SHANNON AND D'ENTRECASTEAUX NATIONAL PARKS

Draft Management Plan

2005

Department of Conservation and Land Management

Conservation Commission of Western Australia

INVITATION TO COMMENT

This draft management plan is an opportunity to provide information, express your opinion, suggest alternatives and have your say on how the Shannon and D'Entrecasteaux national parks will be managed over the next 10 years.

If you prefer not to write your own submission, you could make a joint submission with others. To ensure your submission is as effective as possible:

- make it clear and concise;
- list your points according to the sections and page numbers in the management plan;
- describe briefly each subject or issue you wish to discuss;
- say whether you agree or disagree with any or all of the objectives or strategies within each subject or just those of specific interest to you – clearly state your reasons (particularly if you disagree) and provide supportive information where possible; and
- suggest alternatives to deal with issues with which you disagree.

It is important to indicate those strategies you agree with as well as those with which you disagree. Each submission is important, but those that give reasons for concerns, give support where appropriate and offer information and constructive suggestions are most useful.

All submissions will be summarised according to topics discussed. The management plan will then be reviewed in the light of submissions, according to established criteria (see below). A summary of the submissions will be prepared along with the final management plan, including an indication of how the management plan was amended or not amended in response to the submissions:

1. The draft management plan may be amended if a submission:
   (a) provides additional resource information of direct relevance to management;
   (b) provides additional information on affected user groups of direct relevance to management;
   (c) indicates a change in (or clarifies) Government legislation, management commitment or management policy;
   (d) proposes strategies that would better achieve management objectives and aims; or
   (e) indicates omissions, inaccuracies or a lack of clarity.

2. The draft management plan may not be amended if a submission:
   (a) clearly supports the draft proposals;
   (b) offers a neutral statement or no change is sought;
   (c) addresses issues beyond the scope of the management plan;
   (d) makes points that are already in the management plan;
   (e) is one amongst several widely divergent viewpoints received on the topic and the strategy of the draft management plan is still considered the best option; or
   (f) contributes options that are not possible (generally due to some aspect of existing legislation, or Government policy).

Submissions are welcome for two months after the date of release of the draft management plan. Submissions can be made online at: <http://www.calm.wa.gov.au/national_parks/management/index.html#management_plans>.

Or by writing to:

Planning Coordinator
Shannon and D'Entrecasteaux National Parks Management Plan
Department of Conservation and Land Management
Locked Bag 104, Bentley Delivery Centre
BENTLEY WA 6983

PREFACE

All national parks, conservation parks and nature reserves in Western Australia are vested in the Conservation Commission of Western Australia. The Department of Conservation and Land Management, in accordance with the *Conservation and Land Management Act 1984,* carries out the management of these reserves and prepares management plans on behalf of the Conservation Commission. The Conservation Commission issues draft management plans for public comment and provides final management plans for approval by the Minister for the Environment.

The Conservation and Land Management Act specifies that management plans must contain:

- a statement of the policies or guidelines proposed to be followed; and
- a summary of operations proposed to be undertaken.

This draft management plan is for the Shannon and D'Entrecasteaux national parks, the proposed additions to the parks and the 5(g) reserve adjacent to Lake Jasper. The final management plan will replace the *Shannon Park and D'Entrecasteaux National Park Management Plan 1987-1997* (CALM 1987).

In accordance with section 55 of the Conservation and Land Management Act, the term of the final management plan will be 10 years, or until the plan is superseded by a new management plan.

Changes since the Previous Management Plan

The parks have been managed according to the *Shannon Park and D'Entrecasteaux National Park Management Plan 1987-1997* for the last 17 years. Since 1987, many of the tenure proposals in the previous plan have been implemented, including the gazettal of Shannon National Park in 1988. Due to further tenure proposals and changes since the previous management plan, the Shannon and D'Entrecasteaux national parks now require a new management plan. Changes since the previous management plan include changes in Government legislation and policy, new research and knowledge, increased demand for and use of the parks and a shift in societal values, which are summarised below and reflected throughout this draft management plan.

Changes in Government Legislation and Policy

- The Conservation Commission was formed in 2000 to replace the National Parks and Nature Conservation Authority as the controlling body for the terrestrial conservation reserve system in Western Australia.
- Changes to the Conservation and Land Management Act have given the Conservation Commission responsibility for submitting management plans to the Minister and developing guidelines for monitoring and assessing the implementation of the management plans. Consequently management plans are now outcome-based in terms of performance assessment, and include Key Performance Indicators that will be audited by the Conservation Commission.
- There is an increased commitment by the Government to involve Aboriginal people in management of the conservation reserve system and to raise the profile of Aboriginal culture. The Government released the consultation paper *Indigenous Ownership and Joint Management of Conservation Lands in Western Australia* in 2003.
- A bioregional approach to conserving Australia's biodiversity has been developed. In the south-west 'forest ecosystems' have been defined to further the establishment of a comprehensive, adequate and representative reserve system for the State.
- Old growth forests have been identified as a significant value of the south-west and in 2001 the Government commenced implementation of the *Protecting Our Old Growth Forest* policy. Under this policy several new reserves will be created adjacent to the parks, which add to the reserve system, and provide further nature-based recreation opportunities within the region, but also limit other activities not compatible with

conservation. As part of this policy, Shannon National Park has also been included as one of the parks of the Walpole Wilderness Area, which will raise the profile of the park.

- As part of gazetting wilderness within the Walpole Wilderness Area, the Department has developed a draft wilderness policy. There is an opportunity to gazette wilderness within the parks and this management plan identifies candidate wilderness areas to be managed according to the policy.
- New legislation such as the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, and a new Act to replace the *Wildlife Conservation Act 1950* has been signalled. These changes provide/will provide stronger protection for species and communities within the State.
- The development of an *Environmental Weed Strategy for Western Australia*, which rates weeds according to specific criteria to aid in determining priority for control.
- A Government policy for the control of coastal squatters' huts was adopted in 1999, which facilitates the removal of the structures over a 6-year period. There are 62 squatters' shacks within the parks and the management of these shacks will be in accordance with the policy and this management plan.
- The policy on commercial beekeeping in national parks is being reviewed. This management plan is one of the first to consider the implications of the proposed changes.

New Research and Knowledge

- Recognition of the potential impacts of climate change (and decreasing rainfall).
- Impacts associated with management of the broader catchment have been recognised, in particular adjacent land use impacts on hydrology and water quality within the parks.
- The wetland areas of the parks have been identified as potential acid sulphate soil areas.
- Further surveying and research has been carried out with regards to flora, fauna and communities within the parks. In particular threatened ecological communities have been identified which require specific management to address threats such as feral pigs.
- A series of wetland surveys along the south coast have assessed the values of the wetlands within the parks and many have been identified as being of national importance.
- More knowledge has been gained with regard to diseases and their effects on species within the parks.
- Fire management has undergone a major change recently. There is now a strong emphasis given to using fire to manage for biodiversity at a landscape scale.
- Further surveying has aided in assessing the threat status of the State's plants and animals.
- Landscapes in the State have been identified and described as Landscape Character Types. The parks have been further assessed in terms of scenic quality.
- Archaeological surveys in the parks, in particular in the Lake Jasper area, have dramatically improved knowledge of cultural values.
- Research into the impacts of horse-riding in the parks has been carried out.

Increased Demand for and Use of the Parks

- Pressure on the parks is increasing in terms of recreational use and demand as well as mining, commercial use and infrastructure to service Windy Harbour and private property enclaves.
- There is a marked increase in four-wheel drive use of the parks. Many of the tracks within the parks require consolidating or seasonal closure and the previous management plan needs updating and/or clarification in this regard.
- Many of the visitors to the parks are also seeking new adventure activities that were not planned for in the previous management plan.
- There is increased pressure on the parks to remain remote as visitation to the south-west increases.
- Management arrangements with regards to power-craft on Lake Jasper are no longer workable and impacts warrant changing the previous plan.
- There is a need to identify further opportunities for walk trails and built accommodation to meet the demand for a range of recreational opportunities within the parks. There is also a need to upgrade/rehabilitate many of the existing camping areas.

NOMENCLATURE

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

The word 'Noongar' can be spelt in numerous ways. The spelling of Noongar in this form should be seen to encompass Nyoongar, Nyungar, Noongah and Nyungah spellings.

The 'parks' refer to Shannon National Park, D'Entrecasteaux National Park and the adjacent 5(1)(g) reserve, formerly comprising some private property and part of D'Entrecasteaux National Park. Whilst the 5(1)(g) reserve is not a park, it is intended to be incorporated into D'Entrecasteaux National Park if mining does not occur, or when it is mined and rehabilitated. The 'planning area' refers to the parks (as defined above) and other proposed additions to the parks.

Whilst this management plan is specifically for the 'parks', it is the objective of the Department that the proposed additions to the parks are managed in a similar way, especially where the Department is the managing body. During the life of this management plan, the additions are proposed to be added to either to Shannon National Park or D'Entrecasteaux National Park. Therefore, where management refers to the 'parks', this will include any additions to the parks subsequent to gazettal of this management plan.

When 'South West' is used in this management plan, it refers to the South West Planning Region used by the South West Development Commission, the Western Australia Tourism Commission, and the Department of Planning and Infrastructure or the South West Region of the Department of Conservation and Land Management. The South West Planning Region follows the boundaries of the shires of Harvey, Collie, Boyup Brook and Manjimup. The South West Planning Region does not correspond with the regional boundaries of the South West Region of the Department. When 'south-west' is used, it refers to the general south-west corner of Western Australia.

In this management plan, records used for 'endemic fauna' refer to fauna with their natural range being restricted to the south-west and 'endemic flora' refers to flora being endemic to the Warren bioregion. 'Locally endemic' refers to flora and fauna with a range of less than 150 kilometres.

ACKNOWLEDGEMENTS

This draft management plan was prepared by the Shannon and D'Entrecasteaux National Parks Planning Team: Aberline Nix (Planner and management plan co-ordinator), Rod Annear (former Ranger in Charge, Donnelly District), John Gillard (Donnelly District Manager), Greg Mair (Blackwood District Manager and former Walpole District Manager) and Cliff Winfield (Parks and Visitor Services Regional Leader, Warren Region).

The Planning Team would like to thank the many other Departmental staff who contributed to and commented on sections of this plan over the years (including those who have since changed roles or left the Department).

The assistance of the Shannon and D'Entrecasteaux National Parks Advisory Committee is also especially acknowledged: Peter Keppel (Chairman), Koodah Cornwall, Barbara Dunnet, Andrea Endacott, Dave Evans, Thomas Gerner, Carol McKennay, Don Milligan, Tom Muir, Helen Nixon, Paul Owens, Andy Russell and Joanna Young.

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PART A. INTRODUCTION

1. BRIEF OVERVIEW

The Shannon and D'Entrecasteaux national parks and the adjacent 5(g) reserve (the parks) are located south of Manjimup on the south coast of Western Australia and cover a total area of 171 868 hectares (Map 1 Management Planning Area).

The parks were a result of the recommendations by the Conservation Through Reserves Committee for conservation reserves throughout Western Australia to establish a reserve system for the State (Conservation Through Reserves Committee 1974). One of the many recommendations was for a south coast national park to preserve a large area free from human development, which provided wilderness and solitude for visitors, magnificent coastal scenery, varied natural features and diverse vegetation types. Another recommendation was for a national park to preserve a large area of wet sclerophyll forest based on a river catchment, at a time when much of the karri (*Eucalyptus diversicolor*) forest was not formally reserved, and clear-felling methods were being introduced to the region.

These national parks are now known as D'Entrecasteaux National Park and Shannon National Park, and are a result of the amalgamation of various State forest and timber reserves, Crown land, Shire of Manjimup reserves, conservation reserves, pastoral leases and freehold purchases through the 1970s, 1980s and 1990s. The 5(g) reserve was excised from D'Entrecasteaux National Park in 1994 to allow mining (only part has been mined at this stage) and it continues to be managed similarly to D'Entrecasteaux National Park as much as possible (see Section 3 Management Plan Area).

The parks are managed by the Department of Conservation and Land Management (the Department) from the regional office at Manjimup and through district work centres at Pemberton, Manjimup, Northcliffe and Walpole. The Department manages these areas on behalf of the Conservation Commission of Western Australia (the Conservation Commission).

Shannon National Park includes most of the water catchment of the Shannon River and includes extensive old growth and regrowth karri forest. The old Shannon townsite within the park was once a settlement for timber workers and its interpretive and recreational values are significant.

D'Entrecasteaux National Park has long been valued for its rugged coastlines, beaches and dune systems as well as extensive and nationally significant wetland systems that provide habitat for a range of endemic flora and fauna.

Both parks provide a valuable recreational resource for the local communities in the Manjimup, Pemberton, Northcliffe and Walpole area as well as a significant drawcard within the region (see Section 2 Regional Context).

The conservation values of the parks are a function of their large area and wide diversity of wetland, woodland and forest ecosystems. The parks provide large intact fauna habitats, and protect restricted vegetation communities and rare and priority flora and fauna within the south-west. They also contain the lower reaches of a major group of rivers, including the Donnelly, Warren, Gardner and Shannon. These provide an important conservation and recreational resource as well as water supply potential.

Shannon National Park is included in the proposed 'Walpole Wilderness Area', which includes the existing Mt Frankland National Park, Walpole-Nornalup National Park and four other proposed national parks. The Walpole Wilderness Area, coupled with the D'Entrecasteaux National Park, represents nearly half-a-million hectares of continuous national parks stretching from Augusta in the west to Denmark in the east.

Visitation to the parks is increasing—Shannon National Park as part of the forest experience of the south-west, and D'Entrecasteaux National Park as part of the coastal four-wheel driving, fishing and camping experience. Recreational pressures from increased visitor use include conflicts between user groups, vandalism, domestic dogs being brought into the park, firewood collection, the continued use of closed tracks and the creation of new tracks, camping in sensitive areas, and the spread of *Phytophthora cinnamomi*.

These impacts, along with changing Departmental policy and community expectations, have influenced the review of the previous management plan. This new management plan will provide more effective and relevant guidelines to protect the values of the parks (see Section 4 Key Values) and proposed additions.

2. REGIONAL CONTEXT

The parks and proposed additions (the planning area) are located within the South West Planning Region of Western Australia (Map 2 Regional Context). This region covers an area of 23 970 square kilometres and is the most popular destination for tourists in Western Australia outside of Perth. The planning area is within the local authorities of the shires of Nannup and Manjimup. The region's attractions include the coastal landscapes, beaches, wineries, forests, national parks, caves, festivals and events, and the numerous opportunities for recreation and nature-based tourism.

The South West Planning Region has a population of approximately 132 000 people who mostly live along the western coast in the major towns of Bunbury, Busselton and Margaret River. Other towns in the region include Collie, Donnybrook, Nannup, Bridgetown, Manjimup, Pemberton, Augusta and Walpole. The South West Planning Region has the highest population within regional Western Australia and its growth rate is more than twice that of the national average. By 2011, it is estimated that the population of the region will be 157 300 (South West Development Commission 2003).

The top three employers in the region are manufacturing, retail, and agriculture, forestry and fishing (South West Development Commission 2003).

The region has the most diversified economy of all the State's nine planning regions. In 2002 to 2003 the largest contributors to the region's economy were:

- mineral extraction, processing and manufacturing ($2.2 billion);
- commerce ($977 million);
- tourism ($512 million); and
- agricultural production ($473 million).

Lands vested in the Conservation Commission and managed by the Department (including the parks) are promoted as significant drawcards. The way in which these assets are managed will continue to impact on the tourism and recreational potential of the region. Liaison with local authorities will be important in promoting and managing the conservation and nature-based recreation values of the parks.

Based on Departmental 2003 to 2004 visitation figures, the top five parks within the region were:

- Leeuwin-Naturaliste National Park (1.9 million visits);

- Walpole-Nornalup National Park which includes the Valley of the Giants (291 000 visits);
- Gloucester National Park, which includes the Gloucester Tree (170 000 visits);
- Wellington National Park (135 000 visits); and
- D'Entrecasteaux National Park (81 000 visits. See Section 25 Recreational Opportunities – Visitor Numbers and Trends).

Tenure proposals in the *Forest Management Plan 2004-2013* (Conservation Commission 2004) will add approximately 370 000 hectares to the public conservation estate and create at least 23 new national parks in the South West Planning Region (Map 2 Regional Context) (the *Forest Management Plan* replaces previous proposals under the 1999 *Regional Forest Agreement* and the 1994 *Forest Management Plan*).

The Walpole Wilderness Area will be an added attraction for tourists visiting the South West Region, along with the associated interpretive experiences such as the proposed Walpole Wilderness Discovery Centre. Icon attractions such as the Gloucester Tree and the Tree Top Walk, together with the marketing of the Walpole Wilderness Area, will ensure the continuing value of national parks to the South West Planning Region's economy.

The following management plans for other reserves within the South West Planning Region have been finalised to date:

- The *Lane Poole Reserve Management Plan 1990 – 2000* (the draft revision of a new plan is due for release in 2005);
- the *Leeuwin-Naturalist National Park Management Plan 1988-1998* (the draft of a new plan including Gingilup Swamps Nature Reserve, Scott National Park and other proposed new national parks Yelverton, Bramley and Forest Grove along the Leeuwin-Naturaliste Ridge is due for release in 2005); and
- the *Walpole-Nornalup National Park Management Plan 1992-2002* (this will be incorporated into a management plan for the *Walpole Wilderness Area Management Plan* due also for release as a draft in 2005).

3. MANAGEMENT PLAN AREA

The planning area covered by this management plan (Map 1 Management Planning Area):

The Planning Area

The Parks

- Shannon National Park[1] (gazetted as 52 598 hectares);
- D'Entrecasteaux National Park (gazetted as 116 686 hectares); and
- the 5(g) reserve (400 hectares) in the vicinity of Lake Jasper;

Proposed Additions

- the proposed Cable Sands land addition (1083 hectares) in the vicinity of Lake Jasper;
- the proposed pastoral lease additions to the parks (Quannup 4480 hectares);
- land to be added to the parks under the *Forest Management Plan 2004-2013* (two parcels totalling 1600 hectares); and
- private property enclaves within the parks purchased during the life of this management plan.

In total, the management plan covers an existing reserve area of approximately 169 684 hectares, and may, by the end of the life of the plan, cover an additional 7163 hectares (total 176 847 hectares). The planning area is mostly within the Department's

[1] The park is part is of the Walpole Wilderness Area, and will be mentioned within the proposed Walpole Wilderness Area Management Plan, however the Shannon and D'Entrecasteaux National Parks Management Plan will be the prime document in regards to specific management of Shannon National Park.

Warren Region, with the proposed Cable Sands land addition and one parcel to be added from the *Forest Management Plan 2004-2013* which currently are within the Department's South West Region.

D'Entrecasteaux National Park

D'Entrecasteaux National Park comprises two Class A reserves (No.s 36996 and 43961) vested in the Conservation Commission and set-aside for the purpose of 'national park and water' (see Map 3 Tenure).

At present, D'Entrecasteaux National Park covers an area of approximately 116 686 hectares along a coastline of 130 kilometres, from Black Point in the west to Long Point in the east. Along the open shore of this section, the D'Entrecasteaux National Park extends to the low water mark.

D'Entrecasteaux National Park shares parts of its boundary with Walpole-Nornalup National Park, the proposed national park south of Mt Frankland National Park, Shannon National Park, Gingilup Nature Reserve and two new national parks proposed in the Pemberton-Northcliffe area.

The park also borders unallocated Crown land, State forest and private property. There are also internal enclaves of private property, a pastoral lease and Crown reserves vested in or under the control of the Shire of Manjimup (Windy Harbour [90 hectares] and Camfield [40.5 hectares] townsites on the north-eastern edge of Broke Inlet).

D'Entrecasteaux National Park wholly or partly encompasses the small inlets of the Donnelly, Warren, Meerup and Gardner rivers and Doggerup Creek. It also includes the shoreline of Broke Inlet (to low water mark) and the islands in the inlet (i.e. Shannon, Bald and Clarke islands). Broke Inlet is considered the only large estuary in the south-west with minimal development around its shores and within its catchment. In 1994 the Department recommended that Broke Inlet should become a marine reserve (CALM 1994a), an approach that was ratified by the Government in 2003. The creation of a marine reserve will enable the inlet's conservation and recreation values to be managed in an integrated manner with D'Entrecasteaux National Park.

In 1994, 368 hectares of land in the Lake Jasper area was excised from D'Entrecasteaux National Park and a 5(g) reserve created to facilitate mining (see Section 32 Mining). This land is still within the management plan area (Map 1 Management Planning Area). Part of the reserve has already been mined and rehabilitated and is due to be returned to D'Entrecasteaux National Park.

If mining proceeds on the remainder of the reserve, 1083 hectares provided by Cable Sands as an environmental offset will be added to the park. This land, adjacent to D'Entrecasteaux National Park and already vested in the Department's Executive Director, is partly cleared and has been used for agricultural purposes. It is proposed that the land will be rehabilitated and used primarily for nature-based recreation (see Section 27 Recreational Use). If the mining proposal does not proceed, then the remainder of the 5(g) reserve shall be returned to D'Entrecasteaux National Park, and the Executive Director reserve will be returned to private ownership.

A number of pastoral leases (four of the five available) and private property (seven of the 26 available) have been added to the park since gazettal of the 1987 management plan. These additions total 9976 hectares (7921 hectares of pastoral lease and 2055 hectares of private property).

The park surrounds nineteen private properties (totalling 2629 hectares). Coastal and enclave properties, rather than properties on the edge of the park, will be considered for purchase when they become available (Appendix 1). These properties remain mostly undisturbed and

have high conservation value. Cable Sands currently own five of these private properties, totalling 1309 hectares.

There are also many gazetted road reserves traversing both parks, some of which are currently unimproved. Some of the road reserves leading to private enclaves are poorly located in relation to landscape and environmental values, and should be relocated. Other road reserves may no longer be required such as the extension to Woodarburrup Road through the western end of D'Entrecasteaux National Park to link to Scott Road. These should be cancelled and added to the parks following consultation with the local authority (Appendix 1).

Proposed additions other than the 5(g) reserve and the Executive Director land include the Quannup pastoral lease, a 600 hectare area of State forest to the north of the 5(g) reserve and 1000 hectares of State forest on the east side of Gardner River.

Shannon National Park

Shannon National Park is a Class A Reserve (No. 40836) vested in the Conservation Commission and set-aside for the purpose of 'national park'. The National Park was established in 1988 in accordance with the recommendations of the 1987 management plan. The park incorporated State forest, vacant Crown land, part of Sir James Mitchell National Park and an old school site to cover an area of 52 598 hectares. The boundaries of the park generally follow the catchment of the Shannon River and adjoin State forest, proposed national parks and private property. New national parks to the east and west of the existing park are being created under the *Forest Management Plan 2004-2013* and the Government's *Protecting Our Old Growth Forests* policy.

4. KEY VALUES

The following are the key values that this management plan seeks to protect.

Conservation Values

- Extensive, varied, unique and nationally significant wetland systems that provide habitat for a range of endemic flora and fauna.
- A rich mosaic of vegetation complexes representing wetland, woodland and forest ecosystems protecting restricted vegetation communities and conservation significant flora populations.
- Extensive areas of intact fauna habitat and populations of conservation significant fauna.
- Intact and varied natural landscapes with high scenic quality such as coastal cliffs, lakes, wetlands, inlets, granite outcrops and beaches.
- Sites of outstanding geoheritage, important for research and for understanding the formation of the landscape and environment.
- Statutory protection through reservation of almost an entire water catchment.

Recreational Values

- Remote areas of potential wilderness quality.
- A terrestrial environment that provides opportunities for a wide range of nature-based recreational opportunities including recreational driving, bushwalking, picnicking, camping, fishing and wildlife interaction.
- Coastal day use opportunities for local communities of the lower south-west.
- Long distance hiking and proposed cycling opportunities on the Bibbulmun Track and extension to the Mundi Biddi Mountain Bike Trail respectively.

Cultural Values

- Aboriginal sites and landscapes of mythological, ceremonial, cultural and spiritual significance.
- Sites, landscapes and stories of European exploration, cattle grazing and droving, and timber settlements of cultural and ceremonial significance to non-Indigenous people.

Economic Values

- Nature-based tourism opportunities for commercial tour operators, focussing on the parks' wide range of natural and cultural values.
- Tourism expenditure from visitors attracted by the parks' natural and cultural values.

Educational Values

- An extensive range of community educational and interpretation opportunities to describe the native flora and fauna, Aboriginal and non-Indigenous cultural heritage, fire management and ecology of the south-west and the Department's management of the area.
- A diverse array of natural environments providing numerous research opportunities to increase knowledge associated with ecosystem biological and physical processes, species of flora and fauna and their habitats, and the effects and management of threatening processes.

5. PUBLIC PARTICIPATION

This draft management plan has been developed in consultation with local communities, park users and other interested parties in the following ways:

- public submissions were invited through State and local newspapers during preparation of the draft;
- community consultation meetings were conducted;
- a community advisory committee was formed to have input in the development of the plan;
- other government agencies were consulted, including the Department of Indigenous Affairs, the Department of Environment, Water and Rivers Commission and the Department of Industry and Resources; and
- meetings were held with stakeholder groups and interested individuals.

PART B. MANAGEMENT DIRECTIONS AND PURPOSE

6. VISION

The draft vision for the Shannon and D'Entrecasteaux national parks is that:

> *By the year 2015, the natural and cultural values of the parks are in the same or better condition than in the year 2005 and there will be a greater understanding of the threats and impacts on these values. The parks will continue to support a wide range of nature-based recreational activities whilst preserving the remoteness of the parks. The local community will highly value the parks and will want to be involved in their protection and conservation. The Indigenous cultural heritage of the parks will be kept alive and promoted by active and ongoing involvement of the traditional owners who will have been able to reconnect with and care for their country.*

This vision of this plan is derived from State legislation and policy, and community input. The vision also reflects the key values of the parks and the importance of sustainably managing those values (see Section 4 Key Values).

7. LEGISLATIVE FRAMEWORK

Legislation

The *Conservation and Land Management Act 1984* governs the management of protected areas and, in the process, imposes certain obligations relating to management planning of these areas.

National parks and section 5(1)(g) reserves are vested in the Conservation Commission and managed by the Department in accordance with the Conservation and Land Management Act. Management of these reserves includes the preparation of management plans as required by section 54(3)(a)(i) of the Act, which are to contain a statement of policies or guidelines to be followed in the management of the area, and a summary of the operations proposed to be taken over the life of the management plan (section 55 of the Act).

Each management plan is written with a 10-year time frame. Over this time, the management plan is subject to audit by the Conservation Commission (see Section 10 Performance Assessment). As a result of the review and auditing process, or for some other reason, it may be necessary to amend the management plan. The procedure to make an amendment to a gazetted management plan is governed by section 61 of the Conservation and Land Management Act and involves a public consultation process. If a management plan is considered still relevant after 10 years, it will not be a Departmental priority to replace it. All plans, whether 10 years old or not, remain in force until a replacement management plan is gazetted.

National parks are a category of protected area under the Conservation and Land Management Act and are terrestrial areas of national or international significance for biological, scenic, or cultural values. Commercial exploitation of flora and fauna is not permitted and only recreational pursuits that do not adversely affect ecosystems and landscapes are permitted.

Land reserved as a 5(1)(g) reserve is set aside to achieve the purpose for which the land was reserved, or for which the care, control and management of the land were placed with the controlling body. In the case of the 5(g) reserve in the Lake Jasper area, the purpose is for conservation and mining.

The *Wildlife Conservation Act 1950* also provides for specific protection of native flora and fauna on all lands and waters within the State boundaries (see Section 18 Species and Communities of Conservation Significance). The *Environment Protection and Biodiversity Conservation Act 1999* also contains provisions relating to the protection of nationally-listed threatened species and ecological communities and listing of key threatening processes (see sections 12 Climate Change, 18 Species and Communities of Conservation Significance, 20 Introduced and 21 Other Problem Animals and Diseases).

This management plan is required to conform to the *Bush Fires Act 1954* and satisfy the Fire and Emergency Services Authority that adequate fire protection will be provided for the reserves (see Section 22 Fire). Under section 34 (1a)(a) of that Act, the management plan requires approval from the Authority. Under section 45 of the Bush Fires Act, the Department may take responsibility for the suppression of fires threatening the conservation estate.

Under the *Aboriginal Heritage Act 1972*, the Department is required to report Aboriginal heritage sites and ensure that sites are protected (see Section 23 Indigenous Heritage). The (Commonwealth) *Native Title Act 1993* requires that native title claimants and representative bodies are notified when a management plan is being prepared or major public works undertaken. The South-West Aboriginal Land and Sea Council is the native title representative body for the parks and has a number of functions prescribed under the Native Title Act.

Recreational fishing in the parks is managed under the *Fish Resources Management Act 1994*. However, under the *Conservation and Land Management Regulations 2002*, fishing on lands managed by the Department may be restricted.

The *Mining Act 1978* and the *Petroleum Act 1967* take precedence over the Conservation and Land Management Act. Activities authorised under either of these acts may override the contents of this management plan (see Section 32 Mining).

Obligations and Agreements

Australia is a participant or signatory to a number of international conservation agreements and which affect the management of conservation estate. They include the following:

The Convention on Biological Diversity

Australia signed the Convention on Biological Diversity at the United Nations Conference on Environment and Development (also known as the 'Rio Earth Summit') in 1992. The *National Strategy for the Conservation of Australia's Biological Diversity* was adopted in 1996 as the principal means for co-ordinated implementation of the convention in Australia. Its main goal is to protect biological diversity and maintain ecological processes and systems. To address this goal there has been a number of significant changes to policy and legislation for biodiversity conservation in Australia to strengthen regulatory and institutional mechanisms. This includes the Environment Protection and Biodiversity Conservation Act and the Natural Heritage Trust programs.

Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA)

Australia's treaties with Japan and China came into force in the 1980s to protect migratory birds in these countries. The treaties provide for cooperation between the governments involved to protect shared migratory species and their habitats. Nearly 80 bird species, many of them associated with wetlands, are listed in these agreements.

Migratory birds listed under these agreements are further protected under the Environment Protection and Biodiversity Conservation Act. This Commonwealth legislation stipulates that all actions likely to impact on such species are subject to environmental assessment and approval. This places Australia in a stronger position to meet its international obligations for

the protection and management of migratory birds listed under the JAMBA and CAMBA agreements.

There are four bird species covered under the JAMBA and/or CAMBA agreements that are recorded in the parks (see Section 18 Species and Communities of Conservation Significance).

Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention)

The Convention on Wetlands, signed in Ramsar, Iran in 1971 is an intergovernmental treaty dedicated to the conservation and 'wise use' of wetlands. Australia became a contracting party in 1974. The Convention's mission is:

> *"the conservation and wise use of wetlands by national action and international cooperation as a means to achieving sustainable development throughout the world".*

The Convention encourages contracting parties to designate sites containing representative, rare or unique wetland types, or that are important for conserving biological diversity to the List of Wetlands of International Importance ('Ramsar sites'). These sites need to be managed to ensure their special ecological values are maintained or improved.

There are currently no Ramsar sites in the parks. However it is possible that some of the wetlands in the parks may be nominated for Ramsar listing during the life of this plan as some wetlands have already been identified as being nationally important (see Section 18 Species and Communities of Conservation Significance).

The Australian International Council on Monuments and Sites Charter for the Conservation of Places of Cultural Significance (the Burra Charter)

The Burra Charter was adopted from the Venice Charter at a meeting in 1979 in Burra, South Australia. It has widely been adopted as the standard for 'the conservation of places of cultural significance' in Australia. The Burra Charter has a series of guidelines that include defining significance, establishing significance, conservation policy and procedures for undertaking studies and reports. The Charter also applies to Aboriginal cultural sites.

Other Conventions

Australia is also a contracting party to the Convention on the Conservation of Migratory Species of Wild Animals (called the Bonn Convention), which came into force in 1992. Under this Convention, countries are expected to agree to protect species that regularly migrate across international boundaries. Australia was successful in listing the 11 species of albatross found in the southern hemisphere on the appendices of the Bonn Convention. Dead, sick or injured albatrosses are occasionally found on Yeagarup and Warren beaches. The osprey (*Pandion haliaetus*) is also listed under the Bonn Convention and is found in the parks (see Section 18 Species and Communities of Conservation Significance).

8. MANAGEMENT ARRANGEMENTS WITH ABORIGINAL PEOPLE

The traditional Aboriginal lifestyle was dependent on an intimate knowledge of the land. Noongar people used a deep understanding of the land, its attributes and behaviour to make it easier to acquire food, medicines and the requirements for life. Noongar people lived and cared for the land with one basic and important understanding—people were a part of the environment, not separate from it.

Aboriginal people sought to influence the environment to provide resources. Fire in particular was used to create successional changes in vegetation thus affecting the economy of an area (see Section 22 Fire – History).

When pastoralists came to the area in the late 1800s, they observed the effect that Aboriginal land management had on potential grazing lands. The cattlemen quickly realised the value of burning to promote grazing country, and when Noongar people were removed from the land the pastoralists continued to frequently burn the area as late as the 1970s (Kelly *et al.* 1999).

There has been a renewed interest by the Noongar people to be involved in the management of the public conservation estate in the south-west and an interest to re-establish cultural ties to the land. It is obvious that by working together with Aboriginal people to care for the land, there will be great benefits for the preservation of heritage and environment as well as for cross-cultural awareness.

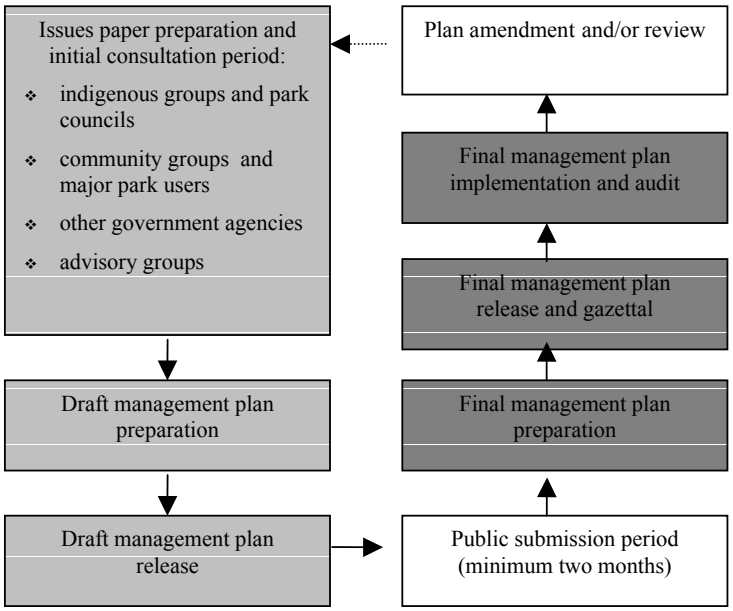
A memorandum of understanding is in place between the Department and the South-West Aboriginal Land and Sea Council. This memorandum sets out both principles and guidelines under which access and co-operative management agreements between the Department and Aboriginal people may be established within the existing provisions of the Conservation and Land Management Act.

Aboriginal people consider the parks to be significant because of previous occupation, and because they have a cultural obligation to understand and care for the area. Aboriginal caring for country is about the whole of the landscape and the interconnected nature of sites, people and environment. It is through these sites that Noongar people can rediscover their heritage and develop a reattachment to the land, rediscovering Aboriginal identity and culture. Aboriginal interpretation of their culture is important within the parks and should be promoted (see Section 41 Information, Education and Interpretation). Participation of Aboriginal people in promoting cultural heritage to visitors could be encouraged, and facilitated through the provision of commercial concessions (see Section 28 Commercial Tourism Operations).

There are currently five registered native title claimant groups that cover part or all of the parks; Combined Single Noongar Claim (WC03/6), South West Boojarah (WC98/63), Southern Noongar (WC96/109), Wagyl Kaip (WC98/70) and Wom-Ber (WC96/105).

9. MANAGEMENT PLANNING PROCESS

The Department initiates the preparation of management plans according to State-wide priorities and on behalf of the Conservation Commission. The process of producing a management plan is as follows:



This management plan, when finalised, will replace the *Shannon Park and D'Entrecasteaux National Park Management Plan 1987-1997* (CALM 1987).

10. PERFORMANCE ASSESSMENT

Audit by the Conservation Commission

The Conservation Commission will measure the success of this plan by using key performance indicators (KPIs), and other mechanisms as appropriate. It is not efficient to measure all aspects of management given resource and technical impediments—consequently, indicators will target key components of the plan. Kanowski *et al.* (2001) defined key performance indicators, when considering the conservation of biodiversity, as:

> "*the minimum set, which if properly monitored, provides rigorous data describing the major trends in, and impacts on, Australian biodiversity.*"

This includes the specification of a measure and target, reporting requirements and a management response to any target shortfall. These components provide a basis for adaptive management, whereby management is altered if necessary to meet a desired outcome.

The Department is responsible for providing information to the Conservation Commission to allow it to assess and audit the success of the Department's management and meeting targets specified in the KPIs. The frequency of these reports will depend upon the requirements of each KPI. Where a report identifies a target shortfall, a response to the Conservation Commission is required. The response may identify factors that have led to the target shortfall, and propose alternative management where appropriate. The Conservation Commission will consider the Department's response on the target shortfall and evaluate the need for action in the context of its assessment and audit function under section 19(1)(g)(iii) of the Conservation and Land Management Act. The Conservation Commission will make the results of audits available to the public.

The application of a KPI within a section is identified throughout the plan and presented with targets and reporting requirements in Appendix 2.

The adequacy of the range of selected KPIs and management will be reviewed following each Conservation Commission audit.

PART C. MANAGING THE NATURAL ENVIRONMENT

The responsibilities of the Department include conservation of biodiversity at ecosystem, species and genetic levels, and the sustainable management of the resources they provide. The Conservation Commission also has a role in biodiversity conservation through the development of policies "…for the preservation of the natural environment…" (section 19(1)(c) of the Conservation and Land Management Act) and the preparation of management plans. The Department is guided by a number of principles in fulfilling its responsibilities, foremost of which are that the diversity and health of ecological communities and native species throughout Western Australia will be maintained and restored, and that a lack of knowledge will not be a reason for postponing measures which mitigate against loss of biodiversity (CALM 2002).

11. BIOGEOGRAPHY

The National Reserve System Program and the National Reserve System of Marine Protected Areas were adopted to establish a comprehensive, adequate and representative (CAR) system of protected areas to conserve Australia's biodiversity. The Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell 1995) and the Interim Marine and Coastal Regionalisation for Australia (IMCRA) (Thackway and Cresswell 1998) provide a planning framework for selecting a CAR system of protected areas (and for bioregional planning more generally). The current Statewide target levels for a CAR system is set at 15%, consistent with national benchmarks (CALM 2003).

Bioregions

The IBRA divides Australia into 85 separate bioregions and 384 subregions, based on lithology, geology, landform, and vegetation. Twenty-six IBRAs are represented in WA. The planning area is predominantly within the Warren bioregion with a small north-eastern section of Shannon National Park within the Jarrah Forest bioregion (Figure 1).

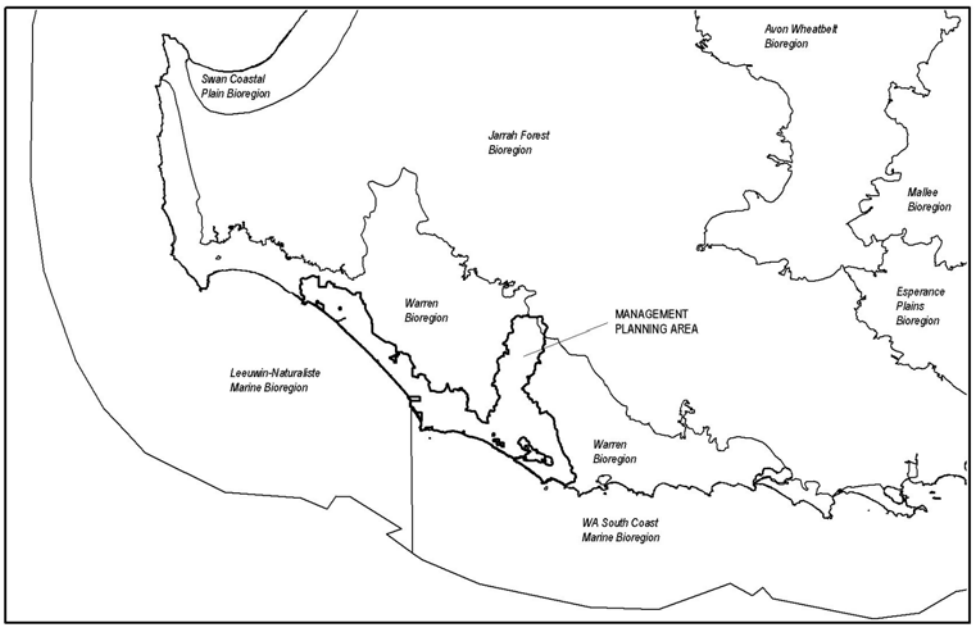


FIGURE 1. Bioregions in the South-West

Warren Bioregion

The Warren bioregion is described as dissected undulating country of the Leeuwin Complex and Albany Orogen with loamy soils supporting karri forest, laterites supporting jarrah-marri forest, leached sandy soils in depressions and plains supporting paperbark/sedge swamps and Holocene marine dunes with peppermint (*Agonis flexuosa*) woodlands, in a moderate Mediterranean climate.

Thirty per cent of the Warren bioregion (260 514 hectares) is protected within formal conservation reserves, of which the parks represent approximately 70%. Additions to the conservation estate proposed under the *Forest Management Plan 2004-2013* (150 502 hectares) will increase the amount of Warren bioregion that is reserved to 48% (CALM 2003). The proposed area of the parks (excluding the proposed Cable Sands addition) will represent approximately 45% of the total protected area within the Warren bioregion (see Section 3 Management Plan Area and Section 32 Mining).

Jarrah Forest Bioregion

The Jarrah Forest bioregion is characterised by jarrah-marri forest on laterite gravels and in the eastern part, by marri-wandoo woodlands on clayey soils (Thackway and Cresswell 1995). Just under 5% of the Jarrah Forest region is within a protected area (212 569 hectares) with only a small portion (1242 hectares—less than 1%) within the Shannon National Park (Department data 2002). Under the *Forest Management Plan 2004-2013* over 500 000 hectares are proposed to be added to the reserve system in the Jarrah Forest bioregion, raising the area protected within the formal conservation estate to 16.8% of the bioregion.

Marine Bioregions

Three major marine biogeographical zones occur on the Western Australian coast: a tropical zone north of North West Cape, a temperate zone east of Cape Leeuwin and a biological overlap zone in between. These three zones are represented by 18 IMCRA bioregions. Parts of both the Leeuwin-Naturaliste and WA South Coast marine bioregions are adjacent to the D'Entrecasteaux National Park converging at Black Head (Figure 1). Within the marine area adjacent to the park, there are three recommended areas for marine reservation (CALM 1994). These include marine waters around Black Point, along Warren Beach and within Broke Inlet.

Forest Ecosystems

Forest ecosystems were defined in the south-west for use in the Western Australian Regional Forest Agreement by Bradshaw and Mattiske (1997). Twenty six forest ecosystems were identified and used to further the establishment of a comprehensive, adequate and representative conservation reserve system to protect the biodiversity of the south-west forest areas. The forest ecosystems are at a finer scale than the bioregional approach for the rest of the State. They are based on key species of the overstorey, the height of the overstorey, canopy cover and the understorey vegetation communities, and are different to the vegetation complexes and vegetation associations referred to in Section 18 Species and Communities of Conservation Significance.

The reservation target for each forest ecosystem in the south-west is 15% of the pre-1750 distribution, except where the forest ecosystem is recognised as rare/endangered and a target of 100% of their remaining extent should be set (ANZECC and MCFFA 1997). To assist in decisions on areas for reservation, information provided at a finer scale is also considered, included vegetation complexes, species richness, the presence of relictual, endemic or disjunct species, old growth forests and wilderness values (see Section 18 Species and Communities of Conservation Significance and Section 25 Recreational Opportunities).

There are 12 forest ecosystems in the planning area, eight of which meet the agreed target for reservation in a formal conservation system (current reservation ranging from 15% to 98%). The addition of the reserve proposals in the *Forest Management Plan 2004-2013* will increase the representation levels of these forest ecosystems. The informal reserve system within State forests is also managed to increase the protection of less well reserved forest ecosystems.

Jarrah Blackwood, Jarrah South and Jarrah Woodland do not currently meet the 15% target for reservation, however with the proposed additions in the *Forest Management Plan 2004-2013* they will reach 23%, 40% and 26% reservation respectively. The target for Bullich and Yate is 100% reservation of extant vegetation, which equates to a target of 87% of pre-1750 distribution. Current reservation of Bullich and Yate is 54%, 98% of which is within D'Entrecasteaux National Park and the 5(g) reserve. The proposed addition of Quannup pastoral lease to D'Entrecasteaux National Park will raise the reservation to 77%. Protection of this ecosystem is required on private land to meet the target of 87%.

Key Points

- The planning area is predominantly within the Warren bioregion with a small portion within the Jarrah Forest bioregion.
- Approximately 30% of the Warren bioregion is in a formal conservation reserve, with proposals under the *Forest Management Plan 2004-2013* to increase this to 48%.
- Less than 5% of the Jarrah Forest bioregion is in a formal conservation reserve. Under the *Forest Management Plan 2004-2013*, this is proposed to increase to 16.8%.
- D'Entrecasteaux National Park is adjacent to three proposed marine reserves (Black Point, Warren Beach and within Broke Inlet).
- The 26 forest ecosystems defined for the Western Australian Regional Forest Agreement are used to assist in the establishment of a comprehensive, adequate and representative national reserve system to protect the biodiversity of the south-west forest area.
- Reserve proposals in the *Forest Management Plan 2004-2013* will significantly increase the representation levels of many forest ecosystems in the national reserve system.
- Twelve forest ecosystems occur in the planning area, eight of which meet the agreed target for the national reserve system.

The objective is to ensure protection of a comprehensive, adequate and representative conservation reserve system within the national reserve system and to maintain or increase the parks' contribution to this system.

This will be achieved by:

1. Acquiring, by purchase, exchange or other means when opportunities arise and funds are available, areas within or adjoining the parks that have significant conservation or recreational values, or management benefits that could assist in protecting areas within the parks and contribute to the national reserve system.
2. Purchasing the Quannup pastoral lease prior to 2015 or having the land vested in the Conservation Commission at the cessation of the lease in 2015.
3. Implementing the recommendations in the *Forest Management Plan 2004-2013* to have 1600 hectares of State forest added to D'Entrecasteaux National Park.
4. Purchasing private property within the parks when it becomes available according to conservation value of the areas and as funds allow.
5. Negotiating with the relevant State agencies and local authorities to add important conservation and recreation reserves under their control to the parks; and
6. Taking into account any refinements to the targets for a CAR system over the life of this management plan.

12. CLIMATE CHANGE

Climatic change has come about as a result of global warming, caused by increases in the concentrations of greenhouse gases such as carbon dioxide, methane and nitrous oxide (IPCC 2001a, Hughes 2003). Consistent with global trends, Australia has warmed approximately 0.8 °C over the last century, mostly after 1950 (Collins *et al.* 2000, Hughes 2003). Predictions for climate change suggest that by 2030, annual average temperatures will be 0.4 to 2.0 °C higher over most of Australia, with slightly less warming in some coastal areas. By 2070, it is predicted that annual average temperatures will increase by 1 to 6 °C (0.8 to 5 °C in the south-west) (CSIRO 2001, Hughes 2003).

Projections for rainfall vary much more, but in general a reduction in autumn, winter and spring rainfalls for much of southern Australia and in particular the south-west are predicted (Howden *et al.* 2003). Decreased rainfall and increased evaporation will lead to more frequent drought (Kothavala 1999, Walsh *et al*. 2001), a reduction in many Australian river flows (Schreider *et al*. 1997, Arnell 1999), and a drying out of wetlands, lakes and moist riparian zones (Howden *et al*. 2003). In the south-west, rainfall and river flows have already declined, and this is expected to continue with rainfall predicted to decline by as much as 60% from 1990 levels by 2070 (CSIRO 2001). Sea levels are expected to rise, potentially in the range of 9 to 88 centimetres by 2100 and extreme weather events are also projected to increase. Changes in ground moisture, temperatures and vegetation may lead to more vigorous fire behaviour in traditionally cooler months and more restricted burning seasons which is likely to have fire management implications (Howden *et al.* 2003).

'Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases' is a key threatening process listed under the Environment Protection and Biodiversity Conservation Act (Environment Australia 2001d). Although the effects of climate change may not be apparent over the lifetime of this plan, and the reduction of greenhouse gas emissions is clearly a global issue, long-term planning on a regional scale is necessary to limit the potential impacts as much as possible, particularly as the south-west has been identified as a region with medium to high vulnerability to climate change impacts such as loss of biodiversity (Pouliquen-Young and Newman 2000, IPCC 2001b).

Potential impacts on biodiversity due to a change in atmospheric carbon dioxide concentrations and climate are considered to be related to:

- changes in animal and plant physiology, productivity and growth;
- changes in life-cycle timing – events triggered by environmental cues may be altered and may break coupling of life cycles and interaction between species; and
- changes in species distribution and abundance – a 3 ^{o}C change in mean annual temperature corresponds to a shift in isotherms of approximately 300 to 400 kilometres in latitude (in the Temperate zone) or 500 metres in altitude (Howden *et al.* 2003, Hughes 2003).

Derived from the changes above, further indirect impacts on biodiversity include:

- an increase in species extinctions as a direct result of physical stress or via interactions with other species (Pouliquen-Young and Newman 2000, Howden *et al.* 2003);
- a decrease in ecosystem diversity;
- a contraction in the range of native species; and
- an impact intensification of other non-climatic stresses such as predation by introduced animals, the spread of environmental weeds, salinisation, changes in hydrology and habitat fragmentation (Pouliquen-Young and Newman 2000).

Species most likely to be affected by climate change are those:

- with narrow temperature or low temperature requirements;

- narrow geographic ranges that are closely associated with local environmental conditions (Hughes 2003);
- those dependent on relatively high rainfall habitats; and
- those which are unable to evolve *in situ*.

The Indian Ocean Climate Initiative suggests that decision-makers need to consider observed and projected climate changes as well as to accommodate increased levels of uncertainty. Therefore, greater importance is placed on land management that:

- protects adequate and appropriate space (e.g. the reserves system);
- provides buffers, corridors and climate refugia;
- incorporates the potential for climate change impacts into species recovery plans;
- limits non-climate stresses so that ecosystems and species can attempt to cope with climate change; and
- uses active adaptive management and monitoring.

Integrating the results of climate change impact studies within current conservation strategies, such as reserve creation, introduced predator and weed control, fire management and reintroduction programs, could help improve the survival of species and ecosystems, and decrease their vulnerability to climate change.

At the time of publication a *National Biodiversity and Climate Change Action Plan* to address the impacts of climate change on biodiversity is being developed.

Key Points

- Predictions for climate change suggest that by 2030, annual average temperatures will be 0.4 to 2.0 °C higher over most of Australia, with slightly less warming in some coastal areas. By 2070, it is predicted that annual average temperatures will increase by 1 to 6 °C (0.8 to 5 °C in the south-west).
- In the south-west, rainfall and river flows have already declined, and this is expected to continue with rainfall predicted to decline by as much as 60% from 1990 levels by 2070.
- The south-west has been identified as a region with medium to high vulnerability to climate change impacts such as loss of biodiversity.
- Reserve creation, introduced predator and weed control, fire management and reintroduction programs, could help improve the adaptability of species and ecosystems, and decrease their vulnerability to climate change.

The objective is to understand and consider the effects of climate change on the management of the parks.

This will be achieved by:

1. Investigating the potential vulnerability of the parks' species and communities to climate change.
2. Protecting adequate and appropriate space as part of the reserve system to provide buffers, corridors and climate refugia.
3. Incorporating the potential for climate change impacts into species recovery plans.
4. Limiting non-climate stresses for species and communities that are vulnerable to climate change.

13. GEOLOGY, LANDFORM AND SOILS

Geology

The majority of the planning area lies within the Proterozoic Albany–Fraser Orogen, although approximately one-third of the D'Entrecasteaux National Park lies in the Phanerozoic Perth Basin (west of the Darling Fault) (Figure 2).

