

PLANNING BRANCH
DO NOT REMOVE

Purnululu National Park

Management Plan

1995 - 2005



MANAGEMENT PLAN No. 33



Department of Conservation
and Land Management



National Parks and Nature
Conservation Authority

PURNULULU NATIONAL PARK

MANAGEMENT PLAN

1995 - 2005

Department of Conservation and Land Management
for the
National Parks and Nature Conservation Authority
Perth, Western Australia, 1995

PREFACE

National parks, nature reserves and marine parks and any other lands reserved under the Land Act and vested in the National Parks and Nature Conservation Authority (NPNCA) are managed by the Department of Conservation and Land Management (CALM).

The NPNCA is responsible for the preparation of management plans for all land which is vested in it. These plans are prepared through the agency of CALM on a regional and area basis. In 1987 the Government made a number of decisions with respect to the preparation of this plan, in particular to ensure the involvement of the Aboriginal traditional custodians in the ongoing management of the Park, but otherwise planning is generally in accordance with the objectives of all national parks, that is, conservation and recreational activities that leave the areas unimpaired for future generations to enjoy.

The Conservation and Land Management Act 1984 (the CALM Act) requires that all national parks be managed so as to fulfil so much of the demand for recreation as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest. The perpetuation, or conservation of parks and their features is of paramount importance. However, it is these same features which make national parks so attractive for visitors; the more spectacular or unusual an area, the greater the demands placed upon it. Parks must, therefore, be managed to ensure that opportunities for use and access are provided in appropriate areas while retaining the integrity of natural and cultural features.

The biophysical and cultural environments of Purnululu National Park and Purnululu Conservation Reserve are recognised as fragile and especially sensitive to uncontrolled access. This management plan provides management of visitor numbers in order to achieve conservation objectives while allowing for appropriate recreational opportunities in a variety of settings. The impacts of visitors on the Park will be monitored and assessed.

A draft management plan for Purnululu National Park and Conservation Reserve was prepared by CALM and issued in May 1989 by the NPNCA for a period of public review extending to October 1989. Following consideration of public comment the NPNCA submitted the final management plan to the Minister, who approved this document as the Management Plan for Purnululu National Park on 18 November 1995.

The plan is divided into two major sections, with Part A presenting background and resource information, and Part B the objectives and strategies for management of the Park. Presenting objectives and strategies in this manner is expected to assist in the implementation of the plan, with particular reference to the role of the Aboriginal traditional owners on the Purnululu Park Council.

In August 1992 as the final management plan was being prepared a dispute developed between members of the Purnululu Aboriginal Corporation as to the identity of the primary traditional owners responsible for country now included within the boundaries of the National Park and Conservation Reserve. PAC advised that the dispute prevented them from participating further in the planning process, and the last stages of the plan were completed without their involvement. The finalisation of this plan was delayed while attempts were made to reach agreement on the issue, but this dispute remains unresolved.

Pending settlement of the issue CALM has offered both parties a place on the Purnululu Park Council so that their interests may be represented. In this document, and as long as the dispute shall remain unresolved, the term "traditional owner" means "Aboriginal persons recognised as being traditionally associated with land within the Park", and the use of the term shall not imply recognition by CALM of one of the disputing parties over the other, nor is it an acknowledgement by the State of the existence of native title to the land.

The inclusion of a specific section on the environmental impact of developments recognises the unique values of Purnululu National Park by providing Park managers with guidelines to protect such values.

Funding to implement the plan is the responsibility of CALM and implementation is subject to available resources.

The management plan has a tenure of 10 years from the date of gazettal.

On 10 November 1994 the Bush Fires Board endorsed this plan under Section 34(1) of the Bush Fires Act (1954) with the requirement that operational detail be made available regularly to the Board.

ACKNOWLEDGEMENTS

This is the first management plan for the conservation estate of Western Australia to provide a formal management structure for the participation of the Aboriginal traditional owners. Special thanks to the people of Purnululu Aboriginal Corporation and Billingjul Aboriginal Corporation, in particular Raymond Wallaby, Bonnie Edwards and the late Sam Butters, for their contributions to the planning process.

Many other people from within CALM and from other organisations (government and community) have contributed to the plan, and their assistance is gratefully acknowledged.

Maps contained in this plan were prepared by Information Management Branch, CALM.

The many people and organisations who prepared submissions on the draft management plan are especially acknowledged.

NOMENCLATURE

Inclusion of a name in this publication does not imply its approval by the relevant nomenclature authority.

CONTENTS

	Page
PREFACE	i
ACKNOWLEDGEMENTS	iii
NOMENCLATURE	iii
CONTENTS	iv
INTRODUCTION	1
1.0 OVERVIEW	1
1.1 Introduction.....	1
1.2 The Study Area.....	4
1.3 Government Decisions.....	5
1.4 Park Boundaries and Tenure.....	7
1.5 Conservation Significance.....	8
1.6 Aboriginal Significance.....	9
1.7 Recreation and Tourism Significance.....	9
1.8 Previous Studies.....	9
1.9 Public Participation.....	10
2.0 PARK MANAGEMENT.....	11
2.1 Aboriginal Participation.....	11
2.2 Management Goals and Objectives.....	12
2.3 Purnululu Park Council.....	12
2.4 Purnululu Community Advisory Committee.....	13
2.5 National Parks and Nature Conservation Authority.....	13
2.6 Department of Conservation and Land Management.....	13
2.7 Purnululu Aboriginal Corporation.....	14
2.8 Billingjul Aboriginal Corporation.....	14
2.9 Reporting Responsibilities.....	15
PART A. BACKGROUND AND RESOURCES	17
A.1 NATURAL RESOURCES.....	17
1.1 Climate.....	17
1.2 Geology.....	17
1.3 Soils and Geomorphology.....	20
1.4 Hydrology.....	22
1.5 Landscape.....	24
1.6 Flora and Vegetation.....	25
1.7 Fauna.....	29
1.8 Rehabilitation.....	30
1.9 Fire.....	34
A.2 CULTURAL RESOURCES.....	35
2.1 Traditional Use and Significance.....	35
2.2 Traditional Aboriginal Activities.....	39
2.3 Protection of Aboriginal Sites and Cultural Objects.....	39
2.4 Colonial Cultural Heritage.....	40
A.3 PUBLIC USE.....	41

3.1	Existing Visitor Use Patterns.....	41
3.2	Access.....	43
3.3	Recreation.....	46
3.4	Commercial Operations.....	49
3.5	Information, Education and Interpretation.....	50
A.4	LIVING AREAS FOR ABORIGINAL PEOPLE.....	51
4.1	Living Area Leases.....	51
4.2	Housing and Residential Services.....	51
4.3	Community Services.....	52
A.5	RESEARCH AND MONITORING.....	52
PART B.	MANAGEMENT STRATEGIES	53
B. 1	PARK MANAGEMENT.....	53
1.1	Purnululu Park Council.....	53
1.2	Purnululu Community Advisory Committee.....	54
1.3	National Parks and Nature Conservation Authority.....	54
B.2	ENVIRONMENTAL ASSESSMENT.....	55
B.3	PARK BOUNDARIES AND TENURE.....	55
3.1	Park Boundaries and Tenure.....	55
3.2	Mining Leases and Exploration Licenses.....	58
3.3	Living Area Leases.....	59
B.4	MANAGEMENT OF NATURAL RESOURCES.....	60
4.1	Resource Management Programs.....	60
4.2	Hydrology.....	61
4.3	Soils and Geomorphology.....	61
4.4	Landscape.....	62
4.5	Flora and Vegetation.....	62
4.6	Fauna.....	63
4.7	Fire.....	63
4.8	Rehabilitation.....	64
B.5	MANAGEMENT OF CULTURAL RESOURCES.....	65
5.1	Purnululu Cultural Heritage Committee.....	65
5.2	Traditional Aboriginal Activities.....	66
5.3	Colonial Cultural Heritage.....	67
B.6	MANAGEMENT FOR PUBLIC USE.....	67
6.1	Framework for Management of Public Use.....	67
6.2	Access.....	68
6.3	Recreation.....	69
6.4	Commercial Operations.....	71
6.5	Information, Education and Interpretation.....	71
B.7	MANAGEMENT FOR RESIDENTS.....	72
7.1	Housing.....	72
7.2	Services.....	72
B.8	SAFETY.....	73
8.1	Visitor Safety.....	73
8.2	Occupational Health and Safety.....	73
8.3	Emergency Procedures.....	74

B.9	PARK ADMINISTRATION.....	74
9.1	Staffing.....	74
9.2	Staff Training.....	75
9.3	Communications.....	75
9.4	Park Headquarters.....	76
B.10	PLAN IMPLEMENTATION.....	76
10.1	Research and Monitoring.....	76
10.2	Park Programs.....	77
10.3	Term of Plan.....	77
REFERENCES		78
APPENDICES		82
APPENDIX 1.	DISCUSSION OF VISITOR SURVEY RESULTS.....	82
APPENDIX 2.	INTERNAL ENVIRONMENTAL ASSESSMENT.....	83
APPENDIX 3.	NPNCA POLICY STATEMENT.....	85
	ABORIGINAL INVOLVEMENT IN NATIONAL PARKS AND NATURE CONSERVATION.....	85
APPENDIX 4.	STRATEGY IMPLEMENTATION TABLE.....	86

MAPS

- Map 1. Locality Map
- Map 2. Park Features
- Map 3. Geology
- Map 4. Exploration Licences
- Map 5. Vegetation
- Map 6. Strategic Block Fences, Regeneration Areas and Photo Monitoring Points
- Map 7. Access Roads, Facilities and Recreation Proposals
- Map 8. Proposed Extensions

TABLES

- Table 1. Major Rock Types and Hydrological Properties
- Table 2. Classification of Vegetation Communities
- Table 3. Land Systems Affected by
- Table 4. Estimated On-ground Visitor Numbers 1986-1993

INTRODUCTION

1.0 OVERVIEW

1.1 Introduction

Until quite recently, a remote and rugged part of the Kimberley region remained largely hidden from the public eye. Before 1982 it was familiar only to the traditional Aboriginal people of the area and to various pastoralists, stockmen, geologists, scientists and locals. It is only since widespread media promotion in 1982-83 that the general public has become aware of the spectacular gorges and domes of the Bungle Bungle massif.

It was recognised right from the outset that there would need to be special recognition and management provided for the cultural heritage of this area and that these concepts would have to be incorporated into the usual model of a national park as it is understood in Western Australia. A national park is an area of great beauty or special scientific, educational or recreational interest which is managed to allow such recreational use by the public as is consistent with the proper maintenance, restoration and protection of the environment. The significance of this area as a national park and its fulfillment of the dual criteria, conservation and recreation, is discussed below.

In response to the early demands for increased information and access to this remote area of the Kimberley, the Environmental Protection Authority (EPA) convened an informal interdepartmental Working Group ... "to investigate and report on the status, vesting and purpose of Bungle Bungle and adjoining land". The Bungle Bungle Working Group prepared a report to the EPA which was presented for consideration by Government in October 1985 (Department of Conservation and Environment 1986).

Much of the appeal of Purnululu National Park and Purnululu Conservation Reserve¹ can be attributed to its remoteness and difficulty of access. The Bungle Bungle massif is a major attraction for tourism in the Kimberley, with visitors focusing on two areas. Echidna Chasm incises through conglomerate in the north-west of the massif, while Cathedral Gorge and Piccaninny Gorge, on the southern face of the massif, are derived from fine sandstone and are associated with perhaps the most potent of the Park's images, the "beehive" domes with their horizontal striations.

With increasing public interest in the Park, a vital task for management is to ensure that visitor use causes the least possible impact on environmental and cultural values while enabling visitors to experience the wilderness² values for which it is renowned.

1 Subsequent reference to 'the Park' is to be read as meaning the Purnululu National Park and the Purnululu Conservation Reserve.

2 A wilderness is an area that is, or can be restored to be:

- of sufficient size to enable the long-term protection of its natural systems and biological diversity;
- substantially undisturbed by colonial and modern technological society; and
- remote at its core from points of mechanised access and other evidence of colonial and modern technological society (Robertson, Vang and Brown 1992).

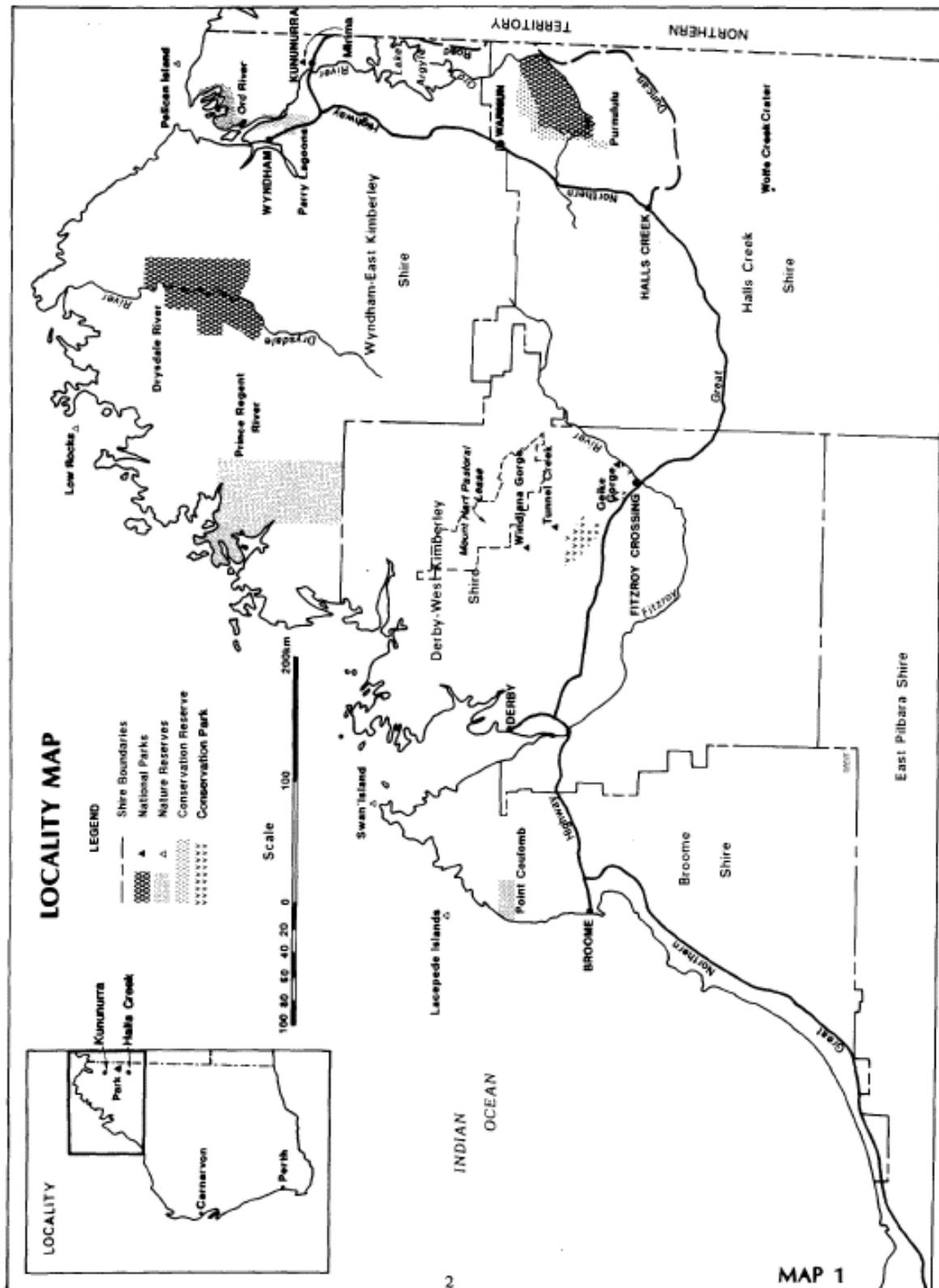
The ongoing participation in the management of the Park by the traditional owners of this region is of particular significance. This plan formally recognises for the first time in Western Australia the social, economic and cultural responsibilities of Aboriginal traditional owners toward their country through the establishment of a Ministerial Committee, the Purnululu Park Council (PPC). This Council, comprising representation from CALM and Aboriginal traditional owners, is to ensure that the cultural and natural values of the Park are maintained, and enhanced wherever possible.

The level of visitor use of the Park is kept relatively low due to the four wheel drive standard of the access road, recognising that most visitors to the Park arrive by road. The benefits of this include minimising impacts of vehicle traffic on the Park - particularly erosion - and the preservation of the remote experience expressed by visitors to be of great significance. Careful monitoring will ensure that informed decisions on preferred visitor numbers and distribution patterns within the Park are made.

The intrinsic natural and cultural values of the Park could be jeopardised through a premature increase in visitor use. The quality of the visitor experience will continue to relate directly to a perception of a largely unspoilt wilderness remote in place and time from major population centres.

The Aboriginal traditional owners' profound identification with the Purnululu area illustrates for the benefit of all Australians a culture intimately related to its environment and with a correspondingly strong sense of responsibility for the protection of the Park and the well-being of visitors.

This management plan aims to conserve the natural and cultural values of the Park for the benefit of present and future generations. Visitors will continue to enjoy a high quality recreational and educational experience largely devoid of imposed forms of support and entertainment. The wilderness experience within the Park offers prospects for embracing an understanding of the affinity between Aboriginal people and the lands upon which they have traditionally lived, and to increase public support for the conservation of the Park's unique biophysical and cultural environment. Such experience is obtainable in a diminishing number of settings as the penetration of modern society into formerly remote natural settings accelerates. In a regional setting, this Park offers a particular kind of experience which complements the broad range of experiences offered to Kimberley visitors.



1.2 The Study Area

1 484 622 ha of land - approximately 3.5% of the Region - is reserved as national parks or nature reserves in the Kimberley (Map 1). However, a further 424 917 ha has been acquired by CALM for inclusion in the conservation estate, giving a prospective total of 1 909 539 ha, or 4.5% of the Region.

There will be increased pressure on these limited conservation areas as visitor numbers to the region escalate and as the resident population of the Kimberley increases. From 1981 to 1991, the Kimberley population grew at a rate estimated at approximately 50% (Department of Regional Development and the Northwest, and Department of Planning and Urban Development 1990). Greater leisure time and a better appreciation of the natural environment has widened public horizons and increased the demand for access to conservation reserves.

Purnululu National Park and Purnululu Conservation Reserve are located in the Kimberley Region within the Halls Creek Shire approximately 160 km south of Kununurra, 120 km north of Halls Creek and 50 km west of the Northern Territory border (Map 1). The area of National Park totals 208 723 ha (including the Bungle Bungle massif which covers 45 000 ha) and the Conservation Reserve 110 602 ha.

Since the arrival of Europeans, the major influence in this area has been exerted by the pastoral industry. The lands in the Ord River valley were first stocked with cattle in the early 1880s. Under the open range cattle production system operating in the Kimberley, cattle concentrated on the major river and stream lines where surface water was available. It was noted very early that the good pastoral land along the rivers became overgrazed if the wet season was late. By the 1930's most of the more productive land along the Ord River was severely degraded and eroding (Department of Conservation and Environment 1986).

In 1967 a large area of the Ord River catchment - including the lands which are now the National Park and Conservation Reserve - was resumed for the purposes of stabilising and regenerating vegetation on lands degraded by previous pastoral practices. This area - Reserve No 28538 - was managed by the Department of Agriculture, which was responsible for removal of stock and rehabilitation of the catchment area. The Park is bordered to the north by Texas Downs and Osmand³ Valley pastoral leases, to the west by Mabel Downs and Sophie Downs, with Alice Downs Station adjoining the south-west corner of the Conservation Reserve. The remaining boundaries, marked by the Panton and Ord Rivers, adjoin Reserve No 28538.

3 Throughout the plan the name Osmand (rather than Osmond) is used to refer to the Range, Valley, Plateau, River and Station. The Geographic Names Committee of the Department of Land Administration defined the accurate spelling of Osmand on 1 September 1988.

1.3 Government Decisions

Following the report of the Bungle Bungle Working Group (1986) (Section 1.1), State Cabinet discussed the Park a number of times and made several decisions regarding the reservation and future management of the area.

In April 1986, State Cabinet approved the vesting of two proposed reserves in the National Parks and Nature Conservation Authority (NPNCA). Reserve No 39897 was given the purpose of National Park and includes the massif and those surrounding lands not then subject to mineral exploration licences. A second area - Reserve No 39898 -adjacent to the National Park, was given the purpose of Conservation. The Government considered national park status was not appropriate for this second reserve because exploration licences, granted under the Mining Act 1978, already existed over the area. This reserve provides for appropriate management of the area surrounding the National Park whilst mineral exploration continues. The two reserves were gazetted on 6 March 1987.

When endorsing the establishment of the proposed National Park and Conservation Reserve, Government in 1987 directed CALM to prepare a management plan for the area. In doing so, the Government made these specific decisions with respect to Aboriginal interests:

- that Aboriginal traditional custodians would be involved in the planning process
- that interested parties, including local government and the Western Australian Tourism Commission (WATC), would be involved in the planning process
- that meaningful ongoing input to management by Aboriginal people who have traditional affiliation with land in the Park be developed
- that employment opportunities be provided for Aboriginal people in the management and interpretation of the Park
- that proposals be developed for Aboriginal people with traditional affiliation to reside in the Park
- that an Aboriginal National Park Ranger Training Program be established.

In 1993 the Government endorsed the concept of a joint CALM / Aboriginal park council to address matters of concern to Aboriginal people. Government also endorsed the formation of a joint CALM / community advisory council to deal with Park management matters of broader local community interest.

1.4 Park Boundaries and Tenure

The Park consists of Purnululu National Park and Purnululu Conservation Reserve⁴ vested in the NPNCA. The National Park became an 'A' class reserve on 13 September 1988. The Conservation Reserve is vested as a 'C' class reserve. It is proposed that the tenure of the existing conservation reserve be changed to 'C' class Conservation Park (Map 2).

When the Park and Reserve were declared they were not officially named, although they were commonly referred to after the major feature of the area, the Bungle Bungle massif. In the languages of the Kija Aboriginal people of the middle Ord River system, Purnululu is the descriptive name given to an area dominated by friable sandstone features. It refers both to the massif and to the area surrounding it and is, therefore, an apt name for the area now gazetted as National Park and Conservation Reserve. Bungle Bungle may be a corruption of the Aboriginal name by early Europeans.

The Park is bounded to the north and west by pastoral leases and to the south and east by the Ord River Regeneration Reserve (Map 2). The boundaries in some cases reflect cadastral rather than biophysical features and hence in some places they are difficult to define on the ground or to manage.

A large area of the Conservation Reserve to the southwest of the current National Park boundary has been determined by the Department of Minerals and Energy to be not prospective for minerals. This area would be a significant addition to the Park as it includes the section of the Bungle Bungle massif currently outside the Park boundaries, Purnululu airstrip, and Walardi and Bellburn camping areas. Negotiations are proceeding on the incorporation of this significant area into the National Park.

At the time of gazettal of the Park, three one hectare reserves for the purpose of Trigonometric Stations were also gazetted. These reserves have historical value as they were monumented by surveyor Harry F. Johnston in 1883. They are, however, situated in culturally and environmentally sensitive locations.

The natural, cultural and scenic values of the closed forests landscapes and surrounding woodlands of Osmand Valley make this area a high priority for inclusion within the National Park. Extension of the National Park to include Osmand Valley Station and the southern part of Texas Downs would increase the number of terrestrial vertebrate species known from the National Park and Conservation Reserve by approximately 5%, including many Torresian species at the local southern limit of their range. It would also place in a reserve the Clawless Gecko, *Crenadactylus ocellatus*, known from no other conservation reserve or national park in north-western Australia. It would greatly increase the representation of the distinctive Wickham land system of hard sandstone ranges, deeply incised gorges and lush riparian vegetation. Management of these areas would increase the protection of the dense riparian vegetation flanking Osmand Creek, its tributaries (for example Mt John Creek), springs and gorges (Woinarski 1990).

4 Names officially approved June 1992.

1.5 Conservation Significance

A large portion of the Ord River Basin was reserved in 1967 for the purpose of stabilising and regenerating vegetation on land which had been degraded by previous pastoral practices. Following the Bungle Bungle Working Group report to the EPA in 1985, part of this Ord River Regeneration Reserve was vested in the NPNCA for conservation and a further part for national park.

Detailed biological survey information on the flora and fauna of the South-East Kimberley Region is limited. However, we do know from some studies already conducted that several plant species exist in the Park which were previously not recorded in Western Australia or are of very limited occurrence. In particular, the sheltered, moist habitats of the Osmand Range and Bungle Bungle gorges are of conservation significance. It was also noted in the Bungle Bungle Working Group Report (1986) that the tree savannah and tropical grassland ecosystems of the Park are important conservation features.

