *Banksia attenuata* – *Eucalyptus* Woodlands).

None of the Floristic Community Types identified above are currently listed as a Threatened Ecological Community at the state or national level. FCTs 29a and 29b have been recommended for listing as Threatened due to their poor reservation status. These communities occur as small areas within the Amendment Area and are expected to be present also within the surrounding areas of proposed or existing Regional Open Space. According to Gibson *et al.*, (1994) FCT 29a and 29b are currently protected in Vacant Crown Land south of Seabird, Bush Forever Site 346 (M91), Trigg Reserve (BF Site 308/M36), Port Kennedy (BF Site 377), Garden Island (BF Site 63), Bush Beach Reserve (Part of BF Site 397), and Vacant Crown Land west of the Caraban Nature Reserve.

Area 4 – Addition to Bush Forever Site 397 (Portion of Lot M1482)

Amendment Area 4 proposes the addition of 20.4ha of Old Quindalup Dune Heath (Q1, Q2, Q3 type vegetation).

The vegetation types of Amendment Area 4 are dominated by Low Open Heaths of *Acacia rostellifera*, *Melaleuca systema* and *Lomandra maritima* (ArMsLm) on the dune slopes and swales and Low Open Heaths of *Melaleuca systema* and *Lomandra maritima* (MsLm) on the upper slopes and dune crests. A small stand of *Xanthorrhoea preissii* Shrubland was identified in low-lying area in the central region of Area 4. A dense stand of *Acacia rostellifera* Closed Scrub occurs at the south-eastern boundary of Area 4.

This area has been mapped as comprising vegetation in good to very good condition with minor disturbance arising from off road vehicle use.

The vegetation of Amendment Area 4 corresponds to FCT 29a (Coastal Shrublands on shallow sands) and 29b (*Acacia* Shrublands on taller dunes).

Floristic Community Types 29a and 29b are not currently listed as Threatened Ecological Communities at the state or National level, however they have been recommended for listing as Threatened due to their poor reservation status. These communities are expected to be present within the surrounding areas of proposed or existing Regional Open Space. According to Gibson *et al.*, (1994) FCT 29a and 29b are currently protected in Vacant Crown Land south of Seabird, Bush Forever Site 346 (M91), Trigg Reserve (BF Site 308/M36), Port Kennedy (BF Site 377), Garden Island (BF Site 63), Bush Beach Reserve (Part of BF Site 397), and Vacant Crown Land west of the Caraban Nature Reserve.

According to the flora and vegetation survey of the area of land directly to the north of Amendment Area 4 (Armstrong, 1996), populations of Priority 3 Flora species, *Styloidium maritimum* and *Conostylis pauciflora* ssp. *euryhipis*, have been recorded in Old Quindalup Dune vegetation similar to that found in Amendment Area 4. During the survey conducted by ATA Environmental in July 2002, the Priority 3 Flora species, *Conostylis pauciflora* ssp. *euryhipis*, was recorded throughout Amendment Area 4, particularly in the ArMsLm and MsLm Vegetation Types. .

Area 5 – Deletion of ROS in WWTP Buffer (Bush Forever Site 397)

Amendment Area 5 encompasses 38.2ha of land east of the coastal foreshore reservation and immediately north of the WWTP site, straddling Lots M1482 and Lot 102. This area of land was originally proposed as Parks and Recreation to allow for a buffer around the WWTP. It has since been identified as containing regionally significant vegetation and is proposed for protection under Bush Forever. The proposed relocation of the WWTP further inland does not require this area of vegetation to be retained as a buffer which has prompted the proposed deletion of this land from the existing ROS reservations under the MRS.

Amendment Area 5 comprises vegetation of the Quindalup and Spearwood Dune Complexes including Old Quindalup Heath (Q1, Q2 and Q3 age dunes) close to the coast and an area of Limestone Heath further inland.

The vegetation of the Old Quindalup Dune Heath includes portions of an old parabolic dune ridge comprising Low Open Heaths of *Melaleuca systema* and *Lomandra maritima* (MsLm) in the western region of Area 5. The lower-lying areas to the west of the parabolic dune comprise Heath to Shrublands of *Acacia rostellifera* (Ar). The parabolic dune ridge forms the inland extent of the Quindalup dunes. To the east of this ridge, the Spearwood Dune vegetation is dominated by Limestone Heaths including large areas of *Dryandra sessilis* Closed Heath and smaller pockets of *D. sessilis* with *Melaleuca cardiophylla* and *Acacia truncata* (McDs / McDsAt). In addition, three small areas of limestone outcropping on the dune ridges comprise Low Open Heaths of *Melaleuca huegelii*, *Melaleuca systema*, *Acacia truncata* (MhMsAt) as well as one small area comprising a *Melaleuca huegelii* and *Acacia truncata* Low Open Heath (MhAt).

Further inland in Amendment Area 5 the deeper soils support a small area of *Banksia attenuata* and *B. menziesii* Low Woodland (BaBm). This vegetation type occurs at the eastern and south-eastern boundary of Area 5.

The vegetation in the eastern region of Amendment Area 5 is in excellent condition. The Quindalup vegetation in the western region is in good condition due to the use of the area by off-road vehicles.

The vegetation of Amendment Area 5 corresponds to FCT 29a (Coastal Shrublands on shallow sands) and 29b (*Acacia* Shrublands on taller dunes) on the Quindalup Dunes. Most of the Limestone Heath vegetation in this area corresponds to FCT 24 (Northern Spearwood Shrublands and Woodlands). The small areas of vegetation type MhMsAt (encompassing approximately 0.6ha) located on the upland limestone outcrops in the central region of Area 5 comprises species consistent with FCT 26a. Prior to the survey conducted by ATA Environmental in July 2002, a review of other surveys conducted on similar landforms in the vicinity of the Alkimos area (ie Seabird and Neerabup) identified vegetation containing *Melaleuca huegelii* in association with *Melaleuca systema* by computer analysis as corresponding to FCT 24 or 29a (Keighery *et al.* 1997). However, during the July 2002 survey a 10x10m quadrat revealed that the floristic composition of the MhMsAt vegetation type is consistent with FCT 26a (Relevee data collected in Amendment Area 5 is contained in Appendix 6).

Previous surveys in the Alkimos area have identified that the Priority 3 Flora species, *Stylidium martima*, was recorded in the vegetation type identified as FCT 26a in Amendment Area 5. The population of *S. martima* was identified as comprising less than 1% of the vegetation cover of the vegetation type (Trudgen and Keighery, 1990). The presence of *S. martima* within Area 5 was confirmed during the July 2002 survey by ATA Environmental, however it was only recorded from the western parcel of MhMsAt.

According to Trudgen and Keighery (1990), *Conostylis pauciflora* ssp. *euryhipis* (P3), was recorded in the Quindalup Dunes but not within Amendment Area 5. This species was identified throughout the study area during the July 2002 survey by ATA Environmental.

The vegetation type MhMsAt was also found to support the Priority 3 Flora species, *Hibbertia spicata* ssp. *leptotheca*. This species was previously recorded from the Alkimos area by Trudgen and Keighery (1990) but was not identified as a significant flora species or listed as a Priority Flora species at the time of the survey. During the course of survey work conducted by ATA Environmental in July 2002, populations of this species (more than 25 plants) were identified in all three *Melaleuca huegelii* dominated hilltops.

Area 6 – Addition of GWTP Buffer

Amendment Area 6 proposes a Parks and Recreation reservation for an area of excellent quality bushland immediately north of the Central City Area zone to form a town park. The Parks and Recreation Reservation encompasses 45.7ha. The southern boundary of the reservation is proposed to include the northern edge of the parabolic dune, a significant landform feature which will provide a backdrop to the Alkimos Central City Area. The town park will abut the Public Purposes reservation for the Ground Water Treatment Plant. It is envisaged that much of the treatment plant buffer will be retained as bushland and managed with the town park. The total area proposed for reservation for Parks and Recreation in the 'town park' area is in excess of 60ha.

Amendment Area 6 comprises vegetation predominantly of the Spearwood Complex, including Banksia Woodland and Limestone Heath, with a band of vegetation of the Quindalup (Q1, Q2 age dunes) Complex at the southern boundary in good to very good condition.

The areas of Banksia in Amendment Area 6 differ in composition and structure to the areas of *Banksia* Woodlands (BaBm) recorded closer to the coast and in the northern ROS. In Area 6, the large areas of Banksia form Low Open Woodlands comprising *B. attenuata* (with scattered *B. menziesii*) and Sheoak (*Allocasuarina fraseriana*) over a High Shrubland of *Jacksonia sternbergiana* (BaAfJs). Other common species in this vegetation type include *Banksia menziesii*, *Banksia grandis* with mixtures of the following species; *Nuytsia floribunda* and *Eucalyptus todtiana*. The dominant understorey species include *Xanthorrhoea preissii*, *Jacksonia sternbergiana*, *Macrozamia fraseri*, *Allocasuarina humilis*, *Hibbertia hypericoides* and *Acacia saligna*.

The Limestone Heath vegetation occurs as pockets within Amendment Area 6 and includes *Xanthorrhoea preissii* Closed Heath with mixtures of *Dryandra sessilis* and *Hakea trifurcata* (XpDsHt) surrounding pockets dominated by Closed Heaths of *Dryandra sessilis*. Other species of the XpDsHt association include *Jacksonia stricta*, *Hakea lissocarpha*,

Melaleuca systema, *Gompholobium tomentosum*, *Bossiaea eriocarpa* and *Hibbertia hypericoides*.

The Old Quindalup Dune Heath which runs along the southern boundary of Area 6 comprises *Melaleuca systema* and *Lomandra maritima* Low Open Heath with scattered *Acacia saligna*, *Rhagodia baccata* over *Lomandra maritima*. Protected areas along this dune comprise Shrublands of *Acacia rostellifera*. The Priority 3 Flora species, *Conostylis pauciflora* ssp. *euryhipis* occurs in the Quindalup Dunes of Area 6.

Based on the floristic composition of the vegetation in Amendment Area 6, the Floristic Community Types occurring in this area include FCT 28 encompassing the *Banksia* Woodlands, FCT 24 in areas of Limestone Heath and FCT 29b for vegetation of the Old Quindalup Dune Heath.

Area 7 – Reduction in Foreshore Reserve / Bush Forever Site 397

The coastal (foreshore) Parks and Recreation reservation is proposed to be rationalised in the western portion of Lot 102 to reflect the relocation of the WWTP and development of a coastal village. It is separately proposed in the southwestern portion of Lot 102 to reduce the reservation from its current width of 300 to 400m from the coast (line of permanent vegetation) to a width of 160 to 300m, thereby reducing the coastal foreshore reserve by 10.2ha in this area. This is to allow more direct access to the coast's regional beaches from the Urban zoned hinterland while retaining major topographic and vegetation features. The foreshore reserve remains wide in the southernmost extremity to accommodate and protect the catchment area of Karli Spring (location shown on Figure 7d(i)) and surrounding representative examples of the Quindalup Dune System, but has been adjusted for better topographic fit. Karli Spring is registered as a site of Aboriginal significance and is said to be associated with the Waugal.

Provision has been made in the coastal foreshore reserve for amenity and parking areas, and concept plans indicating the possible form of development of the coastal village are included in the Coastal Planning Strategy (Report No. 5).

Amendment Area 7 comprises vegetation of the Young and Old Quindalup Dunes. Four reductions are proposed along the coast surrounding the Coastal Node and will mainly reduce the area of Q1, Q2 and Q3 age Quindalup Dunes in the Foreshore Reserve. In most instances the vegetation in this area is in good to very good condition with some pockets cleared or degraded from off-road vehicle use. This area is dominated by Low Open Heaths of *Melaleuca systema* and *Lomandra maritima* (MsLm). Closed Heaths of *Allocasuarina lehmaniana* (Al) occur in the southern Areas interspersed with *Melaleuca systema* (AhMs). Closer to the coast the MsLm vegetation type is dominated by *Spyridium globulosum* (SgMsLm). A small stand of Tuart (*Eucalyptus gomphocephala*) was identified in a degraded portion of the central region of Area 7.

Floristically, the vegetation corresponds to FCT 29b on the Q1, Q2 and Q3 age dunes and S13 on the younger Quindalup Dunes. The Priority 3 Flora species, *Conostylis pauciflora* ssp. *euryhipis* occurs in Amendment Area 7 and has been recorded throughout the Alkimos-Eglinton area.

Area 8 – Public Purposes to Urban

Amendment Area 8 comprises the area of land within Lot 101 which previously formed part of the WWTP ‘Public Purposes’ reservation. Under the proposed MRS Amendment Area 8 is proposed to be rezoned to ‘Urban’ and ‘Urban Deferred’. Amendment Area 8 encompasses 74.7ha.

Amendment Area 8 comprises vegetation of the Quindalup and Spearwood Dune Complexes including Old Quindalup Heath (Q1, Q2 and Q3 age dunes) close to the coast and an area of Limestone Heath further inland.

The vegetation of the Old Quindalup Dune Heath includes an old parabolic dune ridge comprising Low Open Heaths of *Melaleuca systema* and *Lomandra maritima* (MsLm) in the western and central region of Area 8. The lower-lying areas to the west of the parabolic dune comprise Heath to Shrublands of *Acacia rostellifera* (Ar). The parabolic dune ridge forms the inland extent of the Quindalup dunes, however two small pockets of limestone heath comprising *Dryandra sessilis* occur to the north and south. To the east of this ridge, the Spearwood Dune vegetation is dominated by Limestone Heaths including areas of *Dryandra sessilis* Closed Heath where limestone outcrops or is close the surface. The deeper soils in the region support pockets of *Banksia attenuata* and *B. menziesii* Low Woodland(BaBm).

There are occasional stands of Tuart (Eg) on the Q2 age dunes in Amendment Area 8. In most instances the understorey has been completely removed and replaced by introduced grasses and other weed/pasture species.

The vegetation in the eastern region of Amendment Area 8 is in excellent condition. The Quindalup and Limestone Heath vegetation in the western region of the Area is generally in good condition with some pockets degraded or cleared due to the use of the area by off-road vehicles.

The vegetation of Amendment Area 8 corresponds to FCT 29a (Coastal Shrublands on shallow sands) and 29b (*Acacia* Shrublands on taller dunes) on the Quindalup Dunes. Most of the Limestone Heath vegetation in this area corresponds to FCT 24 (Northern Spearwood Shrublands and Woodlands). The inland *Banksia* Woodland (BaBm) correspond to FCT 28.

Previous surveys in the Alkimos area have identified that the Priority 3 Flora species, *Stylidium martima*, and *Hibbertia spicata* ssp. *leptotheca* have been recorded in the vegetation type (MhMsAt) identified as FCT 26a. This community type has not been identified in Amendment Area 8 and the Area is therefore unlikely to support populations of *Stylidium martima* and *Hibbertia spicata* ssp. *leptotheca*.

According to Trudgen and Keighery (1990), *Conostylis pauciflora* ssp. *euryhipis* (P3) was recorded in the Quindalup Dunes of the Alkimos Area and therefore may occur within Amendment Area 8.

Local and Regional Significance of Proposed Changes

The proposed changes to the MRS can be assessed quantitatively as changes to the areas of Vegetation Complexes and principal Vegetation Associations (and associated condition of the

vegetation) proposed to be reserved as part of the ROS areas in the Amendment Area, as shown in the following table.

TABLE 4
Comparison of Vegetation Types, Complexes and Condition of ROS in the
Current and Proposed MRS

	EGLINTON (Includes Areas 1, 2, 3)			ALKIMOS (includes Areas 4, 5, 6)*			TOTAL DIFF (ha)
	Existing MRS (ha)	Proposed MRS (ha)	Diff +/- (ha)	Existing MRS (ha)	Proposed MRS (ha)	Diff +/- (ha)	
VEGETATION COMPLEXES							
Quindalup System	108.1	94.5	-13.6	11.3	30.8	19.5	5.9
Cottesloe System	61.0	71.8	10.8	26.6	35.3	8.7	19.4
VEGETATION TYPE							
Tuart Woodland	0.9	1.2	0.3	0	0.4	0.4	0.7
Banksia Woodland	13.5	28.6	15.1	1.9	34.5	32.6	47.7
Limestone Heath	46.6	42	-4.6	24.7	0.3	-24.4	-29.0
Old Quindalup Heath (Q1,2,3 Dunes)	105.4	91.8	-13.6	11.3	30.8	19.5	5.9
Young Quindalup Heath (Q4 Dunes)	2.7	2.8	0.1	0	0	0	0.1
<i>Cleared</i>	25.1	20.6	-4.5	0.3	0	-0.3	-4.8
TOTAL	194.2	186.9	-7.3	38.2	66.1	27.9	20.5
VEGETATION CONDITION							
Excellent	5.1	29.3	24.2	27.3	43.4	16.1	40.3
Very Good	0	0	0	0	0	0	0
Good	160.6	132.3	-28.3	4.7	22.6	17.9	-10.4
Degraded	8.3	8.2	-0.1	0	0	0	-0.1
Cleared	25.1	20.6	-4.5	0.3	0	-0.3	-4.8

Note: Area of ROS already reserved east of freeway reserve does not form part of these calculations.

* Changes to Foreshore Reserve are discussed in the Coastal Foreshore Section of ER.

The quantitative assessment of the proposed changes, as presented in the above table, identifies that the proposed Amendment will result in a net increase in the area of native vegetation to be reserved in ROS. The net increase of 25.3ha includes 125.3ha and 107.1ha of vegetation representative of the Quindalup and Spearwood Vegetation Complexes, respectively, comprising Banksia Woodland, Young and Old Quindalup Heath and Tuart Woodland vegetation types. The proposed amendment will result in a reduction of 29ha of Limestone Heath mostly from within the Alkimos ROS (24.4ha) and some from the existing Eglinton ROS (4.6ha).

The significance (at a local level) of the proposed ROS boundary changes at Eglinton (ie Amendment Area 1, 2 and 3) will result in a slight reduction in the area of vegetation (2.8ha) to be protected, including areas of Old Quindalup Heath and Limestone Heath. The reduction in Old Quindalup Heath will result in the loss of Low Open Heaths of *Melaleuca systema* and *Lomandra maritima*, *Acacia rostellifera*, *Acacia lasiocarpa* and *Hibbertia racemosa* over Herblands dominated by *Lomandra maritima*. The reduction in Limestone Heath includes the loss of Heath dominated by *Dryandra sessilis*, *Hakea trifurcata*, *Calothamnus quadrifidus*, *Allocasuarina humilis* and *Xanthorrhoea preissii*.

The modifications to the existing Eglinton ROS, and in particular, the deletion of Area 3 and addition of Area 1 have been proposed in this amendment to allow for the protection of conservation values whilst providing for future recreational requirements. Amendment Area 1 includes some cleared land which when compared to vegetated areas proposed for deletion

from the ROS in Area 3, do not appear to be an adequate conservation outcome. However, the retention of the cleared land as part of the addition of Amendment Area allows for the maintenance of a linkage to the ROS to the north and the future use of this cleared land, instead of vegetated area in good or better condition, as active open space.

Small, isolated parcels of Banksia Woodland are reserved in the existing ROS at Eglinton. Under the proposed MRS, most of these smaller pockets will be deleted and a larger band in the northern region of Eglinton, which forms links to Yanchep National Park, will be reserved. Furthermore, a small area of Tuart Woodland will be protected in its entirety under the proposed MRS (total area 1.2ha).

The following table details the existing and potential reservation changes of the various vegetation types recorded in the Regional Open Space areas at Alkimos-Eglinton. These changes are also quantified for the Floristic Community Types recorded in the ROS areas in Table 6.

TABLE 5
Reservation of the Vegetation Types and Florist Community Types in Regional Open Space (ROS) in the Existing and Proposed MRS Amendment

	Current Reservation* (ha)	FCT	Proposed Additions to MRS ROS (ha)				Proposed Deletions to MRS ROS (ha)			Change +/- in Vegetation Type	
			Area 1	Area 2	Area 4	Area 6	Area 3	Area 5	Area 7		
QUINDALUP DUNES											
Vegetation of the Q4 Age Quindalup Dunes											
ScAt	<i>Scaevola crassifolia, Acacia truncata</i> Low Open Heath	0.0	S13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
ScOa	<i>Scaevola crassifolia, Olearia axillaris</i> Open to Closed Heath	0.0	S13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
SnOa	<i>Scaevola nitida, Olearia axillaris</i> Dense Low Heath	0.0	S13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
MiSg	<i>Myoporum insulare, Spyridium globulosum</i> Shrubland	2.7	29a	0.04							+0.04
SgMsLm	<i>Spyridium globulosum, Melaleuca systema, Lomandra maritima</i> Low Open Heath *	0.0	29a							0.5	-0.5
Lm (Q4)	<i>Lomandra maritima</i> Herbland with <i>Acacia truncata, Olearia axillaris</i> Low Heath	0.0	29a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
AlMs	<i>Allocasuarina lehmaniana, Melaleuca systema</i> Closed Heath *	0.0	29a							0.74	-0.74
Al	<i>Allocasuarina lehmaniana</i> Closed Heath *	0.0	29a							0.31	-0.31
Lg	<i>Lepidosperma gladiatum</i> Sedgeland *	0.0	29a							0.4	-0.4
Vegetation of the Q4 Age Stabilised Blowout											
Sn	<i>Scaevola nitida</i> Low Closed Heath to Closed Heath	0.001	29b	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
At	<i>Acacia truncata, Acrotriche cordata, Melaleuca systema, Pimelea ferruginea</i> Low Open Shrubland to Low Shrubland	0.0	29b	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-

		Current Reservation* (ha)	FCT	Proposed Additions to MRS ROS (ha)				Proposed Deletions to MRS ROS (ha)			Change +/- in Vegetation Type
				Area 1	Area 2	Area 4	Area 6	Area 3	Area 5	Area 7	
Ap	<i>Acanthocarpus preissii</i> , <i>Hemiandra pungens</i> Low Open Heath	0.0	29b	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
Vegetation of the Q1, Q2 and Q3 Age Quindalup Dunes											
OaSn	<i>Olearia axillaris</i> , <i>Scaevola nitida</i> Open Shrubland	0.0	S13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
SnAt	<i>Scaevola nitida</i> , <i>Acacia truncata</i> Closed Heath *	4.9	S13	2.85							+2.85
Ar (Q)	<i>Acacia rostellifera</i> Closed Scrub / Heath	40.3	S11	0.67	0.67	0.6	0.62	14.5	2.37		-14.3
ArSg	<i>Acacia rostellifera</i> , <i>Spyridium globulosum</i> Closed Scrub	9.71	S11					3.66			-3.66
ArMs	<i>Acacia rostellifera</i> , <i>Melaleuca systema</i> Low Open Heath	0.0	S11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
ArMsLm	<i>Acacia rostellifera</i> , <i>Melaleuca systema</i> , <i>Lomandra maritima</i> Low Heath	0.0	S11			14.4					+14.4
Ms	<i>Melaleuca systema</i> Low Shrubland to Shrubland	0.39	S11					0.39		0.53	-0.92
MsLc	<i>Melaleuca systema</i> , <i>Lysinema ciliatum</i> Low Closed Heath *	0.0	29b	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
MsLm	<i>Melaleuca systema</i> , <i>Lomandra maritima</i> Low Open Heath *	48.4	29b	3.32	0.03	5.3	9.94	6.63	8.9	7.03	-3.98
BpMsLm	<i>Brachyloma preissii</i> , <i>Melaleuca systema</i> , <i>Lomandra maritima</i> Low Open Heath *	0.29	29b	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
Lm (Q)	<i>Lomandra maritima</i> Herbland	0.0	29b	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
Ac	<i>Acacia cochlearis</i> Closed Heath *	0.42	29b	3.99							+3.99
AcOaMs	<i>Acacia cochlearis</i> , <i>Olearia axillaris</i> , <i>Melaleuca</i> <i>systema</i> Open Heath *	4.7	29b	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
AlSn	<i>Acacia lasiocarpa</i> , <i>Scaevola nitida</i> Low Heath with <i>Lomandra maritima</i>	0.0	29b	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-

	Current Reservation* (ha)	FCT	Proposed Additions to MRS ROS (ha)				Proposed Deletions to MRS ROS (ha)			Change +/- in Vegetation Type	
			Area 1	Area 2	Area 4	Area 6	Area 3	Area 5	Area 7		
Sa	<i>Santalum acuminatum</i> Heath	3.0	29b	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
Ta	<i>Trymalium albicans</i> , <i>Acacia lasiocarpa</i> , <i>Oxylobium reticulatum</i> , <i>Melaleuca systema</i> Low Open Heath	0.0	29b	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
Nf	<i>Nuytsia floribunda</i> Low Woodland	0.19	24	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
SPEARWOOD DUNES											
Sand Surface of the Spearwood Dunes											
BaBm	<i>Banksia attenuata</i> , <i>B. menziesii</i> Low Woodland	12.9	28		18.63			3.31	19.26		+13.4
BaAfJs	<i>Banksia attenuata</i> , <i>Allocasuarina fraseriana</i> Low Open Forest over <i>Jacksonia sternbergiana</i> High Shrubland	0.0	28				45.74				+45.74
EtBaBm	<i>Eucalyptus todtiana</i> , <i>Banksia attenuata</i> , <i>B. menziesii</i> Low Open Woodland	0.0	28	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
EmBAfJs	<i>Eucalyptus marginata</i> , <i>Banksia attenuata</i> , <i>B. menziesii</i> , <i>Allocasuarina fraseriana</i> Low Woodland over <i>Jacksonia sternbergiana</i> High Shrubland *	0.0	28				0.15				+0.15
Ar (S)	<i>Acacia rostellifera</i> Low Closed Forest	0.0	S11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
Af	<i>Allocasuarina fraseriana</i> , <i>Banksia</i> spp., <i>E. todtiana</i> Low Open Forest to Open forest	0.0	28	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
Eg	Tuart (<i>Eucalyptus gomphocephala</i>) Open Woodland to Woodland over <i>Banksia attenuata</i> , <i>Acacia saligna</i> and <i>Xanthorrhoea preissii</i> .	0.9	28		0.29		0.44			0.24	+0.5
Xp	<i>Xanthorrhoea preissii</i> Shrubland	2.53	24			0.08		0.24			-0.15
XpDsHt	<i>Xanthorrhoea preissii</i> , <i>Dryandra sessilis</i> , <i>Hakea trifurcata</i> Closed Heath *	0.0	24				7.31				+7.31
XpHh	<i>Xanthorrhoea preissii</i> , <i>Hibbertia hypericoides</i> Open Heath *	0.0	24				1.0				+1.0

		Current Reservation* (ha)	FCT	Proposed Additions to MRS ROS (ha)				Proposed Deletions to MRS ROS (ha)			Change +/- in Vegetation Type
				Area 1	Area 2	Area 4	Area 6	Area 3	Area 5	Area 7	
ArBa	<i>Acacia rostellifera</i> Low Closed Woodland includes a small admixture of <i>Banksia attenuata</i> , <i>Hardenbergia comptoniana</i> with a very open understorey.	0.0	S11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
Limestone Surface of the Spearwood Dunes											
Ds	<i>Dryandra sessilis</i> Open to Closed Heath	42.1	24		17.05		1.49	9.92	17.98		-9.37
DsHt	<i>Dryandra sessilis</i> , <i>Hakea trifurcata</i> Open to Closed Heath *	8.9	24					7.94			-7.94
DsMh/At	<i>Dryandra sessilis</i> with <i>Melaleuca huegelii</i> or <i>Acacia truncata</i> Closed Heath	0.0	24 or 29a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
MhAt	<i>Melaleuca huegelii</i> , <i>Acacia truncata</i> , <i>Trymalium albicans</i> Low Open Heath *	0.76	24						0.14		-0.14
MhAtMc	<i>Melaleuca huegelii</i> , <i>Acacia truncata</i> , <i>Melaleuca cardiophylla</i> Low Open Heath to Low Closed Heath *	1.14	24	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
MhMsAt	<i>Melaleuca huegelii</i> , <i>Melaleuca systema</i> , <i>Acacia truncata</i> Low Open Heath *	0.62	26a						0.62		-0.62
MhMs	<i>Melaleuca huegelii</i> , <i>Melaleuca systema</i> , Low Open Heath *	0.0	26a			0.07					+0.07
MhTa	<i>Melaleuca huegelii</i> , <i>Thomasia triphylla</i> , <i>Brachyloma preissii</i> Low Open Heath *	0.66	24 or 29a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
MhDs	<i>Melaleuca huegelii</i> , <i>Dryandra sessilis</i> Open Heath to Heath	0.32	24						0.32		-0.32
Ht	<i>Hakea trifurcata</i> Open to Closed Heath	0.56	24	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
HtDs	<i>Hakea trifurcata</i> , <i>Dryandra sessilis</i> Open Heath to Closed Heath *	0.02	24		0.39						+0.39
Cq	<i>Calothamnus quadrifidus</i> Open Heath to Closed Heath	1.68	24		0.41			1.05			-0.64
CqDs	<i>Calothamnus quadrifidus</i> , <i>Dryandra sessilis</i>	1.65	24		0.02			1.09			-1.06

	Current Reservation* (ha)	FCT	Proposed Additions to MRS ROS (ha)				Proposed Deletions to MRS ROS (ha)			Change +/- in Vegetation Type	
			Area 1	Area 2	Area 4	Area 6	Area 3	Area 5	Area 7		
	Open Heath to Closed Heath *										
Mc	<i>Melaleuca cardiophylla</i> Closed Heath	0.57	24						0.57	+0.57	
McDs	<i>Melaleuca cardiophylla</i> , <i>Dryandra sessilis</i> Closed Heath	3.26	24						3.26	-3.26	
McDsAt	<i>Melaleuca cardiophylla</i> , <i>Dryandra sessilis</i> , <i>Acacia truncata</i> Low Closed Heath	1.77	24						1.77	-1.77	
ArMc	<i>Acacia rostellifera</i> , <i>Melaleuca cardiophylla</i> Closed Heath *	6.5	29a					2.48		-2.48	
Ah	<i>Allocasuarina humilis</i> Low Open Heath	0.0	24	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
AsJf	<i>Acacia saligna</i> and <i>Jacksonia furcellata</i> Open Scrub	0.0	24	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
SnAt	<i>Scaevola nitida</i> , <i>Acacia truncata</i> Open to Closed Heath	4.93	24	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
Lm (S)	<i>Lomandra maritima</i> Low Heath	0.0	29a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
C	Cleared	25.42	-	0.32	0.74			5.54	0.33	0.81	-5.63

Note: n/a = vegetation types not recorded in the ROS areas during the July 2002 survey by ATA Environmental.

* Current Reservation does not apply to Amendment Area 7.

TABLE 6 - Changes to the Reservation Status of FCTs in the ROS

FCT	Current Reservation (ha)	Proposed Additions to MRS ROS (ha)				Total Additions	Proposed Deletions to MRS ROS (ha)			Total Deletions	Change +/-
		Area 1	Area 2	Area 4	Area 6		Area 3	Area 5	Area 7		
S11	50.4	0.67	0.67	15.0	0.62	16.96	18.55	2.37	0.53	21.45	-4.49
S13	4.9	2.85	0.0	0.0	0.0	2.85	0.0	0.0	0.0	0.0	+2.85
24	70.38 (+/-0.66)	0.0	17.87	0.08	9.8	27.75	20.24	24.04	0.0	44.28	-16.53
26a	0.62	0.0	0.0	0.07	0.0	0.07	0.0	0.62	0.0	0.62	-0.55
28	13.8	0.0	18.92	0.0	46.33	65.25	3.31	19.26	0.24	22.81	42.44

29a	9.2 (+/-0.66)	0.04	0.0	0.0	0.0	0.04	2.48	0.0	1.95	4.43	-4.39
29b	56.8	7.31	0.03	5.3	9.94	22.58	6.83	8.9	7.03	22.76	-0.18

The Eglinton ROS vegetation is characteristic of Floristic Community Types 29a, 29b (Quindalup vegetations), 24 (Limestone Heath) and 28 (Banksia Woodlands, Tuart Woodland). FCT 24 and 28 are currently well reserved and at low risk in terms of their conservation status. FCT 29a and 29b are poorly reserved in the conservation estate and susceptible in terms of conservation status (Gibson *et al.* 1994). The Amendments proposes to delete the area of FCT 29a/29b reserved in the Eglinton ROS by 27ha, however, the overall area of ROS at Eglinton (irrespective of the MRS Amendment) currently reserves more than 66ha of FCT 29a and 29b. Furthermore, FCT 29a and 29b are currently protected in Bush Beach Reserve (Part of BF Site 397), Trigg Reserve (BF Site 308/ M36), Vacant Crown Land south of Seabird, Bush Forever Site 346 (M91), Port Kennedy (BF Site 377), Garden Island (BF Site 63), and Vacant Crown Land west of the Caraban Nature Reserve.

None of the FCTs identified in the Eglinton ROS are listed by CALM as threatened or identified by the Commonwealth as Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Act, 1999*.

The proposed amendments to the MRS at Alkimos (ie Amendment Areas 4, 5 and 6), include two additions and one deletion to the ROS reservations. Two changes are proposed adjacent to the coast, and a significant addition is proposed further inland surrounding the proposed GWTP.

The proposed amendments adjacent to the coast involve the addition of a 20.4ha parcel of Old Quindalup Heath on Lot 1482 and the deletion of an area of Limestone Heath and Old Quindalup Heath (total area 38.2ha) adjacent to Lot 101.

The addition of Old Quindalup Heath (Amendment Area 4) includes Low Heaths of *Acacia* species (*Acacia lasiocarpa*, *A. truncata*, *A. rostellifera*), *Scaevola nitida*, *Santalum acuminatum* and *Melaleuca systema* with *Lomandra maritima*. This vegetation type is slightly different in structure to the area of Old Quindalup Heath proposed for deletion in Amendment Area 5, which comprises Low Open Heaths of *Melaleuca huegelii*, *Melaleuca systema*, *Acacia truncata* (MhMsAt); *Melaleuca huegelii* and *Acacia truncata* Low Open Heath (MhAt) and smaller pockets of *D. sessilis* with *Melaleuca cardiophylla* and *Acacia truncata* (McDs / McDsAt). The Limestone Heath vegetation MhMsAt is not proposed to be replaced in the Alkimos area under the MRS Amendment (ie Area 4).

The Amendment Areas (Area 4, 5, 6 and 7) at Alkimos also contains vegetation representative of FCT 24, 28, 29a and 29b. However, during the site investigations conducted by ATA Environmental in July 2002, it was identified that three small pockets (total area 0.6ha) of Limestone Heath in Amendment Area 5 (ie vegetation type MhMsAt) were found to support FCT 26a (*Melaleuca huegelii* – *M. acerosa* Shrublands of Limestone Ridges).