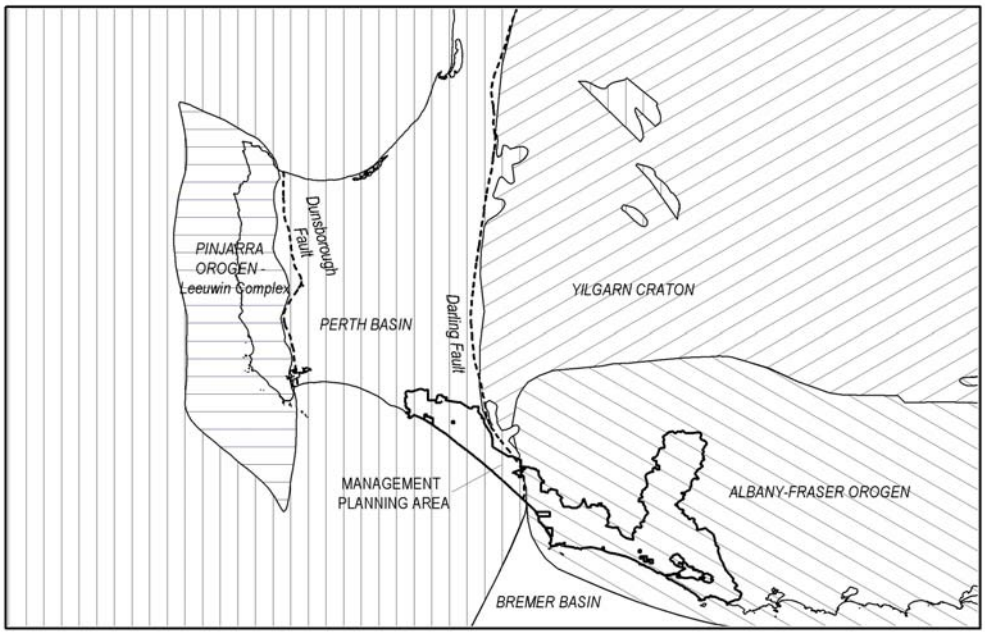


FIGURE 2. Geology of the South-West

The main rock types within the Albany-Fraser Orogen are granite and gneiss intruded by dolerite dykes. These rocks formed mostly during the Mesoproterozoic (1345 to 1140 million years ago) when two continental landmasses (the West Australian Craton and the South Australian Craton) collided with each other.

The southern part of the Phanerozoic Perth Basin contains up to 6 kilometres of sedimentary rocks, the oldest being Early Permian in age (approximately 280 million years old). Extensive rifting of the Basin began in the Early Cretaceous (approximately 140 million years ago), a period of major tectonism associated with the break-up of the supercontinent Gondwana, to which Australia was a part. The well-known columnar-jointed Bunbury Basalt, which outcrops at the mouth of the Donnelly River and at Black Point, was deposited during this time. Cainozoic deposits (63 million years ago to present) overly much of the Albany-Fraser Orogen, the Yilgarn Craton, and the Perth Basin. Eocene (37 to 54 million years ago) marine deposits cover about 70 to 80% of the parks.

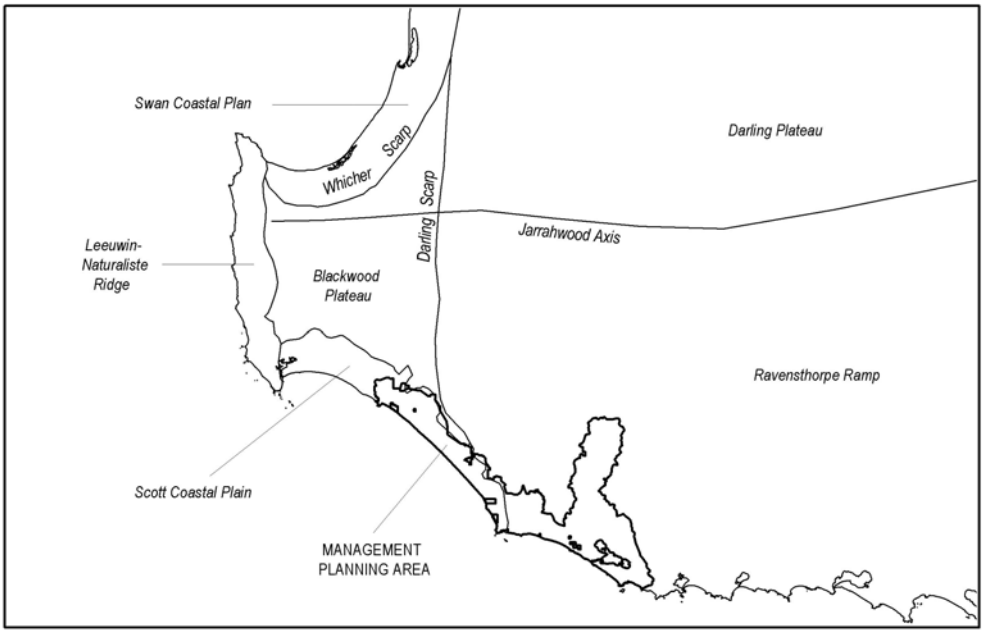
Known Minerals

Known minerals in the parks include bauxite in the northern part of the Shannon basin, coal and lignite deposits within the Scott Coastal Plain from the Warren River westward, heavy mineral sands and limestone. The latter two are the only minerals that have previously been of commercial interest (see Section 32 Mining).

Landform and Soils

The parks cover two major physiographic land units—the Ravensthorpe Ramp and the Scott Coastal Plain (Figure 3). The Scott Coastal Plain is based on deposits of sands of marine and alluvial origin, and is characterised by extensive swampy plains. The Ravensthorpe Ramp is south of the Darling Plateau separated by the Jarrahwood Axis (Cope 1975, Wilde 1981, Wilde and Walker 1984, Hassan 1998). Three broad morphological belts, which lie parallel

to the coast; the coastal belt, the marine and alluvial swampy belt, and the dissected laterite belt overlie these physiographic land units.



(adapted from Hassan 1998 and Cope 1975)

FIGURE 3. Physiographic Units of the South-West

Coastal Belt

The coastal belt comprises consolidated calcareous and siliceous sands and consolidated dunes, both of which support shallow, sandy soils. These soils are shallow, porous and deficient in most nutrients, although iron can be found in some of the deeper soils. Iron and peaty podsols may also occur on the deep sands of dunes.

The coastal belt extends the entire length of D'Entrecasteaux National Park, varying in width from 500 metres near Point D'Entrecasteaux to 9 kilometres in the west and east. The belt consists of aeolian (wind blown) dunes which, in places, form large areas of drifting sand up to 4000 hectares in extent (such as at Yeagarup and Meerup). These coastal dunes have encroached inland over Precambrian bedrock, pre-existing wetlands and estuaries. In general, the dunes are progressively becoming more stable, vegetated and regular in form inland from the coastline (McArthur and Clifton 1975). In other places, the dunes have lithified, creating massive, consolidated ridges, such as those south of Broke Inlet and within the Yeagarup and Callcup areas. Examination of air photography (1951, 1963 and 1975) demonstrate that the northern side of Callcup Dunes migrated inland at a rate of about 1 metre per year during that period (M. Freeman pers. comm. 2004).

Limestone cliffs occur intermittently along the entire length of D'Entrecasteaux National Park, and range in height from 40 metres in the western section near Black Point (where they occur in association with basalt cliffs) to 150 metres in height in the eastern section between West Cliff Point and Cliffy Head. North-west of Doggerup, geologically recent marine deposits have created a new series of dunes in front of the limestone scarp. Beach-building processes appear to be continuing, with the beach at present located about 1 to 2 kilometres from the scarp in the area between Doggerup Creek and the Donnelly River.

Most of the coastal ridges, irregular in form with steep slopes, are covered by younger Holocene (12 000 years ago to present) sand dunes. Older deposits further inland form extensive parabolic dune systems, which are generally stabilised. For example, dunes such as Callcup Hill and Silver Mount are relatively high, reaching 236 metres and 116 metres

respectively. The inland margin of the coastal dunes drops sharply into the extensive, seasonally-inundated, swampy plain.

The sandy soil of the coastal plain is readily eroded by wind. They are extremely susceptible where the coastal dunes are sparsely vegetated, near steep slopes or during strong winds. The steep younger dunes closest to the coast are generally more at risk than the older, stabilised dunes further inland. The coastal dunes are moderately susceptible to water erosion (see Section 15 Soil and Catchment Protection). In the past, water erosion has cut through the primary dune system and allowed the wind to cause the dune blowouts along the coast of the parks. These blowouts can be further exasperated by human activities.

Marine and Alluvial Swampy Belt

The marine and alluvial swampy belt is usually found inland of the coastal dune ridges, where the end of the dune systems brings the land closer to the water table. This belt was created by coastal dunes blocking surface water flow, which has resulted in the formation of a transitional zone of scattered wetlands between the coast and forested laterite plateau.

A prominent example of this is Broke Inlet, which has formed parallel to the coast behind massive consolidated dunes and cliffs. In other areas the wetlands are composed of numerous small lakes, swamps and inundated flats formed in low-lying, interdunal areas or previous lagoons and estuaries (see Section 18 Species and Communities of Conservation Significance – Communities – Wetlands). The area is generally flat (subdued relief to approximately 20 metres above sea level) and is dissected by numerous small streams forming swampy, unchannelled watercourses. In the lower dune slopes and interdunal areas, iron podsols and solonetzic soils with a shallow 'A' horizon are common.

Minor exposures of granitic and gneissic remnants occur as outcropping hillocks 20 to 50 metres above the surrounding wetlands. These exposures become more common towards the south-east of the D'Entrecasteaux National Park. Occasionally, the outcropping rocks rise to form prominent hills, such as Mt Chudalup, Mt Pingerup and Woolbales Hills, which dominate the subdued landscape (see Section 18 Species and Communities of Conservation Significance – Communities – Granite Outcrops).

Dissected Laterite Belt (or Plateau)

The dissected laterite belt occupies the northern half of the Shannon National Park. The plateau can be divided into three landform units, differentiated by the degree of dissection of the laterite duricrust, the shape of valleys and the nature of the drainage network. In the northern part, deeply weathered rocks, laterisation processes and erosional modification have resulted in a gently undulating plateau, which extends into the central section of the park. The central section of the park is characterised by granite exposures on the upper slopes. The third southern unit features an undulating surface with many distinct hills with rounded crests of remnant laterite. In this area, several valleys have broad drainage floors, which form long, swampy corridors.

The laterite plateau is dominated by yellow duplex soils with varying amounts of laterite gravel. Laterite duricrust occurs in some areas with associated red and yellow earths. Light yellow-brown sandy and gravelly loams, in association with weathered granite, dominate the deeply dissected areas on valley slopes. In areas where metamorphosed rock outcrops occur, the soil has a finer texture, mostly of red or brown clay. Granite and gneissic rock outcrops are common on the hills and ridges as well as where the weathered mantle is extensive. Yellow duplex soils with lenses of gravelly pale grey to brown loamy sand are dominant in these elevated regions. In comparison, deep sands and podsol soils are common on the lower slopes. Yellow or light grey solonetzic sandy soils generally occur within swampy areas on the plateau.

Geoheritage

Geoheritage refers to state-wide and nationally significant features of geology that offer important information or insight into the formation or development of the continent, have high landscape value or that can be used for research, teaching or as a reference site.

Carter (1987) identified three significant geological features in the parks—Black Point, Point D'Entrecasteaux and Mt Chudalup. Management recommendations include no coastal development at Black Point, and that the Windy Harbour 'granulite exposures' should be protected from development. Semeniuk (1997) has identified other sites of geoheritage in the parks as part of the assessment of values for the *Regional Forest Agreement for the South-West Forest Region of Western Australia* (Commonwealth of Australia and the State of Western Australia 1999). These sites in the parks are summarised in Appendix 3.

Whilst this inventory is a good start, further systematic, thematic regional inventory work is required to identify and map areas and features, and recommend appropriate activities in these areas. Such information could be used with regards to recreation site design and use as well as during the design of management access tracks and fire breaks. Many of the geological and landform features in the parks are highly susceptible to damage if inappropriately utilised.

Key Points

- Mining interest within the parks is focused on heavy mineral sands and limestone.
- The parks cover two major physiographic land units—the Ravensthorpe Ramp and the Scott Coastal Plain, separated by the Darling Scarp. These are overlaid by three basic landforms: the Coastal Belt, the Marine and Alluvial Swampy Belt, and the Dissected Laterite Belt.
- Geoheritage in the parks include granite outcrops such as Mt Chudalup and Shannon Rock, Point D'Entrecasteaux, Bunbury Basalt areas at Black Point, caves and karst areas in the parks, and coastal dunes such as Yeagarup and Meerup dunes (Appendix 3).

The objective is to maintain the geodiversity and geoprocesses of the parks and protect sites of known geoheritage.

This will be achieved by:

1. Preventing or minimising impacts arising from human activities on geoheritage values in the parks (e.g. restricting foot traffic in sensitive areas such as Mt Chudalup and Black Point [see also Section 18 Species and Communities of Conservation Significance – Communities], protecting caves from disturbance, protecting fossil sites from development, and restricting vehicle use of the dune systems, see Appendix 3 for further details).
2. Undertaking assessments of geoheritage values prior to any proposed works in the parks.
3. Minimising activities in, and public access to, the coastal dune areas that are likely to increase erosion risk and cause significant impacts (e.g. on infrastructure, heritage sites, significant species and communities within the parks).
4. Providing interpretive information on geology within the parks, its relationship with landforms, soils and vegetation and their vulnerability to damage.
5. Continuing to support the collection and recording of information about sites of geoheritage value in the parks.
6. Only allowing geo-scientific research and collection that is consistent with protecting the values of the parks.

14. LANDSCAPE QUALITY

Landscape management is based on the premise that the visual quality of any landscape is a resource in its own right and can be assessed and managed in much the same way as other resource values, such as fauna, flora, water and recreation. The role of landscape management is to ensure that all uses and activities are planned and implemented to complement rather than detract from the inherent visual quality of the environments in which they occur.

In the context of this management plan, the term 'landscape' refers to the appearance or visual quality of an area. For many, visual appearance is the most direct way visitors will experience an area and therefore, is often the criterion by which land management practices are judged.

Landscape Character Types

Every landscape has an identifiable visual character determined by its context of geomorphology, hydrology, soils, vegetation, land-use and cultural heritage values. Most people's understanding and response to their environment is largely visual. According to these features, landscapes in Western Australia have been broadly identified and described as landscape character types in order to assess their visual landscape values (CALM 1994b).

Two landscape character types have been identified in the parks: the Scott Coastal Plain (approximately 58% of the parks) and the Darling Plateau (see Map 4 Landscape Management).

Scenic Quality

Within each landscape character type, the scenic quality has been classed as high, moderate or low (see Map 4 Landscape Management). This is typically based on diversity, uniqueness, prominence and naturalism of landform, vegetation and waterform within each type. Areas of high scenic quality are identified in Table 1.

TABLE 1. Areas of High Scenic Quality in the Parks

Landform	Vegetation	Waterform
Areas of High Scenic Quality		
Deeply defined river valleys of the Donnelly and Warren rivers	Wind-shaped and gnarled vegetation along the coast	Watercourses with changing flow characteristics and features such as the Shannon River
Granite domes which provide obvious contrast to the landform in the surrounding landscape such as Mt Chudalup	Vegetation that shows distinctive displays of seasonal colour	Unusual ocean shorelines and motion characteristics such as at Black Point
Coastal headlands and cliffs such as Black Point, Point D'Entrecasteaux and Cliffy Head	Coastal heaths, peppermint/paperbark woodlands and dune vegetation	All estuaries, lakes, inlets and wetlands such as Broke Inlet and Lake Jasper
Dunes such as the Yeagarup Dunes which have steep and irregular slopes and an abrupt edge transition to low-lying woodland areas	Karri forests as they are unique to the south-west and provide a strong focal point	
Long stretches of undisturbed coastline of D'Entrecasteaux National Park		

(based on CALM 1994b)

In general, most of the parks have high to moderate scenic quality with some areas affected by past land use practices such as mining, road and track placement and past logging activities.

Landscape Management

Landscape management involves maintaining, restoring or enhancing natural and cultural landscape values, as well as planning and designing land use activities and developments to provide diverse views and minimise negative impacts. Human imposed changes to the landscape should be subordinate to the established natural visual character.

Key factors to consider in landscape management include:

- visual changes to the landscape occur continually—natural changes are generally subtle, harmonious and occur very slowly (other than the impacts of fire) whereas human-imposed changes can visually dominate natural elements, appear discordant, alien and can occur abruptly; and
- the ability of the landscape to absorb change without loss of scenic value—depends on factors such as slope, soils, vegetation cover and scope of change.

Guidelines for Management

The Department's Policy Statement No. 34 *Visual Resource Management of Lands and Waters Managed by CALM* provides broad guidelines for landscape management, particularly the planning and implementation of new facilities, buildings, recreation sites, signs and infrastructure.

Areas of high scenic quality (such as Lake Jasper, Yeagarup Dunes, Broke Inlet and Mt Chudalup) are the areas of greatest concern in terms of visual landscape management and are the most sensitive to alterations. Any changes should borrow from the natural established landscape character and not be noticeable to the casual observer.

Changes to areas of moderate scenic quality should borrow significantly from natural elements but may be apparent to the observer.

Areas of low scenic quality are of least visual concern and sensitivity to alterations. Changes should consider natural elements but may be dominant to the observer.

Guidelines for management in high, moderate and low quality scenic landscapes within the parks are included in Appendix 4.

Key Points

- The Shannon and D'Entrecasteaux national parks are representative of two Landscape Character Types: the Scott Coastal Plain and the Darling Plateau.
- The Department's Policy Statement No. 34 *Visual Resource Management of Lands and Waters Managed by CALM* provides broad guidelines for landscape management.

The objective is to protect and enhance the parks visual landscape qualities.

This will be achieved by:

1. Assessing any proposed management activities and development of park facilities to determine their impact on landscape values.
2. Planning fire management programs so as to minimise negative scenic impacts.
3. Liaising with neighbouring landowners and local authorities to ensure the Department's visual landscape management guidelines are considered in any development they may undertake, and provide advice upon request.

4. Encouraging sensitive management of visual resources along the access corridors to tourist destinations and park features (e.g. from impacts from activities such as timber harvesting, mining, plantations, and vegetation clearance).
5. Following the general landscape management guidelines set out in Policy Statement No.34 and Appendix 4.

Key Performance Indicator 14.1 applies (Appendix 2)

15. SOIL AND CATCHMENT PROTECTION

Hydrology

The hydrology of the parks (Map 5 Hydrology) is vital for the creation and maintenance of the biotic systems, provides significant recreational opportunities, and is of considerable regional significance in providing opportunities for development of the public water supply. D'Entrecasteaux National Park is reserved for 'national park and water' purposes (see Section 40 Water Resources).

There are three distinct drainage patterns, which are related to the major physiographic units in the parks:

- on the Coastal Belt where the soil is free draining there is little surface drainage apart from the major river channels which deflect to the south-west before entering the Southern Ocean;
- on the Marine and Alluvial Swampy Belt , seasonally-inundated swampy flats such as the Chudalup, Lower Shannon and Pingerup Plains, the surface drainage has formed dense stream networks; and
- on the Dissected Laterite Plateau the Shannon River, which emanates from broad flat swampy head waters, surface drainage has carved deep V-shaped valleys in the upper and central parts of the catchment.

Rivers

The majority of the rivers and streams in the parks are perennial with marked variations in summer and winter flow with total stream flow for the summer period up to 70 times less than total winter flow. Most streams on the plateau (Shannon National Park) are maintained by groundwater seepage and are often only a series of swampy pools by the end of summer. The character of the rivers, and of river flow to the estuaries, is dictated by their location in the highest rainfall part of the south-west, with predominantly winter run-off from hilly, forested country. Although the major river flow is in winter and spring, some flow generally continues through summer and autumn.

Five rivers run through the parks—the Donnelly, Warren, Meerup, Gardner and Shannon. The majority of the catchment area of the Shannon River and Broke Inlet, a large proportion of the Meerup River (70%), and Doggerup Creek (90%) lie within the parks. The estuaries and lower reaches of the Donnelly, Warren and Gardner rivers are also encompassed within the parks. The four major rivers; Donnelly, Warren, Gardner and Shannon have the potential to yield (if developed for water supply purposes) approximately 680 million cubic metres of water per annum. The Warren River is the single, largest potential source of water in the south-west. Any proposal to use the water resources within the parks or its catchments that is likely to impact on the park's values should be referred to the Environmental Protection Authority for assessment (see Section 40 Water Resources).

Twenty six wild rivers have been identified in Western Australia (Williams *et al.* 1999). Within the parks, the Forth River in D'Entrecasteaux National Park meets the criteria of 'wild', and five other rivers within the parks have been identified as relatively natural (priority 2) for management purposes (Map 5 Hydrology). A wild river is defined as:

> *"those rivers which are undisturbed by the impacts of modern technological society. They remain undammed and exist in catchments where biological and hydrological processes continue without significant disturbance. They occur in a variety of landscapes, and may be permanent, seasonal or dry watercourses which flow only occasionally."* (Williams *et al.* 1999)

Conservation guidelines for the management of wild rivers have been published by Environment Australia (1996b).

Estuaries

The major estuaries of the parks are closed by sand bars for most of the year but can break at various times throughout the year depending on stream flow and sandbar formation. The bars are therefore usually open in mid-winter, when stream flow is greatest. Broke Inlet (covering approximately 4500 hectares) is seasonally open, and several small inlets in the mouths of the Donnelly, Warren, Meerup, Doggerup and Gardner rivers, may be flooded with tidal water for brief periods in early summer.

Lakes and Wetlands

There are many freshwater lakes in the wetland areas of the parks. The largest are Lake Jasper (the largest in the south-west), Lake Maringup and Lake Quitjup, all of which overlie sandy floors. The majority have formed immediately behind the coastal sand dunes that have blocked seaward drainage. Lake Jasper is known as a 'white water lake' due to the lack of tannic acid in the water, which results in good light dispersion and clear water. Most of the smaller reedy lakes, such as lakes Wilson, Smith, Samuel, Florence and Doggerup overlie deep organic sediments.

Dams

A small dam on the Shannon River, north of Shannon townsite was built in 1949 to supply water over the summer months to the former Shannon Mill and residences. The dam is now occasionally used for recreational purposes such as swimming, fishing and marroning.

There are also a number of constructed water points for fire control purposes in the parks.

Groundwater

The groundwater on the Shannon plateau responds relatively slowly to seasonal differences in rainfall. High rainfall causes only small variations in the permanent groundwater table. The watertable lies several metres below the surface in this area and reaches maximum level in September to October (two months after the peak rainfall period) and its lowest in April to May. In winter, shallow perched groundwater systems develop above impermeable layers, which contribute to the majority of the stream flow.

In the coastal and wetland areas, the groundwater systems respond more rapidly to rainfall. In the wetland areas, the watertable lies within a metre of the surface. On the sandy coastal areas, large unconfined aquifers contribute to perennial seepage areas and small streams (e.g. springs near Black Point and Malimup).

The Leederville aquifer and the underlying South West Yarragadee aquifer are to the west of the Darling Scarp and lie underneath the western parts of the parks, in the Black Point and Lake Jasper areas. The Leederville aquifer is the most widely used source of groundwater in the Swan Coastal Plain, and water is used for domestic, irrigation, and industrial uses. The deeper South West Yarragadee aquifer is the largest freshwater aquifer in the south-west, and although partly used for agricultural irrigation, it is now being investigated as an additional source of freshwater (45 gigalitres per annum) for the south-west. Investigations into its

future use include studies on whether this additional extraction would impact on groundwater dependent ecological communities such as the Lake Jasper wetlands.

A small amount of groundwater from within the D'Entrecasteaux National Park currently supplies the settlement at Windy Harbour (see Section 40 Water Resources).

Salinity

Western Australia has the largest area of dryland salinity in Australia and the highest risk of increased salinity in the next 50 years. An estimated 4.3 million hectares (16%) of the south-west (mostly agricultural land) has a high potential of developing salinity from shallow watertables. This is predicted to rise to 8.8 million hectares (33%) by 2050 (Short and McConnell 2000).

The parks are located in high rainfall areas where the risk of salinity is generally low. However, the Warren River catchment and some wetland areas are an exception. The Warren River catchment has been assessed as having a medium risk of developing a shallow water table (Short and McConnell 2000). The upper Warren River catchment (north of the South West Highway) is managed by the Water and Rivers Commission as a 'Water Resource Recovery Catchment', and has been targeted for additional research and management to combat salinity. The salinisation of land in the upper catchment has flow-on downstream effects on aquatic systems, as shown by the high salinity of the Warren River in the upper catchment. The Gingilup-Jasper and Doggerup Creek wetlands have also been identified as having a high risk of salinity (Short and McConnell 2000).

Under the *Salinity Action Plan* (CALM 1996), landscape-scale revegetation was highlighted as a priority area for salinity management. The development of an industry based on maritime pine is one of the key elements for revegetation in the medium rainfall zone (400 to 600 millimetres annual rainfall). In 2000, 150 hectares of maritime pine were planted in the Warren River Water Resources Recovery Catchment as part of the Maritime Pine Project (CALM 2001). There are other major revegetation including commercial plantation programs being undertaken by commercial, private and community groups in the catchments of the parks.

Water Quality

The *State Water Quality Management Strategy No.1* (Water and Rivers Commission 2003) gives guidance for the management of water quality within the parks. The Water and Rivers Commission is the lead agency responsible for sustainable management of Western Australia's water resources. Within the parks, the Water and Rivers Commission only monitor water quality in Donnelly River.

Agriculture is an important land use within the South West Planning Region as discussed in Section 2 Regional Context, and consequently large parts of the catchments of the Warren, Donnelly and Gardner rivers have been cleared for agricultural purposes. However, the use of fertilisers, herbicides and pesticides in these catchments may change the water quality in the lower reaches that are within the parks. Changes in upstream land use adjacent to the parks have the potential to significantly alter water quality within the parks.

In particular, recent changes from beef cattle to dairy cattle in the Black Point Road area on the Scott Coastal Plain have led to an increase in stock numbers, increased groundwater usage, the draining of wetlands, and the discharge of nutrient-enriched surface water run-off to roadside drains which subsequently drain directly into D'Entrecasteaux National Park. Whereas residential subdivisions by the local authority are regulated and the Department is consulted, other land use changes controlled by other agencies do not necessarily involve the Department and surface water control measures are not put in place. Similarly, there have been instances of mineral sands operations discharging water into the parks.

Off reserve land uses of greatest concern are those that:

- change the natural volume of surface water run-off to the parks;
- change the quality of surface water run-off to the parks;
- alter the hydrological cycle of the wetlands within the parks (seasonal flooding); and
- assist weeds being spread through the parks by surface water run-off.

Siltation of watercourses is a consequence of soil disturbance and may result from:

- timber harvesting activities on adjacent land (buffers around watercourses in State forest reduce the amount of sediment);
- the erosion of tracks, walk trails, day use sites and campsites; and
- run-off caused by roadworks, vegetation clearing and fire.

The total sediment supply to the Shannon River is 12 817 tonnes per year, Donnelly River 16 014 tonnes per year and Warren River 109 750 tonnes per year (Commonwealth Government 2001).

There have been blooms of cyanobacterium (sometimes referred to as 'blue-green algae') in the Warren River upstream of D'Entrecasteaux National Park (Water and Rivers Commission 2003 unpublished). It is possible that similar blooms will also occur further downstream within the park if elevated nutrient levels continue.

The EPA (1989) considered the four main estuaries to be healthy, and in the most natural condition of any estuaries in the south-west. The main human impact on the estuaries is the occasional artificial opening of the Broke Inlet and Donnelly River bars. Any future management problems that arise are likely to be derived from land-based activities surrounding the estuaries rather than water-based activities on the estuaries themselves.

The Jasper Wetland System is an outstanding example of a near-pristine, extensive system of freshwater lakes, marshes and shrub swamps and includes the deepest, large freshwater lake in south-western Australia, Lake Jasper. However, nutrient enrichment within the catchment due to a rapidly developing horticultural industry, developing dairy industries, groundwater extraction, exotic fish species and mining (mineral sands) pose a threat to the water quality of the Jasper Wetland System (Jaensch 1993, J. Gillard pers. comm. 2003).

Erosion

When the soil surface is disturbed or vegetation removed, the process of soil erosion can be accelerated (e.g. construction and use of roads, tracks, walk trails and campsites).

Soil erosion also has the potential for downstream impacts on creeks, rivers, lakes, and the estuarine and marine environments by increasing the supply of sediments to rivers.

Churchward *et al.* (1988) and Churchward (1992) have studied the soils of the area within the parks. Some of these soils and landforms are more susceptible to erosion, waterlogging and compaction. Some risk areas within the parks are:

- the coastal plain, which is affected by wind and water erosion. The younger dunes near the ocean are particularly sensitive to erosion, and dunes that lack vegetation or have steep slopes are also susceptible to severe degradation;
- the extensive flats and wetlands;
- the loam soils of the dissected plateau areas, which have a moderately high susceptibility to water erosion; and
- the gravelly soils of the lateritic uplands, which are affected by water erosion with some also prone to wind erosion.

The susceptibility of the soil to erosion and degradation has serious implications for management of the parks. Whilst the inherent erodibility of soils, which depends on soil structure, is difficult to decrease, the erosion associated with human activity can be reduced by appropriate management. The rotation of campsites to allow for rehabilitation, the

hardening of recreation sites and the temporary or permanent closure of tracks are some measures that can reduce the impact of erosion. This, combined with education of visitors on the effects of erosion and the use of appropriate codes of practice, guidelines and on-site investigations prior to any changes in land use, can minimise erosive activity.

The operation of heavy machinery in State forest is guided by conditions detailed in the *Forest Management Plan 2004-2013*. These conditions were determined specifically for the protection of soil in native forest harvesting, however the principles may be modified for the operation of heavy machinery for general Departmental operations within the parks.

Acid Sulfate Soils

Soils that contain iron sulfides within waterlogged sediments are known as 'potential acid sulfate soils'. When these iron sulfides are exposed to air, the minerals oxidise to produce large quantities of sulfuric acid and dissolved metals (e.g. iron, aluminium and occasionally manganese and cadmium). The acid affects both soil and water, and can damage the environment with impacts such as wetland degradation, fish kills, localised loss of habitat and biodiversity, deterioration of surface water and groundwater quality and invasion of acid tolerant waterplants. The dissolved metal mixture can make the soil toxic as well as acidic, so few plants can survive. There are also human health concerns if groundwater or surface water resources used for drinking water or recreational activities become contaminated with sulfuric acid or heavy metals.

The National Working Party on Acid Sulfate Soils (1999) predicted that iron sulfides were present in coastal embayments and estuarine back swamps around Australia with elevations of less than 10 metres above sea level. The indicative distribution of potential acid sulfate soils includes the wetland areas of D'Entrecasteaux National Park. Although there can be some neutralising minerals within soils these are often quickly consumed by the large quantities of sulfuric acid that are released.

In undisturbed states, as the soils presently occur, submergence of the soil materials by water prevents oxygen in the air reacting with the iron sulfides. Acid sulfate soils often go unnoticed, causing no problems until inappropriate drainage, groundwater management or some other disturbance initiates a cycle of acid generation that can be difficult to reverse (B. Degens 2004 pers. comm.). Drainage greatly accelerates iron sulfide oxidation rates, so that large slugs of acid groundwater can be released rapidly into waterways during rainfall events. These slugs cause rapid deoxygenation of waterways and smother aquatic life in addition to the effects imposed by the acid and dissolved metals.

The main risk of environmental degradation in the parks due to acid sulfate soils is considered to be from regional groundwater use, short-term dewatering activities or excavation of large areas within or adjacent to the parks. In some cases, where peat overlying the iron sulfide layer has burnt away, the iron sulfide layer is completely exposed to air (see Section 20 Fire). The best strategy for managing acid sulfate soils is to avoid disturbing or draining the iron sulfide layer (National Working Party on Acid Sulfate Soils 1999). Iron sulfides will not impact on the environment while protected by stable watertables.

Department of Environment guidelines for managing acid sulfate soils where disturbance or dewatering is planned require the proponent to undertake detailed site investigations to determine the depth, extent and acid status of soil. This information is used by the proponent to develop a management plan that avoids oxidation of potential acid sulfate soils and manages any acidity where disturbance is unavoidable.

Key Points

- The water systems of the parks are necessary to maintain the ecosystems of the parks, provide recreational opportunities and are of regional significance for potential development of public water supply.

- The majority of the rivers and streams in the parks are perennial with relatively low flow in the summer months.
- Water quality and hydrology can be affected by development within the parks and adjacent land uses and activities. For example, salinity is a problem in the upper parts of the Warren River catchment outside the park.
- Cyanobacteria blooms have been recorded in Warren River upstream of D'Entrecasteaux National Park.
- The rivers have high water quality apart from experiencing some sedimentation in the upper reaches, possibly resulting from activities outside the park boundaries (e.g. vegetation clearance, logging or use of unsealed roads).
- There are a number of areas within the parks that are susceptible to soil erosion and a number of human activities that need to be carefully managed to reduce erosion risk.
- Some of the wetland areas contain potential acid sulfate soils and it is important that the iron sulfide is not exposed by draining or disturbance of these areas.

The objective is to protect and conserve the quality and quantity of soil and water within the parks, particularly the wetland systems, the rivers and estuaries and the coastline.

This will be achieved by:

1. Ensuring that any proposed developments that may impact on park values are referred to the Department by the Environmental Protection Authority for assessment.
2. Ensuring that the Department is adequately consulted by other agencies such as the Department of Agriculture, Department of Environment, Water and Rivers Commission and Department of Planning and Infrastructure during the early planning stages of land use changes both adjacent to the parks and within the parks' catchments (e.g. by way of a formal agreement).
3. Consulting with adjoining landowners, local authorities, government departments and other stakeholder groups to ensure that activities within adjacent areas do not significantly affect the water resources or other values of the parks.
4. Protecting water sources, wetlands and hydrological processes within the parks from damage or disturbance that may affect water quality or quantity.
5. Supporting the Water and Rivers Commission in any monitoring of water quality and quantity in the parks.
6. Encouraging further research to determine water quality within the parks and assess the impact that this is having upon the environment.
7. Notifying the public when recommended levels of cyanobacteria are exceeded.
8. Minimising exposure of soil to mechanisms of erosion as a result of human activity as appropriate, and rehabilitation.
9. Liasing with the Department of Environment to map the extent of potential acid sulfate soils within high risk areas of the parks and taking these areas into account when any development and/or fire management is planned (see Section 22 Fire and 43 Research and Monitoring).
10. Extending the boundaries of the D'Entrecasteaux National Park to the low water mark along the Donnelly, Gardner, Shannon, Forth and Inlet rivers.
11. Promoting compatible management of Broke Inlet with the purposes and management of D'Entrecasteaux National Park and supporting the creation of a Broke Inlet Marine Park.

Key Performance Indicators 15.1 and 15.2 apply (Appendix 2)

16. NATIVE PLANTS AND PLANT COMMUNITIES

Native Plants

The vascular flora of the south-west is diverse and has a high level of endemism (Hopper 1992). It has been estimated that there are approximately 8000 species, 25% of which are estimated to be endemic to the south-west (Hopper 1992).

There are 889 native vascular flora taxa (includes sub species) known from the parks (210 in Shannon National Park and 854 in D'Entrecasteaux National Park) as well as over 109 introduced taxa (see Section 19 Environmental Weeds). This represents 48% of the total number of vascular taxa in the Warren bioregion.

The major families are Orchidaceae (orchid family – 85), Cyperaceae (sedge family – 66), Myrtaceae (eucalypt and paperbark family – 66), Papilionaceae (pea family – 54), Proteaceae (banksia and grevillea family – 45), Epacridaceae (heath family – 44), Restionaceae (rush family – 40) and Stylidiaceae (trigger plant family – 37). The Warren bioregion has a higher proportion of the monocotyledon families such as Orchidaceae, Cyperaceae and Restionaceae than the rest of the State (Green 1985).

The species list of the vascular flora recorded within the parks was derived from Lyons *et al.* (2000), from survey work conducted by Havel and Mattiske (2000) and Herbarium records. The species list is probably a significant under-estimate for the parks, especially the Shannon National Park, given that the parks contain most of the major habitats of the Warren bioregion such as granite outcrops, karri forest, coastal communities and wetlands (M. Lyons pers. comm. 2002). In addition, the northern part of Shannon National Park is within the Jarrah Forest bioregion, for which a comparable comprehensive study to Lyons *et al.* (2000) has not been compiled.

The collection of wildflowers or other plant parts can reduce the available seed stock and by reducing the numbers of flowers available for cross-pollination, may reduce genetic diversity. Driving into areas to pick wildflowers may lead to the spread of *Phytophthora* and increase fire risk. In order to protect representative plant communities, the Conservation and Land Management Act prohibits the removal of flora and fauna from national parks and nature reserves. Wildflower picking sometimes occurs illegally in the Shannon National Park.

Non-vascular flora such as mosses and liverworts and other biota such as algae, fungi and lichen have not been well studied within the State, with many unnamed and unknown species existing.

The work that has been carried out on non-vascular flora within the State shows that the greatest diversity and abundance of moss species occur in the regions of high rainfall (over 800 millimetres) such as in the south-west, in settings such as granite outcrops, fern gullies and sclerophyll woodlands (Stoneburner and Wyatt 1996, Hopper 1992). Moss species of the south-west have strong affinity with species of southern Australia but are less diverse. Endemism of Western Australian moss species is 2% (four species, including one known from within the parks see Section 18 Species and Communities of Conservation Significance), which compared to vascular plants is very low. However, 25% of the moss species in Western Australia are restricted to Australia, showing a significant level of continental endemism (Stoneburner and Wyatt 1996).

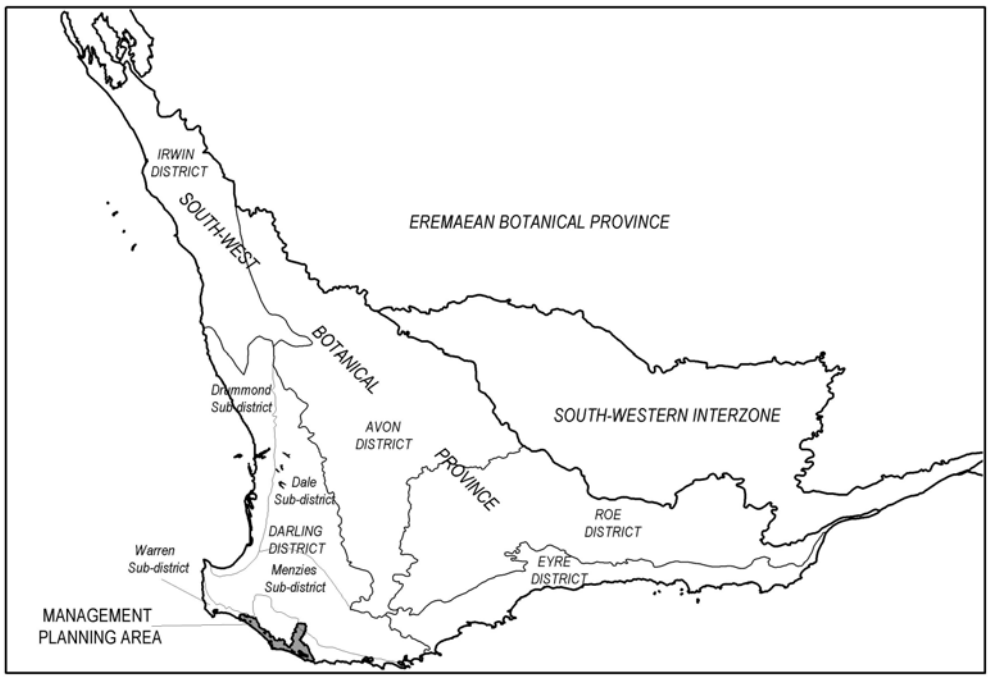
It has been estimated that there may be 250 000 species of fungi in Australia, including about 5 000 mushrooms and similar types (Pascoe 1991). Perhaps only 5 to 10% of Australian fungi have been named and another 10% are known but not named (Bougher and Syme 1998). Most of the fungi that have been named are known from very few locations. This reflects the low knowledge base and attention given to fungi and is not an accurate representation of their distribution. In Western Australia, about 500 species of larger fungi have been recorded, mostly from the south-west (Hilton 1982, 1988), however again this is estimated to be a low proportion of the fungi taxa present in the south-west.

There has been little work within the parks to compile any species lists of non-vascular flora or other biota.

Plant Communities

Phytogeography

Plant communities or vegetation types can be described in a number of different ways. Beard (1980) divided the State into botanical provinces, districts and sub-districts on the basis of ecological, climatic, geological and soil characteristics. The parks are in the Warren Sub-district, which occupies the southern portion of the Darling Botanical District, a division of the South West Botanical Province (Figure 4). The Warren Sub-district encompasses the entire karri forest belt and most of the coastal areas between Albany and Busselton. Beard (1980) also identified vegetation associations across the State. There are 24 vegetation associations within the parks.



(source: Beard 1980)

FIGURE 4. South-West Botanical Province

During the Western Australian Regional Forest Agreement process, vegetation for the forested area within the south-west was considered at forest ecosystem (see Section 11 Biogeography), ecological vegetation system and vegetation complex levels (Mattiske and Havel 1998). Vegetation complexes were the 'finest' scale unit of classification. In the area considered in the Regional Forest Agreement, 312 vegetation complexes were identified with 61 of these in the parks. Those of particular conservation significance are discussed in section 18 Species and Communities of Conservation Significance.

In this management plan, the plant communities of the parks are mainly referred to in terms of these vegetation complexes. The vegetation complexes also provide the basis for determining land conservation units and fire management within the parks (see Section 22 Fire).

Vegetation

The vegetation of the parks is a mosaic of coastal dune, wetland, woodland and forest vegetation types. The variety and distribution of flora within the parks is generally closely linked to the landform units (see Section 13 Geology, Landform and Soils), with changes in vegetation types indicating a corresponding change in soils and landform.

The vegetation of the coastal belt varies from that on largely bare mobile sands to thick low peppermint forest. The wetland areas and low plains are characterised by open low woodlands, thickets and low sedges. The periodic inundation of water in these areas excludes the presence of taller forest type species. There are a large number of species within these areas, including the predominant species *Banksia ilicifolia, B. littoralis*, *Xanthorrhoea* spp., *Jacksonia* spp., and various rushes and sedges.

The laterite areas support the taller forests and woodlands, mostly old-growth, with species such as karri, jarrah and tingle being prominent in these areas. The tall forest dominated by karri, occurs throughout the Shannon National Park and in parts of the D'Entrecasteaux National Park. Its distribution is closely associated with loamy soils derived from granite and gneiss. Pure karri stands occur throughout the Shannon National Park. In the upper reaches of the river basin, karri-marri associations also occur on brown, gravelly, sandy soils and on laterite soils karri-jarrah associations occur. Isolated patches of pure karri stands occur on low hills throughout the lower Shannon Basin, Pingerup Plains and parts of the Chudalup Plains.

The open structure of the canopy in the tall karri forest allows sufficient light penetration for the development of a substantial understorey of small trees and shrubs. In some parts of the forest, karri wattle (*Acacia pentadenia*) forms an impenetrable thicket more than 2 metres high, particularly after being burnt. In other areas hazel (*Trymalium floribundum*), karri oak (*Allocasuarina decussata*) and water bush (*Bossiaea aquifolia*) are major components of the forest understorey in the more open areas of the forest. *Agonis* and *Banksia* species and occasionally native willow (*Callistachys lanceolata*) occur along the streams and swampy watercourses.

This wide variety of vegetation provides a wide range of habitats for native animals and contributes significantly to the parks high conservation and scenic values. Being located in the high rainfall south-west, the parks contain a number of species that are geographically restricted to this zone.

Key Points

- There are 889 native vascular flora taxa recorded in the parks.
- The parks represent 48% of the total number of vascular taxa in the Warren bioregion. The Warren bioregion is important as a centre of diversity of herbaceous perennial taxa and for the conservation of high rainfall taxa.
- It is prohibited to remove flora from the parks.
- The collection of wildflowers or other plant parts can reduce the available seed stock, may reduce genetic diversity and may lead to the spread of *Phytophthora* or increased fire risk.
- There are 61 vegetation complexes in the parks, representing 20% of all complexes in the RFA area (Mattiske and Havel 1998).

The objective is to protect and conserve the structural diversity and distribution of native plants and plant communities of the parks.

This will be achieved by:

1. Identifying native plants and plant communities that may require special protection from threatening processes such as salinity, erosion, environmental weeds, introduced animals, *P. cinnamomi* and fire (see sections 15 Soil and Catchment Protection, 19 Environmental Weeds, 20 Introduced and Other Problem Animals, 21 Diseases and 22 Fire).
2. Rehabilitating native vegetation where disturbance is severe and natural regeneration is less likely to occur (see Section 37 Rehabilitation).
3. Continuing to apply fire for biodiversity conservation according to best practice and

Departmental policy (see Section 22 Fire).
4. Advertising firewood collection areas in the Region and prohibiting firewood collection within the parks (see Section 27 Recreational Use – Overnight Stays – Campfires).
5. Liaising with local authorities and private landholders to promote compatible management on adjoining lands.
6. Undertaking as well as encouraging universities and other organisations to undertake further vegetation and flora surveys in the parks.
7. Providing information to park users about the importance of native plants and plant communities of the parks and their vulnerability to human impact.
8. Prohibiting wildflower picking within the parks and promoting alternative locations for commercial wildflower pickers outside the parks.

17. NATIVE ANIMALS AND HABITATS

In general, there has been a decline in native fauna numbers within the south-west since European settlement. Within the parks, it is possible that three species have become extinct since European settlement of the area. Compared to other areas of the south-west, the parks exhibit a relatively intact fauna, probably due to their good condition, size, relative isolation and continuity with adjoining national parks and State forests. The parks are able to provide a wide range of habitats and corridors for dispersal, along with diverse landforms and high rainfall.

Christensen *et al*. (1985, 1992) suggested that fauna of the south-west forests were distributed along a temperature/moisture gradient, particularly in a north/south direction with secondary factors such as vegetation and soils affecting distribution on a local scale. A high percentage are dependent on habitat elements provided by trees in a mature or derelict state, or by fallen logs for nesting or shelter, especially mammals and birds (Wardell-Johnson and Christensen 1992).

Surveys of the vertebrate fauna of the Western Australian southern forests in the period 1970 to 1982 included four survey locations in the parks (Christensen *et al.* 1985). In the period 1992 to 1993, additional surveys along the south coast of WA were carried out (Jaensch 1992a, 1992b, 1992c and 1993) for waterbirds, frogs, fish and invertebrates within wetlands on Crown land, and involved 13 sites within D'Entrecasteaux National Park. On an ongoing basis, the Department conducts regular monitoring of native vertebrate species as part of the Western Shield program (see Section 20 Introduced and Other Problem Animals), including sites within the parks. A list of the identified fauna within the parks from these sources is presented in Appendix 5. However, fauna information within the parks is still very limited, in particular with regard to invertebrates.

Mammals

There are at least 21 species of native mammals in the parks. This includes one pinniped, four macropods, three possums, four dasyurids, one bandicoot, two rodents and six bats. Although it is thought that only three mammals have become extinct within the parks (the pale field rat *Rattus tunneyi*, the heath rat *Pseudomys shortridgei* and probably Gilbert's potoroo *Potoroo tridactylus gilbertii*—N. McKenzie pers. comm. 2002), populations of many species are thought to have declined and now exist only as small isolated populations (How *et al.* 1987). The causes of decline include vegetation clearing, logging, mining, hunting and altered fire regimes and predation by foxes (*Vulpes vulpes*) (Burbidge and McKenzie 1989).

Most of the mammal species that have contracted in range are within a 'critical weight range' (mean adult body weight between 35 grams and 5.5 kilograms), which renders them particularly susceptible to predation by foxes. Remaining populations persist in refugial habitats that may not be the most favourable to them, but are less favourable to their agent or means of decline (Caughley 1994). Typically, these habitats include densely vegetated

thickets in river, stream and wetland systems, many which also provide corridors for migration. Examples of critical weight range mammals within the parks that have declined include the quokka (*Setonix brachyurus*), which has suffered a major decline and contraction of its geographic range since the 1930s, particularly in the northern jarrah forest (Kitchener 1995, Hayward *et al.* 2003). The woylie (*Bettongia penicillata*), which has contracted in range from 40% of the Australian mainland to less than 1%, and the chuditch (*Dasyurus geoffroii*) which now occupies less than 2% of its former range (Environment Australia 1996a). Larger species such as the western grey kangaroo (*Macropus fuliginosus*) are much less affected by predation by the fox and are relatively common throughout the south-west (Havel 1989).

Fox control as part of the Western Shield program (see Section 20 Introduced and Other Problem Animals), statutory protection and adaptive management is required to maintain and/or increase native mammal populations and in particular threatened species within the parks (see Section 18 Species and Communities of Conservation Significance).

Birds

There are at least 123 species of native birds within the parks. The majority of birds listed for forest areas of the south-west (Christensen *et al.* 1985) occur within the parks. Generally, the highest diversity of bird species can be found in woodland areas of banksia, peppermint and bullich, and the highest number of individuals can be found in tall open forest areas such as karri and jarrah forests (Christensen 1992). The former provide diverse food sources, which is reflected by the high number of species in these areas, whereas the latter provide abundant food sources, but only for the few species that inhabit these areas.

A comparison of bird distribution in the *Field Atlas* (1977 to 1981) and the *New Atlas* (1998 to 2000) shows that 13 bird species have displayed range reductions across Australia that are substantial and systematic (Environment Australia 2001b). Four of these species occur in the parks: black swan (*Cynus atratus*), great cormorant (*Phalacrocoras carbo*), wedge-tailed eagle (*Aquila audax*) and the Pacific heron (*Ardea pacifica*). The habitats of these bird species are protected within the parks and are contributing to the maintenance of the populations of these species across Australia.

Waterbirds

The optimal habitat for waterbirds includes extensive open water, some bare land and extensive tall sedges or low shrub thickets inundated at the base by water 50 to 100 centimetres deep (Jaensch 1992a). Lake Jasper and Lake Maringup are recognised as two of the five most important wetlands for waterbirds across the south coast; based on rankings of number of species, breeding pairs and number of individuals (Jaensch 1992a). Lake Jasper supported the highest number of species found breeding at any one wetland across the south coast.

During a survey of the Jasper Wetland System (comprising Lake Jasper and nearby wetlands) 27 species of birds were recorded, including seven breeding species such as the priority 4 little bittern (*Ixobrychus minutus*) which nests in sedgy thickets of *Taxandria floribunda* (Jaensch 1992a). Lake Jasper exhibited the highest diversity of birds within the Jasper Wetland System with 25 of the 27 species being recorded, followed by Lake Quitjup with 16 species. Three of the species recorded are listed under international treaties (see sections 7 Legislative Framework and 18 Species and Communities of Conservation Significance). The most abundant species in the Jasper Wetland System was the little black cormorant (*Phalacrocorax sulcirostris*) (up to 200 on Lake Jasper).

Threats to the waterbirds in the parks include wildfire, proposed mineral sand mining and recreational use of waterbodies disturbing birds during the breeding or moulting seasons.

Reptiles

Reptiles are poorly represented in the area, with only 30 species of native reptiles recorded in the parks (Christensen *et al.* 1985 and Christensen 1992). Geckoes (one species), goannas

(two species) and legless lizards (three species) are particularly poorly represented. One species of semi-aquatic tortoise occurs in the parks. The most common species of reptiles in the parks are skinks (15 species) and snakes (seven species of elapids, or front fanged venomous snakes, and one blind snake).

Amphibians

There are at least 15 species of frogs within the parks, including two species of tree frog. Substantial areas of sedgeland and shrubland/forest, such as those present at Lake Jasper, support the highest number of the wetland frog species of the south coast of Western Australia. The Jasper Wetland System supports eight species of frogs; all have been recorded at Lake Jasper with a range of three to five species recorded at other lakes (Jaensch 1993).

Fish

Although Australia is considered to have one of the most diverse marine fish faunas, its freshwater fish fauna is depauperate (less than 200 species), highly endemic and lacks many families that are found elsewhere in the world (Morgan *et al*. 1998). This is related to the relative scarcity of rivers and the seasonal nature of the inland waters.

The freshwater fauna of south-western Australia is even more depauperate than that of south eastern Australia. The south-west contains only ten species of native freshwater fish which includes eight endemic to the region. Of these ten species, eight are known to occur within the parks. With the exception of the freshwater cobbler (*Tandanus bostocki*), none of the endemic species typically exceed 140 millimetres in total length. Freshwater cobbler occur at Lake Jasper and Lake Wilson and is the only endemic species targeted by recreational anglers. Though widespread in streams, it is not known from other lakes of the south coast and is largely absent from the parks.

There are also five species that have marine affinities but are still abundant in the estuaries and freshwaters of the parks: mangrove mullet (*Mugil cephalus*), pouched lamprey (*Geotria australis*), blue spot goby (*Pseudogobius olorum*), big-headed goby (*Afurcagobius suppositus*) and the western hardyhead (*Atherinosoma wallacei*).