CALM's Research Bulletin No 6, A Survey of the Wildlife and Vegetation of Purnululu (Bungle Bungle) National Park and Adjacent Areas (Woinarski 1990) summarises the results of 10 weeks of biological survey of the Park and adjacent areas during 1989. The report lists 616 plant, 149 bird, 81 reptile, 41 mammal, 15 fish and 12 frog species from this area. This list adds 244 species of vascular plants to the known flora of the Purnululu area. Notable plants include 12 species new to the Kimberley and two species not otherwise recorded from Western Australia. A number of undetermined specimens may represent new species.

Notable animals include the Grey Falcon, Gouldian Finch, Desert Mouse, Large-footed Mouse-eared Bat, Northern Nail-tail Wallaby, Rock Ringtail Possum, Ningbing Antechinus, the skink *Egernia slateri*, and undescribed species of gecko *Gehrya sp nov*, skink *Lerista sp nov* and turtle *Chelodina sp nov*.

For nine native terrestrial vertebrates, the Purnululu area represents the only recordings in the conservation estate of north-western Australia. Twelve species have been recorded from the Purnululu area and only one other reserve. It is for the conservation of these 21 species that the Park may be critically important. The abundance and diversity of small mammals is very low in degraded habitats. Seventeen weed species (2.8% of the flora) were recorded from the Bungle Bungle area, several of which constitute substantial management problems (Woinarski 1992).

A CSIRO survey, focusing primarily on boundary areas, identified 35 plant species new to the area, four of which had not previously been recorded in Western Australia (Braithwaite, Cowie and Gambold 1991). This survey also recorded for the first time in the area a *Diplodactylus* gecko.

The removal of feral stock and the rehabilitation of degraded land is the critical management requirement to ensure the conservation significance of the Park.

In addition to its biotic value, the Park protects an ancient and remarkable geological feature and a diversity of landforms which provide a high degree of scenic attractiveness.

1.6 Aboriginal Significance

The Purnululu region is an area of great cultural and socio-economic significance to contemporary Aboriginal people. Despite the disruption caused by the arrival of Europeans to the area only 100 years ago, Aboriginal people continue to maintain a strong cultural identity and attachment to this land. Its contemporary relevance, and its significance as a landscape which has been shaped by at least 20 000 years of Aboriginal occupation, was recognised by the Bungle Bungle Working Group (1986).

This adds an undeniable dimension to the fabric of the Park, which can enhance the management of conservation and recreation values. Aboriginal people continue to contribute to the store of knowledge of the natural and cultural resources of the Park, and advise on how this information might best be managed.

1.7 Recreation and Tourism Significance

The unusual shapes and colours of the Bungle Bungle massif have captured the imagination of the tourism industry and the visiting public. The draft management plan for Purnululu National Park gained international attention in 1990 by winning the first

Tourism for Tomorrow Award sponsored by the British tourism industry. This world-wide prize recognises the significance of planning for management with Aboriginal traditional owners in conserving one of the world's most fragile ecosystems.

The Park offers adventure and different cultures, as well as scenic beauty to the traveller. Adventure-style and cultural tourism holidays have become extremely popular with both Australian and overseas visitors. The overall aim of management for this Park should be to maintain the remote wilderness-adventure type of experience which is gained from exploring the unusual landscape.

Strategies have been developed in this plan which provide for appropriate levels of use by residents and visitors while preserving the natural and cultural values of the National Park and Conservation Reserve, allowing the Park to express its intrinsic wilderness character for the benefit of present and future generations of visitors,

1.8 Previous Studies

There have been a number of scientific studies of the area. The EPA Working Group Report (1986) provides an overview of resource data, and makes some general recommendations regarding future management of the area. The major contributors prior to this were land resource studies initiated by CSIRO (Stewart *et. al* 1970) and the WA Department of Agriculture (de Salis 1982 unpubl). Simpkin-Brown (1985 unpubl) compiled a resource document for the area.

Geological studies have been broadly based and include work by Traves (1955) in the Ord-Victoria region, and Dow and Gemuts (1967, 1969) in the East Kimberley region. More recently, specific geomorphological studies have been undertaken by Young (1987).

Vegetation studies have been undertaken by Forbes and Kenneally (1985) and ethnobotanical studies were conducted by Scarlett (1984) and Rose (1984). Both these latter papers were produced as part of a much larger study called the East Kimberley Impact Assessment Project. This project examined the impact of various developments on Aboriginal communities in the East Kimberley region. Many of the papers produced in that study touch on matters relevant to the Park or its Aboriginal residents.

CALM's biological survey (conducted by staff of the CSIRO Division of Wildlife and Ecology) in 1989 added greatly to knowledge of the indigenous flora and fauna of Purnululu National Park and surrounding area, emphasising the conservation significance of the Park (Woinarski 1992). The report expressed particular concern with the effects of feral animals and exotic plants on the Park's ecology and their relationship to rehabilitation of degraded lands. A more recent CSIRO survey has contributed further to an understanding of the ecology of the Park and surrounding area by the identification of species not previously recorded (Sections B 1.6, 1.7) (Braithwaite, Cowie and Gambold 1991).

1.9 Public Participation

In accordance with the 1987 Cabinet decision the CALM planning team consulted extensively with the Aboriginal traditional owners, the Shire of Halls Creek and the WATC. The Purnululu Aboriginal Corporation (PAC) employed the services of a planning consultant to assist with their participation in the plan. The planning consultant and the traditional owners met often with CALM officers through the planning process. PAC prepared a detailed written submission, the contents of which have been drawn upon extensively for this plan.

On-site visits were held, and CALM officers met whenever necessary with representatives of the Shire of Halls Creek and the WATC. Input has also come from the following sources:

- Known interest groups were advised by mail and advertisements placed in the press calling for written public submissions - 37 responses were received. These were collated and analysed and key issues identified. The planning group also had access to written submissions made to the Bungle Bungle Working Group.
- Surveys were conducted during 1987 to ascertain visitor profiles, user patterns and visitor impressions of the Park. Nine hundred replies were received from Park visitors and 124 from aerial passengers (for discussion refer Appendix 1).
- Tourism forums were held in Perth and Kununurra to discuss future use of the Park. Members of the tourism industry attending these forums had opportunities to consider and comment upon options. In addition, a seminar/workshop was conducted in the Park early in 1988 during which tour operators and CALM staff discussed proposals for future Park management.
- The draft management plan was released in May 1989 and open to public review for a period of five months. A joint planning team consisting of representatives of CALM and the traditional owners was established to consider responses from the public. The 53 submissions to the plan were analysed and changes made, where appropriate, in preparation of the final plan. The Analysis of Public Submissions document has been

published simultaneously with this management plan. Major issues identified by public submissions to the draft plan include:

- protection of wilderness values
- support for the role of Aboriginal traditional owners in Park management
- maintenance of access restrictions
- incorporation of Purnululu Conservation Reserve and Osmand Valley into the National Park
- developments to be low-key and referenced to Park values
- revegetation with indigenous species, and
- support for Aboriginal commercial enterprises and employment.

2.0 PARK MANAGEMENT

2.1 Aboriginal Participation

The system of management proposed for Purnululu National Park recognised the valuable contribution that could be made by the Aboriginal traditional owners, and acknowledged their traditional responsibility for the care of the country and the well being of visitors. The Purnululu Park Council will provide them with a formal structure within which the interests of the Aboriginal traditional owners will be represented.

CALM retains responsibility for day-to-day operation of the Park, and the management plan was to be prepared jointly by CALM and the traditional owners. It would then be presented to the NPNCA and the Minister for approval.

In May 1992, as the management plan was being finalised, a dispute arose between some members of PAC who challenged the legitimacy of some of their co-members' claims to traditional ownership of the Purnululu area. Members of this group felt that their interests were not being adequately served by PAC, and requested that CALM negotiate directly with them through the Billingjul Aboriginal Corporation (BAC). PAC advised CALM that because of this dispute they were unable to offer further comment on the document, and consequently the final stages of the plan were completed without their input. The document was referred to PAC, BAC and the Aboriginal Affairs Planning Authority prior to its review by the NPNCA.

After several attempts to negotiate a settlement with PAC and BAC the dispute remains unresolved. Despite the impasse CALM remains committed to the participation of the Aboriginal traditional owners in the management of the Park, and both groups have been offered equal representation on the Park Council until such time as the matter is finally determined.

In June 1993 Cabinet endorsed the concept of an Aboriginal / CALM Park Council to address matters of concern to Aboriginal people, and supported, also, the formation of joint CALM / local community advisory committees to deal with matters of local concern arising from the management of national parks and nature reserves.

2.2 Management Goals and Objectives

The primary goal for management of national parks, as defined in the Conservation and Land Management Act 1984 (the CALM Act) is:

... to fulfil so much of the demand for recreation by members of the public as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest.

Specific goals for management of Purnululu National Park and Purnululu Conservation Reserve are to:

- **Conservation**

Conserve, protect and restore areas of scenic beauty, natural landforms, ecosystems and areas of scientific or cultural importance.

- **Aboriginal Use**

Provide for Aboriginal traditional owners to live in the Park and maintain their customs and practices, consistent with provisions of the Land (Titles and Traditional Usage) Act 1993, the protection of the natural environment and the minimisation of conflict between uses.

- **Recreation**

Provide opportunities and facilities for public recreation, consistent with the protection of the natural environment and minimisation of conflict between uses.

- **Community Relations**

Promote awareness and appreciation of natural processes and the natural and cultural attributes of the Park.

- **Safety**

Protect the lives and property of Park residents, neighbours and visitors to the Park.

- **Research and Monitoring**

Develop and maintain knowledge regarding the biological, physical and cultural environments of the Park to aid future management.

- **Commercial Use**

Ensure that the impacts of industrial and other commercial uses on conservation resources and values are strictly controlled.

2.3 Purnululu Park Council

One of the key initiatives outlined in this plan is the establishment of the Purnululu Park Council (PPC). In 1987 Cabinet recommended this Council be established as a Ministerial Committee, constituted by a formal agreement

between the Minister for the Environment and the Purnululu Aboriginal Corporation (PAC). The Council will provide a forum

for the development of policy in relation to Aboriginal interests in the Park.

The concept of a joint CALM / Aboriginal committee to help resolve issues of concern relating specifically to Aboriginal people was endorsed by Cabinet in June 1993.

2.4 Purnululu Community Advisory Committee

In June 1993 Cabinet also endorsed the creation of a Community Advisory Committee to represent the interests of the broader community.

2.5 National Parks and Nature Conservation Authority

The CALM Act provided for the establishment of the National Parks and Nature Conservation Authority (NPNCA) in which the National Park and Conservation Reserve are vested. It lists the functions of the Authority to include development of policies, provision of advice to the Minister and the preparation, review and monitoring of management plans. This management plan is consistent with the NPNCA's policy on Aboriginal involvement in national parks and nature conservation (See Appendix 3).

2.6 Department of Conservation and Land Management

Functions

The Department of Conservation and Land Management (CALM) was established under the CALM Act and given a range of functions including the management of land and its associated flora and fauna, and to assist the National Parks and Nature Conservation Authority in its functions. CALM is subject to the direction and control of the Minister, and its administrative structure is headed by an Executive Director.

Scope

The scope of the responsibilities of the Department of Conservation and Land Management is represented by its mission statement:

To conserve Western Australia's wildlife and manage lands and water entrusted to the Department for the benefit of present and future generations.

Primary Objectives

CALM has established the following primary objectives in relation to its mission:

Management: To protect, restore and enhance the value of resources entrusted to the Department so as to meet, as far as possible, the diverse expectations of the community.

Conservation: To conserve the indigenous plant and animal species and environmental processes in natural habitats throughout the State.

Recreation: To facilitate the public enjoyment of the natural attributes of public lands in a manner that does not compromise conservation and other management objectives.

Knowledge: To seek a better understanding of the natural environment and to promote awareness and appreciation of its values.

Legislative Base

CALM operates under two principal legislative acts, the CALM Act and the Wildlife Conservation Act. These Acts place a number of statutory requirements on the way in which CALM manages land and wildlife, including that:

- management must be in accordance with a published management plan and all management plans must be made available for public review and comment in the draft phase;
- national parks must be managed to provide public recreation consistent with the conservation of flora, fauna, landscape and other values.

Departmental Policy Statements

Policies of the Department are documented as policy statements and are further elaborated in associated Administrative Instructions. As at March 1994 fifty one policy statements have been approved with many of these being relevant to Purnululu National Park. These documents are available to the public.

Management Structure

CALM has a regional system of management which ensures that CALM officers are on hand to interact with local communities. The CALM Kimberley regional office is located in Kununurra. There is a Park Headquarters located within the Park at Three Ways. Day to day management of the Park is the responsibility of the Ranger-in-Charge, who is answerable to the Kimberley Regional Manager through the District Manager, East Kimberley. Requirements for technical expertise not available in the region are provided by specialist branches within CALM, other Government agencies or private contractors.

2.7 Purnululu Aboriginal Corporation

The Purnululu Aboriginal Corporation (PAC) was incorporated under Commonwealth legislation in 1986, and represents the interests of Aboriginal traditional owners associated predominantly with the Kija language group.

2.8 Billingjul Aboriginal Corporation

The Billingjul Aboriginal Corporation represents the interests of traditional owners associated predominantly with the Jaru language group.

2.9 Reporting Responsibilities

The NPNCA is a statutory body, and the PPC and Community Advisory Committee are Ministerial Committees. All three groups advise the Minister for the Environment on the management of the Park. The responsibilities of the NPNCA are defined in the CALM Act, and include the responsibility to produce management plans for lands which are vested in it, and to monitor the implementation of management plans.

The Purnululu Park Council was established by a Cabinet decision to ensure that the Aboriginal traditional owners have a formal role (together with CALM) in the management of the Park.

The Community Advisory Committee provides for local community input into the management of the Park.

The NPNCA has the statutory responsibility for preparing management plans for the Park, and commenting on and approving major projects, new issues or policies. In addition, the PPC and the Community Advisory Committee may also provide advice on these matters.

There is a strong link between the NPNCA, the PPC and the Community Advisory Committee through the Department of Conservation and Land Management, which is represented on all three bodies.

The roles of the NPNCA, the PPC and the Community Advisory Committee are highlighted through the strategies of Part B of this Plan where they provide focus to the roles of these three bodies.

PART A. BACKGROUND AND RESOURCES

A.1 NATURAL RESOURCES

1.1 Climate

The Park has a typically dry monsoonal climate characterised by two distinct seasons: hot, wet summers (the wet season) and warm, dry winters (the dry season).

Specific data for temperatures, humidity and winds are obtained from Warmun (Turkey Creek), the closest meteorological station to the study area.

The average daytime (maximum) temperature during the dry season - April to October - is approximately 35 °C, ranging from 29.1 °C in July to 38.3 °C in October. The temperature remains relatively high at night, however, frosts may occur during cooler months (June, July, August). After October, the temperature rise is accompanied by an increase in humidity, cloud cover and thunderstorms.

From December to March, temperatures remain very high and conditions are made uncomfortable with high humidity, which peaks at 60% daily mean in February.

The prevailing wind direction throughout the year is north-easterly with some easterly and south-easterly swings. Wind direction is most variable between December and March. Average wind speeds range from 1-10 kph throughout the year, which is slightly less than experienced at Halls Creek.

The mean annual rainfall is about 600 mm with the wet season, extending from November to March. Of the total rainfall, 85% falls between December and March. Most of the rain is localised by thunderstorms. Cyclones do not usually reach this far inland, although associated depressions sometimes bring heavy rain. Rainfall in the region is intense and erratic, typically occurring in isolated events. For example, between 1897 and 1986 the mean number of raindays in Warmun in the month of January was 13; the range of raindays, however, was 2-22. The occurrence of rainfall is also extremely variable from year to year.

Rain falling in the December to March period is critical for plant growth; high temperatures and the sporadic nature of precipitation occurring outside the wet season means that vegetation derives little benefit from unseasonal rain. The effectiveness of rain in this area has declined over the years as vegetation and soils have deteriorated due to past overgrazing by domestic and feral stock. Rain is lost in run off and evaporation, causing the environment to become more arid (Robinson 1970).

1.2 Geology

This section briefly describes the geology of the Park. Detailed descriptions of the geology can be found in Traves (1955), Dow and Gemuts (1967, 1969), Mory and Beere (1985, 1988) and Plumb (1989).

The rocks within Purnululu can be included in four broad geological units (Map 3):

The early Proterozoic (Halls Creek Province) formations can be found in the western part of Purnululu. Those just north of the Park occur as an embayment in the middle Proterozoic rocks (Dow and Gemuts 1967). Included in this group are metamorphosed, tightly folded and faulted metasediments and metavolcanics which are between 2000-1870 million years old (Ma) and granitic rocks which are around 1850 Ma.

The middle Proterozoic rocks are between 1700-1400 Ma. This group includes predominantly shallowwater sedimentary rocks with minor occurrences of volcanic rocks. These rocks form prominent strikeridges north of Purnululu (Dow and Gemuts 1967).

The late Proterozoic rocks are noted for depositional beds of glacial origin (tillite) which crop out widely near Purnululu. Examples of the tillites can be found west of the Piccaninny Structure in the Purnululu Conservation Reserve.

The Palaeozoic Ord Basin is between 590-360 Ma and unconformably overlies the Proterozoic rocks. The best preserved stratigraphic succession of the Ord Basin occurs in the Hardman Syncline. In the centre of the Hardman Syncline is a feature called the Piccaninny Structure thought to be a meteorite-impact structure (Beere 1983).

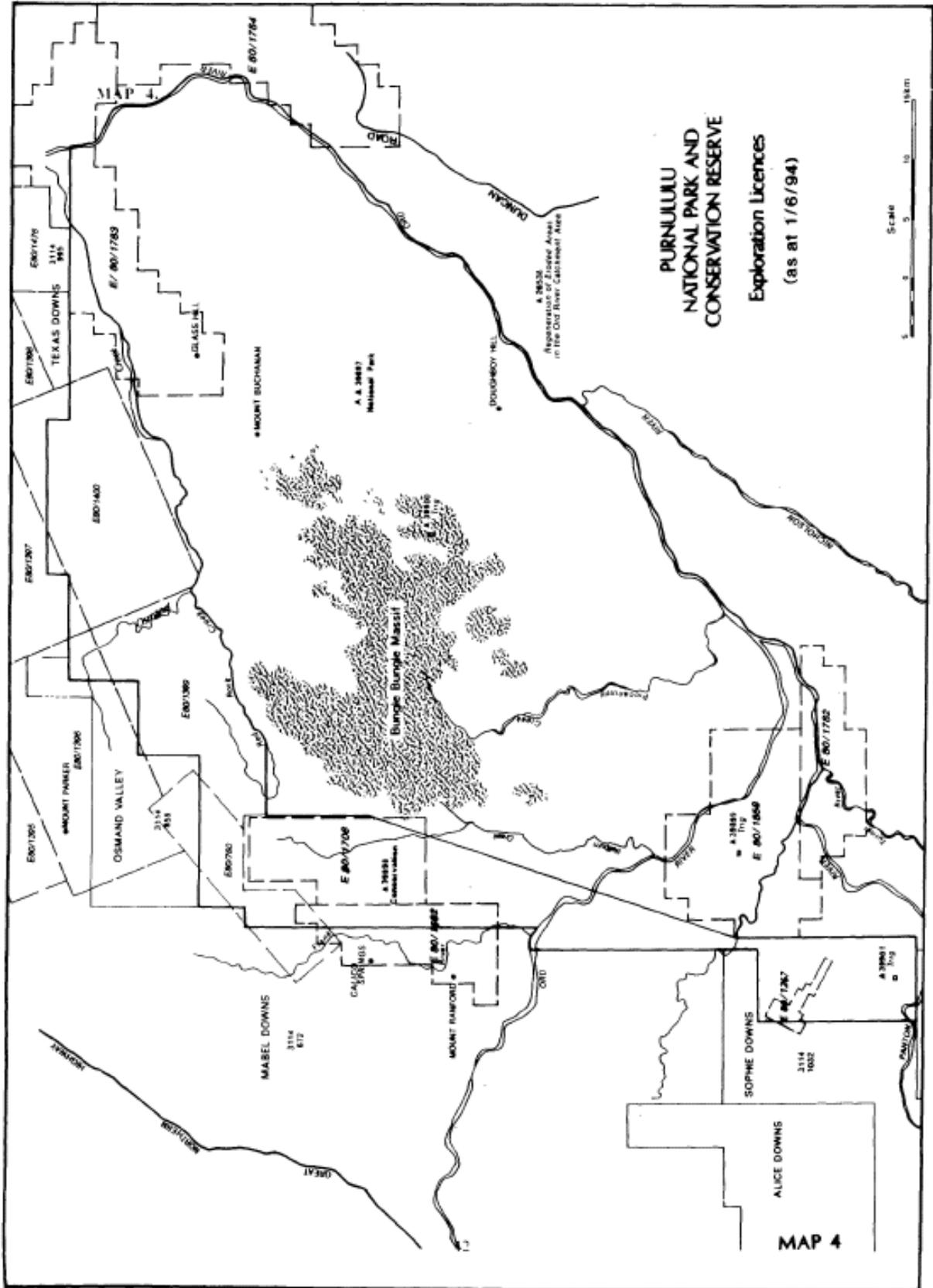
The Antrim Plateau Volcanics forms the base of the Ord Basin and is probably Early Cambrian in age (590-545 Ma). This is an extensive unit that extends as far as Katherine in the Northern Territory. These volcanics form heavily dissected hills and easily eroded black soil plains in the southern and western part of Purnululu. The Antrim Plateau Volcanics are overlain by a sequence of Cambrian (590-500 Ma) shale, limestone and sandstone known as the Goose Hole Group.

The Goose Hole Group includes all sediments considered to be of Cambrian age within the Ord Basin. It includes the Negri Subgroup and the overlying Elder Subgroup.

The Negri Subgroup includes the Headleys Limestone, Nelson Shale, Linnekar Limestone and Panton Formation. The Headleys Limestone lacks fossils and is very resistant to weathering, forming distinctive walls in the western part of Purnululu which protrude above the surrounding country. The overlying Linnekar Limestone is highly fossiliferous, containing trilobite and shell fossils.

The Elder Subgroup includes the Eagle Hawk Sandstone and Overland Sandstone (Map 3). The Goose Hole Group is in turn overlain by the Mahony Group, which is probably of Devonian age (410-360 Ma). This group includes the Glass Hill Sandstone and lesser outcrops of the Boll Conglomerate and Purralili Sandstone.

The Glass Hill Sandstone forms the Bungle Bungle massif and is a friable, porous, well sorted, clean, white, quartz-rich sandstone. It is typically crossbedded and ripple marked indicative of a dry depositional environment. This is also indicated by the occurrence in this formation of rare trace fossils of indeterminate age. The large dome-shaped features and deep crevices found across the massif are formed by weathering and erosion along joint planes.



Economic Geology and Mining

Occurrences of many metalliferous minerals, particularly copper, are known throughout the region. The Proterozoic lithologies in the western and northern part of Purnululu Conservation Reserve are prospective for copper, gold, silver, platinum, diamonds and base metals. The Bungle Bungle Dolomite north of the Park is prospective for stratabound copper, lead and zinc mineralisation. Yttrium is known to occur in the early Proterozoic and middle Proterozoic at two localities north-west of the Piccaninny Structure.

Occurrences of copper minerals have been reported from many localities in the Antrim Plateau Volcanics. Most of these deposits consist of carbonates, chalcocite and cuprite stainings or as native copper occurring as vesicle fillings or as sparse disseminations. Vesicles in the volcanics often contain zeolite gemstones. Copper staining has also been observed in the Headleys Limestone in widespread localities in the area. The Antrim Plateau Volcanics, Glass Hill Sandstone and the carbonate formations in the Ord Basin are potential ground water sources in Purnululu.

In defining interim boundaries for Purnululu National Park, areas with known mineral potential and granted exploration licences were excluded from the National Park. These prospective areas were, however, included in the Conservation Reserve adjoining the National Park (Map 4). This provided for mineral exploration and any eventual mining to proceed in a regulated and environmentally acceptable fashion while enabling both the National Park and Conservation Reserve to be managed as a single unit.

Whilst exploration and mining in national parks is allowed by government policy subject to stringent approvals and controls it is unlikely that applications for either would be approved in Purnululu National Park. Exploration and mining within Purnululu Conservation Reserve is allowed subject to approval by the Minister for Minerals and Energy following recommendations of the Minister for the Environment, the PPC and the NPNCA (Section B 3.2). Any proposal will be subject to environmental assessment by the EPA and the protection of sites and objects of Aboriginal significance as provided for by the Aboriginal Heritage Act 1972-80, and in accordance with environmental assessment procedures identified in this plan (B.2 Environmental Assessment).

Extraction of Road Building Material

Park operations will require materials such as gravel and limestone for road and building construction. Under Section 9(2) of the Mining Act 1978, the Executive Director may authorise the extraction of these materials within the reserve for purposes such as road making or building. Borrow pits will be identified for this purpose.