While different in structure, the floristic composition of the Old Quindalup Heath in Area 4 and 5 corresponds to Floristic Community Types 29a and 29b. These FCTs are currently poorly reserved in the conservation estate, however they are not listed as important by CALM or identified as Threatened Ecological Communities at a Commonwealth level.

The Limestone Heath proposed for deletion at Alkimos (Area 5) is dominated by *Dryandra sessilis* Closed Heath with small pockets of MhMsAt, McDs and MhAt, as described earlier. Most of the Limestone Heath vegetation in this area corresponds to FCT 24 (Northern Spearwood Shrublands and Woodlands). The small areas of vegetation type MhMsAt located on the upland limestone outcrops in Area 5 comprises species consistent with FCT 26a.

The assessment of the FCTs on the Swan Coastal Plain by Gibson *et al.* (1994) identified that FCT 26a is unreserved and susceptible in terms of its conservation status. Gibson *et al.* (1994), identified that the reservation of FCT 26a is limited to eight areas of State Forest and three local government reserves on the southern Swan Coastal Plain.

According to CALM's Threatened Communities Branch (Val English, pers comm, 2002), more recent investigations have determined that there are 61 recorded occurrences of FCT 26a on the Swan Coastal Plain encompassing a total area of 135ha of which 25% is protected in conservation reserves. Furthermore, most of the recorded communities are less than 1ha with the largest site 19ha in area. The three areas of FCT 26a recorded in Amendment Area 5 range in size from 0.16ha to 0.27ha (encompassing a total area of 0.62ha) and are therefore considerably smaller than other communities identified by CALM.

FCT 26a has recently been listed on the State CALM register of Threatened Ecological Communities. It is not however, listed as a Threatened Ecological Community at a national level under the *Environment Protection and Biodiversity Conservation Act*, 1999.

The areas of FCT 26a in Area 5 were also found to support populations of the Priority 3 Flora species *Stylidium maritimum* and *Hibbertia spicata* ssp. *leptotheca*. In addition, the Priority 3 species, *Conostylis pauciflora* ssp. *euryhipis*, was recorded in this FCT in Area 5, however the surveys conducted by ATA Environmental determined that this species is widespread in a variety of vegetation types in the Alkimos-Eglinton area. The proposed deletion of Amendment Area 5 from the MRS will result in the loss of three stands of FCT 26a encompassing approximately 0.6ha.

A significant area of vegetation, approximately 45.6ha, is proposed to be reserved as ROS as part of the buffer requirements for the GWTP. This area of bushland (Amendment Area 6) comprises predominantly Banksia Woodland with scattered parcels of Limestone Heath and a band of Old Quindalup Heath on the southern boundary of the ROS. The Banksia Woodlands differ in structure and composition to those areas of Banksia Woodland proposed for reservation to the north in Eglinton due to the dominance of Sheoak (*Allocasuarina fraseriana*) in the overstorey and *Jacksonia sternbergiana* in the middlestorey. In addition, the area includes increased densities of *Eucalyptus todtiana*, which was not recorded to the north, and *Nuytsia floribunda*.

Limestone Heath vegetation in Area 6 corresponds to FCT 24. The band of Old Quindalup Heath along the southern boundary of the ROS includes *Melaleuca systena* Low Shrubland to Shrubland with scattered *Acacia saligna*, *Rhagodia baccata* over *Lomandra maritima*; *Acacia rostellifera*, *Melaleuca systena* Low Open Heath, and Open Shrublands of *Olearia axillaris* and *Scaevola nitida*. These vegetation types are distinct

from the Old Quindalup Dune vegetation recorded closer to the coast and correspond to FCT 29b.

The ROS proposed to be reserved adjacent to the Alkimos townsite is a suitable size and shape to ensure impacts such as edge effects from surrounding land uses (ie weed invasion, rubbish dumping, fire) will be minimal without excessive requirements for management.

The precise location of significant flora in the Eglinton area has not been recorded, however it is identified that two species of Priority 3 Flora, *Conostylis pauciflora* ssp. *euryhipis* and *Stylidium maritimum*, are known from the Quindalup Dunes. In particular, *Conostylis pauciflora* ssp. *euryhipis* has been recorded in the Q2 age dunes in *Scaevola nitida* Low Closed Heath; *Acacia rostellifera*, *Melaleuca systema* Low Open Heath; *Acacia rostellifera* Closed Scrub/Heath, all of which are likely to occur in proposed additions and deleted Amendment Areas. *Stylidium maritimum* ms has been recorded on the interface of the Q1 age dunes and the Spearwood Dune System. A large area of the Spearwood and Quindalup Dune interface occurs in the existing ROS reservation (to be retained as part of the MRS Amendment).

The regional significance of the proposed amendments are addressed in terms of the values identified for the areas under Bush Forever (Government of WA, 2000).

Eglinton

Current values of BF Site 289	Values of Proposed New ROS at Eglinton
Site protects vegetation of the Quindalup Dunes mostly Q2 or Q3 in age, Q4 limited to area close to coastline, associated blowouts; well separated dunes perched on undulating Spearwood (Tamala) Limestone surface.	As per current values. However, proposed amendment will result in a slight increase in the protection of Q4 age dunes, and a slight reduction in the Q2 and Q3 dunes to be reserved in ROS. An assessment of the Flora of the Quindalup Dunes between the Swan and Irwin Rivers by Griffin (1993) did not identify any recommendations for the conservation of the flora and vegetation of the Quindalup Dunes at Eglinton. Assessment of the floristic composition of the Holocene dunes by Griffin and Trudgen (1994) recommended the excision of Reserve 20561, which runs along the coast, for the conservation of flora and fauna. The boundaries of this reserve are not proposed to be modified at Eglinton.
Provides for the continuation of natural processes comprising 196ha of vegetation of the Quindalup Dunes extending 3.9km inland and linking the coast and other regionally significant vegetation in Yanchep National Park.	The linkage between the coast and inland Yanchep National Park is maintained and improved. The proposed MRS will increase the width of the corridor linkage to the National Park and will include a greater diversity and area of vegetation types in this linkage.
Provides for the protection of soft, sandy shoreline	No amendments are proposed to impact the soft, sandy shoreline at Eglinton.
Protects the Quindalup/ Spearwood Dune interface.	Interface is retained in proposed amendment however the width of the interface is reduced by almost half.
Protects vegetation and fauna habitat typical of the Quindalup / Spearwood units.	Maintains and improves the vegetation types and available fauna habitats typical of the Quindalup and Spearwood Dune units in the proposed ROS.

Current values of BF Site 289	Values of Proposed New ROS at Eglinton
Protects the Alkimos Dune Complex, a system of parabolic beach dunes of Holocene age containing a chronological sequence (Lemmon <i>et al.</i> 1979 in Government of WA, 2000).	As per current values.

Alkimos

The regional value of the vegetation at Alkimos has been assessed as part of Bush Forever (Government of WA, 2000). At Alkimos, the regionally significant vegetation included in BF Site 397 includes the coastal foreshore reserve and the area of bushland adjacent to Lot 101 (Amendment Area 5). The MRS Amendment proposes to retain the coastal foreshore reserve (with minor amendments in the southern region (ie Amendment Area 7)), deletion of the bushland adjacent to Lot 101, and addition of bushland adjacent to the coast (Amendment Area 4) and further inland (Amendment Area 6).

The current values of the existing MRS (ie BF Site 397) in comparison to the proposed MRS are assessed in the following table:

Current Values of BF Site 397	Values of Proposed New ROS at Alkimos
The Site protects vegetation of the younger Quindalup Dune types.	The proposed MRS maintains the reservation status of the Quindalup Dunes, particularly the Q4, Q3 age dunes, in the Alkimos area. It proposes to increase the reservation of the Old Quindalup Dune vegetation in a stand alone parcel adjacent to the coast. In addition, the proposed Amendment improves the diversity and area of vegetation types protected in ROS in the Alkimos area by protecting Banksia Woodlands, and inland Limestone Heath and Old Quindalup Heath not previously protected in the Alkimos area. An assessment of the Flora of the Quindalup Dunes between the Swan and Irwin Rivers by Griffin (1993) did not identify any recommendations for the conservation of the flora and vegetation of the Quindalup Dunes at Alkimos.
Provides for the protection of continuing natural processes by protecting 302ha of bushland of the Quindalup Dunes extending to a maximum of 0.8km inland but generally less.	Griffin and Trudgen (1994) provided specific recommendations for the foreshore reserve at Alkimos (Reserve 20561). In particular, it was recommended that Reserve 20561 should be excised and created as a reserve for the conservation of flora and fauna and landforms. The existing foreshore reserve at Alkimos-Eglinton is maintained in proposed MRS with four minor reductions in the reserve width as described in following section.
Provides for the protection of soft, sandy shoreline.	The proposed amendments to the foreshore reserve at Alkimos (Amendment Area 7) will not impact on the soft, sandy shoreline.
Forms a semi-contiguous north-south vegetated linkage along the coast.	The semi-contiguous north-south vegetated linkage is maintained under the proposed MRS. The ROS Reserve adjacent to the coast has not been altered for most of study area in the Amended MRS. It has, however, been reduced in the southern sector of Alkimos from the proposed Alkimos coastal node to the southern boundary of the Amendment Area. The concept of coastal nodes has been developed for the Amendment Area to allow for additional residential developments in close proximity to the two regional beaches. The siting of coastal village adjacent to the regional beach is considered to be a critical planning objective in the Amended MRS which offers substantial advantages without

Current Values of BF Site 397	Values of Proposed New ROS at Alkimos
	significantly compromising the values of the coastal reserve overall. An important component of the siting of the node has been the relocation of the Alkimos WWTP further to the east to mitigate any potential impacts associated with the buffer requirements of this facility.
Protects only wetland in the Quindalup Dunes north of Perth in the Perth Metropolitan Region.	Under the proposed MRS, the foreshore reserve has been reduced in the vicinity of Karli Spring in light of the relocation of the Waste Water Treatment Plant. The new foreshore reservation line varies between 440m at the southernmost boundary to tie in with the foreshore reservation to the south, and to provide an adequate buffer for Karli Spring, to approximately 130m for most of the length (with a minimum width of 100m).
Protects populations of Priority 3 Flora, <i>Conostylis pauciflora</i> ssp. <i>eurhipis</i> and <i>Stylidium maritimum</i> ms.	<p>The Priority 3 Flora species, <i>Stylidium maritima</i> ms., was recorded in the vegetation type identified as FCT 26a in Amendment Area 5. The population of <i>S. maritima</i> ms was identified as comprising less than 1% of the vegetation composition of the vegetation type (Trudgen and Keighery, 1990 and confirmed during site investigations by ATA Environmental in July 2002.</p> <p><i>Conostylis pauciflora</i> ssp. <i>eurhipis</i>, also a Priority 3 species, has been recorded in the Quindalup Dunes but not within Amendment Area 5 (Trudgen and Keighery, 1990). During the site investigation conducted by ATA Environmental in July 2002 it was identified that this species is widespread in the Alkimos-Eglinton area in a variety of vegetation types.</p> <p>In the proposed areas for addition to the MRS, the occurrence of the Priority 3 Flora species is not known, however based on previous flora surveys (Trudgen and Keighery, 1990 and Armstrong, 1996), <i>Conostylis pauciflora</i> ssp. <i>eurhipis</i> may occur in the Quindalup Dunes of Areas 5, 6 and 7. Populations of <i>Stylidium maritimum</i> and <i>Conostylis pauciflora</i> ssp. <i>eurhipis</i>, have been recorded in Old Quindalup Dune vegetation similar to that found in Amendment Area 4.</p> <p>Although not considered significant during the Trudgen survey of the Alkimos area (Trudgen and Keighery, 1990), <i>Hibbertia spicata</i> ssp. <i>leptotheca</i> is now listed as a Priority 3 Flora species. Significant populations of this species were identified in Amendment Area 5 in the MhMsAt (FCT 26a) vegetation type. It is important to note that during the course of survey work conducted by ATA Environmental in July 2002, a large population of this species (more than 25 plants) was identified immediately to the south of Area 5 to the east of a large clearing. It was identified on a low dune slope in a degraded area of MsLm scattered with <i>Xanthorrhoea preissii</i>.</p>

In summary, the proposed Amendment will result in the following regional changes:

- Increased reservation of the Quindalup Vegetation Complex (approximately 5.9ha)
- Increased reservation of the Cottesloe – Central and South Vegetation Complex (approximately 19.4ha)
- Strengthening of the corridor width and linkage value between the Eglinton ROS and Yanchep National Park.
- Increased corridor width and linkage value between the coastal foreshore reserve

and Eglinton ROS.

- Increased representation of Banksia Woodlands, Tuart Woodland and Old and Young Quindalup Heath in ROS.
- Decreased representation of Limestone Heath in ROS.
- Increased protection of vegetation in excellent condition. Reduced representation of vegetation which is good, degraded or cleared.
- Loss of three small pockets of a vegetation unit potentially corresponding to Floristic Community Type 26a (total area 0.6ha).
- Slight increase in the reservation of poorly reserved FCT 29a and 29b in proposed ROS.
- Potential increased protection of Priority 3 Flora species, *Stylidium maritimum* and *Conostylis pauciflora* ssp. *euryhipis*, by increasing preferred area to reserved in proposed ROS areas.
- Decrease in Priority 3 Flora species *Hibbertia spicata* ssp. *leptothea*.

4.2.3 Proposed Management

Urban and associated development within the Amendment area has the potential to impact directly on remnant vegetation within that area, and indirectly on the adjacent Parks and Recreation areas as a result of increased population.

Potential impacts on the vegetation in the conservation and recreation reserves arising from development of the surrounding areas include recreational activities, intrusion by domestic pets, weed invasion, an increase in the frequency of fires, litter, rubbish dumping, and the use of nutrients and pesticides within the urban area. In addition, habitat fragmentation will occur in some of the conservation reserves due to the construction of road and rail networks through the area (ie Amendment Area 6).

The areas proposed for Parks and Recreation reservation are categorised as having good and very good quality vegetation and a similar portion of degraded and cleared areas as identified in the existing MRS. The protection of bushland in good to excellent condition will be a priority for conservation while vegetation which is degraded or cleared provides opportunities for passive or active recreation in the proposed MRS.

Traditionally, the Commission purchases Regional Open Space and hands it to a long-term management authority such as CALM but also local government. Generally, land for regional reserves is handed over with a Management Plan and some initial development works and funds.

Other options for management include the reduced reliance on government participation and involvement of non-government organisations, local community groups and schools and other institutions. Private or community ownership of areas is also a possibility subject to appropriate restrictions, covenants and management requirements.

It is proposed that Environmental Management Plans and Implementation Strategies be prepared for Regional Open Space in the Amendment Area. Plans are to be prepared at the Local Structure Planning stage, and implemented at subdivision stage.

Detailed management issues which will need to be addressed at the local structure planning stage, as part of a Management Plan and Implementation Strategy for areas regionally significant vegetation, would include:

- The delineation and treatment of boundaries between the Urban and Parks and Recreation areas.
- Treatment of the immediate interface to Parks and Recreation reservations (delineation of a clear boundary, installation of access control measures, etc).
- Management of bushland during infrastructure works in ROS areas.
- Provision of recreation opportunities.
- Access control.
 - Exclusion of domestic cats and feral animals.
 - Fire management.
 - Restricting and controlling the invasion of weeds.
 - Rehabilitation procedures to be used for areas that have been degraded.

In addition, the Plan is to specify monitoring requirements to ensure the recommendations and outcomes of the Plan are adhered to.

Provision will be required at the Local Structure Planning stage (LSP) which will enable the appropriate agencies, landowners or non-government groups to have input to future planning decisions which may impact on the areas for which they will be responsible.

4.2.4 Outcome

The MRS Amendment will result in a net gain in excess of 25.3ha of high quality vegetation within Regional Open Space. The proposed Alkimos ROS will result in the conservation of 66ha of bushland in mostly excellent condition (43.4ha). The proposed Eglinton ROS will result in the conservation of 166ha of bushland in good (132ha) to excellent condition (29.3ha). In addition, a uniform parcel of Old Quindalup Heath (20.3ha) in good condition in the north-western corner of Lot M1482 will strengthen the coastal foreshore reserve in this area.

In summary the following outcomes are likely to result from the proposed Amendment:

- Increased reservation of the Quindalup Vegetation Complex (approximately 5.9ha)

- Increased reservation of the Cottesloe – Central and South Vegetation Complex (approximately 19.4ha)
- Strengthening of the corridor width and linkage value between the Eglinton ROS and Yanchep National Park.
- Increased corridor width and linkage value between the coastal foreshore reserve and Eglinton ROS.
- Increased representation of Banksia Woodlands, Tuart Woodland and Old and Young Quindalup Heath in ROS.
- Decreased representation of Limestone Heath in ROS.
- Increased protection of vegetation in excellent condition. Reduced representation of vegetation which is good, degraded or cleared.
- Loss of three small pockets of a vegetation unit potentially corresponding to Floristic Community Type 26a (total area 0.6ha).
- Slight increase in the reservation of poorly reserved FCT 29a and 29b in proposed ROS.

On this basis, the EPA of ‘*maintaining the abundance, species diversity and geographic distribution of vegetation and flora*’ can be achieved under the proposed MRS Amendment.

4.3 Declared Rare, Priority Flora and other Significant Flora

4.3.1 EPA Objective and Scope of Works

Declared Rare and Priority Flora	
EPA Objective: Protect Declared Rare and Priority Flora consistent with the provisions of the <u>Wildlife Conservation Act, 1950</u> .	
Instruction	Scope of Work:
i.	Investigate those areas within the Amendment proposed for rezoning from ‘Parks and Recreation’ to ‘Urban’, ‘Private Recreation’ to ‘Urban’, ‘Urban’ to ‘Parks and Recreation’, ‘Central City Area’ to ‘Parks and Recreation’ and ‘Public Purposes’ to ‘Urban’ for the presence of Declared Rare and Priority Flora which may be directly or indirectly impacted on by those zoning changes. Supplement this investigation with a survey of CALM’s database.
ii.	Identify other species of significance that may be impacted by the proposal and discuss the reason for their conservation significance. These species may include undescribed taxa; new recorded for the region; species or taxa that are endemic to the region or at the limit of their range; or species confined to specific sites of limited occurrence in the region.
iii.	Retain voucher specimens for all significant species and lodge them with the WA Herbarium.
iv.	Flora survey work should be undertaken during the flowering season (Late winter/spring).
v.	If there is a presence, identify how the population will be affected by implementation of the Amendment. Where necessary specify proposed scheme provisions and management strategies for protection.

4.3.2 Description of Amendment Area

Declared Rare and Priority Flora

The Department of Conservation and Land Management identified one species of Declared Rare Flora (DRF), *Eucalyptus argutifolia*, that has been recorded in the vicinity of the study area. This species was not recorded within the study area during the flora and vegetation surveys (Trudgen and Keighery, 1990a & b, Armstrong, 1996). In addition, CALM listed the following Priority species:

<i>Acacia benthamii</i>	P2
<i>Conostephium minus</i>	P4
<i>Conostylis pauciflora</i> ssp. <i>euryhipis</i>	P3
<i>Grevillea evanescens</i>	P1
<i>Hibbertia spicata</i> ssp. <i>leptotheca</i>	P3
<i>Jacksonia sericea</i>	P3
<i>Lepidium pseudotasmanicum</i>	P4
<i>Melaleuca</i> sp. Yanchep (GJ Keighery 11242)	P2
<i>Thomasia triloba</i>	P3

Two priority species were recorded in the Alkimos-Eglinton area by Trudgen and Keighery (1990) and Armstrong (1996). These are:

- *Conostylis pauciflora* ssp. *euryhipis* Priority 3
- *Stylidium maritimum* Priority 3

In addition, the Priority 3 species, *Hibbertia spicata* ssp. *leptotheca*, was recorded by ATA Environmental during site investigations in July 2002. This species was recorded from Amendment Area 5, in *Melaleuca huegelli*, *M. acerosa* and *Acacia truncata* Low Closed Heath.

Priority 3 species are categorised as poorly known taxa. They are plants which are known from several populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

In the Alkimos-Eglinton area, populations of *Conostylis pauciflora* ssp. *euryhipis* are restricted to the Quindalup Dunes. This species was recorded from five locations within the Amendment Area in vegetation in good to excellent condition.

Three populations of *Stylidium maritimum* were recorded in the Amendment Area by Trudgen and Keighery (1990). This species generally occurs in the *Xanthorrhoea preissii* Shrublands where the Spearwood System abuts the Quindalup Dunes (Q1 age), particularly where this interface is in a swale.

Other Significant Flora

Previous surveys of the Alkimos-Eglinton area by Trudgen and Keighery (1990a and b) and Armstrong (1996) have identified a number of species of interest which are

considered significant primarily due to their limited distribution on the Swan Coastal Plain, as discussed below.

Acacia rostellifera x *saligna* (Mimosaceae)

An established clonal stand of what appears to be a hybrid between *Acacia rostellifera* and *A. saligna* was identified from one location at Alkimos (Trudgen and Keighery, 1990a). According to Trudgen and Keighery, hybrids between related Acacias are not uncommon.

Alyogyne huegelii? var. *glabrescens* ms (Malvaceae)

This is a widespread, variable species which was recorded from a dense stand in the Eglinton area, and adjacent to Pipindinny Swamp just outside the study area (Trudgen and Keighery, 1990b).

Conostylis teretifolia ssp. *planesceus* (Haemodoraceae)

An uncommon taxon found in isolated localities between Gingin, Yanchep and Wanneroo in Banksia Woodland. In the Alkimos area it was recorded at two sites. The original site location data collected in 1990 is insufficient to determine the precise location of this species.

Laxmannia sessiliflora ssp. *australis* (Anthericaceae)

A widespread taxon occurring from Cataby to the Scott River and east to Lort River but in the study area it occurs in its southern most locality on the coastal plain. Recorded once from Alkimos in Banksia Woodland (Trudgen and Keighery, 1990a).

Leptorhynchus scabrus (Asteraceae)

This is a poorly collected species both in the Perth region (where it has been recorded from Mandurah) and elsewhere although, it is fairly widespread extending from Jurien Bay to Bremer Bay. This may be because it is superficially similar to the more widespread and common species *Podotheca chrysantha* or it may indeed be an uncommon species. In the Eglinton and Alkimos area it was locally common at three sites in the Q2 and Q3 area dunes (Trudgen and Keighery, 1990 a and b).

Persoonia comata (Proteaceae)

This species grows on sand in heath and woodland from Yanchep to Eneabba and is at the southern end of its range in the study area. It was found at two sites in the Alkimos area (Trudgen and Keighery, 1990a). The original site location data collected in 1990 is insufficient to determine the precise location of this species.

Petrophile brevifolia (Proteaceae)

According to Trudgen and Keighery (1990a), the material referred to this taxon appears to be an undescribed 'new' species that occurs on the coastal plain and has been confused with *Petrophile media* a widespread species occurring from the Murchison River to Ongerup. This species was recorded in the Alkimos area from three sites. The original site location data collected in 1990 is insufficient to determine the precise location of this species.

Petrophile seruriae (Proteaceae)

Further work on this taxon, a pink variant found on the coastal plain from Perth to Geraldton, will probably result in its recognition as a separate species allied to *Petrophile*

serruriae which is a widespread variable taxa from Geraldton to Albany. This species has been recorded from four locations in the Alkimos area and two sites at Eglinton (Trudgen and Keighery, 1990a & b). The original site location data collected in 1990 is insufficient to determine the precise location of this species.

Tetragonia tetragoniodes (Aizoaceae)

A poorly collect species in the Perth region (Wanneroo) and elsewhere although apparently widespread occurring from Albany to Shark Bay and at Mt Magnet. In the Alkimos-Eglinton area this species was observed once in the dunes above Pipindinny Swamp.

Trymalium albicans (Rhamnaceae)

This species was considered extinct but recent work on the genus found that *Trymalium ledifolium* as previously recognised at the WA Herbarium contained two distinct species, the near coastal *T. albicans* and inland *T. ledifolium*. This species was recorded in the Alkimos and Eglinton areas. The original site location data collected in 1990 is insufficient to determine the precise location of this species. It is not considered to be rare or restricted (Trudgen and Keighery, 1990a and b).

Stylidium repens (Stylidiaceae)

This taxon is another undescribed species and has not previously been recorded south of the Moore River. It is closely related to *Stylidium repens* a widespread and well known species.

Veronica calycina (Scrophulariaceae)

This taxon was recorded from one site in the Alkimos area in Tuart Woodland and is also known from Yalgorup. Most of the habitat type that it occurs in between Yalgorup and Yanchep has been cleared or degraded by grazing and it appears to be rare or at least very uncommon. It is related to *V. calycina* but is more robust and less densely pubescent. *V. calycina* is a widespread species and appears to be confined to the lower south-west in Jarrah or Karri Forest, known from Donnybrook, Pemberton and the Stirling Ranges (Trudgen and Keighery, 1990a).

4.3.3 Potential Impacts

There are no known populations of Declared Rare Flora within the study area. Accordingly, there are no areas which are affected by statutory obligations of the Wildlife Conservation Act, 1981.

The Priority 3 Flora recorded at the site are known from several populations north and south of Perth within the Old Quindalup Dune vegetation type. The Amended MRS will retain some of the populations of Priority species recorded during the initial flora surveys conducted by Trudgen and Keighery (1990a,b) and Armstrong (1996) in Old Quindalup Complex within the Eglinton North ROS (81ha retained) and the Alkimos ROS (30ha retained) and potentially within the foreshore reserve.

4.3.4 Proposed Management

Populations of Priority Flora will be retained in reserved areas of ROS and will be protected through Environmental Management Plans and Implementation Strategies which will be prepared for Regional Open Space (and the immediate interface) (Refer to Section 4.2.4).

The populations of the Priority 3 Flora to be retained in reserved areas of ROS and will be protected through the preparation and implementation of Environmental Management Plans for these reserves.

4.3.5 Outcome

No Declared Rare Flora are impacted by the proposed MRS Amendment.

The Amended MRS will conserve some populations of the Priority 3 Flora by retaining 111ha of Old Quindalup Heath vegetation type within areas proposed for reservation as ROS. There is potential for the protection of the outstanding populations of significant flora in POS by implementing provisions which require the undertaking of a targeted flora survey prior to development of the Quindalup Dune vegetation.

In summary the following outcomes are expected from the proposed MRS Amendment:

- Potential increased protection of Priority 3 Flora species, *Stylidium maritimum* and *Conostylis pauciflora* ssp. *euryhipis*, by increasing preferred area to reserved in proposed ROS areas.
- Decrease in Priority 3 Flora species *Hibbertia spicata* ssp. *leptotheca*.

4.4 Terrestrial Fauna

4.4.1 EPA Objective and Scope of Work

Terrestrial Fauna	
EPA Objective: Maintain the abundance, species diversity and geographical distribution of terrestrial fauna.	
Instruction	Scope of Work:
i.	Undertake a detailed terrestrial fauna survey of those areas with the Amendment proposed for rezoning from 'Parks and Recreation' to 'Urban', 'Private Recreation' to 'Urban', 'Urban' to 'Parks and Recreation', 'Central City Area' to 'Parks and Recreation' and 'Public Purposes' to 'Urban'.
ii.	The survey should assess the presence and distribution of terrestrial fauna species and relate this to the distributions in other conservation areas in the region.
iii.	Identify and document potential impacts on terrestrial fauna and detail management measures to ensure their protection.

4.4.2 Description of Amendment Area

A vertebrate fauna survey of the Alkimos-Eglinton area was undertaken in October, 1996 (Alan Tingay & Associates, 1996). This survey included a trapping program using

Elliott, pit fall and cage traps as well as bird transect surveys, active searching and opportunistic records.

The habitats within the Alkimos-Eglinton area can be broadly separated into three major types that dominate the area. These are based primarily on the broad vegetation units that strongly reflect the underlying soil types and geomorphic features. The main broad habitat types comprise:

- Old Quindalup Heath
- Limestone Heath
- *Banksia* Woodland

Other habitats which constitute a relatively minor portion of the area include heath on the younger Quindalup Dunes, Tuart Woodland and cleared grassland or pasture.

The survey recorded 1 amphibian, 18 species of reptiles, 49 bird species (plus a further nine species at Pipidiny Swamp), and 3 indigenous and 3 introduced mammal species (Appendix 7). A much greater number of species could occur within the Alkimos-Eglinton area based on known distribution and habitat usage. The Alkimos-Eglinton area is expected to support relatively high species diversity due to areal extent, range of habitats and general quality of the habitats within the Alkimos-Eglinton area, combined with the connectivity of the area to other extensive vegetated areas to the north, south and east of similar and different habitat types. The habitats could support at least 3 species of frog, more than 40 reptiles, over 80 birds and about 14 mammals, many of which are bat species (Appendix 7).

The list of recorded and expected species includes 35 species that have been identified as having special conservation significance by being listed under provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and *Wildlife Conservation Act 1950*, on CALM's Priority Fauna list or identified as Significant Bird Species in Bush Forever (Appendix 7). These are discussed further in Section 4.5 of this document.

The survey noted marked differences in the diversity of fauna across major habitat types within the Alkimos-Eglinton area with the greatest species diversity recorded in the *Banksia* Woodland and Old Quindalup Heath habitats (Table 7). To some extent the recorded variation in diversity between habitat types could be related to differences in survey intensity and survey techniques between habitat types. It is reasonable however, to expect a higher vertebrate faunal diversity within the *Banksia* Woodlands due to the greater vertical complexity of this habitat. The suite of species occurring within each main habitat type differs with some species largely restricted to certain habitat types such as the sands of the Quindalup Dunes or rocky outcrops and crevices, while others occur across the range of habitats.

TABLE 7
Diversity Recorded Across Major Habitat Type

Fauna Group	Habitat Type				
	Banksia Woodland	Limestone Heath	Old Quindalup Heath	Tuart Woodland	Grassland/Pasture
Amphibians	-	-	1	-	-
Reptiles	8	2	14	2	-
Birds	34	18	23	18	8
Mammals (native)	2	1	2	1	-
TOTAL	44	21	40	21	8

The primary objective of the environmental approach to the Amended MRS is the preservation of representative biodiversity within the future urban region. Biodiversity is interpreted as the major vegetation types or communities together with their respective flora and indigenous vertebrate fauna. The emphasis has been to retain representative areas of major vegetation types but to include larger areas of those types of vegetation which survey data suggest support the most diverse fauna communities.

The distribution of vertebrate fauna according to major habitat types indicates that, in order to maximise biodiversity, it will be necessary to protect representative samples of the vegetation and habitats within the area. The survey results further suggest that relatively large areas of Quindalup dune heath vegetation and *Banksia* woodland should be the priority for retention as these provide habitats that support the greatest species diversity in the Alkimos-Eglinton area.

Protection of fauna habitat should also consider the interface and transitional areas between major habitats as often fauna are not solely reliant on one habitat type but will use or require resources from adjoining habitats. Maintaining biodiversity of vertebrate fauna in the area also relates to connectivity to other areas of habitat to enable seasonal movement and migration of fauna, and increase the likelihood of regional populations being sustainable.

4.4.3 Proposed ROS Changes

The overall changes to the area of the broad habitat types that will result from the proposed amendments to the ROS provisions, with the exception of the coastal foreshore area (Area 7), are provided in Table 4 in Section 4.2.2 of this report. The information provided indicates the main changes in areas of habitat types will be an overall increase of about 48ha of *Banksia* Woodland and 5ha of Old Quindalup Heath and a reduction of 29ha of Limestone Heath. There will be a total increase of 20.5ha of vegetation and habitat to be reserved within Areas 1, 2, 4, and 6 and a loss of around 10ha from the coastal foreshore area (Area 7).

Within the Eglinton area (Areas 1, 2 and 3) there is a reduction of 7.3ha in total ROS area, 4.5ha of which is identified as having been cleared. The largest changes are an increase in *Banksia* Woodland of 15.1ha, more than doubling the current area, and a reduction of Old Quindalup Heath of 13.6ha, which represents about 13% reduction of the current reservation.

Areas 4, 5 and 6 with the Alkimos area will result in an overall increase in the area of ROS reservation by 27.9ha. This increase results largely from the proposed reservation of an additional 32.6ha of *Banksia* Woodland, a large increase from the current 1.9ha reservation, and an increase of 19.5ha of Old Quindalup Heath which will enable greater than 2.5 times more of this habitat to be retained in the Alkimos area. The changes will also result in a substantial reduction of Limestone Heath reservation with very little of this habitat type (<1ha) being protected in the Alkimos area.

Changes to the coastal foreshore area (Area 7) in the Alkimos area will result in an overall reduction of about 9.8ha of ROS reservations. The main changes are decreases of 7.6ha of Old Quindalup Heath and 2ha of Young Quindalup Heath. The majority of this reduction in area relates to a reduction of about 7ha of *Melaleuca systema*, *Lomandra maritima* Low Open Heath which will remain well represented (>40ha) in other areas of ROS under the proposed MRS.

Within the Old Quindalup Heath habitat type the most substantial proposed changes in terms of areal extent are an increase of heath communities that range from less than 1m high to 2m tall and a reduction of similar area of taller (>2m high) *Acacia rostellifera* dominated Closed Scrub. Over 30ha of the taller units and habitats however, will be reserved under the amended ROS provisions.

Notable overall changes within the Limestone Heath units are a reduction in the area of *Dryandra sessilis* dominated heaths and smaller increase in heaths of *Xanthorrhoea preissii* in combination with *Dryandra sessilis* that are not presently reserved under the current MRS. A considerable area, over 30ha, of *Dryandra sessilis* dominated heaths will however, remain in the MRS reservation under the proposed amendments.

There will be an overall substantial increase in the *Banksia* Woodland as a result of the amendment. The majority of the increase in area results from a large area of *Banksia* Woodland with co-dominant *Allocasuarina fraseriana* over *Jacksonia sternbergiana* shrubland in the eastern portion of the area being added to the ROS provisions (Area 6). There will also be an increase in *Banksia* Woodland as a result of changes to the Eglinton ROS (Area 2).

There is only a limited area of Tuart woodland within the Alkimos-Eglinton area and the proposed amendments to the ROS reservations will marginally increase the area of this habitat in Areas 2 and 6. All changes to units within the Young Quindalup Heath type are of an area less than 0.75ha.

4.4.4 Assessment of Proposed ROS Changes

Habitat Type

The proposed reservations include all major habitat types identified in the Alkimos-Eglinton area. The proposed amended ROS continues to provide a similar range of habitats to that presently reserved and will not result in the loss of important habitat types. An overall increase in the ROS reservations will result following the proposed amendment to the MRS of roughly 20ha (excluding losses associated with the foreshore reserve), thereby providing increased habitat for fauna populations. There will be an increase in the area of all major habitat types with the exception of Limestone Heath

habitat, and minor reductions in the Young Quindalup Heath and cleared areas as a result of the amendment.