Four exotic freshwater species (see Section 20 Introduced and Other Problem Animals) occur in the parks and throughout the south-west, and although there is limited information on the impacts of introduced species in south-western Australia, there have been deleterious effects caused by the same or comparable species in eastern Australia (Morgan *et al.* 1998).

The most common and widespread endemic freshwater species in the south-west are the western minnow (*Galaxias occidentalis*), the night fish (*Bostockia porosa*) and the western pygmy perch (*Edelia vittata*).

Invertebrates

Information on the diversity of invertebrates specifically occurring within the parks is quite poor. The Aquatic Research Laboratory UWA (1992), Jaensch (1993) and Edwards *et al.* (1994) have conducted aquatic invertebrate studies on the wetlands of the south coast. The number of invertebrate taxa recorded in the wetlands varied from 54 at Lake Smith (including 20 Dipterans) to 22 at Lake Jasper. Marron (*Cherax canei*) and gilgies (*Cherax quinquecarinatus* and *C. crassimanus*) are also widespread in small lakes and wetlands within the parks, however populations are decreasing (R. Annear pers. comm. 2004) (see Section 27 Recreational Use – Active Recreation – Fishing and Marroning).

The suite of estuarine benthic animals is represented by only a few species within the Donnelly and Gardner inlets. Only a few obligate estuarine benthic animal species are normally present throughout the year. Invasion of other invertebrates sometimes occurs in spring when the bar is open but few survive the subsequent winter.

There have been some other surveys on invertebrates concentrating in the south-west such as spiders in the karri area (Curry *et al*. 1985), macroinvertebrates of acid peaty flats (Pusey and Edwards 1990), insects in forested areas (Abbott 1992), aquatic invertebrates, fish and amphibians of the Warren bioregion (Trayler *et al.* 1996), aquatic invertebrates in peatlands and shrublands (Horwitz 1997) and crayfish (Austin and Knott 1996, Horwitz and Adams 2000). Abbott (1992) suggested that the total number of insects alone in the south-west forest may be in the order of 15 000 to 20 000 species. No invertebrate species lists have been specifically compiled for the parks.

Key Points

- The parks are valuable for fauna conservation due to their good condition, size, relative isolation and continuity with adjoining national parks and State forests.
- There are 20 mammal, 123 bird, 30 reptile, 15 amphibian and 13 fish native fauna species recorded within the parks which is representative of the diversity of the southern forests (Christensen 1992).
- Invertebrate information is not readily available for the parks.

The objective is to protect and conserve the diversity and distribution of the native fauna and habitats within the parks.

This will be achieved by:

1. Protecting fauna habitats from adverse changes to water quality and quantity, the spread of weeds, introduced animals, disease, and human disturbance (see sections 15 Soil and Catchment Protection, 19 Environmental Weeds, 20 Introduced and Other Problem Animals, 21 Diseases).
2. Implementing appropriate fire regimes to maintain or promote biodiversity within the parks (see Section 22 Fire).
3. Identifying species that are declining in range and protecting existing habitats for these species that occur within the parks.
4. Continuing existing monitoring of fauna populations and encouraging further research in the parks to determine distribution and abundance of species, and in particular invertebrates.
5. Protecting Lake Jasper and Lake Maringup as important waterbird habitats from threats such as wildfire, mining and inappropriate recreational use in particular during the breeding and moulting seasons.
6. Reintroducing native fauna to areas where they are known to have formerly occurred once threatening processes have been identified and mitigated.
7. Working with other agencies and private industry to ensure that extractive industries within or adjacent to the parks do cause adverse environmental impacts (e.g. reduced or increased wetland depth or significant inflow of water contaminants).
8. Controlling introduced species that are damaging or could potentially damage native fauna in ways that do not compromise other conservation objectives (see also Section 20 Introduced and Other Problem Animals).
9. Prohibiting domestic animals within the parks (as per actions prescribed in Section 30 Domestic Animals).

Key Performance Indicator 17.1 applies (Appendix 2)

18. SPECIES AND COMMUNITIES OF CONSERVATION SIGNIFICANCE

At a State level, the Wildlife Conservation Act provides for species of native flora and fauna to be specially protected because they are under the identifiable threat of extinction. Such specially protected wildlife is considered to be 'threatened'. It is probable that during the

implementation of this plan, the Wildlife Conservation Act will be replaced with new legislation to protect biodiversity. A consultation paper, outlining the intent of the proposed Biodiversity Conservation Act, was released in December 2002. Departmental Policy Statements No. 9 *Conservation of Threatened Flora in the Wild* and No. 33 *Conservation of Threatened and Specially Protected Fauna in the Wild* provides management direction for specially protected flora and fauna.

The Commonwealth's Environment Protection and Biodiversity Conservation Act provides a listing of nationally threatened species and ecological communities. Western Australian listings under this Act are currently incomplete. However, the principles applied to Commonwealth listings are essentially the same as those used for listing taxa under the Wildlife Conservation Act, although there is no provision under State legislation to recognise and protect threatened ecological communities (they may receive indirect protection under some other State acts, such as the *Environmental Protection Act 1986*).

As well as threatened species, endemic species (i.e. species restricted in their natural range to a particular area) have conservation significance. When a species is referred to as 'endemic', it could either be endemic to the south-west, a particular bioregion, botanical province, or a protected area such as a national park. In this management plan, records used for 'endemic fauna' refer to fauna with their natural range being restricted to the south-west.

The flora of the south-west has a high level of endemism, as many taxa have had to adapt to small population sizes, poor dispersal and persistence in a subdued, unglaciated landscape for millions of years (Hopper 1992). Therefore, due to the scale of endemism of flora in the south-west and the records used, in this management plan 'endemic flora' refers to flora being endemic to the Warren bioregion.

Also used is the term 'locally endemic' which refers to flora and fauna with a range of less than 150 kilometres.

Fauna

Threatened and Other Specially Protected Fauna

The Wildlife Conservation Act provides for the Minister to declare species to be specially protected for the following reasons:

- they are rare or likely to become extinct (commonly referred to as 'threatened');
- they are presumed to be extinct but may be rediscovered;
- they are subject to international agreement, such as JAMBA or CAMBA (see Section 7 Legislative Framework); or
- they are in need of special protection, other than for the above reasons (e.g. they are uncommon or have commercial value).

There are six threatened vertebrate fauna known to occur within the parks: quokka, chuditch, Australasian bittern (*Botaurus poiciloptilus*), malleefowl (*Leipoa ocellata*), Baudin's (long-billed) black cockatoo (*Calyptorhynchus baudinii*) and Carnaby's black cockatoo (*Calyptorhynchus latirostris*) (Appendix 5). The specially protected New Zealand fur seal (*Arctocephalus forsteri*) is also known to haul out at Black Point in D'Entrecasteaux National Park.

Quokkas are endemic to the south-west and occur in both parks in wooded areas such as *Agonis spp.* close to a water source such as a wetland or river (see Section 18 Species and Communities of Conservation Significance – Communities – Wetlands). While a large population persists on Rottnest Island, there is evidence that the mainland population has declined since European settlement, especially in the northern jarrah forest (see Section 17 Native Animals and Habitats). A recent survey of the southern forests indicated a high number of active quokka populations compared with surveys of the 1970s and 1980s (Burrows and Liddelow 2004). Quokkas are vulnerable to introduced predators, feral pigs

and inappropriate fire regimes impacting on their habitat. Quokkas prefer to feed in vegetation that has been burnt in the previous 10 years. However, a patchwork of vegetation age classes allows the quokka to escape fire and predation.

The majority of the remaining chuditch populations are in jarrah forests of the south-west, patchily distributed and at low densities. They den in hollow logs, burrows and tree hollows. Threats include competition and predation by foxes and feral cats, illegal shooting and poisoning, epidemic disease, land clearing, habitat alteration through the removal of suitable den logs, and road traffic (CALM 1994c). Chuditch have only been sighted at Shannon townsite and on South West Highway on the eastern boundary of the parks. A recovery plan has been prepared for this species that concentrates on impacts of prescribed burning regimes and timber harvesting in jarrah forests, in particular the implications on chuditch diet and breeding sites, and maintenance of refuge and den logs as well as fox control and population and habitat monitoring.

Previously thought to be extinct, the Gilbert's potoroo was rediscovered in 1994 in Two Peoples Bay Nature Reserve. Although it may occur in the dense swamp vegetation within the parks, it is still believed to be locally extinct in the Warren bioregion (see Section 17 Native Animals and Habitats).

The preferred habitat of the Australasian bittern includes shallow vegetated wetlands such as the sedgelands around Lake Jasper and Lake Maringup. The main threats to the bittern are salinisation or drainage of wetlands as they have narrow habitat preferences and are more sensitive to overall habitat loss than many other wetland species. Inappropriate fire regimes, which destroy fringing vegetation, can also reduce habitat suitability (Marchant and Higgins 1990).

The remaining range of the malleefowl appears to be highly fragmented across southern Australia. Within the parks the malleefowl inhabits jarrah forests and the ecotone between karri forests and coastal heath. Highest densities of malleefowl appear to occur on fertile sandy soils with abundant leaf litter (where they can build mounds) with higher rainfall. For this reason habitat that is long unburnt is preferred for nesting (Garnett and Crowley 2000, Benshemesh 1999). Fire can cause local extinction and it may be 15 years before habitat is suitable and at least 40 years before maximum population densities are attained (Benshemesh 1999). Vegetation clearance, increased fire frequency, predation by foxes, inbreeding, infertility, road-kill, and hunting are the main threats for the species.

Baudin's (long-billed) black cockatoo inhabits forest and woodland areas of the south-west, nesting in hollows in mature eucalypts, particularly marri, karri and wandoo (*Eucalyptus wandoo*). Up to a quarter of the species' preferred habitat in the south-west has been cleared for agriculture (Mawson and Johnstone 1997) and in the remaining habitat, density appears to have declined as a result of selective removal of large marri trees from which the species obtains most of its food. Other threats include competition for hollows (see Section 20 Introduced and Other Problem Animals), low reproductive rates and continuing illegal culling by orchardists who see the species as a pest. Maintenance of mature stands of forest within the parks will help to ensure the long-term survival of the species. A recovery plan is being prepared for this species, in conjunction with the red-tailed black cockatoo (*Calyptorhynchus banksii naso*) for which a recommendation to the Minister for the Environment has been made to declare it as threatened (Chapman in prep.).

Carnaby's black cockatoo occur in eucalypt woodlands, shrubland, and hakea and banksia heathlands. They breed in the wheatbelt and the swan coastal plain areas, however, land clearing has removed significant areas of their breeding habitats. Large flocks of cockatoos move to higher rainfall coastal areas after the breeding season. It is during this time that Carnaby's black cockatoo move into the range of Baudin's black cockatoo and the red-tailed black cockatoo. Preferred feeding habitats include heath, *Banksia* woodlands and/or pine plantations, accessible water and trees surrounding watercourses. The parks would be utilised

by the cockatoo in the non-breeding season, most probably the coastal heathlands. A recovery plan has been prepared for Carnaby's black cockatoo (Cale 2003).

The peregrine falcon (*Falco peregrinus*) is a specially protected species that occurs in D'Entrecasteaux National Park. Populations of the peregrine falcon are now generally higher in Australia than elsewhere in the world, however it is considered endangered on a global scale and is also protected under the international CITES treaty, to which Australia is a signatory. The peregrine falcon is not restricted to a particular habitat and can be found along coastal cliffs as well as in woodlands and open grasslands. Peregrine falcons are easily disturbed so public access to cliffs within D'Entrecasteaux National Park where the birds nest should be restricted during the breeding season.

A fossil deposit of the threatened invertebrate the Cape Leeuwin freshwater snail (*Austroassiminea letha*) has been found within the parks but it is not known whether it is extant within the parks.

Possible Reintroductions of Threatened Fauna

The D'Entrecasteaux area has been considered for the reintroduction of the threatened noisy scrub-bird (*Atrichornis clamosus*). Habitat requirements include long-unburnt vegetation (greater than 10 years old) characterised by low forest, scrub/thicket and heath. These formations occur in gullies, drainage lines and the slopes of hills and large granite outcrops, overgrown wetlands and lake margins and in riparian vegetation along rivers and creeks. (Danks *et al*. 1996).

Other possible reintroductions of threatened species include the western ground parrot (*Pezoporus wallicus flaviventris*) and the western bristlebird (*Dasornis longirostris*). The western ground parrot forages and nests on the ground in coastal and near coastal heathlands and also requires long unburnt vegetation (at least 15 years in some areas) (Burbidge *et al.* 1996). The western bristlebird prefers dense low heaths and again has a low tolerance to frequent fire. Fires at less than five- to 10-year intervals may lead to local extinction (Smith 1987).

Priority Fauna

The Department also identifies 'priority' fauna[2] that require additional research to determine their true conservation status. There are 16 priority species of vertebrate fauna within the parks, including one priority 1, one priority 2, three priority 3, eight priority 4 and three priority 5 species (Appendix 5). Threats to the priority mammal and bird species include fox predation, loss of habitat and fragmentation/alteration, altered fire regimes and competition from introduced herbivores.

A recovery plan was prepared for the woylie when it was considered threatened (CALM 1995). Due to success with conservation actions such as captive breeding, translocations and predator control, in 1996 the woylie was removed from the Wildlife Conservation Act list of threatened species and is now priority 5.

The water rat (*Hydromys chrysogaster* – priority 4) has declined substantially in the south-west and along inland rivers affected by salinity and degradation (Lee 1995).

The hooded plover (*Thinornis rubricollis* – priority 4) breeds on coastal beaches of the parks where the eggs and flightless hatchlings are at risk from introduced predators, and pedestrian and vehicular traffic. A management plan for the hooded plover has been prepared by Birds Australia (Raines 2002). The management plan identifies Broke Inlet, Cliffy Head Beach and Mandalay Beach as sites known to have supported breeding hooded plovers. Where

[2] Priority 1 species: taxa with few, poorly known populations on threatened lands.
Priority 2 species: taxa with few, poorly known populations on conservation lands.
Priority 3 species: taxa with several, poorly known populations, some on conservation lands.
Priority 4 species: taxa in need of monitoring.
Priority 5 species: taxa in need of monitoring (conservation program dependent).

pedestrian or vehicle use may impact on breeding hooded plovers, eggs or hatchlings, restrictions may be imposed, such as seasonal closure or fencing of nesting areas.

The black-striped minnow (*Galaxiella nigrostriata* – priority 3) is restricted to the small area of coastal peat flats found from Augusta to Albany, however there are two other disjunct populations in Bunbury and Perth. The centre of distribution is the peat flats surrounding Windy Harbour. The species is found in ephemeral pools and often in the same pools as the salamander fish (*Lepidogalaxias salamandroides*) so appropriate management of these pools is important to preserve these species.

The western mud minnow (*Galaxiella munda* – priority 4) is uncommon throughout most of its distribution, it is most abundant in creeks and streams of the Gardner River and Shannon River catchments. Threats include habitat alteration from changes in hydrology, increased salinisation, siltation and eutrophication which occur through dam construction, groundwater extraction and agricultural and forestry practices in the upper catchments as well as the presence of exotic species.

Balston's pygmy perch (*Nannatherina balstoni* – priority 3) is the most uncommon of the endemic freshwater fishes of the south-west. However Balston's pygmy perch is relatively abundant in a number of shallow pools and creeks that dry up in summer, such as those found between Windy Harbour and Walpole (Jaensch 1992c, Morgan *et al.* 1995, Morgan *et al.* 1998). Threats and conservation recommendations are the same as for the salamander fish.

The salamander fish occurs in ephemeral pools and creeks. Whilst not considered a priority species by the Department, it is considered a restricted species by the Australian Society for Fish Biology and occurs in the same habitats as other priority species (see above). Whereas it once was found as far west as Margaret River and as far east as Albany it is now restricted to a small area of coastal peat flats between Windy Harbour and Walpole. Therefore the small pools that are the habitat for salamander fish and other priority fish species need to be preserved. Morgan *et al.* (1998) warns that when roadside pools are dry in summer, the substrate should not be used for fill or filled in during road maintenance, as these are habitats for the aestivating salamander fish.

There are three priority invertebrate fauna species known within the parks; a copepod (*Calamoecia elongata* – priority 1), a freshwater mussel found in temporary pools on granite (*Fibulacamptus bisetosus* – priority 2), and Doeg's watermite (*Pseudohydraphantes doegi* – priority 2). Doeg's watermite was thought to be extinct after hydrological changes in Pooringinup Swamp in Lake Muir Nature Reserve eliminated the swamp's population but was later discovered in a tributary of Shannon River.

Endemic Fauna

The parks also provide an important habitat for at least 28 endemic fauna including, in addition to two of the threatened and six of the priority species; the honey possum (*Tarsipes rostratus*), common dunnart (*Smithopsis gilberti*), red-capped parrot (*Purpureicephalus spurius*), white breasted robin (*Eopsaltria georgiana*), red-winged fairy wren (*Malurus elegans*), red-eared firetail (*Emblema oculata*), square-nosed snake (*Rhinoplocephalus bicolor*), eight skinks and five fish species.

Relictual Fauna

The high rainfall zone within the south-west is important for relictual fauna with Gondwanan affinities—fauna thought to have originated in the Jurassic/Cretaceous/Tertiary rainforest environments (Hopper *et al.* 1996). Several habitats have been identified within the southern forests that are likely to contain relictual fauna. These habitats are those that are the most similar to the ancient rainforests of the region such as coastal areas with high precipitation, areas receiving run-off from granite areas, winter wet swamps and areas with a southern or south-western aspect such as valley slopes and floors. Relictual fauna within the parks include: the majority of the frogs recorded (13 of the 15 frogs within the parks), the galaxiid fish (four species), the pouched lamphrey (*Geotria australis*), freshwater crayfish,

dragonflies, stoneflies, land snails, earthworms and arachnids (e.g. *Chudalupia meridionalis* and *Chasmocephalon neglectum*). Habitats that contain these relictual fauna should be protected from frequent fire as the fauna are likely to be more vulnerable to such stresses (Hopper *et al.* 1996) (see Section 22 Fire).

International Conventions

There are five bird species recorded within the parks that are covered under international conventions (see Section 7 Legislation). The Caspian tern (*Hydroprogne caspia*), curlew sandpiper (*Caladris feriuginea*) and great egret (*Egretta alba*) are covered under both JAMBA and CAMBA. The white bellied sea eagle (*Haliaeetus leucogaster*) is covered under CAMBA and the osprey is covered under the Bonn Convention. Occasionally albatrosses, which are listed under the Bonn Convention, are sighted in D'Entrecasteaux National Park. Not all these species have been listed as specially protected under the Wildlife Conservation Act yet.

Flora

Rare and Priority Flora

All native flora in Western Australia is protected under the Wildlife Conservation Act. Taxa that are presumed to be extinct in the wild, or likely to become extinct or rare are afforded special protection by being declared to be 'rare flora' under the Wildlife Conservation Act. These specially protected flora are sometimes referred to as 'threatened' flora or 'Declared Rare Flora'. A permit from the Minister for the Environment is required before such flora can be 'taken'.

In addition to rare flora, the Department also refers to 'priority' species. These are species that may be rare but there is insufficient survey data available to accurately determine their true status, or which are rare but not currently threatened and hence are being monitored. Although priority species do not have the same level of legislative protection as rare flora, the priority flora list is maintained as a mechanism to highlight flora of special conservation interest and encourage appropriate management activities in areas such as disease control (see Section 21 Diseases), prescribed burning (see Section 22 Fire – Fire Ecology), road construction and site development.

Six rare and 44 priority flora, occurring in 184 populations, have been recorded in 26 vegetation complexes in the parks (Appendix 6). The rare species are the granite banksia (*Banksia verticillata*), Northcliffe kennedia (*Kennedia glabrata*), globular mignonette orchid (*Microtis globula*), shore spleenwort (*Asplenium obtusatum subsp. northlandicum*), three-lobed meziella (*Meziella trifida*) and a moss (*Rhacocarpus webbianus*).

A number of rare and priority flora have been reported to occur in the parks but require confirmation. These include the rare tall donkey orchid (*Diuris drummondii*), *Thomasia laxiflora* (priority 1), *Eriochilus scaber subsp. orbifolia* (priority 1), *Deyeuxia inaequalis* (priority 1), *Caladenia abbreviata* (priority 2), *Aotus carinata* (priority 4) and *Corybas limpidus* (priority 4) (R. Hearn pers. comm.2004).

The granite banksia is found in coastal areas growing in granite fissures and deeper soil around granite outcrops. This species is killed by fire and regenerates from seed. Its long juvenile period before flowering means populations need to be protected from fire for at least 20 years (see Section 22 Fire). Although the banksia is highly susceptible to *P. cinnamomi* (see Section 21 Diseases), the two populations of the banksia within D'Entrecasteaux National Park have not been affected by the pathogen. The Department will continue to monitor these populations and will develop a phosphite treatment program for the banksias if necessary.

The Northcliffe kennedia grows in scattered locations along the south coast from Northcliffe to east of Esperance on shallow pockets of soil on granite outcrops, in association with mosses and herbs. Fire kills this species and stimulates germination of the seeds in the

seedbank. The populations within the parks require further study and regular monitoring to ensure that several seasons of seed production occur between fires.

The globular mignonette orchid grows in peaty soils in seasonally wet swamps with other more common species of mignonette orchid (*Microtis* species) in a few locations near Albany and Walpole. These orchids only flower after hot summer fires and can be often mistaken for other mignonette orchids. The two known populations within the parks are near Crystal Springs in the eastern end of D'Entrecasteaux National Park in the vicinity of Walpole-Nornalup National Park. Further surveys following summer fires in this area and similar habitats nearby could reveal other populations.

The shore spleenwort is a small glossy fern that occurs in very exposed locations on maritime cliff faces, in shallow pockets of soil over granite gneiss. It is widespread in other parts of Australia but there are less than 200 plants within Western Australia. One population has been recorded on a granite outcrop at Banksia Camp in D'Entrecasteaux National Park. Other nearby populations are known from Breaksea Island and Chatham Island off the south coast, and on cliffs of Torndirrup and Waychinicup national parks.

The three-lobed meziella is a herbaceous plant that was presumed to be extinct until rediscovered in 1992, 200 kilometres west of Albany. It is found in open grey sandy grey clay depressions in winter-wet flats in association with heaths and rushes between Albany and Scott River.

Few non-vascular plants and other biota such as fungi are included in Western Australian threatened and priority listings. These species are poorly known in a taxonomic and conservation sense (it is estimated that only 1% of Western Australia's non-vascular flora is formally named), and their low representation on threatened and priority lists does not reflect their true conservation status (Brown *et al*. 1998). There is one rare and two priority species of moss known to occur within the parks and they have been included in Appendix 6. *Rhacocarpus webbianus* is only known from two locations, Mt Chudalup in D'Entrecasteaux National Park and Two Peoples Bay Nature Reserve.

Species Richness

In addition to the threatened flora of the parks, the Warren bioregion is important as a centre of diversity for herbaceous perennial species and for the conservation of high rainfall flora (Lyons *et al.* 2000). The known species within the parks represent about half the native flora of the Warren bioregion (see sections 11 Biogeography and 16 Native Plants and Plant Communities). Based on predictive modelling, the area of the parks east of the Shannon River and Broke Inlet, is an area of high flora species richness within the south-west (Hearn *et al.* 2003). Another area of predicted high species richness can be found in the Black Point/Lake Jasper area in the west of the parks (Map 6 Species Richness). These areas should be specially protected through appropriate park management.

Endemic, Disjunct and Relictual Flora

There are 24 species that occur within the parks that have narrow ranges of less than 150 kilometres (Appendix 6). These narrow or 'locally' endemic taxa are the most vulnerable to change (climate, hydrological or disease induced) or catastrophic events such as fire. There are also 11 species within the parks that are strictly endemic to the Warren bioregion (including five locally endemic), which represents 34% of the total species endemic to the Warren bioregion. Within the parks, the Lake Jasper area to Donnelly River is considered an area important for flora endemism (Map 6 Species Richness).

Species with disjunct distribution have been very significant in the development of the south-west flora. There are nine species within the parks with disjunct distributions (Appendix 6), with centres important for these species in the Lake Jasper area and in the northern Pingerup Plains (Map 6 Species Richness).

Relictual species include taxa with 'primitive' reproductive systems (gymnosperms, ferns and fern allies), monotypic genera (with a single species in it—often considered to be end of the line taxa of almost extinct genera) and taxa considered to be primitive within their families/genera/subgenera (Hearn *et al.* 2003). Although many of these species are common, the relatively low number of taxa in these groups and their genetic distance from the dominant modern flora makes them important for biodiversity and conservation.

There are 39 relictual species (including 22 monotypic taxa) within the parks (Appendix 6), with the centres important for relictual species in the Lake Jasper area, Mt Chudalup, the Windy Harbour area between Doggerup Creek and Gardner River and the northern Pingerup Plains (Map 6 Species Richness). There seems to be an association with sites of high moisture such as wetland areas, rivers and the bases of granite outcrops (Hearn *et al.* 2003).

These areas that are centres for endemic, disjunct and relictual species within the parks should be specially protected through appropriate park management and the impacts of fire should be analysed.

Communities

Threatened Ecological Communities

There are currently 69 threatened ecological communities across Western Australia that are endorsed by the Minister for the Environment. One of these is recorded within D'Entrecasteaux National Park at Black Point, and is known as 'rimstone pools and cave structures formed by microbial activity on marine shorelines'. This community is considered within Western Australia to be 'endangered' but is yet to be listed under the Commonwealth Environment Protection and Biodiversity Conservation Act.

The '*Reedia spacthacea – Empodisma gracillimum – Schoenus multiglumis* dominated peat paluslopes and sandy mud floodplains of the Warren biogeographical region' community which occurs within both parks, has been identified by the Department as threatened but will be referred to as a priority ecological community until it is endorsed by the Minister.

Once a community has been endorsed by the Minister, they can be forwarded to the relevant Commonwealth Minister to be listed under the Environment Protection and Biodiversity Conservation Act. Of the 69 threatened ecological communities, 16 have been listed under the Commonwealth Act. However, it is likely that over the period of this management plan more threatened ecological communities will be identified and protected under the Commonwealth legislation. It is also likely that over the life of this management plan the new Western Australian Biodiversity Conservation Act will be in place and will provide legislative protection to threatened ecological communities under State legislation.

The microbial communities are stromatolitic and ill-defined structures, which are formed by inorganic precipitation of a mineral phase with microbial control over morphology. Three types of structure may occur in these communities: rimstone pools (terraces), nodular incrustations; and drapes and carbonates in caves. All contain a very similar selection of microbes and may be formed by similar processes. Although little is known about the communities at Black Point, it is known that they are dependant on springs flowing from Black Point and any change in drainage or flow may affect them. They are also very prone to disturbance by human usage and require special protection, in particular from foot traffic (see Section 27 Recreation Use).

There are 23 isolated occurrences of the *Reedia* swamp community in the Warren bioregion with eight within the parks (two in the Shannon National Park and six in the D'Entrecasteaux National Park). The perennially high water tables of these freshwater wetlands are primarily maintained by the humid climate, collection of rainwater from large natural catchment areas by subsurface flow into confined aquifers, and the water storage capacity of peat. A number of priority species are concentrated in these wetlands including *Amperea protensa* (priority 2), *Drosera binata* (priority 2), *Gonocarpus simplex* (priority 3). The *Reedia* swamp

communities are particularly vulnerable to feral pig grazing and trampling (see Section 20 Introduced and Other Problem Animals), severe and/or frequent fire (see Section 22 Fire), disruption of hydrological maintenance of wetlands (see Section 15 Soil and Catchment Protection), nutrient enrichment, and weed invasion (see Section 19 Environmental Weeds).

Vegetation Complexes and Associations

Analysis of the Mattiske and Havel (1998) classification of vegetation complexes in the parks for 'importance'/'significance', in terms of current knowledge, revealed that:

- 25 of the 61 vegetation complexes in the parks contained rare or priority flora; and
- one complex has less that 5% pre-European extent of the complex formally reserved in either existing or proposed conservation reserves and seven complexes reserved at 10 to 15%.

Further work is required to determine whether any additional vegetation complexes within the parks require special regard either because they:

- now only exist as small fragmented areas compared to previous distributions;
- are naturally restricted in size or distribution;
- are threatened in some way;
- represent a significant percentage of the total of that vegetation complex on conservation lands;
- have high species richness; or
- contain high levels of endemic, relictual or disjunct flora.

Using the Beard (1980) classification of vegetation associations, there are eight vegetation types in the parks, which meet or exceed the criteria for significance such as reservation level, and extent of association used by Hopkins *et al.* (2000).

Appendix 7 presents information on the significant vegetation complexes and associations currently identified.

Wetlands

States and Territories may list wetlands as 'nationally important' in the *Directory of Important Wetlands in Australia*. The third edition of this directory (Environment Australia 2001a) lists 851 sites as being nationally important. There are four of these wetlands either partly or wholly in the parks: Gingilup-Jasper Wetland System; Doggerup Creek System; Lake Maringup; and the Broke Inlet System (Figure 5).

D'Entrecasteaux National Park covers the majority of the Gingilup-Jasper Wetland System[3], which encompasses all wetlands on the coastal plain between the Donnelly and Scott rivers, notably Lake Jasper and associated swamps, lakes Wilson, Smith and Quitjup and Gingilup Swamps. The Jasper Wetland System is significant as it is an outstanding example of a near-pristine, extensive system of freshwater lakes, marshes and shrub swamps including Lake Jasper—the deepest, large freshwater lake in the south-west. Lake Quitjup is closed to all boating and fishing and is managed as a biological reference area[4].

The system is a 'biological reservoir' for native freshwater fishes, with a representative of all of the native principle freshwater fish species of the south coast (Australian Nature Conservation Agency 1996, Jaensch 1992c). The wetlands are largely isolated from influences that commonly degrade water quality and from major river systems that are known to contain, or are likely to contain, exotic species. Lake Jasper is a major nursery for native freshwater fish species, in particular the western minnow.

[3] Part of the Gingilup-Jasper Wetland System is also within Gingilup Swamps Nature Reserve, which is to be covered by the management plan currently in preparation for the parks of the Leeuwin Naturaliste Ridge and Scott National Park.
[4] Recreational use is restricted and biological study is encouraged.

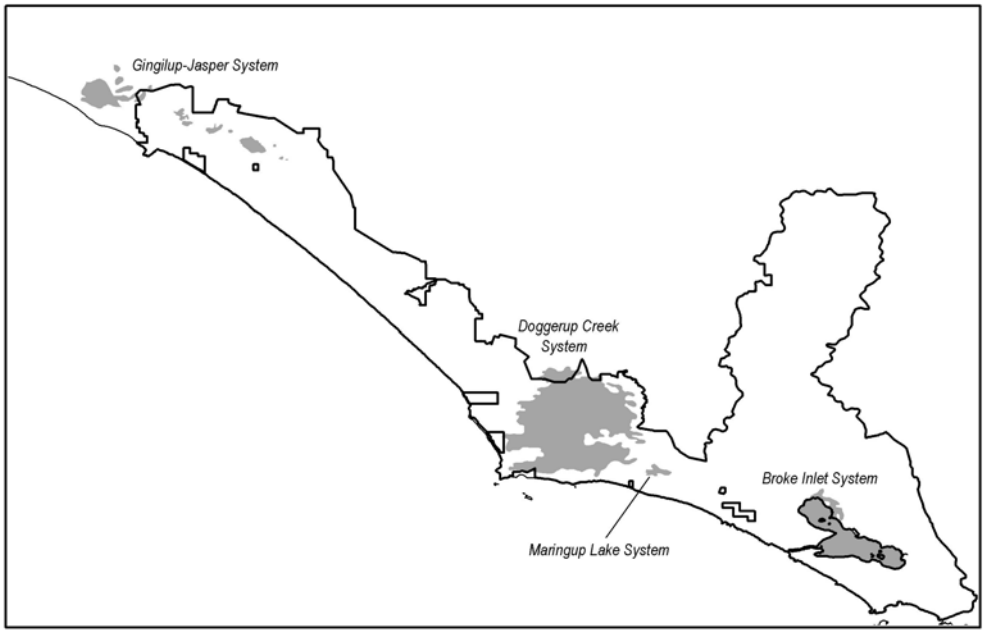


FIGURE 5. Nationally Important Wetlands in the Planning Area

Threats identified associated with this system include: frequent fire, nutrient enrichment due to developing horticultural activity adjacent to Gingilup Swamps, groundwater extraction, exotic fish, and mining of mineral sands (Australian Nature Conservation Agency 1996). Other threats include inappropriate recreational activity such as power boating (see Section 27 Recreation Use – Active Recreational Use in the Parks – Boating).

The Doggerup Creek System is also mostly in D'Entrecasteaux National Park and is a largely undisturbed example of 'acid peat flat', small permanent lakes (Doggerup Lake and lakes Samuel and Florence) and a river (Doggerup Creek). The system contains high levels of endemic fauna, particularly invertebrates such as crustaceans and arachnids and has a high proportion of relictual species. The peat flats are a major habitat for two aestivating inland fish, the black-striped minnow and the salamander fish. The latter is Australia's oldest living teleost fish. Threats to this system include vegetation clearance in the uppermost catchment and frequent fire that may result in erosion of heathland and siltation of the creek system (Australian Nature Conservation Agency 1996).

Lake Maringup is wholly within D'Entrecasteaux National Park and is an outstanding example of a pristine, permanent freshwater lake with peaty marsh. It is a major dry season refuge for native freshwater fish and macroinvertebrates. Potential threats include future extraction of groundwater, frequent fire and the possible spread of exotic wetland plants into the parks such as *Typha orientalis* (Australian Nature Conservation Agency 1996). Maringup Lake is also closed to all boating and fishing and is managed as a biological reference area.

The Broke Inlet System includes Broke Inlet, numerous small lakes and wetlands on the plains around the Inlet and the entire Shannon River. So whilst the inlet itself is not in D'Entrecasteaux National Park, the system does include an area of the park (Figure 5). It is an outstanding example of an unspoilt entire catchment (freshwater river and estuary/inlet system with associated floodplain) in the south-west. The system provides all the life cycle requirements of populations of the endemic black-striped minnow, salamander fish and Balston's pygmy perch. The inlet is a significant drought refuge area for the musk duck (*Biziura lobata*). Threats to the system include exotic fish (specifically trout *Salmo spp.* which have been released in the Shannon River), possible future water supply demands and mineral sand exploration and mining (Australian Nature Conservation Agency 1996).

Granite Outcrops

The granite outcrops and monadnocks of the parks, such as Mt Chudalup and the Woolbales are significant for the abundance and diversity of flora and fauna habitats they provide. The combination of high solar radiation, rapid rainfall run-off and shallow soils on a rocky substrate provide numerous microhabitats. Conditions may vary over a few metres from cool permanently moist shaded caves with water seepage to dry shallow soils and rock surfaces fully exposed to all the elements.

The diversity of microhabitats on granite outcrops has provided a refuge for many species over evolutionary time whilst the surrounding environment was subjected to dramatic climatic changes. The conditions on the outcrops may have facilitated genetic divergence and speciation (Hopper *et al.* 1997). There is a large number of flora that are endemic to the granite outcrops in the south-west and many species occur as disjunct populations or are restricted to the granite outcrops. Three of the rare flora within the parks occur in association with the granite outcrops of the parks; granite banksia, Northcliffe kennedia and the moss *Rhacocarpus webbianus*. The granite outcrop habitats are suitable for the reintroduction of the threatened noisy scrub-bird (Danks *et al.* 1996).

The deeper soils surrounding granite outcrops favour larger woody perennials (this includes eucalypts, wattles and she-oaks). A high number of these species are obligate seeders (i.e. plants that are killed by fire and recruit only from seed) (see Section 22 Fire).

Introduced weed species, mainly annuals, are a threat to granite outcrop communities. Other threats to these communities include feral animals (see Section 20 Introduced and Other Problem Animals), inappropriate fire regimes (see Section 22 Fire) and *P. cinnamomi* (see Section 21 Diseases) (Hopper *et al.* 1997). Recreation can also result in vegetation loss, soil compaction and loss of water infiltration. This increases water run-off and hence the potential for erosion.

Old Growth Forest

'Old growth' or 'ecologically mature' jarrah and karri forest, comprising 51% of Shannon National Park, 19% of D'Entrecasteaux National Park and 6% of the 5(g) reserve, has high biological and conservation value (Figure 6).

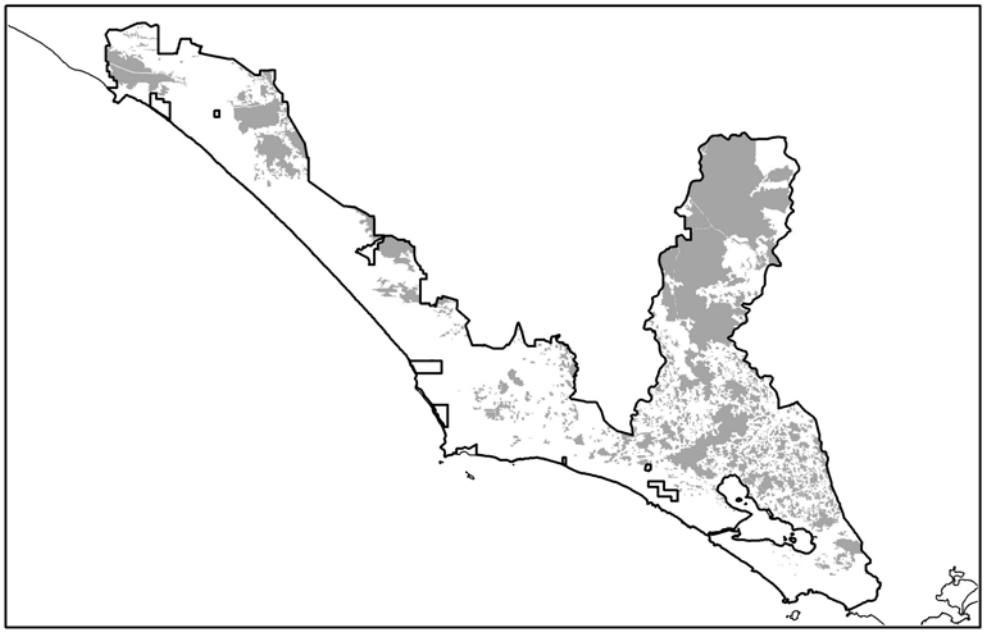


FIGURE 6. Old Growth Forest in the Planning Area

Mature and senescent trees, karri in particular, provide for the requirements of a range of species which otherwise would be unable to live in regrowth forest for many years (Christensen *et al*. 1992). This includes hollow nesters such as the brush-tailed possum (*Trichosurus vulpecula*) and the threatened Baudin's (long-billed) black cockatoo, both of which breed in older trees. Introduced species such as honey bees (*Apis mellifera*) and the laughing kookaburra (*Dacelo novaeguinea*) often compete for hollows (see Section 20 Introduced and Other Problem Animals). Old growth components of the planning area are shown in Table 2.

TABLE 2. Forest Structure in the Planning Area

Planning Area	**Total Forest**	**Total Old Growth (% of Forest)**	**Old Growth by Species**		**Karri by Development Stage***	
			Jarrah (% of Old Growth)	Karri (% of Old Growth)	Mature (% of Old Growth)	Senescent (% of Old Growth)
The Parks						
Shannon National Park	39 658 ha	26 968 ha (68%)	14 121 ha (52%)	12 847 ha (48%)	12 285 ha (96%)	561 ha (4%)
D'Entrecasteaux National Park	25 462 ha	21 893 ha (86%)	16 450 ha (75%)	5443 ha (25%)	5098 ha (94%)	345 ha (6%)
5(g) Reserve	24 ha	24 ha (100%)	24 ha (100%)	-	-	-
Sub Total	65 144 ha	48 884 ha (75%)	30 595 ha (63%)	18 290 ha (37%)	17 384 ha (95%)	906 ha (5%)
Proposed Additions						
Cable Sands Land Addition	0 ha	-	-	-	-	-
Quannup Pastoral Lease	155 ha	155 ha (100%)	107 ha (69%)	47 ha (31%)	47 ha (100%)	-
FMP 2004 Additions	856 ha	562 ha (66%)	299 ha (53%)	263 ha (47%)	263 ha (100%)	-
Sub Total	1011 ha	717 ha (71 %)	407 ha (57%)	310 ha (43%)	310 ha (100%)	-
TOTAL	**66 155 ha**	**49 601 ha (75%)**	**31 001 ha (63%)**	**18 600 ha (37%)**	**17 694 ha (95%)**	**906 ha (5%)**

* Mature old growth is classed 120 years to 250 years old and senescent old growth is greater than 250 years old

The approach of the Conservation Commission and the Department to management of old growth forests, is guided by the Government's *Protecting Our Old Growth Forests* policy and the desire to maintain a mix of vegetation age classes to maximise structural and floristic diversity (see Section 22 Fire).

The intent of this management plan is to protect the area of old growth forest within the parks by managing:

- disturbance and threats to the old growth forest, such as clearing and development;
- fire regimes, as senescent jarrah will regenerate naturally, however karri usually requires larger scale disturbances such as fire to regenerate; and
- wildfire suppression/prevention to avoid intense wildfires that would replace the whole stand with even-aged regrowth.

As well as managing old growth forests, the Department will need to manage forests that are approaching maturity to ensure adequate replenishment of old growth forest within the parks.

The maintenance of old growth forests is a long-term issue that requires planning for several decades and concerns a scale much wider than the parks. The approach of the Department and Conservation Commission to management of this issue will need to be further developed over the life of this management plan.

Key Points

- There are at least six threatened, one specially protected and 16 priority species of vertebrate fauna in the parks.
- There is the possibility of reintroducing a number of threatened fauna into the parks.
- There are at least six rare and 44 priority species of flora in the parks.
- Over the life of the plan, the number of rare and priority flora and fauna within the parks is highly likely to change as more is known about the distribution of the species, taxonomic work is undertaken and threats are appropriately managed.
- The parks provide habitats for a number of geographically restricted or endemic fauna and flora.
- The microbial community at Black Point is the only threatened ecological community endorsed by the Minister, although *Reedia* swamps within the parks have also been identified by the Department as warranting listing. More threatened ecological communities within the parks are likely to be listed over the lifetime of the plan.
- Eight vegetation complexes are under represented (<15% in formal reserves) in the conservation estate reserve system.
- There are four nationally important wetlands either partly or wholly in the parks: Gingilup-Jasper Wetland System; Doggerup Creek System; Lake Maringup; and the Broke Inlet System.
- The granite outcrops and monadnocks within the parks are significant as they provide habitats for an abundance and diversity of flora and fauna.
- Old growth forests within the parks have high biological, aesthetic and social values.

The objective is to protect species and communities of conservation significance.

This will be achieved by:

1. Providing statutory protection for threatened species and ecological communities in the parks by listing them under the Wildlife Conservation Act (or equivalent legislation) and/or the Environment Protection and Biodiversity Conservation Act.
2. Investigating or supporting studies of the habitat requirements and ecology of threatened and priority fauna and flora, and other conservation significant species susceptible to threatening processes.
3. Conserving the habitat that supports threatened and other conservation significant species within the parks and considering them during management activities (see also Section 15 Soil and Catchment Protection, 22 Fire, 27 Recreational Use – Overnight Stays – Campfires, and 32 Mining).
4. Implementing Departmental recovery plans and interim recovery plans for fauna species that are identified within the parks such as the chuditch, Baudin's black cockatoo and Carnaby's black cockatoo, and having due regard for other agency species and community recovery and management plans, such as for malleefowl and the hooded plover.
5. Investigate the possibility of introducing threatened species into the parks such as the noisy scrub-bird, western ground parrot and the western bristlebird.
6. Identifying native plants and plant communities that may be threatened and/or require special protection and management preceding management operations such as site development and fire management operations.
7. Providing information on the location of rare and priority flora and threatened ecological communities within the parks to the State herbarium, and ensuring this information is available to operational staff.
8. Encouraging research into the susceptibility to disease, response to fire, reproduction biology, taxonomy and age to maturity of all threatened and priority flora.
9. Collecting and storing seeds/germplasm for future restoration and recovery programs for threatened flora.

10. Maintaining appropriate fire regimes for fire sensitive species, especially if there are any reintroductions of species that require long unburnt vegetation as habitat.
11. Devising a fire management regime for each appreciable area of wetland vegetation with highest priority given to most important wetlands that have not recently been burnt (e.g. Lake Maringup).
12. Protecting the current level of old growth forests within the parks as well as managing forests that are approaching maturity.
13. Continuing to prohibit fishing, marroning, boating or other recreational use that may have detrimental impact on the wetlands of the parks and in particular, values of Lake Maringup and Lake Quitjup.
14. Carrying out further work on vegetation complexes within the parks to refine significance.

Key Performance Indicators 18.1 to 18.5 apply (Appendix 2)

19. ENVIRONMENTAL WEEDS

An 'environmental weed' is an unwanted species growing in natural ecosystems. Environmental weeds displace native plants, particularly on disturbed sites, by competing with them for light, nutrients and water. They can also have a significant adverse impact on other conservation values by altering animal habitats, harbouring pests and diseases, and increasing the fire hazard.

Environmental Weed Management

An integrated approach to environmental weed management was developed in the *Environmental Weed Strategy for Western Australia* (CALM 1999a). As part of this Strategy, environmental weeds are rated in terms of their environmental impact on biodiversity. The criteria used to determine the rating for each weed are:

- *Invasiveness* – ability to invade bushland in good to excellent condition or ability to invade waterways.
- *Distribution* – wide current or potential distribution including consideration of known history of wide spread elsewhere in the world.
- *Environmental Impacts* – ability to change the structure, composition and function of ecosystems and in particular an ability to form a monoculture in a vegetation community.

The Department's Policy Statement (Draft) *Environmental Weed Management* is used in conjunction with the *Environmental Weed Strategy* to guide the approach and priority setting for the control of environmental weeds on Departmental managed lands and waters. Priorities for action are to first control any weed that impacts on threatened or priority flora, fauna or ecological communities, or that occurs in areas of high conservation value, and then address high, moderate and low rated environmental weeds in decreasing priority as resources allow.

Options for environmental weed management include prevention, eradication, control, containment, or do nothing. It is the preferred option to prevent the introduction of environmental weeds through appropriate management, as eradication is rarely feasible. Methods of control include managing disturbance, the use of herbicides, biological control, manual control and control through the application of fire. Effective control programs encourage the growth of native species and the suppression of weeds with the overall aim of boosting the area's resilience to further weed invasion.

Environmental Weeds within the Parks

Within the parks, weeds and non-native plants have been introduced as a result of European occupation and use of the parks. Many of these species have a very localised distribution, only occurring at the site where they were introduced, but some of the more effective

colonisers have become widespread. To maintain or enhance the natural environment of the parks, it is essential that these introduced plants are managed appropriately.

There are more than 109 species of environmental weeds within the parks (Appendix 8). A wide variety of exotic plants were introduced to domestic gardens around isolated dwellings and townsites in the parks. The introductions have predominantly been small-scale and have remained localised. However in some areas non-native tree species are spreading beyond the original point of introduction (e.g. some wattle species from the old Shannon townsite).

The old Shannon townsite had numerous exotic shrubs and trees, some of which remain now contribute to the setting and history of the site and may have heritage value. Kammann (1993) found that there are 35 introduced trees, shrubs and vines at the Shannon townsite, of which only three have increased their distribution into the surrounding areas of the National Park. Thirteen other species are colonising within the cleared areas of the townsite. Although most species are not extending their range, Tasmanian blackwood (*Acacia melanoxylon*), blackberry (*Rubus fructicosus*) and maritime pine (*Pinus pinaster*) have extended their range into native vegetation and these species, in addition to those that have the potential to spread, may pose a threat if left unmanaged.

Under the *Environmental Weed Strategy* the highest rating environmental weeds in the parks are great brome (*Bromus diandrus*), freesia (*Freesia* hybrid *Freesia alba* x *F. leichtlinii*), hare's tail grass (*Lagurus ovatus*), Victorian tea tree (*Leptospermum laevigatum*), rose pelargonium (*Pelargonium capitatum*) and the arum lily (*Zantedeschia aethiopica*).

Great brome is a tufted annual native to the Mediterranean, it is a widespread weed of offshore islands, wetlands, road verges, granite rocks, pastures and crops in the south-west. Freesia is a hybrid of two South African species that has become a serious weed of urban bushland, coastal heath, woodland and granite rocks from Gingin to Israelite Bay. Hare's tail grass is a hairy annual native to the Mediterranean widespread on sandy soils from Kalbarri to Israelite Bay, especially near the coast. (Hussey *et al.* 1997).

Victorian tea-tree is a large shrub introduced from south-eastern Australia as a garden plant and is now a major bushland weed. It is spreading along road verges between Jurien Bay and Albany and invading coastal heath and woodlands on sandy and lateritic soils (Husey *et al.* 1997). Victorian tea tree is present in the parks at Windy Harbour, near Fish Creek and at the Shannon townsite. This species carries a large seed load and spreads rapidly into disturbed areas or following fire. Although control work has been carried out on most populations within the parks this will need to be continued. At Windy Harbour, Victorian tea tree has been used by lease owners as a windbreak. The Department is currently liaising with the Shire of Manjimup to encourage the removal of this species and replanting with native species.

Rose pelargonium is a straggling shrubby perennial, with compact heads of pink flowers native to South Africa. It is a common weed of beach dunes, banksia and tuart woodlands from Cervantes to Esperance (Husey *et al.* 1997).

Arum lily, native to South Africa, is a widespread and conspicuous weed from the Dandaragan area southwards (Husey *et al.* 1997). It is primarily found in wet, swampy habitats, where it can be a problem by impeding water flow. It was introduced into Australia for horticulture and its large flowers, up to 15 centimetres across, are still used in the cut flower trade. Arum lilies have established significant populations on the lower Donnelly River with some smaller populations in the area between Scott Road and the Donnelly River. Although there has been significant effort put into controlling these populations (particularly those on the lower Donnelly) the populations have persisted and have proved very difficult to eradicate. Ongoing effort is required to stop these populations expanding their current range.

The arum lily is not only rated high under the *Environmental Weed Strategy* it is also 'declared' under section 37 of the *Agriculture and Related Resources Protection Act 1976.*

Landholders, including the Department of Conservation and Land Management, are legally responsible for eradicating plants declared under the Agriculture and Related Resources Protection Act, although the Act does preserve the Department's right to decide priorities and the level of control according to resources. There are three other declared weeds within the parks: apple of Sodom (*Solanum sodomaeum*), golden dodder (*Cuscuta campestris*) and blackberry. The blackberry whilst rated low in the *Environmental Weed Strategy* is a 'Weed of National Significance' and a Strategic Plan has been prepared for its management (ARMCANZ and ANZECC 2000).

Overall, there are few significant infestations in the forested areas of the parks. However, on parts of the coast, which have had a history of grazing and disturbance, there are broadscale infestations of annual herbs and grasses. Marram grass (*Ammophila arenaria*) is an introduced species, which was used in the 1930s to stabilise foredunes along the coast of D'Entrecasteaux National Park. It has now established itself along most of the coastal foredunes and in other destabilised coastal dune areas. Marram open grassland (less than 10% canopy cover) has also established on plains behind recently formed foredunes between the Donnelly and Warren rivers. Many native species, such as coastal pigface (*Carpobrutus virescens*) and hairy spinifex (*Spinifex hirsutus*), are also vigorous foredune colonisers and are common along the majority of the D'Entrecasteaux National Park coastline. These two species are included in a list of preferred species to be used for foredune rehabilitation by the Western Australian Planning Commission (2003).

The non-native yellow stringy bark (*Eucalyptus muelleriana*) was planted in Shannon National Park when the area was State forest. Several of these stands still persist and could be sold for a range of timber industry products (see Section 39 Forest Produce). If these stands are harvested then the areas should be rehabilitated with native forest species.

Key Points

- Weeds can displace native plants, particularly on disturbed sites.
- There are over 109 environmental weed species in the parks. Six have been rated as high priority weeds—great brome, freesia, hare's tail grass, Victorian tea tree, rose pelargonium and arum lily.
- Many ornamental and garden species were introduced into the parks at Shannon townsite and around other settlements and dwellings
- Many of the weed species in the parks are localised.
- There are four declared weeds under the Agriculture and Related Resources Protection Act in the parks.

The objective is to minimise the impact of environmental weeds on park values.

This will be achieved by:

1. Using the guidelines in the *Environmental Weed Strategy* and Departmental policy, control environmental weeds based on the present status, size of infestation, rehabilitation requirements, likely introduction and level of threat of the species, in particular to specially protected fauna and declared rare flora (Appendix 8).
2. Liaising with the Department of Agriculture, landholders and local authorities regarding weed control within the parks and in surrounding areas.
3. Maintaining a register of occurrences and extent of environmental weeds.
4. Minimising disturbance to soil while carrying out management activities, particularly in areas adjacent to sources of weeds.
5. Using local native species for rehabilitation where possible.