1.3 Soils and Geomorphology

Landforms of the National Park and the surrounding area have been mapped by Stewart et. al (1970) and de Salis (1982). The studies were based on land systems, which are areas of land with a recurring pattern of physical and biotic characteristics. The EPA Working Group summarised the information for land systems in the Park. Broadly there are seven land systems within the Park, which can be amalgamated into four distinct areas:

The **Northern Uplands** consist of the Osmand Range, Osmand Plateau and incised structurally controlled valleys. The Osmand Range and Plateau rise up to 400 in above the plains of the south. The plateau is roughly oval in shape, surrounded by near vertical cliffs. It is incised by short valleys in the north, while in the west and south large folds have produced a dramatic series of steep rock faces, valleys and ridge lines. The rocks are Proterozoic siltstones,

sandstones, shales and conglomerates up to 2500 Ma. The Osmand Ranges extend to the east of the Plateau, and are a series of fault bound ridges.

The valleys in this area tend to be narrow V-shaped or flat floored with steep walls. Erosion along structural weaknesses in the rocks by streamflow has produced some spectacular scenery, for example Osmand Creek, Wade Creek and Red Rock Creek. Soils are variable with stony, shallow soils on the upland areas, duplex soils mid slope and alluvial tracts along stream beds and outwash fans.

The Western Uplands are chains of folded hills and ridges, separated by broad undulating valley floors. The high ridges trend north-east to south-east in three main bands 5 km apart, rising over 200 m from valley floors. The footslopes of the ridges are made up of tightly folded hills, particularly around Frank River and Bellburn Creek. The high ridges consist of conglomerates, sandstones, phyllites and limestone. Of particular note is the ridge of old marine limestone which rises up to 30 m above the plains west of the massif and runs for over 15 km, and the high sinuous ridge in the south-west of the Park, rising up to 220 m and continuing unbroken for over 12 km. Soils vary from shallow stony soils on ridge tops to coarse sand and boulders on some footslopes. Gravelly soils occur on valley floors and low ridges, while fine clay soils occur in low, ephemeral wet areas on the periphery of . Areas of alluvium occur on levees along creeks.

Massif and related outliers. The Bungle Bungle massif is a large plateau bound by steep cliff faces and incised with a large number of joint bounded valleys. The beehive or dome forms which characterise parts of the massif are a result of leaching of minerals within the sandstone, erosion of joints in the rocks and the subsequent development of convex upper slopes with near vertical sides. The massif can be subdivided into separate landform units:

The *plateau* surface, which lies about 200 m above the surrounding plain, is relatively flat with distinct benches related to rock type and jointing. It is best developed in the central and western parts of the massif. Of particular interest is the Piccaninny Structure described by Beere (1983) where the deformed rocks, alignment of joints and alteration indicate possible impact by a meteorite.

Incised valley forms are found mainly in the northeastern and western part of the massif. Stream dissection of this area has led to the development of narrow, sheer sided gorges and chasms, extending over a kilometre into the massif.

Domes, towers and sinuous ridges are common in the southern and eastern areas of the massif. They occur as single dome forms, or as tiers, rising up to 150 m. The ridges are formed by silicification of joints. Distinct orange and grey/black bands on the surface are silica and lichen skins, developed over sandstone with a clay cement.

Cliff face. A linear sheer cliffed plateau edge runs along the western side of the massif. There are some small streams incised into the slightly dipping beds of the rock face.

Large incised valley forms are located on the southwest and central south, for example Piccaninny Gorge. These features exhibit structural control along large fractures in the massif. The valleys are flat-bottomed and several kilometres long, with sheer sides rising up to 200 m.

Outliers from the massif are common. These form large, complex domes, tiers and cliffs. There are also small relict domes, sheets and stacks, many of which are deeply weathered and highly erodible.

Plains. Approximately two thirds of the National Park is made up of flat to undulating plains. There is little relative relief, but there is a gentle slope of 100 m away from the massif toward the Ord River. A series of small escarpments and plateau remnants exist along the Ord River.

1.4 Hydrology

Surface Water

Five main river basins drain the East Kimberley region: the Ord, Pentecost, Fitzroy and Keep Rivers drain to the sea and the Sturt Creek inland. By far the largest system is the Ord River Basin, draining more than half of the East Kimberley. A major dam, the Ord River Dam (Lake Argyle) was completed in 1972 to provide water for the irrigation of new agricultural areas. The northern boundary of the Park is about 60 km south and upstream of Lake Argyle. The Park lies entirely within the Ord Dam catchment, but comprises less than 7% of the total catchment area.

Although the area receives an annual rainfall of about 600 mm, the evaporation rate is very high, at more than 2000 mm/yr (Slatyer 1970), and run off is rapid. Consequently, there is very little permanent surface water in the area. All rivers contain running water for periods and many have underflow, but none flow continuously during the dry season. Throughout the dry, however, permanent and seasonal pools of water do exist where groundwater flows from permeable and jointed rocks. Because of the sheltered nature of the terrain the narrow valleys of the massif may contain seasonal and possibly some permanent pools.

Pools and springs provide important refuge areas for flora and fauna in an otherwise seasonally dry landscape. The presence of water also enabled Aboriginal people to remain in this part of the country during the dry season. Several key surface water resources in the Park were traditional dry season camps and as such have special significance for Aboriginal people. The Osmand Creek system provided a safe route for long journeys, with reliable water at frequent intervals.

Groundwater

No detailed investigation of the groundwater resources of the Park has taken place, and what resources exist are likely to be limited and only of local significance (Water Authority of WA pers. comm). It can be expected, however, that suitable groundwater reserves exist to meet the demands of domestic and tourist needs in the Park.

Dow & Gemuts (1969) and Passmore (1964) investigated the hydrogeology of the region. From their research it is possible to predict the likely occurrence of groundwater resources in the Park. The presence of groundwater is dependent upon the local rock types and structural features and is influenced by the thickness and permeability of any overlying alluvium. The hydrological cycle is also affected by

Table 1.
MAJOR ROCK TYPES AND HYDROLOGICAL PROPERTIES

Geological Era	Rock Type	Surface Water	Groundwater	Comments
Lower Proterozoic or Archaean	Halls Creek group and Lamboo Complex	Rare	Not common but may occur where strong jointing and faulting occur.	Groundwater resources generally not predictable from surface indications. Water quality poor, with high concentrations of dissolved salts.
Upper Proterozoic	Igneous	Rare	As for Lower Proterozoic.	May yield water from weathered material or large joints.
	Sedimentary	Plentiful	Good potential aquifers where jointed.	Generally outcrop in rugged country; the hard rocks are difficult to drill but water quality is very good.
Palaeozoic	Antrim Plateau Volcanics	Not Common	Usually present	Good quality water should be obtainable from blocky joints.
	Negri group	Not Common	Present in joints and cavities in limestone beds.	Generally highly mineralized. Surface indication of groundwater not obvious.
Devonian	Elder sandstone	None	Good potential	No bores have been drilled but could produce high quality water.
Cainozoic	Alluvium	Along drainage channels	Good potential	Successful bores exist, especially along drainage lines.

Source: Passmore 1964.

vegetation cover which may deplete surface and shallow underground water through transpiration. Table 1 summarises major rock types and their general hydrological properties.

Many of the producing wells and bores of the region draw water from alluvium. Successful bores have been drilled at the old Bellburn Creek campsite and at Kawarra and further drilling is in progress. Other bores were operated during pastoral days, for example Piccaninny, Dry Swamp and Eaglehawk. Bores located in sandy alluvium should recharge during the wet from nearby sandstones. Water supplies from bore sources could be supplemented by roof catchments and tank storage from Park buildings.

1.5 Landscape

A landscape character type is a broadscale area of land with common visual characteristics predominantly based on landform, vegetation and waterforms and the diversity of these characteristics. Eight landscape character types have been established for the Kimberley Region of Western Australia (Kimber 1988 unpubl). Two - the Uplands and Ord River Plains - are represented in the Purnululu National Park study area.

Springvale Hills Character Type

These uplands extend in a broad band from the Dampier-Fitzroy Plains in the south western portions of the Kimberley Region to the Cambridge Gulf lowlands in the north east. It is geologically and topographically diverse but has common visual characteristics. Subtypes identified within this character type include the Osmand Ranges and the Bungle Bungle massif which each exhibit features common to the broadscale type, yet are marked by distinctive characteristics:

Osmand Range Subtype

The Osmand Range subtype is characterised by rugged ridges and severely dissected valleys. Vegetation cover varies from sparse spinifex islands clinging to steep rock faces to steppe woodland areas of *Eucalyptus brevifolia* and *E. terminalis* to isolated remnant rainforest patches. Valley landscapes are of exceptional visual diversity and distinction with permanent streams, pools and swamps supporting a lush and unusual combination of species. As most of this subtype is inaccessible, past land use has had little permanent impact on scenic quality with the exception of roads and localised erosion in valley areas. Waterforms such as streams and pools are of exceptional visual interest due primarily to their scarcity and combinations of unusual vegetation and landforms.

Bungle Bungle Massif Subtype

The Bungle Bungle massif subtype is characterised by a plateau landscape rising dramatically from the surrounding plain. The contrast between horizontal and vertical planes is emphasised by sheer sided walls rising to 300 m, incised canyons and sandstone towers.

Towers, which occur in clusters, ridges or free standing forms have become synonymous with common images of the Bungle Bungle landscape. Incisions in the sandstone structures of the massif result in gorges and valleys of immense diversity and visual interest such as Piccaninny Gorge which dissects a large portion of the central plateau. Other dissections occur as narrow chasms. Where rock is more resistant to erosion, vertical faces and seasonal waterfalls result. A striking feature of the landform is its banded colour zones and textural patterns emphasised by light and shadow.

Ord Plain Landscape Character Type

The second landscape character type represented in the study area is associated with the Ord River and its major tributaries. The area is underlain by volcanic rock, limestone, shale, siltstone and Elder Sandstone. The Ord River system has formed low lying plains which are largely covered by residual and alluvial soils. Rock outcropping occurs sporadically to provide some interesting relief. The northern section of the type - beyond the National Park boundaries - has been inundated by Lake Argyle.

The landscape is characterised by extensive expanses of undulating sandy plain with low hills in association with the Ord River and its tributaries. Boulders and rock outcroppings are of special interest. Soils are red to yellow sands,

often exposed due to sparse vegetation, drainage channels and erosion. Black soil areas occur along some drainage lines. Vegetation patterns are diverse, ranging from dense streamside forests to uniform grass/shrub expanses. Vegetation cover is classified as steppe woodland with extensive areas of eucalypts, acacia and grasses (spinifex/bunch grass). Patterns are created by combinations of vegetation types either in clumps or singly across the landform. River fringing forests are well developed and sometimes multistoried, with River Red Gum *E. camaldulensis* and cajeput *Melaleuca leucadendra* dominant.

Surface water occurs throughout the type in association with the Ord River and its tributaries such as Piccaninny Creek, Red Rock Creek and Osmand Creek. While most waters are ephemeral in nature, permanent pools such as Blue Hole and Fowl House do occur. Water, when present, becomes a dominant visual attraction. The entire landscape type has had a long history of grazing, which has caused gully erosion, loss of vegetation and stream siltation. The visual legacy of this past land use is severe, with the worst affected areas adjacent to the rivers and permanent pools.

1.6 Flora and Vegetation

A comprehensive survey of wildlife and vegetation of the Park and adjacent area (Woinarski 1992) has added enormously to what was previously only a reasonably descriptive database compiled from a number of broadbased studies in the East Kimberley. The report lists 616 vascular plant species from the Purnululu area, an approximate 50% increase in species from that previously recorded. Thirty five notable species are listed, including several probable new species, new records for Western Australia, new records for the Kimberley and species at the limits of their known range. A more recent survey concentrating on border areas of the Park (Braithwaite, Cowie and Gambold 1991) identified 35 species new to the area, four of which had not been recorded in Western Australia (*Alysicarpus glumaceus*, *Acacia megalantha*, *Phyllanthus grandisepalus* and *Scleria lingulata*).

Perry described the vegetation of the Ord-Victoria area as a part of the CSIRO Land Research Series (Stewart *et. al* 1970). Beard (1979) subsequently described the Kimberley in his vegetation survey of Western Australia, and de Salis (1982) gives an account of the vegetation in his report on the Ord River Regeneration Reserve. De Salis looks at the vegetation with respect to rangeland management, describing the major species composition of each of the land systems. A botanical survey of the Bungle Bungle and Osmand Ranges was undertaken by Forbes and Kenneally (1986) in which 18 vegetation types and an annotated list of 403 species were identified. This survey provided great detail at a number of selected locations, but a large area of the Park had still not been traversed or surveyed,

Ethnobotanical reports by Rose (1984) and Scarlett (1984) described the plant resources known to the Kija people who were traditionally associated with the Purnululu area. They recorded an extensive list of plants used for food, medicine, implements and other uses.

Regionally, the Park falls into an intermediate rainfall zone, characterised by sparse low woodlands and midheight grasslands (Beard 1979). Using the various sources of information mentioned above, and a limited amount of aerial photo -interpretation on, the plant communities of the Park have been classified according to structure. The method was adapted from Beard (1979) and is based on the grass layer as the ecologically dominant structure. There are small isolated tracts of closed forest occurring in which grasses are virtually absent.

Three types of grassland are recognised (Table 2): savannah, where the grass layer is closed and bunch grasses dominate; steppe, where the grass layer is open and spinifex⁵ (hummock) grasses dominate; and mosaic, which is a mixture of both savanna and steppe grasses.

The plateau of the Bungle massif supports a sparse tree steppe with an upper storey of *E. cliftoniana* and *E. aspera*, scattered *E. collina* and a sparse middle layer of *Grevillea* and *Acacia* spp. Ephemeral streams on the plateau support limited pockets of low open forest with a shrub understorey.

The chasms and cliffs of the massif generally hold little permanent water and are, therefore, unable to support closed forests such as those found in Osmand Valley. These sheltered habitats, however, provide refuge for species from drought, climatic variation and fire. Creepers and ferns are common in damp areas and the undescribed palm *Livistona* sp 'Victoria River' is characteristic of the gorges in the western part of the massif. *Grevillea psylantha* is an endemic species known only from the Purnululu area (Forbes and Kenneally 1986). The plains immediately surrounding the massif are mostly hummock grasslands supporting a sparse woodland with an overstorey of *Eucalyptus* spp. and a middle storey of *Grevillea*, *Hakea* and *Acacia* spp.

The vegetation map (Map 5) shows that the National Park comprises a large area of spinifex (hummock) grassland associations surrounded by a narrow band of savanna woodland. An extensive area of savanna woodlands, shrublands and grasslands occurs to the south and east of the Park. The frontage plains of the Ord River have been heavily degraded with extensive sheet and gully erosion resulting in minimal ground cover in places. The major vegetation of the interfluves is an association of introduced species including birdwood grass *Cenchrus setiger* and kapok bush *Aerva javanica*. Of the invasive alien species in the Park, the perennial shrub *Parkinsonia aculeata* appears the most significant from a conservation perspective. This species may occur in dense stands on the banks of the Ord River and appears to have the potential to invade other riparian areas in the Park (Woinarski 1990). *Calotropis procera* is common on some otherwise bare areas where it forms open to moderately dense stands. In depositional zones, patches of denser vegetation can be found, and around permanent pools such as Blue Hole, there is a small but significant area of closed forest.

Permanent and ephemeral streams in the Osmand Valley support the most south-easterly extension of well developed closed forest recorded for the Kimberley which is of regional significance and has special conservation value. Forbes and Kenneally (1986) recorded a number of rare and restricted species from this area.

In May 1988, two sites in the far south-east Kimberley along the northern face of the Osmand Range were visited by survey teams from CALM who were studying remnant rainforests of the Kimberley Region. Preliminary results from these sites show a number of rainforest plants were present as well as a few woodland species. The rainforest plants included some canopy trees and shrubs. These small, isolated thickets depend on the presence of fresh water.

Eucalyptus cupularis grows on the Osmand plateau, and is perhaps the most northerly occurrence of the species (C. Done pers. comm). Hot springs surrounded by pockets of closed forest have been reported. From Winnima Gorge - north of Palms Yard - Forbes and Kenneally (1986) collected a number of important species, and recorded that the surrounding dry steppe woodland is significant and of high educational value.

5 The term spinifex refers to hummock grasses of the genera *Triodia* and/or *Plechtrachne*.

Table 2.
CLASSIFICATION OF VEGETATION COMMUNITIES

Tree and Shrub Layer	Bunch Grassland	Spinifex (Hummock Grassland)	Mosaic Grassland Units	Grassland Absent or Virtually so
Trees and shrubs forming a closed canopy				Closed forest
Trees and shrubs forming a canopy which is generally open	Savanna Woodland	Steppe Woodland		
Trees scattered or sparse	Sparse trees Savanna	Sparse trees Steppe	Sparse trees with mixed bunch grass and spinifex	
Shrubs only	Shrub Savanna	Shrub Steppe	Shrub with mixed bunch grass and spinifex	
Trees and shrubs absent or virtually so	Grass Savanna	Grass Steppe		

Source: Beard 1979.

It is apparent from talking to traditional custodians that there have been some dramatic changes to the vegetation of the Purnululu area since the onset of the pastoral era. Many of the traditional food sources which were once abundant are now scarce, especially the root foods, seeds and lilies (Rose 1984).

Disturbance, including changes in burning practices and selective grazing by introduced animals, appears to have affected some species on the sand plains, favouring the increased occurrence of *Acacia* spp. and the bunch grass *Heteropogon contortus* (Forbes and Kenneally 1986). Anecdotal evidence (R Wallaby) suggests that Cyprus Pine, *Callitris intratropicca* occurred in the Park. This has not been recorded in any flora surveys indicating a very low occurrence, or even that the species is no longer present in the Park due to a history of inappropriate grazing or fire regimes.

Extensive biological survey data is vital in planning for the management of the vegetation on a broad scale. Special areas requiring protection can be identified, such as the sheltered chasms and gorges of the massif and the semi-permanent and permanent streams and waterholes. These areas will not withstand high pressure activities, such as camping or vehicle use.

1.7 Fauna

Woinarski (1990) lists a total of 298 vertebrates (149 bird, 81 reptile, 41 mammal, 15 fish and 12 frog species) for the Purnululu area. This fauna comprises a mixture of widespread species, species typical of the tropical north (Torresian) and a minority of species characteristic of and Australia (Eyrean).

Species are distributed very unevenly within the Bungle Bungle area. Torresian species occur mostly in the relatively tall and dense riparian vegetation of the main water courses and in the more sheltered gorges. These areas represent the local southern (inland) limit for many such species (for example, Bar-breasted Honeyeater, Pale Field-Rat, Large-footed Mouse-eared Bat, Common Koel, Olive Python). Rocky ranges with spinifex - Osmand Range, Bungle Bungle massif, Turner area - have a very different fauna including some notable species whose range is otherwise largely confined to the and centre, including the Desert Mouse *Pseudomys desertor* and the skink *Egernia slateri*. Other rock-dwelling species include the Common Rock-rat, Rock Ringtail Possum, Short-eared Rock Wallaby, White-quilled Rock-Pigeon, Variegated Fairywren, Sandstone Shrike-thrush, Copland's Rock Frog, the monitors *Varanus glauerti*, *V. kingorum* and *V. acanthurus* and the skink *Cryptoblepharus megastictus*.

Another distinctive group of species occurs on the blacksoil plains of the Ord basin; these include the Northern Nailtail Wallaby, Rufous-throated Honeyeater, Rufous Songlark, Golden-headed Cisticola, Australian Bustard and Singing Bushlark. The extensive sandplains surrounding the massif characteristically contain Sand Goanna, Delicate Mouse, Western Chestnut Mouse, Stripe-faced Dunnart and the skink *Lerista greeri*. Yellow-throated Miners, Northern Rosellas and Pied Butcherbirds are abundant where these sandplains carry taller woodlands.

Muir (1983) compiled a list of birds and mammals recorded in the vicinity of Bungle Bungle Outcamp, and CALM staff have since been recording birds sighted in the Park.

At least four species of Macropod occur in the Park: the Euro *Macropus robustus*, Agile Wallaby *M. agilis*, Northern Nailtail Wallaby *Onychogalea unguifera*, and the Short-eared Rock-wallaby *Petrogale brachyotis*. Dingoes

are common in the area and numerous tracks from small mammals and reptiles, as yet unrecorded, are found in sandy creek beds.

Some detailed fauna surveys have been undertaken in nearby areas. Kitchener (1978) reported on museum surveys of Lake Argyle in 1971 and 1972 and an area just south of Lake Argyle - near Lissadell Homestead - in 1976. McKenzie (1981) surveyed certain areas of the southwest Kimberley which is described as similar in both climate and habitat to the East Kimberley.

Kitchener (1978) noted the Ord River area does not appear to support any and zone species. This survey found the East Kimberley relatively rich in bats but with fewer rodents than the North Kimberley. Notably absent from these collections were some arboreal species such as the Sugar Glider and Scaly-tailed Possum. The survey also failed to find any bandicoots or native cats, both of which were known to be in the area at the time of the first European settlement. Overall, the study area appeared low in both species and numbers.

It is reasonable to expect that the sheltered, moist habitats of the gorges and chasms provide refuge for a variety of fauna, just as they have been seen to protect significant flora (A 1.6 Flora). In addition, some of the gorges may protect fire-sensitive species, as there are some areas which show no evidence of recent fire history, and which have rarely if ever been burnt.

15% of the Park comprises grass savanna which is one of the six ecosystem groups most critically in need of conservation on a world-wide basis (Environmental Protection Authority 1980). Unfortunately, this area also includes some of the most degraded parts of the Park. It is encouraging to note that CALM staff have recently observed an apparent increase in the number of emus in this area, perhaps indicating some recovery in condition of the Ord frontage plains.

The presence of domestic pets in national parks, particularly dogs and cats, is a controversial issue. Domestic pets interfere with native wildlife and hence impede wildlife viewing by visitors; they can also be a general nuisance to visitors and, in particular, foul camping and other visitor areas. In some circumstances they may escape and become feral. Because of these problems, CALM does not allow unrestricted entry of domestic pets into conservation reserves, but Departmental policy does allow park residents to keep domestic pets if they are confined to residential areas. However, due to the difficulties in controlling feral cats, and since both domestic and feral cats are well known for their destructive predation on native fauna, cats will be prohibited from the Park including residential areas. Staff living within the Park will be permitted to keep dogs with the permission of the Regional Manager (Section B 4.6).

1.8 Rehabilitation

As a result of exploration from 1876-79, Alexander Forrest prepared favourable reports on Kimberley pasture lands, leading to the introduction of cattle in 1884 from Queensland and New South Wales. A number of good seasons and plenty of surface water saw stock numbers increase rapidly to 673 000 head of cattle in 1918.

This enormous grazing pressure, together with periods of drought and a change in fire regime led to changes in the fragile plains and river frontage ecosystems. Composition of the vegetation changed due to selective grazing and in some places vegetation disappeared altogether from large areas of land, leaving the unprotected soils to be eroded by

wind and water. De Salis (1982) notes that erosion in the Ord River catchment was a subject of concern as early as the 1940s but no action was taken to arrest the damage until it was realised the enormous siltation could threaten the success of the Ord River Dam.

In order to curtail this situation, a large area of the Ord River catchment, including the former Ord River, Turner and parts of Flora Valley, Elvire Downs and Ruby Plains pastoral leases, was resumed by the Government. Control of these lands was vested in the Minister for Agriculture. The Department of Agriculture embarked on a regeneration program with extensive fencing and a stock control program. The mustering and removal of cattle in the Park area began in 1985. Natural rehabilitation was slow to occur due to the extreme degradation of some areas and the lack of soil seed reserves. Strip contour cultivation and limited seeding with some exotic but hardy pioneer species, Buffel grass *Cenchrus ciliaris*, Birdwood grass *C setiger* and Kapok bush *Aerva javanica* have been generally successful. These three species were all very common before the 1985 seeding trials. Only extremely small parts of the areas treated were actually seeded, with most of the treated areas left to regenerate naturally from surrounding vegetation by wind-blown seed. This was also very effective. In both cases the main reason for successful rehabilitation was feral animal exclusion.

Most of the intensive regeneration effort in the first 20 years concentrated on an area outside the Park to the south and east of the Ord River. Efforts to muster cattle and donkeys to the north and west of the Ord (inside the Park) were frustrated by the lack of access to this area for several months each year during and after the wet season.

A resource inventory and condition survey of the Ord River Regeneration Area was carried out by the Department of Agriculture in 1981. In that survey, the area was classified into land systems and land units and an assessment made of each unit, together with recommendations for future management (de Salis 1982).

Since 1985 the Department of Agriculture has turned its attention north and west of the Ord River, to the area which is now National Park and Conservation Reserve. Generally, the worst degradation has occurred on the most productive pasture lands - that is, areas with palatable grasses, close to water and good accessibility. The main exception to this is the black soil plains which have been heavily overgrazed but have remained mainly free of erosion. At the time of the Department of Agriculture survey, the total area of Park which was substantially affected by erosion amounted to about 14 000 ha. While this is an enormous area to rehabilitate, it amounts to only 4.3% of the combined reserved lands. Those land units remaining in good condition tend to be the rugged upland or sandplain areas, generally not close to water and supporting vegetation which is unpalatable to stock.