The highest diversity of vertebrate fauna was recorded in the *Banksia* Woodland habitat type at Alkimos-Eglinton in the 1998 survey. The Amended MRS proposes to significantly increase the area of *Banksia* Woodland retained in ROS from the current 15.4ha to 63.1ha. In addition, the proposed ROS reservation provides for the additional protection of a consolidated block of the *Banksia* Woodland parcel rather than interspersed and isolated patches as in the current MRS. Much of this additional *Banksia* woodland is located on an area of older landform along the eastern margin of the Alkimos-Eglinton area that might provide deeper and more developed soils, and therefore different habitat, than the western areas. The *Banksia* Woodland in the eastern section differs in floristic composition with species such as Sheoak (*Allocasuarina fraseriana*), *Jacksonia sternbergiana*, *Banksia menziesii*, *Banksia grandis*, *Nuytsia floribunda* and *Eucalyptus todtiana* also common.

There has been overall only relatively minor change (increase) in the Old Quindalup Heath habitat types which are known to support a relatively diverse range of fauna, particularly of reptiles, and often a different suite of fauna, particularly of herpetofauna, to other areas such as the *Banksia* woodlands.

The Limestone Heath habitat type recorded a comparatively low faunal diversity in relation to other habitat types in the 1998 survey. The proposed decrease in Limestone Heath habitat area involves reducing the areal extent of predominantly *Dryandra sessilis* heaths. *Dryandra sessilis* dominated vegetation units in particular typically offer limited structural and floristic diversity and are therefore limited in terms of faunal habitat, although these areas provide important seasonal habitat for a range of species when *Dryandra sessilis* is in flower. Despite the reduction in area, this type of vegetation will remain well represented in the ROS provision covering over 30ha and therefore the impact on fauna should be relatively low.

Areas of Limestone Heath also often provide habitat features such as surface rock, crevices and cavities that are not present in other broad habitat types. The vegetation units supporting *Melaleuca huegelii* are typically most likely to have areas of surface rock, although a range of units including the major Limestone Heath unit of *Dryandra sessilis* Open to Closed Heath may have some surface rock. Units with *Melaleuca huegelii* cover a minor area (less than 2ha) of the current and amended ROS provisions.

Areas of Limestone Heath are intermixed with other habitat types such as *Banksia* woodland make the resources provided in these habitat areas readily accessible for a range of fauna that may prefer habitats with greater vertical complexity but feed in adjacent areas of heath. The amended Eglinton ROS will continue to provide interspersed habitat areas, and although there is a reduction in intermixed areas by deletion of Area 5, the proposed Area 6 on the eastern side of the site includes additional areas of Limestone Heath amongst *Banksia* Woodland.

Additional small areas of Tuart Woodland, located at the northern boundary and in the eastern portion of the site, have been incorporated into the areas proposed for retention in Eglinton and Alkimos ROS.

The proposed changes in vegetation units within the Young Quindalup and Old Quindalup Heath habitat types are not expected to greatly affect overall faunal diversity or populations of the area. The structure and diversity of habitats will remain similar to the current ROS reservations.

Connectivity

Proposed changes to the ROS provisions do not significantly alter the connectivity for faunal movement and seasonal migration provided under the current reservations. The corridor for east-west movement identified under the current proposed ROS at the northern boundary of the site is maintained although there is an overall reduction in area of around 7ha. The proposed corridor covers over 180ha of habitat and provides direct linkage between the coastal foreshore through the north-western portion of Eglinton, connecting with Yanchep ROS and Yanchep National Park. The proposed ROS corridor continues to provide continuous linkage from Young Quindalup Heath habitat in the coastal foreshore through the Old Qundalup Heath, Limestone Heath, Banksia Woodland and limited Tuart Woodland habitats.

Other areas of proposed ROS provide connection with adjoining more extensive areas of ROS. The proposed Amendment Area 4 covers over 20ha and connects with the coastal foreshore reserve and the associated north-south corridor similar to the connection provided by Area 5, which is reserved as ROS under the current MRS reservations.

The proposed ROS area encompasses about 46ha in the eastern portion of the site (Area 6) and adjoins and consolidates a considerable area of ROS located immediately to the east, although the Mitchell Freeway will ultimately separate these areas (Figure 4). These areas are expected to be an important linkage for north-south movement between Neerabup and Yanchep National Parks and the region in general although the linkage is not continuous.

The deletions to part of the coastal foreshore reserve (Area 7) result in the loss of about 10ha but do not interrupt an important fauna movement corridor.

4.4.5 Proposed Management

The management requirements for regionally significant vegetation described in Section 4.2.4 will provide for the protection of associated fauna habitats. These provisions also may include specific measures for the protection of particular fauna species such as fencing.

The measures outlined previously with regards to the management of remnant vegetation within the Amendment Area will act to preserve habitat for terrestrial fauna within the Amendment Area. Environmental Management Plans and Implementation Strategies for Region Open Space and the immediate interface will be prepared.

4.4.6 Proposed Outcome

The proposed MRS Amendment will result in a net gain in ROS by in excess of 25ha, therefore providing a net gain in fauna habitat. Significant and representative fauna habitat will be provided through the retention of areas of regionally significant vegetation

in and adjacent to the Amendment area. Provisions in the Scheme will enable specific management provisions for fauna.

The biodiversity and range of habitats of the area will be preserved through the selective preservation of corridors of vegetation representative of the different vegetation communities of the area. Although the proposed amendments will alter the proportions of major habitat types, the changes are not expected to significantly affect the faunal diversity that would be supported by the current ROS reservations.

Planning controls will encourage the retention of remnant vegetation within the Amendment area and the establishment of vegetated corridors and links between preserved areas of regionally significant vegetation and locally significant vegetation. These links and corridors will provide habitat for some terrestrial species and also provide cover for birds and other species moving between the larger areas of preserved vegetation and seasonally migrating to alternative habitats.

4.5 Specially Protected (Threatened) Fauna

4.5.1 EPA Objective and Scope of Works

Specially Protected (Threatened) Fauna	
EPA Objective: Protect Specially Protected (Threatened) Fauna, consistent with the provisions of the <u>Wildlife Conservation Act, 1950</u> .	
Instruction	Scope of Work:
i.	Investigate those areas within the Amendment proposed for rezoning from 'Parks and Recreation' to 'Urban', 'Private Recreation' to 'Urban', 'Urban' to 'Parks and Recreation', 'Central City Area' to 'Parks and Recreation' and 'Public Purposes' to 'Urban' for the presence of Specially Protected (Threatened) Fauna. Supplement this investigation with an assessment of the distribution and habitat preferences of specially protected (Threatened) Fauna from relevant literature sources such as the WA Museum databases and CALM Threatened Fauna database.
ii.	If there is a presence, identify how the population will be affected by implementation of the Amendment. Where necessary specify proposed scheme provisions and management strategies for protection.

4.5.2 Description of Amendment Area

Significant Species

The 1998 survey recorded one species presently afforded protection under provisions of the *Wildlife Conservation Act 1950*. The Short-billed Black-Cockatoo or Carnaby's Cockatoo (*Calyptorhynchus latirostris*) is listed on Schedule 1, which are 'fauna that is likely to become extinct'. This species is also listed as Endangered under provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The Short-billed Black-Cockatoo was observed in the Banksia woodland in the 1998 survey and could also occasionally occur in areas of Limestone Heath or where proteaceous plant species occur. This species seasonally visits the region but breeds in the wheatbelt. The proposed amendments are unlikely to adversely impact on

populations of the Short-Billed Black Cockatoo as protection of *Banksia* Woodland habitat in the conservation estate will be significantly increased as a result of the Amendment. In particular, the reservation of *Banksia* Woodland in good to very good condition will increase by about 15ha at Eglinton and 32ha at Alkimos.

Two additional species of fauna that are specially protected under the *Wildlife Conservation Act 1950*, the Peregrine Falcon (*Falco peregrinus*) [Schedule 4] and Southern Carpet Python (*Morelia spilota*) [Schedule 4], could potentially occur within habitats of the Alkimos-Eglinton area. Schedule 4 species are 'other specially protected fauna'.

The Peregrine Falcon was recorded during the 1998 survey outside the study area in the Tuart woodland surrounding Pipidiny Swamp and could potentially occur in low numbers within *Banksia* and Tuart Woodlands areas of the Alkimos-Eglinton area.

The Southern Carpet Python tends to favour heath over limestone (Limestone Heath) but also occurs in *Banksia* and Tuart Woodland areas. There will be an overall reduction in the reservation area of Limestone Heath, however over 40ha of this habitat type will be protected and additional areas of *Banksia* Woodland will be retained.

The vertebrate fauna survey in 1998 did not locate any species presently listed on CALM's Priority Fauna list, however, three species could occur based on known distribution and available habitats. This includes:

- Southern Carpet Python (*Morelia spilota*) [Priority 4] (also listed on Schedule 4)
- Southern Brown Bandicoot or Quenda (*Isodon obesulus*) [Priority 4]
- Western Brush Wallaby (*Macropus irma*) [Priority 4]

Priority 4 species are listed as taxa in need of monitoring. These species are considered to have been adequately surveyed, or for which sufficient information is available, and are considered not currently threatened or in need of special protection, but could be if circumstances change.

The Southern Brown Bandicoot or Quenda tends to favour low (<1m), dense vegetation and if present would occur throughout the site in all major habitat types provided suitable protection from low vegetation is present. The Western Brush Wallaby is most likely to occur within woodland habitats. The proposed amendments to increase the extent of *Banksia* Woodland protected in ROS will largely benefit most of these species.

Bush Forever identifies Significant Bird Species occurring on the Swan Coastal Plain (Government of Western Australia, 2000). Significant Bird Species are identified in four categories, as follows:

- Category 1 - specially protected under the *Wildlife Conservation Act 1950*
- Category 2 - listed on international JAMBA/CAMBA agreements
- Category 3 - habitat specialists with reduced distribution on the Swan Coastal Plain
- Category 4 - wide-ranging species with reduced populations on the Swan Coastal

Category 1 species known to occur on the site or expected to occur are identified above, some of these however are also considered Category 4. The 1998 survey recorded 10

species listed as Category 3 and 9 species listed as Category 4 (Appendix 7). A further 6 Category 3 and 7 Category 4 species could be expected to occur within the Alkimos-Eglinton area.

Seven of the Category 4 species are birds of prey that may benefit from additional woodland areas for perching and/or feeding. Many of the other Category 3 and 4 species would be expected to largely occur in woodland areas and therefore would benefit from an increased protection of Banksia Woodland areas. This includes species such as Inland and Western Thornbills, Scarlet and Hooded Robins, Varied Sitella, Golden Whistler and Grey Shrike-thrush. Several species such as the New Holland, Spiny-cheeked and Tawny Crowned Honeyeaters occur in habitat types that will change the most in overall area as a result of the amendments, the Limestone Heath and Banksia Woodland. These species are not likely to be significantly impacted.

Species such as the Variegated and White-winged Fairy-wrens and Southern Emu-wren tend to favour dense vegetation of the heathlands. The reduction in Limestone Heath therefore may reduce the habitat protected in the area for these species. Substantial area of over 170ha of Old Quindalup Heath and Limestone Heath combined will however, be protected and large areas within these habitat areas will provide suitable habitat for these wrens. In addition, the coastal foreshore area typically also contains suitable habitat. All of the ROS continues to be linked with more extensive areas of ROS and therefore movement and recolonisation following any disturbance within the reserved areas will be facilitated.

4.5.3 Potential Impacts

The increase in the area of *Banksia* (increased by 15ha at Eglinton and 32ha at Alkimos) and Tuart Woodland to be retained in the proposed MRS will better provide for the conservation of habitat for many of the species of significance identified in the preceding section. Although there may be a reduction in the favoured habitat of some of the species of significance, considerable area of these habitats continues to be reserved as ROS, thereby maintaining habitat for these species.

4.5.4 Proposed Management

The management measures proposed for Specially Protected (Threatened) Fauna and other significant fauna are incorporated within the provisions for fauna in general which are described in Section 4.2.4 of this report. The Management Plans and Implementation Strategies will consider the retention of specific habitat for Threatened Species known to occur, as well as other significant species that may occur, within the Amendment Area.

4.5.5 Potential Outcome

Significant and representative areas of habitat suitable for the identified Specially Protected (Threatened) Fauna will be retained in the proposed MRS Amendment. In addition, the proposed Amendment will result in increased habitat preferred or suitable for significant fauna species.

The biodiversity and range of habitats of the area will be preserved through the selective preservation of corridors of vegetation representative of the different vegetation communities of the area.

4.6 Coastal Environment - Dunes

4.6.1 EPA Objective and Scope of Works

Coastal Environment - Dunes	
EPA Objective:	
Maintain the integrity, function and environmental values of the dune system.	
Instruction	Scope of Work:
i.	Assess the environmental values of the dunal systems to be impacted upon by the proposed reduction in the existing coastal foreshore reserve on Lot 102.
ii.	Identify and document the potential impacts on these values which could arise from development within the coastal foreshore reserve.

4.6.2 Description of Amendment Area

The environmental characteristics of the dunal systems at Alkimos have been assessed as part of the Coastal Planning Strategy (ATA Environmental, 1993). A summary of the findings of this report is presented below.

The coastal foreshore area at Alkimos (Lot 101, 102) is generally backed by a low but wide foredune that occasionally is cliffed. In places a number of beach ridges are developed behind the foredune. These are backed by large primary dunes which give rise to parabolic dunes further inland. However, the coast in this sector is characterised by a small cusped foreland referred to by Woods (1984) as the "Eglinton" beach ridge plain and an embayment to the north that is backed by a 6m high limestone cliff.

In plan view, the cusped foreland is relatively flat and wide. It extends to the south beyond the border of the property and terminated against the limestone cliff to the north. It extends along 1.5km of the Alkimos coast and protrudes seaward behind Eglinton Rocks offshore. The beach on the cusp averages around 20m and 25m wide and has a low to moderate profile. It sweeps in a gradual arc to the north before being broken by an onshore reef in the vicinity of the limestone cliff. The beach on the central part of the cusp is relatively straight however, and approximately 0.8km long. From the property boundary in the south to the limestone cliff, the beach is backed by stretches of foredunes interspersed with higher primary dunes. The foredunes average 1m to 2m in height and are cliffed in places, particularly in the vicinity of the outcropping limestone. The primary dunes are also cliffed in the area proximal to the limestone outcrop.

A number of small blowouts occur along the cusp. In these locations cliffing in the primary dunes is absent and sand is able to migrate inland from the beach. The vast system of parabolic dunes lying behind this part of the coast indicates that in the past huge quantities of sand spilled inland from the beach. It also indicates that this portion of the coast lies in an area experiencing onshore sediment migration, hence the development of an accretionary cusp in the area.

Offshore, the environment is characterised by Eglinton Rocks, a partially emergent reef and closer to shore by seagrass meadows interspersed with sandy patches. A shallow

(<5m) submerged bar exists between Eglinton Rocks and the cusped foreland described above.

The limestone cliff to the north of the cusp backs a shallow bay that has eroded to the cliff line. The cliff is about 6m high and is exposed over about 250m. In places, modern dunal sands drape over the cliff and are themselves steeply cliffed by wave action, being up to 5m high. The beach below the limestone cliff is about 20m wide and has a moderate profile. A small onshore reef lies at the base of the limestone cliff as do a number of 1m to 2m diameter boulders that have dislodged from the cliff.

The Coastal Planning Strategy (ATA Environmental, 1993) identified the following characteristics are applicable to the Alkimos area:

- The wide sandy beach along the southern portion of the Alkimos Sector is highly suited to beach and water based recreational activities.
- The small bay to the north of the foreland provides some protection from the prevailing sea breezes.
- The beach along the northern portion of the Alkimos Sector consists of beach rock/onshore reef and is generally unsuitable for swimming but given favourable weather conditions could be used for beach fishing.
- Swell attenuation across Eglinton Rocks and the shallow bar in its lee produce safe swimming conditions.
- Gently undulating swales within the coastal dunes system permit development of carparks, picnic areas and other amenities such as surf life saving clubs close to the beach.

4.6.3 Potential Impacts

The Coastal Planning Strategy (ATA Environmental, 1993) and Update (ATA Environmental, 1998) determined that the various environmental characteristics of the foreshore area at Alkimos can be protected through the implementation of appropriate management strategies to mitigate the potential impacts associated with the development of the adjacent area.

The principle change to the coastal (foreshore) Parks and Recreation reservation involves rationalisation of the western portion of Lot 102 to reflect the shifting of the WWTP and establishment of a coastal village. No change to the foreshore reservation is proposed north of the southern coastal node 'Alkimos by the Sea'. Coastal engineering investigations by MP Rogers and Associates (1998) and a Coastal Planning Strategy (Report No. 5) has been prepared in support of a reduction below the current coastal setback to accommodate a coastal node.

The proposed coastal village on Lot 102 will provide for the development of a range of public and private facilities including residential development in direct proximity to the district's best regional beach, directly servicing the Alkimos Regional Centre. At the southern coastal village the proposed width of the Parks and Recreation reservation is

115m east of the line of permanent vegetation. The proposed setback is in excess of the 100m minimum required by the WAPC's Coastal Planning Policy.

It is separately proposed in the southwestern portion of Lot 102 to reduce the reservation from its current width of some 300-400m from the coast HWM to a width of some 160m to 300m. This is to allow more direct access to the coast's regional beaches from the Urban zone hinterland while retaining major topographic and vegetation features. The foreshore reserve remains wide in the southernmost extremity to accommodate and protect the catchment area of Karli Spring and surrounding representative examples of Quindalup dunal systems, but has been adjusted for better topographic fit.

Importantly, the dunal system at Alkimos and Eglinton is already severely compromised by the existing zoning which allows for urban development of the coastal landform. In addition, the dunal systems which will be impacted by the proposed modifications to the foreshore reserve (ie Amendment Area 7) are consistent to the system which is protected along the extent of the foreshore reserve at Alkimos-Eglinton.

4.6.4 Proposed Management

The Coastal Planning Strategy has have been prepared for the coastal area at Alkimos-Eglinton. The Strategy outlines the environmental values and recreational opportunities for the foreshore area and prescribes broad strategies to manage potential environmental impacts. Site specific Foreshore Management Plans and Implementation Strategies will be prepared for the foreshore reserves of Alkimos (including Lot 102 and Karli Spring) and Eglinton at the Local Structure Planning stage and implemented at the subdivision stage. The FMPs will ensure that development adjacent to the coast provides a balance between protection of the environment and sustainable development of both recreational facilities within and immediately adjacent to the foreshore reserve.

The following principles and components will apply to the development of the foreshore reserve and will be incorporated into the FMPs:

- all access formalised by construction of roads, paths and car parks;
- fenced dual use paths and pedestrian accessways;
- use of 'coastal access loop' roads to the foreshore reserve to discourage movement of regional arterial traffic;
- incorporation of a highly scenic cycle route along edge of, or within, the foreshore reserve as part of a regional system;
- structures such as pavilions, boardwalks adopted as public facilities which enhance beach access yet offer vital foreshore protection;
- use of fencing and signage as integral methods of access control; and
- coastal rehabilitation/stabilisation and revegetation undertaken for degraded areas, and all others disturbed by development.

Management works and improvements to the foreshore reserve and foreshore management will be initially the responsibility of the landowners but this responsibility will be transferred to the Local Authority over time.

4.6.5 Potential Outcome

The justification for reducing the ROS Reserve adjacent to the coast in the southern region of Alkimos has been determined through coastal engineering and planning studies. The preparation of foreshore management plans for this section of the coast and for the balance of the Alkimos-Eglinton coastal foreshore will ensure the integrity of the coastal environment is maintained and enhanced and that prime regional beaches are able to accommodate a variety of recreational and community demands in a sustainable manner.

On this basis, the EPA objective of '*maintaining the integrity, function and environmental values of the dune system*' will be achieved in the proposed MRS Amendment.

4.7 Coastal Environment – Foreshore (Beach)

4.7.1 EPA Objective and Scope of Works

Coastal Environment – Foreshore (Beach)	
EPA Objective: Maintain the stability of the beaches, and the integrity, function and environmental values of the foreshore area.	
Instruction	Scope of Work:
i.	Assess the environmental values of the foreshore areas (beaches) on Lot 102 that are proposed for development.
ii.	Assess the beach stability and coastal processes, including meteorological and oceanographic conditions of these foreshore areas.
iii.	Identify and document potential impacts on these processes from proposed development.
iv.	Determine minimum coastal setbacks based on an appropriate consideration of extreme storm events, historical erosion trends, sea level change and safety issues.
v.	Identify and document management measures to ensure maintenance of beach stability and the ongoing protection of the environmental values.

4.7.2 Description of Amendment Area

A specific assessment of the coastline between Alkimos and Eglinton was made in 1993 prior to the adoption of the present Metropolitan Region Scheme (MRS) for the area (Alan Tingay & Associates, 1993). This assessment was undertaken to delineate a foreshore reserve line however, it was designed without detailed background information on long-term coastal processes, knowledge of areas of sub-surface limestone and with the significant constraints of the wastewater treatment plant at Lot 101. The width of the current reserve varies but generally has a setback in excess of 100m from the high water mark (HWM), increasing to 300-400m south of the Water Corporation site (Lot 101) to accommodate Karli Spring (as shown on Figure 7d(i)) and representative Quindalup Dunes.

More recently, MP Rogers and Associates were engaged in 1998 to undertake a comprehensive review of the foreshore reservation and justifications for proposed changes based on sound scientific principles and a study of the coastal processes, meteorological and oceanographic conditions of the area (MP Rogers & Associates, 1998). The study included exploratory drilling for limestone, analysis of the latest shoreline movement plans, likely future changes due to the greenhouse effect, potential erosion of the shoreline in a very severe storm, and the determination of minimum setbacks to permanent buildings. The following information provides a summary of the findings of the coastal engineering study by MP Rogers & Associates:

- The coastline in front of the study area is characterised by a 20-40m wide sandy beach in front of a primary dune around 5-10m in height.
- Limestone cliffs and outcrops occur adjacent to Lot 102 and 101 for a distance of 300m.
- Drilling did not encounter strongly cemented limestone at a suitable elevation to provide coastal protection.
- Meteorological and oceanographic conditions in the area indicate that there are significant seasonal and inter-annual changes in the winds, waves and water levels.
- An allowance for 20m of erosion was made to take into account possible climate changes due to the greenhouse effect.
- The dominant coastal processes at Alkimos-Eglinton are the longshore and cross-shore movement of sand caused predominantly by wave action. Seasonal and inter-annual variations in these processes also occur.
- Up to 5000m³/yr of sand is fed from the various nearshore reefs to the study area.
- Shoreline movement plans (1954, 1965, 1988) show the the shoreline in the Alkimos area has advanced up to 30-40m over a 42 year period. To the north of Alkimos, plans show that the shoreline has receded up to 45 to 55m over the same period of time.
- Storm erosion modelling (using a 100 year ARI event) revealed that a recession of the vegetation line around 25m could be expected. Between severe storms, background swell tends to move the eroded sand back on to the beach.

The resultant recommendations of the MP Rogers and Associates (1998) study included the identification of appropriate setbacks to development from the permanent vegetation line at the site, as shown in Figure 9a – 9d. The study determined that the setback to development should range from 65 to 190m to provide an adequate buffer for the long-term erosion trend, erosion during a severe storm and provide an allowance for erosion due to possible climate changes associated with the greenhouse effect.

Provision has been included in the coastal foreshore reserve as proposed for amenity and parking areas, and concept plans indicating the possible form of development of the coastal village are included in the Coastal Planning Strategy (Report No. 5).

4.7.3 Potential Impacts

The ROS Reserve adjacent to the coast has not been altered for most of study area in the Amended MRS. It has, however, been reduced in the southern sector of Alkimos from the proposed Alkimos coastal node to the southern boundary of the Amendment Area. The concept of coastal nodes has been developed for the Amendment Area to allow for additional residential and commercial developments in close proximity to the two regional beaches. The siting of coastal village adjacent to the regional beach is considered to be a critical planning objective in the Amended MRS which offers substantial advantages without significantly compromising the values of the coastal reserve overall. An important component of the siting of the node has been the relocation of the Alkimos WWTP further to the east to mitigate any potential impacts associated with the buffer requirements of this facility.

The reduction in area in the foreshore reserve is more than compensated for by additions to the proposed ROS in the Amended MRS.

The proposed foreshore reserve alignment in the southern half of the Amended MRS was reviewed based on additional coastal stability information provided by MP Rogers & Associates. They determined a development setback line based on the following factors:

- natural erosion/accretion patterns over the last 89 years;
- the 1 in 100 year storm and beach erosion;
- global warming;
- a factor of safety; and
- the presence/absence of sub-surface limestone.

The recommended minimum development setbacks, as measured from the edge of the permanent vegetation line, were not substantially different from the foreshore reserve line shown in the Amended MRS. In two areas, The MP Rogers & Associates study recommended setbacks which were greater than those shown in the existing MRS.

These two locations are at the northern end of the regional beach and at the proposed coastal node at Lot 102 Alkimos. The coastal movement study showed significant fluctuations over the last 50 years for the Alkimos node area and a recent 10 year trend of accretion as identified in the 1993 Alan Tingay & Associates' Alkimos-Eglinton Coastal Strategy and there was little difference between the position of the HWM in 1908 and 1997.

4.7.4 Proposed Management

Foreshore Management Plans and Implementation Strategies will be prepared for the foreshore reserves of Alkimos (including Lot 102 and Karli Spring) and Eglinton. Plan preparation will be undertaken at the Local Structure Planning stage and implementation at the subdivision stage.

An essential requirement for coastal development is to provide a balance between protection of the environment and sustainable development of both recreational facilities within and immediately adjacent to the foreshore reserve.

The following principles and components will apply to the development of the foreshore reserve and will be incorporated into the FMPs:

- all access formalised by construction of roads, paths and car parks;
- fenced dual use paths and pedestrian accessways;
- use of 'coastal access loop' roads to the foreshore reserve to discourage movement of regional arterial traffic;
- incorporation of a highly scenic cycle route along edge of, or within, the foreshore reserve as part of a regional system;
- structures such as pavilions, boardwalks adopted as public facilities which enhance beach access yet offer vital foreshore protection;
- use of fencing and signage as integral methods of access control; and
- coastal rehabilitation/stabilisation and revegetation undertaken for degraded areas, and all others disturbed by development.

Management works and improvements to the foreshore reserve and foreshore management will be initially the responsibility of the landowners but this responsibility will be transferred to the Local Authority over time.

4.7.5 Potential Outcome

The justification for reducing the ROS Reserve adjacent to the coast in the southern region of Alkimos has been determined through coastal engineering and planning studies. The preparation of foreshore management plans for this section of the coast and for the balance of the Alkimos-Eglinton coastal foreshore will ensure the integrity of the coastal environment is maintained and enhanced and that prime regional beaches are able to accommodate a variety of recreational and community demands in a sustainable manner.

On this basis, the EPA objective of '*Maintaining the stability of the beaches, and the integrity, function and environmental values of the foreshore area*' will be achieved in the proposed MRS Amendment.

4.8 Pollution – Odour

4.8.1 EPA Objective

Pollution - Odour	
EPA Objective: Odours emanating from the proposed WWTP and GWTP should not adversely affect the welfare and amenity of other land users.	
Instruction	Scope of Work:
i.	Describe and assess the potential off-site odour impacts associated with the operation of the proposed WWTP and GWTP, taking into account the EPA's current Guidance Statement on the 'Assessment of Odour Impacts'.
ii.	Based on the results of the assessment determine the appropriate separation distance between the proposed WWTP and proposed residential or other sensitive development.
iii.	Identify appropriate management measures to ensure that odour impacts are contained within an appropriate buffer.

4.8.2 Description of Amendment Area

The current MRS had allowed for the WWTP buffer with compatible zonings based on odour modelling done at that time under the then prevailing EPA guidelines. The present odour buffer catered for in the existing MRS at Lot 101 (Figure 3) comprises a distance of approximately 1000m to the north and northeast and 750m to the southeast and 650m to the south surrounding the WWTP. This was based on the provisions of some standard odour control measures at the plant as it developed.

The location of the WWTP is now proposed 700m east of the original location in Lot 101 at Alkimos. This plant is expected to serve the development of both the north-west and north-east corridors which could generate a sewerage catchment of between 350,000 and 900,000 people. The population will more likely be in the order of 640,000.

Options for the location of the WWTP have been aimed at reducing the impact of the plant and its odour buffer on the urban development proposals for the area and, in particular, at maximising the development potential of the land surrounding the proposed regional beach adjacent to Lot 101. In addition, the Water Corporation has indicated its intention to develop a more compact plant, incorporating advanced technology treatment processes and odour control facilities to perform to the requirements of the now more stringent EPA guidelines.

To accommodate the ultimate buffer alignment the proposed amendment reflects a 450m Public Purpose reservation surrounded by a 150m Urban Deferred zoning. The Water Corporation is currently scientifically determining a 'distinct' odour level criteria for the future facility in accordance with the March 2002 EPA Guidance Statement No. 47.

The program, for determination by mid 2005 of the final buffer area, will include sophisticated on-site climatic monitoring and modelling, investigation of the 'speciation' of wastewater odour (understanding the relationship of the basic compounds in odour as measured by dynamic olfactory) and determine the actual odour control performance of the Subiaco, Woodman Point and Beenyup facility upgrades. It is envisaged that by mid

2005 the Corporation will make a final recommendation to the EPA and WAPC on the buffer size and area.

The incorporation of the 150m band of Urban Deferred provides surety that no urban development can take place until the final buffer is determined. It also provides flexibility, enabling urban development outside the final defined buffer to occur by means of a WAPC resolution, without the need for a further MRS Amendment.

Groundwater extracted from bores located in the study area will need to be treated prior to storage in the reservoir. It is expected that this will involve iron removal and water softening as well as chlorination and fluoridation.

The groundwater treatment plant site will occupy an area of about 12ha surrounded by a 66ha buffer of ROS adjacent to the Freeway. Land uses within this buffer will be restricted to open space.

Odour control within the plant is not expected to be necessary since the groundwater is unlikely to contain hydrogen sulphide.

4.8.3 Potential Impacts

The operation of the WWTP and GWTP has the potential to generate off-site odour impacts to surrounding residential or other sensitive developments.

Odour modelling is being conducted by specialist consultants, Consulting Environmental Engineers (CEE), who have extensive experience in this field, on behalf of the Water Corporation to determine the appropriate buffer requirements for the WWTP buffer. A report prepared in June 2002 is contained as Appendix 8 and provides an early indication for the buffer distances required to accommodate the WWTP at Alkimos. The report indicates an appropriate buffer size using off site meteorological data from an existing weather station on the coast.

CEE has recently reported to the Water Corporation that the required buffer would need to be larger than indicated in the above report. This finding is based on three months of on site meteorological data. Based on this advice, the buffer proposed in this MRS is 600m until further scientific work is completed to determine the final buffer size.

The Water Corporation had earlier sought advice from the CSIRO in Victoria, after discussions with the DEP, to confirm the adequacy of the proposed measurement methodology for the Alkimos WWTP. The assessment by CSIRO determined that the methodology used by CEE was adequate to identify the potential odour issues and delineate an appropriate buffer around the treatment plant. A copy of this advice is contained in Appendix 9.

In order to firm up the actual buffer size required, the Corporation has committed to the following actions.

1. Monitor and model weather conditions for at least two years.
2. Investigate the need to install additional weather stations at other nearby sites.
3. Continue its consultancy with CEE to interpret the data reports for integrity and advice.

4. Commence preliminary design of the Alkimos WWTP to firm up the odour emission estimates.
5. Scientifically determine the “distinct” odour criteria for wastewater treatment plants.
6. Investigate the “speciation” of wastewater odours (determine the relationship between Hydrogen Sulphide and other compounds and odour as measured by dynamic olfactometry).
7. Determine the actual odour control performance of the Subiaco, Beenyup and Woodman Point upgrades.

The Urban Deferred zoning will not be lifted until the Water Corporation and the DEP/EPA have approved the final buffer. The final buffer land area will be owned by the Corporation. This condition is reflected in Table S1 – Summary of Environmental Factors (Pollution).

4.8.4 Proposed Management

The Amendment reduces the WWTP buffer to a maximum 600m (from the inner plant boundary) in all directions until scientific evidence shows if it can be reduced further. The Corporation will achieve the final, recommended buffer by comprehensively covering all significant sources of odour. This includes inlet channels, screenings and grit processes, sedimentation tanks, and solids handling facilities. Odourous air will be extracted and treated in odour scrubbers designed to suit the particular application.

An Odour and Noise Management Plan and Implementation Strategy will be prepared for the Waste Water Treatment Plant. The Plan and Implementation Strategy will be developed to ensure that agreed odour emission criteria are met.

The Corporation has completed a number of odour studies for metropolitan WWTP's in recent times, and is committed to meet agreed emission criteria. After the completion of the Subiaco and Beenyup WWTP upgrades, the Water Corporation will test the effectiveness of the odour control measures, prior to a final commitment being made on the Alkimos WWTP buffer in early 2005.

The 300m chlorine storage buffer requirement associated with the GWTP has been addressed through the allocation of a 66ha ‘Park and Recreation’ reservation surrounding the GWTP. The Water Corporation proposes to manage the buffer area for conservation and recreation purposes in association with the adjacent Alkimos town park.

The 300m chlorine storage buffer requirement associated with the WWTP will be incorporated into the odour buffer area.

4.8.5 Potential Outcome

The proposed Amendment can meet the EPA’s objective for odour due to:

- The Water Corporation’s commitment to implement odour control measures to enable agreed emission criteria to be met outside the Wastewater and Groundwater Treatment Plant’s 600m and 300m buffers, respectively.

- The WWTP and GWTP will be subject to the Department of Environmental Protection's licence conditions which will include emission criteria.

On this basis, the EPA's objective of ensuring '*odours emanating from the proposed WWTP and GWTP should not adversely affect the welfare and amenity of other land users*' can be achieved in the proposed MRS Amendment.

4.9 Risk

4.9.1 EPA Objective and Scope of Work

Risk	
EPA Objective: Ensure that public risk associated with the operation of the WWTP and the storage of chlorine at the proposed GWTP is managed to meet the EPA's criteria for individual fatality risk off-site and the DME's requirements in respect of public safety.	
Instruction	Scope of Work:
i.	Describe how the proposed WWTP and GWTP will be designed and managed to ensure that the surrounding residential areas are not adversely affected by risk.
ii.	Consider the EPA's Final Guidance Statement No. 2 'Risk Assessment and Management: offsite Individual Risk from Hazardous Industrial Plant' (EPA, 2000) in this assessment.