Key Performance Indicator 19.1 and 19.2 apply (Appendix 2)

20. INTRODUCED AND OTHER PROBLEM ANIMALS

Problem animals have potential for serious impact on natural systems through direct effects such as predation, habitat destruction, competition for food and territory, introduction of disease, and through environmental degradation by selective grazing, accelerating erosion and polluting streams. Problem animals can be either native species that are impacting on natural or agricultural values or feral animals (introduced species that have become established as wild or naturalised populations).

Feral species in the parks are listed in Table 3. An objective of the Department is to achieve sustained strategic management of problem animals in the parks as per Policy Statement (Draft) *Management of Pest Animals on CALM-Managed Lands*. The Department also has responsibilities for control of declared animals on the lands it manages under sections 39 to 41 of the Agriculture and Related Resources Protection Act.

TABLE 3. Feral Animals Recorded in the Parks

Common Name	Species
Mammals	
Black rat	*Rattus rattus*
Fallow deer	*Dama dama*
Dingo*$^{\nabla}$	*Canis familiaris dingo*
Feral cat	*Felis catus*
Feral dog*	*Canis familiaris familiaris*
Feral pig*	*Sus scrofa*
Red fox*	*Vulpes vulpes*
Horse	*Equus caballus*
House mouse	*Mus musculus*
Rabbit*	*Oryctolagus cuniculus*
Birds	
Laughing kookaburra$^{\nabla}$	*Dacelo novaeguineae*
Fish	
Brown trout	*Salmo trutta*
Mosquito fish	*Gambusia holbrooki*
Rainbow trout	*Oncorhynchus mykiss*
Redfin perch	*Perca fluviatilis*
Invertebrates	
(European) honey bees	*Apis mellifera*
Various molluscs	Includes *Oxychilus* sp.
Yabby	*Cherax destructor*

* Declared species under the Agriculture and Related Resources Protection Act (as of April 2001)

$^{\nabla}$ Considered 'acclimatised' and protected under the Wildlife Conservation Act

Red Foxes and Feral Cats

The red fox is a major threat to small to medium-sized ground dwelling mammals and ground-nesting birds (Environment Australia 1999c, Burbidge and McKenzie 1989). The feral cat is also thought to have been responsible for the extinction of small to medium sized ground dwelling mammals and ground-nesting birds on islands and in the arid areas of the State (Burbidge and McKenzie 1989). Failure of reintroductions of species in the arid areas may also be attributable to the feral cat (Christensen and Burrows 1994). Even though anecdotal evidence suggests otherwise (D. Algar pers. comm. 2004), strong documented evidence that the feral cat has a significant effect on native wildlife in the south-west is scarce (Environment Australia 1999b, Dickman 1996).

Predation by both the red fox and the feral cat are listed as key threatening processes under the Environment Protection and Biodiversity Conservation Act. Five-year threat abatement plans have been prepared for both processes to provide national co-ordination, with the main emphasis on local control programs to ensure recovery of endangered species.

The Department implemented the Western Shield program in 1996 in order to control predators such as the red fox and feral cat. The program involves aerial baiting of (mostly) land managed by the Department using 1080 poison (sodium fluoroacetate) baits to enable native wildlife populations to recover, and to allow the reintroduction of native animals to former habitats once foxes and cats have been controlled. Sodium fluoroacetate occurs naturally in Western Australia in native *Gastrolobium* plants, which has enabled native animals to develop a natural resistance to the poison.

Aerial baiting currently occurs throughout the parks four times a year. The Department maintains a bait-free buffer against private property and around recreation sites within the parks. Additional hand baiting is used to supplement the aerial program in areas to protect specific habitats, known populations of rare animals or new release sites. The current 1080 bait is not particularly effective against the feral cat and research is continuing to develop a bait more attractive to cats.

Rabbits

The rabbit is one of the most widely spread and numerous of the introduced mammals in Australia. Competition and land degradation by feral rabbits is a listed key threatening process under the Environment Protection and Biodiversity Conservation Act and a 5-year threat abatement plan has been prepared (Environment Australia 1999a).

Rabbits are widespread throughout the parks but only appear to reach significant numbers in forest areas that have been cleared and native vegetation replaced with annual grasses (e.g. at Shannon townsite). On the coast, rabbits are common and can reach destructive numbers at times when native vegetation is damaged by grazing (R. Annear pers. comm. 2002). Rabbit numbers in the parks appear to correspond to the impact of myxomatosis and more lately calicivirus.

Pigs

Significant populations have established in the Shannon National Park and are also known from several locations, such as the Pingerup Plains, in D'Entrecasteaux National Park. Pigs have the potential to be very destructive to vegetation and can reach high population densities, particularly in wetland areas. Their habit of wallowing and rooting around the margins of watercourses and swamps can destroy vegetation, cause erosion and remove food and nesting sites of native animals. They pose a threat to ground-nesting birds and can spread environmental weeds. Predation, habitat degradation, competition and disease transmission by feral pigs are key threatening processes (Department of Environment and Heritage 2003) under the Environment Protection and Biodiversity Conservation Act.

Several communities of the *Reedia* swamps (identified as a threatened ecological community – see Section 18 Species and Communities of Conservation Significance) within the parks have been fenced to protect them from further damage from pigs.

There is an annual trapping, baiting and shooting program conducted within the parks. Illegal pig hunting can compromise key values in the parks if hunting dogs are used, and the use of rifles pose a visitor safety hazard. Unsanctioned pig hunters also often access areas that are closed to the public and may potentially spread *Phytophthora* by accessing disease risk areas.

Deer

Fallow deer are known from the park in the Lake Jasper area. Several head of deer were seen in the area north east of Lake Jasper during a wildfire in Summer 1996/1997. It is thought

that they may have escaped from a farming property into the park. There have been few sightings in this area to date and they are not expected to be a problem.

Horses

There are frequent horse sightings and signs of horses in the upper Shannon National Park on Creekbend Road, Strachan Road, Lockyer Road, North Road, Mindanup Road and Arthur Road. These horses are probably the western extremity of those known from the Lake Muir, Rocky, and Murtin area.

Horses, and to a lesser extent deer, can cause some problems in wet areas by trampling and barking trees. They can also spread weeds and *Phytophthora*.

Feral Dogs/Dingos

It is the subject of debate whether the dingo is introduced or native, especially as fossil records date back thousands of years. Either way, the dingo is considered native fauna, protected on conservation estate under the Wildlife Conservation Act. It is now thought the dingo may be a subspecies of the Asian wolf (*Canis lupis dingo* as opposed to *Canis familiaris dingo*) (Long 2003).

Dingos have been known from the park in the past, however it is unlikely that they persist as a pure strain. Dingos readily hybridise with wild dogs and there have been sightings of hybrid wild dogs/dingos by rangers in the past few years. Park campers have also reported hearing dogs/dingos calling at night. Dingos/wild dogs are susceptible to 1080 poison, and sightings have dramatically reduced since the introduction of baiting to control foxes in the parks.

Kookaburras

The Director of the Zoological Gardens introduced the kookaburra from Victoria in 1897 (Long 1981, 1988). Hundreds were imported into many agricultural areas of the State as a means of controlling snakes, rodents and insects. In order to stop the introduced bird from being shot, it was declared to be 'native' under the Wildlife Conservation Act and so remains protected under the Act. The kookaburra does eat native species and compete for food with other carnivorous native birds (e.g. butcherbirds). Although the impacts of the kookaburra are not well studied, Long (1981) considers the kookaburra to cause little damage to other birds and probably only a negligible contribution on any decreases in small bird populations.

Brown and Rainbow Trout

Brown trout were first introduced into Western Australia from stocks in eastern Australia as early as the 1870s and rainbow trout in the early 1900s, as there is a lack of large native freshwater species suitable for recreational fishing. However, it was not until introductions in the 1930s that trout were successfully introduced in the south-west (Department of Fisheries 2002, Morgan *et al.* 2004). Whilst there is evidence that some of these populations are self-sustaining, trout stocks are largely maintained by restocking as there is an absence of suitable spawning sites (Morgan *et al.* 2004, Arthington and McKenzie 1997).

Trout are not released directly into rivers within the parks, although the Department of Fisheries[5] releases, or authorises the release of, trout into the upper reaches of the rivers that flow through the parks. There were between 50 000 and 100 000 trout released into both the Warren and Donnelly rivers in 2000 (Department of Fisheries 2002). Authorised trout stocking occurs without any impact assessment on threatened or other native species, or an assessment to the cost-benefits of stocking for the recreational fishery.

Although many other human pressures impact on aquatic ecosystems (e.g. vegetation clearing, pollution and physical modification of natural habitats), trout still impact on native species directly through predation and also indirectly by competing for food and space

[5] The Department of Conservation and Land Management, under the Wildlife Conservation Act, is responsible for the protection of native fauna, including fish. The Department of Fisheries is also responsible for the protection and management of native and recreational fish species under the *Fish Resources Management Act 1994*.

(Arthington and McKenzie 1997, Jackson *et al*. 2004). However, given the long history of trout stocking in the south-west, clear evidence of changes to aquatic ecosystems is hard to demonstrate. For example, native species vulnerable to trout predation and competition might already be excluded from waterways where trout have been introduced.

Trout are thought to be responsible for impacting the populations of native fish, frogs, aquatic snails, aquatic insects and crustaceans such as marron, koonacs (*Cherax plebejus*) and gilgies (Wager and Jackson 1993, Cadwallader 1996, Department of Fisheries 2002, Jackson *et al.* 2004). The presence of rainbow trout coincides with low native fish species diversity in Western Australia (Arthington and McKenzie 1997) and brown trout have been implicated in the decline in a number of threatened fish species Australia wide, in particular galaxiids and minnows (Arthington and McKenzie 1997, Cadwallader 1996). The impact of trout on native fauna via the spread of pathogens (e.g. from hatchery-produced fish) is unknown.

Jackson *et al.* (2004) criticised trout management in Australia as being too focussed on providing improved recreational angling opportunities at the expense of management of trout impacts. In addition, management of these impacts, such as declining native species, only occurs after the native species is threatened. They suggest that the benefit to the fishery should be compared to the cost to implementing a threatened species recovery program should it be required, and that fisheries management should include an examination of the impacts, costs and benefits of stockings, and designation of waters where native species management is the priority. Further, an overview of the impacts of introduced salmonids by Cadwallader (1996) recommended that research should be carried out by the agencies responsible for salmonid fisheries on the impacts on threatened galaxiids, pygmy perches and species other than fish, in order to take a more proactive approach to protecting native fauna.

Based on the impacts and recommendations discussed above, the release of trout into the waters of the parks will continue to be prohibited. However, the restocking of trout upstream of the parks remains a concern to the Conservation Commission and this Department as it still results in trout within the parks. Morgan *et al.* (2004) recommend that no further stocking of trout should occur in areas of high conservation value until work is undertaken to determine the level of predation by trout on the endemic fauna of the south-west.

Redfin Perch

Redfin perch were originally introduced to Australia from Europe in the 1860s. They were introduced into Western Australia at Albany in the 1890s as a recreational fishing species and spread rapidly throughout some water-bodies and river systems of the south-west. Whilst no longer introduced, they are now very abundant in dams and river systems, and continue to be a targeted recreational species. Although rapid growers and very fecund, redfin populations tend to 'stunt' within a few years, reducing their value as a recreational fish.

Redfin perch can rapidly invade and dominate a river or dam to the detriment of local species. This is due to their fast growth rate, high fecundity and feeding habits. Redfin are predators and will voraciously consume other smaller animals including marron, gilgies, frogs, and insects. Their diet also includes many of the fish species native to the south-west.

Redfin perch are present in the parks throughout the Warren and Donnelly rivers and their tributaries. There are no realistic control options for redfin perch in the parks.

Mosquito Fish

Introduced from Central America to Western Australia in 1934 to control mosquitos and ornamental fish, it was soon realised that mosquito fish will only eat mosquito larvae when all other food sources are depleted. They prey on a wide range of food sources, in particular fish larvae as well as 'grazing' invertebrates (such as *Daphnia*) that control the growth of algae and may indirectly result in toxic algae blooms that affect the populations of native fish (Morgan *et al.* 1998 and Jaensch 1992b). Mosquito fish directly affect native fish species by fin-nipping and other antagonistic behaviours, resulting in fin damage, loss of fitness and reduced reproductive success. Mosquito fish have also been shown to prey on young tadpoles

leading to a reduction in the number of some frog species in areas where the mosquito fish populations are high. Mosquito fish are widespread in the waterways and wetlands of D'Entrecasteaux National Park. Control programs have been implemented elsewhere in the State in small, contained waterbodies using anaesthetic. This method would be impractical for the parks.

Honey Bees

Honey bees were introduced to Western Australia in 1846 from England to pollinate plants grown by early settlers for food. Swarm dispersal from managed hives has resulted in feral honey bees being established across many parts of the State, including the parks. Honey bees are commercially agisted in managed hives throughout the parks (see Section 38 Beekeeping).

Impacts on Recreational Values

Large numbers of honey bees increase the risk of visitors to the parks being stung. Feral honey bees seek water during hot weather and alternate food sources when nectar, pollen and water become scare. Feral honey bees can pollute water supplies when large numbers drown in tanks. Water availability for feral honey bees at recreational sites can be reduced by placing gauze on the end of taps and gravel on the ground underneath.

Impacts on Natural Values

Honey bees may impact on the natural values of the parks in the following ways:

- via competition for tree hollows (Matthews 1984, Oldroyd *et al*. 1994, Paton 1996, Pyke 1999, NSW National Parks and Wildlife Service 2002). Many birds and tree-dwelling mammals use tree hollows for breeding sites and shelter and are already a limited resource without the impact of feral honey bees—once occupied, feral honey bees can remain for 20 to 50 years;
- via competition for floral resources, such as pollen and nectar (Scheltema 1981, Matthews 1984, Paton 1993, 1996, 1997, 2000, Sugden *et al*. 1996, Schwarz and Hurst 1997, Gross and Mackay 1998, NSW National Parks and Wildlife Service 2002). Feral and managed hive honey bees can remove 80% or more of the floral resources produced, due in part to the longer foraging hours of the honey bee. Native species can be displaced which can thereby affect all other dependant or related flora and fauna. Also native bees may be forced to forage for greater periods of time, thereby exposing nest brood to more predators in their absence. Native birds that depend on nectar resources may also be forced to occupy larger territories, thereby excluding smaller birds from these resources;
- via affecting pollination and seed set of native species due in part to inefficient transfer of pollen or physically damaging flowers (Scheltema 1981, Matthews 1984, Gross and Mackay 1998, Schwarz and Hogendoorn 1999); and
- via increasing seed-set in some weeds as the honey bee and introduced plants may be interacting as invasive mutualists (Barthell *et al*. 1994 and 2001).

Although the honey bee has existed in the south-west for the last 150 years, impacts such as those listed above, may be still impacting significantly on the natural ecosystems. The honey bee has been identified as a key threatening process for the three species of black cockatoo inhabiting the south-west (Cale 2003, Chapman in prep.). The problem may be exacerbated by the recent establishment of canola crops in farmlands as chemicals in the pollen of canola contribute to earlier and more frequent swarming of feral bees, which increases the likelihood of new hives establishing in the wild (P. Mawson pers. comm. 2004). However, no studies have been carried out specifically to quantify the impact of the honey bee within the parks.

The feasibility of completely removing feral honey bees from the parks is currently low as localised eradication would probably be followed by recolonisation from new swarms invading the area (Gross 2001). However, a control program should be developed to protect species most at risk from competition within the parks. Any control program should not affect the production or quality of commercially produced honey and needs to be safe for native insect populations. The location and appropriateness of the managed hive sites in the parks also need to be regularly assessed (see Section 38 Beekeeping).

Yabbies

Yabbies are an introduced species to Western Australia. They are native to New South Wales, Victoria and South Australia, and were stocked into farm dams in Western Australia as far back as 1932. Yabbies can now be found in rivers and irrigation dams throughout the south-west. Yabbies are a threat to the native marron fishery, as they breed faster and may carry diseases, which affect other freshwater crayfish.

It is believed that yabbies have been introduced into some waterholes (usually fire water points) in the parks.

Introduced Molluscs

At least two species of native snails (*Helicarion castanea* and *Occirhenea georgiana)* that may well have occurred in the parks are now listed as presumed extinct. The introduction from Europe of the carnivorous snail *Oxychilus* sp. and other molluscs to the area is thought to have been the key factor in these extinctions (John Blyth pers. comm. 2003). Introduced molluscs remain a threat to native species.

Key Points

- There are a number of introduced animals in the parks that can out-compete, prey on, or alter the habitat for native animals. Of single greatest concern is the fox, which is the subject of an ongoing control program.

The objective is to minimise the impact of problem animals and introduced animal control on the key values of the parks.

This will be achieved by:

1. Controlling introduced and other problem animals in the parks based on the following criteria:
   - existing and potential impact of the species on the key values of the park;
   - the efficiency and effectiveness of control measures;
   - locations and availability of resources; and
   - the level of participation of other stakeholders including the community.
2. Complying with the Department's operational guidelines and policies for problem animal control (e.g. the Department's Training Manual for *Safe and Effective Use of 1080 for Vertebrate Pest Control*).
3. Liaising with landholders, local authorities, the Pastoral Lands Board, the Department of Agriculture and Department of Fisheries regarding control of introduced and other problem animals surrounding the parks.
4. Not allowing pets in the parks except guide dogs, dogs associated with search and rescue operations or within any future designated areas (see Section 30 Domestic Animals).
5. Preventing further introductions of non-native animals in the parks, unless as part of a biological control program and under stringent guidelines.
6. Continuing to prohibit stocking of non-native species in all water bodies in the parks and seeking to prevent restocking in rivers that are upstream of D'Entrecasteaux National Park (see Section 27 Recreational Use – Marroning and Fishing).
7. Managing commercial beekeeping within the parks according to environmental and management criteria (see Section 38 Beekeeping).
8. Removing feral bee colonies from areas where there is a high impact on recreational and natural values and minimising the opportunities for feral bees to utilise water provided for recreation purposes (e.g. water tanks).
9. Producing educational material on the impacts of introduced animals such as pigs and recreational fish/yabbies on the natural environment of the parks.
10. Supporting research programs into the control of and impacts of feral animals (also

Section 44 Research and Monitoring).

Key Performance Indicator 20.1 applies (Appendix 2)

21. DISEASES

Plant Diseases

The south-western ecosystems are being impacted by a high number of active plant diseases (Shearer 1994, Wills and Keighery 1994). However, plant disease knowledge is still very rudimentary with much more work required on disease occurrence, the disease organism and impacts, the host and its susceptibility, and environmental processes that may facilitate spread.

Hopper (1994) suggests that there are four factors that in particular may have contributed to the susceptibility of the south-west flora to disease epidemics:

- a flat landscape with predominantly acidic, highly leached and nutrient deficient soils with slow drainage. Diseases such as *P. cinnamomi* thrive in acidic moist soils;
- a rich vascular flora that has been geographically isolated for a long time, with many adaptations for nutrient deficient soils, many involving symbiotic partnerships with microorganisms such as fungi—consequently, a diverse range of vulnerable hosts for diseases;
- a climatic regime where drought is common; and
- the rapid and ongoing human development of the landscape following European settlement including direct destruction or alteration of habitat by fragmentation, altered landscape processes, and introduction of numerous weeds and pests.

The most frequently reported disease groups of the south-western native plant taxa include:

- pythiacious root rots (mostly *P. cinnamomi*, *P. megasperma* and *P. citricola*);
- rusts (mostly *Puccinia* spp. and *Uroycladium tepperianum* gall rusts of *Acacia* species);
- *Armillaria* root rots (*Armillaria luteobubalina*);
- stem cankers (*Botryospaeria* spp., *Zythiostroma* spp. and *Cryptodiaporthe* spp.); and
- leaf spots and blights (Shearer 1994).

Families most affected by disease are Proteaceae, Myrtaceae, Mimosaceae, Papilionaceae, Haemodoraceae, Goodeniaceae, Epacridaceae, Poceae and Chenopodiaceae. These families are represented by 287 species within the parks, equating to almost a third of the recorded vascular plant species of the parks.

Plant pathogens not only have major impacts on vegetation communities but also indirectly impact animal communities. Table 4 shows some effects that a pathogen can have on fauna.

TABLE 4. Possible Effects on Fauna due to the Presence of a Plant Pathogen in a Vegetation Community

Effects on Vegetation	Effects on Fauna
Loss of susceptible plants in the understorey and midstorey	❖ Direct loss of food sources such as seeds, nectar, pollen ❖ Indirect loss of food sources such as invertebrates
Decline in plant species richness and diversity	❖ Loss of food for species that prefer floristically rich vegetation ❖ Loss of seasonal food

Effects on Vegetation	Effects on Fauna
Decrease in plant cover, increase in bare ground, erosion	❖ Loss of habitat for species dependant on thick ground cover ❖ Increased predation risk ❖ Changes to microclimate
Decrease in canopy cover	❖ Loss of food for arboreal species ❖ Loss of habitat for arboreal species
Decrease in litter fall	❖ Decline in litter invertebrates ❖ Decline in invertebrate food sources for insectivores
Post infection increase in frequency of resistant species	❖ Change of food resources

Source: based on Wilson *et al*. (1994)

Disease caused by *Phytophthora*

The most significant disease threat to plants within the parks continues to be the disease known as 'dieback' caused by the microscopic pathogen, the fungal-like water mould; *P. cinnamomi.* It is thought that this pathogen was introduced during European settlement of Western Australia through the soil around roots of plants brought over for cultivation. There are now known to be eight species of *Phytophthora* occurring within the native plant communities of Western Australia. It is recognised that of these species, *P. cinnamomi* is the most damaging. Once infested, susceptible plants are killed and in many cases are eliminated from the site leading to dramatic and permanent changes to native plant communities and their dependent fauna.

Dispersal

The plant pathogen *P. cinnamomi* is able to move autonomously by producing small motile spores that are distributed over long distances through surface and sub-surface water or travel microscopic distances to infect new roots, or by the growth between roots of mycelial threads. The pathogen can be spread in soil and plant material, which can then be transported by vectors such as humans, vehicles and animals. In response to unfavourable conditions such as extended periods of hot dry weather, the pathogen can produce a spore, which is resistant to desiccation that can itself produce further spores or mycelium once conditions are suitable.

Through these dispersal methods, *P. cinnamomi* is continuing to spread through the south-west. The pattern of *P. cinnamomi* distribution is strongly related to the native vegetation community and other site factors such as the presence of watercourses, tracks and roads, with infestation being most common where human activities have taken place in the absence of a hygiene regime.

Effects

The effect of *P. cinnamomi* upon the health of plant communities, and upon the species in them, varies greatly. In many places, lethal root-disease destroys the structure of many native communities, reduces their floristic diversity, decimates their primary productivity and destroys habitat for much dependant native fauna (see Table 4). In some places the pathogen causes little damage at all. Unfortunately in the south-west it is more common to find susceptible communities in vulnerable environments than not.

No simple or single relationship exists between the presence of *P. cinnamomi* and the development of the disease. This is because of the considerable variability, which exists within and between native plant species in their responses to the presence of *P. cinnamomi*, and the complex influence of temporal and spatial variation in environmental forces.

It is evident that among the variety of plant communities occurring within the high rainfall areas of the south-west (>800 millimetres mean annual rainfall), there are four types of distinctive response to the pathogen as follows:

- *no apparent disease at all* – this includes those areas of karri and wandoo forest which contain no floristic elements of the dry sclerophyll (jarrah) forest type and to plant communities on the calcareous soils of the Spearwood and Quindalup Dune Systems and of the Swan Coastal Plain and pedogenically related landscapes;
- *an extremely destructive epidemic of root rot* – this applies within the highly susceptible understorey elements of the dry sclerophyll forest, in banksia woodland and in heathland on podsols, podsolic and lateritic landform;
- *a variable epidemic* – this applies to the dominant jarrah tree component of the forest with all variants in the response of jarrah are coincident with, or preceded by, mass deaths in susceptible elements of the understorey; and
- *an 'endemic' pathogen* – where *P. cinnamomi* has been long established (some 50 years or more) in sites formerly dominated by jarrah/banksia forest and has been very heavily impacted *P. cinnamomi* behaves in a manner characteristic of an endemic pathogen. The forest is often replaced by an open woodland of marri/parrot bush. Periodic outbreaks of mortality in parrot bush (*Dryandra sessilis*) follow, with subsequent regeneration by seed.

Each of these circumstances presents a different problem that requires a separate management response.

A broadscale survey of the D'Entrecasteaux National Park in 1984 revealed that the jarrah forest and woodlands, flats and swamps had a high probability of being infested with *P. cinnamomi* and contained numerous plant species that are highly susceptible to the pathogen or in many cases many susceptible species had already been eliminated. In comparison, the karri forest, yate (*Eucalyptus cornuta*) and bullich (*Eucalyptus megacarpa*) woodlands, stabilised dunes and coastal dunes are thought not to be vulnerable and did not express the symptoms of disease caused by *P. cinnamomi*.

The heathlands of the D'Entrecasteaux National Park have many members of the families Proteaceae and Epacridaceae. These families which include *Banksia*, *Dryandra* and *Leucopogon* are highly susceptible to *P. cinnamomi*. *P. cinnamomi*-induced death of these plants, which often dominate the heathlands, is continuing to significantly alter the structure and composition of the plant communities within D'Entrecasteaux National Park (K. Vear pers. comm. 2002).

P. cinnamomi can also have a major impact on faunal habitats (see Table 4). Species such as the honey possum (*Tarsipes rostratus*) are dependent on plant communities such as the banksia woodlands, which are highly susceptible to diseases caused by *P. cinnamomi*. Such dependent species will be reduced in number or disappear as the autonomous spread of *P. cinnamomi* continues. Impacts may be accelerated if the vectoring of the pathogen by humans into uninfested areas is not minimised.

Management

Effective management of plant diseases requires accurate identification of both the pathogens and their hosts, as well as the nature and extent of genetic variation, which affects the capacity of the pathogen to cause damage, its environmental tolerance and the capacity of the host to resist infection (Podger *et al*. 1996).

Standard management guidelines for the *P. cinnamomi* are described in the Department's Manual: *Phytophthora cinnamomi and disease caused by it* (CALM 2000), the newly revised Policy Statement No. 3 *Management of Phytophthora and Disease Caused by it in Native Vegetation* and the accompanying *Best Practice Guidelines for the Management of Phytophthora cinnamomi*. Dieback caused by *P. cinnamomi* is a key threatening process under the Environment Protection and Biodiversity Conservation Act and a threat abatement plan has been prepared (Environment Australia 2001c).

Management of *P. cinnamomi* within the parks will focus on significant uninfested areas—areas likely to remain uninfested by the autonomous spread of the pathogen in the medium term and referred to as 'protectable areas'—and areas that are already infested but with

significant residual values, such as rare flora or threatened ecological communities. Management strategies will be based on the following three elements:

1. containment or retardation of further autonomous spread at the boundaries of existing infestation;
2. reduction of the rate of vectored spread and establishment of new centres of infestation within protectable areas by:
   - preparing *P. cinnamomi* management plans for new developments such as recreational facilities and planned upgrades, or realignments of management access roads and tracks;
   - controlling feral animals, for example pigs, in these areas;
   - applying phosphite (see below); and/or
   - minimising or prohibiting access into these areas (see Section 26 Visitor Access); and
3. implementation of practices which ameliorate the damaging effects of *P. cinnamomi* where it has already established.

In protectable areas, emphasis of management will be on reduction of vectored spread and establishment of new centres of infestation. To accurately determine the extent of *P. cinnamomi* within the parks and to identify protectable areas, on-ground surveys would be required. However, due to resource limitations the first priority will be to interpret aerial photographs of the parks and combine with knowledge of the disease occurrence to produce a map of probable disease spread and protectable areas within the planning area. On-ground surveys should then be prioritised according to risk to conservation values and/or proposed development.

In 'unprotectable' uninfested areas, infested areas and areas where disease spread remains unknown, standard disease management guidelines will apply. However, in some cases, strict adherence to disease hygiene plans may be difficult. For example, construction of emergency firebreaks in wildfire situations may be required to protect human life.

The chemical 'phosphite' has been shown to prevent *P. cinnamomi* killing susceptible native plants in the wild, provided the treatment is continual. As susceptible threatened species, threatened ecological communities and the habitats of threatened native fauna in the park are identified, a program of repeated applications of phosphite will be developed to help protect them subject to resource considerations. In addition, germplasm from threatened native plants may be collected for cryogenic storage.

Other Plant Diseases

Rusts are the second most frequent pathogen on native plant taxa in the south-west (Shearer 1994). In contrast to *Phytophthora*, rust pathogens on native plants are most likely to be endemic and require living hosts for normal development. There is insufficient information on impacts of rusts on native plant communities.

Another disease that occurs widely in the south-west, is the *Armillaria* root disease caused by the soil-borne pathogen *Armillaria luteobubalina.* This endemic fungus is widespread in forests, woodlands and the coastal heath of the south-west, including areas in the parks. Despite a prolific production of spores, the main mode of spread is by root to root contact between healthy and infected plants. The range of species susceptible to the fungus is very large and poorly defined (at least 50 families and over 200 species), with very little information on the presence of resistant or tolerant species. The highest impact of the disease is in regrowth karri, marri and jarrah forests as a result of the harvesting and thinning operations which provide stumps that *A. luteobubalina* can readily colonise and then infect regrowth saplings and residual trees. Many species that resist infection by *P. cinnamomi* are susceptible to *A. luteobubalina* (Pearce *et al*. 1986, Shearer and Tippett 1988, Shearer *et al*. 1997a, 1997b, 1998).

Mundella yellows is a recently described disease thought to be an introduced virus or virus-like organism of unknown origin possibly spread by insects. It is a slow dieback disease of

eucalypts (23 species in Western Australia are known to be affected) and may also affect sheoaks, banksias and wattles. The disease causes progressive decline, yellowing and then death of the trees. The disease has been observed to occur across a scattered distribution in Australia, mostly in coastal areas and mostly in areas of high disturbance such as farmland, roadsides and urban parks (CSIRO 2000, Handol *et al*. 2002). It has not been observed in the parks or in many native undisturbed forests to date, but it is still regarded as a potential threat to native tree species as little is known about the cause or spread of the disease. General plant disease hygiene practices should be implemented to minimise the risk of spreading any new diseases into the parks through human activity.

Animal Diseases

The frog fungus (*Batrachochytrium dendrobatidis*) that lives as a parasite in the skin of frogs and other amphibians, known internationally since 1996 was confirmed to occur in Western Australia in 1998 (although testing of historical material has shown the earliest occurrence of the fungus in the Albany region in 1985). The fungus can cause sporadic death in some populations to 100% death in others (Environment Australia 2002). Studies have shown that there is a broad zone of infection from just north of Geraldton south to Augusta and east to Esperance however this does not imply that all frog populations are infected within this zone (Aplin and Kirkpatrick 2001). Four species of frogs have been shown to be infected more frequently than most other species. Two of these species are found within the parks; the slender tree frog (*Litoria adelaidensis*) and the western banjo frog (*Limnodynastes dorsalis*). Populations of these frogs should be monitored to detect any significant decline in numbers. The infection of amphibians with this fungus is a key threatening process under the Environment Protection and Biodiversity Conservation Act and a threat abatement plan will be prepared.

Key Points

- *P. cinnamomi* is the most significant pathogen threatening plants within the parks and may kill susceptible plants, irreversibly changing the plant and fauna communities of the area. Other pathogens in the parks include *A. luteobubalina,* rusts and stem canker.
- *P. cinnamomi* spreads by producing small spores that are distributed through surface, sub-surface and stream flows, can transfer between plants by mycelium growth and can be spread by humans, vehicles and animals moving infested plant material and soil.
- Jarrah forest and woodlands, flats and swamps in the D'Entrecasteaux National Park are vulnerable to being infected by *P. cinnamomi* and are continuing to change as a result of the actions of the pathogen.
- Frogs in the parks may be at risk of infection with the frog fungus *Batrachochytrium dendrobatidis*.

The objective is to prevent introducing plant and animal diseases into disease-free areas and minimise the spread or impact where they are already present.

This will be achieved by:

1. Mapping disease spread and identifying probable protectable areas within the parks using aerial photographs or similar, and available knowledge of disease spread.
2. Developing protocols for prioritisation and management, including on-ground surveys, of protectable areas and high conservation areas.
3. Requiring Conservation Commission approval of any new development in a protectable area.
4. Implementing seasonal road closures to minimise disease spread as necessary.
5. Providing the public with information about plant disease, emphasising the need to stay on approved roads and tracks and other ways to minimise the impacts of disease.

6. Following the guidelines in the Department's manual on *P. cinnamomi* (CALM 2000) and Policy Statement No. 3.
7. Planning the construction of any new roads, firebreaks and tracks or any operation that requires soil or plant material movement so that the risk of spreading *P. cinnamomi* is minimised.
8. Identifying and treating threatened plants, threatened ecological communities and habitats of threatened native animals with phosphite where feasible.
9. Continuing to implement the training and accreditation program to ensure that all Departmental staff entering protectable areas are aware of what is required of them for *P. cinnamomi* management compliance.
10. Liasing with neighbours and local authorities to minimise cross-boundary disease spread.
11. Encouraging research into the effects that *P. cinnamomi* and other pathogens are having on the plant and animal associations within the parks, taxonomy, biogeography and ecology of the disease agents, hosts and associates.
12. Restricting the movement of *A. luteobubalina* by establishing quarantine areas depending on the scale of infestation.
13. Liasing with the Western Australian Museum and other researchers to increase knowledge of frog fungus, and other animal diseases within the south-west.
14. Documenting any outbreaks of new diseases within the parks (plant or animal).

Performance Indicator 21.1 applies (Appendix 2)

22. FIRE

History

Pre-European Settlement

Evidence of frequent fires has been documented dating to 2.5 million years in the south-west of Western Australia, indicating that fire has been a major evolutionary influence since at least that time (Dodson and Lu 2000, Dodson and Ramrath 2001, Hassell and Dodson 2003), and maybe as early as the mid Miocene, approximately 15 million years ago. The former date coincides with a major climatic change from subtropical to Mediterranean (i.e. warm/hot summers, summer droughts and cool winters), which is thought to have led to an associated increase in fire, as evidenced by charcoal in sedimentary deposits. Rainforest species characteristic of the subtropical climate of the Tertiary period (approximately 65 to 1.5 million years ago) were replaced by species characterised by scleromorphy, lignotubers, and large persistent woody fruits that were pre-adapted to nutrient deficient soils (Main 1996). These pre-adaptations were ideally suited to the drought and fire conditions that were to become more prevalent.

Fire, climate and vegetation have a long association on the Australian continent, one that pre-dates the arrival of humans by millions of years (Churchill 1968, Singh *et al*. 1981, Kershaw *et al*. 2002). The relatively recent arrival of Aboriginal people (probably within the last 60 000 years) would undoubtedly have led to changes in fire patterns and fire environment, regardless of the extent of 'firestick farming' by Aboriginal people (Hallam 1975, Kershaw 1986, Pyne 1991, Hassell and Dodson 2003). Fire intervals appeared to be much shorter in areas continually occupied by Aboriginal people in contrast to areas of the south-west that were historically unoccupied, such as the offshore islands and southern forests (Hassell and Dodson 2003). Fire regimes in areas frequented by Aboriginal people had a controlling effect on vegetation composition and structure, presumably evolving with the economic and ecological needs of the people (Hassell and Dodson 2003). Aboriginal people are likely to have utilised fire to their advantage, opening up dense vegetation for ease of access, encouraging prolific growth of forage to aid in the harvesting of game and for the protection of camping spots and areas of high resource value (Hallam 2000).

The co-existence of fire, people and of natural ecosystems that exhibit a variety of responses to different fire regimes has resulted in diverse patterns of response at the species, community and ecosystem level during the last 60 000 years.

Post Aboriginal arrival, the vegetation was burnt to varying degrees by a combination of natural and human-induced sources. Debate continues as to the extent of 'fire-stick' farming, and to what extent fire regimes where manipulated. For example, a review of Aboriginal usage of fire for the period 1696 to 1890 by Abbott (2003) proposes that in coastal and forested areas of south-west Western Australia, Aboriginal people lit fires, principally in summer, that could be large and burn up to hundreds of hectares at three- to 5-year intervals. This would have varied depending on the flammability of sites (e.g. salt-laden coastal vegetation, steep south-facing slopes or riparian vegetation in higher rainfall areas). The suggested fire regime is supported by studies of Ward *et al*. (2001), who examined fire scars on approximately 160 grass trees at 50 sites throughout the south-west jarrah forests. However, Hopper (2003) suggests caution is required before inferring landscape-scale burning from Aboriginal firestick farming from fire scars on individual trees and colonial diaries from untrained observers.

Post-European Settlement

Significant areas of the D'Entrecasteaux National Park have a long history of grazing by domestic stock and frequent burning by graziers, commencing in the late 1800s and continuing until areas became National Park. Bill Ipsen, who used to run cattle in the Yeagarup and Bolghinup areas, wrote that the cattlemen mimicked what they believed to have been the traditional burning methods of the Aboriginal people (Ipsen 2000):

> "*They lit fires at selected points on a four year rotation in order to provide good feed for their cattle and to prevent catastrophic fires from causing serious long-term damage to the forest. Essentially, in order to provide an abundance of new shoots for cattle feed, they used the same technique as the Aborigines who burnt patches of country in a circle in order to see and trap game*."

Frequently burnt areas supported an open woodland structure with a grassy understorey, which has gradually changed under the more infrequent fire regimes introduced in the mid 1930s. Lew Scott, who had leases in the Lake Jasper area, said that the grasses had disappeared:

> "*…Because its not burnt, you have to burn to get the native grass. You burnt wherever you could … it was only a little fire, it never used to get up in the trees and burn the possums… Controlled burning first came in 1934-35, something like that. They weren't very severe with it but as time went on it got worse and worse, so it was impossible to burn … That's what killed the coast country."*

Irrespective of the burning patterns of Aboriginal people and the graziers of the past, environmental conditions have been altered to such a degree over the past 100 years that the application of historic fire regimes may no longer meet biodiversity conservation objectives (Hopper 2003). Factors such as private property, towns and cities, cleared land, weeds and contemporary conservation values contribute to these changing conditions. The south-west has been subjected to massive social and landscape changes over this period, and it would be inappropriate to try to restore traditional fire regimes in most instances. Rather, this knowledge should be used where appropriate to contribute to the development of ecologically-based fire regimes at a landscape scale.

Recent History

The fire history of the parks is detailed on Map 7 Fire History. This provides a useful starting point when planning for fire regimes within fire management units (see Section 22 Fire – Fire Management). Over the last decade, there have been a number of escapes from prescribed burns, but these have generally been kept to a small size by quick suppression action (Table 5 Wildfire Causes in the Parks 1989 to 2001).

TABLE 5. Wildfire Causes in the Parks 1989 to 2004

Fire Season	Causes					Total
	Lightning (no./area)	Human-induced			Unknown	
		Accidental (no./area)	Deliberate (no./area)	Escape from prescribed burns (no./area)		
2003-2004			1 (2 ha)			**1**
2002-2003	5 (24 476 ha)	1 (16 ha)	1 (500 ha)			**7**
2001-2002	3 (7470 ha)		3 (29 ha)		1 (650 ha)	**7**
2000-2001						**0**
1999-2000		1 (2 ha)	3 (76 ha)	1(400 ha)		**5**
1998-1999		1 (160 ha)	1 (17 ha)			**2**
1997-1998				3 (4650 ha)		**3**
1996-1997						**0**
1995-1996		1 (1950 ha)		1 (140 ha)		**2**
1994-1995	1 (3 ha)					**1**
1993-1994	2 (19 520 ha)	1 (12 ha)	3 (729 ha)	1 (2040 ha)	1 (<1 ha)	**8**
1992-1993			3 (271 ha)		1 (<1 ha)	**4**
1991-1992	1 (<1 ha)		2 (<1 ha)	1 (3500 ha)		**4**
1990-1991	1 (400 ha)	1 (2 ha)	4 (4676 ha)	1 (80 ha)		**7**
1989-1990		2 (15 ha)	1 (31 ha)			**1**
Total	**13 (24.1%) 51 870 ha (72.3%)**	**8 (14.8%) 2157 ha (3.0%)**	**22 (40.7%) 6332 ha (8.9%)**	**8 (14.8%) 10 810 ha (15.1%)**	**3 (5.6%) 651 ha (<1%)**	**54 71719 ha**

In the period 1989 to 2004, 54 wildfires were reported in the parks. Of these, 38 were human-induced (criminal or accidental arson), which burnt a total of 29 289 hectares. Thirteen wildfires attributed to natural causes (lightning strikes) burnt a total of 51 870 hectares. Table 5 details the wildfires according to either natural or human-induced causes.

There were three wildfires that left the parks and burnt adjacent private properties in the period 2000 to 2004. The two largest were 210 hectares caused by lightning in 2001/2002 and 153 hectares caused by arson in 2002/2003. The third was an 8 hectare wildfire in 2002/2003 caused by an escape from a non-Departmental burn.

The high number of deliberately lit fires (arson) is of particular concern. Education is an important part of dealing with arson and the Department will seek to co-operate with agencies such as the Fire and Emergency Services and Police with education and enforcement to combat arson affecting conservation estate.

Fire Ecology

Flammable vegetation and a Mediterranean-type climate with hot dry summers and cool wet winters, ensures that fire will continue to shape the environment within the parks. The flora of the parks, in particular, possesses a variety of traits that enable persistence in this fire-prone environment (Gill *et al.* 1981), including:

- soil protection of buried buds;
- bark protection of aerial buds;
- bud survival and sprouting;
- fire stimulated flowering;
- fire triggered opening of fruits; and
- on-plant seed storage.

For many species, reproduction and regeneration are cued or enhanced by fire and for some plant communities, is necessary for the maintenance of floristic and structural diversity (Burrows and Wardell-Johnson 2003). However, some species are sensitive to fire, or particular fire regimes (Table 6), and no single fire regime is optimal for all species.

Typically, these species are confined to more mesic or less flammable environments such as riparian zones, wetlands and granite outcrops where fire is less frequent (see Section 18 Species and Communities of Conservation Significance). Generally plant communities in the drier, upland areas of the forest are burnt more frequently and display a greater resilience to fire. Extreme regimes, such as sustained, high frequency burning or infrequent but large, intense fire regimes, are more likely to be the most damaging to biodiversity values (Burrows and Friend 1998, Burrows and Wardell-Johnson 2003).

TABLE 6. Species Vulnerable to Fire or Extreme Fire Regimes

Fauna	Flora
Require specialised habitats	Killed by fire
Have low fecundity	Have short life spans
Exist as discrete dispersed populations	Long juvenile periods
Have low dispersal capacity	Canopy-stored seed
Require mature late successional state vegetation	Regenerate only from seed ('obligate' seeders)
Prone to predation	

source: Burrows and Friend (1998) and Burrows and Wardell-Johnson (2003)

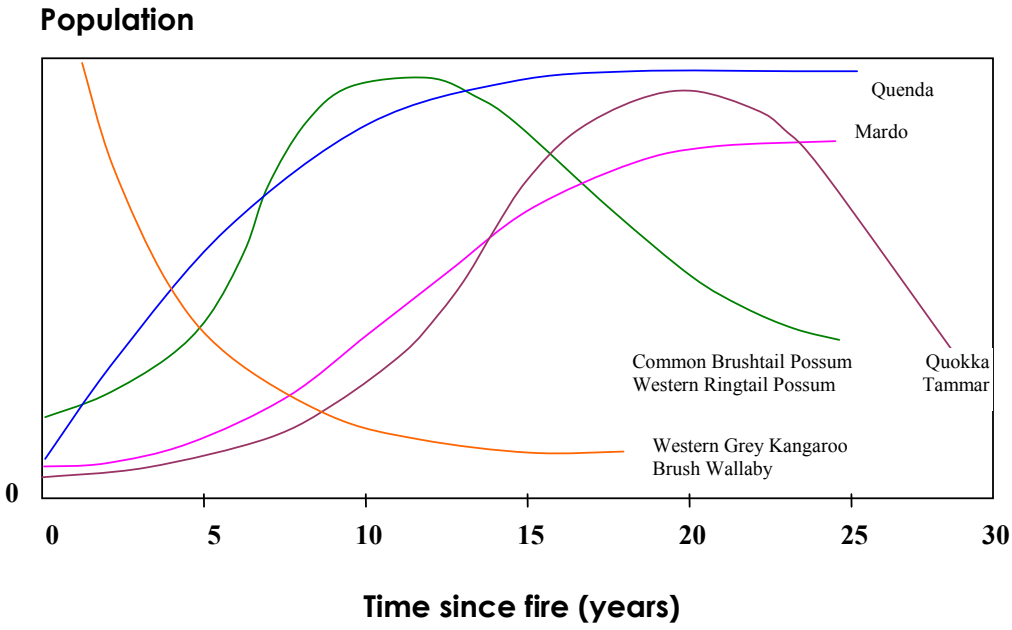
Fire sensitive species in the parks include fauna such as the threatened quokka and flora such as the rare Northcliffe kennedia and granite banksia, as well as communities such as the *Reedia* swamps which are a proposed threatened ecological community (see Section 18 Species and Communities of Conservation Significance).

The rate at which plant species are able to regenerate and produce adequate seed for regeneration after fire needs to be considered in determining the minimum prescribed frequency of burning. For example, Burrows *et al.* (1995) showed that the majority of understorey plants on upland high rainfall jarrah forest sites flower within 3 years of fire. Of the 17 species known to have juvenile periods longer than 3 years within the south-west, 10 of these occur within the parks (Burrows *et al*. in prep.). On low lying sites such as gullies and broad valley floors, some species may take six to 7 years to flower after fire. This has implications for prescribed burning—on the basis of current knowledge, doubling the juvenile period (which is defined as the time when at least 50% of the population has reached flowering age), of the slowest maturing fire sensitive species to allow for the replenishment of seed banks, provides a minimum interval between fires that are lethal to adults of that species (see Section 22 Fire – Fire Management).

Wet sclerophyll forests, such as karri, usually produce important habitats for relictual taxa as moist conditions restrict the period where the vegetation is susceptible to fire for two to 3 months annually (see Section 18 Species and Communities of Conservation Significance). In contrast, jarrah/marri forest and shrublands are susceptible to fire for at least twice that period.

Research indicates that the immediate impact of fire on fauna is directly proportional to the scale of the fire, the intensity of the fire, the patchiness of the fire and the interval between fires (Friend 1995, Burrows and Friend 1998, Friend 1999). This impact will be modified by the presence of predators where displaced species have to travel across open ground to find suitable habitat (Friend 1999).

For mammals at least, the response post-fire is reasonably predictable and consistent (Figure 7) and could be considered in terms of their life history categories based on shelter, food and breeding requirements, and the scale, intensity and patchiness of the fire (Burrows *et al*. 1999, Friend 1999). Responses are largely dependent on vegetation structure and floristic composition, which simplifies the prediction of fire impacts (Friend 1999). Friend also noted that the post-fire response patterns of reptiles was less predictable, and that the response of amphibians was extremely variable.



(source: N. Burrows pers. comm. 2003)

FIGURE 7. Idealised Relationship between the Abundance of Various Forest Mammal Species and Time since Fire

The Department is developing a 'Fauna Distribution Information System' that is a tool designed to predict the likely presence of fauna in particular habitats and to aid the fire manager in developing fire regimes and burn prescriptions that incorporate the needs of fauna. The fire response patterns of flora in the south-west are currently being collated into the Department's 'Fireresponse' database. At the time of drafting this management plan, incomplete information on post-fire regeneration strategies, time to first flowering, time to peak flowering, time to flowering decline, and disease sensitivity of approximately 1500 species have been collated into this database (N. Burrows pers. comm. 2004).

Coastal Woodlands

There has been no detailed fire research on the plant communities in the coastal woodlands to determine the effect of various fire regimes. Observations following summer wildfires suggest that high-intensity fires in woodlands of yate and peppermint usually kill large mature trees and lead to the development of dense understorey thickets of peppermint and wattle. Large areas of woodland between the Donnelly River and Black Point were converted to dense thickets following severe summer fires in 1988 (Bradshaw 2000). Further research and adaptive management experimentation is required to determine the most appropriate fire regime for these coastal woodlands.

Wetlands

Inappropriate fire regimes, coupled with the impacts of climate change, can have detrimental impacts on some wetlands (see Section 18 Species and Communities of Conservation Significance). Over the past 30 years, winter rainfall in the south-west has declined by 10 to 20% (Indian Ocean Climate Initiative 2002). This has had the effect of drying out the organic substrates of some wetlands and predisposing them to fire.

Indicators of fire impacts in organic rich wetlands include burnt edges, exposed roots, remnant pedestals and cracked soil. Fire in a wetland can both spatially and temporally change the aquatic habitat—many of these changes are likely to be short term, while others could be long term. These impacts include removing shade and organic matter provided by the fringing vegetation, reducing ground litter and consequently the organic input into the system, increasing exposure to light and raising the temperature of the water body (P. Horwitz

et al. 2003). However there is a lack of knowledge on the long term impacts of fire in these areas.

The community has raised the issue of fire and the subsequent formation of acid sulfate soils across the waterlogged areas of the parks (see Section 15 Soil and Catchment Protection). Fire can potentially accelerate the oxidation of iron sulfides in wetlands (particularly where associated with shallow peat materials) and generate large quantities of sulfuric acid (B. Degens pers. comm. 2004). However, there have not been any instances to date of fire causing acid sulfate soils in the wetlands of the south coast.

Identification and mapping of the organic soil complexes within the parks and ongoing research of fire impacts will be important in developing appropriate fire regimes for these systems (see Section 15 Soil and Catchment Protection and Section 44 Research and Monitoring).

Granite Outcrops

The fire frequency of granite outcrops is lower than the surrounding landscape because the vegetation is often low in stature and biomass, and fragmented by areas of sheet rock or boulders that provide a discontinuous distribution of flammable material that limits fire spread under mild/moderate conditions (Hopper 2000). Granite outcrops, such as Mt Chudalup and Mt Pingerup in D'Entrecasteaux National Park, therefore act as refuges for fire-sensitive species. These areas have several populations of rare and priority flora as well as endemic, relictual and disjunct species that may be vulnerable to frequent fire (see Section 18 Species and Communities of Conservation Significance). However, some species on granite outcrops may require infrequent fire under certain conditions to regenerate. Hopper (2000) found a high number of fire-sensitive obligate seeders (77%) regenerating post-fire on a granite outcrop in the wheatbelt, and suggested

> *"…intervals between fires measured in decades are likely to be required to ensure an adequate seed bank is available and local extinction is averted".*

This may be the case with granite outcrops within the parks also, and requires further investigation.

Sensitive vegetation complexes such as wetlands, coastal woodlands and granite outcrops need to be identified so that appropriate fire regimes can be put in place. Once this work is completed, the findings will be used, where necessary, to identify appropriate fire regimes.

This information must be combined with other considerations (e.g. public risk, protection of community assets, recreation sites or plantations), and will be used as a basis in determining the frequency, season and spatial arrangement of prescribed burning (see Section 22 Fire – Fire Management).

Fire Behaviour

Weather conditions suitable for the ignition and spread of fires typically occur on a regular basis from October until the latter part of May each year. Dry periods during the cooler months may also provide opportunities for fire spread, particularly in drought years.

Fire behaviour is affected by wind speed, topography, fuel dryness, the amount and type of fuel, air temperature and relative humidity (Sneeuwjagt and Peet 1985). Different vegetation types accumulate fuel at different rates and have different fire behaviour characteristics. Within each major fuel type there is a threshold weight of dry fuel above which fire behaviour in summer conditions may be severe and too dangerous to be suppressed by direct fire suppression methods, even on days of moderate fire danger.

The vegetation types in the parks are karri forest (pure and mixed), even-aged jarrah and karri regrowth, jarrah/marri forest, peppermint woodland and coastal and seasonally inundated heathland/wetland communities. These differing vegetation types have different fire

behaviours associated with them and unique considerations for fire suppression activities. The wetlands are generally very difficult areas in which to suppress fires because of their high flammability and poor accessibility. This often results in very high rates of fire spread and very low rates of fireline production (the time taken to produce a mineral earth firebreak).

Fire Management

The influence of fire in shaping biodiversity has been clearly demonstrated. However, in addition to using fire to manage biodiversity, the Department must also consider the risk to human life and damage to other values (e.g. property and forest products). It does this in a hierarchical manner—the Department first considers the requirements to achieve biodiversity conservation objectives, and then undertakes a systematic wildfire threat analysis to determine the level of threat posed by wildfire to assets within and adjacent to the parks, such as life, property, community assets and other values. Fire management can then be modified, if necessary, so that the risk or threat of wildfire can be adequately dealt with in addition to achieving biodiversity objectives. Although by default, regimes for biodiversity conservation may achieve wholly or in part, strategic asset protection objectives as well.