The most degraded areas occur in the Antrim, Nelson and Elder land systems (de Salis 1982). 33.5% of the total erosion in the Park has occurred in the Antrim lowlands unit which is a narrow belt to the north and west of the massif with cracking clay soils and a sparse to open savanna woodland which has been heavily grazed.

The Nelson land system lies along both sides of the Ord River. The frontage land unit comprises the silts and loams of the Ord River flood plains and supports a fringing woodland over a ground storey of mixed perennial grasses. The area has suffered severe gully erosion and makes up about 30% of the total eroded area. The interfluvial lower slopes of the Nelson land system have also suffered severe erosion. The calcareous soils form thin surface crusts but are friable and powdery if disturbed. Most of the vegetation has been removed from this land unit. The lower slopes of the Elder land system also have friable calcareous soils. The sparse vegetation has been heavily grazed, causing some gully and sheet erosion.

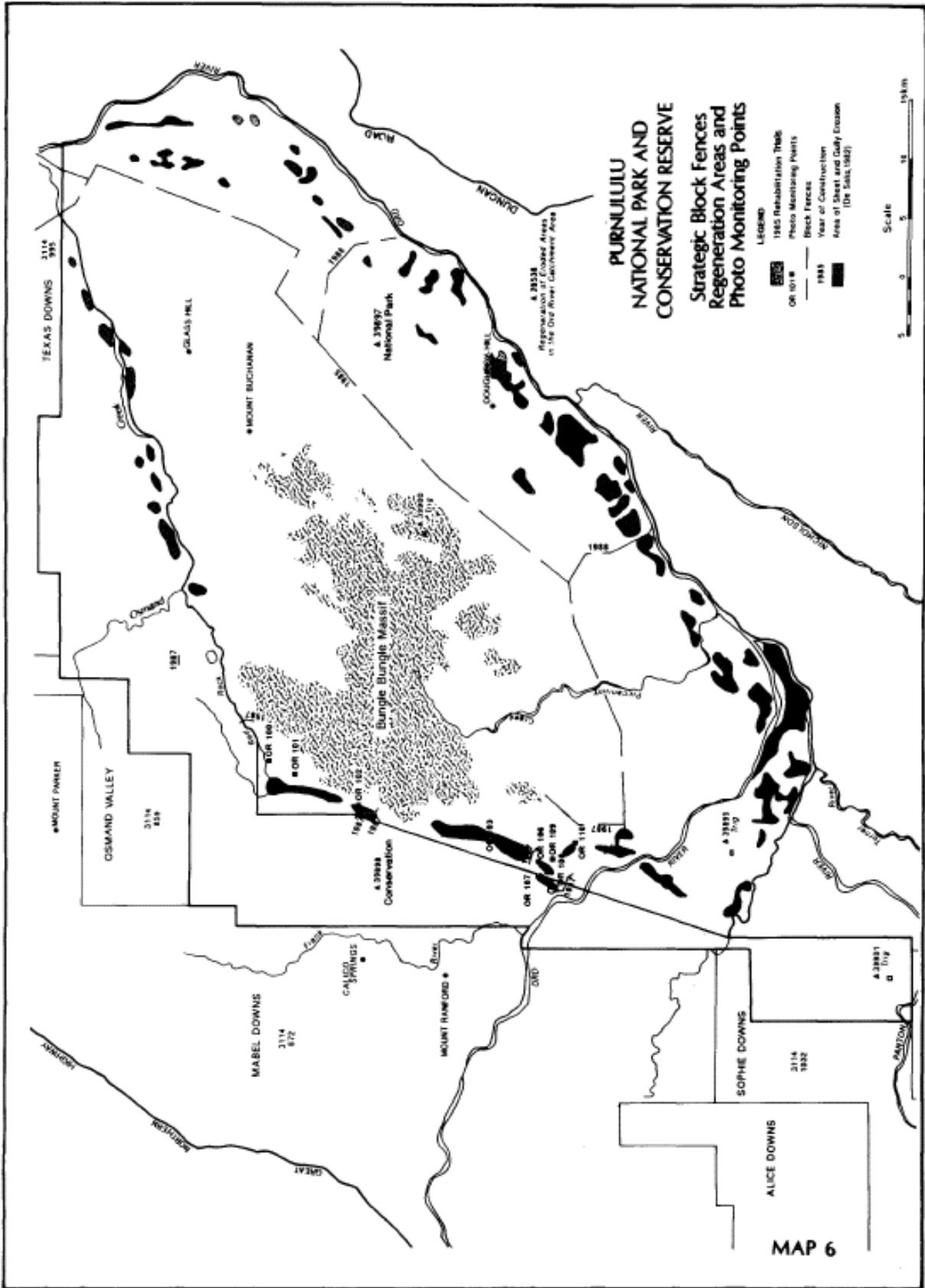


Table 3. LAND SYSTEMS AFFECTED BY EROSION

Land System	Sheet Erosion		Gully Erosion		TOTAL	
	Area (ha)	% Of Total	Area (ha)	% of Total	Area (ha)	% of Total
Dockrell Uplands	46	0.9	98	1.1	144	1.0
Elder Ceustas	99	2.0	689	7.9	788	5.8
Elder Lower Slopes	693	14.0	1248	14.3	1941	14.2
Antrim Lowlands	2918	58.8	674	19.1	4592	33.5
Nelson Interfluve Lower Slopes	1095	22.0	767	8.8	1862	13.6
Nelson Cracking Clay Plains			60	0.7	60	0.4
Nelson Frontage	114	2.3	3960	45.3	4074	29.7
TOTALS	4965	100.0	8738	100.0	13703	100.0

Source: de Salis 1982.

Rehabilitation Program

The aim of the existing rehabilitation program is to stabilise soils through the return of perennial vegetation. This requires a reduction in grazing pressure and re-establishment of vegetation by natural regeneration, cultivation and re-seeding.

In early 1985, a 90 km stock fence was constructed between Osmand Creek in the north and Dixon Range in the south. This fence restricted cattle movement making their mustering and removal more efficient. During 1985 and 1986, approximately 25 000 head of cattle were mustered and removed from the Ord River frontage, Osmand Creek and Purnululu area. In addition, some 3 500 donkeys, 600 cattle and nine camels were destroyed with the assistance of the Agriculture Protection Board.

The program of feral animal control was continued in 1987, organised jointly between the Department of Agriculture, CALM and the Agriculture Protection Board. A total of 599 donkeys and 643 cattle were shot in the Park that season. Relatively few cattle or donkeys were found on the western side of the massif at that time, but the Osmand Creek and Ord River systems still support populations of both. An Agriculture Protection Board cull in October of 1990 recorded fewer head than expected, indicating that methods of control are proving effective. This is further evidenced by substantial natural regeneration occurring in some of the more degraded areas. Dense vegetation and deep gorges provide safe refuge for stock and make mustering or shooting very difficult.

In order to reduce reinfestation of stock and confine those animals already in the area, a number of block fences were constructed in 1987-88 (Map 6). Some photographic monitoring points and trial plots for regeneration were established in 1986. In addition to the cultivated plots some large scalded areas east of

Blue Hole have quickly responded to the reduced grazing pressure and maintained a good cover of selfseeded, short annual grasses over the 1987 dry season. During the 1990 dry season a grader was used to rip highly degraded areas in patches alongside the main internal road. In October 1990 inspection showed a large reservoir of seed and organic debris accumulating in these cultivated areas. Reports from Park Rangers in March 1991 indicate very high germination rates following a return to average rainfall after several years of drought. It is expected that the combination of natural and cultivated processes in the absence of grazing by feral stock will lead to substantial improvements in ground cover and to stabilisation of eroding soils.

Some inherently stable land systems are further protected by their inaccessibility to feral animals (Dockrell and Wickham land systems and the uplands of the Elder, Buchanan, Gordon, Headley and Antrim land systems), while the spinifex slopes of the Gordon land system are basically unpalatable to stock. These should require little direct input apart from a management policy that prevents degradation in the future.

However, areas of the Nelson land system and the frontage/erosional plains of the Gordon land system are far less resilient land systems. They will require considerable work to return large areas from their current degraded status to even fair range condition. The tussock grasslands, composed of mid-height perennials, are particularly prone to overuse and degradation. Erosion (caused by overgrazing and consequent destruction of the vegetation cover) has produced a smooth, hard, bare surface in many parts of these grasslands. Water infiltration rates are low and soil seed bank reserves are virtually non-existent. These less resilient vegetation types must be protected from further deterioration. It is in these areas that rehabilitation management activities should initially concentrate.

Where possible, rehabilitation will be viewed in the context of the Ord River catchment sedimentation problem, with priority given to areas of greatest sediment contribution. A photographic record will continue in monitoring site recovery. Woinarski (1990) states that the use of - or at least experimentation with - native pioneer grasses should be mandatory. Also recommended is much more extensive experimentation using native plant species for the rehabilitation of all degraded areas in the Park. This experimentation into rehabilitation should be considered over a long enough period to incorporate the influence of burning regime and over many years of rainfall variability.

1.9 Fire

Fire has always been a feature of the northern Australian environment. Natural fires, the result of lightning, often occur during the build up to the wet season around October-November and through to the wet season. However, fire also occurs as a result of human activities and practices, and this has been the case throughout the 20 000 or more years of Aboriginal occupancy of the Kimberley.

The usual pattern of traditional Aboriginal burning was to fire small strategic patches of country at different times, with occasional larger burns later in the season resulting in a complex mosaic of different fire ages (Haynes 1985, Kimber 1983, Lewis 1985). Other research indicates this patchy burning produces a mixture of open and dense vegetation which supports a range of animal species with different forage and shelter requirements (Burbidge 1985, Hallam 1985, Latz and Griffin 1978). Such a mosaic also provides an effective buffer against passage of wildfires.

Since the turn of the century burning practices have been greatly modified with the movement of Aboriginal people from the bush to population centres. At the same time, throughout much of north-west Australia, pastoralists adapted the use of fire to promote the productivity of cattle. Information from local residents of the East Kimberley indicates that the general practice of pastoralists has been to fire the spinifex country to promote feed for cattle. Sometimes fire was also used to drive cattle. No detailed records have been kept, but fires during the pastoral era have tended to be large, apparently resulting in larger, more homogeneous areas unlike the small scale mosaic of vegetation patterns resulting from traditional Aboriginal burning practices.

Selective grazing pressure and frequent widespread fire led to changes in the vegetation. The mosaic structures have mostly been destroyed and it is believed that this has played a major part in the disappearance or reduction of many plants and animals. Burbidge (1985) and others have noted a decline in the critical weight range mammals (45 g - 5 kg) of the and zone which seems to coincide with the cessation of traditional burning practice. By manipulating fire periods, intensities and size, habitat suitability can be controlled for particular target species and ecological diversity maximised (Woinarski 1990). For example, the Desert Mouse (*Pseudomys desertor*) favours areas of mature spinifex subject to infrequent fires.

In recent years, since the resumption of pastoral lands as a regeneration reserve, fire has been rare in the Purnululu area. The continued grazing pressure kept vegetation to a minimum, at times removing it altogether. Reduction of feral animal numbers since 1985 has, in places, resulted in the rapid growth of some grasses and shrubs causing an accumulation of fuel.

An interim burning program has commenced in the Park pending development of a formal management program. This is necessary to comply with CALM Fire Management Policy (Policy Statement No 19). It aims to reduce the risk and effect of wildfire in the Park, and to protect regenerating areas from wildfires.

A.2 CULTURAL RESOURCES

2.1 Traditional Use and Significance

The Aboriginal traditional owners of this region are river people. They are members of several major language groups, and most of them are multilingual, or at least bilingual. Their languages include Kija, Jaru, Malngin and Miriuwung.

In terms of the larger region of which Purnululu National Park is part, the focus of Aboriginal life is the Ord River system. In the local Aboriginal languages, place names refer to particular features of the Ord River and its tributaries: narrow gorges and large pools of water; rockholes or soaks in the river's upper reaches or tributaries where the flow is seasonal or intermittent; places where it flows over flat slabs of rock; and places where it fans out and forms a sandy bed, are all features which may be named and serve as reference points for surrounding areas. The confluences and the rocks, trees and other features are similarly named.

In this kind of landscape, features such as rocky outcrops, sandy areas and stands of trees are viewed in terms of their relation to rivers, creeks, streams and their confluences. Thus the Bungle Bungle massif is described in relation to the Ord River and two of its tributaries, Osmand and Bellburn Creeks.

Occupation and Use

Places where people used to gather are located along rivers or creeks. Such places were hubs of economic activity, including a widespread trading network, and social life. People gathered from a number of surrounding areas at a large water pool at the invitation of the head of the group owning the site to take part in joint harvests. They took a large quantity of fish, possibly by stunning them with a toxic substance placed in the pools which was extracted from the leaves of certain bushes and plants - several could be used for this purpose - or by netting the fish in large rolls of spinifex pushed through the pool. Some fish might be dried on rocks or sheets of bark, and were sometimes salted in the drying process, then wrapped in bundles of paperbark. The heads of families from other areas taking part in the harvest would make gifts to the head of the local group before returning to their lands. The harvest might take four to five days and during this time people would also be busy with other activities such as arranging marriages and performing ceremonies, including those connected with rites of passage.

Middle-aged people of the current generation describe such gatherings, in which they took part during their childhood and early adulthood, with nostalgia. These places are still visited for fishing and harvesting of fruits, tubers, and other foods. They teach their children about the resources of the land and its religious meaning, and they tell stories of events, both in the lifetime of known generations and in the Dreaming. They educate their children in their vast knowledge of the geological characteristics of the land, its waters, plants, and animals, and the use of fire to manage its resources.

In addition to the riverine environment, two other types of environment occur within the Purnululu National Park area which were related to the seasonal patterns of traditional life: the sandplains which occur predominantly to the south and east of the massif, and the uplands, or hills and ranges. In terms of their economic importance, the uplands can be further divided into plateau and fringe. The sandplain area and the margins of the upland zones, including the massif itself, were all of economic and spiritual importance. Areas of significance including sandstone overhangs with rock art, hand stencils, engravings and seed/ochre grinding marks occur at frequent intervals along the base of the massif. These sites are associated with water, though not all are permanent sources of water.

During periods of heavy rain, the run-off from the massif forms large, temporary pools of water around its perimeter. This run-off maintains a fringe woodland community dominated by *E. collina*. This fringe was generally occupied and used by small groups of people for limited periods of time during and immediately after the heavy rains, when water is widely distributed throughout the landscape.

In addition, there is oral and archaeological evidence of Aboriginal use of the top of the massif. Oral accounts tell of small groups of people living there for short periods, and include descriptions of the means of their ascent and descent. In some places it was necessary to use a ladder made by cutting notches in a pole. To ensure a descent by the same route stone trail markers were used.

In the Purnululu National Park area groups of people speaking a common language are the custodians of extensive areas of land. At that level, mythological accounts provide the basis for boundaries between groups. Within these large language-defined groups, individual or family groups are responsible for smaller areas on secondary drainage systems, with confluences and interflaves frequently serving as boundaries. These localised groups, while related by common language and much else, may also be distinguished by minor dialectal differences and localised

mythological sites and events. Traditional Aborigines refer to these named local areas in discussing the interests of individuals and families.

A senior man is head of each local group, and is responsible for organising its economic activities, including trading relations, settling disputes between people within his group or territory, arranging and participating in religious rituals, and managing and protecting the local area. He and his group share responsibility for the safety of all persons who are on their land; hence the importance of seeking appropriate permission before entering the land of another group - for any purpose - even to travel through it. Moral tales convey the warning that people who enter others' land without appropriate permission not only risk suffering severe sanctions themselves, but also put the custodians at risk.

A widespread exchange network, called winan, exists throughout the Kimberley. Much is known about the routes and extent of winan in the East Kimberley, including its links with similar networks in the Daly River and the Western Desert areas. Ritual plays a role and objects used in ceremonies are exchanged. Primary exchanges in the past appear to have been in economic commodities: tools, weapons, raw materials, and foodstuffs (mostly prepared for long-term storage). This system of exchange was based on trading partnerships established between individuals of different and geographically separated groups. It was necessary to assure that obligations to one's primary trading partner were met, but exchange was not limited to that partner.

Accounts of winan at places where large numbers of people gathered - for example on the Ord River - suggest comparisons with barter and exchange practices of societies in other parts of the world. These stories tell of large numbers of people meeting together, where the people came from, what they brought with them to trade and how the trading was conducted. Within the region of which Purnululu National Park is a part, Aborigines may acquire proprietary interests in land in a number of ways but primarily through their father (and father's father), and through their mother (and mother's father). Interests in land may also be acquired through place of birth, place of conception and through the sites of burial of close relatives.

Present Aboriginal Interest

Radiocarbon dating of artefacts shows that Aboriginal people have lived in the region for at least 20 000 years and it is possible that further archaeological study will reveal earlier occupation. The present Aboriginal traditional owners of Purnululu National Park have maintained their continuous responsibility for it. Some were born in the area which is now a national park; close relatives as well as ancestors are buried there. Even children and young people who had yet to visit the area knew its features and its stories long before its 'discovery' by the media in 1982-83.

Middle-aged Aboriginal people, then living in Warmun (Turkey Creek) and surrounding areas, tell stories of how they helped pastoralists in the Purnululu area in the past and remark that the cattle business could not have prospered without their knowledge of the country. They point out tracks they made for pastoralists' vehicles and where they camped. Barely scratching the surface of the ground they reveal evidence of their earlier habitation and that of older generations: rusting tobacco tins and pannikins, parts of a child's toy constructed from tobacco tins and wire, as well as stone tools. Some of these things still lie undisturbed in remote rockshelters. Some people can point to the outlines of their hands on the walls of rockshelters, painted by their fathers with pipeclay or red ochre when they were children. Older men point out the ceremonial grounds where they were initiated, and name the people who attended, and where they were from. Disturbance of these places is illegal under the Aboriginal Heritage Act 1972-80.

Aboriginal people describe with sadness the changes to the land and the rivers since the arrival of Europeans in the Kimberley. The principal changes have resulted from overgrazing and subsequent soil erosion; once large and abundant water holes are now 'covered up' and have little or no water in them. Places they remember as big, deep waters filled with fish - bream, rock cod, perch, barramundi, catfish - and crocodiles, water goannas and turtles, are now stagnant shallows with few fish or other creatures in them.

Some bush tucker is rare or no longer to be found. One such food was the formerly abundant seed of a grass that grew along creek banks and on the flats. Cattle quickly ate it out. Some animals once prized as food have also become locally extinct - or nearly so - in the Purnululu area. These animals include bandicoot and possum as well as kangaroo and emu. Some traditional custodians consider that these local extinctions and the present condition of the country result from the fact that they have been denied control of the area for nearly a century. They wonder if the Dreaming took the plants and animals away because Aboriginal traditional custodians have been prevented from looking after the country by means such as planned burning and the performance of ceremony.

Purnululu is a rich area in the view of Aboriginal people, and they belong to it. It is country to which they have the strongest ties of spirit, early history and personal identity. It is also country on which they pin their hopes to develop communities according to their own plans. Their plans include independence, based on creating appropriate educational and health facilities under their own direction and economic enterprises such as tourist-based ventures; these all add up to creating communities in which individuals are healthy and can develop with pride and independence their Aboriginal way of life. Aboriginal society is, like all others, continuously changing in response to changing circumstances.

The Aboriginal traditional owners of the Purnululu area formed their respective organisations in response to the changing social and political situation that resulted from the Western Australian Government's proposal to gazette the area as a national park. To accommodate both Aboriginal and European involvement in the area, the Aboriginal people have needed to adopt European mechanisms to ensure that they retain their traditional role of responsibility, and can maintain a continuing role in managing the land.

Consistent with the Government decisions described in the Introduction (Section 1.3), this plan provides for Aboriginal people to live in Purnululu National Park. The concept of an inhabited national park is new in Western Australia, but many successful models exist in other States of Australia and elsewhere around the world. An inhabited national park is one which makes provision for occupation by the traditional owners of that land, and integrates the protection of natural and cultural ecosystems. The International Union for the Conservation of Nature and Natural Resources (IUCN) - a global association of scientists and managers who draw up guidelines for nature conservation - endorses the concept of the occupation of traditional lands by indigenous people, and utilisation of resources in a sustainable manner in harmony with their environment (IUCN 1980).

The presence of Aboriginal people living on traditional land can substantially enhance the management of a national park. An Aboriginal National Park Ranger Training Program was undertaken in Purnululu National Park with two men nominated by the traditional owners completing the course and subsequently employed in the Park. Proposals have been developed for the establishment of living areas for Aboriginal residents.

2.2 Traditional Aboriginal Activities

Hunting and gathering of native food species is an important aspect of traditional Aboriginal relationships with the land. Religion, ceremony and sustenance are closely interwoven and the taking of native foods and products is fundamental to the maintenance of cultural heritage. Between 1867 and 1900 legislation recognising Aboriginal rights to forage was enacted in Western Australia, Queensland, Victoria and South Australia. The intervening years have seen many amendments to the early legislation, with the rights of Aboriginal people to hunt and fish for food very often being considerably reduced in the process (Australian Law Reform Commission 1984).

In Western Australia the Wildlife Conservation Act 1950 contains general provisions relating to the taking of certain flora and fauna. Under Section 23 Aboriginal people are exempted from some of these provisions, and may take flora and fauna for food from land - including Crown land - excepting a nature reserve or wildlife sanctuary. Food so taken may be sufficient only for a person and family but not for sale, and not taken if the species is likely to become unduly depleted. This exemption requires the consent of the occupier of that land.

National parks, State forests and other lands managed by CALM are deemed to be 'occupied' for the purposes of this Act. It follows, therefore, that the consent of the Executive Director is required for Aboriginal people to hunt, fish or gather from the Purnululu National Park and Purnululu Conservation Reserve.

In the Northern Territory, Aboriginal people have generally unrestricted rights to hunt for food - except for the purpose of sale - and for ceremonial purposes. Provision has been made for hunting and foraging in Gurig, Uluru and Kakadu National Parks. In each of these Parks, the plans of management require that the effects of traditional use be monitored, and if any species or community is threatened by these practices, then controls may be established in consultation with traditional owners. Similarly, in other countries, such as Canada, Alaska, Finland, Nepal and New Zealand, native people pursue hunting and gathering activities in parks and reserves.

It has been suggested that modern technology such as guns and vehicles have upset the balance between hunting and conservation for Aboriginal people but there has been very little research to evaluate the impact of these practices. The Australian Law Reform Commission (1984) recognises these viewpoints and acknowledges that no simple solution is possible. The Commission suggests, however, that more equitable arrangements may take account of Aboriginal traditions and practices, of their historical and continuing relationship to the land, and the fact that cultures are dynamic and traditions change.

2.3 Protection of Aboriginal Sites and Cultural Objects

Under Aboriginal customary law, the Aboriginal traditional owners of the Purnululu region are responsible for country including the National Park and Conservation Reserve. In particular, they have responsibility and obligations in relation to the protection, preservation and management of areas and objects of Aboriginal significance associated with that country. These responsibilities and obligations are of continuing importance to the traditional custodians. It is important for CALM to facilitate the carrying out of these responsibilities and obligations. Under the provisions of the Aboriginal Heritage Act 1972-80 all Aboriginal sites and Aboriginal cultural objects in Western Australia are protected. The Trustees of the Western Australian Museum advise and assist

the Minister for Aboriginal Affairs and are responsible for the administration of the Act. The Trustees are responsible for the care and protection of Aboriginal sites and objects (as defined in the Act).

As of June 1988, research undertaken in the course of an Aboriginal cultural resources documentation program instigated and coordinated by PAC has recorded over 250 areas of continuing significance to traditional custodians. A further 80 sites of archaeological and/or historical significance have been located within the National Park and adjacent Conservation Reserve. This research is continuing.

The management and protection of these areas and others yet to be recorded, is of vital concern to traditional custodians. There is an urgent need to establish an appropriate mechanism by which the development of Park infrastructure can proceed without endangering the cultural heritage of Aboriginal people.

In recognition of this need, the traditional owners established the Purnululu Cultural Heritage Committee (PCHC). The members of this committee comprise senior Aboriginal people with cultural responsibilities to country now gazetted as the National Park and Conservation Reserve. The functions of this Committee include consideration of proposals which may affect the Aboriginal cultural heritage of the region and to advise the PPC and, where necessary, the Trustees of the Western Australian Museum.

2.4 Colonial Cultural Heritage

The first European records of the East Kimberley area were made by Alexander Forrest who explored the area in the late 1870s. Land in the Kimberley was available for lease from 1880, and the lands along the Ord River were quickly stocked with cattle. The Bungle Bungle Working Group Report (1986) describes the pastoral history of the Park area including the various lessees. A large area of the Ord River catchment including the present Park was resumed from pastoral use in 1967 for the purpose of regeneration. Very little management occurred in the vicinity of the Park until 1985, when an extensive stock fence was constructed and cattle mustering commenced. A few signs remain in the Park of the early pastoral history: some old stock yards, derelict fence lines, the bare remains of an old camp and as some disused bores.