4.9.2 Description of the Amendment Area

The Perth's Future Water study (WAWA, 1995) identified the northern groundwater sources as the favoured option for future augmentation of Perth's water supply, as well as meet the rapidly growing local demands. The most recent major addition to this is the Neerabup scheme. The Eglinton groundwater scheme is required to supply the Alkimos-Eglinton area, as well as the area south.

Land was previously acquired for the GWTP within the proposed Alkimos WWTP buffer with some sharing of common facilities including chlorination, operations, buildings etc. Negotiations with Eglinton Estates and LandCorp determined that the potential relocation of the GWTP to the north-eastern corner of Lot 102 was feasible.

The GWTP is proposed to be built in one stage in approximately the year 2010, as demand dictates. The production limit will be 79ML/day and up to 17GL per year. The production limit of 79ML/day favours single stage development of the water treatment plant and borefield.

The operation of the plant will involve treatment using aeration, partial softening, filtration, disinfection and flouridation with a similar plant design to the existing Neerabup groundwater treatment plant. Treated water would then be pumped to the Carabooda Reservoir via a common inlet/outlet main.

The pre-chlorination, bulk chlorine storage facility will be located in a separate building on the proposed Water Corporation site.

Chlorination Facilities

The chlorination facilities of both the GWTP and WWTP will be designed and constructed in accordance with the Water Corporation's Design Standards for Chlorination Plants. These structures have been developed with a philosophy of minimising risk. The chlorination plants will be operated and maintained in accordance with the Corporation's Chlorine Hazard and Safety Management System.

4.9.3 Potential Impacts

The groundwater treatment plant has been relocated off Lot 101 to a site within the eastern end of the proposed Alkimos ROS adjacent to the Freeway. This area is surrounded by regional open space and transport corridors.

The designation of a 300m (non-residential) buffer and 500m evacuation buffer around the GWTP and 600m around the WWTP meets the EPA Guidance Statement No. 2: 'Guidance for Risk Assessment and Management: Off-site Individual Risk from Hazardous Industrial Plant' (EPA, 2000) thereby ensuring no individual fatality risk off-site associated with chlorine storage will occur.

In the evacuation buffer of 300 to 500m from the plant boundary the preferred land use is non-residential (also note that schools, aged care and other educational facilities and other sensitive non-residential land uses should not be established in this area). The land, however can be used for a large range of other uses. Within the 300m buffer land uses will be much more constrained as it is a hazard buffer.

4.9.4 Proposed Management

According to the EPA's "Guidance for Risk Assessment and Management: Off-site individual risk from Hazardous Industrial Plant" the risk levels to be adhered to are:

- Residential – one in a million or less per year.
- Industrial – fifty in one million or less per year.
- Commercial – five in a million or less per year.
- Regional Open Space – not stated, but in active open areas, it is ten in a million or less per year.

In addressing the on-site risk that may deter off site risk, both the Alkimos WWTP and the Eglinton GWTP will be surrounded by an 1800mm chainwire security fence with signs warning of hazard placed at regular intervals. The fence will be placed at what is known as the inner plant boundary, which is further surrounded by land the Corporation will own as a buffer. For the GWTP this will be a chlorine risk buffer, for the WWTP the odour buffer will also incorporate the much smaller chlorine risk buffer. The Corporation's standard practice at its Perth plants is to induct all visitors and accompany them while on-site. Refer to the attached plan A for the location and surrounding land uses of both plants.

Addressing the off-site risk, the most sensitive risk will be posed to the proposed residential areas to the north, south and west of the WWTP. In comparison the GWTP

will be almost surrounded by Regional Open Space apart from some industrial land to the northwest. Part of the Mitchell Freeway intrudes into the buffer on the eastern side. The GWTP also will consider an evacuation buffer up to 500m from the plant centroid that is dealt with by operational management and is not shown on any statutory plans. This is a lesser issue for the WWTP as the 500m radius evacuation buffer from the centroid of the chlorination facility will occur within the 600m odour buffer from the inner plant boundary. The assessment methodology below applies to the chlorination facility at both the GWTP and the WWTP.

The Water Corporation's chlorination facilities are designed using best practice engineering design and operated using best industry management systems. The Water Corporation has established a Corporate Chlorine Hazard and Safety Management System (CHSMS) which has been reviewed by the Department of Minerals and Petroleum Resources (DMPR). This is applied to all new wastewater and water treatment plants.

The CHSMS sets the necessary standards, procedures and guidelines for the design, operation and management of chlorine facilities. It establishes the reporting requirements, monitoring of standards (both design and equipment), change control and emergency procedures. Emergency response simulations are conducted in accordance with the requirements of the standards and the Corporation's incident management procedures. These range from desktop simulations through to full simulations involving all relevant emergency services (including Fire and Emergency Services Association, Police and any local agencies in non-metropolitan regions).

For the Eglinton GWTP, as well as the Statutory Risk Buffer, the Corporation has sited the plant in an area of Regional Open Space. This should ensure that any task of evacuation (if it is necessary) is more readily managed.

The Corporation's chlorine facilities incorporate many features designed to reduce risk such as containment building designs (including drive in enclosed delivery bays), all vacuum systems, and state of the art 24 hour per day monitoring and alarm systems.

The development of the Corporation's standard designs have been carried out in close liaison with Department of Minerals and Petroleum Resources (DMPR) and meet the requirements to reduce risk to as low as reasonably practical. We have all our standard designs documented including relevant drawings, manuals and procedures.

The Corporation carries out Quantified Risk Assessments (QRA) on all necessary facilities and the outcome of these QRA's are examined and approved by DMPR.

An applicable project that can be used to give an indication of the likely outcome of a QRA for the GWTP and the WWTP is the Stirling Dam project. The scope of this QRA was to:

- identify hazardous incidents associated with the transfer, storage and use of chlorine;
- evaluate offsite risks;

- assess three design options (8, 10 and 14 drums) and;
- determine the sensitivity of the assessment to the ability of the building to maintain its integrity in the event of catastrophic drum failure and to the building air change rate.

The predicted risk levels for all the options considered were within the EPA criteria. The maximum individual risk at the site boundary is less than 5 in a million per year for all three design options. This decreases to less than 1 in a million at the 300m radius line for all scenarios using 3 air changes per hour.

The QRA dated April 2000 was compiled by Det Norske Veritas. The same methodology will be used for the Alkimos WWTP and Eglinton GWTP, at the definition stage (prior to design) of both projects. This is likely to be 2004 for the WWTP and about 2008 for the GWTP. The DMPR are then involved in endorsing the QRA. The QRA will use on site wind data that will be available in January 2003.

The Water Corporation will require a licence to store hazardous materials on site from the (DMPR). The DMPR will require that the quantity of hazardous materials stored does not present a hazard beyond the boundary of the buffer area. If this is not the case, quantities would need to be reduced or additional risk reduction measures implemented such that this requirement is met.

The DMPR has well established criteria that need to be met in order to obtain this licence. The Water Corporation has an established Chlorine Hazard and Safety Management System which assures the DMPR requirements are met and maintained. Prior to seeking a Dangerous Goods Licence the Water Corporation will provide DMPR with the necessary Quantified Risk Assessment and general arrangement information for approval.

4.9.5 Proposed Outcome

The implementation of the above measures will ensure that the risk associated with the operation of the WWTP and GWTP to public health and safety are in accordance with the EPA criteria.

The Water Corporation will implement best practice measures, including appropriate design of the storage building, testing and monitoring of mechanics and preparation of an Emergency Response Plan to prevent the potential risk to the public of chlorine storage at the site. On this basis, the EPA's objective for the management of public risk associated with chlorine at the GWTP and WWTP can be achieved in the proposed MRS Amendment.

4.10 Noise

4.10.1 EPA Objective and Scope of Work

Risk	
EPA Objective: Protect the amenity of nearby residents from noise impacts resulting from activities associated with the WWTP by ensuring that noise levels meet statutory requirements and acceptable standards.	
Instruction	Scope of Work:
i.	Demonstrate that noise associated with the operation of the WWTP will meet statutory levels at nearby future residential areas.

4.10.2 Description

Potential noise emissions from the operation of the WWTP include noise generated from process equipment, warning devices and vehicle access to and from the site.

An acoustic assessment has recently been undertaken for the "Woodman Point Environmental Improvement Project". The Woodman Point plant has been expanded to approximately the ultimate capacity expected at Alkimos. Measures were undertaken to reduce noise at Woodman Point, and these are outlined in the report. Alkimos has the advantage of being surrounded by a ridgeline (as shown in Figure 10), and it is not anticipated that significant additional measures will be required to meet noise regulations. It is standard practice to house noisy equipment such as blowers and dewatering equipment in appropriately designed acoustic enclosures or buildings.

4.10.3 Potential Impacts

The generation of noise from the operation of WWTP has the potential to impact on surrounding residences and other land uses. The acoustic assessment of the Woodman Point WWTP shows the noise contours to be attenuated for the closest residence some 700m away. At Alkimos the closest residence will be over 500m from noise sources at the proposed WWTP. Importantly, the noise contours of the Woodman Point site are not constrained by topographical features as the Plant is sited on a dune crest.

For this reason, a 600m buffer has been identified at Alkimos with the potential to reduce this to 450m following confirmation by the Water Corporation that potential impacts of noise, as well as odour and risk, can be managed. Until this is demonstrated, the Water Corporation is committed to managing the buffer at 600m with the prospect of reduction to 450m following the acceptance of the findings of the appropriate studies.

4.10.4 Proposed Management

The operation of the Wastewater Treatment Plant will comply with existing and future noise regulations. In particular, the existing Environmental Protection (Noise) Regulations, 1997.

The proposed siting of the WWTP in a depression (as shown in Figure 10) will assist noise reduction when compared to the Woodman Point plant which is located on a rise above Lake Coogee allowing for noise to drift further. The Water Corporation will ensure all statutory noise requirements will be met at the Alkimos WWTP and the Eglinton GWTP. Noise generation from equipment within the WWTP would be set to ensure that noise levels at 1m from each item of noise generating equipment is no greater than 85dBA. It is expected that this would ensure that allowable neighbourhood noise levels would be met at the edge of the proposed buffer zone.

In addition, careful equipment selection and placing all pumps other noise generating equipment inside buildings will attenuate noise generation. The Corporation's own Occupational Safety and Health requirements generally dictate noise controls rather than any offsite issues.

The following noise attenuation measures have been utilised at the Woodman Point WWTP (Hering Storer Acoustics, 1999) and are likely to be implemented at the Alkimos WWTP:

- Effluent pump intakes to be installed with deep acoustic louvres
- Enclose odour control fans or lag the fan casings
- Decanters to be installed with a fan cowl
- Blower discharge to be installed with an silencer
- Sludge treatment exhaust fan to be installed with deep accoustic louvres

The Water Corporation will prepare and implement a Noise Management Plan and Implementation Strategy to ensure the management of noise is addressed and managed at the proposed Waste Water Treatment Plant.

Importantly, a buffer of 600m has been designated around the WWTP to protect the Plant from encroachment of future land development and to ensure that land use contiguous with the WWTP is of a compatible nature. Such a buffer dimension will adequately allow for noise attenuation from the Plant.

The location of access roads to the WWTP will be carefully sited to ensure consideration of nearby residences and developments.

4.10.5 Proposed Outcome

The Water Coproration will operate the WWTP to ensure the Plant meets the requirements of the *Environmental Protection (Noise) Regulations, 1997*. On this basis, the EPA's objective of '*protecting the amenity of nearby residences from noise impacts resulting from activities associated with the WWTP*' can be meet.

5. ENVIRONMENTAL MANAGEMENT COMMITMENTS

The proponent makes the following commitments regarding the management of the environmental factors identified by the Environmental Protection Authority as relevant to the proposed Amendments to the Metropolitan Region Scheme and Local Authority Schemes.

5.1 Environmental Management Plans

The following environmental management plans shall be prepared in accordance with the specifications set out in Attachment 1 of the Minister for the Environment's Statement that a Scheme may be implemented (to be advised):

Regional Open Space

- Prepare Environmental Management Plans and Implementation Strategies for Eglinton and Alkimos Regional Open Space and the immediate interface.
- Implement bushland, native fauna and recreation management objectives as outlined in the environmental management plans.

Coastal Reserve

- Prepare Foreshore Management Plans and Implementation Strategies for Alkimos and Eglinton to identify measures to preserve the natural environment of the area, while accommodating the local and regional recreational demands.
- Implement foreshore management measures as outlined in the foreshore management plans.

Pollution

- An Odour and Noise Management Plan and Implementation Strategy will be developed to ensure that agreed odour and noise emission criteria are met at the WWTP and GWTP.
- The Water Corporation proposes to manage the WWTP and GWTP buffer area for conservation and selective recreation purposes.
- Water Corporation to undertake a quantitative risk assessment (QRA) for the chlorine storage buffer at the WWTP and GWTP to ensure regulations can be met.

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.

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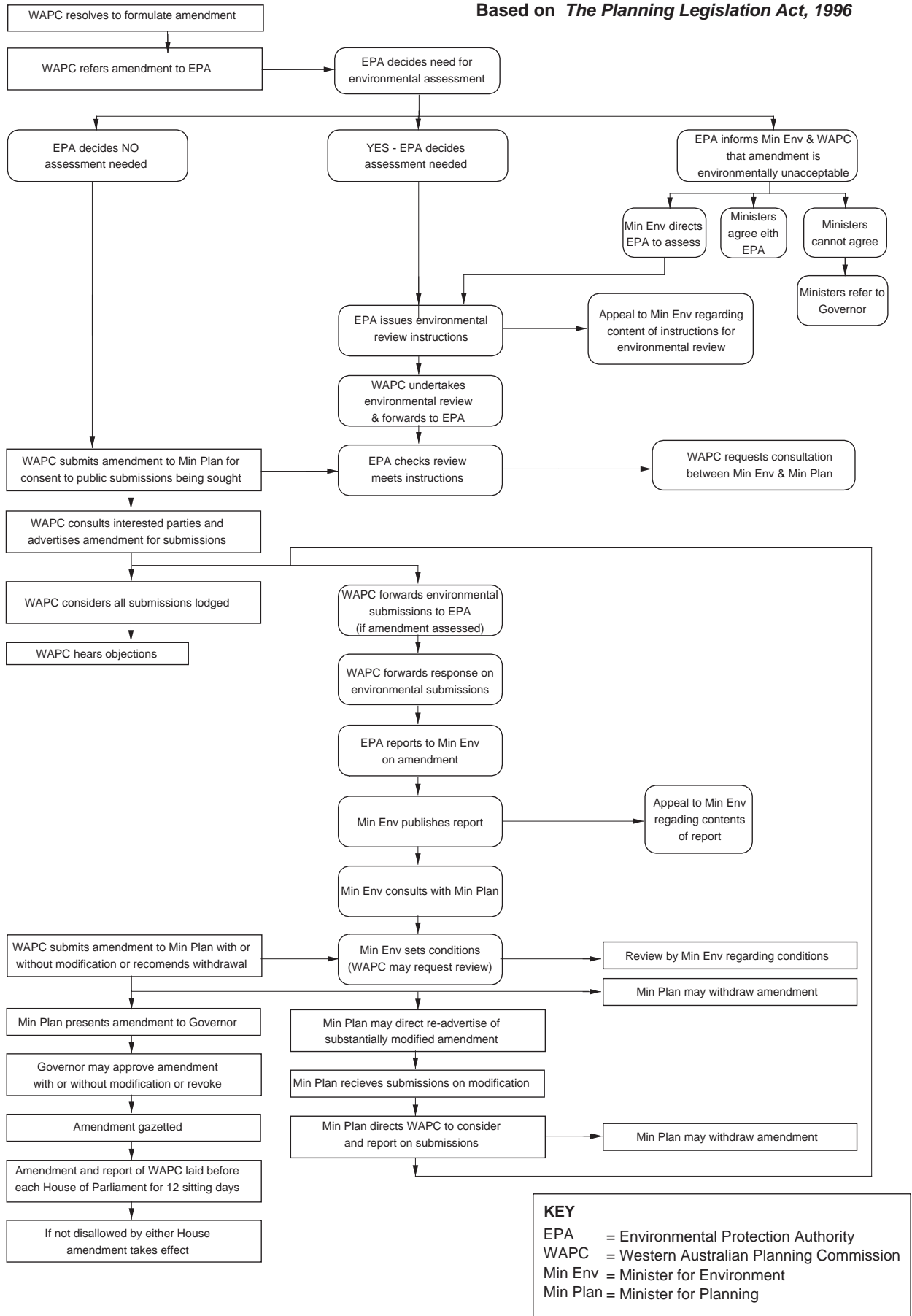
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FIGURES

Preparation & Environmental Assessment of MRS & Amendments

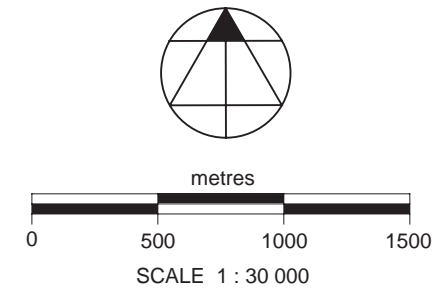
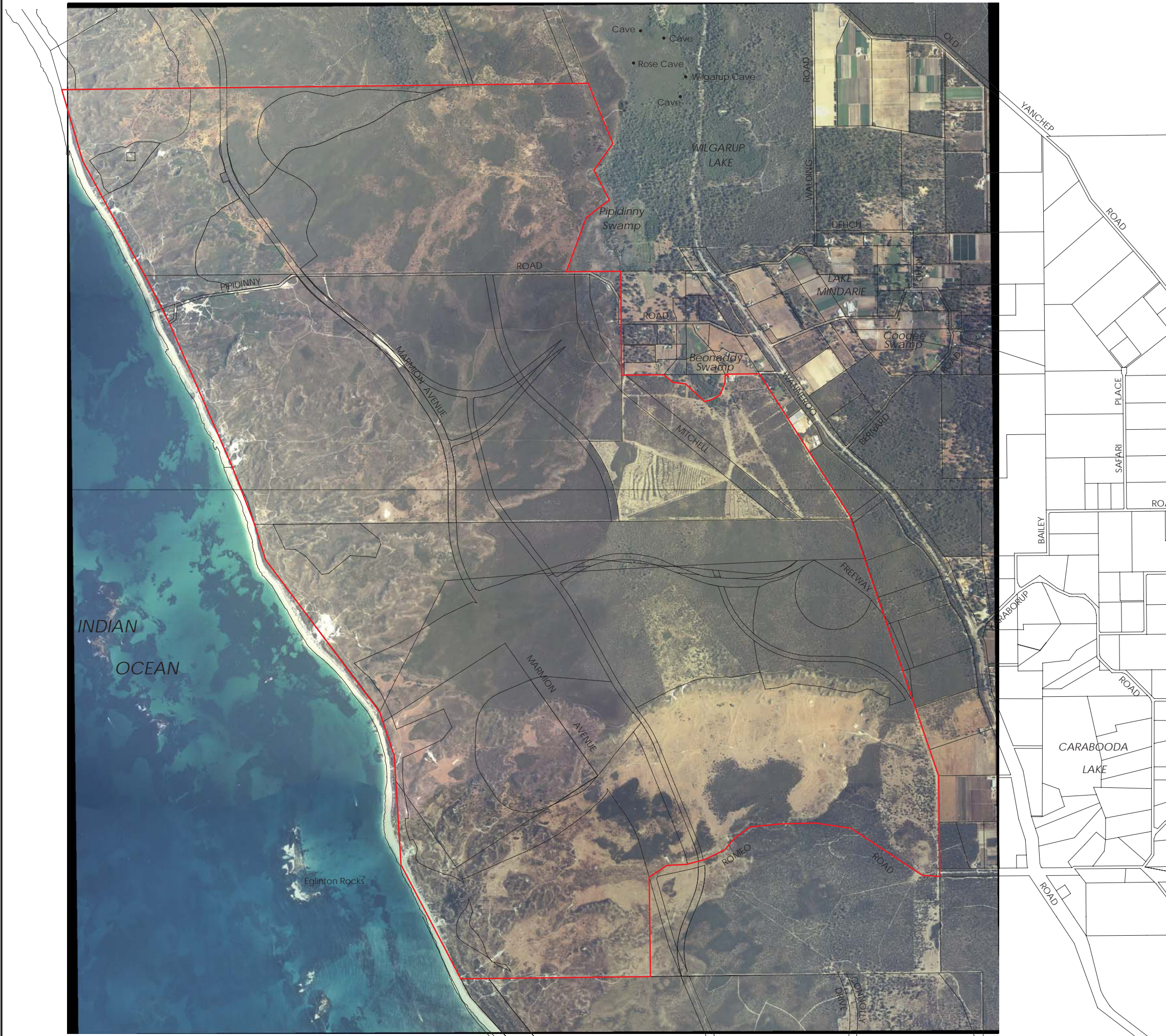
Based on *The Planning Legislation Act, 1996*



SOURCE: Western Australian Planning Commission, 1996

KEY
 EPA = Environmental Protection Authority
 WAPC = Western Australian Planning Commission
 Min Env = Minister for Environment
 Min Plan = Minister for Planning



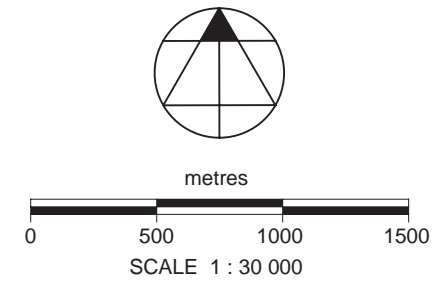
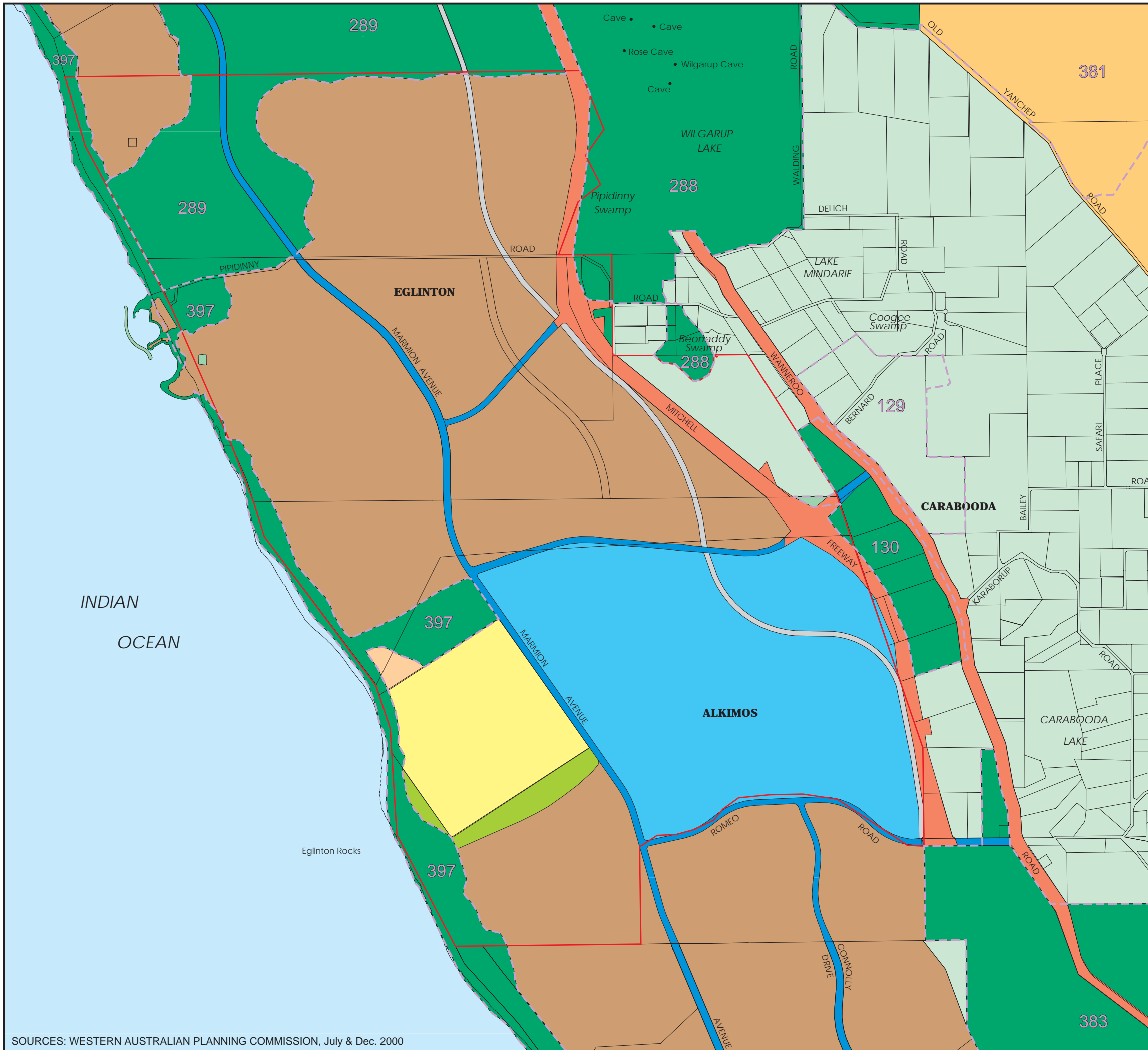


LEGEND

— Boundary of Land within which
Ammdments to the MRS are Proposed



ALKIMOS - EGLINTON
ENVIRONMENTAL REVIEW
AMENDMENT AREA
FIGURE 2

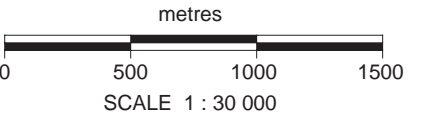
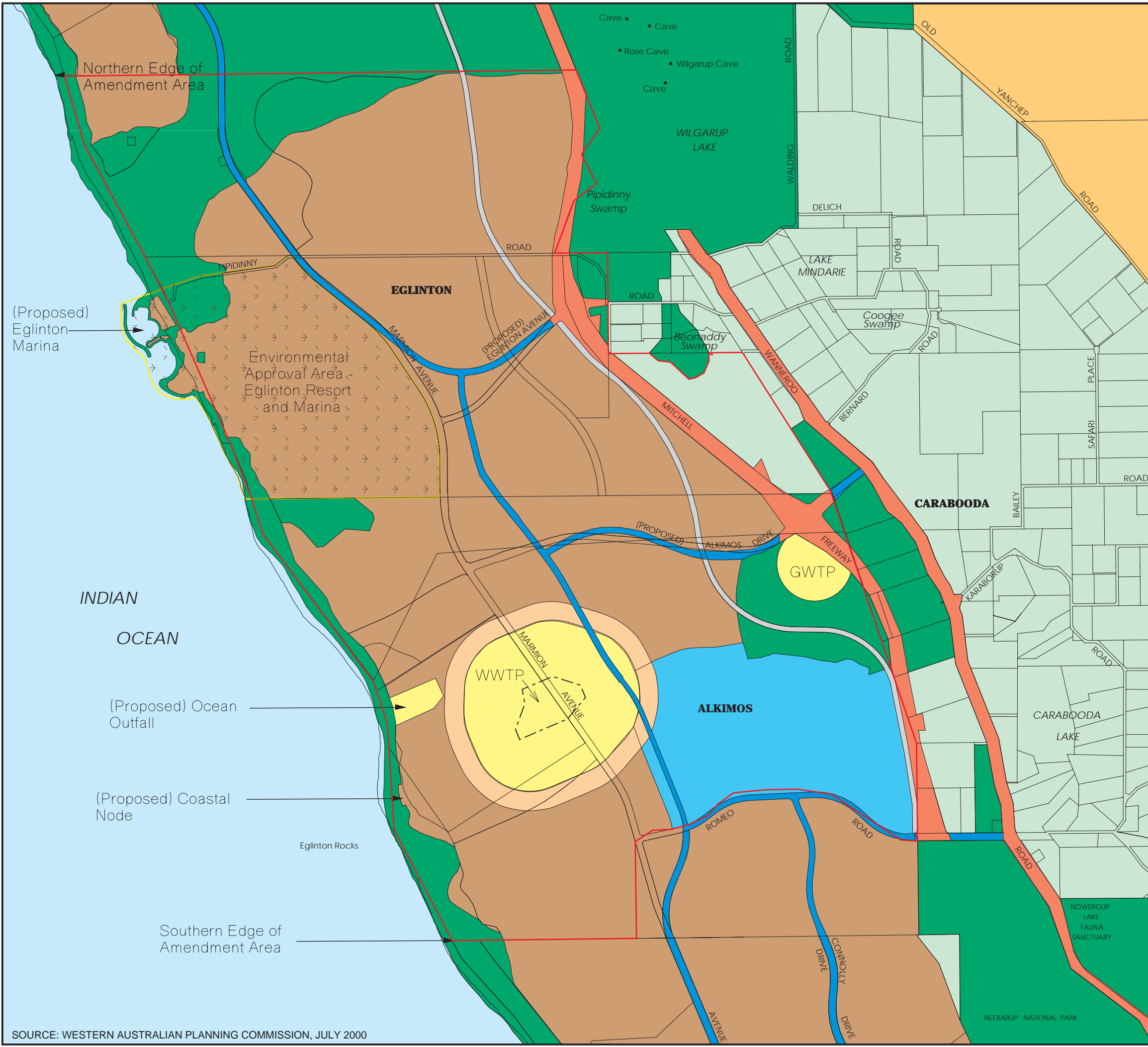


- LEGEND**
- Amendment Area Boundary
 - Bush Forever 2000 Boundary and Site Number
 - Cadastral Boundary
 - MRS RESERVATIONS**
 - Parks and Recreation
 - Railways
 - State Forests
 - Controlled Access Highways
 - Important Regional Roads
 - Public Purposes
 - MRS ZONES**
 - Urban
 - Urban Deferred
 - Central City Area
 - Rural
 - Private Recreation



ALKIMOS - EGLINTON
ENVIRONMENTAL REVIEW
**CURRENT MRS &
BUSH FOREVER SITES**

FIGURE 3



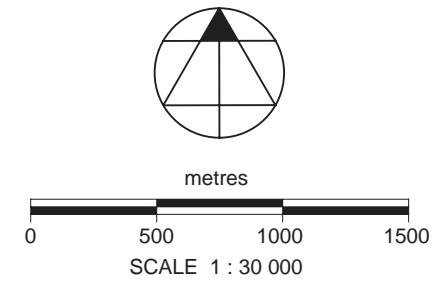
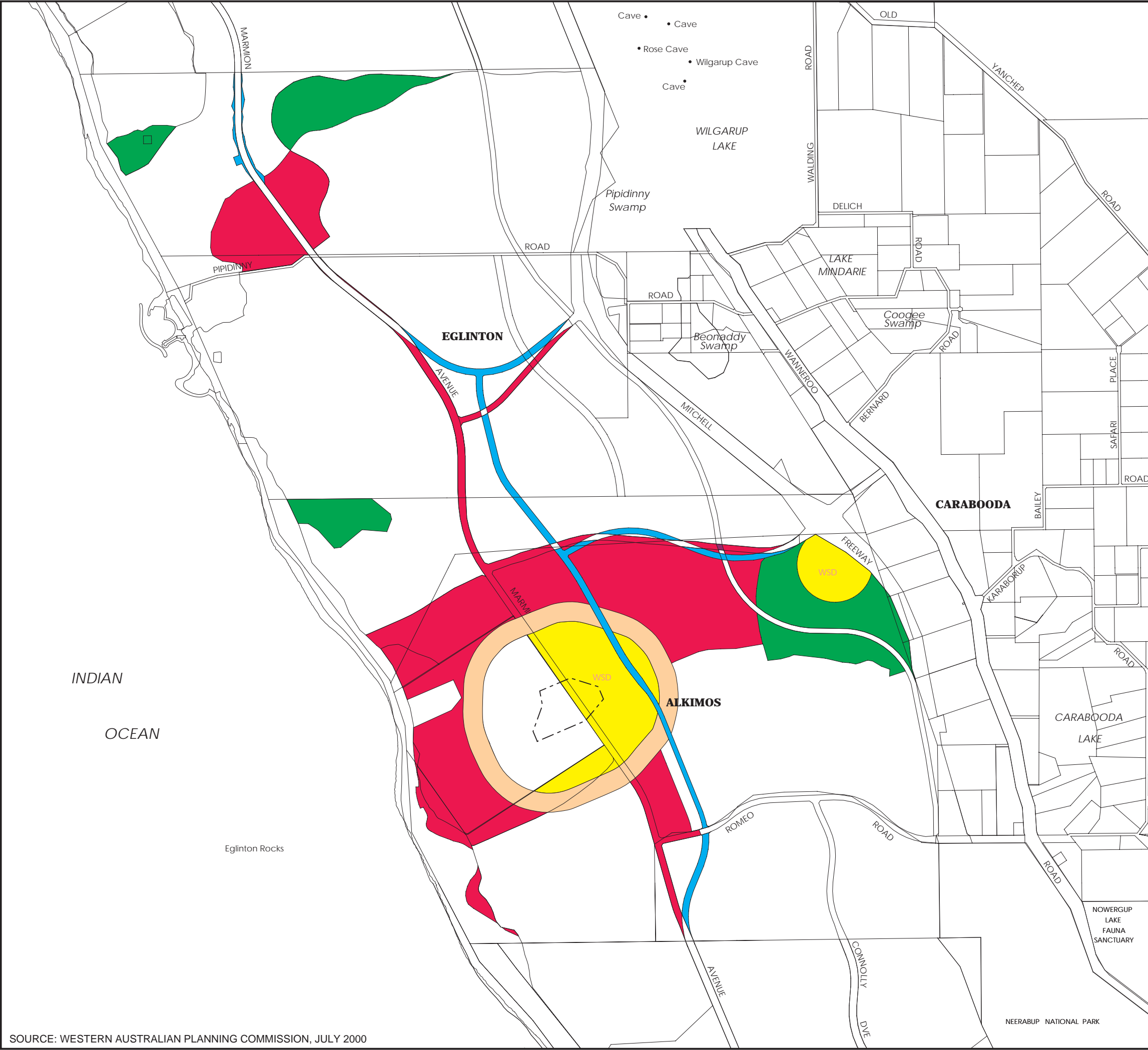
LEGEND

- Amendment Area Boundary
- RESERVATIONS**
- Parks and Recreation
- Railways
- State Forests
- Controlled Access Highways
- Important Regional Roads
- Public Purposes
- ZONES**
- Urban
- Urban Deferred
- Central City Area
- Rural