Fire planning is guided by 12 scientific principles, which are included as Appendix 9 (Burrows and Friend 1998 and the Fire Ecology Working Group 1999). Departmental policy on fire management has been updated in the Policy Statement (Draft) *Fire Management,* which was made available for comment in February 2004.

Managing fire for biodiversity conservation objectives requires consideration at four scales:

- *bioregional scale* – these are the bioregions defined in Section 11 Biogeography;
- *forest landscape scale* (30 000 to 100 000 hectares) – these consist of landscape scale units which are a mosaic of local ecosystems and landforms repeated in a similar form across a kilometres-wide area. In the south-west these are based on amalgamations of vegetation complexes (see Section 18 Species and Communities of Conservation Significance and Appendix 7) and referred to as Landscape Conservation Units;
- *fire management scale* (500 to 5000 hectares) – a fire management unit is an element within the landscape, and may comprise a sub-catchment or some other logical mapped management boundary; and
- *vegetation complex scale* – these consist of areas within a fire management unit that may be subjected to different burn frequencies or intensities (e.g. uplands versus wetland complexes).

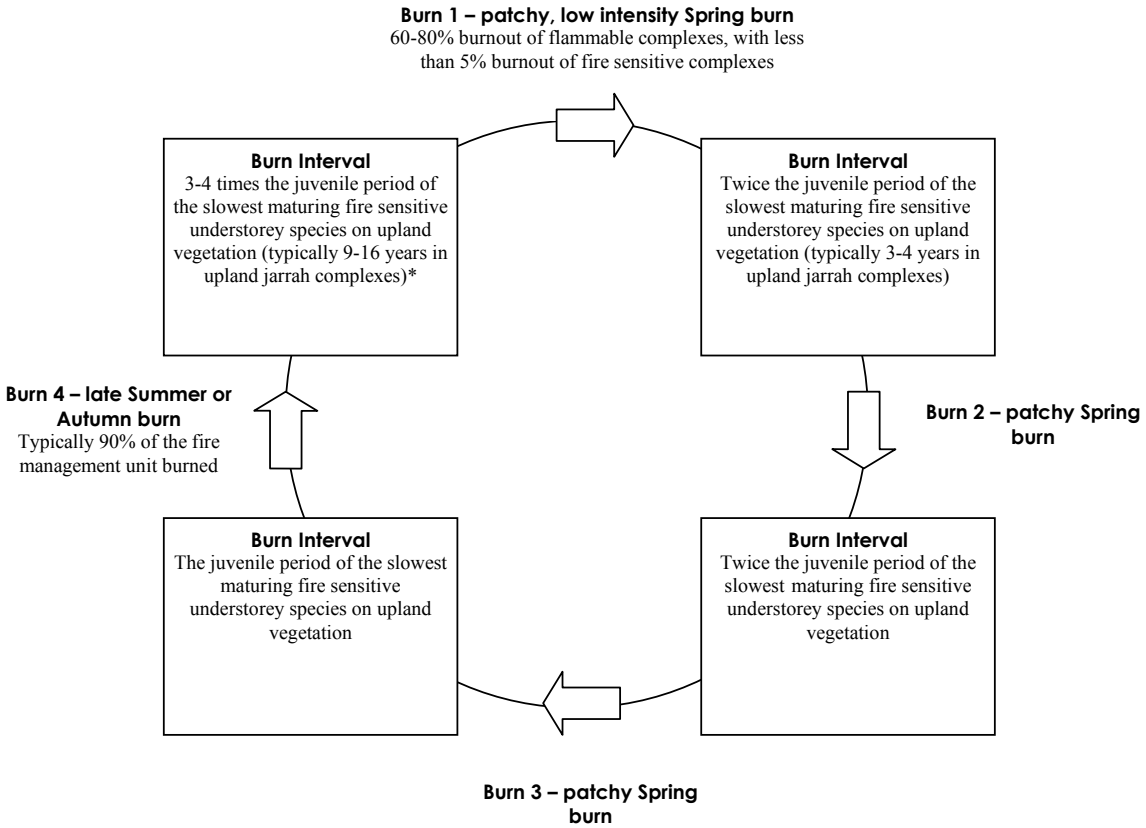
It is the last three levels that are of most interest in this management plan. Havel and Mattiske (2000) identified 26 Landscape Conservation Units in the south-west, based on amalgamations according to their burning characteristics of the 315 vegetation complexes (see Section 16 Native Plants and Plant Communities). Within these Landscape Conservation Units, the concept is to provide a mosaic of different burn histories. The parks incorporate parts of eight Landscape Conservation Units (however, the parks only include very minor portions of three of these) (Map 8 Fire Landscape Conservation Units).

The concept for fire management on Departmental lands is to provide a spatial and temporal diversity of burnt and unburnt areas by varying the season of burn, frequency and intensity of fire based on vital attributes and life histories of fire sensitive taxa and vegetation communities (See Section 22 Fire – Fire Ecology). The Department is currently applying this concept to four pilot study sites across the south-west; the Walpole Wilderness Area, 'Monadnocks and Eastern Wandoo', 'Blackwood Plateau' and the Perup. The studies involve the collection and organisation of data on fire history, the fire regime requirements of the biota, and the strategic asset protection requirements. This information is then manipulated utilising computer modelling tools to assist in analysing the implications of different fire regimes at the Landscape Conservation Unit scale and at the local or fire management unit scale. Subject to the outcomes of this study, the concept outlined above will be applied to the parks and in the broader forest context.

In the interim, the Department will continue to focus its attention on the maintenance and protection of life and property, fire sensitive communities, fire sensitive species, and recreation assets.

Burning may also be planned to deliver specific research outcomes to guide future management. Particular regimes may be implemented under controlled research protocols or under an adaptive management approach. These experiments may define areas as Scientific Reference Areas' of up to 500 hectares. These areas will be reserved from prescribed fire and protected from wildfire, and will provide long unburnt reference points for variables used to measure the impacts of a particular fire regime.

With each Landscape Conservation Unit, an ecological fire regime is devised that accommodates the most fire prone (least sensitive) vegetation complex and protects the most fire sensitive areas. This will typically require consideration of two habitat types—the fire prone habitats such as upland areas and the fire sensitive habitats such as wetlands, granite outcrops and valley floors. A typical fire regime for a Landscape Conservation Unit incorporating the two habitat types is shown in Figure 8. This may vary depending on the fire response of flora and fauna species of the parks. Where there is the need to protect human life and property or high value assets this regime may be modified.



* The fire-free period needs to cater for (a) the juvenile period of the slowest maturing species in the block, (b) the reproductive life cycle of the shortest lived fire sensitive flora species and (c) habitat requirements of fire sensitive fauna.

(adapted from Burrows and Friend 1998, and N Burrows pers. comm. 2002)

FIGURE 8. Conceptual Ecological Fire Regime Incorporating Within-Burn Patchiness and Diversity of Season and Interval

The parks contain numerous populations of rare and priority species. Burning is considered to be 'taking' under the Wildlife Conservation Act and Ministerial approval must first be obtained before known areas containing rare flora can be burnt. To ensure that any special requirements of these species can be considered in fire management, reference is made to rare and priority flora databases maintained in Departmental work centres and the Department's Wildlife Branch is notified of any burn proposals.

Implementing this fire regime whilst protecting other sensitive vegetation complexes and habitats from frequent fire will require the use of the existing track network but also seasonal weather conditions, natural fire barriers and landscape variation in fuel moisture levels. For example, fuel moisture differentials will be used to attempt to prevent fire from burning into wetland areas. However, care has to be taken as material can smoulder and start fires months afterwards. Roads and tracks will be maintained according to the Department standards to ensure safe access for the fire fighting vehicles and permit effective fire containment. In many of these areas, internal tracks are used for management purposes only and should be closed to the public at all times with physical barriers in years between burns.

Road, firebreak and fireline construction and maintenance using infested machinery can lead to the introduction or spread of *P. cinnamomi* (see Section 21 Diseases). Earthworks can accelerate erosion and alter the hydrology of an area by impeding drainage, resulting in the intensification of disease expression in some vegetation and landform types. Consequently, fire management activities must be planned and undertaken with strict erosion control and *P. cinnamomi* management measures in place. Inappropriate earthworks may cause more damage in the long term compared to a large fire. It may be appropriate to identify areas where management of fire will not include heavy machinery. Where temporary roads, firebreaks or firelines are constructed during fire suppression activities, these areas should be rehabilitated as soon as practicable (see Section 37 Rehabilitation).

In order to complement fire management within the parks, the Department will seek the co-operation of adjoining land managers to ensure complementary fire management on adjacent lands. In addition, other agencies controlling land adjoining the parks, such as the Department of Main Roads, Department of Land Administration, Department of Environment, Water and Rivers Commission, the shires of Nannup and Manjimup, as well as Fire and Emergency Services Authority of Western Australia, need to be considered in fire management. Ongoing liaison will occur with these agencies in regard to fire protection and prevention.

Based on all available information, the Department will, through the Master Burn Plan planning process, prepare a 3-year indicative fire program, which will incorporate both conservation and protection objectives, and be reviewed on an annual basis. This will also include the preparation of prescribed burning plans and the completion of a pre-burn checklist that considers all potential environmental impacts, especially the need to control diseases, and minimise impacts on landscape and visual resources. All burns carried out in the parks by external agencies, such as local brigades, will be carried out according to the prepared strategies of the Department.

In the future, fire management carried out by the Department may benefit from advances in technology or from new knowledge gained through research, monitoring and experience. During the life of the management plan, fire regimes may be reviewed to incorporate any of these new findings. Fire regimes may also need to be reviewed to incorporate changes that may arise due to unforseen events, such as wildfires.

Although the specific details of the Department's fire management activities for the parks are not included in this management plan, the Master Burn Plan is made available for public comment annually. The consultation process usually involves the District and Regional Fire Co-ordinators meeting with interested community groups and local authorities to discuss the proposed Master Burn Plan. The Conservation Commission will be forwarded the proposed Master Burn Plan for their input and through their audit function, they will periodically

examine the Department's completion of the Master Burn Plan. A copy of the fire program is also available at each Department District office.

Key Points

- Early settlers regularly burnt coastal areas of the D'Entrecasteaux National Park to mimic traditional burning methods. This type of fire regime led to a canopy of mature trees over a grassy understorey. The decline of the burning regime from the 1930s that perpetuated this type of vegetation onwards has led to a far more sclerophyllous understorey.
- Fire sensitive species and vegetation complexes are most typical in wetland and riverine communities, and granite outcrops.
- Most wildfires in the parks are due to human activities and education of the public will be invaluable in protecting the parks.
- The Department is developing a fire management system based on the response of flora and fauna to particular fire regimes. At the time of writing, the fire response database contains information on 1500 plant species and 52 animal habitats. The system maintains biodiversity by varying season, intensity and placement of burn throughout the landscape, and accounts for wildfires in the burn regime.

The objective is to maintain conservation values while protecting people, property and recreation assets in and near the parks.

This will be achieved by:

1. Implementing fire management for the parks according to the Regional Master Burn Plan which will integrate fire management in the parks with that of the surrounding lands based on knowledge of the fire response of flora, fauna and landforms to particular fire regimes.
2. Providing opportunity for the public to have input into the Master Burn Plan process annually, or as appropriate.
3. Continuing to focus on the protection of life and property, fire sensitive communities, fire sensitive species, and recreation assets.
4. Ensuring that any new construction of roads, firebreaks or firelines are carried out under strict hygiene and avoid significant environmental impact.
5. Continuing to liaise with local authorities and the local Bush Fire Brigades to ensure community protection from fire is at an appropriate level.
6. Restricting visitor entry to the parks when appropriate on days of 'Extreme' fire danger or where predicted fire activity may threaten park users in particular areas.
7. Actively promoting public education and awareness on:
   - the contribution of fire to the maintenance of biodiversity;
   - the damaging effects of inappropriate fire on park values;
   - fire risk; and
   - safety and survival to people and property.
8. Facilitating and participating in ecological research on fire ecology, biological indicators and habitat requirements of fauna and vegetation communities before implementing major changes in fire regime in the parks.
9. Incorporating new technology and/or knowledge, in particular knowledge of negative impacts of fire regimes on biodiversity values into the fire regimes within the parks.
10. Ensuring that an analysis of wildfire potential is incorporated into all risk analyses for work proposed in the parks, and that appropriate risk mitigation work is undertaken during developments.
11. Liasing with the Department of Environment and the Department of Agriculture in the mapping of organic rich as well as potential acid sulfate soils within the parks.

Key Performance Indicators 22.1 to 22.4 apply (Appendix 2)

PART D. MANAGING OUR CULTURAL HERITAGE

In Western Australia, the Aboriginal Heritage Act protects places and objects customarily used by, or traditional to, the original inhabitants of Australia. A register of such places and objects is maintained under the Aboriginal Heritage Act; however, the Act also provides protection for sites whether they have been entered on the register or not. Under the Act it is an offence for anyone to in any way alter an Aboriginal site or object without the relevant Minister's permission.

National heritage is one of seven matters of national environmental significance specifically protected by the Environment Protection and Biodiversity Conservation Act. Under the *Environment and Heritage Legislation Amendment Act (No. 1) 2003*, a National Heritage List will record the natural, Indigenous and historic places with outstanding national heritage. Actions that are likely to have an impact on the National Heritage values of a National Heritage place require approval from the Australian Minister of the Environment and Heritage.

The Australian Heritage Council maintains the Register of the National Estate under the *Australian Heritage Council Act 2003* as a record of important natural, cultural and Indigenous heritage places. The Register of the National Estate has no legal effect on private, local or State government property owners.

23. INDIGENOUS HERITAGE

There are 21 registered sites on the permanent register under the Aboriginal Heritage Act and 11 on the interim register (March 2004) within the parks. These sites include numerous artefact sites, two fish trap sites, two quarry sites, one burial site and one mythological site. The majority of sites occur in the Lake Jasper, Doggerup Creek and Meerup Dunes areas with a few sites also at Black Head/Malimup, Broke Inlet, Windy Harbour, Warren Beach, Long Point, Donnelly River and Fish Creek. A report prepared by Kelly *et al.* (1999) makes recommendations for the management of some of the most important known Aboriginal sites in the parks. Some work has been undertaken to protect these sites, although in places further work is still required. Artefacts continue to be uncovered as a result of erosion, road building and vegetation disturbance.

As the register is not a comprehensive listing of all sites, assessments will be necessary prior to any operations where there is potential to inadvertently damage sites. Appropriate approvals under the Aboriginal Heritage Act are required to proceed with any works that may affect Indigenous heritage values.

Currently, there are no sites on the National Heritage List or the Register of the National Estate for Indigenous culture within the parks.

Aboriginal Use and Occupation

There is evidence that Aboriginal people have occupied the southern coastal areas of Western Australia for at least 6000 years. There are thought to be at least 13 different Aboriginal groups in the south-west, collectively known as Noongars. The word Noongar, or its linguistic equivalent, is identifiable as the word for an Aboriginal person from this region although they may have different vocabularies. The traditional groups closest to the parks are from the Murram (murrum) group (Crawford and Crawford 2003).

The south-west of Western Australia was the first region of the state affected by European settlement. Within about 50 years of the founding of the Swan River Colony in 1829, the local traditional lifestyle had all but disappeared as the region was cleared and transformed into an agricultural-based economy especially along the coast and in the Wheatbelt.

What is known about the Aboriginal use and occupation of the parks has been pieced together from historical records, the discovery of many Aboriginal sites, and from oral histories. The parks, in particular D'Entrecasteaux National Park, were an ideal place to live as they were fertile, ecologically diverse and with little limitation of food or fresh water (Kelly *et al.* 1999).

Lake Jasper is of particular archaeological and cultural significance to Aboriginal people. Numerous Aboriginal stone artefacts occur on the lakebed amongst numerous tree and grasstree stumps up to 10 metres below current surface levels. This indicates the presence of a number of major campsites, quarry/factory sites and 'chipping floor' sites within a prehistoric forest landscape (Dortch 1990, 1995 and 1996, WA Planning Commission 1997). Several of these sites occur at the edge of Lake Jasper which are vulnerable to disturbance and change in water levels. Appropriate management of recreational use of the lake is required to protect these sites (see Section 27 Recreational Use – Active Recreational Use – Boating).

Key Points

- Archaeological and ethnographic sites have been recorded at many places throughout the parks.
- Some sites are threatened by current visitor use, especially at the edge of Lake Jasper.

The objective is to protect and conserve the Aboriginal cultural heritage and cultural resources within the parks.

This will be achieved by:

1. Complying with provisions of the Aboriginal Heritage Act prior to commencing any potentially damaging operations, and ensuring that actions are implemented as necessary to prevent damage to culturally significant places and objects within the parks.
2. On an ongoing basis, consulting with Aboriginal people, the State Aboriginal Site Register and the Register of the National Estate for sites of Aboriginal Heritage significance, and ensuring that actions are implemented as necessary to prevent damage to culturally significant places and objects within the parks.
3. Developing a communication plan to increase Aboriginal cultural heritage awareness for park visitors.
4. Developing a cultural heritage site management plan to protect and maintain known sites.
5. Identifying where possible, areas for Aboriginal cultural and ceremonial purposes based on traditional occupation and use.

Key Performance Indicators 23.1 and 23.2 apply (Appendix 2)

24. NON-INDIGENOUS HERITAGE

The Dutch were exploring the south coast of Western Australia as early as 1627. In 1791 Captain George Vancouver, in command of the sloop HM Discovery and armed tender Chatham, left Falmouth, England to survey the southern coast of New Holland on his way to America. It was the first hydrographic survey of the southern coast of Australia. Vancouver's survey began at Chatham Island (Map 1 Management Planning Area) on

27 September 1791 and during the following 19 days charted over 400 kilometres of coastline, which included the discovery of King George Sound. Vancouver and his expedition took possession for Britain of the land seen "North West of Cape Chatham or far as we might explore its coasts" (Royal West Australian Historical Society 1995).

In 1792, just a year after Vancouver, Admiral Bruny D'Entrecasteaux led the largest scientific expedition in the 18th Century sent to explore Australia. D'Entrecasteaux's party consisted of two research ships; the Recherche and the Esperance, and 16 scientists from the French Society of Natural History. They began their survey of the southern coast between Silver Mount and the Donnelly River on 5 December 1792. Point D'Entrecasteaux was named after the admiral as they passed, however D'Entrecasteaux and his party were largely unimpressed with the land they sighted from their ships (Royal West Australian Historical Society 1995).

Little interest was shown in the area over the next 40 years other than by the sealers and whalers that were operating along the coast just prior to and after settlement in Albany in 1826. Many were ex-convicts who had served their time in Van Dieman's Land (Fernie and Fernie 1989).

In 1831 Lieutenant William Preston made a trip in a whaleboat from near Peaceful Bay, around Point D'Entrecasteaux finally ditching in heavy seas "six miles north west of Point D'Entrecasteaux" (probably either on Doggerup or Malimup Beach). Preston and his men all survived a hike from this point to Augusta and then on to 'Murray River' describing the coastline of what is now D'Entrecasteaux National Park (Cross 1833).

Later, in 1841, the adventurous William Nairne Clark (Fernie and Fernie 1989) also explored the area. On his first trip Nairne Clarke sailed as far west as Chatham Island and walked to Broke Inlet principally to report on the suitability of the land for grazing and farming. On his second visit to the area, also in 1841, Nairne Clark travelled as far as Point D'Entrecasteaux and spent nearly 2 weeks camped on Sandy Island. From here, in the company of two of his men, Nairne Clark set out on foot to explore the country between Point D'Entrecasteaux and Nornalup. He describes the beginning of his journey:

> *"We walked about 7 miles straight into the interior from the beach to the hills about Point D'Entrecasteaux and far inland abound in rich sheep pasture, and as we traversed the plains, we everywhere found them of great extent, abounding in fine cattle feed, plentifully watered".*

In the 1850s farmers began settling in the Pemberton, Manjimup and surrounding areas. Edward Reverly Brockman settled on the Warren River and built Warren House. He bred horses which he shipped to India and also raised sheep. Settlers in the area found that the land on the coast provided much needed summer grazing for their stock and many families began droving their cattle to the coast each summer.

The Muirs, Scotts, Gibletts, Youngs, Wheatleys, Moirs, Blechendens, Dousts, Mottrams and others took out leases and purchased land along the coast from the 1880s in what is now D'Entrecasteaux National Park with grazing continuing in some areas up until the 1980s. The cattle could not be kept on the coast for too long or they began to suffer 'coasty', a trace element deficiency. They usually spent about four or five months on the coast beginning between Christmas and New Year and returning inland in late May or early June before calving (Heritage and Conservation Professionals 2000). Their droving routes took them through the parks, with some stock routes later becoming formalised into vehicle tracks (e.g. Deeside Coast Road).

As the cattlemen sometimes spent long periods on the coast, they built huts to provide shelter. Some of these early huts, such as Bolghinup Hut and Coodamurrup Hut, remain. Stockyards and later loading ramps were also constructed. As many of the historical structures are made from perishable materials, active measures are needed to preserve them. One grazing lease

still remains in the area (Quannup) although this is not currently stocked. Other grazing leases have progressively been bought and incorporated into the parks (see Section 3 Management Plan Area).

Between 1901 and 1903 there were reports of oil prospectivity along the coast between the Donnelly and Warren rivers. Although there was disagreement about the likelihood of finding oil, several test bores were sunk, near the mouth of the Warren River and on the Fly Brook. One bore reached a depth of 500 metres. An interested spectator in these drilling operations was Colonel 'Biltong' Vialles who stayed on to raise cattle after the failed oil exploration. His property on the lower Warren River is still known today as 'The Colonels'.

On 29 May 1911, the 900 ton iron barque *Mandalay* sailing from Delagoa Bay, Mozambique to Albany was driven on shore by prolonged south-west gales. The wreck can sometimes be seen from Mandalay Beach when tides and sand shift to uncover the steel structure. A second ship, the *Michael J Goulandris*, was wrecked 22 kilometres south-west of Windy Harbour on 21 December 1944. Two thousand tonnes of rations bound for Perth floated into shore between Salmon Beach and Fish Creek. Many of the locals took advantage of the situation by hauling loads of the cargo by hand, by cart or using horses. Then, in order to hide their bounty from the authorities, they buried what they had salvaged in their gardens.

Timber milling came to the area in 1912 and in the 1920s land settlement schemes opened up more land for farming. About 15% of the Shannon National Park has been logged over the past century with most of the timber going to the Shannon Mill which operated between 1950 and 1970. During the life of the mill, the residents of the Shannon townsite used the parks extensively for recreation. Hunting, marroning and fishing were popular pastimes and near the townsite a golf course and cricket oval were constructed. A small amount of the D'Entrecasteaux National Park has also been logged mostly for Warren River cedar (*Taxandria juniperina*) which was used in boat building.

From the days of the early cattlemen, the park was used for recreation, particularly fishing on the coast and in the inlets. More huts were constructed throughout the park, mostly as weekenders and fishing shacks (see Section 27 Recreational Use – Overnight Stays – Squatters' Huts). Huts continued to be built in the parks until the late 1970s and early 1980s. Forty-three were constructed at the mouth of the Donnelly River, the first being built in the 1920s. As the area is not accessible by road, all materials used in the construction of the huts were brought in by boat.

While there are a number of non-Indigenous cultural heritage places on the local authorities' municipal inventories within the parks, there are no sites registered on the National Heritage List, the Register of the National Estate or the Western Australian Register of Heritage Places.

Key Points

- European involvement within the parks mostly started in the late 1800s with droving of cattle to the coast for grazing.
- Stockmen huts, bridges and stockyards are significant European structures in the parks.
- The wreck of the Mandalay is sometimes visible from the coast within the D'Entrecasteaux National Park.

The objective is to protect and conserve the non-Indigenous cultural heritage of the parks.

This will be achieved by:

1. Protecting and maintaining non-Indigenous cultural features of educational or historical significance (see also Section 27 Recreational Use – Overnight Stays –

Squatters' Huts).

2. Protecting non-Indigenous cultural heritage during any new developments or management programs.
3. Restoring where applicable non-Indigenous cultural sites in the parks through liaison with community groups, the WA Museum and the WA National Trust.
4. Collating existing information on historic sites located in the parks and maintaining a current register of sites.
5. Providing information and interpretation to the public in regard to important sites and past non-Indigenous use within the parks.

PART E. MANAGING RECREATION AND TOURISM

It is recognised that the public conservation estate managed by the Department has the capacity to provide a significant portion of the public's growing demand for outdoor recreation and tourism, in particular 'nature-based' tourism, and in doing so contribute significantly to the social, psychological, physical and economic wellbeing of the community (see Section 2 Regional Context). An assessment of the economic value of recreation and tourism in the area between Manjimup and Walpole (incorporating the parks) determined to be approximately $62 million dollars annually, could be attributed to nature-based activities, the natural environment and the attraction of tall forests (Carlsen and Wood 2004). Consequently, the proposals in this management plan and the Department's subsequent management activities are important to the regional economy.

The number of visitors to the State's reserve system has increased markedly over the past decade, from 4.8 million visits in the 1992 to 1993 year to over 10.2 million in 2002 to 2003. The reason for such significant visitor interest is simple: the estate managed by the Department covers an area of more than 24 million hectares of lands and waters protecting unique landscapes, geological formations, plants and animals, and cultural sites. Conserving these lands and waters for future generations, and managing them for recreational use by the present one, is a complex process.

Firstly, public expectations for recreation and tourism within the conservation estate are as diverse as the environments the Department manages. Secondly, whilst the public conservation estate bring many benefits to the community as well as the community to the environment (see Section 42 Working with the Community), the desire to interact with these unique environments can lead to significant impacts on the natural environment. This part of the management plan addresses these issues, at the same time ensuring that visitors are able to gain an appreciation and understanding of the parks' values by providing appropriate nature-based recreation opportunities, which should, in turn, foster an appreciation and understanding of the conservation of these areas.

The Department's re-drafted Policy Statement No. 18 *Recreation, Tourism and Visitor Services* outlines the principles, operational guidelines, procedures and administrative controls in relation to facilitating recreation and tourism on the public conservation estate. This management plan follows the policy guidelines within Policy Statement No. 18 where applicable.

25. RECREATIONAL OPPORTUNITIES

Regional Recreational Context

The parks are within the most visited area of the State outside of the metropolitan area (see Section 2 Regional Context). Recreation opportunities within the South West Planning Region are varied and numerous, although many are nature-based and include four-wheel driving, scenic driving, biking, boating, walking, caving, climbing, sight seeing, camping, fishing, swimming, surfing and picnicking. These opportunities are provided in national parks, State forests, proposed national parks, local authority managed lands, Crown lands and privately owned lands.

The location and size of the parks make them an important resource for recreation and tourism in the South West Planning Region but in particular for the local community. Visitors to the parks include people from the towns of Pemberton, Northcliffe, Manjimup, Nannup and Walpole as well as those who travel from further afield to enjoy the opportunities that the parks offer as part of the experience of the whole region (Map 2 Regional Context).

Whilst some of the opportunities of the parks are also present in other natural areas of the South West Planning Region, what sets the parks apart is their remoteness and undeveloped nature (see Section 4 Key Values). The D'Entrecasteaux National Park contains over 130 kilometres of coastline. This coast is relatively isolated and is an important area for coastal four-wheel driving and remote camping, and consequently provides a different coastal experience than the west coast (e.g. such as that provided by Leeuwin-Naturaliste National Park).

Most recreation opportunities in the parks are nature-based, consistent with the purposes of national parks. However as a large area of the South West Planning Region is conservation or proposed public conservation estate, especially in the area of the parks, opportunities for activities such as horse-riding, dog exercising, sandboarding, climbing, or caving are generally limited.

Recreation activities in D'Entrecasteaux National Park are concentrated on coastal areas and the park's rivers—areas of high scenic value and where a combination of recreation opportunities are available—including Black Point, Donnelly River, Yeagarup Dunes, Warren Beach, Malimup Beach, Salmon Beach, Windy Harbour, Gardner River, Coodamurrup Beach, Fish Creek, Broke Inlet, Banksia Camp and Mandalay Beach. Other recreation areas are focussed on waterbodies and scenic viewpoints such as Lake Jasper, Mt Chudalup, Mt Pingerup and Woolbales.

In the Shannon National Park most recreation and tourism activities are centred on the old Shannon townsite, Shannon River and the Great Forest Trees Drive. There are few other areas promoted or developed for recreation and tourism in Shannon National Park. In terms of recreation in the karri forests of the region, the Valley of the Giants and Walpole-Nornalup National Park as well as the parks around Pemberton such as Gloucester, Warren and Beedelup national parks have a far higher visitation than Shannon National Park.

The Bibbulmun Track runs through the whole region and includes five overnight shelters across both parks.

The promotion of the Walpole Wilderness Area (which includes Shannon National Park) may increase visitation to the parks as the southern part of the region gains a higher profile.

Visitor Numbers and Trends

Until recently, visitation data in the parks has been difficult to collect because of the numerous entry points to D'Entrecasteaux National Park. Traffic counters are now in place at seven points through the parks.

In the 12 months to June 2004, visitation recorded at Ritter Road, Salmon Beach Road and Mandalay Beach Road in D'Entrecasteaux National Park totalled 58 589 visits[6]. Visitation from other entry points such as Black Point Road, Lake Jasper Road and Donnelly Boat Landing is estimated to be approximately 22 800 visits per year. The number of visitors to Shannon Campground within Shannon National Park is estimated to be approximately 5200 visits per year. This is a total of approximately 87 000 visits to the parks in the 2003 to 2004 year. In addition to these figures, estimates of visitors to the Bibbulmun Track within the Donnelly District are 37 000 visits for the 2002 to 2003 year.

Salmon Beach Road/Point D'Entrecasteaux had the highest recorded visitation within the parks in the 2003 to 2004 year which is to be expected as it is two-wheel drive accessible, has a high level of facilities (Windy Harbour townsite and Point D'Entrecasteaux Lookout) and the area is very scenic and attractive to visitors.

[6] A visit is the number of people per day visiting a specific location. The visit figure comprises both recorded numbers of visits from traffic counter devices, surveys and other data sources as well as estimated numbers of visits based on field observation.

For much of the year, the majority of park visitors come on weekends from nearby towns and farms, recreating—especially fishing and four-wheel driving—on the coast. During long weekends and the summer and autumn holidays, there is also a substantial influx of tourists sightseeing, recreational driving, camping and fishing. There are also 126 tour operators (March 2002) licensed to use the parks for a wide range of nature-based activities (see Section 28 Commercial Tourism Operations), however not all licensed operators actually use the parks.

The most recent information on visitors to the parks comes from a 1999 survey of over 200 visitors. The main points of interest from the survey were that:

- 75% were repeat visitors, with more than half having visited the parks five times or more;
- over 80% of park visitors used four-wheel drive vehicles to enter the parks;
- around 55% of visitors to the parks came from country areas of the State (18% from Manjimup, Pemberton, Northcliffe and Walpole) and 37% from the Perth metropolitan area;
- visitors highly valued aspects of the parks such as unspoiled surroundings, sense of remoteness, nature/wilderness, scenic views and four-wheel driving and camping opportunities;
- the main activities undertaken were fishing, camping, four-wheel drive driving, bushwalking, sightseeing and relaxing;
- visitors to the parks rated the enjoyment, satisfaction and pleasure of their visit very highly, indicating a liking for the current level of services and development in the parks; and
- even though most visitors wanted the parks to stay as they were, there were some suggestions for extra services or facilities that they would like provided such as toilets, rubbish bins, drinking water and a general improvement of park facilities.

Although the visitation figures to the parks have fluctuated over the last 10 years, there seems to be an overall increase in visitation to the parks. Visitation is likely to continue to increase with a prediction for nature-based tourism growth of 20% per annum in Western Australia (Commonwealth of Australia and the State of Western Australia 1998).

The challenge for managers is preserving these experiences, the ‘unspoiled surroundings’ and sense of remoteness whilst providing for increased visitation.

Visitor Management Settings

Typically as the use of natural areas such as national parks increases, resource conditions change until the character of the setting has been modified to a point where it no longer has the attributes that originally attracted people to the area. Thus the initial users are displaced by people who are more tolerant of the changed resource conditions, with the process continuing until a uniform high level of services and facilities are provided within the natural area. This is the idea of ‘recreational succession’—the very conditions of an area that attract recreational use are inevitably changed by that use (Prosser 1986).

The provision of visitor services, facilities and experiences in the parks should also consider the range of opportunities available in neighbouring parks and forests across the south-west. The Department aims to provide visitors with a wide range of nature-based experiences on the public conservation estate whilst ensuring that impacts on the environment are managed within acceptable limits.

The Recreation Opportunity Spectrum developed by Clark and Stankey (1979) has been commonly applied as a standard planning tool in natural areas to address this issue. The Department proposes the use of ‘visitor management settings’, derived from the Recreation Opportunity Spectrum principles, to manage for recreational succession in natural areas such as national parks.

Visitor management settings are purely to guide the Department in determining what sort of recreation development may be appropriate within the settings. It is hoped that this system will prevent the natural areas within the parks being subjected to incremental development.

The criteria for the settings are still being finalised by the Department on a State-wide basis and will be included in the final management plan. An early version of the settings and criteria are included in Appendix 10 and can be used for public comment on the direction the Department is taking in providing a range of recreation opportunities across these parks. Proposed visitor management settings have been used throughout this management plan (see tables 7, 8, 9, 10 and 11).

Wilderness

There is a growing awareness from within the community and the scientific world that wilderness areas support values that should be protected from the impacts of modern technological society. These values include:

- maintenance of the integrity of ecological processes, with wilderness areas including the most natural land remaining;
- protection of biodiversity;
- maintaining opportunities for solitude, inspiration and self-reliant recreation;
- providing an insight into the past and a baseline for management in the future; and
- representing a vast store of knowledge, ideas and genetic resources yet to be discovered from which human society will continue to benefit. The protection of the biodiversity of wilderness areas helps maintain the widest range of options for the future.

The International Union for Conservation of Nature and Natural Resources, now known as the World Conservation Union, defines wilderness as a:

> *"…large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition".*

This management planning process will determine which areas, if any, are appropriate to be designated as a 'wilderness area' within the parks and gazetted under section 62(1)(a) of the Conservation and Land Management Act. The Conservation Commission and the Department are seeking public input into the possible creation of wilderness areas within the parks through the management planning process.

The Australian Heritage Commission has compiled and maintains the National Wilderness Inventory (NWI), which is designed to identify wilderness quality across Australia. The NWI uses a quality index rating of 0 to 20, with 20 being the highest quality.

The NWI data for the parks (Map 9 Wilderness Quality) has been based on the following criteria—however, it does not take into account the proposed Vehicle Access Strategy in this management plan (Appendix 11) and that beach four-wheel drive access is available on some of the beaches:

- remoteness from settlement – how remote a site is from permanent human occupation;
- remoteness from access – how remote a site is from established access routes;
- apparent naturalness – the degree to which a site is free from permanent structures associated with modern technological society; and
- biophysical naturalness – the degree to which a site is free from biophysical disturbances caused by the influence of modern technological society.

The Department's Policy Statement No. 62 *Identification and Management of Wilderness and Surrounding Areas* provides for areas that have a NWI wilderness quality index of at least 12, and a minimum size of 8 000 hectares to be identified as candidate areas for wilderness

during the management planning process. Four 'candidate wilderness' areas in the parks have been identified (Map 9 Wilderness Quality) within the following forest blocks:

- Chesapeake and Pingerup blocks (north of Broke Inlet);
- Chudalup block (east of Windy Harbour Road);
- Malimup and Callcup blocks (centred on Meerup River); and
- Yeagarup block (part of the Yeagarup Dune system).

Whilst four candidate areas have been identified, subsequent to public submissions to the draft management plan, the final management plan will determine which, if any of these should be gazetted.

To guide assessment of whether wilderness should be gazetted within the parks, the main points from Policy Statement No. 62 that will influence management of any gazetted wilderness areas within the parks are:

- wherever possible, ground disturbing activities for fire management will be conducted outside of wilderness areas—this includes construction and maintenance of access roads, firebreaks, fuel-reduced buffers, and water points;
- prescribed burning within wilderness areas may be carried out for the protection and maintenance of biological values and processes as determined through the preparation of area and regional management plans, and interim management guidelines;
- appropriate fire protection strategies according to established standards will be implemented around wilderness areas where life, property and natural resource values may be threatened;
- management of wilderness areas and its surrounds will be consistent with the principles in the Malimup Communiqué[7];
- use of mechanised transport is not permitted within wilderness areas, except for emergency or essential management operations, or reasons of cultural importance;
- the landing of motorised and non-motorised aircraft within wilderness areas will not be permitted, with the exception of non-fixed wing aircraft access for rescue and essential research and management operations;
- constructed walk trails, signs, track markers and toilets will not be provided in wilderness areas;
- any existing vehicle tracks and constructed walk trails within wilderness areas that are not required for emergency and essential management purposes will be closed;
- any existing incompatible recreation and tourism uses and/or structures within wilderness areas will be removed and rehabilitated;
- education and/or recreation expeditions will be permitted within wilderness providing they are consistent with the maintenance of the qualities of the area;
- commercial recreation and tourism is not permitted within wilderness areas; and
- the taking of forest produce will not be permitted within wilderness areas.

Policy Statement No. 62 sets out the general guidelines for management of any gazetted wilderness areas and surrounding buffer areas with regards to managing the values and threats to wilderness values of the areas. Any gazetted wilderness areas within the parks will correspond with the most remote of the visitor management settings and be consistent with the finalised policy on wilderness. Candidate wilderness areas that are not gazetted will be managed according to the visitor management settings assigned in the final management plan.

Whilst public input is welcomed on the gazetting of specific areas of wilderness within the parks, any comments on the principles of gazetting wilderness areas within the State and general management thereof is outside this management planning process—a separate process was undertaken to gain public input into the Department's Policy Statement No. 62.

[7] The Malimup Communiqué was developed between Aboriginal communities, government authorities and non-government environmental groups in May 1998 at Malimup Springs in Western Australia. It is concerned with Aboriginal people and the management of areas reserved/zoned as wilderness, primarily within national parks, or other lands reserved for conservation or recreational purposes.

Key Points

- Overall visitation to the parks is increasing, with visitors valuing the unspoilt surroundings, sense of remoteness, nature/wilderness, views and the four-wheel driving and camping opportunities provided by the parks.
- The paradox for managers of natural areas is in preserving the unspoilt surroundings and sense of remoteness whilst visitation continues to grow.
- Recreational succession can be avoided by assigning areas to different visitor management settings for the life of the plan.
- The provision of recreation experiences, facilities and services in the parks considers the range of opportunities available in neighbouring parks and forests across the region.
- The Department is seeking to designate wilderness areas across the State to protect the natural, recreational and scientific values of these areas.

The objective is to provide visitors with a range of sustainable nature-based experiences to facilitate their understanding of the natural values of the area.

This will be achieved by:

1. Ensuring future recreational development is guided by the visitor management settings.
2. Formally protecting wilderness values within the parks by gazetting 'wilderness areas' under section 62 of the Conservation and Land Management Act.

Key Performance Indicators 25.1 and 25.2 apply (Appendix 2)

26. VISITOR ACCESS

Lands and waters managed by the Department are generally open to public recreational use. However, there are some areas where public access is restricted for reasons of safety, cultural sensitivity, disease control, protection of conservation values, preservation of a particular recreational experience and/or maintenance of roads and tracks.

Types of Access

The following types of access are available to gain access to and through the parks (Map 10 Public Access – Vehicle and Boat and Map 11 Public Access – Walk Trails).

Motor Vehicles

Most visitors to the parks arrive by car. The standard of vehicle access within the parks varies from roads accessible by two-wheel drive vehicles to tracks accessible by four-wheel drive vehicles only for part of the year.

Motorbikes and Bicycles

Motorbikes and bicycles share the same roads as motor vehicles with motorbikes requiring licensing to gain access to the parks. Mountain bike off-road access is proposed to be provided by the long distance Munda Biddi trail through Shannon National Park (see Section 27 Recreational Use – Active Recreation Use – Cycling).

Boat

Other access to the parks is provided from the coast and along the waterways. For example the mouth of the Donnelly River and mouth of Broke Inlet can be reached by boat throughout the year, the Warren River provides access by canoe to parts of the park which are otherwise inaccessible and boats can approach if not land at all of the beaches in D'Entrecasteaux National Park.

Walking
Limited walking trails are provided within and to the parks. The Bibbulmun Track, which begins near Perth and travels through parts of both parks, provides access by foot and is the most developed and promoted of the walking trails.

Horse-riding
Early settlers created their own access to the parks when riding to the coast with their cattle for grazing. Outside the parks these stock routes are generally now two-wheel drive routes. Inside the parks, these tracks have mostly now reverted to natural vegetation or have been used for another purpose such as four-wheel driving or walking. Some horse-riding tracks are used by a commercial operator to gain access to areas around Fish Creek and some tracks have been used by private horse-riders around Jasper Beach Road and Deeside Coast Road (see Section 27 Recreational Use – Active Recreational Use and Section 28 Commercial Tourism Operations).

Access Demand
Demand for vehicle access by visitors within the parks is either:

- destination-based, for example in order to fish, go marroning or to camp; or
- as an activity in its own right, such as four-wheel driving or scenic driving.

Destination-based access has traditionally predominated in the parks. However the surge in popularity of four-wheel drive ownership has increased the demand for driving as an activity, especially within the D'Entrecasteaux National Park.

In 2002 there were 180 103 new four-wheel drives sold in Australia, an increase of 31% over the last 5 years (Federal Chamber of Automotive Industry figures). The WA 4WD Association states that there are almost 200 000 four-wheel drives registered in Western Australia alone.

Four-wheel drive ownership in Western Australia is forecast to continue to increase over the life of this management plan. This means that experiences that challenge the driver and/or vehicle such as crossing the Yeagarup Dunes, climbing Calcup Hill or crossing one of the many rivers will continue to be demanded by visitors. For example, 39 vehicles were recorded on Yeagarup Beach over Easter 1987 whereas in 1999 there were over 200.

This demand inevitably leads to conflict between vehicles and the maintenance of environmental values, other vehicles and opportunities for other users (walkers), and can compromise public safety and the Department's duty of care. Illegal use of off-road vehicles occurs throughout the parks, particularly in the Yeagarup Dunes and on beaches in the park. An increased level of access within the parks has also led to demands on park facilities. Day use facilities and informal camping areas that were once adequate are now becoming significantly degraded and unable to sustain current visitation levels.

Fully satisfying the demand for access within the parks could compromise the qualities of remoteness that are highly valued by visitors and the community (see Section 25 Recreational Opportunities – Visitor Management Settings). The type of access provided affects the level and type of use of an area. Therefore, access needs to be carefully managed in consultation with visitors to the parks and according to the proposed visitor management settings. This will ensure that visitors will continue to have access to a wide variety of experiences within the parks.

Roads and tracks proposed to remain open to park visitors are shown in Map 10 Public Access – Vehicle and Boat, Map 11 Public Access – Walk Trails, and Appendix 11. The wide variety of access that has been planned for the parks ranges from walking tracks to sealed roads suitable for two-wheel drive vehicle access. The activities associated with the different types of access are detailed in Section 27 Recreational Use.

Two-Wheel Drive Vehicle Access

Most of the Shannon National Park was once State forest and a number of logging and fire management tracks have been constructed throughout the park, especially in its northern half. Although, many of these tracks are now overgrown or closed, Preston and Nelson roads as well as various smaller roads, remain. The usage of Nelson Road has significantly reduced due to the moratorium on logging of old growth forests and proposed creation of new parks within the adjacent State forest. However as areas of State forest still exist east of Shannon National Park between Nelson Road and the South West Highway, Preston Road is still used in conjunction with other smaller roads within and adjacent to the park. A review of the various smaller tracks is recommended to alleviate noise, dust and visual impacts on the park values.

Access in Shannon National Park for visitors will be provided along a few well-maintained gravel roads suitable for two-wheel drive vehicles including Deeside Coast Road, Curtin Road, Creekbend Road, Strachan Road, Upper Shannon Road and Lower Shannon Road which, with part of the sealed Middleton Road, form the Great Forest Trees Drive. Other two-wheel drive roads include Bevan Road, Dog Road, and Jeffery Road (Map 10 Public Access – Vehicle and Boat).

Mandalay Beach Road, D'Entrecasteaux Drive and Salmon Beach Road provide two-wheel drive all-year access to the coast. Other two-wheel drive roads within the parks are Broke Inlet Road, parts of Chesapeake Road, part of Summertime Track, Lewis Road, Donnelly Boat Landing Road, and Jangardup Road (Map 10 Public Access – Vehicle and Boat). Some parts of both parks are accessible from sealed main roads or highways that run through or alongside the parks such as the South West Highway and Windy Harbour Road. This road network provides two-wheel drive vehicle access to the diversity of natural features within the parks.

Improving access by upgrading from four-wheel drive to two-wheel drive increases visitation. This places additional pressure on end-point facilities and the natural environment, and consequently changes the visitor experience. It could also duplicate the recreational experiences of adjacent parks and those elsewhere in the State. For these reasons, providing additional two-wheel drive access within the parks is not proposed in this management plan.

Proposed road developments for State and local authority roads in the south-west are detailed in Main Roads WA (1997). There are three proposals—deemed low priority—that are adjacent to the parks. To improve traffic flow and safety conditions, South West Highway (a State road) is proposed to be widened to a Type 5 sealed road (7 metre seal width) and provide overtaking lanes. Middleton Road (a local authority road between Northcliffe and the South West Highway) is proposed to be widened (currently less than 6 metres wide) and upgraded to a Type 5 sealed road to ensure adequate capacity and road safety.

Windy Harbour Road (also a local authority road and approximately 5.3 metres wide) is proposed to be upgraded to a Type 4 sealed road (6 metre seal width) to facilitate and encourage further tourism in the area, and to ensure adequate capacity and road safety.

When implementing road developments, Main Roads WA and the local authorities are required to undertake the necessary environmental impact assessments according to the Environmental Protection Act, the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and the Wildlife Conservation Act.

Four-Wheel Drive Vehicle Access

In the past the cattlemen used to access most of the coastal areas throughout the park by horse; today access is gained to the coast usually by four-wheel drive vehicles. The increase of four-wheel drive use of D'Entrecasteaux National Park has placed significant pressure on the conservation values of the park. What once was irregular and mainly seasonal four-wheel

drive access by locals has increased to year-round use by many sectors of the community with hundreds of four-wheel drives in the park during peak periods.

Much of the coastline in the D'Entrecasteaux National Park is sensitive to erosion, with several large mobile dune-fields interspersed by areas of consolidated wind-blown sand. Many of the vehicle tracks in the park traverse sensitive landforms that may be seasonally inundated or easily eroded (see Section 15 Soil and Catchment Protection). *Phytophthora* in the park is also extensive with vehicles being a major factor in its spread (see Section 21 Diseases). Some of the beaches are habitats for breeding birds such as fairy terns (*Sterna nerveis*) and hooded plovers (priority 4 – see Section 18 Species and Communities of Conservation Significance) and vehicle use on these beaches can damage nests during the breeding season.

Continuing to educate users on the appropriate techniques for four-wheel driving in the parks (e.g. reducing tyre pressure in sensitive landforms such as sand dunes) could aid in reducing the impacts of four-wheel driving. However, in some cases such as for disease or erosion control, habitat protection or to maintain visitor experience, access may need to be managed by either track reinforcement, realignment, closure (permanent or seasonal) or by use of a permit system (Map 10 Public Access – Vehicle and Boat and Appendix 11).

Management Access

Management access tracks are closed to public vehicle use although walkers may use them. These roads and tracks are predominantly needed for fire management. However, they may also be used for flora and fauna monitoring, baiting and trapping feral animals, water monitoring, access for maintenance, and for weed control.

Some management access tracks were at one time open for public use. Whenever public vehicle access to a track is removed, there may be resistance. Vandalism to gates at newly closed tracks is common in D'Entrecasteaux National Park as is the formation of new tracks to get round barriers.

In contrast, Shannon National Park has few four-wheel drive tracks open for public use. Controlling access within the Shannon National Park is much easier as the density of the surrounding forest prevents vehicles from leaving public roads and tracks.

Key Points

- Visitors to the parks seek 'destination-based' access as well as opportunities for four-wheel driving and scenic driving as specific activities.
- Access needs to be carefully managed so it does not compromise the qualities of remoteness and wilderness valued by visitors.
- Two-wheel drive vehicle access to the coast is catered for in the parks and adjacent areas.
- Two-wheel drive roads already provide access to most types of significant natural features in the parks.
- The timber industry has developed a network of log-haulage roads through the Shannon National Park with Preston Road and Arthur Road currently still being used for log-haulage.
- Four-wheel drive use in the D'Entrecasteaux National Park has increased and is forecast to continue to increase due to the popularity of four-wheel drive ownership.
- Some of the current four-wheel drive access tracks traverse sensitive landforms and require repair, realignment or closure.
- Vehicles are contributing to the spread of *Phytophthora* through the parks.
- Track closure sometimes results in vandalism and further environmental damage in D'Entrecasteaux National Park.

The objective is to provide and maintain a range of access types that do not adversely impact on conservation or other values of the parks and facilitate

the visitor's appreciation of the parks' natural values.

This will be achieved by:

1. Maintaining, upgrading, realigning, rehabilitating or closing roads and tracks as indicated in the Vehicle Access Strategy (Appendix 11).
2. In addition to those identified in the Vehicle Access Strategy, in consultation with the Conservation Commission, realigning or removing and rehabilitating tracks if in the future there is an adverse impact on fragile areas or they are deemed not required.
3. Closing access to sites with significant safety and/or environmental issues.
4. Continuing to prohibit vehicles driving off established roads and tracks except by authorised persons in exceptional circumstances.
5. Ensuring management access tracks are effectively closed to the public.
6. Providing information to visitors explaining why they cannot access certain areas, alternative routes, and where similar experiences may be provided.
7. Negotiating to cancel unnecessary road reserves within the parks and adding these to the Shannon and D'Entrecasteaux national parks.
8. Introducing a code of practice for driving on four-wheel drive tracks and beaches within the parks.
9. Not upgrading or improving access to areas within the parks without first ensuring that the level of access is appropriate for the level of facilities provided at recreation sites.
10. Negotiating with private property owners, Main Roads Department and local authorities to ensure that road reserves to park enclaves are best located to protect environmental and landscape values of the parks and satisfy owners access requirements.
11. Liasing with Main Roads WA where development is proposed in a road reserve adjacent to the parks to ensure appropriate management with regards to flora surveys, *P. cinnamomi*, weeds, drainage control, visual amenity and rehabilitation.
12. Continuing to work together with four-wheel drive associations and other community groups to maintain and/or rehabilitate tracks.
13. Ensuring that at least the following conditions are imposed on log haulage operations within the parks:
    - trucks to be limited to a speed of 60 kilometres per hour;
    - further road or verge development is managed to minimise disturbance;
    - vegetation cannot be removed from the road verges unless for public safety (slashing is allowable if required to improve visibility);
    - appropriate disease control procedures are implemented;
    - the maintenance standard is to be acceptable to the District Manager; and
    - gravel for log road maintenance is to be obtained from outside the parks and existing pits within the parks are to be rehabilitated.
14. Assessing alternative routes for log haulage outside the parks.

Key Performance Indicator 26.1 applies (Appendix 2)

27. RECREATIONAL USE

Recreation use in the parks is shown in Map 12 Existing Recreation Use.

Active Recreational Use in the Parks

Recreational Driving

Many owners of four-wheel drives seek 'adventure' or 'challenge' driving experience within the parks (see Section 26 Visitor Access). Rough four-wheel drive tracks, sand dunes, creek and river crossings and diverse scenery combine to attract an increasing number of four-wheel drive clubs and enthusiasts to the parks.

It is important that any recreational driving within the parks complies with the Conservation and Land Management Regulations to avoid damage to the environment, damage or injury to visitors and their vehicles and conflict with other users. Some four-wheel drive clubs regularly volunteer their time to environmental projects in the parks, such as to rehabilitate tracks, clear rubbish and remove weeds. Unfortunately, there are still many recreational drivers within the parks who are not aware of, or ignore, the need to minimise environmental impacts.

Although it may appear that dune systems like the Yeagarup Dunes would not be adversely affected by off-road driving, the dune vegetation is very sensitive to four-wheel driving and visitors who choose to leave the marked tracks can cause dune damage. As the dunes regularly change shape and can form very steep dune faces, visitors who leave marked tracks also place themselves and property at risk. There is one marked track that crosses the Yeagarup Dunes which is checked regularly to ensure it provides a safe passage to the beach. However, due to natural dune movement access to and across the dunes is likely to be cut off during the life of this plan. The Department will consider an alternative route if the environmental impacts are minimal, or put in place management options to keep the current route open.