The area has not been subject to much direct use - except for cattle grazing - apparently because of the very rough terrain. Until recent interest emerging in the 1980s, it seems that the only other European people to visit this area were the occasional geological expeditions and mining exploration teams, and a very small number of people visiting for recreational purposes.

A.3 PUBLIC USE

3.1 Existing Visitor Use Patterns

Regional Patterns

The Kimberley Region is experiencing a major increase in visitor traffic. Tourism figures produced by the Australian Bureau of Statistics (Department of Regional Development and the Northwest and Department of Planning and Urban Development 1990), based on commercial accommodation data, showed an increase in visitor numbers to the Kimberley Region from 1980 to 1989 of approximately 108%. Total visitor trips for 1992/93 were 481,000 with an estimated "dollars spent" value of \$129,000,000.

The WATC (1987) has conducted research to identify market segments and preferences. The results of these studies attribute much of the increased tourism to the Region's diverse appeal. The Kimberley can offer visitors a wide range of attractions, including the 'Australian outback'; the Region also has its own distinctive character for the visitor to experience.

The segmentation studies show that people's attitudes and preferences are different now to what they were a decade ago. More people now seek holidays which include adventure, different cultures, interesting landscapes and scenery as well as new experiences. An example of changing demand is the increased popularity of luxury camping with high quality catering in tent accommodation. The emphasis is on more information and education; smaller, more intimate developments; and the need for an authentic Australian environment (WATC 1987). The tourism industry has responded rapidly to these demands and Purnululu National Park is seen by many to increase the diversity - and perhaps provide the major attraction - of the Region.

The Kimberley is serviced by daily jet air services from Perth and Darwin to Kununurra, Derby and Broome. There is only one access road which joins Purnululu National Park to the main regional road, Highway One (now completely sealed around the continent), between Halls Creek and Kununurra. The Park access road passes through some extremely rugged terrain and crosses numerous creeks along the way. It is suitable only for four wheel drive, high clearance, vehicles. Commercial tour operations to the Park have developed rapidly since the area's first promotion in 1982. In 1990 there were 40 tour operators based either in Western Australia or interstate with tour programs featuring the Bungle Bungle massif. Of these, there were four Kimberley-based tour operators and five Kimberley air charter companies servicing the area. The vehicle-based tour operators provide a four wheel drive camping holiday, usually featuring two to three nights in the Park. There are at least two operators providing guided walks/hikes through the area.

All of the local air charter companies provide scenic flights over the Bungle Bungle massif, and there is an authorised landing area in the south-eastern portion of the Park which can accept aircraft weighing up to 5700 kg gross. Strict conditions apply to the use of this airstrip. Purnululu airstrip was opened to commercial flights in June 1992 for a trial period. Visitors link with licensed operators for a ground tour of the Park. Scenic helicopter flights also operate. The impact on the Park of these activities will be closely monitored.

Tourism Input to the Plan

A representative of the WATC was appointed to the planning group to assist in preparation of this management plan. The Commission prepared and circulated a discussion paper on tourism in the Bungle Bungle area in 1987.

Twenty four written responses were received from members of the tourism industry. Members of the industry and related groups were then invited to attend forums in either Perth or Kununurra to discuss the positions put forward in the submissions.

The discussion groups at each forum agreed that the remoteness and wilderness characteristics of the area comprise the principal attraction and that excessive commercialisation would spoil this. Group participants made constructive suggestions regarding such management issues as access, entrance fees, tourist services, Park development, leases and permits and the formation of an advisory body.

Visitor Survey

Despite the rugged access and fairly hostile conditions, visitor numbers to the Bungle Bungle area have steadily increased since the early 1980's. No visitor statistics were recorded prior to 1986; in that year estimates were compiled from information provided by tour operators and figures projected from data collected by CALM staff. Road traffic counters have been used since 1987 to count vehicles; daily records are kept by Park Rangers (Table 4).

According to a visitor survey conducted in the Park in 1987 (Colreavy and Cavana 1988), only 16% of visitors went beyond existing recreation sites in the Park. 67% of survey respondents indicated that they appreciated the experience of remoteness, but most people preferred to be directed to features of interest through signs, maps and information.

A survey conducted between April and May 1994 confirmed visitor appreciation of the scenic values and the rugged isolation of the Park, and indicated support for improved low key facilities such as signs and visitor information.

Campsites were established at Bellburn Creek and Kurrajong on the western side of the massif during 1987. Pit toilets were provided at both of these camping areas. A new area was developed a short distance from the existing Bellburn Creek site. The latter has been rehabilitated, with a small area retained for the use of a limited number of group tours. The Kurrajong campsite has been redeveloped to improve visitor privacy and traffic flow; to enable rehabilitation of degraded areas, and to allow for group sites.

Despite the different origins and ages of visitors and regardless of their method or direction of travel, virtually all visitors to the Park in 1987 appreciated the intrinsic values of the natural environment, enjoying the camping and scenery and natural history.

There is a strong preference from Park visitors (Colreavy and Cavana 1988) and from respondents to the draft management plan to retain the natural, unspoiled character of the area and protect it from degradation, misuse and overt commercialisation. Visitors indicate a desire to have a 'wilderness' experience in this Park. The wilderness theme is complemented by the cultural heritage of the area. This heritage value has the potential to become a major attraction for visitors along with the obvious scenic values.

Consideration will be given to a zoning system which could be used to balance retention of the Park's natural values with the range of activities visitors wish to undertake. A separate issues paper will be released for public comment when zoning options are being examined.

Table 4.
ESTIMATED ON-GROUND VISITOR NUMBERS 1986-1993

	1986	1987	1988	1989	1990	1991	1992	1993
On-ground Visitors (April-September)	2000*	3000#	4000#	5000#	7000#	7000#	8000#	9000#

* Figure derived from Ranger observations and tour operators' data (to the nearest '000)

Figures derived from road traffic counter in Park (to the nearest '000)

3.2 Access

Roads

Road access to the Park is difficult because of the extremely rugged terrain and numerous creek crossings. During the wet season and at times of intermittent rainfall, the water level in the creeks may rise and flood very rapidly. Construction and maintenance of roads in the area is very costly.

The assistance of the Main Roads Department was sought early in the planning phase to advise on the selection of an access route into the Park resulting in the preparation of a detailed road planning report (Main Roads Department 1988).

The Park is surrounded to the north and west by pastoral stations and to the south-east by the Ord River Regeneration Reserve. The nearest major road is the

Great Northern Highway, which is 30 km to the west of the Park. To the east of the Park is Duncan Road which serves pastoral stations along the Western Australia - Northern Territory border.

Access Route

There is only one four wheel drive standard public access route currently in use, known as the Spring Creek Track. A second route via the Osmand Valley pastoral lease was also in use until early 1987 when it was closed by the lessee.

The Spring Creek Track commences 109 km north of Halls Creek on the Great Northern Highway, just north of Spring Creek. The track follows the Ord River valley east, then turns north-east towards Sally Malay Bore. It crosses some very rough terrain and major creeks, its winding path taking it about 50 km before reaching Three Ways junction within the National Park.

The main access route to the Park connects with a four wheel drive track which extends in an arc around the western face of the massif from Echidna Chasm to Piccaninny Creek (Map 7). This track follows and crosses numerous creek beds. Access to the gorges is generally along stream beds which consist of cobbles and boulders.

Route Options

The selection of route options was governed by both management priorities and by terrain and drainage patterns. The option of an access route from the Duncan Road was not explored as this would inevitably open public access to the Ord River Regeneration Reserve and the vast eastern part of the Park. The modest management structure envisaged for the Park could not possibly cope with opening up this large area; nor is it seen as desirable to allow increased vehicle activity in the vicinity of the Ord frontage plains.

For these reasons, the access corridor connects the Great Northern Highway with the western part of the Park. A single access road is preferred to dual or multiple points of access because of,

- reduced development and maintenance costs
- more effective monitoring and control of vehicles and visitors
- minimising the number of vehicle tracks in this sensitive environment.

Road Standard

It is essential that road access is consistent with the wilderness character of the Park and therefore the single four-wheel-drive access road will be maintained at an appropriate standard.

The staging of road and track development is critical to Park management. It would degrade both the environment and the visitor experience to facilitate public access beyond the capability of on-ground management and infrastructure.

Internal Roads

An effective network of roads and tracks is needed within the Park to service the needs of visitors, Park residents and management. In their study of the area the Main Roads Department also considered the realignment of roads within the Park (1988). The final alignment follows the north-south arterial link, connecting with major campgrounds and the main access road. The PPC may nominate further day-use sites and selected interest points, in which case feeder tracks and appropriate vehicle parking space will need to be developed.

The standard of the north-south internal track is intended to be improved to sustain higher levels of use by four wheel drive vehicles and to facilitate access by residents of the Park to the airstrip. In some areas, because of the soil type and intensity of use, it may be necessary to form and gravel surfaces to reduce the level of environmental impact. Some additional tracks will be required for management purposes, such as fire management and access to rehabilitation areas and areas of cultural importance to traditional custodians if requested by the Park Council. Access will be required for the servicing of facilities to the ranger station and to living areas within the National Park.

Aerial Access

Currently the most popular method of viewing the Park is from the air. Kimberley air charter companies conduct aerial tours over the Park, departing from Wyndham, Kununurra and Halls Creek. In 1993 an estimated 20 000 passengers were carried. The rapid growth in demand for air tours to view the spectacular landforms has led to a degree of congestion over the massif during the peak viewing times of early morning and late afternoon during the dry season. The Civil Aviation Authority has issued an instruction to pilots designating flight patterns and procedures. The planes currently used for these flights are mostly four to six seaters. It is possible that use of larger aircraft may help reduce congestion of airspace over the massif.

Many tour holiday packages are now offering passengers the option of a pre-booked flight over Purnululu National Park. There is an opportunity for air charter companies to link with local or around

Australia bus tours, safari holidays or air package holidays. The Purnululu airstrip was opened to commercial use in June 1992 for a trial period, and despite passenger numbers being low the operational logistics outlined in the scheme's guidelines have proven to be successful.

The fly/drive scheme will be reviewed to provide for expressions of interest in additional fly/drive operations, and to replace the current annual approval system with longer term licences.

Three on-ground tour operators have been authorised to link with flights into the Park in order to provide day tours by four wheel drive. Bellburn campsite has been redeveloped to cater for visitors staying overnight in the Park. Some of the Aboriginal traditional owners hope to conduct tours of the Park with a special focus on Aboriginal culture and interpretation. The airstrip will increase the range of visitor experiences, enhance emergency access and service Park management and residents' requirements.

During the period 1988-1994 helicopter flights have been available within the Park. The unauthorised emergency landing strip on the western side of the massif will be closed, but the associated helipad will be retained for emergency purposes. An airstrip and helipad complying with Civil Aviation Authority standards were completed in 1991, and are located two kilometres south of the Walardi camping area. The helipad is used for scenic helicopter flights on an approved flight path over the massif, and over 50% of Park visitors (4 500 in 1993) take the flight each year. The airstrip is used for management and emergency purposes, and for regulated commercial fly/drive operations during the dry season.

It is desirable to balance and separate the use of the Park by ground and air visitors as the constant presence of aircraft over walkers and campers can impact significantly on ground visitors' experiences.

3.3 Recreation

As described earlier, the general theme for the Park is one of a remote unspoilt environment where visitors may seek a wilderness experience if they wish, and all may enjoy the natural and cultural features of the area. While developments will be kept to a minimum in the Park, some visitor facilities are necessary to protect the environment and allow reasonable levels of visitor use.

Provision of recreation opportunities and facilities on conservation lands should be guided by the following principles, as outlined in CALM's recreation policy statement:

- The values of the land as a whole should be maintained. The natural systems (including landscapes, particular sites, biota) should be able to sustain the form of recreation, or its ancillary activity, which is proposed or occurring.
- Recreational activity should be compatible with the purpose of the land or the established land use priority.
- The widest range of activities consistent with the purpose of vesting should be allowed, but uses which impair other forms of use, or jeopardise the safety of other users, should be controlled or eliminated.
- Park management should be capable of supervising activities, particularly where land values may be impaired. If this is not possible, the activity should where practicable be restricted, relocated or eliminated.

With these guiding principles in mind, the general provisions for access and recreation management in this Park can be summarised as follows:

- General vehicular access should be restricted to the western part of the massif, in an arc from Osmand Creek to Piccaninny Creek. Within this area there may be parts which will be further restricted because of the presence of cultural sites, erosion potential and important biological features. This area will generally accommodate vehicular-based visitor access and be the focus of management.
- The eastern section of the Park, including much of the massif, should have limited access for walkers. This may need to be regulated by a permit system, depending on demand. There will be a need for a limited number of management only tracks for regeneration, fire control purposes and cultural management.
- Park facilities will be located primarily in the western sector of the Park.
- Existing and potential regeneration areas should be recognised and duly protected with suitable access arrangements.
- Throughout the Park there are sites and areas of cultural significance to Aboriginal people which should be given high priority for protection. Access by traditional owners to these sites should be allowed along approved routes.
- Vehicle access into the Park should continue to be limited to the dry season (1 April - 31 December).
- Aerial access and limited wet season access within the Park may be facilitated in accordance with Park guidelines.
- Park entry fees will be charged to assist in the management and maintenance of Park facilities.

Bushwalking

Bushwalking is an activity enjoyed by people of all ages and interests. In the visitor survey conducted in the Park during 1987 (Colreavy and Cavana 1988), 92% of respondents indicated they had explored gorges, and almost 68% had been bushwalking. The two most popular areas visited were the Piccaninny area (87%) and Echidna Chasm (54%). In order to preserve the remote undeveloped character of the Park, and to promote its appreciation the condition of access track surfaces will be monitored and maintained as necessary. While the needs of the elderly or disabled must be considered and provided for wherever possible, walking

is the best method to fully appreciate the diversity and scale of the landscape of the Park.

A small but increasing number of Park users seek a very remote experience, wanting to venture into the wild and navigate across country, but the majority of visitors are not equipped with these skills and prefer to follow marked paths to well-defined, or recognisable destinations. Bushwalks may vary greatly in difficulty and may be designed

according to a wide range of characteristics. It is necessary, therefore, to provide a range of opportunities to meet the needs of the visiting public and to provide adequate protection for the Park. Bushwalks can vary according to length, construction and navigation and visitor safety should be a priority in their planning and design. The repeated patterns of the domes, complex systems of gorges and creeks and harsh environmental conditions must all be considered in the choice of paths and provision of information.

Remote camping associated with bushwalking is currently permitted at Piccaninny Gorge. The demand for wet season bushwalking can be facilitated by aerial access, and guidelines will be prepared to provide for remote camping in other approved areas within the Park.

Walking generally creates a fairly low impact on the environment, but problems may arise due to level of use and/or sensitivity of the site. Where a path is intensively used, walking can lead to soil compaction and erosion, resulting in loss of vegetation. The sandstone of the massif is extremely friable, especially once the surface skin is broken. These rocks are very susceptible to shear stress, and even rubber-soled shoes will easily crush or break the surface layer. Furthermore, it has been found that the sandstone is weakened when saturated or when affected by fire (Young 1987). High levels of use can result in environmental impact through inadvertent or deliberate vandalism, such as damage to cultural sites, disturbance of fauna and littering or polluting the environment.

These problems can usually be avoided or minimised through careful selection and design of paths and effective visitor information programs. Clear signs, interesting brochures and good information at the starting point are all important. For some Park features, tour guides or rangers may provide the best means of interpretation; guides also afford a greater degree of protection for places which are especially sensitive or unsafe.

Camping

Camping is an essential part of the remote bush experience, and will be the major form of accommodation in the Park. The low-key nature of the area should be complemented by facilities and standards which do not intrude upon the landscape.

The campsites at Kurrajong and Bellburn were not adequate to cope with the growing increase in demand. From as early as 1987 some crowding was evident during peak periods, although the improved organisation of camp sites in 1988 improved this situation. In 1989 a total of 4752 ground visitors entered the Park, and in 1993 this figure rose to 9098. In response to this increase in visitor pressure the Walardi campsite was established, and the Kurrajong site extended. The Bellburn site was refurbished in 1992. Monitoring of visitor numbers will continue, and it may be necessary to implement further measures to ensure maintenance of Park values. A booking system may be required.

The need for new camping areas and their location will need to be carefully determined. With current visitation trends it is likely that a third general camping area will be required during the period of this plan. Accommodation options ranging from permanent camps to built facilities appropriate to the Park environment will be considered under lease/licence arrangements. Any new development or redevelopment of existing facilities will undergo internal environmental assessment (Section B.2).

Limited opportunities exist for commercial operators to provide a seasonal camping facility. Such a facility is available at Bellburn campsite for visitors arriving by air under the fly/drive scheme, while Walardi and Kurrajong

cater for campers. Some private travellers (vehicle-based) and four wheel drive operators may choose a commercial campsite for their visit.

It is important that a range of camping options is provided in the Park and that each type of camping is segregated. The different options can be summarised as seasonal camps, small group camping, individual camping and remote (back-pack) camping.

Because of the sparse vegetation firewood is limited. To minimise adverse impacts on the Park environment, there is a need to encourage the use of alternatives for cooking, such as gas stoves or barbecues. Where campfires are permitted they will be limited to designated areas only. Consideration will be given to the provision of wood supplied from sources outside the Park.

Remote camping is permitted at Piccaninny Gorge. Wet season bush walking will involve remote camping as existing camping areas are all located at the western side of the massif, and are too far from the feature areas.

Day-Use Sites

There are many sites within the Park to which visitors are attracted for recreation. In order to preserve the natural and cultural values of these places, it is necessary to prepare individual site management plans and to regulate visitor activity. Since the potential for crowding exists at day-use sites, such areas will be monitored to ensure that impacts of foot and vehicle traffic do not cause degradation of the resource or the experience.

3.4 Commercial Operations

There has been interest expressed by various parties wanting to provide commercial services within the Park. Most of these proposals relate to provision of visitor accommodation and tour services. With the introduction of commercial use of Purnululu airstrip in June 1992, three approved operators are providing guided tours of the Park with accommodation at Bellburn campsite for overnight visitors. Helicopter scenic flights have been operating since 1987, and this form of aerial access has proven to be very popular with visitors, combining spectacular views of the Park with minimal environmental disturbance.

Approved commercial operations should enhance the appropriate use and enjoyment of the Park and reduce the impact of visitors.

The CALM Recreation Policy (Policy Statement No 18) states that fees will be charged for commercial operations for the sale of products and services for reward or other consideration. Recent amendments to legislation require all commercial operations to be licensed. These include:

- vehicle tours and safaris
- guided walks
- minor activities and services e.g. souvenir outlets.

Input from both the tourism industry forums and the PAC submission highlight the importance of a carefully planned and coordinated approach to the development of tourism services, facilities and infrastructure. Commercial operations that are approved will be subject to conditions which maintain and protect Park values. The licence

system will ensure operations and developments are carefully staged and monitored to measure the effects of visitor impact on the physical and cultural environment of the Park as well as on the facility or operation.

Some Aboriginal traditional owners wish to conduct commercial tours to and within the Park. The opportunity exists for further commercial enterprises associated with the Park to be owned and conducted by traditional owners.

3.5 Information, Education and Interpretation

The dissemination of information is an integral part of CALM's role in the management of conservation areas, informing the public of opportunities for recreation and services, and providing information which assists management and improves understanding of conservation. Many communication channels are available for visitor information, interpretation and community education. Visitor contact on-site is a most effective means of communicating to individuals and groups, but it is labour intensive and must be augmented by pre-visit brochures, publicity, advice, on-site signs and displays. Souvenir publications can provide effective post-visit information. Despite the relatively low visitor numbers to the Park so far, there is an extremely high demand for information about this remote area. Promotion through the media and many commercial journals has stimulated the curiosity of travellers.

Since 1993 Park rangers have conducted regular visitor activity programs, the most popular being slide presentations held at the camping areas. These sessions are attended by 50 % of Park visitors. Although not specifically designed for the purpose, the Park headquarters is also serving as an interim "visitor centre" where regular contact is made between CALM staff and visitors. As tourist numbers increase, there is an accompanying need for a more formal contact centre to service the needs of visitors. The Threeways area is a strategically favourable location for such a facility.

In the absence of a full interpretative program for the Park, interim information has been provided including a brochure, signs and information boards in the Park and in CALM's Regional Office in Kununurra. Public comment indicates that more information would be appreciated. Visitors to the Park require good quality information, signs and maps; they want to be able to learn about this unusual, different environment and they particularly appreciate meeting and talking with CALM staff.

The naming of features and points of interest, and the provision of Park management information, is a matter of great importance to the traditional owners. It is often difficult or inappropriate to translate place names from Aboriginal languages to English, and in many cases it is culturally inappropriate. The naming of locations within the Park will, therefore, require consultation with Aboriginal traditional owners.

A.4 LIVING AREAS FOR ABORIGINAL PEOPLE

In April 1986, in response to representations by Aboriginal people with traditional affiliation to the Purnululu area, the Western Australian Government recommended that CALM develop proposals for Aboriginal people with traditional affiliation to reside in the Park.

In 1986 the Purnululu Aboriginal Corporation (PAC) was established as an incorporated body under Commonwealth legislation to represent the interests of the traditional owners of the Bungle Bungle region. Members of this association currently live as far afield as Halls Creek, Balgo, Lake Gregory and Mowanjum, and many reside in East Kimberley communities such as Warmun, Frog Hollow, Glen Hill, Bow River Station, Kununurra, Wyndham and in the Park itself

In 1992 some of the Aboriginal traditional owners from the Jaru language group broke from PAC, and are now represented by Billingjul Aboriginal Corporation (BAC).

To date, three Aboriginal family groups from PAC and BAC have expressed a desire to live within the Park. It is not yet certain how many people may take up residence. Despite the obvious desire of many of these people to reaffirm links with their country, moving residence requires careful consideration and planning. Many of these people have lived for many years now in other settlements and towns; most have houses with electricity and running water; their children attend schools and a number have permanent or casual employment. It is likely that any move to the National Park will be a gradual process for some, while for others it may always be a seasonal or occasional visit.

4.1 Living Area Leases

In accordance with Section 100 of the CALM Act, the Executive Director may, on such terms and conditions as he thinks fit, grant a lease of the National Park or Conservation Reserve provided it is in conformity with a management plan and with the approval of the Minister and the NPNCA.

At a meeting in July 1987 with representatives of PAC the, then, Minister for CALM agreed in principle to the establishment of residential lease areas under provisions of the CALM Act. It was proposed that these living areas should be similar in size to excisions which have been negotiated on pastoral leases, and at present there are proposals for three such living areas in the Park. The Government has placed a moratorium on the granting of new Aboriginal living area leases while a review of current applications is conducted, and progress on this issue will be determined by the outcome of this review.

4.2 Housing and Residential Services

Essential services required as a first step in the development of living areas include finalisation of boundaries, housing, water, power, waste disposal and communication. Some assistance (provision of a water bore and storage shed) has already been provided at one living area by the Argyle Social Impact Group. Temporary housing has been provided at one of the lease areas in the Park, and bores and hand pumps have been installed at the other two sites. It

is the aim of the Aboriginal traditional owners to initiate community development and housing programs for the residential lease areas in a way which minimises impact on Park values.

4.3 Community Services

Health services are currently provided at Warmun by the Kimberley Public Health Service. In addition, a doctor from the Kununurra District Hospital visits once a week. Park residents have to travel to Warmun for consultations. The possibility of medical emergencies in the Park is of considerable concern due to the long, rough journey by road to the Great Northern Highway, though the presence of a new airstrip and PAC's access to the Corporation's aircraft ameliorates this concern to some degree.

Education facilities will be required for Park residents, both children and adults. A number of possible arrangements could meet the needs of the community, including an independent school. PAC has had primary school facilities established in the Park for several years. Aboriginal residents require suitable communications facilities to be established for their use including HF radios and telephone.

A.5 RESEARCH AND MONITORING

The purpose of monitoring is to detect change and to identify the impact of management activities. Although monitoring and research are closely linked, research often establishes baseline data from which a monitoring program can develop and provides managers with data from which the state of a resource can be judged. Resources change over time and implementing a monitoring program will allow the extent of change to be measured and enable decisions about management actions to be undertaken so as to influence that change.

Monitoring will consist of programmed observing, recording and interpreting of data over time, designed to identify changes in natural and cultural systems of the Park. It will focus on the assessment of change in the condition of:

- biological and physical resources and values such as fauna, vegetation, landscape, and exotic plants and feral animals
- physical and cultural resources such as rock art and archaeological sites, sites of significance to Aboriginal people and sites of historic value
- patterns and trends of visitor use and the satisfaction and perceptions of visitors
- visitor facilities and infrastructure.

There has been relatively little scientific research undertaken within the Park. There is still a great deal to be learned about the natural and cultural resources of the area and how these are affected by management practices and visitor use.

PART B. MANAGEMENT STRATEGIES

B. 1 PARK MANAGEMENT

1.1 Purnululu Park Council

The objective⁶ is to provide the Aboriginal traditional owners with meaningful management input in relation to the Purnululu National Park and Purnululu Conservation Reserve.