ALKIMOS - EGLINTON ENVIRONMENTAL REVIEW
MRS AS AMENDED BY AMENDMENT 1029/33
 FIGURE 4

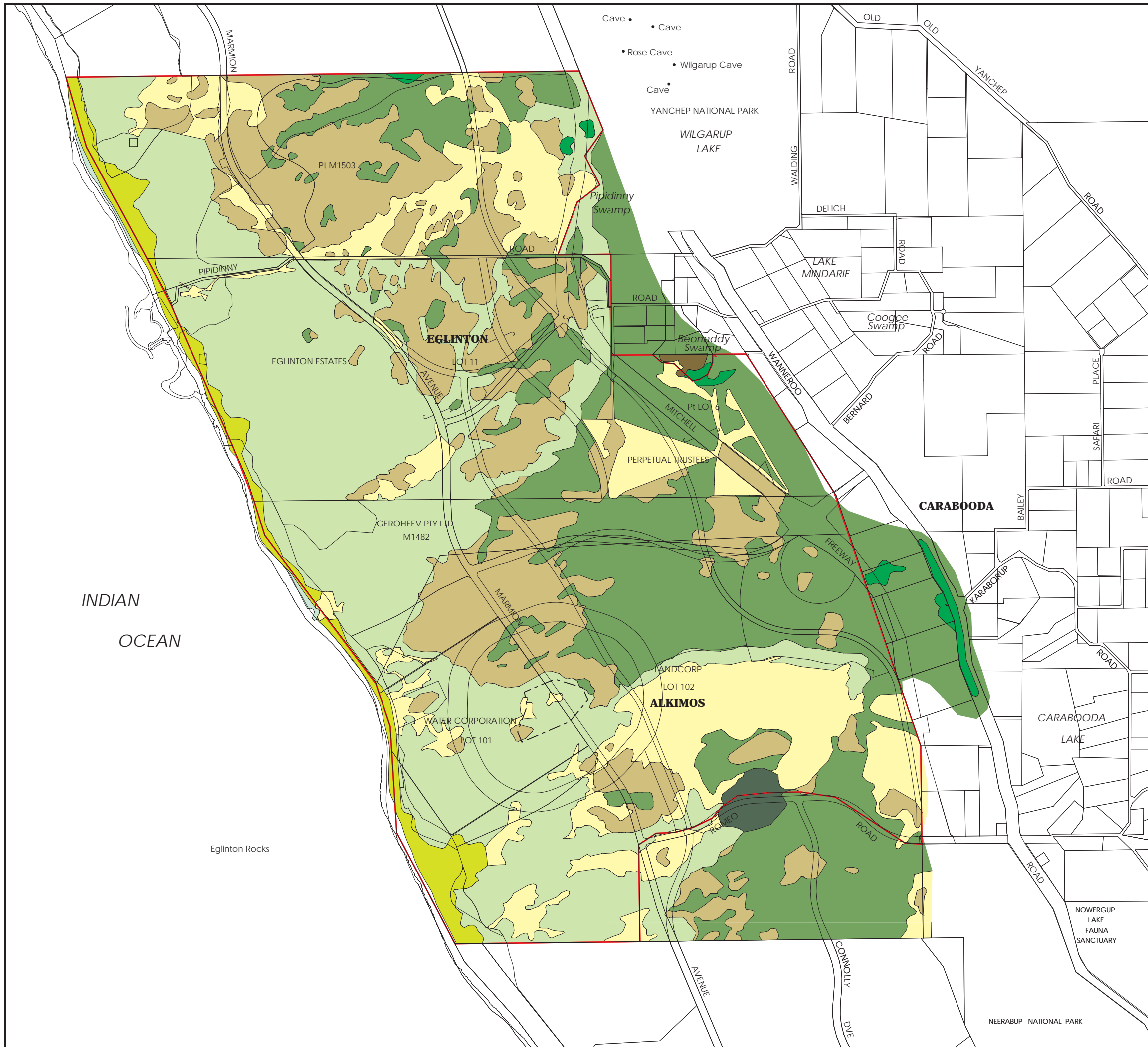
SOURCE: WESTERN AUSTRALIAN PLANNING COMMISSION, JULY 2000



LEGEND

- Amendment Area Boundary
- Excluded from Other Regional Roads Reservations & included in Central City Area Zone.
- Excluded from Urban Deferred, Central City Area & Private Recreation Zones, & from Parks & Recreation, Public Purposes (WSD), & Other Regional Roads Reservations & included in Urban Zone.
- Excluded from Private Recreation & Central City Area Zones, & from Other Regional Roads Reservation & included in Public Purposes (WSD) Reservation.
- Excluded from Private Recreation & Central City Area Zones, & from Other Regional Roads & Public Purposes Reservations and included in Urban Deferred Zone.
- Excluded from Urban & Central City Area Zones & included in Parks & Recreation Reservation.
- Excluded from Urban & Central City Area Zones, & from Parks & Recreation Reservation & included in Other Regional Roads Reservation.
- Excluded from Other Regional Roads Reservations & included in Railways Reservation.
- - - Waste Water Treatment Plant Site Boundary


ALKIMOS - EGLINTON
ENVIRONMENTAL REVIEW
ZONING & RESERVATION
CHANGES ADDRESSED BY THE ER
 FIGURE 5



LEGEND

— Amendment Area Boundary

QUINDALUP DUNES

Q4 **Vegetation of the Q4 Age Quindalup Dunes**
 Open to Low Closed Heaths to Shrublands dominated by *Scaevola crassifolia* and *Olearia axillaris*; *Scaevola nitida*, *Acanthocarpus preissii* and *Hemiandra pungens* or *Acacia rostellifera*. The stand area is dominated by a grassland of *Spinifex longifolius* and *S. hirsutus*.

Q4b **Vegetation of the Q4 Age Stabilised Blowout**
 The stabilised blowout at Ningana (Pt Lot M1503) comprises a Low Closed Heath of *Scaevola nitida* on the swales and dune slopes; *Acacia truncata*, *Melaleuca systena* Low Shrubland on the dune crest; and Low Open Heaths of *Acanthocarpus preissii* and *Hemiandra pungens* at the landward extent of the blowout.

Q **Vegetation of the Q1, Q2 and Q3 Age Quindalup Dunes**
 Low Open Heaths of *Melaleuca systena*, *Acacia rostellifera*, *Acacia lasiocarpa* and *Hibbertia racemosa* over Herblands dominated by *Lomandra maritima*.

SPEARWOOD DUNES

Sand surface of the spearwood dunes

Babm ***Banksia attenuata* and *B. Menziesii* Low Woodland**
 Over *Allocasuarina humilis*, *Hibbertia hypericoides*, *Xanthorrhoea preissii* and *Hakea ruscifolia* over a sedge/herb layer of *Mesomelaena pseudostygia* and *Desmodiadus flexuosa*

Eg **Tuart (*Eucalyptus gomphocephala*) Open Woodland to Woodland**
 Over *Banksia attenuata*, *Acacia saligna* and *Xanthorrhoea preissii*.

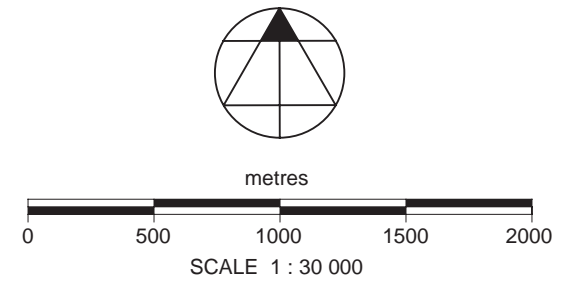
Ar ***Acacia rostellifera* Low Closed Woodland**
 One stand of this unit occurs in the northern region of Pt Lot M1503 and includes a small admixture of *Banksia attenuata*, *Hardenbergia comptoniana* with a very open understorey.

Limestone surface of the spearwood dunes

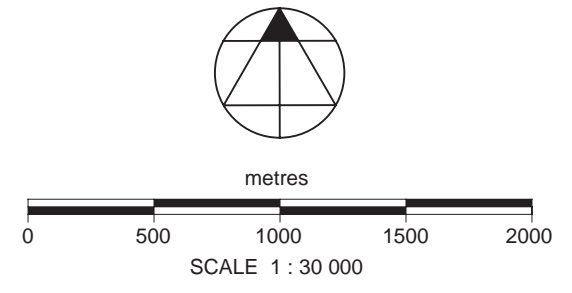
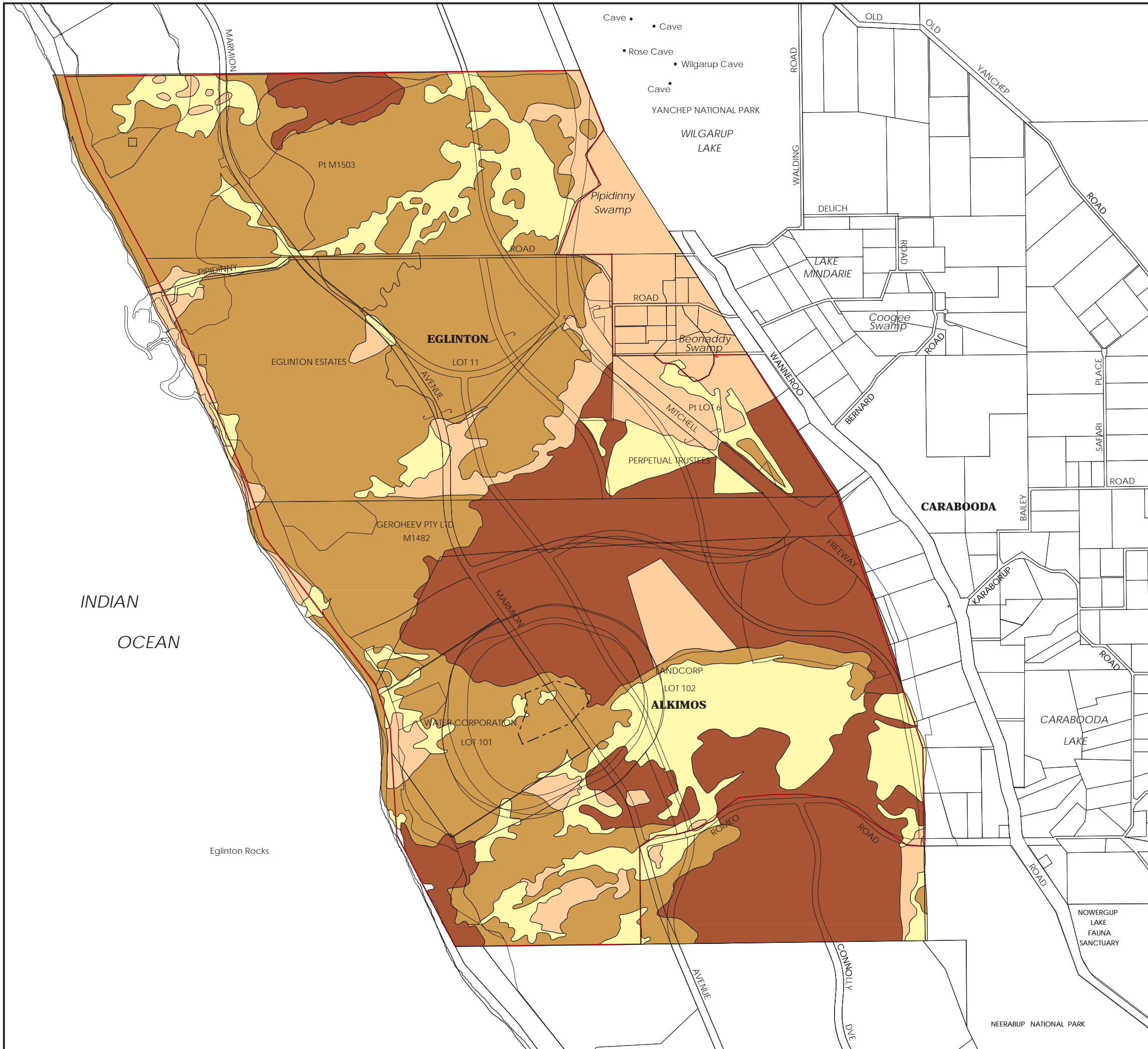
Lh **Open to Closed Heaths on Limestone**
 Dominated by an admixture of *Dryandra sessilis*, *Hakea trifurcata*, *Calothamnus quadrifidus*, *Allocasuarina humilis*, *Melaleuca cardiophylla* and *Xanthorrhoea preissii* with *Melaleuca huegelii* where limestone outcrops strongly.

Strand

Cleared



ALKIMOS - EGLINTON
 ENVIRONMENTAL REVIEW
VEGETATION ASSOCIATIONS
 FIGURE 7(i)



- LEGEND**
- Amendment Area Boundary
 - Excellent
 - Good
 - Degraded
 - Cleared



ALKIMOS - EGLINTON
 ENVIRONMENTAL REVIEW
VEGETATION CONDITION
 FIGURE 7(ii)



metres


0 100 200 300 400 500

SCALE 1 : 10 000

LEGEND

- Ex Vegetation Condition Boundary
- Study Area Boundary
- Exchange Area Boundary
- Cadastral Boundary

Refer to Figure 7f(ii) for Vegetation Cond. Legend

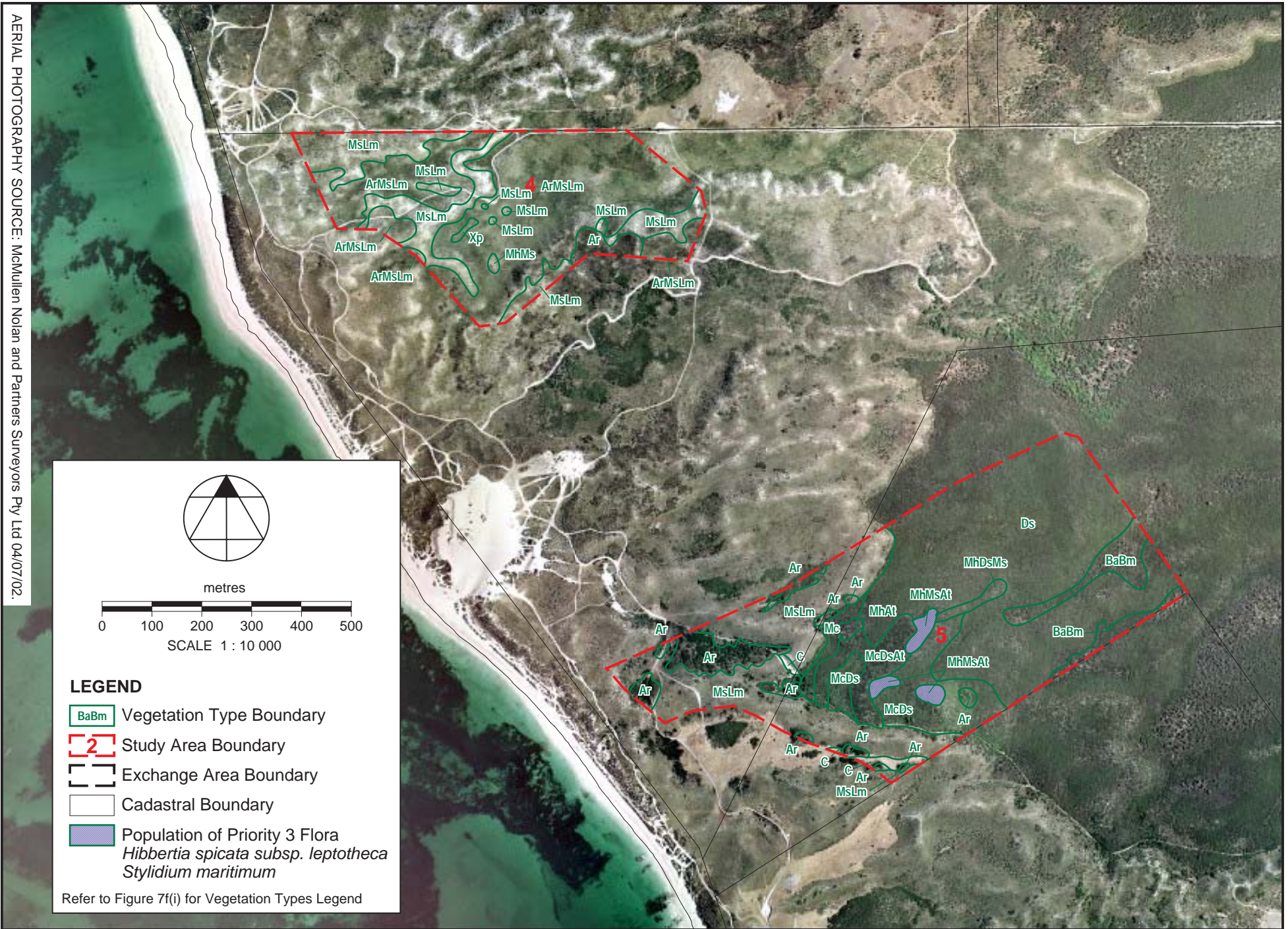


ATA
Environmental
environmental scientists

ALKIMOS - EGLINTON
ENVIRONMENTAL REVIEW
**VEGETATION CONDITION OF
ROS AMENDMENT AREAS 1, 2 & 3**
FIGURE 7a(ii)

ALKIMOS - EGLINTON ENVIRONMENTAL REVIEW
VEGETATION TYPES OF ROS AMENDMENT AREAS 4 AND 5

AERIAL PHOTOGRAPHY SOURCE: McMillen Nolan and Partners Surveyors Pty Ltd 04/07/02.



metres

0 100 200 300 400 500

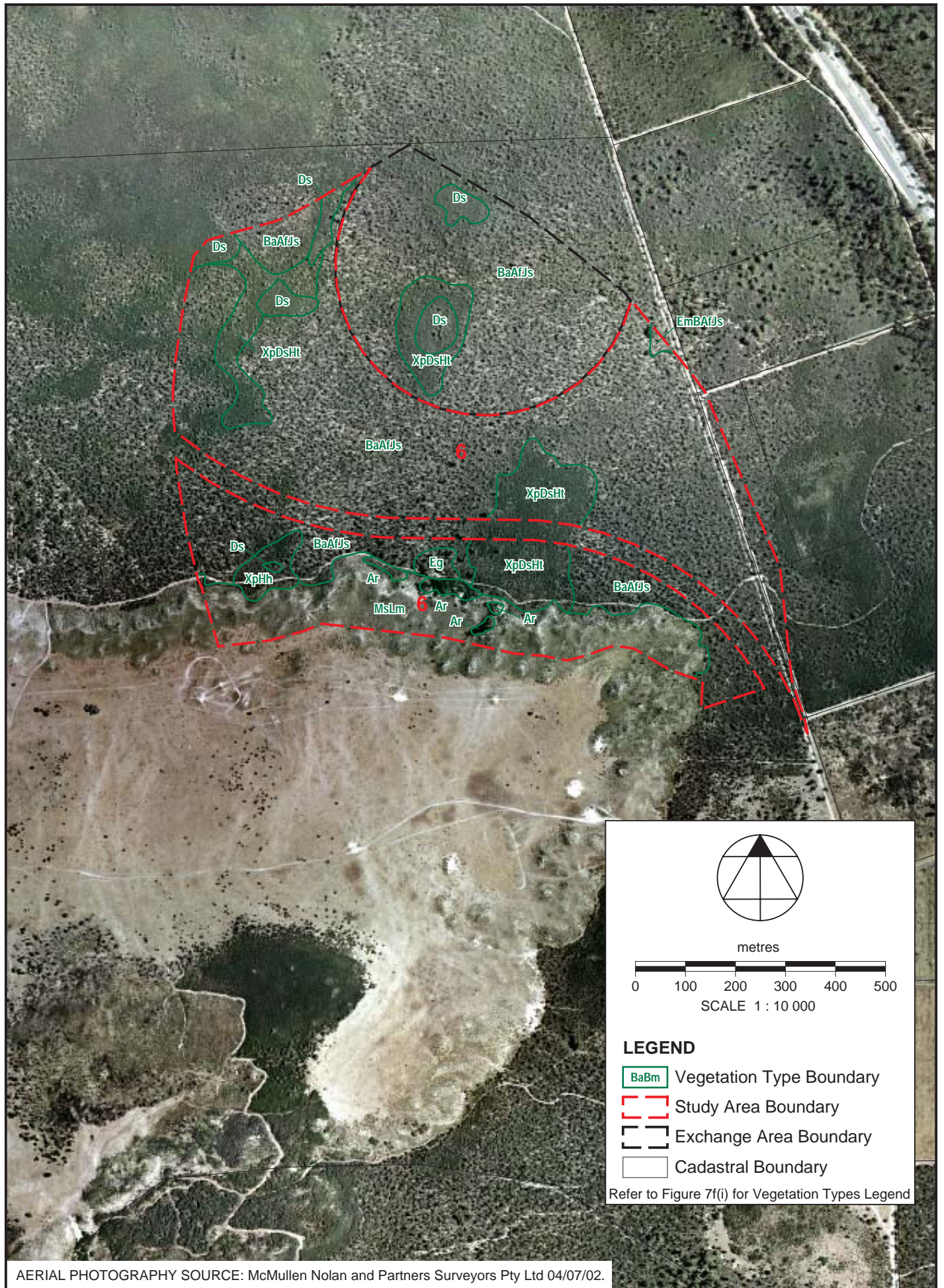
SCALE 1 : 10 000

LEGEND

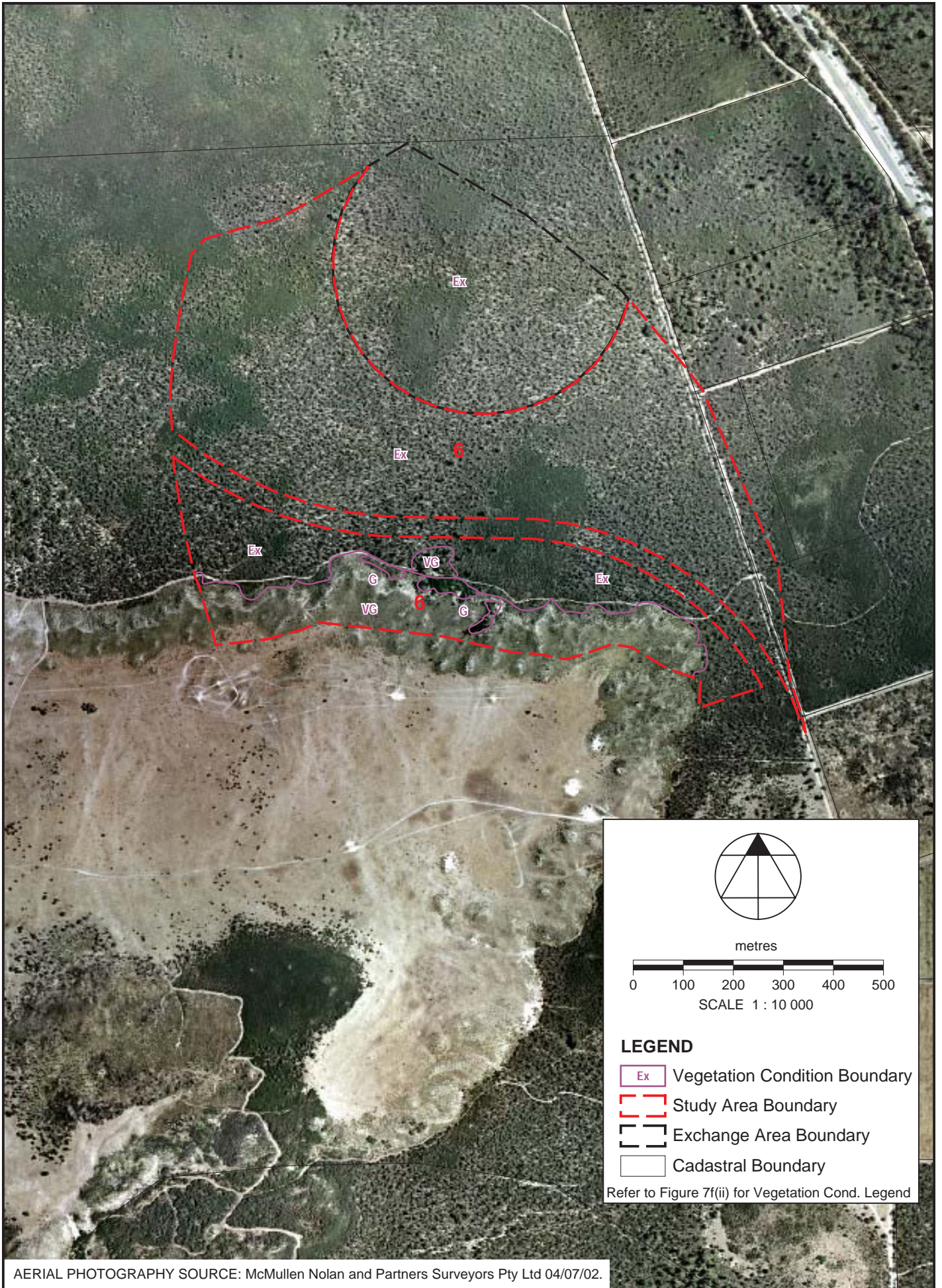
- BaBm Vegetation Type Boundary
- 2 Study Area Boundary
- [] Exchange Area Boundary
- [] Cadastral Boundary
- [] Population of Priority 3 Flora
Hibbertia spicata subsp. *leptotheca*
Stylidium maritimum

Refer to Figure 7f(i) for Vegetation Types Legend

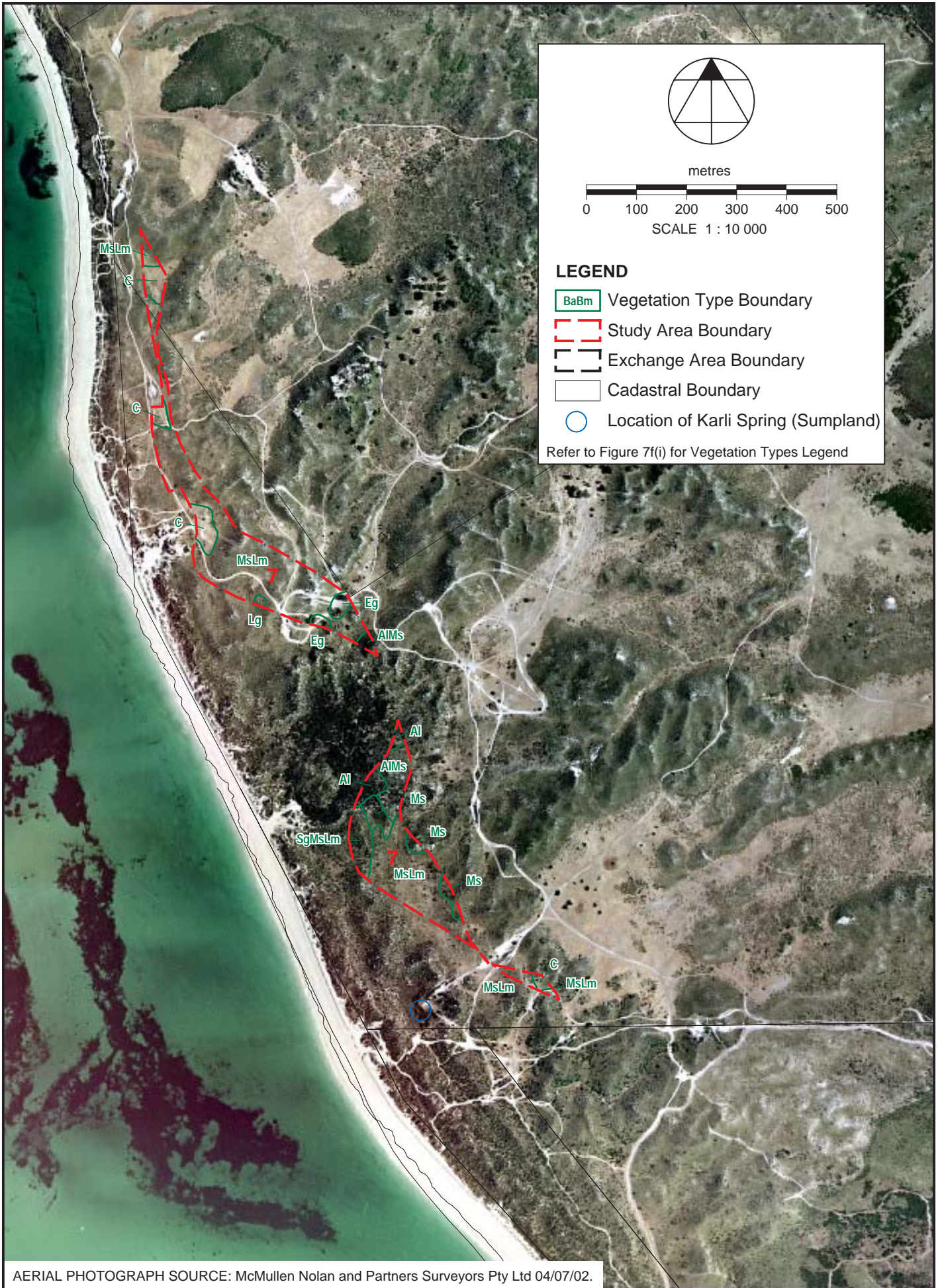
FIGURE 7b(i)

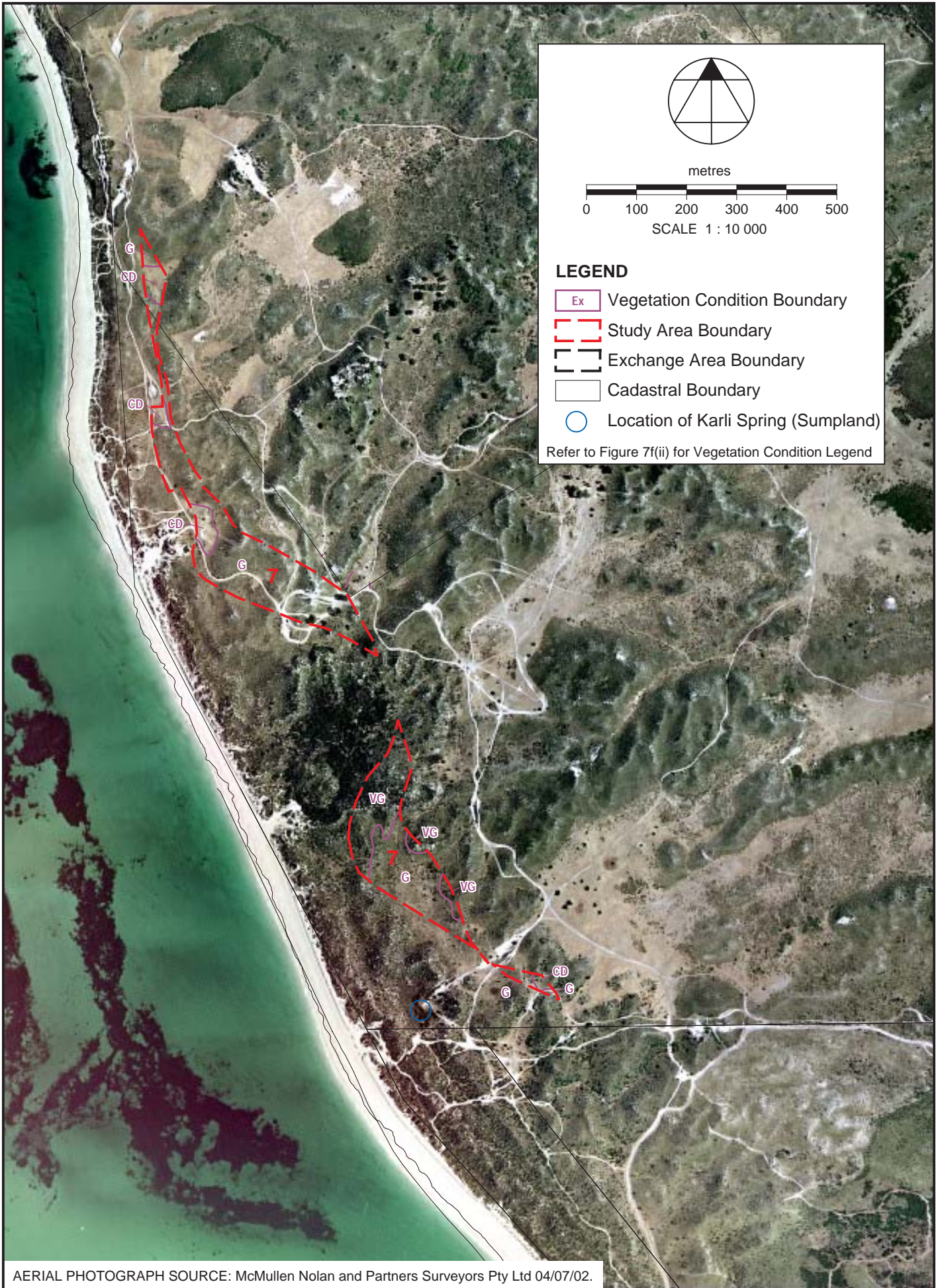


AERIAL PHOTOGRAPHY SOURCE: McMullen Nolan and Partners Surveyors Pty Ltd 04/07/02.