While the use of dune buggies on the beaches of D'Entrecasteaux National Park has decreased, the use of four-wheel motorbikes for off-road riding and accessing beaches for fishing has increased. Many trail motorbikes also regularly visit the parks (particularly D'Entrecasteaux National Park) and drive off-track through sensitive vegetation and dune systems. Motorbikes are also able to get around gates and barriers placed to close roads and tracks.

All vehicles within the parks must be registered under the *Road Traffic Act 1974,* and all drivers must possess a current driver's licence. The relevant road rules, such as not driving under the influence of alcohol or drugs and not using excessive speed, also apply. Any vehicle registered under the *Control of Vehicles (Off-road Areas) Act 1978* is not permitted to operate in the parks except under exceptional circumstances with permission from the District Manager (such as four-wheel drive bikes that can facilitate disabled person access).

Key Points

- Shannon and D'Entrecasteaux national parks provide many opportunities for challenging driving experiences.
- Inappropriate recreational driving can cause damage to the environment.
- Recreational driving needs to be controlled in the Yeagarup Dunes to protect vegetation and visitor safety and enjoyment.
- All vehicles must be registered and drivers have to obey normal road rules.

The objective is to provide opportunities for recreational driving within the parks that do not conflict with other users, damage the environment or cause damage or injury to visitors and their vehicles.

This will be achieved by:

1. Ensuring any motorised vehicle used in the parks is appropriately registered and complies with the Department's requirements.
2. Not permitting vehicles to drive off marked tracks or roads within the parks (Map 10 Public Access – Vehicle and Boat).
3. Maintaining a defined track across the Yeagarup Dunes and informing drivers that leaving the marked route is not permitted.
4. Maintaining some areas of the parks as vehicle-free by instituting appropriate visitor management settings and/or gazetting wilderness.
5. Developing and distributing information on appropriate behaviour in the parks for four-wheel drivers and those looking for 'challenge' driving experiences.

6. Continuing to work with local, state and national four-wheel drive and off-road vehicle clubs and associations to actively promote responsible use in the parks.

Key Performance Indicator 27.1 applies (Appendix 2)

Bushwalking

In its various forms, bushwalking can encompass everything from a short, leisurely stroll to a major trek lasting days or even weeks. In comparison with motorised types of access, bushwalking enables visitors to experience the natural environment at close quarters. Six categories of walking trails are recognised by Standards Australia (2001), from trails where there is no modification to the natural environment (Class 6) to broad, hard surfaced tracks suitable for wheelchair use (Class 1). All categories may be provided for in the parks.

This gradation from remote to developed fits in with the visitor management settings approach (see Section 25 Recreational Opportunities – Visitor Management Settings) with the more developed trails provided in the more 'developed' settings although it is recognised that many trailheads are more developed than the overall setting of the walk (such as for the Mt Pingerup Walk). Existing walking trails in the parks are described in Table 7 and shown in Map 11 Public Access – Walk Trails.

TABLE 7. Walking Trails within the Parks

Walk	Length (One Way)		Class(es) 1-6	Management Setting
	km	Days		
❖ Pt D'Entrecasteaux Lighthouse	0.5	<1 hour	2	Well built walking trails in concentrated area of modified environment
❖ Shannon Dam	3.5	0.5	2	
❖ Pt D'Entrecasteaux to Tookalup	2	2 hours	2 to 3	Well built walking trails in mostly natural areas
❖ Mt Chudalup	1	1 hour	3	
❖ Great Forest Trees Walk	4	0.5	3	
❖ The Rocks	5.5	0.5	3	
❖ Mt Pingerup	3	0.5	4	Formed walking trails in predominantly natural areas
❖ Highway Access Track to Bibbulmun Track	4	0.5	4	
❖ Bibbulmun Track – *Gardner River to Lake Maringup*	15.9	1	4	Natural walking routes in natural areas
❖ Bibbulmun Track – *Woolbales to Long Point*	17.2	1	4	
❖ Bibbulmun Track – *Dog Rd to Mt Chance*	19.4	1	4	
❖ Bibbulmun Track – *Mt Chance to Woolbales*	20.4	1	4	
❖ Bibbulmun Track – *Lake Maringup to Dog Rd*	24.5	1	4	
Total	120.9 km			

The impact of bushwalking on the physical environment, while generally low, can be quite variable depending on soil conditions, topography and intensity of use. Soil compaction and erosion problems are the main issues of concern, although other impacts such as the introduction and/or spread of weeds and plant diseases or the escape of fires from campfires

may also occur. Usually these problems can be effectively minimised through the sensitive location and design of paths and careful selection of campsites.

Where no rubbish collection facilities are provided by the Department, all rubbish should be carried out according to the 'clean, crush and carry' philosophy of rubbish disposal. Where no toilet facilities are provided by the Department, all toilet waste should be buried at least 100 metres from any creek or watercourse at a depth of at least 15 centimetres.

There can be safety problems associated with long distance hikes including the threat of wildfire or becoming lost or injured. Such problems can largely be overcome through the provision of a self-registration system, effective signs and visitor information programs designed to ensure walkers are adequately informed about and equipped to handle the conditions they will encounter.

The Bibbulmun Track has the most developed facilities of any trail in the parks, and is the most promoted and most heavily used. However, an increasing number of park visitors are looking for more remote off-track experiences or walking routes. The diverse landscapes of the parks provide for a greater range of opportunities for walking tracks than currently available. In particular, opportunities for Class 5 and 6 walks are absent and will be considered.

Some potential bushwalking opportunities have been identified and are described in Table 8 below. These walking trails will be considered during the life of this plan. Further walks may be developed as the need arises as long as they fit within the visitor management setting of the area, provide an increase in the range of natural values that can be appreciated and environmental disturbance is minimised.

TABLE 8. Opportunities for Additional Walking Trails within the Parks

Walk	Length		Class(es) 1-6	Management Setting
	km	Days		
❖ Windy Harbour to Pt D'Entrecasteaux	< 5 km	1	2 to 3	Well built walking trails in mostly natural areas
❖ Shannon Townsite Walk	< 5 km	1	2 to 3	
❖ Tookalup to Salmon Beach	< 5 km	1	3	
❖ Black Point	5 to 10 km	1	2 to 4	
❖ Donnelly River	~15 km	1 and 2	3 to 4	
❖ Lake Jasper	5 to 10 km	1	4	Formed walking trails in predominantly natural areas
❖ Yeagarup Lake to Yeagarup Dunes	5 to 10 km	1	4	
❖ Northern Shannon Circuit	10 to 25 km	2	3 to 5	
❖ Crystal Springs to Woolbales	5 to 10 km	1	4 to 5	Natural walking routes in natural areas
❖ West Broke Walk	10 to 20 km	2	4 to 5	
❖ Lake Jasper to Black Point	15 to 20 km	2	4 to 5	
❖ Lake Maringup to Mandalay Beach via Broke Inlet Mouth (providing loop walk in conjunction with Bibbulmun Track)	35 to 45 km	3	4 to 6	Natural walking routes in remote natural areas
❖ Boat Landing Rd to Yeagarup Dunes	15 to 20 km	2	5 to 6	

Key Points

- Bushwalking enables visitors to experience the natural environment at close quarters.
- There are approximately 120 kilometres of walking tracks of classes 2 to 4 provided within the parks.
- Although the impact of bushwalking on the environment is generally low, soil compaction, loss of vegetation, the spread of weeds and diseases such as *Phytophthora*, littering and campfire escapes can occur.
- Walkers need to be aware of the safety problems associated with bushwalking in a remote area.

The objective is to provide a range of bushwalking opportunities across a range of landscapes that do not adversely impact on conservation, landscape and other values.

This will be achieved by:

1. Careful appraisal of visitor needs and environmental impacts as well as the availability of resources for construction and ongoing maintenance.
2. Considering options for the provision of new or altered tracks of a variety of classes.
3. Ensuring that the standard of new tracks is appropriate to the relevant visitor management setting.
4. Constructing and locating all tracks in accordance with established planning procedures and environmental controls, for example:
   - tracks located so as to enhance visitor experiences and, where appropriate, interpretation opportunities;
   - alignments and grades selected so as to provide a range of standards to suit user requirements and safe access with minimum disturbance to the natural environment and minimum maintenance;
   - signposting tracks to indicate their degree of difficulty;
   - providing tracks of a uniform class where possible;
   - minimising risks to the users and interference to park values;
   - locating walking tracks in the parks that complement or link up with tracks on adjoining lands, where practicable;
   - constructing interpretive walks and shorter loop paths to a standard suitable for use by people with disabilities, where practicable; and
   - providing boot cleaning stations for disease control.
5. Developing and making available to bushwalkers a code of conduct that applies to bushwalking within the parks including:
   - recommended party size;
   - camping and campfire policy; and
   - toilet waste disposal and general waste disposal.
6. Providing adequate information from which visitors can choose the walk best suited to their needs and interests.
7. Encouraging long-distance bushwalkers to register their intentions in logbooks or with the Department.
8. Controlling bushwalking in areas temporarily or permanently closed for reasons such as disease management, protection of threatened species, rehabilitation or impact from fire.
9. Introducing management controls including the issuing of permits, the temporary resting or closure of tracks and backpack campsites where the intensity of hiking in remote areas threatens resource values or the enjoyment of other users.

Cycling

Cycling brings health benefits, allows for disabled access and encourages closer interaction with the environment. Demand for all-terrain cycling has increased markedly over the past

decade, as evidenced by the increase of sales of mountain bikes in Western Australia (in 1999 over 90% of all bikes sold in Western Australia were mountain bikes).

While the Department recognises these benefits, and is actively developing mountain biking trails throughout the State, cycling can also conflict with other users and have impacts on the environment. Possible environmental impacts include facilitating the spread of disease, destruction of vegetation and soil erosion. A study within the south-west showed that mountain bike riders would support a code of conduct to promote protection of the environment and that there is a need to raise rider awareness and understanding of diseases such as *P. cinnamomi* (Goeft and Alder 2000).

The Department is gradually developing the Mundi Biddi Trail, a long-distance mountain bike trail through State forest and national parks from Perth to Albany. Facilities will include campsites, toilets, picnic sites and water tanks at regular intervals. The trail will be implemented in three stages, with the third stage linking Northcliffe and Albany and passing through Shannon National Park (Map 12 Existing Recreational Use). The details of this stage are still being developed in consultation with communities and user groups, and will be provided for in the final management plan. The proposed alignment currently includes Shannon townsite but the final alignment may pass through the park on a more direct route between Northcliffe and Fernhook Falls on Deep River, east of D'Entrecasteaux National Park. The possibility of loop trails along the length of the trail is being investigated.

The Mundi Biddi Trail and associated loops should be sufficient to meet the demands for mountain bike use in the parks. As it is a purpose built trail conflict with other users should be minimised. If the trail is not constructed during the life of this plan, then other opportunities for mountain biking consistent with the visitor management settings will be considered.

Key Points

- Most bike sales in Western Australia are mountain (off-road) bikes.
- Impacts to be managed include conflict with other users and the spread of disease, vegetation damage and soil erosion.
- The Munda Bindi long-distance mountain bike trail is proposed to traverse Shannon National Park.

The objective is to provide opportunities for bike riding that minimise the impact on the environment and on other visitors.

This will be achieved by:

1. Continuing to facilitate cycling on public access roads in the parks (Map 10 Public Access – Vehicle and Boat).
2. Educating cyclists about the impacts on the environment and actions that can be taken to minimise these impacts.
3. Allowing off-road cycling on the Munda Bindi Trail and associated loops, or on similar specifically designated cycle tracks within the parks if the Munda Bindi is not constructed.

Horse-riding

Horse-riding in natural bush settings and scenic coastal areas is a popular recreational activity in the south-west. According to Departmental policy, horse-riding may be permitted in national parks where:

- the activity is a pre-established use;
- where environmental and social impacts are considered manageable; and

- where the activity does not conflict with other values.

The previous management plan allowed public horse-riding along 1 kilometre wide corridors centred on both Jasper Beach and Deeside Coast Road as well as one commercial operation in D'Entrecasteaux National Park between Gardner River and Broke Inlet and along Deeside Road.

Biological and physical impacts of horse-riding include trampling and grazing of plants, spreading weeds and disease, disturbing native fauna, soil compaction and erosion. The level of impact is dependent on the extent, frequency and intensity of use, topography and soil type. Climatic aspects such as rainfall and wind speed are also compounding factors. Some sites are therefore susceptible to more damage than others, especially areas with steep slopes, sandy or clayey soils, and wetland areas. The landscapes of the D'Entrecasteaux National Park generally have a very low capability to sustain uses that involve disturbance of the soil or vegetation, such as horse-riding. The previous management plan prescribed that the effects of horse use in the parks be monitored and suggested that the plan be amended as appropriate dependant on the information gained from the monitoring.

Phillips (2000) studied the impacts of trampling, compaction, erosion, grazing and the spread of plant diseases and weeds of a commercial tour operator in D'Entrecasteaux National Park. The results indicated that low levels of horse-riding cause a significant degree of vegetation and soil impact, and potential erosion, invasion and spread of weeds and *Phytophthora* (Phillips 2000, Phillips and Newsome 2002). The conclusion of the study was that the environmental impacts of horse-riding, when undertaken on a commercial tour operator basis with strict controls in place, are localised and can be managed.

Newsome and Phillips (2002) identified three management options:

- prohibiting use – *"the most effective means of minimising the impacts of horse-riding"*;
- unrestricted open access; and
- managing tour operators.

They concluded that "*…open access of protected areas for recreational horse-riding is inconsistent with conservation objectives and should not be allowed.*" However, they acknowledged that managed access using tour operators could directly control the number of users and area of use.

It is therefore recommended that one operator will be allowed to continue horse-riding tours in the Fish Creek area subject to conditions. However, no public bridle trails will be provided in D'Entrecasteaux National Park.

In comparison to D'Entrecasteaux National Park, much of the Shannon National Park is capable of supporting horse use on the network of existing roads and tracks as the soils are more stable, the vegetation is less susceptible to *Phytophthora*, and the conflict with other users is not as great. However, adjacent State forest can provide similar opportunities for horse-riding so no bridle trails will be provided within Shannon National Park. Horses are classed as vehicles under the Road Traffic Act and are therefore permitted on gazetted public roads. Horse-riding has been occurring alongside Deeside Coast Road which can continue under the Road Traffic Act.

Key Points

- Horse-riding can lead to conflict with other users, trampling and grazing of plants, spread of weeds and plant disease, disturbance to native fauna, soil compaction and erosion.
- The landforms of the D'Entrecasteaux National Park have a low capacity to sustain horse-riding.

- There is currently one commercial horse-riding company licensed in the D'Entrecasteaux National Park and recent research suggests that the impacts can be managed if adequately confined.
- There are opportunities for public bridle trails in neighbouring State forest.

The objective is to provide horse-riding opportunities in the parks that minimise the impact on the environment and on other visitors.

This will be achieved by:

1. Allowing one commercial horse riding operator) as per Departmental policy and licence conditions in Appendix 13 (see Section 28 Commercial Tourism Operations).
2. Restricting the commercial horse-riding operation to designated tracks on a rotational basis to minimise impacts.
3. Prohibiting recreational horse-riding within the parks.
4. Encouraging recreational horse-riding in areas outside the parks which are able to sustain this activity.

Key Performance Indicator 27.2 applies (Appendix 2)

Boating

The main water bodies in and near the parks used for boating are Broke Inlet, the Warren, Gardner and Donnelly rivers and Lake Jasper. Different types of boats and water-craft used in the parks include power-craft (power-boats and jet-skis), sail-craft and kayaks/canoes/rafts. Uses include fishing, water-skiing, jet-skiing and gaining access to destinations such as the mouth of the Donnelly River or Broke Inlet.

The environmental impacts of canoeing and sailing are relatively small whereas power-craft use can have negative effects upon other water users, flora and fauna, water quality and may cause bank erosion or disturbance to sensitive lakes or riverbeds. Some activities also require additional facilities such as launching ramps, small jetties and parking bays for trailers.

Canoeing and other forms of non-motorised boating are allowed within the parks on Shannon Dam, Lake Jasper and all of the rivers within the parks (Map 10 Public Access – Vehicle and Boat and Map 12 Existing Recreational Use). Power-boat use is allowed along the Donnelly River from the mouth of the river to Boat Landing Road and in the lower reaches of Gardner River. Commercial licences to operate power-boat tours on the Donnelly River (see Section 28 Commercial Tourism Operations) will be permitted as long as monitoring shows that there are no adverse environmental impacts.

The previous management plan for the parks allowed for power-craft use on Lake Jasper in an area gazetted by the Department of Planning and Infrastructure for such use. However, regular inspection of Lake Jasper by the Department of Planning and Infrastructure and the Department has shown that previous management arrangements were not workable or enforceable and the effort needed to ensure compliance by power-craft users is not an effective use of financial and staff resources. For example:

- most of the buoys used to demarcate the ski area are either removed by users or the wind;
- information signs at the boat launching ramp to reinforce the power-craft zone were regularly vandalised;
- power-craft routinely operate outside the 'power-craft zone' and use most parts of the lake;
- the designated swimming area is one of the most popular areas used by power-craft;
- an increasing number of jet-skis are using the lake;
- power-craft towing skiers come close to the lake edge at high speed to 'drop-off' skiers as well as when pulling skiers away from the lake edge, creating backwash which can lead to shoreline erosion;

- complaints are often received from day visitors and campers about the noise pollution caused by power-craft on the lake, and visual 'pollution' caused by the buoys.

Archaeologists and divers from the Western Australian Museum identified a number of submerged Aboriginal sites on the bed of Lake Jasper in 1989 (see Section 23 Indigenous Heritage). Local Aboriginal people believe that the continued use of power-craft on the lake is disrespectful due to the presence of these sites and the uniqueness and significance of the area to Aboriginal people.

A systematic overview of the environmental values of the wetlands, rivers and estuaries in the region conducted by the former Water and Rivers Commission (Pen 1997), lists Lake Jasper as an important wetland. This report also recognises water-skiing on Lake Jasper as a potentially major degrading activity. In addition, Lake Jasper and the surrounding wetlands are listed in the Directory of Important Wetlands in Australia (Environment Australia 2001a) (see Section 18 Species and Communities of Conservation Significance).

Overall, the Aboriginal significance of the site and its listing as an important wetland justify the closing of Lake Jasper to power-craft.

Key Points

- Most boating in the parks occur in Broke Inlet (the shores and islands of the inlet are in the parks), the Warren, Gardner and Donnelly rivers, Shannon Dam and in an area gazetted for power-craft use on Lake Jasper.
- Power-craft can have negative effects on other users, flora and fauna, water quality and may cause bank erosion or sediment disturbance.
- Lake Jasper's conservation values are formally recognised by Environment Australia and the Water and Rivers Commission.
- Submerged Aboriginal sites have been discovered at Lake Jasper since the publication of the last management plan for the area and local Aboriginal people find the continued use of power-craft to be disrespectful to these sites and their culture.

The objective is to provide for boating recreation activities that are compatible with protecting and maintaining conservation values and without impairing other recreation activities.

This will be achieved by:

1. Applying to the Department of Planning and Infrastructure to rescind the gazettal of areas of Lake Jasper for power-craft use.
2. Prohibiting the use of jet-skis (and other personal water-craft) on Lake Jasper and other water bodies within the parks, and providing adequate signposting and information regarding this at the start of major access roads, in particular to Lake Jasper.
3. Removing and rehabilitating the boat ramp at Lake Jasper.
4. Providing information about alternative boating areas in the region.
5. Providing new boating facilities related to activities only where they are directed toward the appreciation of the parks natural values, and are carefully selected and planned to minimise compaction, erosion, removal of vegetation and littering.
6. Permitting the use of non-motorised craft on the Shannon Dam, Lake Jasper and all of the rivers within the parks, and prohibiting use in all other water bodies of the park.
7. Providing appropriate information on river difficulty and water levels for water-craft users and particular canoeists and paddlers.
8. Allowing public power-boat use of navigable reaches of the Donnelly River and Gardner River as long as physical, biological and social impacts are minimised.
9. Permitting one commercial operator to run power-craft tours of Donnelly River subject to relevant monitoring and licensing conditions (see Section 28 Commercial

Tourism Operations) which will include level of use.

10. Providing written information and signs at popular boat launching areas regarding hazards and boating regulations for boat users in liaison with the Department of Planning and Infrastructure.

Key Performance Indicator 27.3 applies (Appendix 2)

Marroning and Fishing

Due to agricultural development and associated factors such as stream salinity and eutrophication, marron distribution is now restricted to the streams and pools in forested areas of the south-west, where water quality is higher. It is possible that increased land use pressures could result in a further loss of marron habitat in the forested areas, which currently provide all of the marron catch from wild (natural) populations. Predation by introduced species such as trout, redfin perch and laughing kookaburras has added to the problems created by increased harvesting and reduced habitat (Morrisey 1978).

Marroning is a popular activity in the parks during an open season (usually a short period in summer). Marron occur in the rivers and most of the permanent freshwater lakes in the parks. Although the species has a high reproductive capacity, most marron populations have been over-fished to the point where it is often difficult to catch specimens of legal size.

Impacts caused by marroning include disturbance of river banks and shoreline vegetation, littering and escapes from campfires. Some marroners are responsible for making new tracks or removing or avoiding barriers. Some of the closed vehicle tracks in the park continue to be used to gain seasonal access to marroning sites. Those on the Windy Harbour Road in particular are poorly located, and have created substantial visual scars in an otherwise natural landscape. These marroning tracks are often located in low-lying inundated areas, where the potential for disease spread is high.

There is also a small number of people who access the park to fish for gilgies and koonacs. The issues associated with these activities are similar to that of marron fishing.

The land-based impacts of freshwater fishing are also similar to marron fishing and are mostly related to access tracks (both vehicle and foot), vegetation disturbance and ancillary activities such as camping, rubbish disposal and campfires. Lake Maringup and Lake Quitjup are closed to fishing and kept as biological reference areas (see Section 18 Species and Communities of Conservation Significance).

A number of native and introduced fish species are found in the lakes, rivers and wetlands of the parks (see Section 17 Native Animals and Habitats). Fish sought by anglers include native species such as the freshwater cobbler and introduced species such as brown trout, rainbow trout and redfin perch.

Trout are not stocked in the waters of the parks, although the Shannon River has been stocked in the past and the upper reaches of the Warren and Donnelly rivers, which lie outside the parks, are regularly re-stocked (see Section 20 Introduced and Other Problem Animals).

There are two main types of coastal fishing in the parks: beach fishing, where most access is gained directly to the beach by vehicle, and rock or reef fishing. Rock and reef fishing sites usually have foot access tracks, some of which traverse steep cliffs or sensitive landforms prone to erosion or compaction. Some of these tracks are poorly located and constitute a threat to users, the environment or both. Rock and reef fishers will often go to extreme lengths and take great risks to access favoured fishing sites (see Section 29 Visitor Safety).

Beach fishing is one of the most popular recreational activities in the parks and is often associated with four-wheel drive access. However, some beach fishing sites are only

accessible by foot, such as Salmon Beach. Typically, beach fishers access a beach by four-wheel drive vehicle, stay for a day or overnight on the beach (weather permitting). During salmon fishing season (usually March to May) up to 200 vehicles have been counted on one beach (Yeagarup Beach, Easter 1999).

Key Points

- Marroning is a popular activity in the parks during open season but the fishable stocks have declined.
- Impacts of marroning and fishing in general include disturbance to riverbanks and shoreline vegetation, rubbish disposal, campfire escapes, and uncontrolled access. Controlling access tracks to marroning and fishing sites is also a significant problem.
- There are a number of introduced species of fish within the parks from past stocking practices and the current practice is to stock the upper reaches of rivers that flow to the coast through the parks.
- Rock/reef fishing is a high risk activity undertaken by users of the parks with some walking tracks that access rock or reef fishing sites poorly located and posing a threat to users and/or the environment.
- Beach fishing is one of the most popular recreational activities within the parks, adding additional pressure on the parks through the use of four-wheel drive vehicles to access fishing sites.

The objective is to allow sustainable marroning and fishing where this does not lead to degradation of the environment.

This will be achieved by:

1. Allowing fishing and marroning in all water bodies in the parks (subject to knowledge about impacts), except Lake Maringup and Lake Quitjup, subject to Fisheries Regulations.
2. Prohibiting fishing on Lake Maringup and Lake Quitjup (and any other water body, if impacts are deemed by the Department to be unacceptable, after public consultation) under the Conservation and Land Management Regulations.
3. Continuing to prohibit stocking of non-native species in all water bodies in the parks and seeking to prevent restocking in rivers that are upstream of D'Entrecasteaux National Park (see Section 20 Introduced and Other Problem Animals).
4. Continuing to seek ways of preventing continued use of closed tracks by marroners (see Section 26 Visitor Access and Appendix 11).
5. Ensuring that any fishing access walking tracks are safely located and do not pose a risk to users or the environment. Inappropriately located fishing access tracks will be relocated, or closed and rehabilitated.
6. Allowing beach camping (see Section 27 Recreational Use – Overnight Stays).
7. Providing information about beach and rock fishing, especially about safe access points to the coast (see Section 29 Visitor Safety).

Surfing and Swimming

Surfing is popular at Black Point and Salmon Beach within D'Entrecasteaux National Park. Black Point has become extremely popular with surfers. Surfing conditions at Black Point are often ideal when conditions on the west coast are 'blown out'. However, since there is often a large swell working over the reef it can be dangerous for inexperienced surfers. Salmon Beach has a range of surfing breaks from reef to sand bar breaks and attracts a wider range of surfers from beginners to very experienced.

The activity of surfing poses few threats to the park environment although the ancillary activities of the users of surf beaches can have large impacts. Camping and picnic sites near popular surfing places seem to have a higher incidence of conflict between campers,

vandalism to park furniture, damage to the environment and occurrences of dogs being brought into the park. Surfers prefer convenient tracks to the beach and require vantage points to assess conditions.

Careful management of areas adjacent to surfing beaches is required to minimise the impact on the environment. For example, camping in a fragile area such as Black Point has had an unacceptable impact on the environment. The existing camping area should be relocated due to the current impacts and increasing use. Due to the limited access and camping opportunities and the remote nature of D'Entrecasteaux National Park, surf competitions generally will be prohibited.

Swimming occurs in the parks at Lake Jasper, Lake Yeagarup, the rivers, the ocean, inlets and in Shannon Dam. Some of the beaches adjoining the parks are not appropriate for swimming due to the strong rips and deep channels close to the shore. Ocean conditions can also change quickly and unexpectedly.

Key Points

- Popular surf beaches in the parks include Black Point and Salmon Beach.
- The impacts on camping and picnic sites near surf beaches include conflict between users, vandalism to park furniture, damage to the environment, proliferation of access tracks, and the effects of domestic animals being constantly brought into the parks.
- Swimming along the coast of the parks can sometimes be dangerous due to the strong rips and deep channel close to shore.

The objective is to allow for beach activities such as surfing and swimming in the parks except where there is a threat to the environment or a risk to public health or visitor safety.

This will be achieved by:

1. Providing different camping areas for specific user groups to minimise conflicts.
2. Providing and clearly signposting camping areas that have noise curfews and if there are areas able to sustain them; curfew free areas close to popular surfing beaches (see Section 27 Recreational Use – Overnight Stays).
3. Providing access tracks and vantage points at surfing areas where appropriate.
4. Providing risk management signs or other information as appropriate at surfing beaches.
5. Consulting with and, as appropriate, involving surfers in aspects of management of the parks that affect surfing including camping, access and specific environmental impact problems.
6. Prohibiting surfing competitions in D'Entrecasteaux National Park unless it can be shown that all the impacts can be acceptably managed.
7. Providing a range of information to visitors about any hazards associated with swimming in the parks.

Sandboarding

Sandboarding involves the use a specialised board to 'surf' down steep sand dunes. Sandboarding has become increasingly popular amongst young age groups. However, according to Departmental policy sandboarding is generally an unacceptable recreation activity on public conservation lands, particularly in coastal areas of high conservation value. Impacts include:

- the activity itself plus the ascent of the dune (often on top of the fringing surviving vegetation) is particularly destructive of vegetation;

- the Department does not have the resources to manage and monitor the activity in D'Entrecasteaux National Park so it is very hard to keep sandboarders in a single designated area of dunes;
- access to a suitably steep site in the dunes by vehicle can be dangerous and leaving the marked tracks is not permitted (see Section 26 Visitor Access); and
- the dune topography constantly changes and a designated sandboarding area may quickly become unsuitable or dangerous.

Key Points

- Departmental policy is that sandboarding is generally unacceptable on public conservation lands.
- Sandboarding can have impacts on dune vegetation and access to sandboarding areas can be dangerous.

The objective is to protect the sand dune environment and minimise risk to public health and visitor safety.

This will be achieved by:

1. Prohibiting sandboarding in the parks.
2. Providing signage and/or information as to why sandboarding is prohibited in the parks.

Abseiling and Rock Climbing

In recent years there has been a marked increase in abseiling in Western Australia (and to a much lesser extent, rock climbing) by organised groups, often on a commercial basis (see Section 28 Commercial Tourism Operations). Abseiling as a motivational or team building exercise is also becoming more common. This, plus the rise in the number of adventure tourism companies, has led to an increase in requests for access to the cliffs and granite monadnocks within the parks for these activities.

Abseiling can involve large groups of beginners under instruction. The participants do not necessarily have experience in mountain safety and climbing, and group instructors have a responsibility to ensure that all members of the group observe safety, environmental and ethical standards. This requires certain minimum standards of experience and competency in instructors and acceptable student to instructor ratios.

In the parks, the impacts made by abseiling parties have related predominantly to access to sites. For example, in the Donnelly River and Long Point area, some access tracks have proven very hard to stabilise and wind and water erosion has caused problems. In addition, the only granite areas suitable for these activities are diverse ecotones that often contain rare and priority flora (see Section 18 Species and Communities of Conservation Significance).

Due to the fragile and sensitive nature of the limestone cliffs and granite monadnocks favoured for abseiling or climbing in the parks there are few, if any, areas environmentally suitable for these activities. Therefore, abseiling and rock climbing will generally not be permitted in the parks. Groups and individuals will be directed to seek locations outside the parks. The only case where abseiling and rock climbing may be permitted in the parks is as part of other licensed adventure activities (see Section 28 Commercial Tourism Operations). Some companies have already set up abseil trees in the parks where participants climb a tree by using a rope or steel ladder then abseil to the ground. As there is little impact on the tree, these trees will be the preferred sites for licensed abseiling activities in the parks.

Key Points

- There are few, if any, environmentally suitable areas for abseiling or climbing within the parks.
- Occasional enquires are made to abseil or climb the limestone cliffs and granite monadnocks in the parks.
- Some companies have set up abseil trees in the parks.

The objective is to prevent adverse impacts from abseiling and climbing on conservation, landscape and other park values.

This will be achieved by:

1. Allowing the use of abseil trees in the parks where part of a licensed adventure activity program but encouraging groups to use trees outside the parks
2. Prohibiting abseiling and climbing on limestone cliffs and granite monadnocks in the parks.

Caving

In comparison to other cave and karst features in Western Australia, the caves in the parks are small and shallow. Some of these caves have unique geological or geomorphological features and others have Aboriginal cultural significance (Appendix 3 and Section 23 Indigenous Heritage). While caving is not a popular activity in the parks, some use of the caves does occur, often as a side activity related to illegal camping in caves. Some caves pose a visitor risk and require closure, or signs to make visitors aware of these hazards.

Cave values require special protection, as once damaged, cave formations may never reform or take thousands of years to re-establish. Cave ecosystems can also support unique relict ecological communities. Little is known about the ecological communities in the caves of the parks and further research is required.

Therefore, access to caves within the parks will only be allowed to registered speleological clubs or certified tour operators that carry public indemnity insurance. A cave classification system is being developed as part of Policy Statement No. 18, in consultation with the Western Australian Speleological Group and the Australian Speleological Federation. Classification currently includes 'tourist cave', 'self-guiding cave', 'adventure cave' and 'restricted access' and details for recommended management. As the system is further developed, the caves within the parks should be classified and managed accordingly. All caves within the parks should be considered restricted access until an assessment has been made of the values and level of risk.

Key Points

- Caving is not a popular activity in the parks, but caves are occasionally used for illegal camping.
- Once damaged, cave formations may never reform or take thousands of years to re-establish. Cave ecosystems can also support unique relict ecological communities.

The objective is to sustainably manage the caves and karst systems in the parks for their intrinsic, ecological, and cultural values.

This will be achieved by:

1. Only allowing registered speleological clubs or certified tour operators that carry public indemnity insurance to access caves within the parks.
2. Alerting park users to the potential hazards within caves.
3. Classifying caves in the parks according to the Department's cave management

classification system in Policy Statement No. 18.

4. Considering possible adverse impacts on cave features when undertaking surface management operations.
5. Not divulging cave locations in the parks on the Department maps or publications.
6. Gating and locking caves (temporarily or permanently) if:
   - there is no practical alternative to preventing damage to the cave formations, flora, fauna, or the cave itself;
   - there is no practical alternative to protecting significant decoration, scientific work undertaken, rehabilitation or protecting the general public from a particularly dangerous area;
   - it is practical to do so without damaging the cave; and
   - it is practical to do so without disturbing essential airflow and/or waterflow for cave fauna (such as bats).

Flying and Hang Gliding

Aircraft activities undertaken in the parks are currently confined to chartered or private flights over the parks and occasional landings in the parks. The Department's fire detection aircraft also regularly fly over the parks between November and May each year. There is a gravel airstrip in close proximity to Shannon National Park, which is sometimes used. Ultralight aircraft flying from Manjimup at times land in the park on the beach at the mouth of the Warren River and in the Yeagarup Dunes.

According to Departmental policy (see Section 25 Recreational Opportunities – Wilderness), the landing of motorised and non-motorised aircraft within wilderness will not be permitted, with the exception of non-fixed wing aircraft access for emergency (requires approval from the Executive Director) and essential research and management operations (requires approval of Conservation Commission). Departmental policy also specifies that the relevant authorities will be asked to control aircraft movements over wilderness (under 610 metres for fixed wing aircraft and under 460 metres for helicopters) except for emergency and management operations. If any wilderness areas are gazetted within the parks, Departmental policy will apply.

Hang gliding in the parks occurs at Salmon Beach and Cliffy Head on an irregular basis. Hang gliding from both these points requires a cliff top launch with a cliff top landing at Cliffy Head and a beach landing at Salmon Beach. The opportunity for using the same sites for parapenting (which is similar to hang gliding but utilises a fully controllable parachute to soar once launched from a cliff top) also exists.

Due to the infrequency of hang gliding within the parks, the impacts of the activity have been limited. In general, the use of access tracks and the trampling of vegetation at the launch sites are the key environmental impacts likely to occur. Any increased demand for hang gliding use of the parks would need an assessment of the potential impacts and safety concerns before a particular site developed for launching could be approved.

Key Points

- There are only occasional ultralight aircraft landings in the Yeagarup area and irregular hang gliding activity at Salmon Beach and Cliffy Head.
- There would be restrictions on aircraft landing in or flying over gazetted wilderness areas of the parks.

The objective is to allow for safe flights over and within the parks without damaging the environment or the public enjoyment of the parks.

This will be achieved by:

1. The operation of all aircraft on or over the parks complying with the relevant Federal and State air safety regulations and procedures.
2. Prohibiting all non-emergency aircraft (including ultra-light) use unless on established airstrips and where the purpose is considered to be consistent with the objectives of this management plan.
3. Restricting aircraft landing within gazetted wilderness areas of the parks according to Departmental policy.
4 Liaising with the relevant authorities to control aircraft movements under 1500 metres over gazetted wilderness except for emergency and management operations.
5. Continuing to allow hang gliding at Cliffy Head and Salmon Beach provided environmental impacts or conflicts with other users are minimised.
6. If demand increases for launch areas for hang gliding, erect ramps, safety barriers, railings and/or safety signs to protect environmental values and the safety of visitors if required and in consultation with users.
7. Ensuring that all hang gliding in the parks is in accordance with the rules and regulations of the Civil Aviation Safety Authority and the Hang Gliding Federation of Australia.

Special Events

It is possible that during the life of this plan that 'one-off' special events are proposed within the parks. These could involve large groups of people and camping in the parks. Special events have the potential to have a significant impact on the parks and on the experience of other visitors. Approval may be given to use parts of the parks, subject to approval from the Conservation Commission.

The following general criteria apply:

- the event must be of national significance;
- the event must be consistent with the visitor management setting in which it is to be held (see Section 25 Recreation Opportunities – Visitor Management Settings);
- strict hygiene controls must be enforced to eliminate the risk of disease spreading further in the parks;
- any permitted temporary fixtures or facilities constructed for the event must be removed at the completion of the event; and
- any site disturbance such as trail markings must be removed and the site rehabilitated at the completion of the event.

Before events are approved, the availability of suitable areas outside the parks will be considered. Similarly, the potential impacts on the environment and other visitors, the safety risks to the people involved in the event and the cost-benefits for the management of the area will also be considered.

Key Points

- Occasionally permission will be sought to allow special events to take place wholly or partly in the parks.
- Before any special event is allowed in the parks it must be shown that it is of national significance and cannot be held in a suitable area outside the parks.

The objective is to permit special events of national significance that do not adversely impact on environmental values or visitor experiences, are carried out in a safe manner and are cost-neutral to the Department.

This will be achieved by:

1. Allowing special events subject to approval and conditions stipulated by the Conservation Commission and the Department.
2. Ensuring that special events are held only within an appropriate visitor management setting according to the proposed activity and pose no adverse impact on the environment, and there is no suitable alternative outside the parks.

Non-commercial, Education and Not-for-Profit Activities

Non-commercial, educational and not-for-profit groups use the parks on a regular basis to conduct bushwalking, camping, leadership, outdoor education and personal development programs. Over the last 10 years the number and scale of operations by such groups has grown considerably and is expected to continue as the parks continue to provide large, relatively undisturbed areas that have fairly limited vehicle access.

Non-commercial, educational and not-for-profit groups have the potential to offer experiences and services to park visitors that would not otherwise be available. They may also be able to provide access to visitors with special needs (e.g. visitors with physical disabilities), deliver interpretation and education messages that foster appreciation and understanding of the parks or assist with other park operations. For example, several four-wheel drive clubs have assisted the Department in carrying out park maintenance and management works in D'Entrecasteaux National Park.

These groups range from well-organised multi-national organisations that have trained staff and codes of practice to small school groups with varying levels of preparation and expertise. The level of impact on the environment and level of management input also varies.

Areas within the parks that offer the best conditions for such activities generally coincide with areas favoured by other user groups (e.g. the section of the Bibbulmun Track that goes through the parks). This can lead to competition or conflict between groups wanting to use the same area.

Although these groups usually favour 'bush' camping with no facilities, there has become a need to develop larger group base camps that are more hardened and have more facilities such as toilets and fire rings (see Section 27 Recreational Use – Overnight Stays).

The Department requires all organised non-commercial, educational and not-for-profit groups to gain permission from the local regional or district office prior to undertaking their activities. Guidelines and forms have been prepared for groups seeking Departmental permission for such activities (<http://www.calm.wa.gov.au/tourism/non-commercial_activities.html>).

Key Points

- The parks are used regularly by non-commercial, education and not-for-profit groups to take advantage of the relatively undisturbed areas and camping facilities.
- These groups have the opportunity to provide visitors with experiences that would not be available otherwise.
- The level of impact varies with the level of preparation and expertise of the groups.
- Groups such as these create a need for more formal camping areas, which can conflict with other user groups.

The objective is to ensure that non-commercial, education and not-for-profit activities are compatible with other park management objectives.

This will be achieved by:

1. Ensuring that all non-commercial, educational and not-for-profit groups gain

permission before undertaking activities in the parks.
2. Developing a booking and entry permit system for non-commercial, educational and non-profit groups to avoid overuse and conflict between users.
3. Ensuring strategically located hardened group camping areas are provided that can be used by non-commercial, educational and not-for-profit groups as well as the general public (see Section 27 Recreational Use – Overnight Stays).
5. Develop specific codes of practice and guidelines for non-commercial, educational and not-for-profit groups using the parks.
6. Exploring opportunities for non-commercial, educational and not-for-profit groups to contribute to park management by organising or participating in service projects such as rehabilitation, weed control, rubbish collection or other activities.
7. Investigating partnerships between the Department and non-commercial, educational and not-for-profit groups that provide opportunities for the delivery of education and interpretation programs for park visitors.
8. Only allowing the use of management access tracks for vehicle use by non-commercial, educational and not-for-profit groups strictly in emergency situations, or where assisting the Department with management activities.

Passive Recreational Use in the Parks

Scenic Driving

During a visitor survey conducted in the parks in 1999 (see Section 25 Recreational Opportunities – Visitor Numbers and Trends), sightseeing (51%), four wheel driving (66%) and pleasure driving (55%) were all popular activities carried out in the parks. Sightseeing and driving for pleasure are important recreational pursuits for many visitors. A large proportion of visitors experience the park and gain their enjoyment and appreciation of the natural environment in this way.

Generally, scenic drives are built to a standard capable of accommodating two-wheel drive vehicles. There are two formal scenic drives in the parks—the Great Forest Trees Drive in the Shannon National Park and the drive to the lookout at Point D'Entrecasteaux (Map 12 Existing Recreation Use). Other two-wheel drive access roads include:

- Boat Landing Road to Donnelly River;
- Lewis Road to Warren Beach Track;
- Windy Harbour Road to the settlement of Windy Harbour;
- Deeside Coast Road through Shannon National Park;
- South West Highway through Shannon National Park linking Manjimup and Walpole;
- Broke Inlet Road to the settlement of Camfield and Broke Inlet;
- Mandalay Beach Road to Mandalay Beach;
- Salmon Beach Road to Salmon Beach; and
- D'Entrecasteaux Drive from Windy Harbour to Pt D'Entrecasteaux.

These roads cross a variety of landscapes and provide additional scenic driving opportunities (Map 10 Public Access – Vehicle and Boat).

Much of the access for vehicles to the coastal areas of the parks is confined to four-wheel drives (see Section 26 Visitor Access and Map 10 Public Access – Vehicle and Boat), there is some pressure to increase access for two-wheel drive vehicles for scenic driving purposes and in particular commercial bus tours, however, two wheel drive access is already available to the diversity of features in the park. Also, 26% of park visitors surveyed in 1999 indicated that the aspects of D'Entrecasteaux National Park they most valued were the unspoiled surroundings, isolation and peace, with another 8% reporting that the parks natural features were most important. Some park visitors (12%) were concerned that an increase in the quality of access in the parks would diminish the very characteristics that they came for (see Section 25 Recreational Opportunities – Visitor Management Settings).

It is important to protect the remoteness of the parks, and it is planned that two-wheel vehicle access will continue to be limited in the parks and particularly along the coast of D'Entrecasteaux National Park (see Section 26 Visitor Access – Two-Wheel Drive Vehicle Access and Appendix 11). If further scenic drives are required through the parks over the life of this plan, the existing road network and links to roads external to the parks should be considered. No new or improved public vehicle access will be permitted other than that identified in the Vehicle Access Strategy (Appendix 11).

Key Points

- Approximately half of the visits to the parks include scenic driving as an activity.
- There needs to be a balance between providing two-wheel drive and four-wheel drive access so as to not affect the natural settings enjoyed whilst scenic driving.

The objective is to provide a range of scenic driving opportunities that facilitate appreciation of the natural values of the parks without compromising natural and other recreational values.

This will be achieved by:

1. Maintaining the designated scenic drives and tourist routes.
2. Preparing promotional and interpretive material about the scenic drives and tourist routes throughout the park and disseminating this through appropriate outlets such as tourist centres, Streetsmart maps and RAC guides.
3. Using the existing network of roads for developing scenic opportunities in the parks and linking any new scenic drives in the parks with surrounding natural areas, where appropriate.
4. Implementing the Vehicle Access Strategy (Appendix 11)

Day Use

A day use area is any recreation site that is designed specifically for day visits only. This includes picnic and barbecue sites, lookouts, interpretive stops, short walks and nature viewing sites. Day use sites range from primitive sites such as small clearings with no facilities to well developed sites with many facilities which are generally provided in the more developed settings (see Section 25 Recreational Opportunities – Visitor Management Settings). Existing and proposed day use sites are shown in Table 9. Other sites may be provided after more detailed planning and public consultation.

TABLE 9. Day Use Sites for Recreation within the Parks

Site	Park Info	Toilet	BBQ	Picnic Tables	Shelter	Vista Point	Management Setting
D'Entrecasteaux National Park							
Lake Yeagarup*	P	E	E	E	P		Mostly natural with low-key facilities
Donnelly Boat Landing	E	E	E	E	E		
Pt D'Entrecasteaux	E					E	
Tookalup		E				E	Predominantly natural with basic facilities
Salmon Beach		E		E	E		
Mt Chudalup	E	E	E	E	E	E	
Mt Pingerup						E	Natural with no facilities or structures

Site	Park Info	Toilet	BBQ	Picnic Tables	Shelter	Vista Point	Management Setting
Shannon National Park							
GFTD – Upper Shannon Rd	E	E	E	E	E		Mostly natural with low-key facilities
GFTD – Shannon Dam	P		E	E		E	Predominantly natural with basic facilities
GFTD – Which Tree is That?	E					E	
GFTD – Curtin Tank Site	E			E			
GFTD – Snake Gully Lookout	E			E		E	
GFTD – Big Tree Grove	E						
GFTD – Cow Bells				E			

* Outside the park but would be an entry point to D'Entrecasteaux National Park
E Existing, P Proposed, GFTD Great Forest Trees Drive

If unmanaged, picnicking and barbecuing can result in various localised impacts including the trampling and loss of understorey plants, soil compaction and erosion, littering, and removal of both live and dead vegetation for campfires. These impacts can be minimised through careful site selection, facility placement and design, and the provision of firewood or alternative cooking facilities (see Section 27 Recreational Use – Overnight Stays).

Site selection and development is influenced by environmental considerations, the role the site plays in providing a range of opportunities for the visitor to appreciate the natural values of the parks, fire management and the visitor management setting of the area. There are often day use components of camping areas however they are covered in the following section.

Key Points

- A day-use area is any recreation site designed specifically for day visits only and includes picnic and barbecue sites, lookouts, interpretive stops, short walks and nature viewing sites.
- Impacts of picnicking and barbecuing are similar to camping and include trampling, soil compaction and erosion, littering and firewood collection.
- Day use sites are also found at camping areas across the parks.

The objective is to provide day-use facilities appropriate to the environment and desired management setting that encourage visitor enjoyment and understanding of park values.

This will be achieved by:

1. Designing and developing day use sites in accordance with Departmental policy and design standards, site capability, environmental impact assessment and the visitor management setting of the area.
2. Provide rubbish bins at selected sites depending on high use or demand but encouraging visitors to remove their own litter.
3. Prohibiting campfires, unless firewood is provided by the Department or brought in from outside the parks and lit only in provided fire rings (see Section 27 Recreational Use – Overnight Stays – Campfires).
4. Providing fire rings or gas/electric barbecues at day use sites where necessary.

Overnight Stays

Built Accommodation

Built accommodation in the parks is provided for walkers in the Bibbulmun Track shelters, the Shannon Lodge at the Shannon townsite and in various squatters' huts in the D'Entrecasteaux National Park (see Section 27 Recreational Use – Overnight Stays – Squatters' Huts). Use of built accommodation in the parks as overnight accommodation dates back to cattlemen in the 1880s (see Section 24 Non-Indigenous Heritage). More recently, squatters' huts have been built by holiday-makers and have a range of building styles and standards.

The Shannon townsite, the proposed land exchange at Lake Jasper (see Section 32 Mining), and the Donnelly River mouth in particular, offer opportunities to further develop a range of built accommodation in the parks (and camping areas), to be provided either by the Department or by way of commercial concession (see Section 28 Commercial Tourism Operations). Shannon townsite would be ideal for further built accommodation as the area already supports significant development and good two-wheel drive access to the area exists.

The range of built accommodation to be considered include basic shelters, such as styles reflective of Aboriginal culture or the three-sided structures used for the Bibbulmun Track, to more developed facilities such as huts, lodges or chalets in a natural bush/stockman style within the more developed settings of the parks (see Section 25 Recreational Opportunities – Visitor Management Settings).

Other more basic shelters may also be considered to support long-distance walking or cycling in the parks (see Section 27 Recreational Use – Active Recreational Use).

It is proposed to provide the following built accommodation in the parks (Table 10). Other accommodation may be provided after more detailed planning and public consultation. However, the Department aims to only provide opportunities that are not otherwise provided adjacent to the parks.

TABLE 10. Built Accommodation for Recreation within the Parks

Site	Type	Access	Management Setting
Existing sites			
Bibbulmun Track – Gardner	Basic – 3 sided shelter	walking	A mostly natural setting with low-key accommodation and facilities
Bibbulmun Track – Lake Maringup	Basic – 3 sided shelter	walking	
Bibbulmun Track – Dog Pool	Basic – 3 sided shelter	walking	
Bibbulmun Track – Mt Chance	Basic – 3 sided shelter	walking	
Bibbulmun Track – Woolbales	Basic – 3 sided shelter	walking	
Bibbulmun Track – Long Point	Basic – 3 sided shelter	walking	
Existing sites that will be considered for redevelopment			
Shannon Townsite	Developed – lodges or chalets	2wd	A concentrated area of modified environment with a range of facilities
Donnelly River Huts	Developed – huts	Boat	
East's Hut	Developed – hut	4wd	

Site	Type	Access	Management Setting
Coodamurrup (Moore's) Hut	Developed – lodge or hut	4wd	
Mottram's Hut area	Developed – hut	4wd	
Banksia Camp	Developed – hut	4wd	
Opportunities for additional sites			
Cable Sands proposed addition	Developed – lodges or chalets	2wd	A concentrated area of modified environment with a range of facilities
Summertime Rd/Malimup Beach*	Basic shelter	4wd	A mostly natural setting with low-key accommodation and facilities
Proposed Mundi Biddi Trail	Basic shelters as necessary along the length of the trail	bike	
Lake Maringup to Mandalay Beach via Broke Inlet Mouth* (providing loop walk in conjunction with Bibbulmun Track)	Basic shelter	walking	

* area has been identified as near or within candidate wilderness areas

Key Points

- There is built accommodation within the parks along the Bibbulmun Track, at Shannon Lodge and throughout D'Entrecasteaux National Park in squatters' huts.
- There are further opportunities to develop built accommodation at Shannon townsite and at the mouth of the Donnelly River, replacing or utilising the area currently used for squatters' huts.

The objective is to provide a range of opportunities for park visitors to stay overnight in the parks in appropriately located and designed built accommodation with due consideration to the commercial interest adjacent or near the parks.

This will be achieved by:

1. Providing a range of visitor accommodation as per Table 9 and after more detailed site planning has been undertaken.
2. Ensuring built accommodation is:
   - built to a safe structural standard;
   - environmentally sensitive and energy efficient;
   - ensures a sense of place and reflects vernacular architecture;
   - low maintenance;
   - commercially viable; and
   - fire resistant.
3. Considering a booking system for any built accommodation with restricted access, or accommodation that requires numbers to be limited.
4. Investigating opportunities for partnerships with commercial concessionaires to provide built accommodation within the parks (see Section 28 Commercial Tourism Operations).

Camping

Camping within the parks varies from camping in large camping grounds with facilities as at the Shannon townsite, to remote, informal camping sites as along the coast of

D'Entrecasteaux National Park. Some of the informal sites are rapidly expanding and consequently being degraded. Increasingly, large organised groups with up to 30 vehicles are seeking places to camp close to the coast. With no suitable planned campgrounds available, such groups have had a severe impact on the environment with regards to toilet wastes, rubbish disposal, firewood collection, vegetation removal, erosion and soil compaction.

Most camping within the parks is associated with some other form of recreation activity, such as bushwalking or fishing, and is located along the coast or various rivers and streams. The majority of camping sites in the parks have few facilities, with the exception of the Shannon townsite and the Shire of Manjimup's Windy Harbour townsite. Outside the parks there are camping areas in the adjacent Walpole-Nornalup National Park, Warren National Park and other proposed national parks near Pemberton. The towns of Walpole, Pemberton, Northcliffe, Manjimup and Nannup also provide camping facilities.

Education and not-for-profit groups camp throughout the parks, generally at informal or remote sites not accessible by vehicle (see Section 27 Recreational Use – Active Recreational Use). The standards and camping methods employed by these groups vary dramatically, as some employ minimum impact practices whilst others do not. These groups also require base campsites capable of accommodating larger numbers. There are currently no established guidelines for managing camping of these groups.

Camping in its current form in the parks, particularly coastal camping, is not sustainable. In some instances it may be necessary or desirable to redesign sites or limit access/visitor numbers at particular campsites in order to protect the environment and experience. There is currently no camping booking system in the parks.

At some of the larger campsites in the parks, there is often conflict between camping groups because of the lack of defined campsites—groups often end up in close proximity to each other. Conflict often arises over noise, either from generators, other camping appliances or campers themselves. There is a need to separate campers who are seeking different experiences, regulate use of generators and implement curfews at certain sites to improve visitor experiences in the parks (see Section 27 Recreation Use – Active Recreational Use in the Parks – Surfing and Swimming).