In 1987 the Government agreed to the concept of joint management between CALM and Aboriginal people with traditional affiliations to land within Purnululu National Park and Conservation Reserve. This would be put into effect through the development of a Ministerial Advisory Committee to be known as the Purnululu Park Council (PPC) which would include representatives of the relevant Aboriginal people and CALM officers. The PPC would serve as a forum for discussion, and provide advice to the Minister for the Environment on all issues within the National Park and Conservation Reserve of interest to Aboriginal people.

In 1993 the Government reviewed the Park Council concept, and endorsed the formation of joint CALM / local Aboriginal committees to address issues of concern to Aboriginal people. It also supported the concept of joint CALM / local community advisory committees to deal with broader issues of concern arising from the management of parks and reserves.

Although the question of appropriate Aboriginal representation remains unresolved this plan provides for Aboriginal representation on a Park Council which should become functional once representatives have been chosen.

STRATEGIES

1. All matters of Aboriginal interest in the Park will be referred to the PPC for its consideration. The PPC will develop park management policies in relation to these matters and will report directly to the Minister for the Environment.
2. The PPC will determine its procedures and will meet regularly.
3. The PPC will refer any matter relating to Aboriginal cultural heritage to the Purnululu Cultural Heritage Committee for advice and comment prior to making any decisions on the matter.
4. Any matter on which agreement cannot be reached will be referred to the Minister for the Environment for direction.

6 The objectives for Park management describe briefly an overall intention for management. Specific intentions are reflected in management strategies, and are linked to the objective(s) for that section by a statement summarising significant various implications for management..

5. The PPC will keep the NPNCA and the Community Advisory Committee (see 1.2 below) briefed on decisions arising from the PPC so that they can consider such decisions and advise the Minister independently as they see fit.
6. Joint Jaru / Kija representation on the PPC will remain in place until the current dispute is resolved, after which Aboriginal representation on the PPC may be varied to reflect the outcome of the dispute.

1.2 Purnululu Community Advisory Committee

In its review of management arrangements in 1993 Cabinet provided for an Advisory Committee for the Park and Conservation Reserve to consist of representatives from the wider community. Purnululu Community Advisory Committee members will be selected primarily on the basis of expertise, experience, personal interest and public profile. Members will be appointed by the Minister for the Environment. Government representation will be kept to a minimum, and will usually be confined to one officer of CALM.

STRATEGIES

1. A Community Advisory Committee will be formed as soon as practicable after the release of this plan.
2. The Community Advisory Committee will keep the PPC and NPNCA briefed on its decisions.

1.3 National Parks and Nature Conservation Authority

The CALM Act provided for the establishment of the National Parks and Nature Conservation Authority (NPNCA) in which the National Park and Conservation Reserve are vested. It lists the functions of the Authority to include development of policies, provision of advice to the Minister and the preparation, review and monitoring of management plans.

STRATEGY

1. The NPNCA will keep the PPC and the Community Advisory Committee briefed on decisions arising from the NPNCA in relation to the Park so that they can consider such determinations and advise the Minister independently as they see fit.

B.2 ENVIRONMENTAL ASSESSMENT

The objective is to ensure that all developments are consistent with the environmental and cultural values of the Park.

Developments include all activities other than minor maintenance. These activities include construction and upgrading of roads, siting of borrow pits, walking tracks, buildings and associated infrastructure.

STRATEGIES

1. New development proposals and some operations will require internal environmental assessment prior to implementation.
2. CALM, in association with the PPC and the Community Advisory Committee, will develop a policy on the internal environmental assessment of development proposals and operations, including identification of proposals and operations which should be subject to such assessment, to ensure developments and operations have minimal impact on the natural and cultural resources and values of the Park.
3. Where internal environmental assessment is required, a written report will be prepared and submitted to the PPC and the Community Advisory Committee.
4. Prior to making their assessment, the PPC will seek the advice of the Purnululu Cultural Heritage Committee in relation to any report on the impact of a proposed development or operation on Aboriginal heritage values of the Park.

B.3 PARK BOUNDARIES AND TENURE

3.1 Park Boundaries and Tenure

The objective is to ensure that land tenure and Park boundaries provide the best possible protection to the environmental and cultural values of the area.

The current boundaries of the Conservation Reserve are determined by the mineralisation and potential for mining. Cadastral boundaries do not reflect biophysical attributes or provide adequate protection for ecological or landscape units. There are culturally and biologically important areas adjacent to the current Park boundaries, in particular the Osmand Valley and Osmand Range. Definition of boundaries is difficult in some areas, exacerbating management problems such as uncontrolled vehicle movement and feral animal intrusion. Where possible, future boundaries will be defined according to major ridgelines and other significant landscape or ecological features (Map 8).

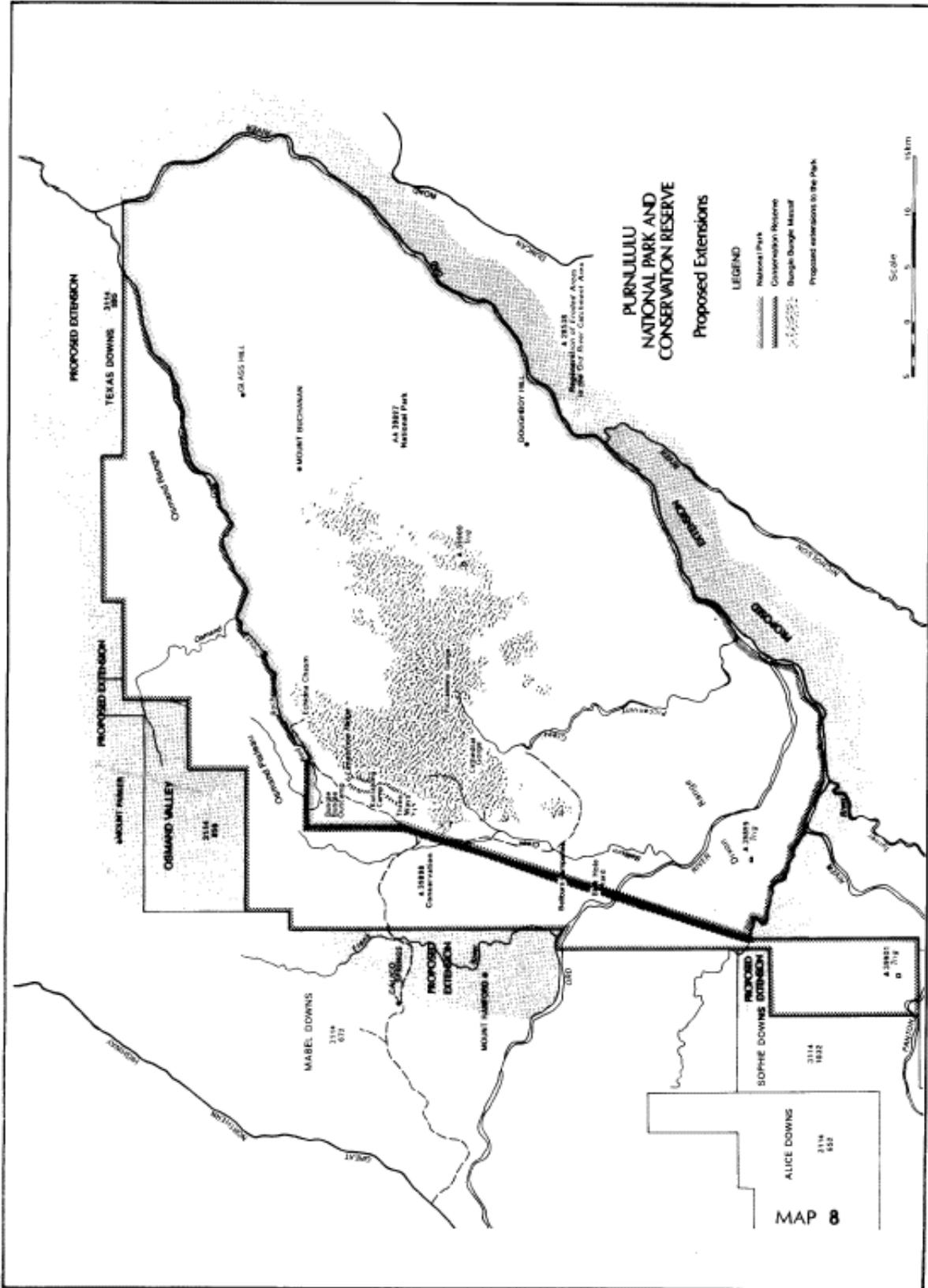
Negotiations with the Department of Minerals and Energy (commenced in 1991) may lead to the inclusion of areas of the Conservation Reserve into the National Park.

The current situation with respect to mineral exploration in the Conservation Reserve allows for licences to continue to be granted subject to agreed conditions.

Existing trigonometric reserves are located in rugged terrain making access difficult, and are in areas of Aboriginal significance. The historical and cultural values of the existing trigonometric sites require that use of these sites be restricted.

STRATEGIES

1. Any negotiations on future preferred boundaries of the Purnululu National Park will ensure that land tenure and Park boundaries provide the best possible protection to the environmental and cultural values of the area.
2. The PPC and the Community Advisory Committee will comment on proposals to extend the National Park into the Conservation Reserve, and into adjacent pastoral leases as opportunities arise.
3. Lease holders will be consulted to determine a preferred course of action for future management of adjacent lands. Three possible courses of action to be considered are:
 - Government acquisition of portions of leases from current leaseholders
 - agreements for management as per Section 16 of the CALM Act
 - restructuring of boundaries with adjacent properties.
4. CALM will liaise with appropriate bodies to incorporate sections of the Ord River Regeneration Reserve into the National Park.
5. Further discussions will be held with DOLA with a view to transferring existing trigonometric sites out of the Park. If alternative sites are to be located within the Park, the advice of the PPC will be sought.



3.2 Mining Leases and Exploration Licenses

The objectives are to:

- **Protect the National Park from the impacts of exploration and mining.**
- **Comply with established procedures for assessment of such proposals as may arise for exploration and mining within Reserve No 39898, Purnululu Conservation Reserve.**

The Precambrian geology of the Conservation Reserve indicates prospectivity for minerals such as copper, platinum, diamonds, gold and base metals. River channels may be prospective for alluvial minerals. The Bungle Bungle massif appears to have no important mineral potential except perhaps for ground water.

There are several exploration licences within the Conservation Reserve to the north and west of the massif (Map 4).

Purnululu Conservation Reserve is open to exploration and mining, and Government policy allows for exploration and mining within national parks subject to close scrutiny including EPA assessment and Parliamentary approval of mining. It is unlikely that mining activity will occur within the sandstone massif of Purnululu National Park because of the low prospectivity of the area. The Conservation Reserve is already subject to exploration and has several approved tenements.

All developments within the Park including mining and exploration activities will be subject to an internal environmental impact procedure (Section B.2). This assessment will also satisfy the provisions of the Aboriginal Heritage Act 1972-80 as it relates to the protection of Aboriginal sites and objects of significance.

STRATEGIES

1. Applications for an exploration licence to undertake non ground-disturbing exploration within the Purnululu National Park would require notification to DEP, referral to CALM and the NPNCA and the concurrence of the Minister for the Environment. If approved the licence would be subject to strict environmental conditions. Exploration involving significant environmental disturbance may be approved following referral to CALM, NPNCA and EPA if required. Productive mining in the Park would be subject to EPA assessment, concurrence of the Minister for the Environment and Parliamentary approval.
2. Exploration licences within Purnululu Conservation Reserve may be approved by the Minister for Minerals and Energy following referral to CALM, recommendations of the NPNCA and the Minister for the Environment, and would be subject to strict environmental guidelines. Exploration involving environmentally significant disturbance may be referred to the EPA if required. In the case of productive mining proposals approval may be granted following assessment by the Department of Minerals and Energy, receipt by CALM/NPNCA of a Notice of Intent, and recommendations of the NPNCA and the Minister for the Environment. EPA can assess if significant impact is likely, and in the case of formal assessment the Minister for the Environment may impose conditions.
3. The PPC and the Community Advisory Committee may provide advice to the Minister on all mining and exploration proposals.

4. Applications for mining activity that may result in significant disturbance may be referred to the Department of Environmental Protection. Conditions consistent with this management plan will be recommended in order to minimise impacts on the biophysical and cultural environments and to ensure effective subsequent rehabilitation.

3.3 Living Area Leases

The objective is to provide suitable areas for Aboriginal people to live within the Park.

Some of the Aboriginal traditional owners have requested approval to establish residential areas in the Park. Under the CALM Act the Executive Director may grant leases on such terms and conditions as he thinks fit with the approval of the Minister and the NPNCA. The NPNCA has agreed in principle to the establishment of three residential lease areas in the Park to come into effect at the same time as this plan, however final Ministerial approval will depend on the outcome of the current review into Aboriginal living area applications. Should approval be granted Aboriginal people residing in the Park will require access to their lease areas.

STRATEGIES

1. Ministerial approval will be sought to establish three living areas for Aboriginal traditional owners within the Park. With the approval of the Minister and the NPNCA, the Executive Director will grant leases for living areas at a peppercorn rent for the maximum permissible term under the CALM Act. The living area leases will include negotiated terms and conditions which secure reasonable Aboriginal aspirations while taking due account of other Park values.
2. Aboriginal residents shall have appropriate access to approved living areas.
3. The PPC and the NPNCA will provide advice to the Minister on all matters pertaining to Aboriginal living areas and access.
4. All site planning and design and construction criteria will be subject to an internal environmental assessment procedure (Section 13.2) and will be consistent with the management for residents' requirements (Section B.7).
5. Applications for additional living areas will be endorsed by the Aboriginal traditional owners prior to their consideration by the PPC.

B.4 MANAGEMENT OF NATURAL RESOURCES

4.1 Resource Management Programs

The objective is to provide a formal planning process which ensures the most appropriate management strategies are developed and implemented in relation to the Park's natural resources.

Resource management programs (RMPs) will be prepared for the strategic areas of

- Hydrology
- Soils and Geomorphology
- Landscape
- Flora
- Fauna
- Fire
- Rehabilitation

The RMPs will specify in detail the management actions required for particular issues. An RMP has the advantage of being dynamic and able to reflect change in knowledge or status.

An annual operations plan will provide the basis for management decisions until the RMPs are available. Copies of the operations plan and works program will be submitted by the Regional Manager to the PPC and the Community Advisory Committee.

Geographic Information Systems (GIS) are an extremely effective method of managing spatial databases. This is particularly the case in a complex environment such as the Park where information is generated by multi-disciplinary teams. Databases could be maintained for fire frequency, areas of significance to Aboriginal people, and infrastructure. Information in a GIS has the advantage of being unaffected of staff turnover and enables continuity of information.

STRATEGIES

1. An annual works program will be prepared and submitted to the PPC and the Community Advisory Committee for their consideration.
2. An annual operations plan will be prepared for each category of natural resource (including fire and rehabilitation) to provide the basis for management decisions in relation to natural resources until the RMPs are developed. This plan will be submitted to the PPC and the Community Advisory Committee for their consideration.
3. Resource management programs will be prepared in order to provide detailed information on each natural resource and its management. These programs will be submitted to the PPC and the Community Advisory Committee for their consideration.

4. A GIS will be established.

4.2 Hydrology

The objective is to conserve ground and surface water resources.

Location of living areas and visitor facilities within the Park will depend on the availability of sustainable potable water resources. Siting of bores should ensure that drawdown does not affect wetland areas and ephemeral wetland sites. Permanent waterholes, springs and seeps give rise to important ecological islands in the area, and management will ensure that unnecessary disturbance does not occur. The areas surrounding surface waters are rich in archaeological and ethnographic significance. Access to these areas will be carefully managed.

STRATEGIES

1. A resource management program (Section B 4. 1) will be prepared for hydrological resources of the Park, including river systems, permanent waterholes, springs, seeps and groundwater. The program will include monitoring of groundwater extraction, and an assessment of available water resources.
2. In the development of all Park facilities an internal environmental assessment procedure will determine impacts on hydrology (Section B.2).
3. The conservation of scarce water resources will be incorporated in the design of future Park buildings.

4.3 Soils and Geomorphology

The objectives are to:

- **Protect the surface of the Bungle Bungle massif from degradation.**
- **Ensure visitors, residents and Park operations have a minimal impact on soil stability.**

Although the rocks of the massif vary, their resistance to erosion is generally very low; the domes are particularly susceptible once the surface layer is broken. Rocks of the massif are at their weakest when saturated (Young 1987) and the soft rock surfaces may be easily damaged by vandalism.

A long history of overgrazing by cattle and donkeys has resulted in degradation and erosion of soils in the Park. Sheet and gully erosion are common on much of the plains, especially along the frontage plains of the Ord River and the lower reaches of Bellburn Creek. Black cracking clays have a high degree of shrink and swell. As such they should be avoided where possible for roads, tracks and structures.

STRATEGIES

1. A resource management program (Section B 4. 1) will be prepared for the management of soils and the surface of the massif and outliers.
2. In the development of all Park facilities an internal environmental assessment procedure will consider the impact of the proposed development on soils (Section B.2).

4.4 Landscape

The objective is to conserve the landscape features of the Park.

The diversity of landscape throughout the National Park and Conservation Reserve results in a high degree of scenic attractiveness. Landscape provides the major attraction for Park visitors. Changes to landscape occur continually by both natural and human induced forces, with those induced by human activity generally appearing more negative than natural changes.

STRATEGIES

1. A resource management program (Section B 4. 1) will be prepared for the protection of landscape. The visual resources of each landscape character type will be assessed and areas of high scenic quality requiring special management will be recorded. Degraded area in need of rehabilitation will also be assessed.
2. In the planning and development of all Park facilities, an internal environmental assessment procedure will consider impacts on visual landscape values. (Section B.2).

4.5 Flora and Vegetation

The objective is to restore and maintain the various ecosystems of the Park with particular emphasis on conservation of rare, endangered and restricted vegetation associations and species.

Few of the Park's vegetation associations have been adequately surveyed. Some vegetation associations in the Park are poorly represented or not represented in conservation reserves elsewhere. Extensive areas on the Ord frontage plains, and the alluvial areas around creeks and rivers are degraded due to feral animal overgrazing. In some areas vegetation composition has altered in response to disturbance. Exotic species including perennial shrubs and pioneer grasses are present in the Park. Species of flora with limited distribution occur in the Park and on adjacent land, particularly in the Osmand Valley.

STRATEGIES

1. A resource management program (Section B 4. 1) will be prepared for the Park's flora, including the use of appropriate fire management practices, and assessment of exotic species and proposals for their prevention, eradication or control.

2. In the development of all Park facilities an internal environmental assessment procedure will consider the impact of the proposed development on flora (Section B.2).
3. Vegetation surveys will aim to assess and define significant species and associations in the Park.

4.6 Fauna

The objective is to restore and maintain fauna populations of the Park with particular emphasis on conservation of threatened, endangered, and restricted species of fauna and their habitats.

Recent surveys have substantially improved knowledge of the Park's fauna. Increasing numbers of some species of fauna have been observed by CALM management staff. Remnant vegetation provides specialised habitats for fauna, particularly sheltered, moist niches in gorges and chasms of the Osmand Range, Bungle Bungle massif and Ord River.

Competition from feral animals has almost certainly suppressed populations of native species. The reduction of feral animal biomass since 1985 presents an opportunity for baseline data to be gathered. Without appropriate management, domestic pets may interfere with native wildlife or cause a general nuisance to visitors.

STRATEGIES

1. A resource management program (Section B 4. 1) will be prepared for the Park's fauna, including an assessment of feral species and proposals for their eradication or control.
2. In the development of all Park facilities an procedure will consider the impact of the proposed development on fauna (Section B.2).
3. Surveys will aim to assess species, population levels, and conservation status and habitat requirements of fauna in the Park.
4. Domestic animals will be allowed in the Park only under conditions of permit as provided by the Executive Director and in accordance with guidelines developed by the PPC. Domestic cats will not be allowed in the Park.

4.7 Fire

The objectives are to:

- **Use fire as a management tool to enhance habitat diversity and ecological sustainability.**
- **Protect the community and environmental values within and adjacent to the Park from damage or destruction from wildfire.**
- **Understand the role of fire and its impacts on the Park.**

Before the arrival of Europeans, Aboriginal people in the Purnululu area lit patches of country at different times, creating a mosaic of vegetation at different stages of recovery from fire. This provided a range of habitat conditions for many animal species as well as decreasing the damaging effects of intense wildfires. Some moist sheltered areas of the National Park and Conservation Reserve appear to have rarely been burnt. These and other areas are likely to support fire sensitive species of restricted distribution and are of special conservation value.

Information about the long-term effects of various fire regimes including fire exclusion is relatively limited and any fire management plan must be under constant review and accompanied by research and monitoring programs. Records should be kept of all fires in the Park both planned and unplanned and wherever possible, the effects of such fires monitored. A GIS provides an efficient mechanism for the recording and manipulation of such data, including areas of consistent vegetation, topography and fire interaction.

STRATEGIES

1. A resource management program (Section B 4.1) will be prepared on fire management for the Park which will include research needs and priorities.
2. In the development of all Park facilities an internal environmental assessment procedure will consider the proposed development in the context of fire protection (Section B.2).
3. Until a fire management plan is prepared, prescribed burning in the Park will be restricted to research, the protection of life and property, and strategic burning to protect the Park from wildfire.
4. Fire management procedures will comply with CALM Policy Statement No 19 (Fire Management Policy) and provisions of the Bush Fire Act.

4.8 Rehabilitation

The objective is to minimise erosion and rehabilitate degraded areas within and adjacent to the Park.

Large areas in the Park are degraded because of overgrazing by cattle and donkeys. Sheet and gully erosion occurs on many of the plains, especially along the frontage of the Ord River and Bellburn Creek. The soils and surfaces within the Park are fragile and prone to erosion. While pressure from feral animals can be controlled care is required when siting roads, tracks and other facilities. Continued co-operation between the Department of Agriculture, CALM, the Aboriginal traditional owners and the Agriculture Protection Board is desirable for effective rehabilitation.

Exotic species, including the woody weeds *Calotropis procera* and *Parkinsonia aculeata*, have aggressively colonised degraded flats and riparian areas, and Noogoora Burr has been recorded immediately adjacent to the Park.

STRATEGIES

1. A resource management program (Section B 4. 1) will be prepared on rehabilitation of the Park's degraded resources. This program will include reference to the prevention, control and eradication, if feasible, of exotic flora and fauna.
2. All Park developments will be subject to an internal environmental assessment procedure which will refer to erosion potential and to rehabilitation requirements (Section B.2).
3. Until a rehabilitation management plan is prepared, rehabilitation operations will be in accordance with the annual operations plan (Section B 4. 1, Strategy 2) and referred to the PPC and the Community Advisory Committee for their consideration.

B.5 MANAGEMENT OF CULTURAL RESOURCES

5.1 Purnululu Cultural Heritage Committee

The objectives are to:

- **Recognise, protect and promote the Aboriginal cultural values in the National Park and Conservation Reserve.**
- **Ensure the protection, preservation and management by the PCHC of all Aboriginal sites and objects within the National Park and Conservation Reserve.**

Under the provisions of the Aboriginal Heritage Act 1972-80, all Aboriginal sites and cultural objects in Western Australia are protected, including those sites and objects located within national parks and other reserves. Under Aboriginal customary law, traditional owners continue to be responsible for protection and management of sites and objects of cultural significance occurring in the Purnululu area. The Aboriginal cultural environment is best managed by the Aboriginal traditional owners.

The traditional owners of the Purnululu area have established the Purnululu Cultural Heritage Committee (PCHC) to consider any proposals in relation to the National Park or Conservation Reserve which may affect the Aboriginal cultural heritage of the region, and to advise the PPC and, where necessary, the Trustees of the Western Australian Museum and the Minister for Aboriginal Affairs as to any adverse impact. Jaru and Kija people, and other appropriate traditional owner groups will be represented on the PCHC.

STRATEGIES

1. All matters pertaining to Aboriginal cultural heritage including Aboriginal sites and objects will be referred to the PCHC.
2. Aboriginal cultural heritage information will be held in confidence unless approved in writing by the PCHC.

3. Access to any site of Aboriginal significance will not be permitted or encouraged unless specifically agreed to by the PCHC.
4. The PPC will refer applications for work and/or research to the PCHC for its advice.
5. Neither the Aboriginal traditional owners, nor the PCHC will be required to divulge or otherwise compromise any cultural information.

5.2 Traditional Aboriginal Activities

The objective is to provide for Aboriginal people to maintain their social, economic and religious practices in harmony with the conservation and management of the natural and cultural resources of the Park.

Traditional practices including hunting and gathering are an important element in the maintenance of Aboriginal cultural heritage. Aboriginal traditional owners have with permission hunted and collected traditional bush foods within the Park by means including firearms, subject to agreeing that in some areas firearms would be prohibited. It is proposed that some animals will be hunted according to stringent controls. According to the Wildlife Conservation Act, the Executive Director may consent to Aboriginal people taking flora or fauna from the Park, sufficient only for food for themselves and their families, but not for sale.