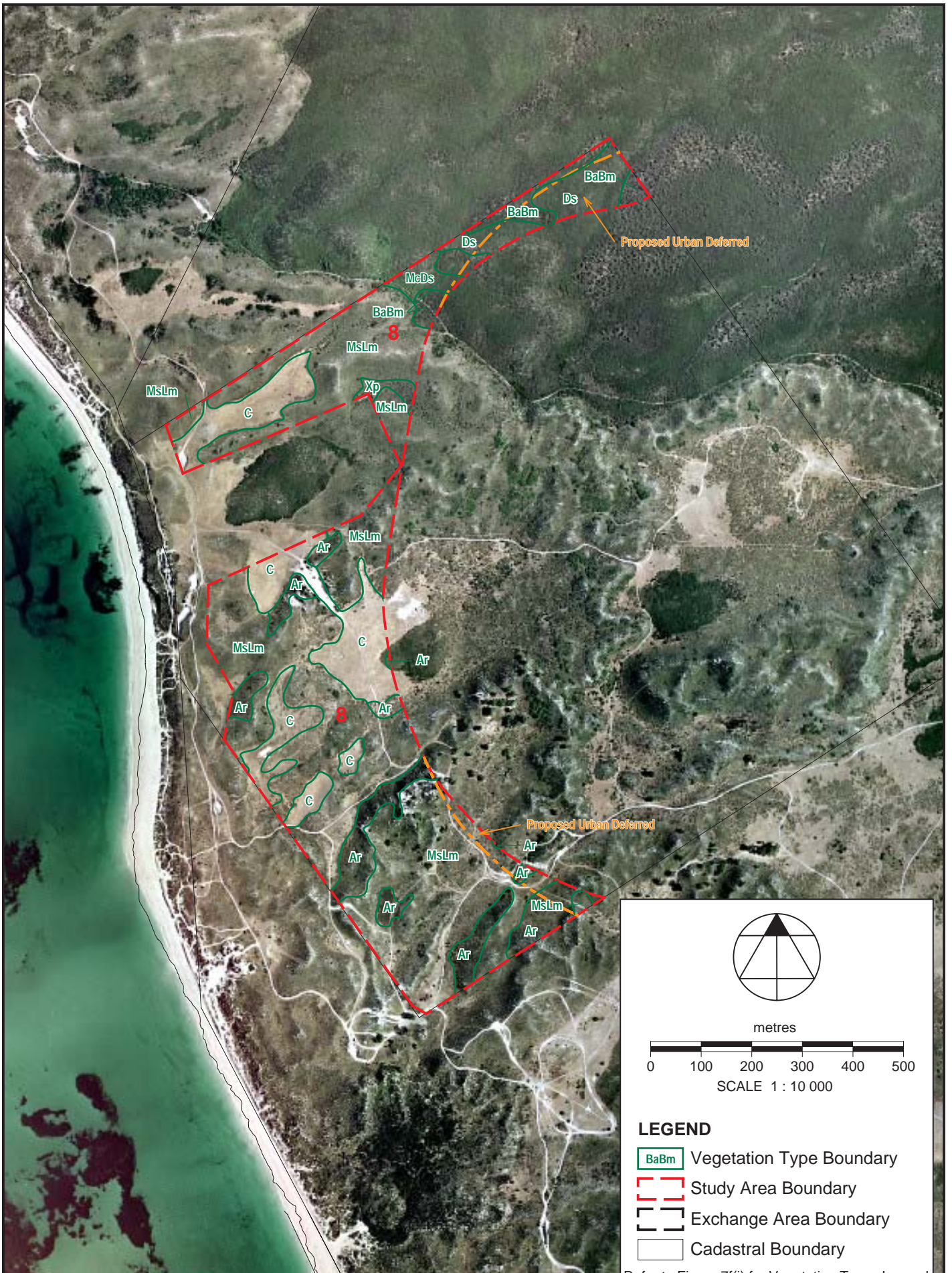


AERIAL PHOTOGRAPHY SOURCE: McMullen Nolan and Partners Surveyors Pty Ltd 04/07/02.

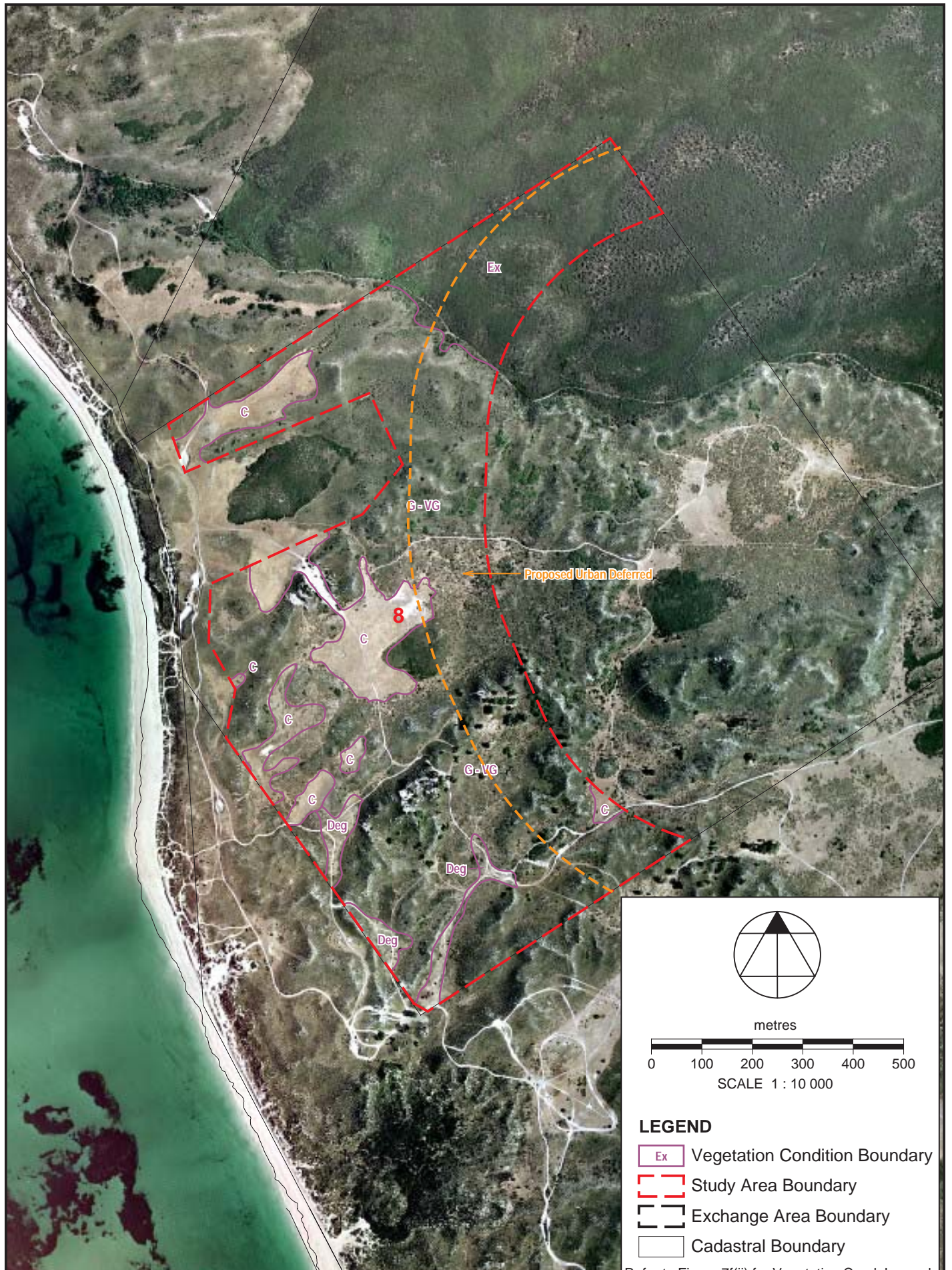




AERIAL PHOTOGRAPH SOURCE: McMullen Nolan and Partners Surveyors Pty Ltd 04/07/02.



AERIAL PHOTOGRAPHY SOURCE: McMullen Nolan and Partners Surveyors Pty Ltd, 4-7-02.



AERIAL PHOTOGRAPHY SOURCE: McMullen Nolan and Partners Surveyors Pty Ltd 04/07/02.

metres

0 100 200 300 400 500

SCALE 1 : 10 000

LEGEND

- Ex Vegetation Condition Boundary
- Study Area Boundary
- Exchange Area Boundary
- Cadastral Boundary

Refer to Figure 7f(ii) for Vegetation Cond. Legend

VEGETATION TYPES LEGEND

APPLICABLE TO FIGURES 7a(i) - 7f(i)

QUINDALUP DUNES

- S Vegetation of the Strand

- Vegetation of the Q4 Age Quindalup Dunes**
- ScAt *Scaevola crassifolia*, *Acacia truncata* Low Open Heath
- ScOa *Scaevola crassifolia*, *Olearia axillaris* Open to Closed Heath
- SnOa *Scaevola nitida*, *Olearia axillaris* Dense Low Heath
- MiSg *Myoporum insulare*, *Spyridium globulosum* Shrubland
- SgMsLm *Spyridium globulosum*, *Melaleuca systema*, *Lomandra maritima* Low Open Heath *
- Lm (Q4) *Lomandra maritima* Herbland with *Acacia truncata*, *Olearia axillaris* Low Heath
- Lg *Lepidosperma gladiatum* Sedgeland *

- Vegetation of the Q4 Age Stabilised Blowout**
- Sn *Scaevola nitida* Low Closed Heath to Closed Heath
- At *Acacia truncata*, *Acrotriche cordata*, *Melaleuca systema*, *Pimelea ferruginea* Low Open Shrubland to Low Shrubland
- Ap *Acanthocarpus preissii*, *Hemiandra pungens* Low Open Heath

- Vegetation of the Q1, Q2 and Q3 Age Quindalup Dunes**
- OaSn *Olearia axillaris*, *Scaevola nitida* Open Shrubland
- SnAt *Scaevola nitida*, *Acacia truncata* Closed Heath *
- Ar (Q) *Acacia rostellifera* Closed Scrub / Heath
- ArSg *Acacia rostellifera*, *Spyridium globulosum* Closed Scrub
- ArMs *Acacia rostellifera*, *Melaleuca systema* Low Open Heath
- Ms *Melaleuca systema* Low Shrubland to Shrubland
- MsLc *Melaleuca systema*, *Lysinema ciliatum* Low Closed Heath *
- MsLm *Melaleuca systema*, *Lomandra maritima* Low Open Heath *
- BpMsLm *Brachyloma preissii*, *Melaleuca systema*, *Lomandra maritima* Low Open Heath *
- AIMs *Allocasuarina lehmaniana*, *Melaleuca systema* Closed Heath *
- Al *Allocasuarina lehmaniana* Closed Heath *
- Lm (Q) *Lomandra maritima* Herbland
- Ac *Acacia cochlearis* Closed Heath *
- AcOaMs *Acacia cochlearis*, *Olearia axillaris*, *Melaleuca systema* Open Heath *
- AlSn *Acacia lasiocarpa*, *Scaevola nitida* Low Heath with *Lomandra maritima*
- Sa *Santalum acuminatum* Heath
- Ta *Trymalium albicans*, *Acacia lasiocarpa*, *Oxylobium reticulatum*, *Melaleuca systema* Low Open Heath
- Nf *Nuytsia floribunda* Low Woodland

SPEARWOOD DUNES

- Sand Surface of the Spearwood Dunes**
- BaBm *Banksia attenuata*, *B. menziesii* Low Woodland
- BaAfJs *Banksia attenuata*, *Allocasuarina fraseriana* Low Open Forest over *Jacksonia sternbergiana* High Shrubland

- EtBaBm *Eucalyptus tottiana*, *Banksia attenuata*, *B. menziesii* Low Open Woodland
- EmBAfJs *Eucalyptus marginata*, *Banksia attenuata*, *B. menziesii*, *Allocasuarina fraseriana* Low Woodland over *Jacksonia sternbergiana* High Shrubland *
- Ar (S) *Acacia rostellifera* Low Closed Forest
- Af *Allocasuarina fraseriana*, *Banksia* spp., *E. tottiana* Low Open Forest to Open forest
- Eg Tuart (*Eucalyptus gomphocephala*) Open Woodland to Woodland over *Banksia attenuata*, *Acacia saligna* and *Xanthorrhoea preissii*.
- ArBa *Acacia rostellifera* Low Closed Woodland includes a small admixture of *Banksia attenuata*, *Hardenbergia comptoniana* with a very open understorey.
- Lm (S) *Lomandra maritima* Low Heath

- Limestone Surface of the Spearwood Dunes**
- Ds *Dryandra sessilis* Open to Closed Heath
- DsHt *Dryandra sessilis*, *Hakea trifurcata* Open to Closed Heath *
- DsMh/At *Dryandra sessilis* with *Melaleuca huegelii* or *Acacia truncata* Closed Heath
- MhAt *Melaleuca huegelii*, *Acacia truncata*, *Trymalium albicans* Low Open Heath *
- MhAtMc *Melaleuca huegelii*, *Acacia truncata*, *Melaleuca cardiophylla* Low Open Heath to Low Closed Heath *
- MhTa *Melaleuca huegelii*, *Trymalium albicans*, *Brachyloma preissii* Low Open Heath *
- MhDs *Melaleuca huegelii*, *Dryandra sessilis* Open Heath to Heath
- MhMsAt *Melaleuca huegelii*, *Melaleuca systema*, *Acacia truncata* Low Open Heath *
- Ht *Hakea trifurcata* Open to Closed Heath
- HtDs *Hakea trifurcata*, *Dryandra sessilis* Open Heath to Closed Heath *
- Cq *Calothamnus quadrifidus* Open Heath to Closed Heath
- CqDs *Calothamnus quadrifidus*, *Dryandra sessilis* Open Heath to Closed Heath *
- Mc *Melaleuca cardiophylla* Closed Heath
- McDs *Melaleuca cardiophylla*, *Dryandra sessilis* Closed Heath
- McDsAt *Melaleuca cardiophylla*, *Dryandra sessilis*, *Acacia truncata* Low Closed Heath
- ArMc *Acacia rostellifera*, *Melaleuca cardiophylla* Closed Heath *
- AsJf *Acacia saligna* and *Jacksonia furcellata* Open Scrub
- SnAt *Scaevola nitida*, *Acacia truncata* Open to Closed Heath
- Xp *Xanthorrhoea preissii* Shrubland
- XpDsHt *Xanthorrhoea preissii*, *Dryandra sessilis*, *Hakea trifurcata* Closed Heath *
- XpHh *Xanthorrhoea preissii*, *Hibbertia hypericoides* Open Heath *

- C Cleared

Note: * indicates vegetation types not previously identified by Trudgen (1990)

PRINTED: Wed 17 Sep 03

CHECKED BY: SM 17-9-02

DRAWN BY: EDS/TE/GLM 17-9-02

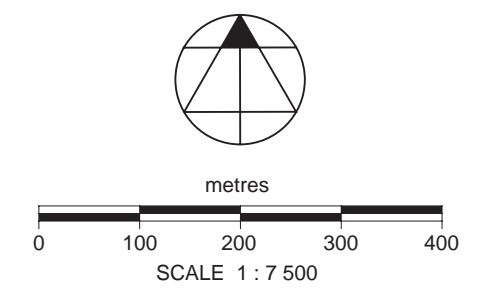
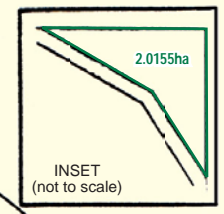
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


VEGETATION CONDITION RATING SCALE (Government of WA, 2002)

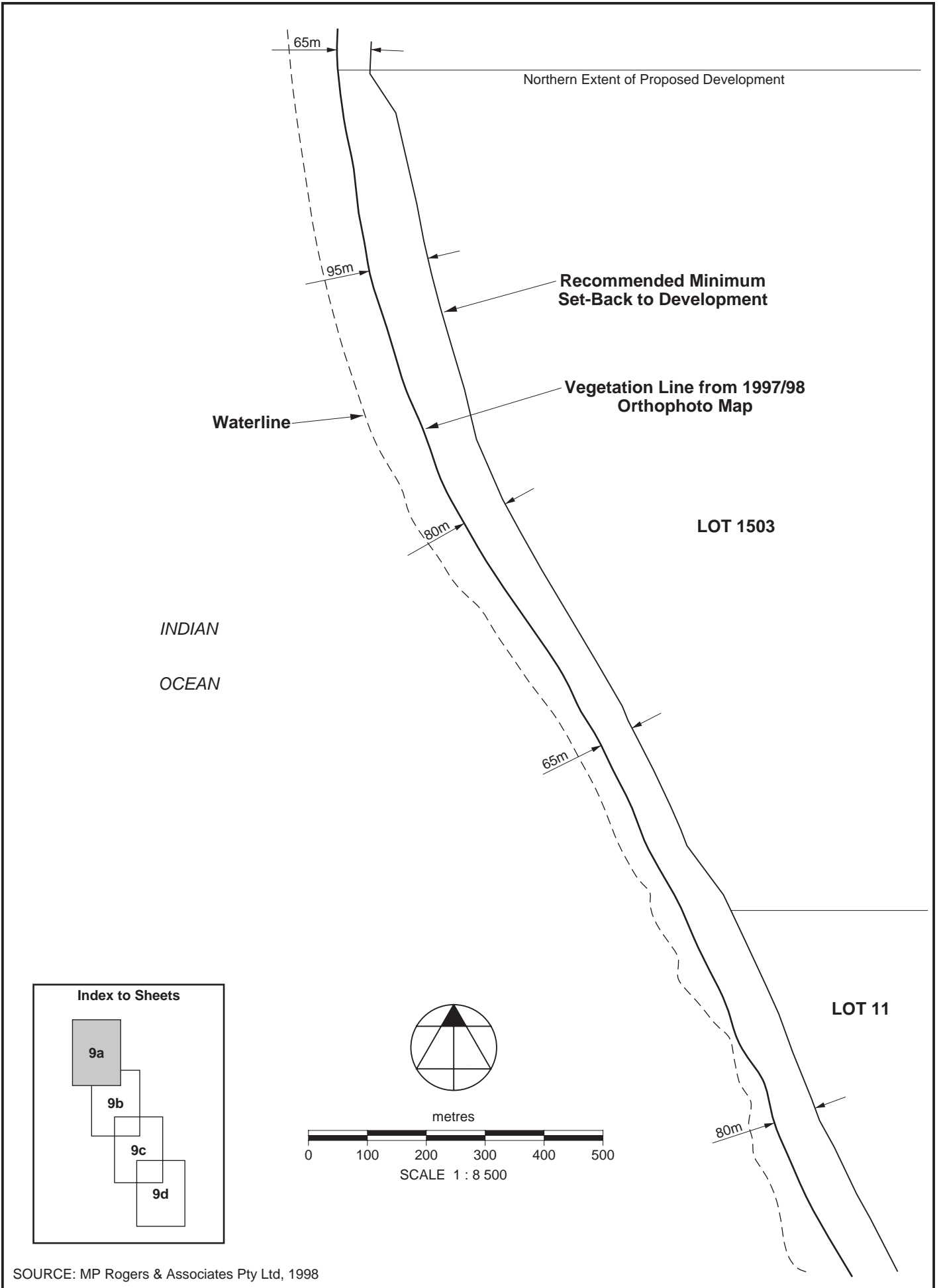
APPLICABLE TO FIGURES 7a(ii) - 7f(ii)

- P** **Pristine**
Pristine or nearly so, no obvious signs of disturbance.
- Ex** **Excellent**
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. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
- Deg** **Degraded**
Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
- CD** **Completely Degraded**
The structure of the vegetation is no longer intact and the area 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.
- C** **Cleared**
The area is totally devoid of native vegetation.

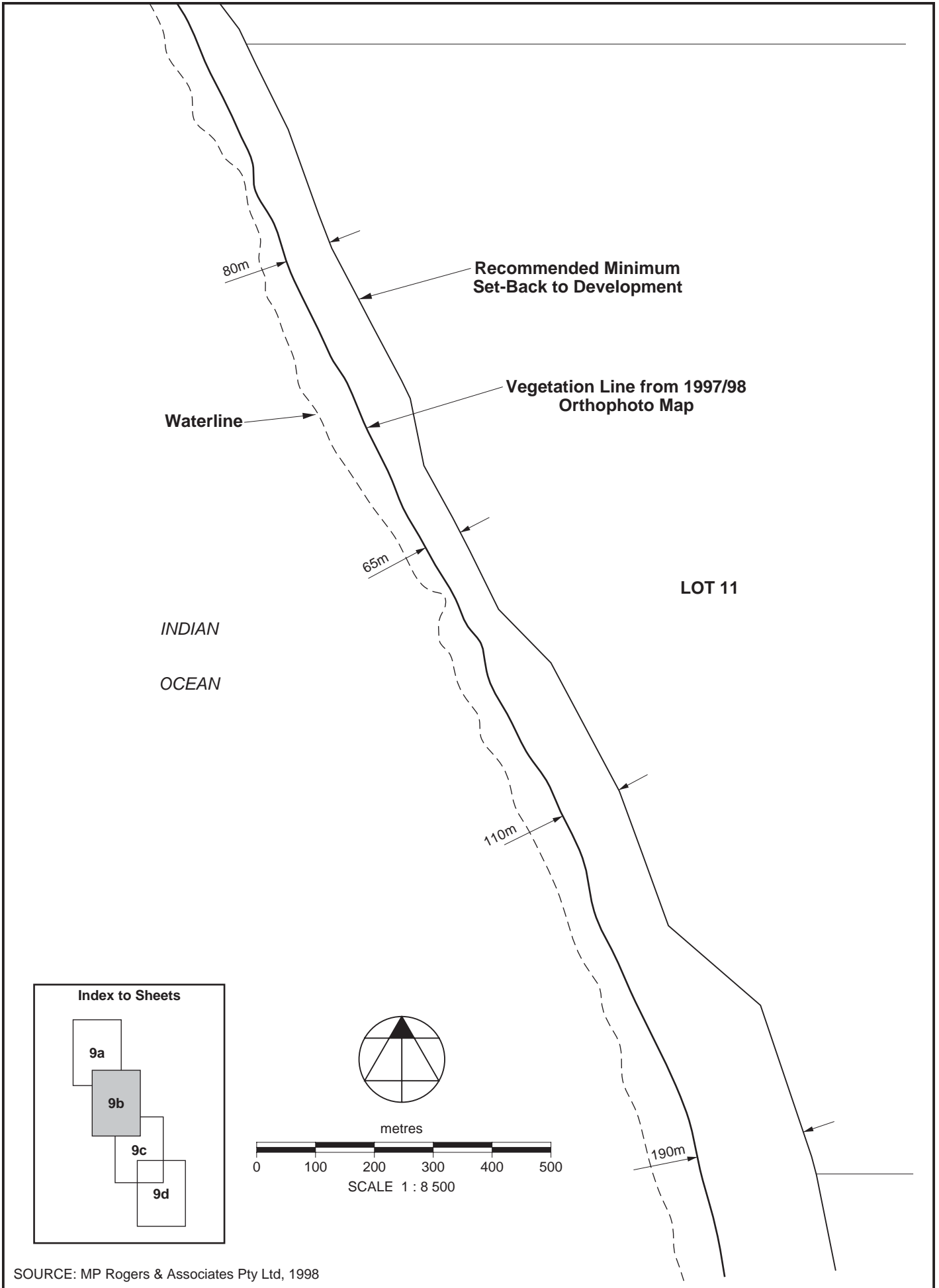


LEGEND

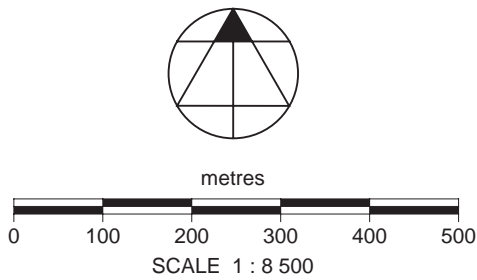
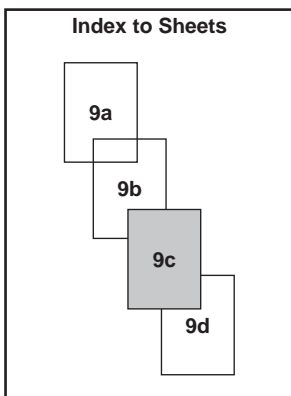
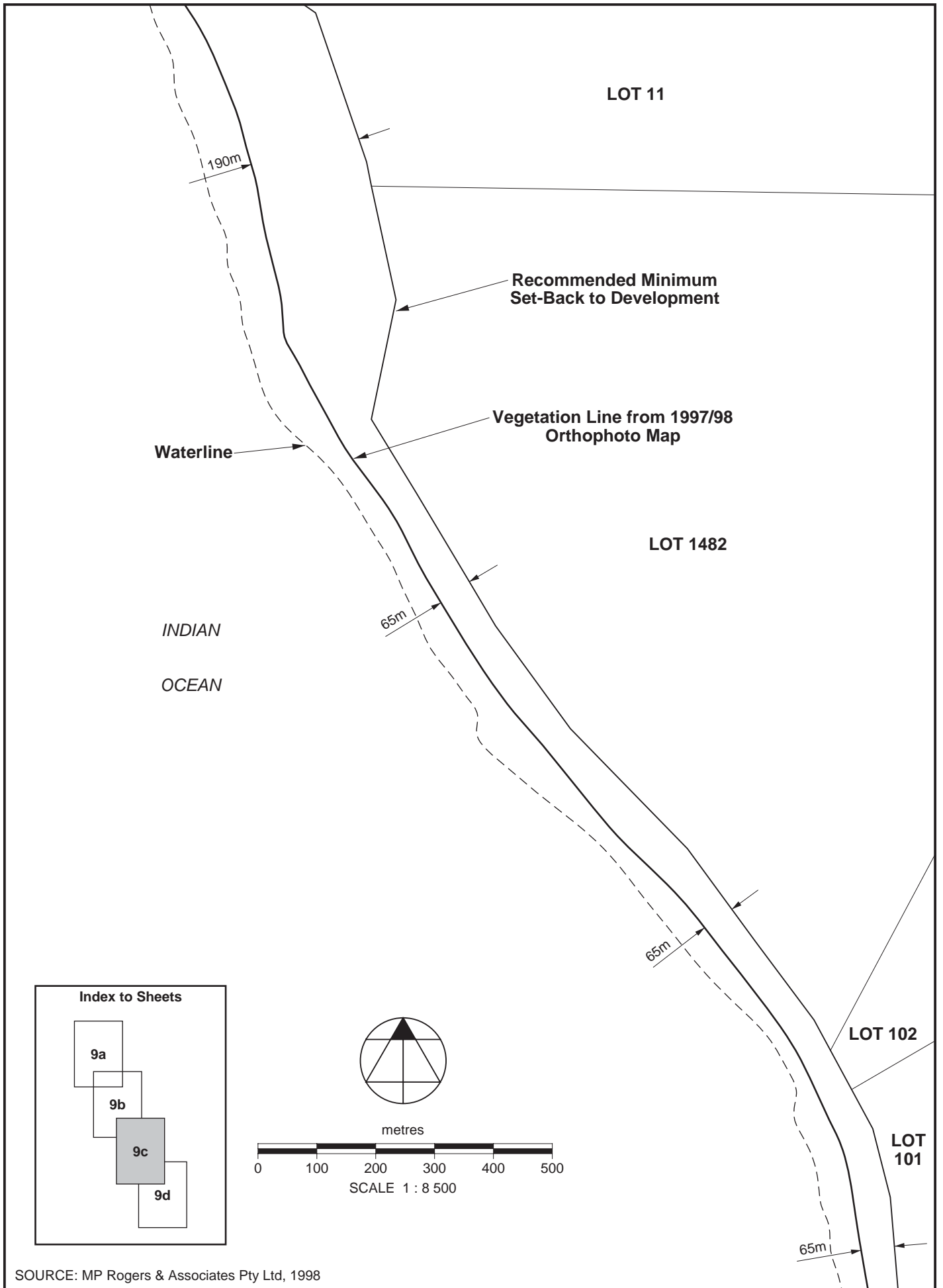
-  Ocean Dunes Pty Ltd Land to be Transferred to the Crown (33.8623ha)
-  Offshore Land Reclaimed by Ocean Dunes Pty Ltd to Remain in Crown Ownership (5.3928ha)
-  Existing Foreshore Reserve to Remain in Crown Ownership (2.0739ha)



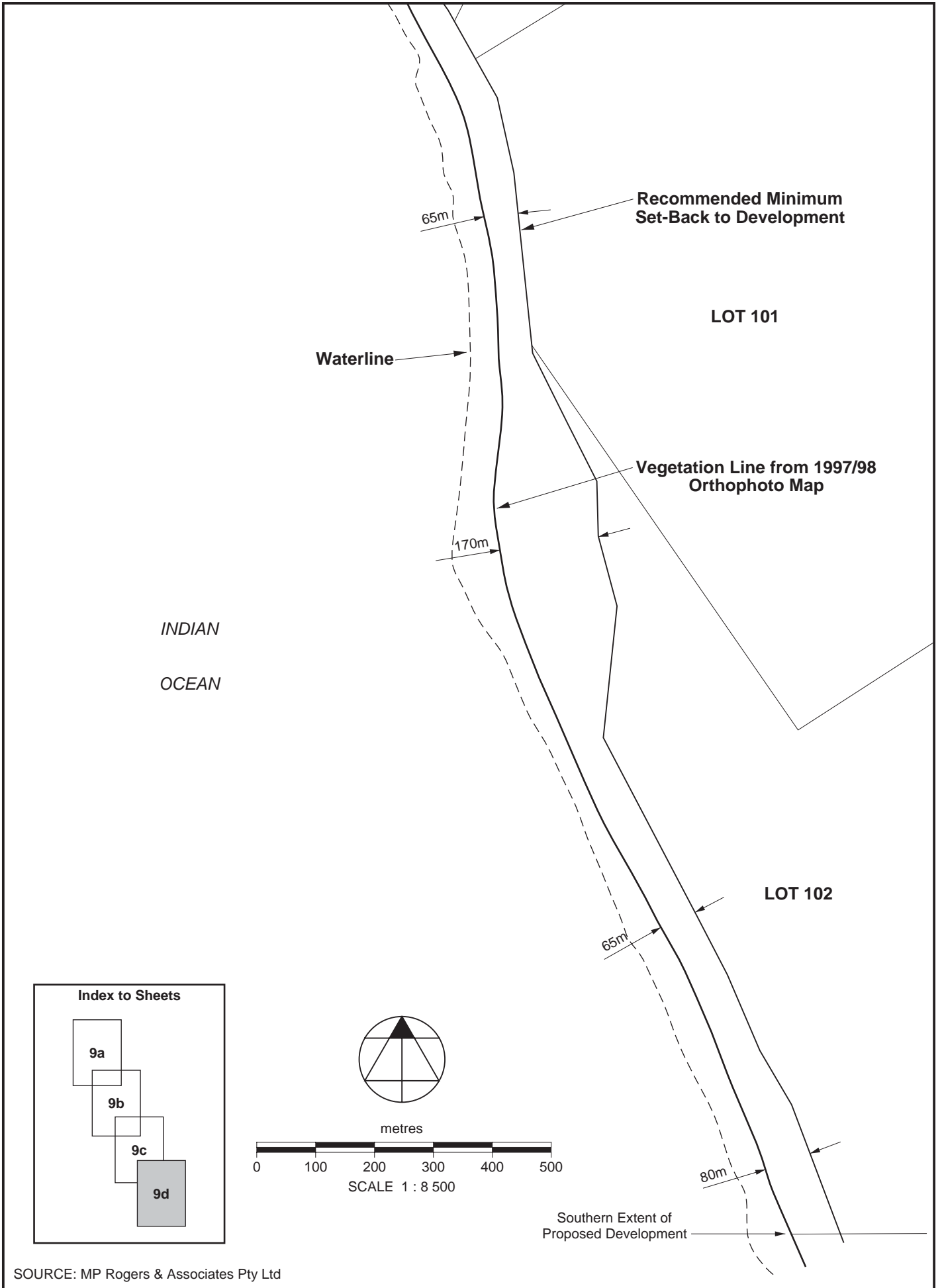
SOURCE: MP Rogers & Associates Pty Ltd, 1998