Proposals for camping in the parks acknowledge that a range of camping opportunities is appropriate, providing visitors with more diversity and choice, and allowing visitors to be directed away from sites unable to sustain heavy use. Five classes of camping areas have been devised for the parks and are described in Appendix 12 (this may be further refined for the final management plan).

These areas will be provided throughout the parks as per Table 11. Other areas may be provided after more detailed planning and public consultation.

TABLE 11. Camping Areas within the Parks

Campsite	Type	Access	Management Setting
Existing sites			
Shannon Townsite Crystal Springs	Camping Ground Camping Area	2WD 2WD	A concentrated area of modified environment with a natural background with a range of facilities
Coodamurrup Beach Malimup Beach (Summertime Rd to Meerup River) Yeagarup Beach	Beach Camping Beach Camping Beach Camping	4WD 4WD 4WD	A predominantly natural area with basic facilities

Campsite	Type	Access	Management Setting
Existing sites that may require moving and/or upgrading of campsite type			
Warren River	Camping Area	canoe	A concentrated area of modified environment with a natural background with a range of facilities
Gardner River mouth	Camping Area	4WD	
West Firebreak Track Camp	Basic Campsite	4WD	
Coodamurrup (Moore's) Hut area (Moore's Track Campsite)	Camping Area and Basic Campsites	4WD	
Fish Creek area	Basic Campsites	4WD	
Lake Jasper	Camping Area	4WD	A mostly natural setting with low-key facilities
Black Point area	Camping Area	4WD	
Donnelly River – Mouth	Camping Area	Boat	
Oilwell Track	Camping Area and Basic Campsite	4WD	
Banksia Camp	Camping Area	4WD	
Long Point	Basic Campsite	4WD	
Little Long Point	Basic Campsite	4WD	
Twin Karris Beach	Basic Campsite	4WD	A predominantly natural area with basic facilities
Yeagarup Beach – Warren River to Donnelly River	Beach Camping and Basic Campsites	4WD	
Warren Beach Rd	Basic Campsite	4WD	
Warren Beach	Beach Camping and Basic Campsites	4WD	
Summertime Rd	Basic Campsites	4WD	
Broke Inlet mouth	Basic Campsites	4WD and boat	
West Broke Beach (between Broke Inlet mouth and Fish Creek)	Basic Campsite	4WD	
Coal Point Camp	Basic Campsite	4WD	
Broke South	Basic Campsite	4WD	
Opportunities			
Cable Sands proposed addition	Camping Ground	2WD	A concentrated area of modified environment with a natural background and a range of facilities
Donnelly River – Scott Rd	Basic Campsite	2WD and canoe	A mostly natural setting with low-key facilities
Jasper Beach	Beach Camping and Basic Campsites	4WD	A predominantly natural area with basic facilities
Shannon River	Wild Camping	walking	Remote natural area with no site modification and no facilities

Key Points

- There are many unplanned informal campsites and formal campsites at capacity within the parks with most of these being degraded by heavy use.
- Large organised groups require planned large campsites to minimise environmental and social impacts.
- There is a need to separate campers who are seeking different experiences, regulate use of generators and implement curfews at certain sites to improve visitor experiences in the parks.

- There is no booking system for any form of accommodation or camping within the parks.
- A better range and quality of camping opportunities are required.

The objective is to provide a range of quality camping opportunities in the parks whilst minimising environmental impacts and conflicts between users.

This will be achieved by:

1. Providing a range of camping opportunities and settings with varying physical, social and managerial conditions as per Table 11.
2. Restricting access to and rehabilitating any campsites being impacted by overuse or inappropriate use.
3. Considering a booking system for any campsites with restricted access or for campsites that require limiting of numbers.
4. Reducing the impact of campfires by implementing the campfire strategies outlined in Section 27 Recreational Use – Overnight Stays.
5. Developing a network of campsites for walkers in conjunction with long distance bushwalking opportunities provided in the parks.
6. Prohibiting the use of or restricting the operating hours of portable generators or battery charging plants at some sites and implementing noise curfews at other campsites when necessary.
7. Charging fees for camping at all sites other than within any future gazetted wilderness areas.
8. Providing information on the location of designated (formal) camping sites, facilities available and fees and charges to the public.
9. Permitting overnight accommodation on boats subject to conditions appropriate to the waterways concerned.

Key Performance Indicators 27.4 and 27.5 apply (Appendix 2)

Campfires

The weather along the south coast is often cold, wet and windy. A campfire not only provides warmth but also can provide a focal point for groups and encourage social interaction. To many campers, campfires are a traditional part of the camping experience. However, there are impacts caused by campfires, principally from the collection of firewood or the actual fire itself.

Firewood collection has detrimental effects on the natural environment, including loss of vegetation cover, reduction in habitat integrity, the spread of disease and possible changes to the nutrient balance of ecosystems. The area around fireplaces also suffer from vegetation loss and compaction, the accumulation of ash and the failure of groundcover to regenerate where there have been continuous campfires. Campfire escapes can lead to wildfires (see Section 22 Fire – History). Sites impacted by campfires and firewood collection can take many years to recover and regenerate. Hot ash and coals left on beaches after illegal campfires can also be a public health risk as burial does not preclude the material being unearthed and burning unwitting beach users.

Within the parks, campfires can only be lit in fire rings or appropriate containers. In the Shannon and D'Entrecasteaux national parks this is a significant problem as campers often light illegal and informal campfires even at formal campsites. Significant degradation can be seen at many campsites including tree stumps from felled trees and large fire scars.

The current observed impact of campfires and projected increases in visitation to the parks requires action to reduce future impact on the park environment. Alternatives such as fuel stoves are available and these are more efficient, quicker and cleaner for cooking and are ideally suited for 'wild' campsites. The provision of firewood for campfires at park entry

(mill-ends, or by-products of roading or logging operations) greatly reduces firewood collection in the parks. However, there are significant management costs associated with firewood supply.

Key Points

- Firewood collection can lead to significant loss of vegetation cover, reduction in habitats, the spread of disease and has the ability to change the nutrient balance of ecosystems.
- The lighting of campfires can impact site vegetation, be a public safety risk and can devastate large areas of the parks if campfire escapes occur.
- Campfires are only permitted in the parks in approved fire rings or containers.
- A significant problem in the parks is the continued collection of firewood from within the parks and the lighting of illegal ground campfires.

The objective is to reduce the impact of campfires on the parks' environment.

This will be achieved by:

1. Prohibiting any campfire not lit in provided fire rings or barbeques except in the case of beach camping. Campfires on beaches will be allowed in an approved container that completely contains the fire and lifts it from the ground (e.g. a cut down drum on bricks) and so long as all coals and fire wastes from fires are removed from the parks.
2. Prohibiting campfires totally at 'wild' campsites (fuel stoves can still be used).
3. Prohibiting firewood collection by the public within the parks.
4. Providing pre-visit information for visitors regarding the campfire policy in the parks.
5. Signposting areas of State forest on the approaches to the parks where firewood collection is permitted.
6. Placing fire rings at designated campsites where feasible.
7. Supplying firewood to entry points to the parks or at the more developed camping sites such as Camping Areas and Campgrounds (see Appendix 12 for definitions) where feasible.
8. Prohibiting campfires on days of Very High or Extreme fire danger.
9. Providing gas or electric barbeques to selected overnight and day use sites where feasible.
10. Educating the public on the impacts of firewood collection on the parks' values.

Key Performance Indicator 27.6 applies (Appendix 2)

Squatters' Huts

There are 62 squatters' huts located throughout the D'Entrecasteaux National Park. These huts were built on Crown land without legal tenure before the park was declared. Some of the older huts were built by pastoralists who brought cattle to the coast for summer grazing and by the former Forests Department for staff involved in forest assessment or manning fire lookouts. However, families or groups of friends currently use the majority of the huts on a private basis with only a few available to the public.

The Department is responsible for preventing any new huts being constructed within the parks. It is also responsible, in consultation with the Conservation Commission, for determining the future of existing squatters' huts within the D'Entrecasteaux National Park through this management plan.

There are seven key management issues that should be considered relating to squatters' huts in the D'Entrecasteaux National Park:

- the impact of the huts on conservation values;
- the impact of the huts on aesthetic values;
- the environmental health and safety risks;
- financial advantage for the hut dwellers in the national park;
- equity for visitors to the park;
- the heritage values; and
- the role they play in providing recreational opportunities.

The clearing of land associated with both the construction of huts and subsequent access, has impacted on the already fragile environments in which the huts are located. The majority of structures are on fragile coastal dune systems or riverbanks and this has often led to serious erosion, fire hazards and pollution of river systems.

Access to huts within the parks has resulted in vegetation clearing (decades ago), the introduction of weeds and other disturbances to the native vegetation. The introduction of pets with the occupants of the huts can disturb local fauna (see Section 30 Domestic Animals).

In terms of aesthetic values, the huts often occupy the most desirable coastal locations but can be unsightly and have generally been constructed without regard for proper building and health regulations. These dwellings can detract from scenic values and discourage public access to the coastal regions.

Sewage and household waste disposal systems in the huts are often primitive and can become serious health and pollution risks to river and estuary. Further, the huts will continue to deteriorate over time and pose a safety threat, with respect to loose tin and the presence of asbestos. The huts may be a structural safety threat to the occupants as well as visitors in the vicinity of the huts.

The hut dwellers can also been seen to have gained financially from the current situation. Previously they did not pay rental to the Crown or local authority, but had the free use of local facilities. The huts located at the mouth of the Donnelly and Gardner rivers have a prime position and create a visual and a physical barrier to other users. This is clearly not equitable.

The previous management plan for the parks allowed life-time leases to the hut dwellers near the mouth of the Donnelly River. However, life-time leases were determined to not be legally possible and the hut dwellers indicated collectively that they did not wish to be bound by the conditions outlined in the 1987 management plan as this precluded them selling their huts or passing them onto other family members. In 1990, the squatters negotiated new occupancy licences for the huts. The licences were to be current for a period of 7 years to 30 June 1997, with a further option of renewal to 2007 with these continuing until the new management plan is gazetted.

A State Government policy for the control of coastal squatters' huts was adopted in 1999. Under this policy, leases to a maximum of 6 years can be issued to existing hut occupiers after which the huts must be removed. The policy has been applied to the squatters' huts in the shires of Coorow, Carnamah, Irwin and Dandaragan. However, the policy excludes shacks situated on reserves subject to a management plan under the Conservation and Land Management Act, such as the huts in D'Entrecasteaux National Park. This management plan proposes that the management of squatters' huts in the D'Entrecasteaux National Park be in accordance with the principles of the Government policy.

Existing occupants of the squatters' huts in the D'Entrecasteaux National Park will be permitted to remain for a period of up to 6 years following the gazettal of the management plan if they enter into a lease arrangement with the Department, provided that there are no circumstances that require the huts to be removed sooner (e.g. for public safety). This 6-year period is to allow for reasonable usage, while deterring extensive improvements or redevelopment.

This 6-year tenancy is subject to the following conditions:

- the sites are to be left in a clean and tidy condition upon completion of occupancy and any cost of removal of the huts and rehabilitation of the site is to be borne by the hut 'owner';
- no further vegetation clearing or access improvements are to be undertaken;.
- no improvements or extensions to buildings are to be undertaken, apart from those sanctioned jointly by the local authority and the Department for safety or health reasons; and
- the payment of an annual lease fee to the Department (subject to Consumer Price Index movements) to cover the provision of public recreation facilities and other management requirements for hut areas.

This applies to all huts within the park with the exception of the two huts at Banksia Flats (Mottram's and Fisherman's huts). This ex-pastoral lease was purchased by the Department and added to the park with the agreement that the previous lessee would retain access to the two huts until 2015. A heritage study of the huts other than those at the mouth of the Donnelly River showed that some huts had heritage value (see Section 24 Non-Indigenous Heritage): Coodamurrup (Moore's) Hut, Bolghinup Hut and East's Hut (Heritage and Conservation Professionals 2000). These huts may be retained by the Department for cultural heritage and interpretative purposes.

The Department may also consider upgrading or modifying some of the huts to use as built accommodation sites for visitors as the opportunity to stay in simple built accommodation in natural surroundings is appropriate in some situations (see Section 27 Recreational Use – Overnight Stays and Section 28 Commercial Tourism Operations).

Key Points

- There are 62 squatters' huts in the D'Entrecasteaux National Park which are mostly used for private purposes.
- The huts currently impact on the conservation and aesthetic values of the parks and pose a public safety risk and are not consistent with the principles of equitable use of the parks.
- Management of the huts within D'Entrecasteaux National Park needs to be in general accordance with Government policy, therefore existing occupants of the huts will be allowed to stay for up to 6 years from the gazettal of the management plan if they take up a Conservation and Land Management Act lease.
- Some huts may need to be removed earlier due to public safety concerns or if the occupier refuses to enter into and abide by a formal lease.
- Some huts may be retained and/or modified/upgraded by the Department for public use or heritage reasons.

The objective is to retain useful huts or huts with recognised historic value and remove others that impact on other park values.

This will be achieved by:

1. Requiring a lease arrangement to be entered into as soon as the final management plan is gazetted, which will expire 6-years after gazettal (excluding the two huts at Banksia Flat, which will remain until 2015). The lease will include the condition that where required the cost of removal of the hut and rehabilitation of the site at the end of this 6-year period is to be borne by the leasee.
2. Introducing a lease fee indexed to the Consumer Price Index movements immediately following the gazettal of the management plan, in accordance with the State's coastal shack policy.
3. Allocating funding received by the District for leases and licences to management of

the hut removal program.
4. Inspecting the huts on an annual basis to determine whether they are in need of demolition within the 6-year lease period (if they not used regularly and in a poor state of repair).
5. Ensuring demolition of the huts if there is a refusal to accept the terms of the lease.
6. Registering heritage huts on the local Municipal Inventory or the State Register as appropriate.

28. COMMERCIAL TOURISM OPERATIONS

A commercial concession is a right granted, in consultation with the Conservation Commission, by way of lease or licence for occupation or access and use (respectively) of an area of land or water managed by the Department. Commercial concessions can increase the range of recreation opportunities and facilities within national parks. Commercial concessions must be consistent with the purpose of the park, the protection of its values and with the objectives of this plan.

Leases, which allow a lessee to occupy a particular area of land, are granted under section 100 of the Conservation and Land Management Act. A lease provides security to protect significant investments and may be up to 21 years with an option of a further lease up to 21 years. The length of a lease is usually proportional to the level of investment and the return on that investment. At present, there are no leases issued within the parks, although it is possible that future accommodation facilities will be developed through a lease arrangement. These may include development of overnight accommodation in the park (see Section 27 Recreational Use – Overnight Stays).

Licences allow operators to access and use lands and waters managed by the Department. All private tour operators conducting commercial tourist activities on conservation reserves are required to obtain a licence in accordance with the Conservation and Land Management Act. Licensing enables the Department to monitor access and use of lands and waters under its control, and ensure that the conservation values of these areas are maintained. By protecting these values, tour operators will be able to continue to visit areas maintained to the satisfaction of visitors.

The Department issues two types of licences, depending on the nature of the activity, the security of the resource, and the risk to the participants. 'T' Class licences are issued when the activity is open to many operators. In these circumstances, environmental and visitor management objectives can be achieved simply through appropriate licence conditions. The majority of tour operators fall into this category and examples include safari tours and guided walks. The term of the licence depends on the level of accepted tourism accreditation achieved by the operator. Currently the Department issues one-, three- and 5-year licences as follows:

- a 1-year licence is issued to an operator who is not accredited with any program;
- a 3-year licence is issued to an operator who is accredited with one tourism program. The operator can be accredited with a business accreditation program such as the National Tourism Accreditation Program or an ecotourism activity/product accreditation program such as the Eco Certification Program (formerly known as Nature and Ecotourism Accreditation Program); and
- a 5-year licence is issued to an operator who is accredited with two tourism programs such as a business accreditation program and an ecotourism activity/product accreditation program.

The Department can grant a licence for up to 5 years and renew it for the same period. There are 106 operators in D'Entrecasteaux National Park and 111 for Shannon National Park with 'T' Class licences (March 2004). Not all of these operators actually run tours in the parks. Most of the operators that do use the parks run vehicle-based tours across Yeagarup Dunes

and/or stop at developed recreation sites. A few commercial tour operators use less accessible areas of the parks.

The other type of licence issued by the Department is the 'E' Class licence. 'E' Class licences are issued where there are safety, environmental or management concerns and the number of licences needs to be restricted, such as with boat tours in confined areas. Generally 'E' Class licences are issued following a formal 'Expression of Interest' process. There are currently no operators with 'E' Class licences in the parks. Opportunities could include boat tours on the lower Donnelly or commercial horse-riding tours (see Section 27 Recreational Use – Active Recreational Use). In these cases, licences should be limited to one operator per activity and should be issued as 'E' class licences after an Expression of Interest process. The current operator conducting horse riding tours in the parks holds a 'T' Class licence but after this management plan has been approved, an Expression of Interest process should commence as soon as practicable. Conditions for commercial horse-riding will be formulated for the specific area to be used by the licensee and will include the basic conditions included in Appendix 13 along with the Department's normal commercial tour operators licence conditions.

Fees are associated with all commercial tourist activities conducted on lands or waters managed by the Department in the parks. Tour operators licensed to operate in the parks can be found on the Department's NatureBase webpage.

Key Points

- Tourism concessions can increase the range of services and recreational experiences within national parks.
- All commercial tour operators require a licence from the Department. Accreditation with a tourism program will enable a long-term licence to be issued.
- Leases may be issued to private operators to manage huts or other facilities on a commercial basis.

The objective is to ensure that commercial tourism activities are compatible with other park management objectives and to extend the range of services and recreational experiences available in the parks through the involvement of private enterprise.

This will be achieved by:

1. Considering tourism concessions that:
   - are consistent with the park vision (see Section 6 Vision) and management objectives;
   - facilitate park management; and
   - provide a service or facility to park visitors that the Department would not otherwise be able to provide.
2. Encouraging licence holders that operate in the parks to undertake tourism industry accreditation appropriate to their activities.
3. Investigating the establishment of camping and chalet accommodation locations as part of future commercial tourism leases at locations within the parks (e.g. at the Donnelly River mouth).
4. Not providing concessions within the parks if adequate facilities or services exist, or they can be developed outside the parks that meet visitor needs.
5. Ensuring any commercial recreation and tourism operations in the parks are cost-neutral to the Department.

29. VISITOR SAFETY

In addition to a genuine concern for visitor welfare, the Department has a legal responsibility to consider the personal safety and welfare of visitors to the public conservation estate. The Department aims to minimise the potential for injuries and misadventure to visitors, in a manner that does not render the environment sterile or unnecessarily diminish visitor use and enjoyment in the process. However, some activities (e.g. hang gliding, caving, abseiling and fishing from rocks) are considered high risk and are carried out at the visitor's own risk (see Section 27 Recreational Use – Active Recreational Use.

The Department often manages areas that are remote from emergency services, hard to access by emergency vehicles and not within mobile phone network coverage. The Department manages the risks presented to visitors by the natural, cultural and developed environments by implementing a visitor risk management program (Policy Statement No. 53 *Visitor Risk Management*), which includes:

- carrying out periodic safety audits of all park recreation sites, facilities and visitor services to identify and assess risks and potential hazards, using this information as part of the basis for preparing and implementing recreation site and facility maintenance programs;
- developing and maintaining a database to monitor the hazard condition of sites and facilities and the frequency, situation and type of injury and misadventure incidents that occur in the parks; and
- promptly investigating all reported visitor accidents and injuries on Departmental managed lands and waters and implementing appropriate risk mitigation measures.

The Department also works closely with the State Emergency Service, the Western Australian Police Service, St Johns Ambulance and volunteer fire brigades in managing visitor risk within the parks.

Rock fishing from areas within the parks such as at Black Point has resulted in a number of deaths by drowning, most recently in 2003. Unfortunately signage highlighting the danger of rock fishing or walking along some coastal areas is not always enough to stop people from taking risks. In doing so, they also place others at risk who may attempt to save them. Consequently there have been calls to provide or allow buoyancy devices in some of these areas. The Department is currently investigating the practicalities of this.

Key Points

- Visiting and enjoying natural areas can involve visitor risks either through the activity itself or by natural events (e.g. wildfire).
- The Department has a moral and legal responsibility to minimise visitor risk. It does this by implementing Departmental policy and a visitor risk program.
- Recreation sites are regularly audited to identify visitor risks.

The objective is to minimise risks to public safety associated with visiting areas managed by the Department while maintaining a range of visitor experiences wherever possible.

This will be achieved by:

1. Preparing and disseminating visitor risk management guidelines and providing assistance and training for staff and volunteers.
2. Applying industry standards and utilising appropriate expertise and quality of materials in the design and construction of facilities and structures.
3. Continuing to implement the Department's visitor risk management program.
4. Providing information (including signs where those hazards associated with structures, facilities or natural attractions may not be obvious) to enable visitors to consider risks in planning their activities in the parks.

5. Adopting codes of safe conduct for recreational activities within the parks (such as four-wheel driving, hiking, swimming, fishing, diving, and canoeing, as well as abseiling and caving where permitted) and promoting and publicising them as appropriate.
6. Develop protocols for visitors on what to do and where to go if caught in a wildfire in the parks.
7. Investigate methods of improved emergency communication within the parks.

Key Performance Indicator 29.1 applies (Appendix 2)

30. DOMESTIC ANIMALS

Domestic animals such as cats, dogs[8] and horses are not allowed in the parks (see Section 20 Introduced and Other Problem Animals and Section 27 Recreational Use – Active Recreational Use). However many people take their pets with them, particularly dogs, when they travel. This is a significant problem in D'Entrecasteaux National Park. It is important that dogs and other domestic pets are not taken into national parks as:

- domestic dogs and cats can predate on native fauna;
- the lasting scent left by dogs can scare some native fauna away. This can also affect the opportunity for visitors to interact with wildlife;
- domestic animals can increase the spread of weed species and also increase vegetation disturbance. For example, seed transmission through the digestion system of a horse can take up to 10 days (St John-Sweeting and Morris 1991);
- dog faeces carry diseases which can be harmful to wildlife and people;
- dogs can interfere with the enjoyment of other park visitors; and
- fox baits regularly used in national parks are poisonous to dogs (see Section 20 Introduced and Other Problem Animals).

Under special circumstances, domestic animals can be permitted in national parks under the Conservation and Land Management Regulations in 'designated areas'. There are no designated areas in the vicinity of the parks. The closest area to the parks where dogs are permitted are in the dog exercise areas at Windy Harbour (managed by the Shire of Manjimup). Extending this dog exercise area east into the national park may be investigated as there is a demand for additional dog exercise areas, however significant bird breeding areas near Gardner River need to be avoided. The implications on the fox baiting program also needs to be looked at.

Key Points

- Although domestic animals are not allowed in the parks, visitors bringing dogs into D'Entrecasteaux National Park remain a problem.

The objective is to protect the parks and visitors from the impact of domestic animals.

This will be achieved by:

1. Prohibiting dogs and other domestic animals entering the parks.
2. Promote the use of kennel facilities in neighbouring towns.
3. Investigating the feasibility of designating an area for dogs within D'Entrecasteaux National Park from the existing dog exercise area at Windy Harbour to 4 kilometres east of the township along the beach towards Gardner River.

[8] The exception is guide and hearing dogs for visually and hearing impaired visitors and specially trained dogs for search and rescue operations, which may be allowed in all areas.

PART F. MANAGING SUSTAINABLE RESOURCE USE

31. TRADITIONAL HUNTING AND GATHERING

Legislation recognises Aboriginal rights to hunt and fish for food. Under section 23 of the Wildlife Conservation Act, Aboriginal people are exempted from some of the provisions of the Act related to the taking of flora and fauna. Aboriginal people may take flora and fauna for food for themselves and their family from lands and waters, including Crown land, but not from nature reserves. The consent of the 'occupier' of the land is required. In the case of national parks and conservation parks, the consent of the Conservation Commission and the Department's Executive Director is necessary for Aboriginal people to hunt, fish or gather food for their own sustenance. Conditions associated with approval include:

- that the use of wildlife is sustainable;
- food taken is not sold;
- the activity does not impinge on the safety of others; and
- the activity is consistent with other land management objectives.

According to traditional Aboriginal custom, an Aboriginal person would also have to gain permission from the local cultural group before hunting or gathering in country outside their own area. Over the life of this plan the native title rights of Aboriginal people may change, including hunting and gathering. The Department will ensure conformity with any changes to legislation or Government policy during the life of the plan.

Key Points

- Aboriginal people may seek to hunt or gather from within the parks. Exemptions within the Wildlife Conservation Act allow this customary activity to occur provided certain conditions are in place.

The objective is to enable Aboriginal people to collect traditional foods within the parks where it is sustainable and does not pose a threat to the safety of other users.

This will be achieved by:

1. Allowing Aboriginal people to hunt and/or gather in the parks, provided:
   - they are either from a cultural group associated with the parks or have permission from Aboriginal people who can speak for the country;
   - have authorisation from the Conservation Commission and the Department's Executive Director; and
   - safety and sustainability issues have been discussed and addressed.
2. Ensuring that management conforms to any legislative or policy changes during the life of this plan.

32. MINING

Mining[9] on land and waters managed by the Department is subject to the *Mining Act 1978*, the *Petroleum Act 1967*, the Environmental Protection Act, the Wildlife Conservation Act and various State Agreement acts.

The exploration for, and subsequent mining of, minerals in Western Australia is primarily administered by the Department of Industry and Resources through the granting of various tenements including prospecting licenses, exploration licences and mining leases. The Department of Industry and Resources also administrates the exploration for, and subsequent extraction of petroleum resources through the granting of exploration permits and production licences. The holders of tenements are required to meet conditions to retain the right to explore and develop.

The Department of Industry and Resources refers projects that may potentially cause significant environmental impacts to the Environmental Protection Authority under section 38 of the Environmental Protection Act. The Environmental Protection Act takes precedence over most other acts. Under the Memorandum of Understanding between the Department of Industry and Resources and the Environmental Protection Authority all mining proposals wholly or partly within 2 kilometres of a national park, marine park, State forest or proposed conservation reserve will be referred to the Environmental Protection Authority for assessment. The Conservation Commission, the Department and individuals can also refer proposals for assessment. During the assessment process, the Department has the opportunity to comment on the impact of the proposals.

Further to this, the former Department of Minerals and Energy (now Department of Industry and Resources) produced an information booklet, the *Guidelines for Mineral Exploration and Mining within Conservation Reserves and other Environmentally Sensitive Areas* (Department of Minerals and Energy 1998). This document sets out the basic procedures and conditions to be applied to applications for mining tenements.

The Petroleum Act requires that no petroleum exploration/production will be approved within reserves vested in the Conservation Commission until the Minister for State Development (formerly Minister for Mines) obtains the recommendations of the Minister for the Environment.

In terms of the tenures of the planning area, the Mining Act requires that mining can be undertaken in national parks and State forest subject to the Minister for State Development obtaining the concurrence of the Minister for the Environment and in the case of national parks, the consent of both Houses of Parliament. The Conservation Commission provides advice to the Minister for the Environment.

However, mining is also subject to Government policy applicable at the time. At the time of publication, the State Government's policy is to prohibit mineral and petroleum exploration and extraction in national parks (and nature reserves). More specifically, the Government's position is that only applications lodged before 10 February 2001, for access to national parks (or nature reserves) for mineral or petroleum exploration or production, will be considered. It is also the Government's policy that there would be a net benefit to conservation involved in approving mining and petroleum exploration and extraction in conservation reserves. Net conservation benefits are determined on a case-by-case basis, but could include land additions and contributions to land management such as weed and/or feral animal control and rehabilitation.

[9] Mining includes exploration, fossicking, prospecting and mining operations.

Mining can be undertaken in 5(g) reserves subject to the recommendations of the Minister for the Environment and the Conservation Commission. Approval of the Minister for State Development is also required.

Mineral Resources and Prospectivity

Cable Sands (WA) Pty Ltd located an area of titanium mineralisation (mineral sands) in the Jangardup area adjacent to the boundary of the D'Entrecasteaux National Park in the early 1990s. Further exploration (200 kilometres of drilling within D'Entrecasteaux National Park) found that the orebody extended further south (referred to as 'Jangardup South'). The mineralisation is similar in size and relative value to the nearby Jangardup mine which opened in 1994 and is at the end of its productive life.

In 1994, Cable Sands proposed to the Government to excise Jangardup South (368 hectares) from D'Entrecasteaux National Park and create a 5(g) reserve along with 32 hectares of private property. The proposal is the subject of the *Reserves Bill 1995*, which was passed by State Parliament. The Bill involves offsetting the national park land excision with the ceding of a 1083 hectare parcel of land north of Lake Jasper to the Department (vested in the Executive Director). Cable Sands still have exploration and mining rights over this parcel of land.

Part of the northern portion of the 5(g) reserve has been mined as part of the Jangardup mining activities and has since been rehabilitated. This land is due to be returned to D'Entrecasteaux National Park when the Environmental Protection Authority and the Department sign off on the rehabilitation.

Approval has not yet been given for the mining of the remainder of the 5(g) reserve. In the event that it is not approved, the 1083 hectare land parcel will transfer back to Cable Sands and the 5(g) reserve will be incorporated back into D'Entrecasteaux National Park. Therefore, the rehabilitation and/or recreation development (see Section 27 Recreation Use – Overnight Stays) of the parcel of land is ultimately dependent on mining being approved in the remainder of the 5(g) reserve. Both the 5(g) reserve and the parcel of land in the meantime will be managed as if they were national park and subject to the provisions of this management plan (see Section 3 Management Plan Area). The 1083 hectare parcel of land vested in the Executive Director of the Department is referred to as the 'Cable Sands addition' throughout the plan.

An Environmental Review and Management Program is being prepared by Cable Sands in accordance with requirements under Part IV of the Environmental Protection Act. As part of the Review, Cable Sands has undertaken geological, hydrological and environmental assessments of the area to address any possible impacts of the proposed Jangardup South mine on neighbouring park values. Appropriate Aboriginal heritage surveys will also need to be conducted at Jangardup South (Ministry for Planning 1997).

A small agricultural-lime quarry (1.3 hectares) located approximately 1.5 kilometres north-west of Windy Harbour has been operating since 1972 under the provisions of the former *Mining Act 1904* (Mineral Claim 70/13595) when the surrounding area was vested in the Shire of Manjimup for 'recreation and camping'. In 1984, the surrounding area was set aside as part of the D'Entrecasteaux National Park. Since then, various concerns about the operation have been raised with respect to the inability to apply appropriate conditions under the Mining Act 1904. It is estimated that the pit has a remaining life of 30 to 35 years with an approximate capacity of 3500 tonnes of lime per annum. In addition to the localised disturbances of the pit itself, other impacts associated with the quarry include management of the haulage roads through the parks to provide access to the minesite.

A transitional mining lease under the Mining Act 1978 was applied for in 1983, but has not processed for various reasons including, most recently, the need for the proponents to obtain native title clearances. However, following the Miriuwung Gajerrong Native Title High Court determination of August 2002, native title is considered to be extinguished on reserves

vested under the *Land Act 1933*, prior to 23 December 1996. Therefore, the proponent should now be able to obtain a mining lease under the 1978 Mining Act. Grant (transition) of the mining lease requires the concurrence of the Minister for the Environment and approval of both Houses of Parliament. Alternatively, the tenement could be excised from the park before the grant is made, but the Department does not see this as desirable.

Two petroleum exploration titles cover those parts of the parks underlain by Perth Basin sediments. Three oil wells were drilled along the Warren River in 1902, which were the first oil wells in the State. However not much seismic surveying has been conducted to evaluate the hydrocarbon potential of these areas.

Petroleum exploration licences and mining tenements in the parks are shown in Table 12.

TABLE 12. Mining Tenements and Petroleum Exploration Licences within the Parks

Tenement	Holder	Status	*Area within Parks (ha)			Target Resource
			DE NP	5(g)	CSA	
Mineral Exploration Licences						
E70/398 E70/588 E70/589	Cable Sands WA Pty Ltd	Granted	 <1	 215 177	583	Titanium mineral deposits
E70/2534 E70/2464	Metal Sands Ltd	Pending	1702 1550	196 204	769 219	Titanium mineral deposits
Mineral Claim (under Mining Act 1904)						
MC70/13595	DM, GJ, HF, HH& KE Jackson	Granted	1.3			Limestone
Mining Leases						
M70/993 (overlies E70/588 & 589) M70/974	Cable Sands WA Pty Ltd	Pending	<1	219	 583	Titanium mineral deposits
M70/997# M70/362 M70/363	Cable Sands WA Pty Ltd	Granted	 1 162	8.1 <1 <1		Titanium mineral deposits
M70/48	DM, GJ, HF, HH& KE Jackson	Pending	1.3			Limestone
Petroleum Exploration Licences						
EP381	Geopetro Resources, Southern Amity Inc.	Granted	3972			Petroleum and gas
EP416	Empire Oil Company (WA) Ltd	Granted	24 992	400	1083	Petroleum and gas

* the areas are either D'Entrecasteaux National Park – including pastoral lease and State forest additions, the 5(g) reserve or the Cable Sands addition
# this part of the 5(g) reserve has already been mined and was rehabilitated 2002 to 2003 and is to be reincorporated into D'Entrecasteaux National Park when the rehabilitation is deemed acceptable by the Environmental Protection Authority and Department

Approvals for mining within or adjacent to the parks will be expected to include contributions to national park management in accordance with the net conservation benefit principles. Such benefits could include properties that are enclaves within the boundaries of D'Entrecasteaux National Park as additions to the National Park (see Section 3 Management Plan Area).

Basic raw materials including gravel, shale, sand, clay and limestone are sometimes sourced by the Department from within the parks and used for park maintenance activities. Others can only use basic raw materials sourced within the parks if no other resource is reasonably available and the work benefits the management of the parks.

Key Points

- Mining is not permitted in national parks unless approved by both Houses of Parliament.
- Exploration, mining and petroleum/gas production activity within or adjacent to the parks may have a significant impact on national park natural and cultural values.
- There are 12 mining tenements and two petroleum exploration licences within the parks.
- There is a small lime quarry in D'Entrecasteaux National Park near Windy Harbour and a large mineral sands operation north of the park near Lake Jasper.
- In 1994, 368 hectares were excised from D'Entrecasteaux National Park and along with 32 hectares of private property made a 5(g) reserve in a conditional exchange for 1083 hectares owned by Cable Sands. Part of the 5(g) reserve has already been mined and rehabilitated. Cable Sands propose to mine the remainder of the 5(g) reserve subject to the Environmental Review and Management Program, Environmental Protection Authority advice and a decision by the Minister for the Environment.
- Basic raw materials including gravel, shale, sand, clay and limestone are sometimes sourced from within the parks and used for park management activities.

The objective is to minimise the impact of exploration and resource extraction within and adjacent to the parks on values of the parks.

This will be achieved by:

1. Ensuring proposed mineral sands operations on the 5(g) reserve do not adversely impact on the cultural, ecological and biological integrity of Lake Jasper Wetland System.
2. Incorporating the 5(g) reserve back into D'Entrecasteaux National Park either as mining and rehabilitation is undertaken (along with the land vested with the Executive Director), or alternatively if the mining proposal is withdrawn.
3. Providing formal advice to the Environmental Protection Authority and the Department of Industry and Resources in relation to environmental assessments of proposed exploration and mining activities within or adjacent to the planning area.
4. Ensuring that any mining or exploration activities that have the potential to impact on parks' values are subject to the Conservation and Land Management Regulations and other relevant Government policy are strictly adhered to for appropriate operating procedures.
5. Ensuring that all sites in which any mining activity occurs are rehabilitated according to Department rehabilitation standards and guidelines.
6. Ensuring all mining companies carry out stringent disease control.
7. Liasing with the Department of Industry and Resources and the holders of the agricultural-lime quarry north-west of Windy Harbour to bring their operations under the current mining protocols of the 1978 Mining Act.
8. Considering natural, cultural and landscape values in selecting sites for basic raw materials extraction
9. Only allowing basic raw materials sourced within the parks to be used by others if no other resource is available and the work benefits the management of the parks.
10. Closing and rehabilitating existing exhausted pits.

33. COMMERCIAL FISHING

The commercial fishing industry relies on selected beaches along the south coast (ocean-based fishery) and a number of major inlets (estuarine-based fishery), including Broke Inlet.

The ocean-based fishery is based on the salmon and herring season (February to April), rock lobster season (November to June) and shark, deep-sea and abalone fishing. The estuaries are usually fished commercially from May to October. The majority of operators hold several fishing licences and fish on a year-round basis.

While fishing operations take place outside the parks (off shore or in Broke Inlet), land-based operations such as power-boat servicing, launching and catch transfer may take place in the parks (or at Camfield for Broke Inlet). Therefore, the use of vehicles, power generators and other equipment can affect park values.

A commercial, ocean-based fishery operates from Windy Harbour and adjacent to Gardner Beach. Other fishing operations occur out of Windy Harbour on a seasonal basis. A salmon-fishing concession is held for the Gardner Beach area, which involves considerable use of vehicles on the beach. All operators mostly use Windy Harbour reserve for accommodation and do not camp in the parks.

The Department of Fisheries controls all fishing operations. The Department's Policy Statement No. 51 *Access for Commercial Fishing through CALM Lands* recognises that existing rights of access will be maintained unless problems related to environmental degradation or conflict with visitor access and use occur.

Key Points

- The commercial fishing industry relies on selected beaches along the south coast including Gardner Beach and a number of major inlets, including Broke Inlet.
- The use of vehicles, power generators and other equipment can affect conservation values of the parks and the experience of other park users.
- The Department of Fisheries controls all fishing operations, however the Department controls access through the parks.

The objective is to continue to allow access for commercial ocean and estuarine fishing subject to conditions that minimise the on-shore impacts on values of the parks and park visitors.

This will be achieved by:

1. Ensuring the on-shore environmental and social impacts of fishing operations within the parks are minimised.
2. Using Departmental guidelines to control access for commercial fishermen through the parks.
3. Liaising with the Department of Fisheries to ensure that any changes to fishing operations do not adversely affect the values of the parks or experiences of the users.
4. Not permitting any new access tracks within the parks for commercial fishery use.

34. DEFENCE FORCE TRAINING

The policy on defence force training on Departmental managed estate recognises that it is an acceptable use of some lands and waters (Policy Statement No. 54 *Defence Force Training on CALM Managed Lands and Waters*). This can also apply to emergency services training. However, some activities can conflict with the conservation objectives and recreation values of the Department managed estate. For this reason, some activity types are not generally

appropriate in certain categories of the Department managed lands and waters such as nature reserves.

Activities that have occurred in the parks include survival and navigation exercises, driver training, leadership and search and rescue training. Generally, communication between the Department and the defence forces is good and the activities are carried out in appropriate areas and in a manner unlikely to cause damage to park values or disruption to visitors.

Defence force training activities will be assessed on an individual basis against the criteria detailed in the policy, so that the particular requirements of each exercise can be considered, impacts assessed and appropriate conditions applied. In order for proper consideration to occur, the defence force unit or unit training coordinator must make written application to the Regional or District Manager at least three months before the proposed exercise.

Key Points

- Defence training is a legitimate activity but must be carried out in appropriate areas and in an environmentally sensitive manner.
- Activities will be assessed on an individual basis and a written application has to be made to the Department before any training exercise can be carried out in the parks.

The objective is to minimise the impact of defence force and/or emergency service training exercises in the parks.

This will be achieved by:

1. Continuing to liaise with the Defence forces, and other organisations likely to conduct emergency services training exercises in the parks, and encouraging them to seek alternative suitable venues outside the parks.
2. Ensuring any activities are carried out according to the prescriptions of Departmental policy.
3. Liaising with all organisations likely to conduct training exercises regarding the adoption of minimal impact techniques during training exercises in the parks.
4. Prohibiting training exercises in sensitive areas likely to be damaged by the activities.

35. SCIENTIFIC AND RESEARCH USE

The natural and cultural values of national parks make them highly desirable sites for research. Research activities by external agencies or research centres are supported where they contribute to the understanding of natural or social processes within the area, and where such activities do not themselves threaten or disrupt these processes. This information is of value to the Department in refining management operations.

Wildlife research by external researchers operates under a permit system managed by the Department's Wildlife Branch. It is a condition of the permit system that results are forwarded to the Department. However, occasionally research is undertaken by external researchers that does not require a wildlife research permit (e.g. social research) and goes undetected by the Department.

The Department is working to further develop relationships with universities to conduct social research in the region, principally through the Nature-Based Tourism Research Reference Group. This group comprises representatives from the Department and all Western Australian universities. The group assists regions and districts of the Department find university researchers to deliver management solutions to recreation/tourism issues. Projects are usually put forward by field staff and listed on the Department's NatureBase webpage.

For more information on scientific research to be undertaken by the Department see Section 44 Research and Monitoring.

Key Points

- National parks are a valuable resource for a wide range of research projects undertaken in the state.
- Wildlife research within the parks requires a permit from the Department's Wildlife Branch.
- The Nature-based Tourism Research Reference Group provides a link between universities and the Department in carrying out recreation and tourism research.

The objective is to encourage and assist external researchers where the outcomes are relevant to the Department.

This will be achieved by:

1. Assisting, wherever possible, external agencies and individuals where their research contributes directly to Departmental strategies, output business plans and the auditing of this management plan.
2. Applying a permit system for research proposals from outside the Department that specifies conditions under which work may be carried out and results disseminated.
3. Continuing to issue permits for wildlife research within the parks as appropriate.
4. Proposing nature-based tourism research projects through the Nature-based Tourism Research Group for listing on NatureBase.

36. PUBLIC AND PRIVATE UTILITIES AND SERVICES

Utility corridors are often requested so that electricity, gas, telephone and water services can be provided to enclaves of private property within the parks, or as the most direct route for these services to other nearby lands. The construction and subsequent maintenance of these corridors, as with all access routes, can result in impacts on scenic quality, soil erosion, the introduction of weeds and disease as well as create problems for managing visitor access.

The privatisation of telephone, power and gas services may lead to duplication of 'public' utility corridors in or adjacent to the parks. In addition, more requests for telecommunication towers and co-location on Departmental structures for radio and/or telecommunication communications are being made. It is recommended that no new non-Departmental structures are permitted within the parks. Co-location on existing structures may be allowed in the parks as long as any ancillary equipment shelters or ground works associated with the proposal are contained within an existing lease area or disturbed area, and any on-ground works can be managed without long-term impact on the parks' values.

An Infrasound Monitoring Facility within the Shannon National Park has been approved on a lease basis as part of an international network of stations monitoring a ban on nuclear testing. Conditions placed on the facility were that it had to be in a remote situation with dense undergrowth to reduce background noise and disturbance over the expected 100-year life of the project. The site will be managed during installation of the facility and through ongoing Commonwealth management of the area to ensure environmental impacts are minimised.

Key Points

- Utility corridors provide power or telephone services to enclaves of private property within the parks, or are a direct route for these services to other nearby lands.
- Impacts of construction and maintenance of these corridors include degraded landscape values, soil erosion, weed introduction, disease spread and associated

access problems.
- Specific sites may be sought within the parks to provide radio and/or telecommunications facilities to public or private agencies.
- An Infrasound Monitoring Facility has approval to be built within the Shannon National Park.

The objective is to minimise the impact of public and private utilities and services on the values of the parks.

This will be achieved by:
1. Ensuring that public and private utilities can demonstrate that alternatives to corridors or sites within the parks have been considered prior to seeking approval from the Department.
2. Not permitting any new non-Departmental communication towers to be constructed within the parks, and assessing other proposed corridors or sites against the potential impacts on landscape and natural values.
3. Permitting co-location on existing communication structures as long as any ancillary structures such as equipment housing and ground works do not impact in the long-term on the park's values.

37. REHABILITATION

Rehabilitation is the establishment of a stable, self-regulating ecosystem following disturbance, consistent with the purpose for which the area is managed. The requirement for rehabilitation on the public conservation estate derives from either an inherited situation in which disturbance occurred in the absence of any commitment to rehabilitate, or as part of a planned management program. Rehabilitation may be required following additions to the parks, gravel pit working, road works, recreation site closure or redevelopment, or activities associated with fire suppression.

The Department's Policy Statement No. 10 *Rehabilitation of Disturbed Land* provides guidelines for the rehabilitation of lands managed by the Department based on the following principles:

- land should be managed as far as possible to avoid disturbance;
- rehabilitation should be the last option in a series of management decisions designed to protect environmental values; and
- rehabilitation should aim to restore original values and help to enhance all potential uses provided the priority uses are not adversely affected.

Where possible, local native species should be used for rehabilitation purposes. This ensures the greatest degree of success, enables new vegetation to blend into the existing environment, and limits the introduction of exotic (non-local) plants and disease. Sources of brushing material (branches of trees and shrubs used to stabilise mobile dune systems) should also be free of disease.

Key Points
- Rehabilitation of lands managed by the Department can be either an inherited problem or the result of a planned activity.
- Use of local native species during rehabilitation ensures the greatest degree of success, and preserves the biodiversity and landscape of the area.

The objective is to restore degraded areas to as near a natural state as possible.

This will be achieved by:

1. Rehabilitating, closing or relocating roads, tracks and other disturbed areas that have the potential to erode or impact on visual amenity.
2. Actively involving private and public groups and individuals in rehabilitation programs.
3. Ensuring local flora is used in rehabilitation schemes.

Key Performance Indicator 37.1 applies (Appendix 2)

38. BEEKEEPING

Commercial beekeeping has developed into a small but significant industry in Western Australia, with an average annual total income for honey production of $9.3 million and a total worth (including pollination of agricultural and horticultural crops) of approximately $120 million per annum (Manning 1992). Apiarists in Western Australia have traditionally relied on large areas of native vegetation for honey production, and are increasingly dependent on lands managed by the Department as other areas are cleared for urban development and agriculture.

For all apiary sites on Crown land in Western Australia (including land not managed by the Department), the apiarist must obtain a permit from the Department. As of June 2004, there were 3226 permits for apiary sites on Crown land. The majority of these sites are in the jarrah forest between Mundaring and Collie, the sandplains north of Yanchep to Geraldton, the woodlands of the Goldfields and Ravensthorpe Range, and the southern forest between Donnybrook and Walpole. Seventeen per cent (558 sites) are currently on conservation reserves managed by the Department with approximately a further 13% (412 sites) within proposed conservation reserves.

The Department's Policy Statement No. 41 *Beekeeping on Public Land* provides for general guidance for the management of apiculture on Crown land. This policy is currently under review. As part of current Departmental policy, a moratorium on new apiary sites in national parks has been in place since 1992. Under the draft policy the Department will maintain (and renew) current apiary site permits on all classes (tenures) of land, but permit no additional apiary sites on land currently or proposed to be reserved primarily for nature conservation purposes[10], until a management plan has been prepared. The Department, through the management planning process, will consider whether access for beekeeping is either retained at the current level, increased, decreased or phased out based on appropriate environmental and management criteria (Appendix 14). Thus the management planning process will identify suitable areas for beekeeping whilst minimising the potential impacts of honey bees (see Section 20 Introduced and Other Problem Animals).

Whilst it is recognised that feral honey bees are more of a threat to the values of conservation reserves than managed honey bees, there is little knowledge about the range of conditions under which honey bees leave the hive and become feral. It is suggested that feral populations can be eliminated from areas after unfavourable conditions, such as drought or fire, as long as there is not a constant supply of managed hive bees swarming into the wild (Scheltema 1981).

When allowing an introduced pollinator to persist within a conservation reserve, the dynamics between the native pollinators (which includes mammals, birds and insects) and the native flora and dependent fauna need to be considered. The abundance of the native bee species in the south-west (estimated in the 1000s) reflect the diversity and complexity of pollination mechanisms of the flora of the region, with almost half the plant species being primarily bee

[10] Lands reserved primarily for nature conservation includes national parks, conservation parks, nature reserves and 5(1)(g) and (h) reserves.

pollinated (Scheltema 1981). Further monitoring and research is required in the south-west to quantify the impacts of managed and feral honey bees within the natural environment.

There are currently 34 apiary sites in the Shannon National Park and eight in the D'Entrecasteaux National Park including proposed additions (April 2004 data). These sites are located approximately 3 kilometre apart. This distance, chosen by the industry, minimises honey bee interaction between sites and the potential transfer of honey bee diseases.

Each apiarist usually has a network of sites between Geraldton and Albany and moves the hives according to nectar flow cycles. During periods of low nectar flow in the south-west forests, the apiarists place their hives in the northern sandplain country where there are enough resources to maintain hive strength and viability during winter. Therefore, the sites within the planning area often go many years without being utilised.

Predicted impact between honey bees and values within the planning area have been assessed using the environmental and management criteria (Appendix 14). Consequently, the planning area has been categorised as being either:

- 'suitable' for apiary sites;
- 'suitable but conditional'; or
- 'highly constrained'.

Predicted interaction between apiary sites and threatened flora and significant habitats and communities within the planning area were made by Departmental experts and based on the best available knowledge at the time of publication.

Subsequent to the planning area being categorised into either one of the three levels of suitability for apiary sites, a review was made of the current sites within the planning area (Appendix 14). This review showed that 37 of the 42 current sites were within suitable but conditional areas and five within highly constrained areas. Two of the highly constrained sites are in close proximity to a threatened ecological community which has flowering plants that have been evaluated as being potentially impacted by honey bees on a year-round basis. Two other sites are in close proximity to a recreation site and the remaining site is in close proximity to a Class 1 or 2 walk trail as well as an environmental weed infestation that honey bees have been evaluated as assisting in increasing seed set.

Only a small part of the planning area was categorised as being suitable without additional conditions. New sites are permitted within these areas as long as there is existing access and according to the standard apiary permit conditions.

The 37 sites within suitable but conditional areas, may have additional conditions placed on the permit, to be determined by the District, and the Department's Nature Conservation, Science, and Parks and Visitor Services divisions. Examples of additional conditions may include seasonal restrictions, hive limits, structural modifications to the hives to restrict the queen, increased disease hygiene control and/or regular monitoring of the apiary site. New sites are permitted within these areas, subject to there being existing access.

The five sites that are highly constrained (867, 4029, 4262, 5081 and 5217) will be cancelled and relocated, where possible, in negotiation with the apiarists. This may include sites within the parks within areas evaluated as being suitable, or suitable but conditional or in an area outside of the planning area. No new sites are permitted within the highly constrained areas.

The current sites on Crown land within 2 kilometres of the planning area boundary were also assessed during the planning process. One site was found to be within 2 kilometres of a threatened ecological community within D'Entrecasteaux National Park. This site (5950) is recommended to be closed and relocated. Twenty other sites outside the planning area were identified that require additional conditions to protect the values of the planning area.

Whilst the approach outlined above will be maintained throughout the life of the plan, the methodology of categorising the planning area into classes of suitability will need to be adaptive over the life of this plan, to ensure that the criteria used are the best available, and the categorisation of the planning area remain in line with current knowledge of the planning area values. Any change in the categories of the planning area or criteria should ideally coincide with the time that the apiary permits are due for renewal.

Apiary sites adjoining the planning area and not on Crown land may also impact on its environmental values. Where a significant environmental impact to recognised values (e.g. threatened ecological communities) may occur, such proposals could be referred to the Environmental Protection Authority for assessment.

Further information on beekeeping, including the standard conditions for apiary sites, can be obtained from the Department's webpages: <http://www.naturebase.net/forest_facts/apiary/index.html>.

Key Points

- Beekeeping is a significant industry in the south-west and throughout Western Australia.
- Introduced honey bees may have an impact on the natural and recreational values of the parks, however feral honey bees are more of a threat to natural values than well managed honey bees.
- There are currently 34 apiary sites in the Shannon National Park and eight in the D'Entrecasteaux National Park and proposed additions.
- There will be a precautionary and pragmatic approach with regards to beekeeping in the parks.
- Areas of the parks have been assessed as being either suitable, suitable but conditional or highly constrained for apiary sites as per environmental and management criteria in Appendix 14.

The objective is to minimise the impact of introduced honey bees on values of the parks and park visitors whilst supporting the beekeeping industry within the State.

This will be achieved by:

1. Supporting research on the impact of beekeeping on native flora and fauna within natural ecosystems of the south-west and adapting management to incorporate new knowledge.
2. Renewing, with standard conditions, the permits for sites within areas identified as being suitable for apiary use and reviewing every 5 years.
3. Renewing, with additional conditions, the permits for sites within areas identified as being suitable but conditional for apiary use, and reviewing every 5 years.
4. Allowing new sites and transfer of sites within areas identified as being suitable or suitable but conditional, subject to the appropriate conditions.
5. Cancelling, and relocating where possible, apiary sites that are within the highly constrained areas, and not permitting any new sites in these areas.
6. Monitoring apiary use within the planning area and any corresponding impacts within the areas identified as suitable but conditional, to aid in the review process.
7. Controlling feral bees within the parks, where feasible (see Section 20 Introduced and Other Problem Animals).
8. Reviewing the criteria for determining suitability of areas, and consequently the categories of suitability within the planning area, used in this management plan, as new knowledge becomes available and/or as circumstances change.
9. Liaising with beekeepers (including through the Beekeepers Consultative Committee) and the Department of Agriculture to ensure the most efficient and sustainable use of sites.