None of the rivers or creeks in the Park flows continuously during the dry season. A few permanent and semi-permanent pools exist which provide refuge for a variety of flora and fauna. These waterholes have traditionally provided refuge also for the Aboriginal people of the area.

The gathering of native honey (sugarbag) and the use of trees and other vegetation for production of tools and artefacts, construction of shelters and for firewood could cause impacts such as the localised depletion of vegetation, especially around living areas and along roads and tracks.

STRATEGIES

1. In consultation with the PCHC, the PPC shall recommend areas within the Park for use by Aboriginal traditional owners for traditional activities such as hunting and gathering, or for ceremonial purposes.
2. In consultation with the PCHC, the PPC shall develop guidelines pertaining to Aboriginal hunting and gathering as well as ceremonial activities to ensure that:
 - natural resources do not become unduly depleted
 - incompatible activities are not carried out in or near visitor use areas
 - the possibility of interruption or intrusion by visitors is minimised
 - firearms in the Park will be licensed and separately registered with CALM's District Manager and operated within strict safety procedures (Section B 8.2)
 - suitable access is provided to areas established for hunting and gathering
 - a system for monitoring the use of natural resources of the Park will be developed and implemented.

5.3 Colonial Cultural Heritage

The objective is to protect the Colonial cultural heritage of the Park.

The Colonial history of the Purnululu area is defined largely by its long association with the pastoral industry, with land being available for lease from 1880. Under the open range cattle production system cattle preferentially concentrated on major river lines including the Ord River, where they were initially sustained by the abundance of surface water and productive native grasses.

By the 1930s most of the more productive land along the Ord River was severely degraded and eroding. A large area of this catchment including the present Park was resumed from pastoral use in 1967 for the purpose of regeneration. Various signs of the early pastoral history remain in the Park, including disused stock yards and bores, derelict fence lines and an abandoned campsite. Many of the Aboriginal traditional owners and their families have had a long association with the pastoral industry in this area, and there is still much oral history material available.

STRATEGY

1. The Colonial cultural heritage of the Park will be recorded and future management will take Colonial heritage values into consideration.

B.6 MANAGEMENT FOR PUBLIC USE

6.1 Framework for Management of Public Use

The objectives are to:

- **Provide for public use consistent with the proper protection of the natural and cultural environments of the Park.**
- **Ensure that management takes account of the Park's unique qualities, in particular the public perception of its wilderness character.**

A framework for management of public use will need to provide a mechanism by which visitor impact upon the Park can be monitored and assessed, in determining how best to protect the Park's natural and cultural environments.

Impact of use will include physical, biological, cultural and social impacts. Such impacts will need to be monitored on a regular basis. Any proposal for new developments in the Park, including camping grounds, will require internal environmental assessment (Section B.2).

STRATEGIES

1. Maintain low key public access in a way which retains the wilderness values of the Park.

2. Ensure that proposals for future visitor facilities, including provision of commercial accommodation, are consistent with the Park's unique natural and cultural values.
3. Encourage appropriate nature-based recreation activities which enhance visitor appreciation of the Park.
3. Monitor visitor numbers and the impacts of visitor use.
4. All proposed visitor developments will be subject to an internal environmental assessment procedure (Section B.2).
5. A system of zoning will be considered to provide a base for the regulation of activities within defined locations.

6.2 Access

The objective is to provide access which is consistent with the maintenance of Park values.

Road Access

The extremely rugged terrain including numerous creek crossings makes road access into the Park difficult. During periods of heavy rainfall creeks may rise and flood, cutting off road access within or to the Park. The access road passes through Mabel Downs pastoral lease for most of its length. Both the main access route and internal tracks cross numerous creek beds and wide tracts of country which have high erosion potential.

In the event of approved aerial access to the Park during the wet season, vehicle access within the Park will be limited to those roads traversing the more stable pindan soil types which can sustain limited vehicular traffic during wet conditions.

Sites of cultural and biological significance may be at risk from visitor and vehicle impact. In the visitor survey conducted during 1987 and in the responses to the draft management plan in 1989, there was general approval of the four wheel drive standard of access, although a quarter of those surveyed in 1987 suggested that some road works were necessary or desirable in the Park (Colreavy and Cavana 1988).

STRATEGIES

1. Road access will continue to be low key to maintain the wilderness character of the Park. Guidelines for road access will be developed in consultation with the PPC and the Community Advisory Committee, and will reflect the current four-wheel drive sole access arrangements, wet season access restrictions, and fee collection arrangements.
2. An internal environmental assessment procedure will be applied to proposed road developments (Section B.2).

Aerial Access

An airstrip has been developed in the Park. This provides an opportunity for visitors to fly in to the Park, join a conducted tour, stay overnight and fly out the next day, or to join a shorter tour which arrives and departs by air on the same day. This is the preferred method to access the Park so that visitor impacts are limited, and the feeling of relative wilderness can be maintained.

The Bellburn camping area has been redeveloped to provide low-key facilities for such tours, and shelter, parking and toilet facilities have been developed at Purnululu airstrip.

Opportunities exist for wet season aerial access to cater for bushwalkers and day visits. Guidelines have been developed to ensure that the activities of air charter companies and ground tour operators are safe, and that impacts on the Park including on visitors and residents are minimised.

Helicopter access during the dry season is currently limited to one operator who must adhere to a defined flight path over the massif. Landings are restricted to a specified area at Bellburn airstrip. Aerial access will be managed to minimise conflict with other Park users.

STRATEGIES

1. Guidelines on aerial access developed by CALM will be monitored and reviewed by the PPC and the Community Advisory Committee. Applications for use of the Park airstrip will be processed by CALM in accordance with these guidelines.
2. Guidelines for wet season helicopter access will be prepared by CALM and referred to the PPC and the Community Advisory Committee.
3. Fees will continue to apply for aircraft landing rights at the airstrip, and for helicopter operations at the Park. Relocation of the helicopter operator's camp will be considered, and referred to the PPC and the Community Advisory Committee.

6.3 Recreation

The objective is to provide recreational opportunities and experiences consistent with the maintenance of natural and cultural values.

Bushwalking

Walking is one of the best ways for visitors to appreciate the diversity and scale of the landscape. Some short/medium length walks (Map 7) have proved very popular with visitors to the Park (Colreavy and Cavana 1988). The vast area of the massif, the similarity of the terrain in places and extreme climatic conditions pose a risk to the unwary or ill-prepared walker. Visitors who are bushwalking or exploring gorges want the environment to appear as natural and undisturbed as possible.

Some areas in the Park are of special biological and cultural significance and visitor access will be restricted. Many landscape surfaces in the Park are highly susceptible to damage and accelerated erosion. Remote bushwalking

involving overnight camping is permitted at Piccaninny Gorge. Wet season bushwalking can be facilitated by aerial access.

STRATEGIES

1. Guidelines for walking access will be developed, and referred to the PPC and the Community Advisory Committee.

These guidelines will include reference to:

- the protection of cultural, biological and landscape values
- permits for overnight, extended, wet season, or unmarked walks
- a code for minimal impact bushwalking
- Visitor safety.

2. An internal environmental assessment procedure (Section B.2) will be applied to proposed walks.

Day Use Areas

The quality of the visitor experience and protection of the Park's unique natural and cultural environments is closely related to visitor densities.

STRATEGIES

1. Day use areas will be developed subject to review by the PPC and the Community Advisory Committee.
2. An internal assessment procedure (Section B.2) will be applied to the upgrading of current and proposed day use areas.

Camping

The majority of visitors stay two days or more in the Park. Camping is a form of accommodation consistent with the remote bush experience. Designated camping areas are considered the most appropriate means for managing visitor accommodation while maintaining Park values.

STRATEGIES

1. Current camping areas at Bellburn Creek, Walardi and Kurrajong will be monitored and improved as required.
2. Further camping areas will be developed subject to internal environmental assessment and referral to the PPC and the Community Advisory Committee. It is likely that new areas will be developed in the hills away from the massif within the Conservation Reserve.
3. Development of remote camping areas linked to low-impact bushwalking and wet season aerial access will be considered subject to appropriate guidelines, and referral to PPC and the Community Advisory Committee.

6.4 Commercial Operations

The objective is to ensure that commercial operations are encouraged, but conducted in such a way as to maintain and enhance visitor experiences while preserving Park values.

CALM Policy Statement No 18 (Recreation, Tourism and Visitor Services) allows commercial involvement in national parks and in areas such as the Purnululu Conservation Reserve. Opportunities for several commercial activities exist in the Park. Current commercial operations include four-wheel drive vehicle tours, scenic flights, and fly/drive tours. Demand also exists for accommodation within the Park in the form of appropriate seasonal or permanent facilities sympathetic to the Park environment, and operated under lease/licence agreements with CALM. The Government and CALM wish to encourage Aboriginal commercial enterprises and other employment initiatives. Commercial operators and visitors will need to be kept informed of the important natural and cultural values of the area.

STRATEGIES

1. Commercial operations which facilitate visitor enjoyment of the Park will be encouraged, but will be required to recognise the very high natural and cultural values of the area and comply with the limitations these impose.
2. Commercial operations will be subject to scrutiny by the PPC and the Community Advisory Committee, and to internal environmental assessment.
3. All concessions, whether lease or licence, will require the approval of the NPNCA and the Minister.

6.5 Information, Education and Interpretation

The objective is to provide visitors with information which will enhance their safety, knowledge, appreciation and enjoyment of the natural and cultural resources of the Park and the Region.

Information provided to visitors will be expanded to cover areas known to be inadequate, for example, the cultural importance of the area to Aboriginal people. Provision of interesting, relevant and useful information ensures a greater degree of public support and participation in implementing management objectives.

STRATEGIES

1. Guidelines for the provision of information, education and interpretation will be developed, consistent with the Park policy on public use (Section B 6. 1), and referred to the PPC and the Community Advisory Committee.
These guidelines will include reference to:
 - interpretation programs
 - Aboriginal involvement in Park management

- visitor information/orientation facilities
 - flora and fauna and the ecological basis underlying their management
 - Aboriginal and Colonial cultural history
 - information on the state of the access road, fees and visitor safety.
2. Internal environmental assessment procedure (Section B.2) will be applied to developments associated with the provision of information, education and interpretation.

B.7 MANAGEMENT FOR RESIDENTS

7.1 Housing

The objective is to provide suitable housing and service arrangements for residents within the Park.

There has often been an inadequate understanding of the requirements which people have for housing in remote areas, and an associated lack of proper planning and materials. There exists an opportunity in the Park for the development of housing and provision of services to be sympathetic to the needs of residents and to reflect Park values.

STRATEGIES

1. Residential development plans will be produced in accordance with guidelines prepared by the PPC, and will be submitted to the PPC, the Community Advisory Committee and the NPNCA for their consideration. These plans will be compatible with the overall planning philosophy for the Park and sympathetic to environmental and cultural values.
2. Residential development plans including the provision of housing, facilities and other essential services will be subject to an internal assessment procedure (Section B.2).

7.2 Services

The objective is to allow for the provision of adequate and suitable health, education and communication facilities for Park residents.

Medical emergencies in the Park may pose serious problems due to the long, rough road to the highway. There will be a need by resident communities for some form of continuing health care service. Education facilities will be required for Park residents.

STRATEGIES

1. Where provision of community services entails construction or major alteration of facilities it will be subject to an internal assessment procedure (Section B.2).

2. The PPC will develop guidelines on the provision of community services, including health, education and communication facilities.

B.8 SAFETY

8.1 Visitor Safety

The objective is to plan and provide for the safety of Park visitors.

The Park presents the potential for serious risk to the safety of visitors. It is generally lacking ready supplies of water, and with very high temperatures for much of the visitor season it presents the hazards of dehydration and heat stress to the unwary and ill-prepared visitor. The combination of high growth rates of vegetation in the wet season and a long dry season, accompanied by high temperatures, can present a high fire risk.

The Aboriginal traditional owners of Purnululu National Park have a strong sense of responsibility for the safety of visitors.

STRATEGIES

1. Guidelines for visitor safety will be developed by CALM, and reviewed by the PPC and the Community Advisory Committee. Advice will be provided for visitors in brochures and on notice boards.
2. Public awareness of safety will be promoted.

8.2 Occupational Health and Safety

The objective is to plan and provide for the health and safety of Park staff and residents.

CALM is committed to ensuring the highest possible standards of occupational health and safety. The Department will provide safe working conditions by seeing that every effort is made to avoid, remove or remedy the causes of industrial accidents or occupational ill-health. Each individual has a responsibility to develop safe and healthy work practices and conditions. There is a need for Park staff and residents to be trained in health and safety practices.

STRATEGIES

1. All Park staff will be trained in first aid, occupational safety, basic bushcraft and survival skills, radio communications, search and rescue, fire management and safe use of firearms.
2. Firearms in the Park will be licensed, registered with the CALM District Manager and operated in accordance with strict safety guidelines.

8.3 Emergency Procedures

The objective is to provide procedures for emergencies which may occur in, or threaten, the Park.

The unique landscape and rugged access and climatic conditions of Purnululu National Park pose special risks and constraints. Because of the Park's size and remoteness, any sick or injured people are unlikely to receive early treatment. High temperatures for much of the year will cause visitor discomfort and pose a potential safety hazard. There is a high risk of wildfire in the Park with its extensive grasslands and long dry season.

STRATEGIES

1. Procedures will be developed for civil or medical emergencies. These will be regularly reviewed.
2. Park staff and residents will be kept informed of emergency procedures.
3. Staff will be trained in fire suppression management, search and rescue procedures and first aid (Section B 8.2).

B.9 PARK ADMINISTRATION

9.1 Staffing

The objectives are to:

- **Ensure that sufficient numbers of adequately trained staff are appointed to implement the plan.**
- **Provide opportunities for Aboriginal people to be employed wherever possible and appropriate in the Park.**

The implementation of this management plan will place substantial demands on Park, Regional and District staff and on members of the PPC, particularly in planning (for example, preparation of resource management programs), design, supervision and interpretation.

To maximise Aboriginal employment in the management of the Park, working hours and conditions will need to be structured to meet the cultural obligations of Aboriginal staff and contract workers.

STRATEGIES

1. Provide adequate staff to implement this plan.
2. The PPC will develop guidelines for the selection and induction of staff employed by CALM within the Park. Selection guidelines will attend to CALM policy.

3. Staff requirements will be monitored to ensure adequate protection and management of the Park.
4. Promote the appointment of Aboriginal traditional owners to staff positions.
5. The PPC will investigate additional categories of employment for Aboriginal people including contracts, consultancies and other forms of fulltime or part-time employment.

9.2 Staff Training

The objectives are to:

- **Provide Park staff with cross-cultural training.**
- **Develop the skills and attitudes of Park staff to facilitate the implementation of the management plan.**

Staff in Purnululu have a special need for good communication skills, cultural awareness and interpretative ability. Staff need to be aware of the provisions of the CALM Act, National Parks Regulations and the Wildlife Conservation Act as they apply to the Park. Staff will be encouraged to participate in training and personal development courses.

STRATEGY

1. Staff training and development programs will be provided for staff in accordance with guidelines developed by the PPC (Section B 7.2).

9.3 Communications

The objective is to provide and co-ordinate communication links which will assist the management of the Park in an effective and cost efficient manner consistent with Park values.

The communication needs of Park residents and visitors include appropriate telephone and radio facilities. Park staff require HF radios in vehicles to enable effective management especially in relation to the safety of residents and visitors.

STRATEGIES

1. An appropriate communications network will be established and maintained for the Park. In planning for and installing communication facilities, the communication needs of Park residents and visitors will be considered.
2. Installation of communication facilities will comply with internal environmental assessment procedures (Section B.2).

9.4 Park Headquarters

The objective is to provide adequate facilities for Park management in a centralised area which are compatible with environmental and cultural features of the Park, and consistent with principles of energy efficient design.

Two multi-purpose buildings have been established in the Park close to the Three-Ways junction. The establishment of a Park Headquarters is a major capital works development requiring detailed planning.

STRATEGIES

1. A Park Headquarters development plan will be produced and referred to the PPC and the Community Advisory Committee.
2. Site development plans will be prepared before the construction of management facilities as identified in the development plan and subject to an internal environmental assessment procedure (Section B.2).

B.10 PLAN IMPLEMENTATION

10.1 Research and Monitoring

The objective is to conduct research and monitoring which will enhance the knowledge and understanding of the Park and provide information relevant to management.

There is a need to increase knowledge of the Park's cultural and natural resources to enable the development of more effective management practices. Information should be stored so that it is easily retrieved, and able to be disseminated appropriately. It is likely that proposals for research will exceed CALM's resources. A table of this management plan's implementation strategies is provided in Appendix 4.

Some cultural information is extremely sensitive and cannot be available for unrestricted use. Pen-nits are required for research at Aboriginal sites under Section 16 of the Aboriginal Heritage Act 1972-80.

STRATEGIES

1. Compile an inventory of natural and cultural resources of the Park and transfer to GIS as the facility becomes available (Section B 4. 1).
2. Establish research and monitoring priorities in accordance with guidelines developed by the PPC and the Community Advisory Committee.
3. Research proposals will be referred to the PPC for its consideration. The advice of the PCHC will be sought for research proposals involving matters of cultural significance.

4. The use and dissemination of Aboriginal cultural information will be subject to approval by the PCHC.

10.2 Park Programs

The objective is to implement strategies for management on a priority basis to achieve optimal management of the Park.

The plan includes a broad range of strategies designed to achieve optimum management of the Park, its resources, residents and visitors. These strategies require funding for their implementation; this will be achieved on a priority basis as funds are available. CALM is responsible for the allocation of funds to achieve management objectives for the Park.

STRATEGIES

1. Priorities for management strategies and a fiveyear implementation plan will be prepared and referred to the PPC and the Community Advisory Committee.
2. The implementation plan will be reviewed annually by the PPC and the Community Advisory Committee, and an annual progress report will be prepared by CALM staff for their consideration.
3. The NPNCA will monitor the implementation of the Purnululu National Park management plan as required under the CALM Act.

10.3 Term of Plan

STRATEGIES

1. The term of this plan will be ten years, in accordance with Section 55(6) of the CALM Act.
2. There is provision under Section 61 of the CALM Act for the plan to be amended, as required. If proposed amendments mean major changes to the plan, the revised plan will be released for the statutory period of public review.
3. The management plan will be reviewed five years following gazettal. This review will identify the extent to which management objectives have been achieved and strategies implemented, the reasons for lack of intended achievement or implementation, and a summary of information which may affect future management. The review will be released for public comment for the statutory period of two months.

REFERENCES

- Australian Law Reform Commission (1984). *Aboriginal Customary Law: The Recognition of Traditional Hunting, Fishing and Gathering Rights*. Reference on Aboriginal Customary Law Research Paper No 15. ALRC, Sydney.
- Beard, J.S. (1979). *The Vegetation of the Kimberley Area*. Vegetation Survey of Western Australia. Explanatory Notes to Sheet 1. UWA Press, Nedlands.
- Beere, G.M. (1983). The Piccaninny Structure - a cryptoexplosive feature in the Ord Basin, East Kimberley. *Geol. Surv. WA Rec.* 6.
- Braithwaite, R.W., Cowie, I.D. and Gambold, N. (1991). Report to Australian Heritage Commission on Middle Ord Region (Bungle Bungle). CSIRO Division of Wildlife and Ecology, Darwin NT.
- Bungle Bungle Working Group (1986). Final Report to the EPA. Bulletin No 261. Dept of Conservation and Environment, Perth WA.
- Burbidge, A A. (1985). Fire and Mammals in Hummock Grasslands of the Arid Zone. In: Ford, J. (Ed) (1985). *Fire Ecology and Management in Western Australian Ecosystems*. Proceedings of May 1985 Symposium, WAIT Environmental Studies Group Report No 14.
- Colreavy, M. and Cavana, M. (1988). Bungle Bungle National Park and Conservation Reserve. Visitor Survey. April -September, 1987. Dept Conservation and Land Management, WA.
- Department of Agriculture (1985). Maps showing Pastoral Potential in the Kimberley Region, Western Australia. 1:500 000 scale. 3 maps and notes. Rangeland Management Branch, Dept of Agriculture, Perth.
- Department of Conservation and Land Management (1987). Strategies for Conservation and Recreation on CALM Lands in Western Australia. Unpublished Report.
- Department of Main Roads (1988). Bungle Bungle National Park. Access Road Planning Report. Report No 0090P. Unpublished Report.
- Department of Regional Development and the Northwest and Department of Planning and Urban Development (1990). Kimberley Region Plan Study Report. A Strategy for Growth and Conservation. Perth WA.
- De Salis, J. (1982). Resource Inventory and Condition Survey of the Ord River Regeneration Area. Western Australian Department of Agriculture. Unpublished Report.
- Dow, D.B. and Gemuts, 1. (1967). Dixon Range, Western Australia. Bureau of Mineral Resources. Geol Geophys Aust. Explanatory Notes SE/52-6: 1-15 [1:250 000 geological map series].
- Dow, D.B. and Gemuts, 1. (1969). Precambrian geology of the East Kimberley region. Bureau of Mineral Resources. Geol. Geophys. Aust. Bulletin No 106.

- Environmental Protection Authority (1980). Conservation Reserves for Western Australia. System 7. Perth WA.
- Forbes, S. and Kenneally, K. (1985). Bungle Bungle and its Surrounds: its Botanical Significance. *Environment WA* 7(2): 8-11.
- Forbes, S. and Kenneally, K. (1986). A Botanical Survey of Bungle Bungle and Osmand Range, South-Eastern Kimberley, Western Australia. *West Aust Nat.* 16: 5-7
- Hallam, S.J. (1985). The History of Aboriginal Firing. In: Ford, J. (Ed) (1985). *Fire Ecology and Management in Western Australian Ecosystems*. Proceedings of May 1985 Symposium, WAIT Environmental Studies Group Report No. 14.
- Haynes, C.D. (1985). The Pattern and Ecology of Munwag: Traditional Aboriginal Fire Regimes in North Central Arnhem Land. *Proc Eco. Soc of Aust.* 13: 203-204.
- International Union for the Conservation of Nature and Natural Resources (1980). World Conservation Strategy: Living Resource Conservation for Sustainable Development. Gland, Switzerland.
- International Union for the Conservation of Nature and Natural Resources (1988). Resolutions of 17th General Assembly, Costa Rica.
- Kimber, P. (1988). Landscape Character Types for the Kimberley Region, Western Australia. Unpublished report.
- Kimber, R. (1983). Black Lightning: Aborigines and Fire in Central Australia and the Western Desert. *Archaeology in Oceania* 18: 38-44.
- Kitchener, D.J. (1978). Mammals of the Ord River Area, Kimberley, Western Australia. *Rec. West. Aust. Mus.* 6(2).
- Latz, P.K. and Griffin, G.F. (1978). Changes in Aboriginal land management in relation to fire and to food plants in central Australia. In: *The Nutrition of Aborigines in Relation to the Ecosystems of Central Australia*. (Eds B.S. Hetzel and H.J. Frith) pp 77-85. CSIRO, Melbourne.
- Leonard, M. and Hammond, R. (1983). Landscape Character Types of Victoria. Forest Commission, Victoria.
- Lewis, H.T. (1985). Burning the 'Top End': Kangaroos and Cattle. In: Ford, J. (Ed) (1985). *Fire Ecology and Management in Western Australian Ecosystems*. Proceedings of May 1985 Symposium, WAIT Environmental Studies Group. Report No 14.
- McKenzie, N.L. (1981). Mammals of the Phanerozoic South-West Kimberley, Western Australia Biogeography and recent changes. *L Biogeog.* 8: 263-280.

- Mory, A.J. and Beere, G.M. (1985). Palaeozoic stratigraphy of the Ord Basin, Western Australia and Northern Territory. *Geo Surv WA*. Report 14: 36-45.
- Mory, A.J. and Beere, G.M. (1988). Geology of the onshore Bonaparte and Ord Basins in Western Australia. *Geo Surv WA*. Bulletin 134.
- Muir, B.G. (1983). Annotated List of Birds and Mammals Recorded in the Vicinity of Bungle Bungle. Unpublished Report.
- Passmore, J.R. (1964). The Hydrology of the Cambridge Gulf, Lissadell and Dixon Range. *Geol Surv WA*. Rec 2.
- Perry, R.A. (1970). Pasture Lands of the Ord-Victoria Area. In: Stewart, G.A. *et al* (1970). *Lands of the Ord-Victoria Area; WA and Northern Territory*. CSIRO Land Research Series No 28.
- Plumb, K.A. (1989). Halls Creek Province and the Granites-Tanami Inlier - regional geology and minor mineralisation. In: *Geology of the Mineral Deposits of Australia and Papua New Guinea*. AusIMM. In preparation.
- Purnululu Aboriginal Corporation (1988). Management Plan Submission regarding Purnululu (Bungle Bungle) National Park and Conservation Reserve. Unpublished Report.
- Robertson, M., Vang, K. and Brown, A.J. (1992). Wilderness in Australia. Issues and Options - A Discussion Paper. Minister for the Arts, Sport, and Environment and Territories, Canberra ACT.
- Robinson, C.S. (1970). Ecology of the Hardman Basin, Northern Territory. Animal Industry and Agriculture Branch, Northern Territory. Technical Bulletin No 6.
- Rose, B.D. (1985). Preliminary Report: Ethnobotany in the Bungles. East Kimberley Working Paper No 5. CRES, ANU.
- Scarlett, N. (1985). A Preliminary Account of the Ethnobotany of the Kija People of the Bungle Bungle Outcamp. East Kimberley Working Paper No 6. CRES, ANU.
- Simpkin-Brown, J. (1985). A Resource Inventory of the Bungle Bungle Area, East Kimberley Region, Western Australia. Unpublished Report.
- Slatyer, R.O. (1970). Climate of the Ord-Victoria Area. In: Stewart, G.A. *et al* (1970). *Lands of the Ord-Victoria Area; WA and Northern Territory*. CSIRO Land Research Series No 28.
- Stewart, G.A. *et al* (1970). *Lands of the Ord-Victoria Area; WA and Northern Territory*. CSIRO Land Research Series No 28.
- Stuart-Street, A. and Kirkpatrick, B.A. (1990). Landscape Character Types of Western Australia. Preliminary Draft, Department of Conservation and Land Management.