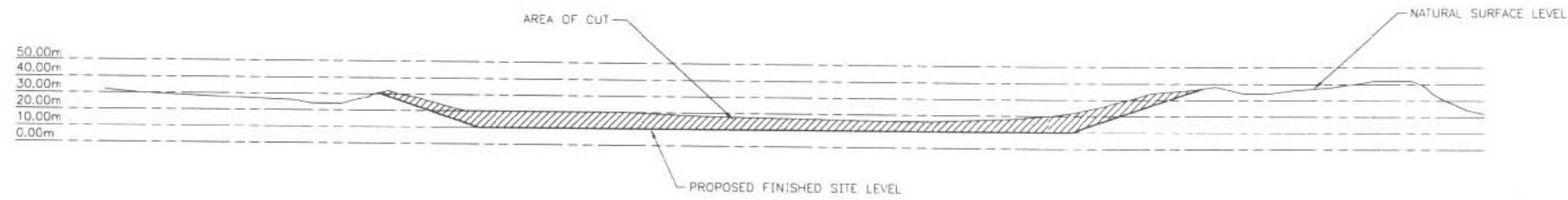
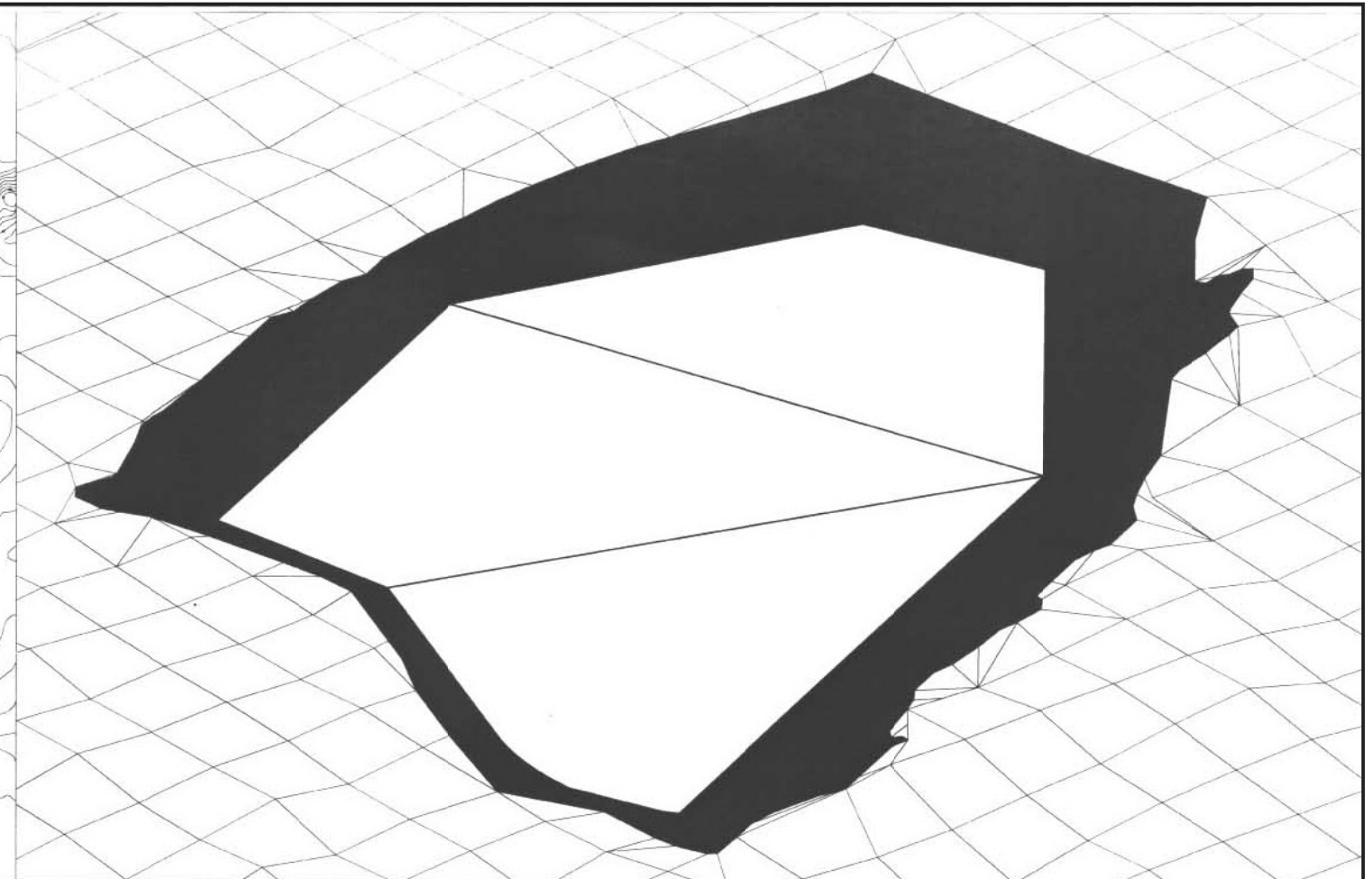
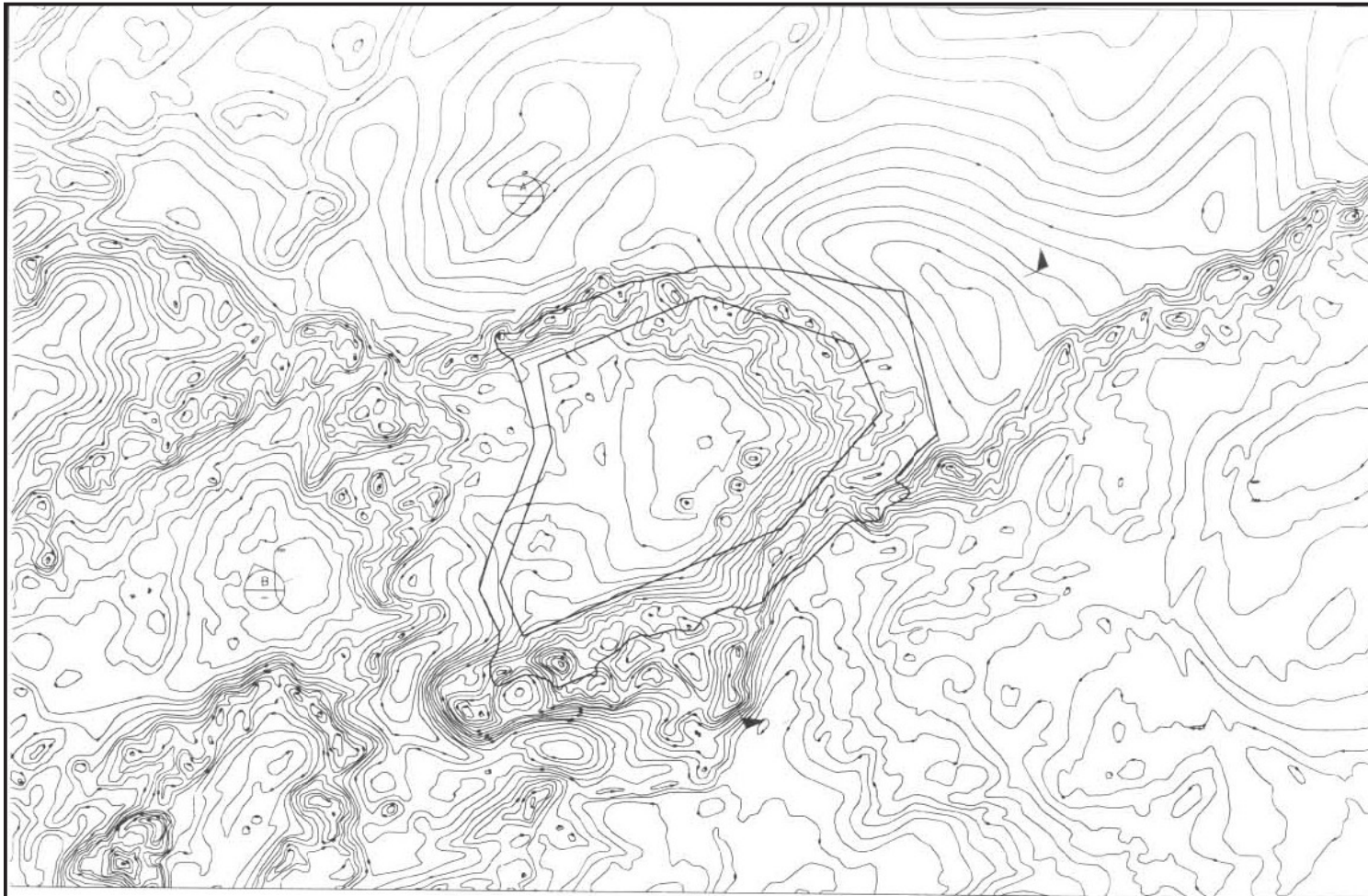
SOURCE: MP Rogers & Associates Pty Ltd, 1998



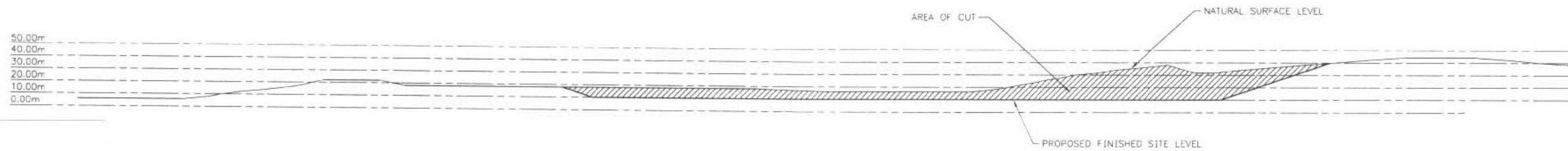
SOURCE: MP Rogers & Associates Pty Ltd, 1998



SOURCE: MP Rogers & Associates Pty Ltd



PRELIMINARY ONLY



ALKIMOS - EGLINTON
ENVIRONMENTAL REVIEW
**ALKIMOS WWTP SITE
CONTOURS AND SECTIONS**

FIGURE 10

APPENDICES

APPENDIX 1

ENVIRONMENTAL PROTECTION AUTHORITY ENVIRONMENTAL REVIEW INSTRUCTIONS

Please do not remove
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ENVIRONMENTAL ASSESSMENT OF
PLANNING SCHEMES AND THEIR
AMENDMENTS



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METROPOLITAN REGION SCHEME

AMENDMENT NO. 1029/33

ALKIMOS - EGLINTON

(ASSESSMENT NO.1365)

ENVIRONMENTAL REVIEW INSTRUCTIONS

Proposal Summary

Amendment No. 1029/33 to the Metropolitan Region Scheme (MRS) proposes a number of changes to zonings and reservations in the Alkimos – Eglinton region (refer to Attachment 1). These have been proposed following a review of development options for the region in which the principles of the Western Australian Planning Commission's *Liveable Neighbourhoods: Community Design Code* have been adopted. The Amendment area is located approximately 40 kilometres northwest of Perth, and the Alkimos - Eglinton site is approximately 2,660 hectares in size. This land was zoned to accommodate urban development in 1994. This proposed amendment modifies certain zones and reserves to change the location and areas of a number of major land uses. The formal assessment and Environmental Review relates to these changes. Essentially the key aspects of the proposed Amendment which these Environmental Review Instructions relate to are:

- Removal from the coast of the Public Purposes reservation (to accommodate the proposed Alkimos Wastewater and Groundwater Treatment Plants) and relocation to separate smaller sites (with the existing reservation for the ocean outfall site to be retained);
- Removal of Private Recreation and Urban deferred zonings, originally put in place around the Public Purposes (Wastewater and Groundwater Treatment Plants) site for buffer purposes;
- reservation for Parks and Recreation (P&R) (to establish a town park) of an area adjacent to the Alkimos Regional Centre including a portion of the dunal ridge and a portion of the buffer for the Groundwater Treatment Plant;
- rationalisation of the area of the northern P&R reservation;

- reduction of the coastal foreshore P&R reservations, particularly immediately west of the proposed Alkimos City Centre to provide better access to the prime regional beach and facilitate the establishment of a coastal village; and
- introduction of an area of P&R reservation at Alkimos North, adjacent to the proposed golf course development, to provide a better environmental and topographic boundary to the open space areas proposed as part of the 1991 environmental approval for the golf course.

These aspects of the Amendment raise a number of significant environmental issues as detailed below.

Regionally significant vegetation

- The proposed amendment will directly impact upon Bush Forever sites 397 (Coastal Strip from Wilbinga to Mindarie) and 289 (Ningana Bushland, Yanchep/Eglinton). Both sites consist of the Cottesloe Complex – Central and South and the Quindalup Complex, and include significant flora and fauna. These sites are indicated as “subject to further investigation” in Volume 1 of Bush Forever. Practice Note 14 in Appendix 3 of Bush Forever allows scope for amendments to Parks and Recreation Reserves to achieve wider conservation and planning outcomes.
- Potential impacts on Bush Forever Site 289 include a direct loss of Quindalup heath from the southern portion to accommodate urban development. In exchange, an inland area of banksia woodland abutting Bush Forever Site 289, and a coastal landform feature and Quindalup heath around an existing trig point on the coast are to be added.
- Potential impacts on Bush Forever Site 397 include a loss of a portion of Quindalup complex to allow for:
 - the development of a coastal village and a regional beach (approximately 10ha lost); and
 - the removal of the existing P&R reservation immediately north of the existing Wastewater Treatment Plant (WWTP) site and rezoning it to Urban.

In exchange proposed additions to the P&R reservations include:

- 20ha on the northern boundary of Lot M1482 adjacent to the coast; and
 - an area of banksia and tuart woodland immediately to the north of the Central City Area zone (approximately 66ha). A portion of this land will be in the buffer area to the Ground Water Treatment Plant (GWTP) (approximately 24ha). Currently the proposed northern suburbs rail line extension transects this area of proposed P&R. There is proposed to be an overall net gain in areal terms of 30 hectares of Parks and Recreation zoning.
- Specifically the clearing of portions of the Bush Forever sites for urban development could result in a loss of significant flora and fauna, vulnerable vegetation communities and habitat for fauna at the limit of their range. Potential impacts on remaining bushland and fauna from adjacent urban development could also result, with impacts specifically associated with weed invasion, rubbish dumping, increased fire risk and increased predation from domestic pets.

Coastal processes

- The site includes approximately 7.5km of coastline.
- The Amendment, however, will not impact upon all of this coastline but rather will reduce the existing coastal foreshore reservation in two places on Lot 102 by some 10 hectares. The reduction is to allow for the development of a coastal village and a regional beach. At the site of the coastal village the reduction is proposed to be to 115 metres from the line of permanent vegetation, down from 145 metres. At the proposed regional beach the reduction is expected to a width of 160 – 300m down from 300 – 400m. In exchange the coastal foreshore reservation is proposed to be increased on the northern boundary of Lot M1482 by approximately 20ha.
- The coastline is characterised by a 20 to 40m wide sandy beach in front of a primary dune of around 5 to 10m in height. The majority of the coastline does not include a foredune. However, the section which is proposed to be reduced does include a sizeable foredune suggesting some accretion in recent years.
- Limestone cliffs and outcrops are located approximately 500m north of the proposed coastal village extending for approximately 300m along the coast.
- Potential impacts on the existing coastal processes (associated with the foreshore reserve) as a result of the proposed reduction include a loss of regionally significant vegetation (as detailed above) and increased access to the coast contributing to increased erosion and instability of the shoreline and dunes, and increased off-shore sediment movement. Specific, potential impacts on the vegetation have been addressed above.

Buffer – noise, odour and risk

- The current Public Purposes reservation for the WWTP incorporates an odour buffer based on detailed odour modelling.
- The amendment proposes to relocate the WWTP site 600m to the east to a dune valley. In doing so the buffer area to be included in the proposed Public Purposes reservation is to be reduced to 300m from the inner plant boundary. The buffer will, however, extend to 450m on the eastern side of the plant so that it may be wholly contained within the dune valley to screen it from surrounding residential areas.
- The Water Corporation has advised that a more compact plant incorporating advanced technology treatment processes and odour control facilities including covering treatment units will enable the buffer area to be reduced.
- A proposed reduction in the buffer could result in future residents being exposed to unacceptable levels of odour, noise and risk. Therefore, the assessment will need to demonstrate that the advanced technology treatment processes and odour control facilities will achieve odour, noise and risk reduction targets so that impacts can be contained within the reduced buffer.
- The proposed GWTP requires a buffer to ensure that the public is not exposed to unacceptable risk associated with chlorine storage at the plant. Assessment of the buffer requirements and public safety measures to be implemented is required to ensure that risk meets acceptable standards.

1. Introduction

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. Amendment 1029/33 to the Metropolitan Region Scheme is being assessed because it raises significant environmental factors.

When a scheme amendment is subject to an assessment by the EPA the Responsible Authority (Western Australian Planning Commission) is required to prepare a report (referred to as an Environmental Review) addressing the environmental factors relevant to the amendment. The Environmental Review should be prepared in accordance with the Instructions issued by the EPA, which outline the scope and content of the Environmental Review and also describe how to prepare the Environmental Review. The Instructions for the preparation of the Environmental Review of the Amendment are included below in Section 2.

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 the environmental assessment of a scheme amendment is given in Attachment 2.

The scheme amendment that is the subject of this assessment is called Metropolitan Region Scheme Amendment No. 1029/33 Alkimos – Eglinton.

The amendment proposes to amend the Metropolitan Region Scheme to facilitate changes to the existing zoning in the Alkimos – Eglinton region to reflect the planning principles behind the Commission's *Liveable Neighbourhoods* Policy.

The Responsible Authority should advise all landowners that are included within the amendment area about the Environmental Review, if this has not already occurred.

A map showing the location of the proposed amendment is shown in Attachment 3.

2. Instructions

2.1 Status of the Instructions

While preparing the Instructions the EPA 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 Department of Environmental Protection (DEP) provides services and facilities to the EPA. In many cases the DEP 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 under Section 100(c) of the Environmental Protection Act.

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

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 not only in relation to the scheme amendment 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 (commonly referred to as deferred factors) describe how those factors will be considered during a later stage of the planning process (eg. subdivision and development conditions), 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;
 - prepare draft 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 4.

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 5 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. methods for advertising the availability of the Environmental Review.

2.3 Environmental factors relevant to this scheme amendment and deferred environmental factors

The EPA, following consideration of the factors related to the scheme amendment, 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 may also identify 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 the scheme amendment to the extent that the Responsible Authority should show how these factors could be addressed at a later level of planning (eg. subdivision or development). These factors are called "deferred environmental factors".

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". This list may include "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 6.

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

The amendment proposes to amend the Metropolitan Region Scheme to facilitate the development of the land for various purposes including residential, public purposes, parks and recreation, regional roads and town centre development.

2.5 Environmental factors relevant to the scheme

The EPA has identified environmental factors which are relevant to the scheme area and should be addressed in the Environmental Review document in the manner specified in Table 1 below. The EPA considers that these factors are relevant to this amendment and should be assessed in order to identify the environmental concerns related to this area at the earliest possible stage in the statutory planning process.

It should be noted that the key environmental factors are vegetation communities, coastal processes, odour and risk (associated with proposed buffers for the WWTP and the GWTP). The Amendment proposes rezoning portions of existing P&R reservations in the Alkimos – Eglinton region to urban. These areas have been identified in "Bush Forever" (Government of WA, 2000) as having regional conservation significance. Other areas are proposed for inclusion in the Parks and Recreation reservation: a key issue is their compensatory environmental values. These rezonings also involve reductions in the existing coastal foreshore reserve in two locations. Impacts on dune stability and beach profiles are, therefore, possible.

The Amendment also proposes to establish buffers for the proposed WWTP and GWTP. Higher levels of technology and an enclosed building are proposed to reduce the impacts of

odour and risk (associated with chlorine storage) on future residents within the near vicinity of the plants. These proposals will need to demonstrate that the impacts can be mitigated.

The EPA has, therefore, recognised that the potential impacts of the Amendment could adversely affect:

- the regional representation of coastal vegetation communities on the Swan Coastal Plain through a direct loss of vegetation from clearing for urban development;
- coastal processes including beach profiles and dune stability through encroachment into an active area of coastal accretion and erosion; and
- the amenity and safety of future residents near the WWTP and the GWTP through exposure to odour and risk (associated with chlorine storage).

The EPA considers that these impacts need to be investigated and conditions developed to go into the scheme to manage these impacts.

Table 1: Environmental factors relevant to the amendment

CONTENT		EPA Objective	SCOPE OF WORK
Factors	Site specific factor		Matters to be addressed in the Environmental Review in addition to generic requirements
BIOPHYSICAL			
Terrestrial Flora	Vegetation and flora	Maintain the abundance, species diversity and geographic distribution of vegetation and flora	<p>Undertake a detailed vegetation and flora survey of those areas within the Amendment proposed for rezoning from "Parks and Recreation" to "Urban", "Private Recreation" to "Urban", "Urban" to "Parks and Recreation", "Central City Area" to "Parks and Recreation" and "Public Purposes" to "Urban".</p> <p>Surveys shall be undertaken by appropriately trained and experienced persons under appropriate seasonal conditions to identify the diversity, distribution, and condition of the existing vegetation and flora which may be directly or indirectly impacted by zoning changes.</p> <p>Map and describe the vegetation and relate these mapped units to soil/landform types.</p> <p>Describe the area of each vegetation complex and floristic community type to be cleared.</p> <p>Undertake the assessment at a level that allows the Selection Criteria and the specific criteria for coastal reserves outlined in Bush Forever Volume 2 (Government of WA 2000) to be addressed in detail. The survey should address all relevant regional datasets outlined in Bush Forever, detail the site-specific vegetation and flora attributes and take into consideration the EPA's current Position Statement on "General Requirements for Terrestrial Biological Surveys for EIA in WA".</p> <p>Demonstrate how the proposed additions and deletions to the proposed and existing Parks and Recreation Reserve contribute to the conservation regionally (i.e. of Bush Forever sites in the same geomorphic units on the Swan Coastal Plain north of the Swan River) of vegetation communities and flora. This consideration should refer to all relevant regional studies listed in Bush Forever (eg Griffin 1993 and Griffin and Trudgen 1994) and should address the likely uses within the proposed Parks and Recreation reservations i.e. Recreation (district playing fields, picnic areas) and bushland conservation.</p> <p>Measures to ensure the protection of areas of bushland within the Parks and Recreation reservations from impacts associated with urban development and associated activities should be identified and documented.</p>

ENVIRONMENTAL PROTECTION AUTHORITY

	Declared Rare, Priority Flora and other significant flora	Protect Declared Rare and Priority Flora consistent with the provisions of the Wildlife Conservation Act 1950.	<p>Investigate those areas within the Amendment proposed for rezoning from "Parks and Recreation" to "Urban", "Private Recreation" to "Urban", "Urban" to "Parks and Recreation", "Central City Area" to "Parks and Recreation" and "Public Purposes" to "Urban" for the presence of Declared Rare and Priority Flora which may be directly or indirectly impacted on by these zoning changes.. Supplement this site investigation with a survey of CALM's database.</p> <p>Identify other species of significance that may be impacted by the proposal and discuss the reason for their conservation significance. These species may include undescribed taxa; new records for the region; species or taxa that are endemic to the region or at the limit of their range; or species confined to specific sites of limited occurrence in the region.</p> <p>Retain voucher specimens for all significant species and lodge them with the WA Herbarium.</p> <p>Flora survey work should be undertaken during the flowering season (late winter/spring).</p> <p>If there is a presence, identify how the population will be affected by implementation of the Amendment. Where necessary specify proposed scheme provisions and management strategies for protection.</p>
Terrestrial Fauna	Terrestrial Fauna	Maintain the abundance, species diversity, geographic distribution of terrestrial fauna.	<p>Undertake a detailed terrestrial fauna survey of those areas within the Amendment proposed for rezoning from "Parks and Recreation" to "Urban", "Private Recreation" to "Urban", "Urban" to "Parks and Recreation", "Central City Area" to "Parks and Recreation" and "Public Purposes" to "Urban".</p> <p>The survey should assess the presence and distribution of terrestrial fauna species and relate this to the distributions in other conservation areas in the region.</p> <p>Identify and document potential impacts on terrestrial fauna and detail management measures to ensure their protection.</p>
	Specially Protected Threatened Fauna	Protect Specially Protected (Threatened) Fauna, consistent with the provisions of the Wildlife Conservation Act 1950	<p>Investigate those areas within the Amendment proposed for rezoning from "Parks and Recreation" to "Urban", "Private Recreation" to "Urban", "Urban" to "Parks and Recreation", "Central City Area" to "Parks and Recreation" and "Public Purposes" to "Urban" for the presence of Specially Protected (Threatened) Fauna. Supplement this site investigation with an assessment of distribution and habitat preferences of specially protected (Threatened) Fauna from relevant literature sources such as the WA Museum databases and CALM threatened fauna database.</p> <p>If there is a presence, or likely to be a presence identify how the population will be affected by implementation of the Amendment. Where</p>

ENVIRONMENTAL PROTECTION AUTHORITY

			necessary specify proposed scheme provisions and strategies for protection.
Coast	Dunes	Maintain the integrity, function and environmental values of the dune system	Assess the environmental values of the dunal systems to be impacted upon by the proposed reduction in the existing coastal foreshore reserve on Lot 102. Identify and document the potential impacts on these values which could arise from development within the coastal foreshore reserve.
	Foreshore (beach)	Maintain the stability of the beaches, and the integrity, function and environmental values of the foreshore area.	Assess the environmental values of the foreshore areas (beaches) on Lot 102 that are proposed for development. Assess the beach stability and coastal processes, including meteorological and oceanographic conditions, of these foreshore areas. Identify and document potential impacts on these processes from proposed development. Determine minimum coastal setbacks based on an appropriate consideration of extreme storm events, historical erosion trends, sea level change and safety issues. Identify and document management measures to ensure maintenance of beach stability and the ongoing protection of the environmental values.

POLLUTION

Factors	Site specific factor	EPA Objective	Matters to be addressed in the Environmental Review in addition to generic requirements
Air	Odour	Odours emanating from the proposed Wastewater Treatment Plant and Groundwater Treatment Plant should not adversely affect the welfare and amenity of other land users.	Describe and assess the potential off-site odour impacts associated with the operation of the proposed Wastewater Treatment Plant and Groundwater Treatment Plant taking into consideration the EPA's current draft Guidance Statement on the "Assessment of Odour Impacts". Based on the results of the assessment determine an appropriate separation distance between the proposed Wastewater Treatment Plant and proposed residential or other sensitive development. Identify appropriate management measures to ensure that odour impacts are contained within an appropriate buffer.
Non-chemical emissions	Risk	Ensure that public risk associated with the operation of the Wastewater Treatment Plant and the storage of chlorine at the proposed Groundwater Treatment Plant is managed to meet the	Describe how the proposed Wastewater Treatment Plant and Groundwater Treatment Plant will be designed and managed to ensure that the surrounding residential areas are not adversely affected by risk. Consider the EPA's Final Guidance Statement No. 2 "Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant" (EPA, 2000) in this assessment.

ENVIRONMENTAL PROTECTION AUTHORITY

		EPA's criteria for individual fatality risk off-site and the DME's requirements in respect of public safety.	
	Noise	Protect the amenity of nearby residents from noise impacts resulting from activities associated with the Wastewater Treatment Plant by ensuring that noise levels meet statutory requirements and acceptable standards	Demonstrate that noise associated with the operation of the Wastewater Treatment Plant will meet statutory levels at nearby future residential areas.

2.6 Deferred environmental factors

No deferred factors have been identified at this stage. In this context it should be noted that the EPA's assessment of this amendment does not include the construction of the proposed Groundwater Treatment Plant, Wastewater Treatment Plant and associated ocean outfall site.

APPENDIX 2a

**‘A REPORT ON THE FLORA AND
VEGETATION OF THE ALKIMOS
AREA AND CONSERVATION
ISSUES AFFECTING IT’
(TRUDGEN AND KEIGHERY, 1990)**

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APPENDIX 2b

**‘A REPORT ON THE FLORA AND
VEGETATION OF THE NINGANA
AREA AND CONSERVATION
ISSUES AFFECTING IT’
(TRUDGEN AND KEIGHERY, 1990)**

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APPENDIX 2c

**‘VEGETATION CONDITION AND CONSERVATION
VALUES LOTS 8 AND 11 EGLINTON’
(ARMSTRONG, 1996)**

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APPENDIX 3

**FLORA LIST
ALKIMOS-EGLINTON**

APPENDIX 3
ALKIMOS-EGLINTON FLORA LIST

As recorded by:

^A Trudgen and Keighery (1990) A Report on the Flora and Vegetation of the Alkimos Area and Conservation Issues Affecting It. Prepared for LandCorp

^B Trudgen and Keighery (1990) A Report on the Flora and Vegetation of the Ningana Area and Conservation Issues Affecting It. Prepared for LandCorp

SPECIES	ALKIMOS ^A	NINGANA ^B
<i>GYMNOPHYTA</i>		
ZAMIACEAE		
Macrozamia fraseri	x	x
<i>ANGIOSPERMAE</i>		
MONOCOTYLEDONS		
POACEAE		
*Agropyron racemosum	x	x
*Aira cupaniana	x	x
Amphipogon turbinatus	x	x
*Avena barbata	x	x
*Briza maxima	x	x
*Briza minor	x	x
*Bromus diandrus	x	x
*Catapodium rigidum	x	x
Danthonia acerosa	x	x
Danthonia caespitosa	x	x
Danthonia occidentalis	x	x
*Ehrharta calycina	x	x
*Ehrharta longiflora	x	x
Microlaena stipoides		x
Poa drummondiana	x	x
Poa porphyrociadus	x	x
Spinifex hirsutus	x	x
Spinifex longifolius	x	x
Stipa compressa	x	x
Stipa flavescens	x	x
CYPERACEAE		
Baumea juncea		x
Carex preissii		x
Isolepis cernua	x	x
Isolepis nodosa	x	x
Lepidosperma costale	x	
Lepidosperma gladiatum	x	x
Lepidosperma squamatum	x	
Lepidosperma scabrum	x	
Schoenus clandestinius	x	
Mesomelaena pseudostygia	x	x
Schoenus curviflorus	x	
Schoenus grandiflorus	x	x
Schoenus subbartus	x	x

RESTIONACEAE		
<i>Alexgeorgia nitens</i>	x	
<i>Hypoleana exsulca</i>	x	
<i>Loxocarya flexuosa</i>	x	x
<i>Lyginia barbata</i>	x	
CENTROLEPIDACEAE		
<i>Centrolepis drummondii</i>		x
DASYPOGONACEAE		
<i>Acanthorcarpus preissi</i>	x	x
<i>Lomandra casepitosa</i>	x	
<i>Lomandra maritima</i>	x	x
<i>Lomandra suaveolens</i>	x	
XANTHORRHOEACEAE		
<i>Xanthorrhoea preissii</i>	x	x
PHORMIACEAE		
<i>Dianella divaricata</i>	x	x
ANTHERICAEAE		
<i>Corynotheca micrantha</i>	x	x
<i>Laxmania sessiflora</i> ssp. <i>australis</i>	x	
<i>Sowerbasa laxiflora</i>	x	
<i>Thysanotus arenarius</i>	x	x
<i>Thysanotus patersonii</i>	x	x
<i>Thysanotus triandrus</i>	x	x
<i>Tricaryne elatior</i>	x	x
ASHPHODELACEAE		
* <i>Trachyandra divaricata</i>	x	x
COLCHICACEAE		
<i>Burchardia umbellata</i>	x	x
HAEMODORACEAE		
<i>Anigozanthos humilis</i>	x	
<i>Anigozanthos manglesii</i>	x	x
<i>Conostylis aculeata</i> ssp. <i>aculeata</i>	x	x
<i>Conostylis candicans</i> ssp. <i>calicola</i>	x	x
<i>Conostylis pauciflora</i> ssp. <i>euryhipis</i>	x	x
<i>Conostylis teretifolia</i> ssp. <i>planescens</i>	x	
<i>Haemodorum laxum</i>	x	
<i>Haemodorum spicatum</i>	x	
<i>Haemodorum panicutaum</i>	x	x
IRIDACEAE		
* <i>Gladiolus caryophyllaceus</i>	x	x
<i>Orthrosanthos laxus</i>	x	
* <i>Romulea rosea</i>	x	x
ORCHIDACEAE		
<i>Microtis unifolia</i>	x	x

DICOTYLEDONS		
URTICACEAE		
<i>Parietaria debilis</i>	x	x
CASUARINACEAE		
<i>Allocasuarina fraseriana</i>	x	x
<i>Allocasuarina humilis</i>	x	x
PROTEACEAE		
<i>Adenanthos cygnorum</i>		x
<i>Banksia attenuata</i>	x	x
<i>Banksia grandis</i>	x	x
<i>Banksia menziesii</i>	x	x
<i>Conospermum triplinervium</i>	x	x
<i>Dryandra lindleyana</i>	x	x
<i>Dryandra sessilis</i>	x	x
<i>Grevillea vestita</i>	x	x
<i>Hakea costata</i>	x	x
<i>Hakea lissocarpha</i>	x	x
<i>Hakea prostrata</i>	x	x
<i>Hakea ruscifolia</i>	x	x
<i>Hakea trifurcata</i>	x	x
<i>Persoonia comata</i>	x	x
<i>Petrophile brevifolia</i>	x	
<i>Petrophile linearis</i>	x	
<i>Petrophile macrostachya</i>	x	x
<i>Petrophile serruriae</i>	x	x
<i>Stirlingia latifolia</i>	x	
SANTALACEAE		
<i>Exocarpos sparteus</i>	x	x
<i>Leptomeria preissiana</i>		x
<i>Leptomeria spinosa</i>		x
LORANTHACEAE		
<i>Nuytsuia floribunda</i>	x	x
CHENOPODIACEAE		
<i>Rhagodia baccata</i>	x	x
AMARANTHACEAE		
<i>Ptilotus polystachyus</i>	x	
<i>Ptilotus stirlingii</i>	x	x
AIZOACEAE		
* <i>Carpobrotus edulis</i>	x	x
<i>Carpobrotus virescens</i>	x	x
* <i>Tetragonia decumbens</i>	x	x
<i>Tetragonia tetragoniodes</i>		x
<i>Threkeidia diffus</i>	x	
PORTULACAEAE		
<i>Calandrinia liniflora</i>	x	x
CARYOPHYLLACEAE		

*Petrohagia valuzina	x	x
RANUNCULACEAE		
Clematis microphylla	x	x
LAURACEAE		
Cassytha flava	x	x
Cassytha glabaris		x
Cassytha comiformis		x
Cassytha racemosa	x	x
ERASSIACEAE		
*Cakile maritima	x	x
*Heliophila pusilla	x	x
*Lepidium bonariense		x
DROSERACEAE		
Drosera pallida	x	
CRASSULACEAE		
Crassula glomerata	x	x
Crassula exserta	x	x
*Crassula dlomerata	x	x
PITTOSPORACEAE		
Pronaya fraseri		x
MIMOSACEAE		
Acacia cochlearis	x	x
Acacia cyclops	x	x
Acacia huegelii	x	
Acacia lasiocarpa var lasiocarpa	x	x
Accacia pulchella var glaberrima	x	x
Acacia rostellifera	x	x
Acacia saligna	x	x
Acacia truncata	x	x
Acacia rostellifera x saligna	x	
PAPILIONACEAE		
Bossiaea eriocarpa	x	x
Daviesia divaricata		x
Gompholobium tomentosum	x	x
Hardenbergia comptoniana	x	x
Hovea trisperma	x	x
Isotropis cuneifolia	x	
Jacksonia furcellata	x	x
Jacksonia sternbergiana	x	x
Jacksonia stricta	x	x
Kennedia prostrata	x	x
*Medicago polymorpha	x	x
*Melilotis indica	x	x
Oxyiobium reticulatum	x	x
Sphaerolobium ?medium	x	x
Templetonia retusa	x	x
*Trifolium campestre	x	x

GERANIACEAE		
Geranium molle		x
Geranium solanderi	x	x
*Pelargonium capitatum	x	x
Pelargonium littorale	x	
POLYGALACEAE		
Comesperma calymega	x	
Comesperma integerrimum	x	x
Comesperma volubile	x	
EUPHORBIACEAE		
Adriana quadripartita	x	x
*Euphorbia terracina		x
Phyllanthus calycinus	x	x
Ricinocarpos glaucus	x	
STACKHOUSIACEAE		
Stackhousia huegelii	x	x
SAPINDACEAE		
Dodonea aptera	x	
Diplopeltis huegelii		x
MALVACEAE		
Alyogyne huegelii (?var glabrescens)		x
RHAMNACEAE		
Cryptandra mutila		x
Cryptandra ?pungens	x	
Spyridium globulosum	x	x
Spyridium tridentatum	x	x
Trymalium aibicans	x	x
STERCULIACEAE		
Thomasia cognata	x	x
Thomasia triphylla	x	
DILLENIACEAE		
Hibbertia hypericoides	x	x
Hibbertia racemosa	x	x
Hibbertia spicata	x	
VIOLACEAE		
Hybanthus calycinus	x	
THYMELACEAE		
Pimelea calciocola	x	
Pimelea ferruginea	x	x
MYRTACEAE		
Calothamnus quadrifidus	x	x
Calytrix angulata	x	
Eremaea pauciflora	x	

Eucalyptus decipiens	x	
Eucalyptus gomphocephala	x	x
Eucalyptus marginata	x	x
Eucalyptus todtiana	x	
Leptospermum spinescens	x	x
Melaleuca acerosa	x	x
Melaleuca cardiophylla	x	x
Melaleuca huegelii	x	x
Melaleuca trichophylla	x	
APIACEAE		
Daucus glochidiatus	x	x
Eringium pinnatifidum		x
Homalosciadum homalocarpum	x	x
Trachymene pilosa	x	x
Xanthosia huegelii	x	
EPACRIDACEAE		
Acrotriche cordata	x	x
Astroloma pallidum	x	x
Conostephium pendulum	x	
Leucopogon insularis	x	
Leucopogon parviflorus	x	x
Leucopogon polymorphus	x	x
Leucopogon aff polymorphus	x	x
Leucopogon propinquus	x	x
Lysinema ciliatum		x
PRIMULACEAE		
*Anagallis arvensis	x	x
GENTIANACEAE		
*Centaurium erythraea	x	x
LAMIACEAE		
Hemiandra pungens	x	x
SOLANACEAE		
Anthocercis littorea	x	x
*Solanum nigrum	x	x
*Solanum sodomaeum	x	x
SCROPHULARIACEAE		
*Dischisma arenarium	x	x
Veronica aff. calycina	x	
OROBANCHACEAE		
*Orobanche minor		x
MYOPORACEAE		
Eremophila glabra		x
Myoporum insulare	x	x
RUBIACEAE		
Opercularia vaginata	x	x

CUCURBITACEAE		
*Cucurbita pepo		x
CAMANULACEAE		
*Wahlenbergia capensis	x	
LOBELIACEAE		
Lobelia heterophylla		x
Lobelia tenuoir	x	x
Istoma hypcorateriformis	x	x
GOODENIACEAE		
Lechenaultia linarioides	x	x
Scaevola canescens	x	x
Scaevola crassifolia	x	x
Scaevola holosericea		x
Scaevola paludosa	x	
Scaevola nitida	x	x
Scaevola thesioides	x	x
Verreauxia rainwardtii	x	
STYLIDIACEAE		
Levenhookia stipitata	x	x
Stylidium brunonianum	x	x
Stylidium calcaratum	x	x
Stylidium junceum	x	x
Stylidium piliferum	x	
Stylidium repens	x	
Stylidium sp (S. maritima M.S.)	x	x
ASTERACEAE		
Gnaphalium sphaericum	x	x
Helichrysum cordatum	x	x
*Hypochoeris giabra	x	x
Lagenifera hugelii	x	
Leptorhyncuos scabrus	x	x
Millotia tenuifolia	x	x
Olearia axillaris	x	x
Olearia rudis	x	x
Podolepis canescens	x	
Podolepis gracilis	x	x
Podotheca angustifolia	x	x
Podotheca gnaphalioides	x	x
Quinetia urvillei	x	x
Senecio lautus	x	x
Siloxerus humifusus	x	x
*Urospermum picroides		x
*Ursinia enthemoides	x	x
Waitzia suaevoleons	x	x

APPENDIX 4

BUSH FOREVER SITE INFORMATION RELEVANT TO ALKIMOS-EGLINTON

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APPENDIX 5

SELECTION CRITERIA FOR THE IDENTIFICATION OF REGIONALLY SIGNIFICANT BUSHLAND AND APPLICATION TO THE ALKIMOS-EGLINTON STUDY AREA

APPENDIX 5

Selection Criteria for the Identification of Regionally Significant Bushland and Application to the Alkimos-Eglinton Study Area

CRITERIA	EXISTING MRS	PROPOSED AMENDMENT
Representation of Ecological Communities A number of areas selected to represent the range of ecological communities and the place in which these communities merge.		
Inclusion Guidelines:		
<ul style="list-style-type: none"> ▪ Areas which are good examples of each floristic community type, selected to be representative of the vegetation of a geomorphic unit. 	The Alkimos-Eglinton study area comprises the following Floristic Community Types: 24 Northern Spearwood Shrublands and Woodlands 26a <i>Melaleuca huegelii</i> – <i>M. acerosa</i> Shrublands of limestone ridges 28 Spearwood <i>Banksia attenuata</i> or <i>Banksia attenuata</i> – <i>Eucalyptus</i> Woodlands 29a Coastal Shrublands on shallow sands 29b <i>Acacia</i> Shrublands on taller dunes S11 Northern <i>Acacia rostellifera</i> – <i>Melaleuca acerosa</i> Shrublands S13 Northern <i>Olearia axillaris</i> – <i>Scaevola crassifolia</i> Shrublands S14 <i>Spinifex longifolius</i> Grasslands and Low Shrublands The ROS reservations under the existing MRS retain all of the FCTs listed above, with the exception of FCT S11 which is found in only one location in the Alkimos-Eglinton study area.	The reservation of bushland under the proposed MRS will retain all representative FCTs found in the Alkimos-Eglinton area, with the exception of FCT S11. The proposed MRS includes areas of bushland in excellent condition, not previously proposed for reservation under the MRS. The ER identifies commitments to be implemented at local structure planning stage to ensure that the unreserved FCT 26a; the poorly reserved FTCs 29a and 29b as well as FCT S11 are protected within local open space.
<ul style="list-style-type: none"> ▪ Areas contributing to at least 10% or 400ha of each vegetation complex, whichever is the larger, in at least five separate areas. 	The existing MRS proposes to retain approximately 121ha of the Quindalup Vegetation Complex and 112ha of the Cottesloe-Central and South Vegetation Complex.	The MRS Amendment will result in a slight increase in the reservation status of the Cottesloe - Central and South (an additional 19.4ha) and the Quindalup Vegetation (an additional 5.9ha) Complexes within the Perth Metropolitan Region. Based on the proposed additions, the Amendment will satisfy the criteria of protecting a minimum of 10% or 400ha in the Perth Metropolitan Area. In addition, there would be a significant gain in high quality vegetation (approximately 40.3ha) and associated biodiversity in this geographic location.
<ul style="list-style-type: none"> ▪ Best available examples of each natural wetland group and wetland types within each group, where the wetland has a direct relationship with bushland of regional significance. 	The Amendment area includes Karli Spring, a small wetland located in the southwest corner of the site within 200m of the coast. The spring contains permanent water and experiences only minor water level fluctuations. Karli Spring is not identified as a wetland in the 'Wetlands of the Swan Coastal Plain' (Hill <i>et al.</i> , 1996), however according to the Water Resource MP (Woodward Clyde, 1996), it can be classified as a Conservation Category wetland in accordance with the criteria outlined in EPA Bulletin 686. In the current MRS the foreshore reserve is up to 385m wide to incorporate Karli Spring.	Under the proposed MRS, the foreshore reserve has been reduced in the vicinity of Karli Spring in light of the relocation of the Waste Water Treatment Plant. The new foreshore reservation line varies between 440m at the southernmost boundary to tie in with the foreshore reservation to the south, and to provide an adequate buffer for Karli Spring, to approximately 130m for most of the length (with a minimum width of 100m).
<ul style="list-style-type: none"> ▪ Areas identified as being of national or international significance through treaty / convention / policy. 	Not Applicable	Not Applicable

CRITERIA	EXISTING MRS	PROPOSED AMENDMENT
Diversity Areas with a high diversity of flora and /or fauna species or communities in close association.		
Inclusion Guidelines:		
<ul style="list-style-type: none"> ▪ Areas with high flora diversity at the community, species or genetic level. 	<p>A total of 210 native flora species was recorded from the Alkimos-Eglinton study area by Trudgen and Keighery (1990a and b). The flora recorded from the area is relatively typical of the flora of the south-west of WA and is comparable to that of other surveys undertaken in coastal and near coastal areas on the Swan Coastal Plain (Trudgen and Keighery, 1990a and b). Variations in flora at the family and species level in coastal areas in the south-west region is largely due to the gradual change in climate, particularly the decrease in rainfall.</p> <p>The greatest floristic diversity was recorded in the Banksia Woodlands.</p>	<p>The proposed Amendment will increase the reservation of the most floristically diverse vegetation type (Banksia Woodland) from 15.4ha to 63.1ha.</p>
<ul style="list-style-type: none"> ▪ Areas with a high diversity of plant associations, assemblages or communities relative to the area. 	<p>All vegetation types occur within the existing ROS reservation at Eglinton. The ROS reservation at Alkimos provides for the protection of only two of the five vegetation types found in the area.</p>	<p>The proposed MRS Amendment provides for the protection of all vegetation types at Eglinton. The proposed ROS at Alkimos includes three vegetation types within the reservation.</p>
<ul style="list-style-type: none"> ▪ Areas with a high diversity of faunal assemblages 	<p>Studies of the distribution of vertebrate fauna according to major habitat types in the Alkimos-Eglinton area, indicates that in order to maximise biodiversity, it will be necessary to protect representative samples of the vegetation in the area. It was determined that the Quindalup Dune Heath (especially the <i>Calothamnus quadrifidus</i> heathland) and the Banksia Woodland should be reserved where ever possible as these provide the best fauna habitats in terms of both species numbers and populations.</p>	<p>The proposed MRS maximises the diversity of fauna assemblages by protecting an increased area of the Quindalup Dune heath and the Banksia Woodland.</p>
Rarity Areas containing rare or threatened communities or species, or species of restricted distribution.		
Inclusion Guidelines:		
<ul style="list-style-type: none"> ▪ Threatened Ecological Communities 	<p>The existing MRS does not contain any Floristic Community Types (FCT) currently listed as Threatened Ecological Communities (TECs).</p> <p>The Alkimos-Eglinton area does support two FCTs, 29a and 29b, recommended for listing as TECs. These occur as small populations within the existing MRS.</p>	<p>As per the existing MRS, the proposed MRS does not contain any TECs. However, the Amendment does allow for increased protection of FCT 29a and 29b by increasing the area of the Quindalup and Cottesloe Complexes in which these FCTs occur.</p>

CRITERIA	EXISTING MRS	PROPOSED AMENDMENT
<p>Rarity Areas containing rare or threatened communities or species, or species of restricted distribution.</p> <ul style="list-style-type: none"> Habitat or rare, uncommon or restricted flora and / or fauna species and / or species outside or at the limit of their normal range. 	<p>Flora Two Priority 3 species were identified in the Alkimos-Eglinton study area by Trudgen and Keighery (1990), including:</p> <ul style="list-style-type: none"> <i>Conostylis pauciflora</i> ssp. <i>euryhipis</i> <i>Stylidium maritimum</i>. <p>In the Alkimos-Eglinton area, populations of <i>Conostylis pauciflora</i> ssp. <i>euryhipis</i> are restricted to the Quindalup Dunes. This species was recorded from five locations at Alkimos-Eglinton in vegetation in good to excellent condition. Therefore under the current MRS, this species is potentially protected in 121ha of ROS.</p> <p>Three populations of <i>Stylidium maritimum</i>. were recorded in the Amendment. This species generally occurs in the <i>Xanthorrhoea preissii</i> Shrublands where the Spearwood System abuts the Quindalup Dunes (Q1 age), particularly where this interface is in a swale.</p> <p>Fauna Two Schedule species of vertebrate fauna the, Short-billed Black-Cockatoo (<i>Calyptorhynchus latirostris</i>) (Schedule 1) and the Peregrine Falcon (<i>Falco peregrinus</i>) (Schedule 4), were observed in the Alkimos-Eglinton area during the 1996 survey.</p> <p>The Short-billed Black Cockatoo was observed in the Banksia woodland whilst the Peregrine Falcon was recorded outside the study area in the Tuart woodland surrounding Pipidinny Swamp. Both of these species have been recorded in surrounding areas including Wilbinga and Yanchep National Park, or are expected to occur in areas of suitable habitat.</p> <p>The existing MRS proposes to protect these species by reserving 7.6ha of Banksia Woodland and 1.2ha of Tuart Woodland as part of the Regional Open Space.</p> <p>Two species of Priority Fauna were also recorded in the Alkimos-Eglinton study area including the Keeled Legless Lizard (<i>Pletholax gracilis</i>) (Priority 2) and the Western Slender Blue Tongue (<i>Cyclodomorphus brachialis</i>) (Priority 4). Both of these species were recorded in the Old Quindalup Heath which is well conserved under the existing MRS with 92ha protected in the Eglinton ROS and 10.7ha at Alkimos.</p>	<p>Flora The MRS Amendment will retain a greater area of the Quindalup and Cottesloe Complex in better quality condition and thereby providing for the protection of the Priority 3 species <i>Conostylis pauciflora</i> ssp. <i>euryhipis</i> and <i>Stylidium maritimum</i>.</p> <p>Fauna The proposed MRS Amendment proposes to substantially increase the protection of habitat important to the Short-Billed Black Cockatoo and the Peregrine Falcon. The Amended MRS will result in the reservation of 63ha of Banksia Woodland and the reservation of all the Tuart Woodland (1.2ha) occurring in the Alkimos-Eglinton study area.</p> <p>The proposed MRS Amendment also provides for the protection of Old Quindalup Heath which is important to the Priority listed species the Keeled Legless Lizard and the Western Slender Blue Tongue. Although the Amendment will reduce the habitat of these species at Eglinton by up to 14ha, the Amendment will increase its reservation at Alkimos by 19.5ha. Therefore increasing the overall reservation of Old Quindalup Heath by 6ha.</p>
<ul style="list-style-type: none"> Areas supporting rare, uncommon or restricted communities and /or communities outside of or at the limit of their normal range. 	<p>The Alkimos-Eglinton study area does not support any vegetation types or communities that are restricted to it or at the limit of their normal range.</p>	

CRITERIA	EXISTING MRS	PROPOSED AMENDMENT
<p>Maintaining Ecological Process or Natural Systems Maintenance of ecological processes or natural systems at a regional or national scale.</p>		
Inclusion Guidelines:		
<ul style="list-style-type: none"> ▪ Large areas in natural condition with natural process intact or largely so. 	The existing MRS retains 32.5ha of bushland in excellent condition, 191ha of bushland in good condition.	The proposed MRS Amendment will result in the reservation of a greater area of bushland in excellent (73ha) condition. To allow for this reservation the area of good quality vegetation to be reserved is slightly reduced to 180ha.
<ul style="list-style-type: none"> ▪ Fauna habitats providing specific requirements for feeding/breeding /nursery functions. 		
<ul style="list-style-type: none"> ▪ Substantial wildlife corridors connecting bushland areas. 	The existing and proposed MRS provide for the connection of the Yanchep National Park to the coast and thereby conserving a continuous sequence of the Quindalup and Spearwood dune system for fauna movement.	The connection between the National Park and the coast is improved in the proposed MRS which increases the width of the ROS area and consequently reduces the impacts resulting from edge effects.
<ul style="list-style-type: none"> ▪ Habitat for significant populations of migratory birds. 	Not applicable	Not applicable
<p>Scientific or Evolutionary Importance Areas containing evidence of evolutionary processes either as fossilised material or as relict species and areas containing unusual or important geomorphological or geological sites. Areas of recognised scientific and education interest as reference sites or as examples of the important environmental processes at work.</p>		
Inclusion Guidelines:		
<ul style="list-style-type: none"> ▪ Areas with remains of flora and fauna now extinct (fossil sites) 	Not relevant to the Amendment Area.	
<ul style="list-style-type: none"> ▪ Areas with primitive or relict flora and fauna surviving for earlier times. 		
<ul style="list-style-type: none"> ▪ Areas with fossil or other records of past climates or environs. 		
<ul style="list-style-type: none"> ▪ Long-term scientific / educational monitoring sites or study areas 		

General Criteria for the Protection of Wetland, Streamline, and Estuarine Fringing Vegetation and Coastal Vegetation

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

CRITERIA	EXISTING MRS	PROPOSED AMENDMENT
<p>Inclusion Guidelines:</p> <ul style="list-style-type: none"> ▪ CC wetlands assoc. with regionally significant bushland, their fringing vegetation and associated upland vegetation. 	<p>The existing MRS provides for the protection of Karli Spring, a Conservation Category wetland, in the coastal foreshore reserve.</p>	<p>The proposed MRS provides for the protection of Karli Spring, a Conservation Category wetland, in the coastal foreshore reserve.</p>
<ul style="list-style-type: none"> ▪ Coastal vegetation within the accepted coastal management zone. 	<p>A specific assessment of the coastline between Alkimos and Eglinton was made in 1993 prior to the adoption of the present Metropolitan Region Scheme (MRS) for the area. The 1993 Foreshore Reserve line was designed without detailed background information on long-term coastal processes, knowledge of areas of sub-surface limestone and with the significant constraints of the wastewater treatment plant at Lot 101. The width of the current reserve varies but generally has a setback in excess of 100m from the high water mark (HWM), increasing to 300-400m south of the Water Corporation site (Lot 101) to accommodate Karli Spring and representative Quindalup Dunes.</p> <p>The existing ROS reservation at Eglinton (Bush Forever Site 289), and to a lesser extent the foreshore ROS (Bush Forever Site 397), meet the criteria for coastal reserves including:</p> <ul style="list-style-type: none"> ▪ Quindalup dune types (mostly Q2 or Q3 in age (BF289); Q4 limited in BF289, dominant in BF397) ▪ Continuing natural processes – Quindalup dunes extending 3.9km inland and encompassing 196ha of bushland (110 in ROS, 86ha in foreshore reserve) in BF289; encompassing 302ha of Quindalup Vegetation Complex in Foreshore Reserve and extending not more than 800m inland (BF397). ▪ Shoreline – soft sandy (BF289); soft and rocky areas (BF397). ▪ Linkage – comprises Quindalup / Spearwood interface (minimum width of corridor 600m) (BF289); part of semi-continuous N-S linkage (BF397). ▪ Vegetation – typical Quindalup / Spearwood units (BF289). ▪ Habitats – provides habitat for approx. 30 birds, 1 mammal, 8 reptiles, and 2 significant bird species (BF289). 	<p>The ROS Reserve adjacent to the coast has not been altered for most of study area in the Amended MRS. It has, however, been reduced in the southern sector of Alkimos from the proposed Alkimos coastal node to the southern boundary of the Amendment Area. The concept of coastal nodes has been developed for the Amendment Area to allow for additional residential developments in close proximity to the two regional beaches. The siting of coastal village adjacent to the regional beach is considered to be a critical planning objective in the Amended MRS which offers substantial advantages without significantly compromising the values of the coastal reserve overall. An important component of the siting of the nodes has been the relocation of the Alkimos WWTP further to the east to mitigate any potential impacts associated with the buffer requirements of this facility.</p> <p>The ROS reservation under the proposed MRS at Eglinton, and to a lesser extent the foreshore reserve extending along the coast at Alkimos-Eglinton, meet the criteria for coastal reserves including:</p> <ul style="list-style-type: none"> ▪ Quindalup dune types (mostly Q2 or Q3 in age (at Eglinton); Q4 limited at Eglinton, dominant in coastal reserve) ▪ Continuing natural processes – Quindalup dunes extending 3.9km inland and encompassing 187ha of bushland (101 in ROS, 86ha in foreshore reserve) at Eglinton; foreshore reserve width has been maintained along the coast with the exception of the southern coastal node at Alkimos where it has been reduced to allow for the siting of a regional coastal node. ▪ Shoreline – soft sandy at Eglinton; soft and rocky areas along foreshore reserve. ▪ Linkage – comprises Quindalup / Spearwood interface (at Eglinton); part of semi-continuous N-S linkage (foreshore reserve).

		<ul style="list-style-type: none"> ▪ Vegetation – typical Quindalup / Spearwood units (at Eglinton). ▪ Habitats – provides habitat for approx. 30 birds, 1 mammal, 8 reptiles, and 2 significant bird species (BF289). <p>In addition, the foreshore reserve at Alkimos provides for the protection of Karli Spring, an Aboriginal site and only wetland known to occur on the Quindalup dunes north of Perth in the PMR.</p>
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Criteria not relevant to determining Regional Significance, but which may be applied when evaluating areas having similar values.

Attributes which taken alone do not establish regional significance, but which can add to the value of bushland and enhance its contribution to Bush Forever.

CRITERIA	EXISTING MRS	PROPOSED AMENDMENT
Inclusion Guidelines:		
<ul style="list-style-type: none"> ▪ The area is a regional recreation resource. 		
<ul style="list-style-type: none"> ▪ The area is of historical significance or contains significant sites (post-European settlement) 	Not Applicable	Not applicable
<ul style="list-style-type: none"> ▪ The area contains a site or sites of significance for Aboriginal people. 	One site of particular interest to Aboriginal people is Karli Spring. The existing MRS retains this site within the Foreshore Reserve	As per the existing MRS.
<ul style="list-style-type: none"> ▪ The area has social value to a community group. 	Not at present	The MRS Amendment proposes to retain native bushland in an urban setting. In particular, a large area of bushland is proposed to be retained adjacent to the Alkimos City Centre, which will
<ul style="list-style-type: none"> ▪ The area has aesthetic value as a notable landscape feature or viewpoint. 		

APPENDIX 6

RELEVE DATA AMENDMENT AREA 5 (FCT 26A)

APPENDIX 6
RELEVE DATA COLLECTED FROM AMENDMENT AREA 5

ATA Environmental conducted a vegetation survey of the proposed MRS Amendments on 5 July 2002. In particular, releve information was collected from Amendment Area 5 (Alkimos) within an area of vegetation considered to correspond to Floristic Community Type 26a, as presented below.

South west interface with Quindalup dune (in valley) comprising <i>Melaleuca cardiophylla</i> 1-2m Closed Heath with <i>Dryandra sessilis</i> also common. Other common species include <i>Hardenbergia comptoniana</i> , <i>Acacia rostellifera</i> (in small patches). <i>Grevillea preissii</i> common.	
Top of Hill – 10 x 10m releve	Coordinates: 373 647mN 650 1872mE
<i>Melaleuca huegelii</i> , <i>Acacia truncata</i> , <i>Melaleuca systema</i> , <i>Leucopogon?</i> <i>Sprengloides</i> , <i>Dryandra sessilis</i> , <i>Grevillea preissii</i> , <i>?Cosmelia rubra</i> , <i>Desmocladus flexuosus</i> , <i>Drosera</i> sp (climbing), <i>Trachymene pilosa</i> , <i>Lomandra maritima</i> , <i>Dryandra lindleyana</i> , <i>Hibbertia spicata leptotheca</i> , <i>Hypochaeris glabra</i> , <i>Leucopogon parviflorus</i> , <i>Lagarus ovatus</i> , <i>Lagenifera huegelii</i> , <i>Austrostipa</i> sp., <i>Cassytha racemosa</i> , <i>Senecio lautus</i> , <i>Caladenia flava</i> , <i>Templetonia retusa</i> , <i>Bossiaea eriocarpa</i> , <i>Romulea rosea</i> , <i>Opercularia vaginata</i> , <i>Rhagodia baccata</i> , <i>Pelargonium capitatum</i> , <i>Eremophila glabra</i> .	
<i>Hibbertia spicata</i> – on top of hill (19 plants) in open areas among limestone and shallow brown soil.	373 647mN, 650 1872mE to 373 608mN, 650 1879mE
<i>Melaleuca huegelii</i> – <i>M. systema</i> also on taller hill only ~30m in diameter right on top of hill surrounded by <i>M. cardiophylla</i> - <i>D. sessilis</i> . More <i>Hibbertia spicata</i> on this hill >25 plants <i>Stylidium maritimum</i> – 3 plants	373 518mN 6501915mE
Limestone wedge. Top of largest hill/ridge	373 458mN 650 2019mE
Comprising <i>Melaleuca huegelii</i> - <i>Acacia truncata</i> . Species composition same as lower MhAtMs areas. <i>Hibbertia spicata</i> (3 plants) in open limestone area.	
Low ridge to east still MhDsMs	373 642mN 650 2122mE
Other species include <i>Grevillea preissii</i> , <i>Dryandra lindleyana</i> , <i>Acacia truncata</i> , <i>Leucopogon?</i> <i>Sprengloides</i> , <i>Petrophie serruriae</i> , <i>Templetonia retusa</i> , <i>Hakea prostrata</i> , <i>Hakea trifurcata</i> , <i>Opercularia vaginata</i> , <i>Cassytha racemosa</i> , <i>Desmocladus flexuosus</i> .	
<i>Hibbertia spicata</i> in MaLm dunes >25 plants on south facing mid-slope.	373 436mN 650 1714mE

APPENDIX 7

**VERTEBRATE FAUNA LIST
ALKIMOS-EGLINTON**

APPENDIX 7
VERTEBRATE FAUNA LIST – ALKIMOS-EGLINTON

Key:

X: recorded during 1998 survey

+: expected to occur

En: Endangered under *Environment Protection and Biodiversity Conservation Act 1999*

S1: Schedule 1 under *Wildlife Conservation Act 1950*

S4: Schedule 4 under *Wildlife Conservation Act 1950*

P4: Priority 4 taxa

SB3: Bush Forever Significant Bird Species Category 3

SB4: Bush Forever Significant Bird Species Category 4

AMPHIBIANS			
MYOBATRACHIDAE			
Heleioporus eyrei	Moaning Frog	+	
Limnodynastes dorsalis	Western Banjo Frog/Pobblebonk	X	
Myobatrachus gouldii	Turtle Frog	+	
REPTILES			
GEKKONIDAE			
Christinus marmoratus	Marbled Gecko	+	
Crenadactylus ocellatus	Clawless Gecko	+	
Diplodactylus alboguttatus	White-spotted Ground Gecko	+	
Diplodactylus polyophthalmus	Speckled Stone Gecko	+	
Strophurus spinigerus	South-western Spiny-tailed Gecko	X	
Underwoodisaurus milii	Barking Gecko	+	
PYGOPODIDAE			
Aclyis concinna	Javelin Legless Lizard	+	
Aprasia repens	South-western Sandplain Worm Lizard	+	
Delma fraseri	Fraser's Legless Lizard	X	
Delma grayii	Gray's Legless Lizard	+	
Lialis burtonis	Burton's Legless Lizard	X	
Pletholax gracilis	Keeled Legless Lizard	X	
Pygopus lepidopus	Common Scaly Foot	+	
AGAMIDAE			
Pogona minor	Western Bearded Dragon	X	
Tympanocryptis adelaidensis	Western Heath Dragon	+	
VARANIDAE			
Varanus gouldii	Gould's Monitor	+	
Varanus tristis	Black-tailed Monitor	+	
SCINCIDAE			
Cryptoblepharus plagiocephalus	Snake-eyed, Fence or Sun Skink	X	
Ctenotus australis	Western Limestone Ctenotus	+	
Ctenotus fallens	West Coast Ctenotus	X	

<i>Ctenotus impar</i>	South-western Odd-striped Ctenotus	+	
<i>Cyclodomorphus celatus</i>	Western Slender Bluetongue	X	
<i>Egernia kingii</i>	King's Skink	+	
<i>Egernia napoleonis</i>	South-western Crevice Egernia	+	
<i>Hemiergis quadrilineata</i>	Two-toed Earless Skink	X	
<i>Lerista elegans</i>	West coast Four-toed Lerista	X	
<i>Lerista lineopunctulata</i>	West Coast Line-spotted Lerista	X	
<i>Lerista praepedita</i>	Western Worm Lerista	+	
<i>Menetia greyii</i>	Common Dwarf Skink	X	
<i>Morethia lineoocellata</i>	Western Pale-flecked Morethia	+	
<i>Morethia obscura</i>	Southern Pale-flecked Morethia	+	
<i>Tiliqua occipitalis</i>	Western Bluetongue	X	
<i>Tiliqua rugosa</i>	Bobtail	X	
TYPHLOPIDAE			
<i>Ramphotyphlops australis</i>	Southern Blind Snake	X	
BOIDAE			
<i>Morelia spilota</i>	Southern Carpet Python	+	S4, P4
ELAPIDAE			
<i>Demansia psammophis</i>	Reticulated Whip Snake	X	
<i>Echiopsis curta</i>	Bardick	X	
<i>Neelaps bimaculatus</i>	Black-naped Snake	+	
<i>Neelaps calonotus</i>	Black-striped Snake	+	
<i>Notechis scutatus</i>	Western Tiger Snake	+	
<i>Pseudonaja affinis</i>	Dugite	X	
<i>Suta gouldii</i>	Gould's Hooded Snake	+	
<i>Simoselaps bertholdi</i>	Jan's Banded Snake	+	
<i>Simoselaps fasciolatus</i>	Narrow-banded Snake	+	
<i>Simoselaps semifasciatus</i>	Southern Half-girdled Snake	+	
BIRDS			
CASUARIIDAE			
<i>Dromaius novaehollandiae</i>	Emu	X	SB4
PHASIANIDAE			
<i>Coturnix pectoralis</i>	Stubble Quail	+	
ACCIPITRIDAE			
<i>Elanus axillaris</i>	Black-shouldered Kite	+	
<i>Lophoictinia isura</i>	Square-tailed Kite	+	SB4
<i>Haliastur sphenurus</i>	Spotted Harrier	X	
<i>Accipiter fasciatus</i>	Brown Goshawk	X	SB4
<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk	+	SB4
<i>Aquila audax</i>	Wedge-tailed Eagle	X	SB4
<i>Hieraaetus morphnoides</i>	Little Eagle	X	SB4
FALCONIDAE			
<i>Falco berigora</i>	Brown Falcon	X	SB4
<i>Falco longipennis</i>	Australian Hobby	+	
<i>Falco peregrinus</i>	Peregrine Falcon	+	S4, SB4
<i>Falco cenchroides</i>	Nankeen Kestrel	X	

TUNRICIDAE			
Turnix varia	Painted Button-quail	+	SB4
CHARADRIIDAE			
Vanellus tricolor	Banded Lapwing	+	
COLUMBIDAE			
Columba livia	Rock Dove	+	
Streptopelia senegalensis	Laughing Turtle-Dove	X	
Streptopelia chinensis	Spotted Turtle-Dove	+	
Phaps chalcoptera	Common Bronzewing	X	SB3
Ocyphaps lophotes	Crested Pigeon	X	
CACATUIDAE			
Calyptorhynchus latirostris	Short-billed Black Cockatoo	X	En, S1, SB4
Cacatua roseicapilla	Galah	X	
PSITTACIDAE			
Trichoglossus haematodus	Rainbow Lorikeet	+	
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	+	
Barnardius zonarius	Australian Ringneck	X	
Purpureicephalus spurius	Red-capped Parrot	+	
Neophema elegans	Elegant Parrot	+	
Neophema petrophila	Rock Parrot	+	SB3
CUCULIDAE			
Cuculus pallidus	Pallid Cuckoo	+	
Cacomantis flabelliformis	Fan-tailed Cuckoo	X	
Chrysococcyx basalis	Horsfield's Bronze-Cuckoo	+	
Chrysococcyx lucidus	Shining Bronze-Cuckoo	X	
STRIGIDAE			
Ninox novaeseelandiae	Southern Boobook	+	
TYTONIDAE			
Tyto alba	Barn Owl	+	
PODARGIDAE			
Podargus strigoides	Tawny Frogmouth	+	
AEGOTHELIDAE			
Aegotheles cristatus	Australian Owlet-Nightjar	X	
APODIDAE			
Apus pacificus	Fork-tailed Swift	+	
HALCYONIDAE			
Dacelo novaeguineae	Laughing Kookaburra	X	
Todiramphus sanctus	Sacred Kingfisher	X	
MEROPIDAE			

<i>Merops ornatus</i>	Rainbow Bee-eater	X	
MALURIDAE			
<i>Malurus splendens</i>	Splendid Fairy-wren	X	SB3
<i>Malurus lamberti</i>	Variiegated Fairy-wren	X	SB3
<i>Malurus leucopterus</i>	White-winged Fairy-wren	X	SB3
<i>Stipiturus malachurus</i>	Southern Emu-wren	+	SB3
PARDALOTIDAE			
<i>Pardalotus striatus</i>	Striated Pardalote	X	
ACANTHIZIDAE			
<i>Sericornis frontalis</i>	White-browed Scrubwren	X	SB3
<i>Calamanthus campestris</i>	Rufous Fieldwren	+	
<i>Gerygone fusca</i>	Western Gerygone	X	
<i>Acanthiza apicalis</i>	Inland Thornbill	X	SB3
<i>Acanthiza inornata</i>	Western Thornbill	+	SB3
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	X	SB3
MELIPHAGIDAE			
<i>Anthochaera carunculata</i>	Red Wattlebird	X	
<i>Anthochaera lunulata</i>	Western Wattlebird	X	SB4
<i>Manorina flavigula</i>	Yellow-throated miner	+	
<i>Lichenostomus virescens</i>	Singing Honeyeater	X	
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	+	
<i>Lichmera indistincta</i>	Brown Honeyeater	X	
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	X	SB4
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater	+	SB4
<i>Phylidonyris melanops</i>	Tawny-crowned Honeyeater	+	SB4
<i>Acanthorhynchus superciliosus</i>	Western Spinebill	+	
<i>Epthianura albifrons</i>	White-fronted Chat	+	
PETROICIDAE			
<i>Petroica multicolor</i>	Scarlet Robin	X	SB3
<i>Petroica goodenovii</i>	Red-capped Robin	+	
<i>Melanodryas cucullata</i>	Hooded Robin	+	SB3
<i>Eopsaltria georgiana</i>	White-breasted Robin	+	SB3
NEOSITTIDAE			
<i>Daphoenositta chrysoptera</i>	Varied Sitella	+	SB3
PACHYCEPHALIDAE			
<i>Pachycephala pectoralis</i>	Golden Whistler	X	SB3
<i>Pachycephala rufiventris</i>	Rufous Whistler	+	
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	X	SB3
DICRURIDAE			
<i>Grallina cyanoleuca</i>	Magpie-Lark	X	
<i>Rhipidura fuliginosa</i>	Grey Fantail	X	
<i>Rhipidura leucophrys</i>	Willie Wagtail	X	
CAMPEPHAGIDAE			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike	X	
<i>Lalage sueurii</i>	White-winged Triller	X	

ARTAMIDAE			
Artamus cinereus	Black-faced Woodswallow	X	SB4
Artamus cyanopterus	Dusky Woodswallow	+	SB4
Cracticus torquatus	Grey Butcherbird	X	
Gymnorhina tibicen	Australian Magpie	X	
CORVIDAE			
Corvus coronoides	Australian Raven	X	
MOTACILLIDAE			
Anthus novaeseelandiae	Richard's Pipit	X	
DICAEIDAE			
Dicaeum hirundinaceum	Mistletoebird	+	
HIRUNDINIDAE			
Cheramoeca leucosternus	White-backed swallow	X	
Hirundo neoxena	Welcome Swallow	X	
Hirundo nigricans	Tree Martin	X	
Hirundo ariel	Fairy Martin	+	
SYLVIIDAE			
Cincloramphus mathewsi	Rufous Songlark	+	
ZOSTEROPIDAE			
Zosterops lateralis	Silveryeye	X	
MAMMALS			
TACHYGLOSSIDAE			
Tachyglossus aculeatus	Short-beaked Echidna	+	
PERAMELIDAE			
Isoodon obesulus	Southern Brown Bandicoot	+	P4
TARSIPEDIDAE			
Tarsipes rostratus	Honey Possum	+	
MACROPODIDAE			
Macropus fuliginosus	Western Grey Kangaroo	X	
Macropus irma	Western Brush Wallaby	+	P4
MOLOSSIDAE			
Mormopterus planiceps	Southern Freetail-bat	+	
Nyctinomus australis	White-striped Freetail-bat	+	
VESPERTILIONIDAE			
Nyctophilus geoffroyi	Lesser Long-eared Bat	+	
Nyctophilus gouldi	Gould's Long-eared Bat	+	
Nyctophilus timoriensis	Greater Long-eared Bat	+	
Chalinolobus gouldii	Gould's Wattled Bat	+	
Chalinolobus morio	Chocolate Wattled Bat	X	
Vespadelus regulus	Southern Forest Bat	+	

MURIDAE			
Mus musculus	House Mouse	X	
Rattus fuscipes	Bush Rat	X	
Rattus rattus	Black Rat	+	
CANIDAE			
Vulpes vulpes	Fox	X	
LEPORIDAE			
Oryctolagus cuniculus	Rabbit	X	

APPENDIX 8

REPORT ON A BUFFER ZONE FOR PROPOSED FUTURE ALKIMOS WASTEWATER TREATMENT PLANT

Consulting Environmental Engineers 2002

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Please refer to a hard copy of the
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APPENDIX 9

ASSESSMENT OF CEE METHODOLOGY CSIRO 2002

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