Traves, D.M. (1955). The Geology of the OrdVictoria Region of Northern Australia. Bureau of Mineral Resources, Australia. Bulletin 27.

WA Government (1981). Aboriginal Heritage Act 1972-1980.

WA Government (1984). Conservation and Land Management Act 1984.

WA Tourism Commission (1987). Submission to the Draft Plan of Management for the Bungle Bungle National Park. Unpublished Report.

Williamson, D.N. and Chalmers, LA. (1982). Perceptions of Forest Scenic Quality in Northeast Victoria. Forest Commission, Victoria.

Woinarski, J.C.Z. (Ed) (1990). A Survey of the Wildlife and Vegetation of the Purnululu (Bungle Bungle) National Park and Adjacent Area. Final report to the WA Department of Conservation and Land Management from CSIRO Division of Wildlife and Ecology, Darwin. Unpublished Report.

Young, R.W. (1987). Erodibility of Sandstone Surfaces of the Bungle Bungle, East Kimberley Region. Report to the Heritage Committee of Western Australia.

APPENDICES

APPENDIX 1. DISCUSSION OF VISITOR SURVEY RESULTS

The Purnululu National Park with its spectacular scenery and remote location has captured the imagination of the travelling public. Relatively few people are actually getting into the Park at present, but those who have are so impressed that their word-of-mouth, together with increasing media attention, will guarantee greater visitor numbers in the future.

Those people who take the great trouble and effort required to reach the massif are vitally interested in its future management and protection. This is evidenced by the very high return rate (94%) of questionnaires and the great amount of detail and thought which were put into the comments.

Most visitors appear to be couples on extended holidays, probably travelling around Australia. Many visit other national parks on their trip. About 50% of visitors appear to travel up from the south, and about 30% across from the Northern Territory. More than half the visitors in 1987 were from interstate. Only 17% of respondents were on organised commercial tours; the rest were independent travellers.

The preferred style of accommodation is camping, with most people enjoying basic bush camping. Some visitors, however, would appreciate the comfort of a commercial campsite with better facilities provided.

Virtually all visitors appreciated the intrinsic values of the natural environment, enjoying the camping, scenery and natural history. Most people visited named places, following well-established tracks and walks; relatively few explored further afield or ventured into unmarked gorges.

Most visitors saw nothing of the Aboriginal cultural history of the Park, although many indicated an interest. There was a general demand for information of all types in the Park, including maps, directional signs and interpretive information.

There is a challenge here for management to resolve: to maintain a natural, unspoilt, wilderness ambience, while providing suitable visitor facilities which enhance a safe, comfortable and informative trip.

From a management perspective, the major observations based on visitors' comments are:

- Retain the Park in its natural state with no development nor commercialisation
- Some roadworks are required to reduce erosion of tracks
- More literature, information, maps and signs are needed
- Present campsites and facilities require improvement
- Increased involvement of Aboriginal people in park management would be appreciated
- Further road access and more walks are required
- Visitors enjoy a high level of contact with Park Rangers.

APPENDIX 2. INTERNAL ENVIRONMENTAL ASSESSMENT

1. New development proposals and some operations will require internal environmental assessment prior to implementation. A report on relevant developments will be prepared, and will include:

- reason for the proposal
- description and justification of proposal
- location of proposal including consideration of alternative locations
- description and justification of design including proposed materials
- description of natural resources including flora and fauna and assessment of potential impacts (especially regarding rare and restricted associations, habitats and species)
- description of potential impacts on drainage and soils and associated vegetation
- description of potential for erosion and weed infestation and methods of prevention and control.
- description of potential impacts on ground or surface water including the quantities of water to be used, water quality, and potential impacts on fauna and flora, both aquatic and terrestrial
- assessment of impact on landscape values
- assessment of implications for fire management
- description of methods of rehabilitation where required
- details of logistics, costs and necessary equipment

The PCHC will advise the PPC in the preparation of a report on the impact of the proposed development or operation on Aboriginal heritage values of the Park.

Development should aim as far as possible to achieve:

- minimal impact on the natural and cultural environment
- the use of materials which are congruent with Park values
- energy-efficiency in design, construction and operation
- the conservation and wise use of limited water resources.

Development and operations that will be subject to assessment include:

- alterations to, and maintenance of, existing developments that involve disturbance of ground vegetation beyond the original area disturbed during construction, or which alter the colour, size or external appearance of the development.
- new vehicle tracks, walks and service lines (water pipes, electricity lines)
- new buildings (including residential development), water tanks, campground and day use sites
- new signs, and alterations to signs that change the message conveyed
- the location of new borrow pits.

2. Developments and operations that will not be subject to assessment include:

- maintenance grading of existing tracks and the airstrip
- slashing/vegetation control of the run-off strips each side and ends of the airstrip

- forming and gravelling existing tracks (provided borrow pits for gravel have been subject to assessment)
- alterations to, and maintenance of, existing developments that involve no change in area of soil/vegetation disturbance, or size, colour and external appearance
- replacement/repainting of signs where there is no change in the message conveyed
- prescribed burning operations for the protection of the Park, its residents and visitors
- feral animal control operations involving aerial shooting
- any emergency operations to deal with safety matters.

APPENDIX 3. NPNCA POLICY STATEMENT

ABORIGINAL INVOLVEMENT IN NATIONAL PARKS AND NATURE CONSERVATION.

In relation to Aboriginal involvement in nature conservation, the NPNCA:

1. will ensure that Aboriginal relationships to land of cultural significance are recognised and maintained;
2. recognises that under Aboriginal customary law, traditional Aboriginal custodians have their own cultural rights and responsibilities toward certain areas;
3. resolves to consult with Aboriginal people having special affiliation to lands vested with the Authority regarding the management of those lands;
4. determines to negotiate on a case by case basis with each group of Aborigines having an affiliation to conservation lands to resolve such issues as availability of living areas;
5. acknowledges that the Aboriginal cultural environment is best understood by Aboriginal people, and wherever possible, the Authority will involve Aborigines in the protection and management of cultural sites on conservation lands;
6. undertakes to address land management issues of interest to Aboriginal people so as to ensure equity for all public interest groups whilst carrying out its primary functions for the conservation and appreciation of the natural environment as laid down in the CALM Act (1984) and the Wildlife Conservation Act (1950).

APPENDIX 4. STRATEGY IMPLEMENTATION TABLE

Management Strategies

1.0 PARK MANAGEMENT

1.1 Purnululu Park Council

1. All matters of Aboriginal interest in the Park will be referred to the PPC for its consideration. The PPC will develop park management policies in relation to these matters and will report directly to the Minister for the Environment.
2. The PPC will determine its procedures and will meet regularly.
3. The PPC will refer any matter relating to Aboriginal cultural heritage to the Purnululu Cultural Heritage Committee for advice and comment prior to making any decisions on the matter.
4. Any matter on which agreement cannot be reached will be referred to the Minister for the Environment for direction.
5. The PPC will keep the NPNCA and the Community Advisory Committee briefed on decisions arising from the PPC so that they can consider such decisions and advise the Minister independently as they see fit.
6. Joint Jaru / Kija representation on the PPC will remain in place until the current dispute is resolved, after which Aboriginal representation on the PPC may be varied to reflect the outcome of the dispute.

1.2 Purnululu Community Advisory Committee

1. A Community Advisory Committee will be formed as soon as practicable after the release of this plan.
2. The Community Advisory Committee will keep the PPC and NPNCA briefed on its decisions.

1.3 National Parks and Nature Conservation Authority

1. The NPNCA will keep the PPC and the Community Advisory Committee briefed on decisions arising from the NPNCA in relation to the Park so that they can consider such determinations and advise the Minister independently as they see fit.

2.0 ENVIRONMENTAL ASSESSMENT

1. New development proposals and some operations will require internal environmental assessment prior to implementation.
2. CALM, in association with the PPC and the Community Advisory Committee, will develop a policy on the internal environmental assessment of development proposals and operations, including identification of proposals and operations which should be subject to such assessment, to ensure developments and operations have minimal impact on the natural and cultural resources and values of the Park.
3. Where internal environmental assessment is required, a written report will be prepared and submitted to the PPC and the Community Advisory Committee.
4. Prior to making their assessment, the PPC will seek the advice of the Purnululu Cultural Heritage Committee in relation to any report on the impact of a proposed development or operation on Aboriginal heritage values of the Park.

3.0 PARK BOUNDARIES AND TENURE

3.1 Park Boundaries and Tenure

1. Any negotiations on future preferred boundaries of the Purnululu National Park will ensure that land tenure and Park boundaries provide the best possible protection to the environmental and cultural values of the area.
2. The PPC and the Community Advisory Committee will comment on proposals to extend the National Park into the Conservation Reserve, and into adjacent pastoral leases as opportunities arise.
3. Lease holders will be consulted to determine a preferred course of action for future management of adjacent lands. Three possible courses of action to be considered are:
 - Government acquisition of portions of leases from current leaseholders
 - agreements for management as per Section 16 of the CALM Act
 - restructuring of boundaries with adjacent properties.
4. CALM will liaise with appropriate bodies to incorporate sections of the Ord River Regeneration Reserve into the National Park.
5. Further discussions will be held with DOLA with a view to transferring existing trigonometric sites out of the Park. If alternative sites are to be located within the Park, the advice of the PPC will be sought.

3.2 Mining Leases and Exploration Licenses

1. Applications for an exploration licence to undertake non ground-disturbing exploration within the Purnululu National Park would require notification to DEP, referral to CALM and the NPNCA and the concurrence of the Minister for the Environment. If approved the licence would be subject to strict environmental conditions. Exploration involving significant environmental disturbance may be approved following referral to CALM, NPNCA and EPA if required. Productive mining in the Park would be subject to EPA assessment, concurrence of the Minister for the Environment and Parliamentary approval.
2. Exploration licences within Purnululu Conservation Reserve may be approved by the Minister for Minerals and Energy following referral to CALM, recommendations of the NPNCA and the Minister for the Environment, and would be subject to strict environmental guidelines. Exploration involving environmentally significant disturbance may be referred to the EPA if required. In the case of productive mining proposals approval may be granted following assessment by the Department of Minerals and Energy, receipt by CALM/NPNCA of a Notice of Intent, and recommendations of the NPNCA and the Minister for the Environment. EPA can assess if significant impact is likely, and in the case of formal assessment the Minister for the Environment may impose conditions.
3. The PPC and the Community Advisory Committee may provide advice to the Minister on all mining and exploration proposals.
4. Applications for mining activity that may result in significant disturbance may be referred to the Department of Environmental Protection. Conditions consistent with this management plan will be recommended in order to minimise impacts on the biophysical and cultural environments and to ensure effective subsequent rehabilitation.

3.3 Living Area Leases

1. Ministerial approval will be sought to establish three living areas for Aboriginal traditional owners within the Park. With the approval of the Minister and the NPNCA, the Executive Director will grant leases for living areas at a peppercorn rent for the maximum permissible term under the CALM Act. The living area leases will include negotiated terms and conditions which secure reasonable Aboriginal aspirations while taking due account of other Park values.
2. Aboriginal residents shall have appropriate access to approved living areas.
3. The PPC and the NPNCA will provide advice to the Minister on all matters pertaining to Aboriginal living areas and access.
4. All site planning and design and construction criteria will be subject to an internal environmental assessment procedure (Section B.2) and will be consistent with the management for residents' requirements (Section B.7).
5. Applications for additional living areas will be endorsed by the Aboriginal traditional owners prior to their consideration by the PPC.

4.0 MANAGEMENT OF NATURAL RESOURCES

4.1 Resource Management Programs

1. An annual works program will be prepared and submitted to the PPC and the Community Advisory Committee for their consideration.
2. An annual operations plan will be prepared for each category of natural resource (including fire and rehabilitation) to provide the basis for management decisions in relation to natural resources until the RMPs are developed. This plan will be submitted to the PPC and the Community Advisory Committee for their consideration.
3. Resource management programs will be prepared in order to provide detailed information on each natural resource and its management. These programs will be submitted to the PPC and the Community Advisory Committee for their consideration.
4. A GIS will be established.

4.2 Hydrology

1. A resource management program (Section B 4. 1) will be prepared for hydrological resources of the Park, including river systems, permanent waterholes, springs, seeps and groundwater. The program will include monitoring of groundwater extraction, and an assessment of available water resources.
2. In the development of all Park facilities an internal environmental assessment procedure will determine impacts on hydrology (Section B.2).
3. The conservation of scarce water resources will be incorporated in the design of future Park buildings.

4.3 Soils and Geomorphology

1. A resource management program (Section B 4. 1) will be prepared for the management of soils and the surface of the massif and outliers.
2. In the development of all Park facilities an internal environmental assessment procedure will consider the impact of the proposed development on soils (Section B.2).

4.4 Landscape

1. A resource management program (Section B 4. 1) will be prepared for the protection of landscape. The visual resources of each landscape character type will be assessed and areas of high scenic quality requiring special management will be recorded. Degraded areas in need of rehabilitation will also be assessed.
2. In the planning and development of all Park facilities, an internal environmental assessment procedure will consider impacts on visual landscape values. (Section B.2).

4.5 Flora and Vegetation

1. A resource management program (Section B 4. 1) will be prepared for the Park's flora, including the use of appropriate fire management practices, and assessment of exotic species and proposals for their prevention, eradication or control.
2. In the development of all Park facilities an internal environmental assessment procedure will consider the impact of the proposed development on flora (Section B.2).
3. Vegetation surveys will aim to assess and define significant species and associations in the Park.

4.6 Fauna

1. A resource management program (Section B 4. 1) will be prepared for the Park's fauna, including an assessment of feral species and proposals for their eradication or control.
2. In the development of all Park facilities an procedure will consider the impact of the proposed development on fauna (Section B.2).
3. Surveys will aim to assess species, population levels, and conservation status and habitat requirements of fauna in the Park.
4. Domestic animals will be allowed in the Park only under conditions of permit as provided by the Executive Director and in accordance with guidelines developed by the PPC. Domestic cats will not be allowed in the Park.

4.7 Fire

1. A resource management program (Section B 4. 1) will be prepared on fire management for the Park which will include research needs and priorities.
2. In the development of all Park facilities an internal environmental assessment procedure will consider the proposed development in the context of fire protection (Section B.2).
3. Until a fire management plan is prepared, prescribed burning in the Park will be restricted to research, the protection of life and property, and strategic burning to protect the Park from wildfire.
4. Fire management procedures will comply with CALM Policy Statement No. 19 (Fire Management Policy) and provisions of the Bush Fire Act.

4.8 Rehabilitation

1. A resource management program (Section B 4. 1) will be prepared on rehabilitation of the Park's degraded resources. This program will include reference to the prevention, control and eradication, if feasible, of exotic flora and fauna.
2. All Park developments will be subject to an internal environmental assessment procedure which will refer to erosion potential and to rehabilitation requirements (Section B.2).

3. Until a rehabilitation management plan is prepared, rehabilitation operations will be in accordance with the annual operations plan (Section B 4.1, Strategy 2) and referred to the PPC and the Community Advisory Committee for their consideration.

5.0 MANAGEMENT OF CULTURAL RESOURCES

5.1 Purnululu Cultural Heritage Committee

1. All matters pertaining to Aboriginal cultural heritage including Aboriginal sites and objects will be referred to the PCHC.
2. Aboriginal cultural heritage information will be held in confidence unless approved in writing by the PCHC.
3. Access to any site of Aboriginal significance will not be permitted or encouraged unless specifically agreed to by the PCHC.
4. The PPC will refer applications for work and/or research to the PCHC for its advice.
5. Neither the Aboriginal traditional owners, nor the PCHC will be required to divulge or otherwise compromise any cultural information.

5.2 Traditional Aboriginal Activities

1. In consultation with the PCHC, the PPC shall recommend areas within the Park for use by Aboriginal traditional owners for traditional activities such as hunting and gathering, or for ceremonial purposes.
2. In consultation with the PCHC, the PPC shall develop guidelines pertaining to Aboriginal hunting and gathering as well as ceremonial activities to ensure that:
 - natural resources do not become unduly depleted
 - incompatible activities are not carried out in or near visitor use areas
 - the possibility of interruption or intrusion by visitors is minimised
 - firearms in the Park will be licensed and separately registered with CALM's District Manager and operated within strict safety procedures (Section B 8.2)
 - suitable access is provided to areas established for hunting and gathering
 - a system for monitoring the use of natural resources of the Park will be developed and implemented.

5.3 Colonial Cultural Heritage

1. The Colonial cultural heritage of the Park will be recorded and future management will take Colonial heritage values into consideration.

6.0 MANAGEMENT FOR PUBLIC USE

6.1 Framework for Management of Public Use

1. Maintain low key public access in a way which retains the wilderness values of the Park.
2. Ensure that proposals for future visitor facilities, including provision of commercial accommodation, are consistent with the Park's unique natural and cultural values.
3. Encourage appropriate nature-based recreation activities which enhance visitor appreciation of the Park.
4. Monitor visitor numbers and the impacts of visitor use.

5. All proposed visitor developments will be subject to an internal environmental assessment procedure (Section B.2).
6. A system of zoning will be considered to provide a base for the regulation of activities within defined locations.

6.2 Access

1. Road access will continue to be low key to maintain the wilderness character of the Park. Guidelines for road access will be developed in consultation with the PPC and the Community Advisory Committee, and will reflect the current four-wheel drive sole access arrangements, wet season access restrictions, and fee collection arrangements.
2. An internal environmental assessment procedure will be applied to proposed road developments (Section B.2).

Aerial Access

1. Guidelines on aerial access developed by CALM will be monitored and reviewed by the PPC and the Community Advisory Committee. Applications for use of the Park airstrip will be processed by CALM in accordance with these guidelines.
2. Guidelines for wet season helicopter access will be prepared by CALM and referred to the PPC and the Community Advisory Committee.
3. Fees will continue to apply for aircraft landing rights at the airstrip, and for helicopter operations at the Park. Relocation of the helicopter operator's camp will be considered, and referred to the PPC and the Community Advisory Committee.

6.3 Recreation

1. Guidelines for walking access will be developed, and referred to the PPC and the Community Advisory Committee. These guidelines will include reference to:
 - the protection of cultural, biological and landscape values
 - permits for overnight, extended, wet season, or unmarked walks
 - a code for minimal impact bushwalking
 - visitor safety.
2. An internal environmental assessment procedure (Section B.2) will be applied to proposed walks.

Day Use Areas

1. Day use areas will be developed subject to review by the PPC and the Community Advisory Committee.
2. An internal assessment procedure (Section B.2) will be applied to the upgrading of current and proposed day use areas.

Camping

1. Current camping areas at Bellburn Creek, Walardi and Kurrajong will be monitored and improved as required.
2. Further camping areas will be developed subject to internal environmental assessment and referral to the PPC and the Community Advisory Committee. It is likely that new areas will be developed in the hills away from the massif within the Conservation Reserve.

3. Development of remote camping areas linked to low-impact bushwalking and wet season aerial access will be considered subject to appropriate guidelines, and referral to PPC and the Community Advisory Committee.

6.4 Commercial Operations

1. Commercial operations which facilitate visitor enjoyment of the Park will be encouraged, but will be required to recognise the very high natural and cultural values of the area and comply with the limitations these impose.
2. Commercial operations will be subject to scrutiny by the PPC and the Community Advisory Committee, and to internal environmental assessment.
3. All concessions, whether lease or licence, will require the approval of the NPNCA and the Minister.

6.5 Information, Education and Interpretation

1. Guidelines for the provision of information, education and interpretation will be developed, consistent with the Park policy on public use (Section B 6.1), and referred to the PPC and the Community Advisory Committee. These guidelines will include reference to:
 - interpretation programs
 - Aboriginal involvement in Park management visitor information/orientation facilities
 - flora and fauna and the ecological basis underlying their management
 - Aboriginal and Colonial cultural history
 - information on the state of the access road, fees and visitor safety.
2. Internal environmental assessment procedure (Section B.2) will be applied to developments associated with the provision of information, education and interpretation.

7.0 MANAGEMENT FOR RESIDENTS

7.1 Housing

1. Residential development plans will be produced in accordance with guidelines prepared by the PPC, and will be submitted to the PPC, the Community Advisory Committee and the NPNCA for their consideration. These plans will be compatible with the overall planning philosophy for the Park and sympathetic to environmental and cultural values.
2. Residential development plans including the provision of housing, facilities and other essential services will be subject to an internal assessment procedure (Section B.2).

7.2 Services

1. Where provision of community services entails construction or major alteration of facilities it will be subject to an internal assessment procedure (Section B.2).
2. The PPC will develop guidelines on the provision of community services, including health, education and communication facilities.

8.0 SAFETY

8.1 Visitor Safety

1. Guidelines for visitor safety will be developed by CALM, and reviewed by the PPC and the Community Advisory Committee. Advice will be provided for visitors in brochures and on notice boards.
2. Public awareness of safety will be promoted.

8.2 Occupational Health and Safety

1. All Park staff will be trained in first aid, occupational safety, basic bushcraft and survival skills, radio communications, search and rescue, fire management and safe use of firearms.
2. Firearms in the Park will be licensed, registered with the CALM District Manager and operated in accordance with strict safety guidelines.

8.3 Emergency Procedures

1. Procedures will be developed for civil or medical emergencies. These will be regularly reviewed.
2. Park staff and residents will be kept informed of emergency procedures.
3. Staff will be trained in fire suppression management, search and rescue procedures and first aid (Section B 8.2).

9.0 PARK ADMINISTRATION

9.1 Staffing

1. Provide adequate staff to implement this plan.
2. The PPC will develop guidelines for the selection and induction of staff employed by CALM within the Park. Selection guidelines will attend to CALM policy.
3. Staff requirements will be monitored to ensure adequate protection and management of the Park.
4. Promote the appointment of Aboriginal traditional owners to staff positions.
5. The PPC will investigate additional categories of employment for Aboriginal people including contracts, consultancies and other forms of full-time or part-time employment.

9.2 Staff Training

1. Staff training and development programs will be provided for staff in accordance with guidelines developed by the PPC (Section B 7.2).

9.3 Communications

1. An appropriate communications network will be established and maintained for the Park. In planning for and installing communication facilities, the communication needs of Park residents and visitors will be considered.
2. Installation of communication facilities will comply with internal environmental assessment procedures (Section B.2).

9.4 Park Headquarters

1. A Park Headquarters development plan will be produced and referred to the PPC and the Community Advisory Committee.
2. Site development plans will be prepared before the construction of management facilities as identified in the development plan and subject to an internal environmental assessment procedure (Section B.2).

10.0 PLAN IMPLEMENTATION

10.1 Research and Monitoring

1. Compile an inventory of natural and cultural resources of the Park, and transfer to GIS as the facility becomes available (Section B 4. 1).
2. Establish research and monitoring priorities in accordance with guidelines developed by the PPC and the Community Advisory Committee.
3. Research proposals will be referred to the PPC for its consideration. The advice of the PCHC will be sought for research proposals involving matters of cultural significance.
4. The use and dissemination of Aboriginal cultural information will be subject to approval by the PCHC.

10.2 Park Programs

1. Priorities for management strategies and a five-year implementation plan will be prepared and referred to the PPC and the Community Advisory Committee.
2. The implementation plan will be reviewed annually by the PPC and the Community Advisory Committee, and an annual progress report will be prepared by CALM staff for their consideration.
3. The NPNCA will monitor the implementation of the Purnululu National Park management plan as required under the CALM Act.

10.3 Term of Plan

1. The term of this plan will be ten years, in accordance with Section 55(6) of the CALM Act.
2. There is provision under Section 61 of the CALM Act for the plan to be amended, as required. If proposed amendments mean major changes to the plan, the revised plan will be released for the statutory period of public review.
3. The management plan will be reviewed five years following gazettal. This review will identify the extent to which management objectives have been achieved and strategies implemented, the reasons for lack of intended achievement or implementation, and a summary of information which may affect future management. The review will be released for public comment for the statutory period of two months.