10. Referring to the Environmental Protection Authority any proposal for an apiary site on adjoining private land where significant impacts may occur on the parks' values.

39. FOREST PRODUCE

In accordance with section 99A of the Conservation and Land Management Act, the Executive Director can grant a license to take forest produce[11], from national parks provided it is:

- to remove exotic trees;
- used for therapeutic, scientific or horticultural purposes; or
- for essential works.

Essential works include works that are required to establish or re-establish access to land or to provide a firebreak. Forest produce, including seed, that is taken in connection with essential works can be sold, or used by the Department. There are stands of introduced tree species such as yellow stringybark, which could be selectively logged from the parks and sold by the Department as forest produce.

The Department may choose to collect seed itself, for use within the parks. Using local seed and the subsequent regeneration of native vegetation is the preferred method of rehabilitation (see Section 37 Rehabilitation).

Key Points
- Various introduced species can be harvested and sold from the parks.

The objective is to allow the removal of forest produce in the parks for purposes permitted in the Conservation and Land Management Act.

This will be achieved by:
1. Prohibiting the removal of any native forest produce for commercial use from the parks (enforced by the Conservation and Land Management Act).
2. Harvesting introduced trees that do not have landscape value and retaining the royalties for park operations.
3. Removing trees that pose a threat to the public or facilities, or that obstruct designated access tracks and using these trees as much as possible for park management and facilities.
4. Rehabilitating with native flora any area where forest produce is removed, where necessary.

40. WATER RESOURCES

D'Entrecasteaux National Park has a purpose of 'national park and water' (see Section 3 Management Plan Area). Rivers of the D'Entrecasteaux National Park have been identified as being important future water resources in the region (I. Loh pers. comm. 2004).

Surface Water

In areas 'proclaimed' under the *Rights in Water and Irrigation Act 1914*, the Water and Rivers Commission ensures that water use is within sustainable limits, through a system of

[11] 'Forest produce' includes trees, parts of trees, timber, sawdust, chips, firewood, charcoal, gum, kino, resin, sap, honey, seed, bees-wax, rocks, stone and soil.

issuing licences for approved users. Within the parks, the Donnelly and Warren river catchments are proclaimed under the Act. Water can be taken from a watercourse in unproclaimed areas without a licence so long as the flow is not 'sensibly' diminished, thereby affecting the rights of downstream users. There are no licensed users of the surface water within the parks. The water for Camfield is obtained from rainwater tanks and Shannon Dam is used for water for Shannon townsite.

Outside the parks, in the upper reaches of the Warren and Donnelly rivers and their tributaries, there are approximately 40 licensed farm dams servicing the agricultural region (totalling 15 to 20 gigalitres per year). However, as stock and domestic water abstraction under 1500 kilolitres per year are exempt from the licensing process, and unproclaimed areas do not require licensing, there can be no accurate picture of total water abstraction in the upper catchments. The monitoring that the Water and Rivers Commission undertakes indicates that the current levels of abstraction are not producing significant effects on the environment.

Groundwater

Similarly, groundwater catchments are also proclaimed under the Rights in Water and Irrigation Act. The Blackwood Groundwater Area is a proclaimed groundwater area under the Act. Within the parks, the Blackwood Groundwater Area is in the Black Point/Lake Jasper area.

The Shire of Manjimup obtains water for Windy Harbour townsite from groundwater bores within D'Entrecasteaux National Park near Salmon Beach Road. The Water and Rivers Commission, as yet, do not require the Shire to obtain a licence for this activity as it is in a non-proclaimed area. The Shire of Manjimup has indicated that they would like to obtain security with regards to this water extraction activity.

Future Use

Whilst the purpose of D'Entrecasteaux National Park currently allows use of the water resources within the park, as part of the Water and Rivers Commission licensing process, the proponent would need approval from the land 'owner' (in this case the Conservation Commission) to access the land. Unless the Conservation Commission agrees to allow access to the proponent, no licensed use of the water resources could take place in the park. However, as the Water and Rivers Commission have the authority to investigate water resources, it is possible that exploration bores could be installed without the approval of the Conservation Commission or the Department.

There are several dairy farms in the Black Point area being planned (see Section 15 Soil and Catchment Protection) which will involve significant water abstraction and will be licensed by the Water and Rivers Commission under the Rights in Water and Irrigation Act as they are in a proclaimed groundwater catchment area.

There are general plans to introduce new public water supply dams in one or more of the upper catchments of the Warren, Donnelly and Gardner rivers in the next 25 years (I. Loh pers. comm. 2004), which may greatly impact on the flows of the rivers within the park. However these plans are not formalised and no details exist at present other than the plan to dam the Donnelly River within part of the proposed Greater Beedelup National Park. This dam may have the capacity to supply up to approximately 60 gigalitres per year (I. Loh pers. comm. 2004) and would significantly affect the flow within the Donnelly River in the park.

If the water resources within the park or in the upper catchments of the rivers in the park are to be used for further major agriculture or public water supply purposes, it is recommended that proposals are formally assessed by the Environmental Protection Authority.

Key Points

- D'Entrecasteaux National Park is reserved for 'national park and water' purposes although there is no licensed water abstraction within the parks at present.
- Some water abstraction occurs in the Warren and Donnelly River catchments upstream of D'Entrecasteaux National Park.
- No water abstraction could occur in the D'Entrecasteaux National Park without the Conservation Commission permitting access to the proponent.
- Long-term water abstraction proposals in the upper reaches of the rivers of D'Entrecasteaux National Park could affect flows in the park.
- Most of the Windy Harbour water supply comes from boreholes in D'Entrecasteaux National Park.

The objective is to minimise the impact of water resource use in the parks' catchments.

This will be achieved by:

1. Requesting that the Water and Rivers Commission liaise with the Department when investigating water resources in the parks to ensure that environmental impacts are minimised.
2 Referring any proposals for significant use of the water resources of the parks or in the upper catchments, to the Environmental Protection Authority for formal assessment.
3. Liaising with the Water and Rivers Commission to ensure sufficient environmental flows are maintained if damming occurs in the upper catchments, and that a monitoring program is instigated to determine environmental thresholds where abstraction is permitted.
4. Recommending to the Water and Rivers Commission that unproclaimed areas are examined to determine impacts of unlicensed water use on the values of the parks' rivers and groundwater resources with a view to proclaiming these areas.
5. Liaising with Shire of Manjimup and Water and Rivers Commission to ensure that water extraction for Windy Harbour is sustainable and does not impact on park values.

PART G. INVOLVING THE COMMUNITY

41. INFORMATION, EDUCATION AND INTERPRETATION

The parks provide a valuable opportunity for community education about coastal processes and landforms, wetlands, forests and cultural heritage. An effective information, education and interpretation program is vital to achieve the goals and objectives for the management of the parks. It informs the public of the attractions, facilities and recreational opportunities available, and assists the public to appreciate and understand the natural and cultural environments. It also fosters a sense of community ownership of the parks and engenders support for their management, while encouraging appropriate behaviour. For example, the facilities and signs within D'Entrecasteaux National Park are regularly vandalised, burnt or removed—appropriate education of park users on the values of the park and the need to manage the area to conserve these values for future generations could influence this antisocial behaviour.

The process of community education consists of three parts:

- Information – provides details of facilities, available activities, features and regulations and includes off-site promotion of the parks and brochures.
- Education – provides resources and programs designed specifically for various educational groups and includes teacher's resource packs, student work sheets and support materials.
- Interpretation – explains natural and cultural features and management activities to enrich visitor experiences and includes on-site signs, information shelters, brochures, and guided interpretive activities.

Education and interpretation programs will concentrate on raising awareness of the parks' conservation values and their vulnerability to human impact and the positive actions visitors can take to support the management of the parks. In addition, visitor risk information and information to assist visitors to navigate their way around the parks should be developed.

Interpretation for the parks is being done on a regional basis with an encompassing theme of experiencing the dynamic nature of the Warren Region in the deep south, from river catchments and tall forest to the coast. An additional three primary themes have been developed:

- discover a diversity of places and the dynamic processes that shape this region;
- explore the interrelationships within a variety of forest and other wildlife communities; and
- contemplate the connection of the many faces of people caring for this country.

Sites identified so far within the parks that would be suitable for communicating these themes include Point D'Entrecasteaux, Mt Chudalup, Lake Jasper, Yeagarup Dunes, Shannon River and Shannon townsite. More may be identified over the life of the management plan.

Existing education and interpretation programs include the Great Forest Trees Drive within Shannon National Park. The drive is assisted by radio and illustrated map-book and takes visitors through 48 kilometres of karri forest within the park (Map 12 Existing Recreation Use). There are six picnic and information stops provided, including details of the history of Shannon townsite, the birds, trees, flowers and mammals likely to be encountered within the park, and the effects of logging, fire, disease and farming on the area.

Education and interpretation programs linking the six parks within the Walpole Wilderness Area (including Shannon National Park) will also be developed.

Key Points

- The Shannon and D'Entrecasteaux national parks provide a valuable opportunity for community education about coastal processes and landforms, wetlands, forests, fire management and cultural heritage.
- Increased community ownership of the parks is needed to gain support for park management and to curb anti-social behaviour such as vandalism.

The objective is to promote community understanding and awareness of the conservation values of the parks and engender support for effective management of the parks.

This will be achieved by:

1. Developing and implementing a communication plan for interpreting the parks' values.
2. Developing a range of interpretation and education programs, facilities and media that highlights the natural and cultural heritage and management issues.
3. Liaising closely with other agencies, organisations and individuals (such as tourism agencies, tour operators, schools and museums) who have similar interests in interpretation of the parks' values.
4. Providing opportunities for visitors to make contact with Departmental staff and others involved with interpreting the parks' values.
5. Developing and implementing projects within the parks that will foster positive visitor attitudes to environmental issues.
6. Providing information at key access points to orientate and introduce visitors to the parks.
7. Disseminating 'Code of the Coast' information (see Section 26 Visitor Access) on park brochures, on appropriate information boards and tourist bureaux, and by erecting signs at the start of four-wheel drive tracks to the coast.

Key Performance Indicators 41.1 and 41.2 apply (Appendix 2)

42. WORKING WITH THE COMMUNITY

Community involvement is an integral component of the Department's operations. The community, as groups or individuals, is encouraged to be involved in both the planning and management of many of the Department's activities, including volunteer programs.

The community have been involved in drafting this management plan by providing initial comments on their perspective of the issues within the parks by way of written submissions and participation in issue workshops. In particular, interested community members have been invited to be part of the Shannon and D'Entrecasteaux Advisory Committee, which advised the Management Planning Team throughout the preparation of the draft management plan.

Ongoing community support is essential for the successful implementation of the management plan once finalised. The most important step will be to involve Aboriginal people, adjacent land owners, users, tour operators and interest groups.

Community groups are encouraged to take part in volunteer activities throughout the parks such as clean up days and help with management activities such as erosion control and track maintenance. Not only does the Department benefit from these activities, but the volunteers also gain meaningful and enjoyable experiences in an area of interest.

Key Points

- The community have been involved in preparing this plan and ongoing community support is essential for the successful implementation of this management plan once finalised.
- The Department supports voluntary activities, which contribute to achieving nature conservation and management objectives, and which build community awareness, understanding and commitments to these objectives.

The objective is to facilitate effective community involvement in management of the national parks.

This will be achieved by:

1. Continuing to involve interested local individuals and organisations in conservation and land management programs within the parks.
2. Continuing to support volunteer involvement in the Departmental programs by providing meaningful work.
3. Supporting the maintenance of a volunteer database.
4. Recognising the value of volunteers through a rewards and recognition program.
5. Encouraging the formation of a 'friends of' group for the parks.

Key Performance Indicator 42.1 applies (Appendix 2)

PART H. MONITORING AND IMPLEMENTING THE PLAN

43. ADMINISTRATION

The Department follows a purchaser–provider model to deliver operations on the ground, principally through nine regional centres that are further sub-divided into districts. The parks extend across two Districts (Frankland and Donnelly) of the Warren Region. The implementation of the management plan is the responsibility of the District Manager, Donnelly District.

The implementation of this management plan will be subject to Service Provision Agreements within the Department, determined annually but forecast over a 3-year period. The preparation of the Service Provision Agreements should involve including, where applicable, the recommendations for action within this management plan. Every effort will be made to attract external resources to assist in implementing the plan.

44. RESEARCH AND MONITORING

Research and monitoring are essential components of management, and are required to successfully implement this management plan. They can lead to a better understanding of the values of the planning area, increase knowledge, aid in performance assessment against the objectives of the management plan and provide a scientific basis for improving and adapting future management to achieve best practices.

The Department's Science Division undertakes research within the Region either with assistance from regional and work centre personnel or as part of larger state-wide projects. Additional internal research is conducted or facilitated by the Parks and Visitor Services Output, principally through the Visitor Satisfaction Survey, the Visitor Statistics Program, and the Nature-based Tourism Research Reference Group. The latter focuses on developing relationships with universities to facilitate nature based tourism research (see Section 35 Scientific and Research Use).

Research Requirements

It is appropriate that research and monitoring involves a wide range of organisations and groups. The involvement of volunteers, educational institutions and individual researchers can reduce research and monitoring costs, thereby helping to provide quality information for the benefit of the broader community.

Departmental research gives priority to:

- describing and documenting Western Australia's biological diversity;
- providing knowledge on how best to conserve the State's biodiversity; and
- increasing knowledge of visitor use patterns and profiles (e.g. demographics, level of use of recreation sites, visitor expectations and perceptions).

Allocating priority for research and monitoring may result in conducting programs that have relatively little direct management application to the planning area but significant direct application to the conservation estate and species or communities elsewhere.

Research itself has the potential to adversely impact upon the values of the planning area. Proposals for research should be assessed as to their suitability and be subject to appropriate conditions if necessary.

Research and Monitoring Projects in the Parks

In the case of this management plan, specific research projects should also assist in meeting the requirements of the Key Performance Indicators (Appendix 2). This will include gaining a better understanding of those values identified as being most at risk (sensitive to disturbance) and to management practices most likely to have adverse social and ecological impacts. Consideration of research projects that examine the impacts of unanticipated changes to conditions, such as adjoining land use, should also be given priority.

The following research and monitoring has been identified throughout the management plan.

- An integrated catchment management approach will be important in researching patterns and processes within the parks' catchment area in areas such as hydrology, water quality, soil quality and erosion (see Section 15 Soil and Catchment Protection).
- Further fauna surveys are needed to determine whether the threatened and specially protected fauna are still present in sustainable numbers (see Section 18 Species and Communities of Conservation Significance). Management will need to ensure that their habitats are conserved and consider specific requirements for each species particularly in relation to predation, fire regimes and plant disease occurrence. More surveying in the parks would give a more accurate picture of the actual numbers and populations of threatened or priority species within the parks.
- The distribution and abundance of introduced animals and environmental weeds is important (see sections 19 Environmental Weeds and 20 Introduced and Other Problem Animals). These species are recognised as having an impact on conservation values, and monitoring in association with control should be escalated in co-operation with pastoralists and adjoining property owners.
- The distribution and spread of plant diseases within the parks requires further research (see Section 21 Diseases).
- Fire management research depends on preliminary assessments of flora and fauna to determine the burning regime for each fire landscape unit. The hydrological impact and impact on potential acid sulfate soils/ organic rich wetlands of burning (if any) should also be assessed (see Section 22 Fire).
- Rehabilitation strategies for dune stabilisation and rehabilitation within the parks need to continue to evolve. These strategies may be undertaken effectively in association with community groups (see sections 35 Rehabilitation and 41 Working with the Community).
- Continuing social research is required to increase current knowledge by determining profiles of park visitors, the level of use of recreation sites, patterns of usage and visitor perceptions for future management.
- The impact of recreation and facilities on the environment of the parks should be monitored. The need for additional facilities will also need to be monitored, taking into consideration population changes in nearby areas, visitor management settings and access.
- Social research and monitoring projects should determine if recreation, environmental education and interpretation activities are meeting visitor needs. The impacts of all activities should be monitored, and changes to management made if any impacts are unacceptable.

Key Points

- In order to implement this management plan and achieve the objectives contained within, research and monitoring is required to improve understanding of the parks' values and aid in performance assessment.
- Future management of the parks will be adaptive based on increased knowledge and understanding of the values and processes within the parks.

The objective is to increase knowledge and understanding of flora, fauna, natural processes, and visitor use to provide for better management of the parks and to measure the performance of the management plan.

This will be achieved by:

1. Conducting research and monitoring, as resources permit and according to priority, that focuses on issues and key values required to report on this management plan, the establishment of baseline information and in assisting the implementation of this management plan. This may include:
   - Surveying native flora and fauna within the parks to develop more complete species lists (see sections 16 Native Plants and Plant Communities, and 17 Native Animals and Habitats).
   - Assessing the threats to the parks by surveying the extent of weeds, feral animals and plant diseases within the parks (see sections 19 Environmental Weeds, 20 Introduced and Other Problem Animals, 21 Diseases).
   - Supporting research programs into the control of feral animals (see Section 20 Introduced and Other Problem Animals).
   - Assessing the impact of fire on weeds, regeneration and wetlands (see Section 22 Fire).
   - Identifying the fire-sensitive flora within the parks and the minimum fire interval for different areas based on ensuring no extinctions occur (see Section 22 Fire).
   - Determining fire tolerance of rare and priority flora (see Section 22 Fire).
   - Conducting research into the specific habitat requirements of selected threatened or restricted fauna (see Section 18 Species and Communities of Conservation Significance).
   - Researching the impacts of catchment land-use and management practices on ground and surface waters and soil quality within the parks (see Section 15 Soil and Catchment Protection).
   - Conducting research into different rehabilitation strategies (see sections 15 Soil and Catchment Protection and 37 Rehabilitation).
   - Monitoring the impact of recreation and facilities on the environment of the parks (see Section 27 Recreation Use).
   - Implementing an integrated program of social research, survey and monitoring within the parks to determine visitor numbers, patterns, preferences and perceptions, and to assess levels of satisfaction with park management (see Section 25 Recreational Opportunities – Visitor Numbers and Trends).
2. Identifying and initiating other integrated research and monitoring programs, as resources permit and according to priority, that facilitate management of the planning area.
3. Regional and District staff liaising with relevant staff from other Divisions to determine research priorities, and documenting these in Service Provision Agreements.
4. Providing information gained through research, monitoring and experience to the District and Region where it can be stored in Regional and District office libraries.
5. Developing and maintaining a database of historical, current and required research on the planning area.
6. Incorporating research and monitoring findings into interpretive and educational material where appropriate.
7. Encouraging and supporting, wherever possible, external agencies, institutions, volunteers, individuals and other organisations to carry out research and monitoring projects where this contributes directly to the management of the planning area or the delivery of Departmental strategies and Divisional business plans.
8. Ensuring that research and monitoring activities do not adversely impact on the values of the planning area.
9. Pursuing external funding sources to assist in achieving research and monitoring objectives.
10. Adapting management of the parks, as needs be, according to increases in knowledge of the values and processes of the parks and adjacent areas.

Key Performance Indicator 44.1 applies (Appendix 2)

45. TERM OF THE PLAN

The Shannon and D'Entrecasteaux National Parks Management Plan is for a period of 10 years from the date the management plan is approved. At the end of the 10-year period, the management plan may be reviewed with full public consultation and re-submitted by the Conservation Commission to the Minister for the Environment for approval. The Conservation and Land Management Act also specifies that in the event of such a revision not occurring by the end of the management plan's specified life-span, the plan will remain in force in its original form, unless it is either revoked by the Minister or a new plan is approved.

GLOSSARY

1080	A naturally occurring toxin (sodium fluoroacetate) found in many native south-west Western Australian plants known as 'poison peas' (*Gastrolobium* sp.)
Acid peat flat	A large level area with acidic, humus-rich soil that contains a large amount of peat
Acid Sulfate Soils	The common name given to soils containing iron sulfides
Adequate	In terms of a comprehensive, adequate and representative protected area reserve system; adequate enough to maintain the ecological viability and integrity of populations, species and communities
Aquatic	Living or growing in or on water
Aquifer	A layer of rock which holds and allows water to move through it, and from which water can be extracted
Autonomous	Existing or capable of existing independently
Benthic	Occurring at, or relating to, the bottom of a body of water
Biodiversity	The variety of all life forms: the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form; often considered at three levels: genetic diversity, species diversity and ecosystem diversity
Biogeography	The study of both geography and biology including the relationships between plants, animals, soils, water, climate and humans
Biotic	Of, or relating to living things; caused or produced by living organisms
Calcarenite	Composed of or containing calcium compounds, particularly calcium carbonate
Catchment	The surface area from which water runs off to a river or any other collecting reservoir
Commercial concession	A lease or licence, administered by the Department to conduct commercial operations on lands or waters held by the Conservation Commission or the Marine Parks and Reserves Authority
Comprehensive	In terms of a comprehensive, adequate and representative protected area reserve system; comprehensive enough that the full range of ecosystems recognised at an appropriate scale are reserved
Conservation	The protection, maintenance, management, sustainable use, restoration and enhancement of the natural environment
Critical weight mammals	Mammals weighing between 35 grams and 5 kilograms. These Australian mammals have been the most affected by environmental changes following European settlement
Cryogenic storage	Storage at very low temperatures
Declared rare flora/fauna	Threatened flora or fauna gazetted under the Wildlife Conservation Act
Declared species	Either plants that are declared as weeds or animals that are declared as pests. A list of declared species, with their levels of declaration in various areas of the State is published annually in the Government Gazette pursuant to section 37 of the *Agricultural and Related Resources Protection Act 1976*
Dieback	A disease of plants caused by the infection by the soil-borne fungal-like water mould of the genus *Phytophthora*
Disjunct	Separated or disjoined populations of organisms. Populations are said to be disjunct when they are geographically separated from the main range
Ecological community	An integrated assemblage of species that inhabit a particular area
Ecosystem	A community or an assemblage of communities of organisms, interacting with one another and the environment in which they live
Ecotone	A sharp boundary between adjacent biological communities
Eco-tourism	Tourism focused on appreciation of ecological values, such as to see particular biota or to visit national parks and other reserves
Endemic	Flora or fauna that is confined in its natural occurrence to a particular region
Environmental weed	An unwanted plant species growing in natural ecosystems that modifies natural processes, usually adversely, resulting in the decline of the communities they invade; usually an introduced plant
Estuarine	Relating to a water passage where the tide meets a river current; especially an arm of the sea at the lower end of a river
Eutrophication	The enrichment of water by nutrients, such as compounds of nitrogen or phosphorus. It causes an accelerated growth of algae and higher forms of plant life. These consume more oxygen often leading to a oxygen deficit, which can have a major detrimental effect on the fish other aquatic organisms
Exotic	A species occurring in an area outside its historically known natural range as a

	result intentional or accidental dispersal by human activities
Extant	Still existing
Fauna	The animals inhabiting an area; including mammals, birds, reptiles, amphibians and invertebrates. Usually restricted to animals occurring naturally and excluding feral or introduced animals
Feral	A domesticated species that has become wild
Fireline	A mineral earth break between the fire and the area you are trying protect
Fire regime	The combination of season, intensity, interval, extent and patchiness of fire in a given area over time
Floodplain	A plain bordering a watercourse and subject to flooding
Flora	The plants growing in an area; including flowering and non flowering plants, ferns, mosses, lichens, algae and fungi (although fungi are strictly speaking not plants). Usually restricted to species occurring naturally and excluding weeds
Floristic diversity	Diversity relating to plants
Fungus	Saprophytic and parasitic spore-producing organisms usually referred to as plants that lack chlorophyll but actually a separate kingdom to plants and animals and include moulds, rusts, mildews, smuts, mushrooms, and yeasts
Genetic	To do with the hereditary units that are composed of sequences of DNA
Geography	The science of the Earth's form, physical features, climate and population
Geoheritage	State-wide to nationally significant features of geology, including igneous, metamorphic, sedimentary, structural, palaeontologic, geomorphic, pedologic or hydrologic attributes that offer important information or insights into the formation or evolution of the continent; or that can be used for research, teaching or as a reference site
Geology	The study the history of the earth and its life especially as recorded in rocks
Geomorphology	The study of the earth surface features and their formation
Germplasm	The genetic material with its specific molecular and chemical makeup that comprises the physical foundation of the hereditary qualities
Groundwater	All free water below the surface in the layers of the Earth's crust
Habitat	The place where an animal or plant normally lives and reproduces
High Water Mark	In relation to tidal waters means highest level of water at spring tides
Holocene	The present geological time period commencing 12 000 years ago
Host	The organism from which a parasite obtains its nutrition or shelter
Hydrology	The scientific study of the characteristics of water, especially of its movement in relation to the land
Indigenous	Native or belonging naturally (to a place)
Inorganic	Involving neither organic life nor the products of organic life
Karst	A limestone region with underground streams and many cavities caused by dissolution of the rock
Introduced species	See *Exotic*
Invertebrate	Animals without backbones, for example, insects, worms, spiders and crustaceans
Landform	All the physical, recognisable, naturally formed features of land having a characteristic shape; includes major forms such as a plain, mountain or plateau, and minor forms such as a hill, valley or alluvial fan
Landscape	Appearance or visual quality of an area determined by its geology, soils, landforms, vegetation, water features and land use history
Landscape Character Type	A broad scale area of land with common visual characteristics based on landscape
Lithology	The study and description of the general, gross physical characteristics of a rock, especially sediments composed mainly of broken fragments of pre-existing minerals or rocks that have been transported from their places of origin, including colour, grain size, and composition
Low Water Mark	In relation to tidal waters means lowest level of water at spring tides
Macropod	A member of a superfamily which includes kangaroos, rat-kangaroos and wallabies
Mesic	Of, or adapted to, a temperate, moderately moist habitat
Microbes	Micro-organisms, especially bacteria that cause disease
Microbial	Involving or caused by microbes
Midden	A mound or deposit containing shells, animal bones, and other refuse that indicates the site of a human settlement
Morphology	The form and structure of an organism or one of its parts
Motile	Exhibiting or capable of movement
National Park	National parks have national or international significance for scenic, cultural or biological values, and can accommodate recreation without detracting from these values. They are managed to conserve wildlife and the landscape for scientific

	study and to preserve features of archaeological, historical or scientific interest. They are also managed to allow forms of recreation that do not adversely affect their ecosystems or landscapes
Naturalised species	Introduced plants that are well established in the wild i.e producing offspring and colonising new areas. Compared with introduced plants that are not naturalised. (e.g. ornamental plants around abandoned forestry settlements such as Shannon townsite)
Nature-based tourism	Tourism that is dependent upon the resources of the natural environment and incorporates a range of tourism experiences including adventure tourism, eco-tourism and aspects of cultural and rural tourism
Obligate	Restricted to a single mode of behaviour or environmental condition, such as an obligate aerobe that is dependent on the presence of molecular oxygen to breathe
Organic	Of, relating to, or derived from living organisms
Palaeontology	The study of life in the geological past
Paluslopes	Paluslopes are hill slope wetlands created by hill side seepages. Peat Paluslopes have a sand and peat base rather than the saprolitic (clay) base
Pathogen	Any organism (bacterium or virus) or factor that causes disease within a host
Physiographic unit	A prominent landform as considered in relation to its origin, cause, or history
Pleistocene	The geological time period commencing about 2 million years ago and ending at the Holocene 12 000 years ago
Precipitation	Any form of water, such as rain, snow, sleet or hail, that falls to the Earth's surface
Priority species	A Departmental term for flora and fauna that may be rare or threatened but for which there is insufficient survey data available to accurately determine their true status. Priority species also include rare species that are currently not threatened. Species are grouped from 1 to 5 according to the perceived urgency for further survey
Quaternary	The present geological period commencing around 2 million years ago, includes the Pleistocene and recent Holocene time periods
Rehabilitation	The process necessary to return disturbed land to a predetermined state, in terms of surface, vegetational cover, land-use and/or productivity
Recreation	Generally considered in this management plan to be the day-use of the parks by locals
Relictual	A surviving individual, population, community or species that is characteristic of an earlier period in evolutionary history
Representative	In terms of a comprehensive, adequate and representative protected area reserve system; representative enough that the reserves reflect the biotic diversity of the ecosystems
Riparian	Relating to or growing on the bank of a natural watercourse
Sclerophyll forest	There are two types of sclerophyll forest, dry and wet, both of which have a canopy of eucalypts. Sclerophyllous plants have hard leaves with lignin which prevents the leaves from wilting in dry conditions. Dry sclerophyll are 10 to 30 metres tall and have a hard-leaved understorey, whereas wet sclerophyll forests are taller than 30 metres and have a soft-leaved understorey, such as tree ferns
Symbiotic	A biological relationship which benefits both parties
Soil erosion	A combination of processes in which soil is loosened, dissolved, or worn away, and transported from one place to another by climatic, biological or physical agents
Spores	Primitive, usually unicellular, reproductive body produced by plants and some micro-organisms and capable of development into a new individual either directly or after fusion with another spore
Statutory	Enacted or required by law
Stromatolitic	A sedimentary structure consisting of laminated carbonate or silicate rocks, produced over geological time by the trapping, binding or precipitating of sediment by groups of micro-organisms
Swamp	A wetland often partially or intermittently covered with water
Taxa	A defined unit (for example, species or genus) in the classification of plants and animals
Teleost	Of or belonging to the Teleostei – a large group of fishes with bony skeletons, including most common fishes
Temperate	Of mild temperature, the Temperate Zone is the area or region between the tropic of Cancer and the Arctic circle in the Northern Hemisphere or between the tropic of Capricorn and the antarctic circle in the Southern Hemisphere
Tertiary	The geological period commencing around 65 million years ago and ending at the Quaternary period 2 million years ago, includes five defined time periods

Threatened ecological community	Threatened ecological communities are assessed by the Department and endorsed by the Minister of the Environment. They are non-statutory (although some protection is afforded under the Acts of the Department of Environment and Department of Planning and Infrastructure) unless listed under the Commonwealth Environment Protection and Biodiversity Conservation Act. There are four categories of threatened ecological communities: presumed totally destroyed, critically endangered, endangered (may be destroyed within 20 years) and vulnerable (may be destroyed within 50 years). As with flora, there are also possible threatened ecological communities that are allocated Priority 1 to 5 within the Department.
Tourism	Generally considered in this management plan to be visitors from outside the area staying overnight in or adjacent to the parks
Tropical	A region or climate that is frost-free with temperatures high enough to support year-round plant growth given sufficient moisture, the Tropical Zone is the land between the tropic of Cancer and the tropic of Capricorn
Understorey	The shrubs and plants that grow beneath the main canopy of a forest
Vascular plants	Plants having a specialised conducting system that includes xylem and phloem
Vectors	An organism that transmits a pathogen
Vertebrate	Animals that have a spinal column which includes fish, amphibians, reptiles, birds and mammals
Wetland	Land or areas (as tidal flats or swamps) containing much soil moisture

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PERSONAL COMMUNICATIONS

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Dr David Algar, Senior Research Scientist, Woodvale Research, Science Division.
Rod Annear – Ranger in Charge 1996-2003, Donnelly District, Regional Services Division.
John Blyth – Acting Manager, WA Threatened Species and Communities Unit, Nature Conservation.
Dr Neil Burrows – Director, Science Division.
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Roger Hearn – Regional Ecologist, Warren Region, Regional Services Division.
Mike Lyons – Research Scientist, Woodvale Research, Science Division.
Dr Peter Mawson – Senior Zoologist, Wildlife Conservation Branch, Nature Conservation Division.
Norm McKenzie – Principal Research Scientist, Woodvale Research, Science Division.
Kevin Vear – Phytophthora Co-ordinator, Nature Conservation Division.

Department of Industry and Resources

Mike Freeman – Senior Land Use Planning Geologist.

Department of Environment

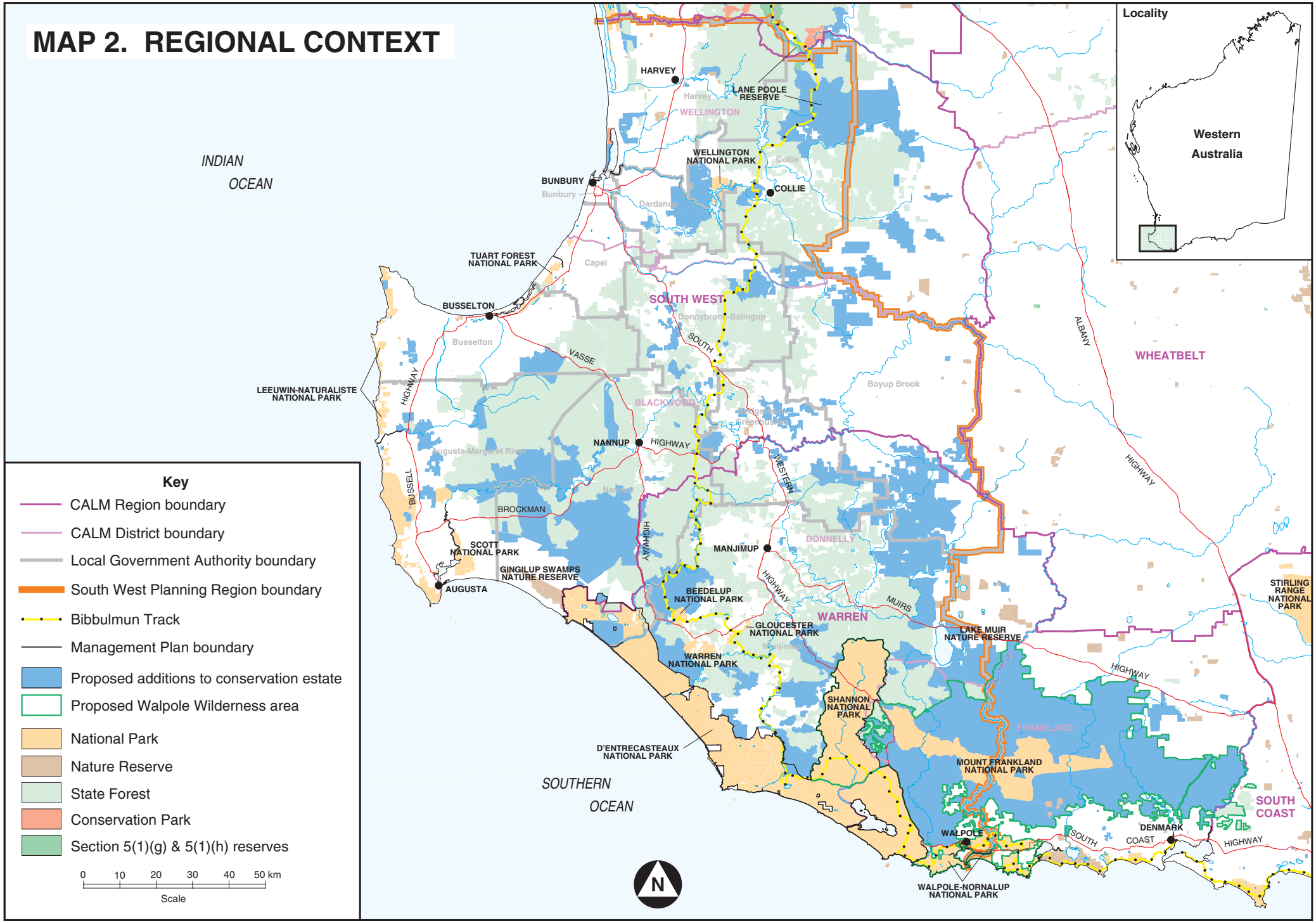
Brad Degens – Manager Acid Sulfate Soil Risk Mapping, Land and Water Quality Branch.

Water and Rivers Commission

Ian Loh – Program Manager, Strategic Projects Branch.

MAP 1. MANAGEMENT PLANNING AREA

MAP 2. REGIONAL CONTEXT

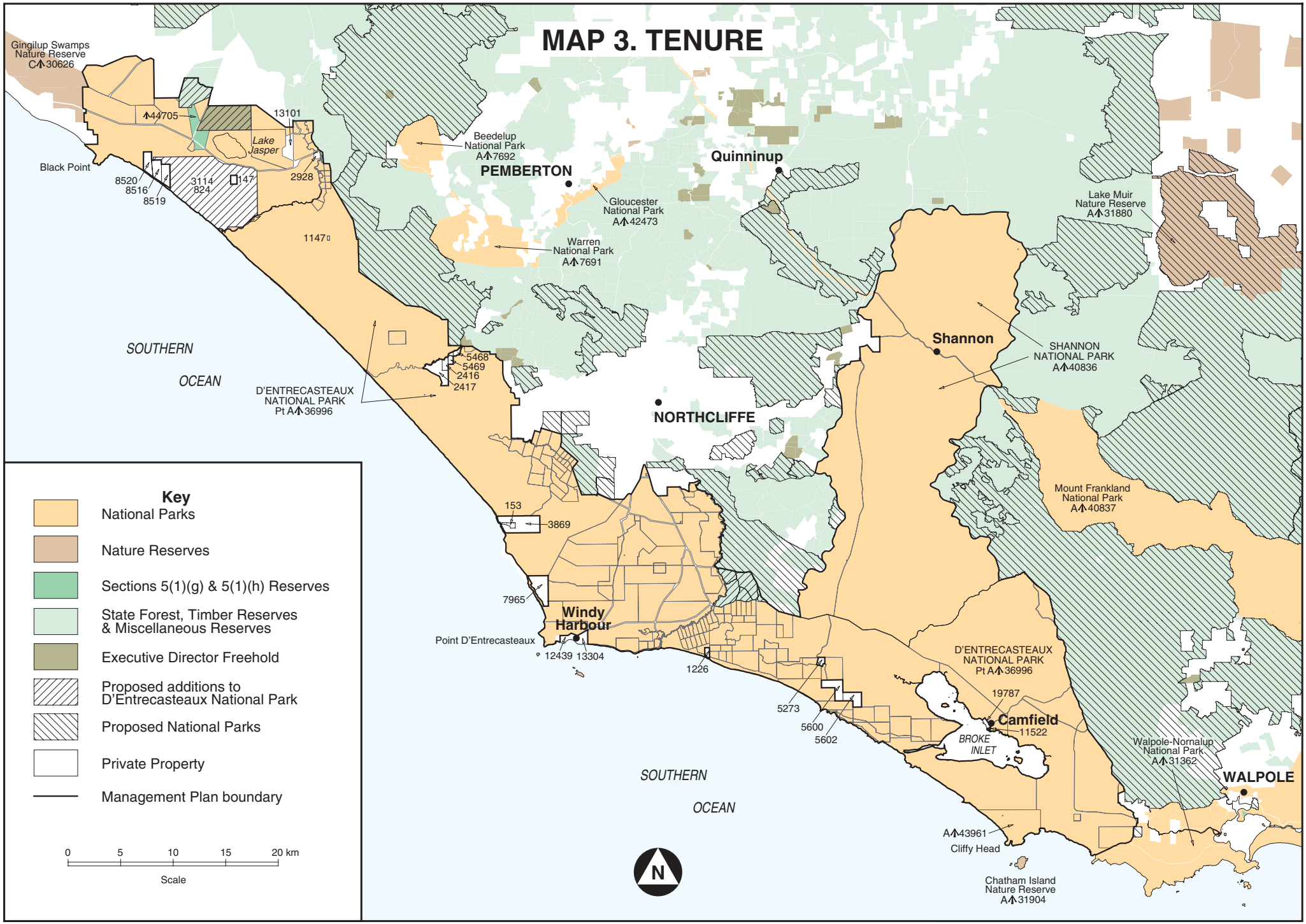


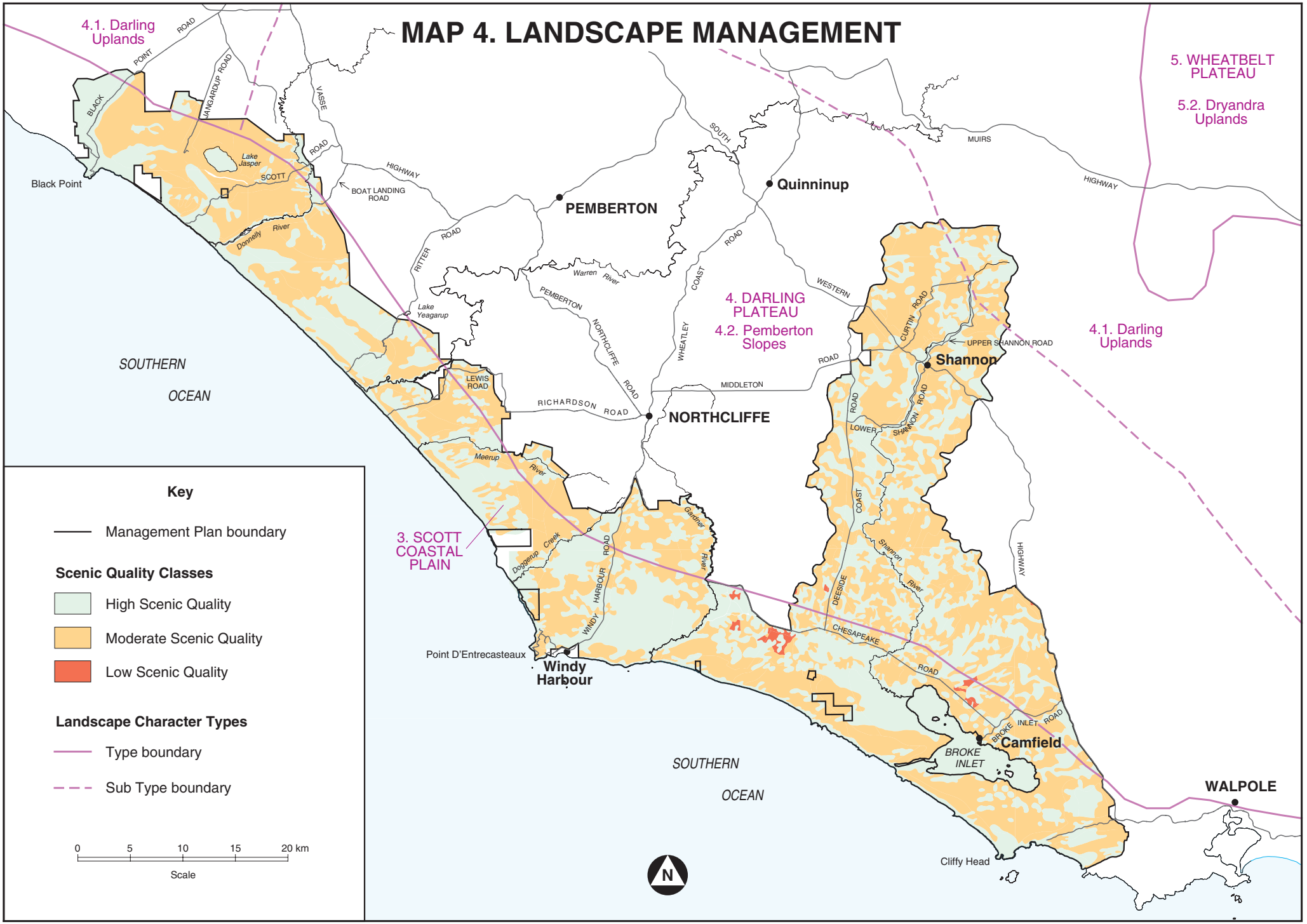
Key

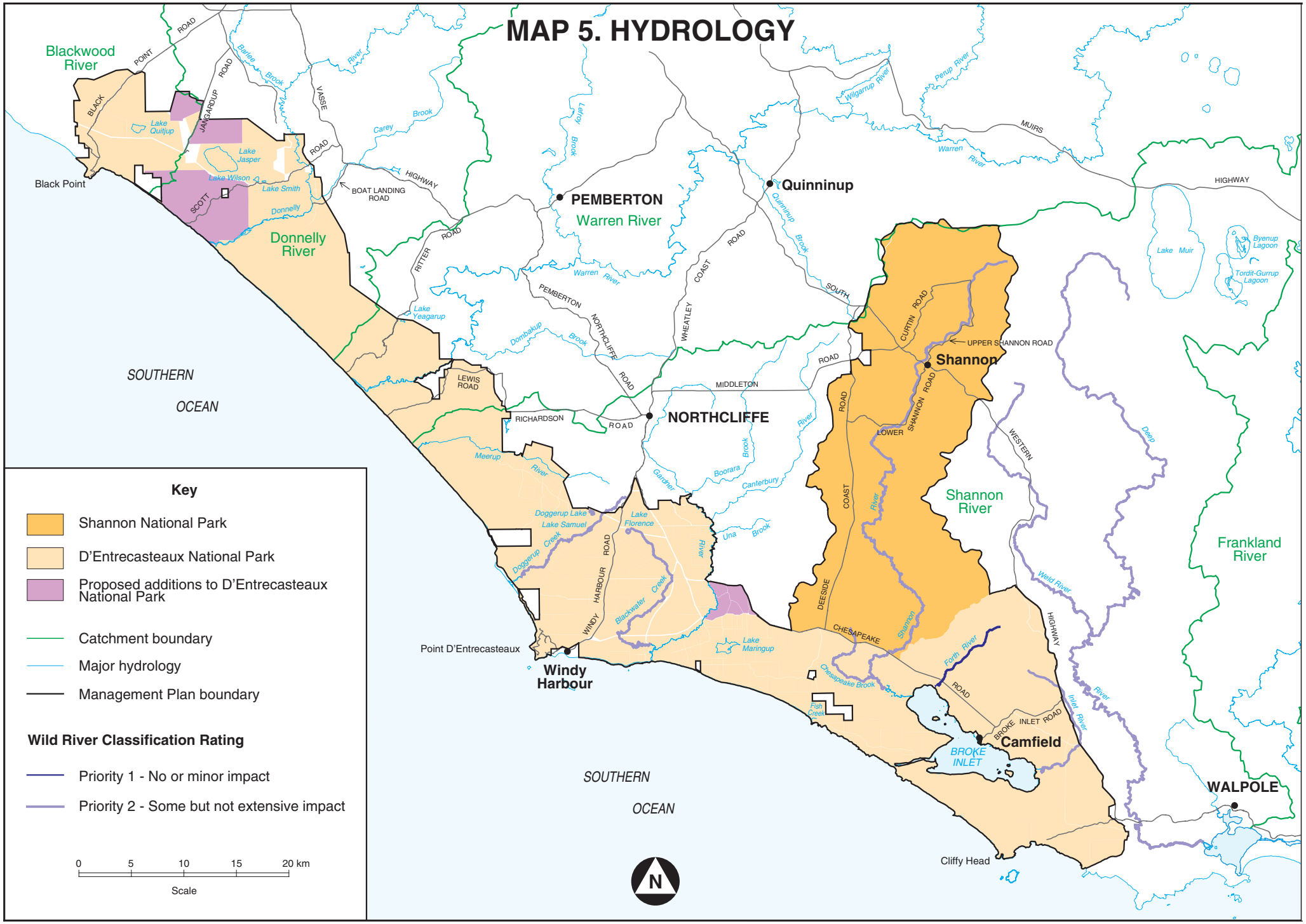
- CALM Region boundary
- CALM District boundary
- Local Government Authority boundary
- South West Planning Region boundary
- Bibbulmun Track
- Management Plan boundary
- Proposed additions to conservation estate
- Proposed Walpole Wilderness area
- National Park
- Nature Reserve
- State Forest
- Conservation Park
- Section 5(1)(g) & 5(1)(h) reserves

0 10 20 30 40 50 km

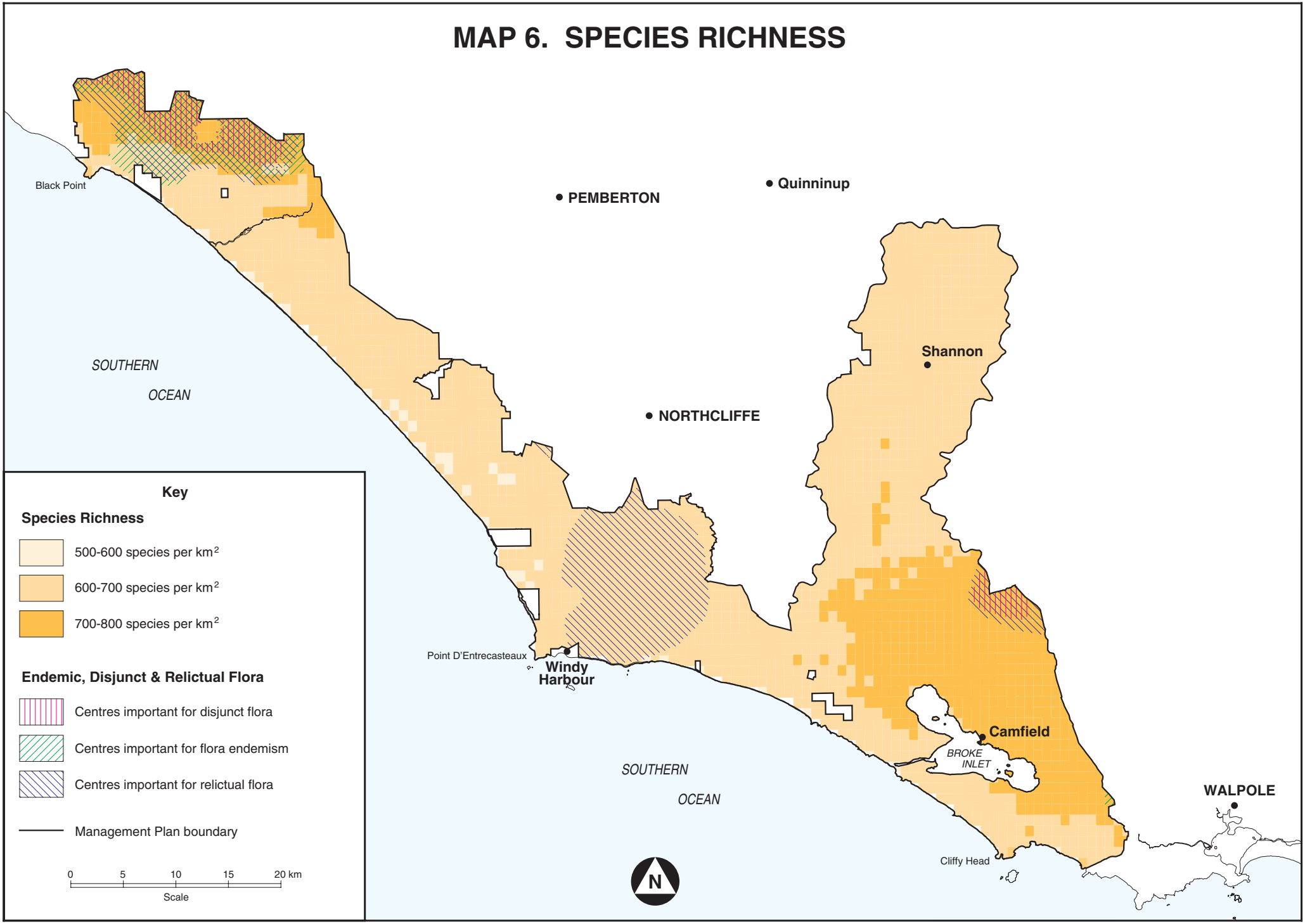
Scale


MAP 3. TENURE
Gingilup Swamps Nature Reserve C 30626
44705
13101
Lake Jasper
Black Point
8520
8516
8519
3114
824
147
2928
1147
Beedelup National Park A 7692
PEMBERTON
Quinninup
Gloucester National Park A 42473
Warren National Park A 7691
Lake Muir Nature Reserve A 31880
SOUTHERN
OCEAN
D'ENTRECASTEAUX NATIONAL PARK Pt A 36996
5468
5469
2416
2417
NORTHCLIFFE
Shannon
SHANNON NATIONAL PARK A 40836
Mount Frankland National Park A 40837
153
3869
7965
Windy Harbour
Point D'Entrecasteaux
12439
13304
1226
D'ENTRECASTEAUX NATIONAL PARK Pt A 36996
19787
5273
5600
5602
Camfield
11522
BROKE INLET
Walpole-Nornalup National Park A 31362
WALPOLE
SOUTHERN
OCEAN
A 43961
Cliffy Head
Chatham Island Nature Reserve A 31904
N
Key
National Parks
Nature Reserves
Sections 5(1)(g) & 5(1)(h) Reserves
State Forest, Timber Reserves & Miscellaneous Reserves
Executive Director Freehold
Proposed additions to D'Entrecasteaux National Park
Proposed National Parks
Private Property
Management Plan boundary
0
5
10
15
20 km
Scale

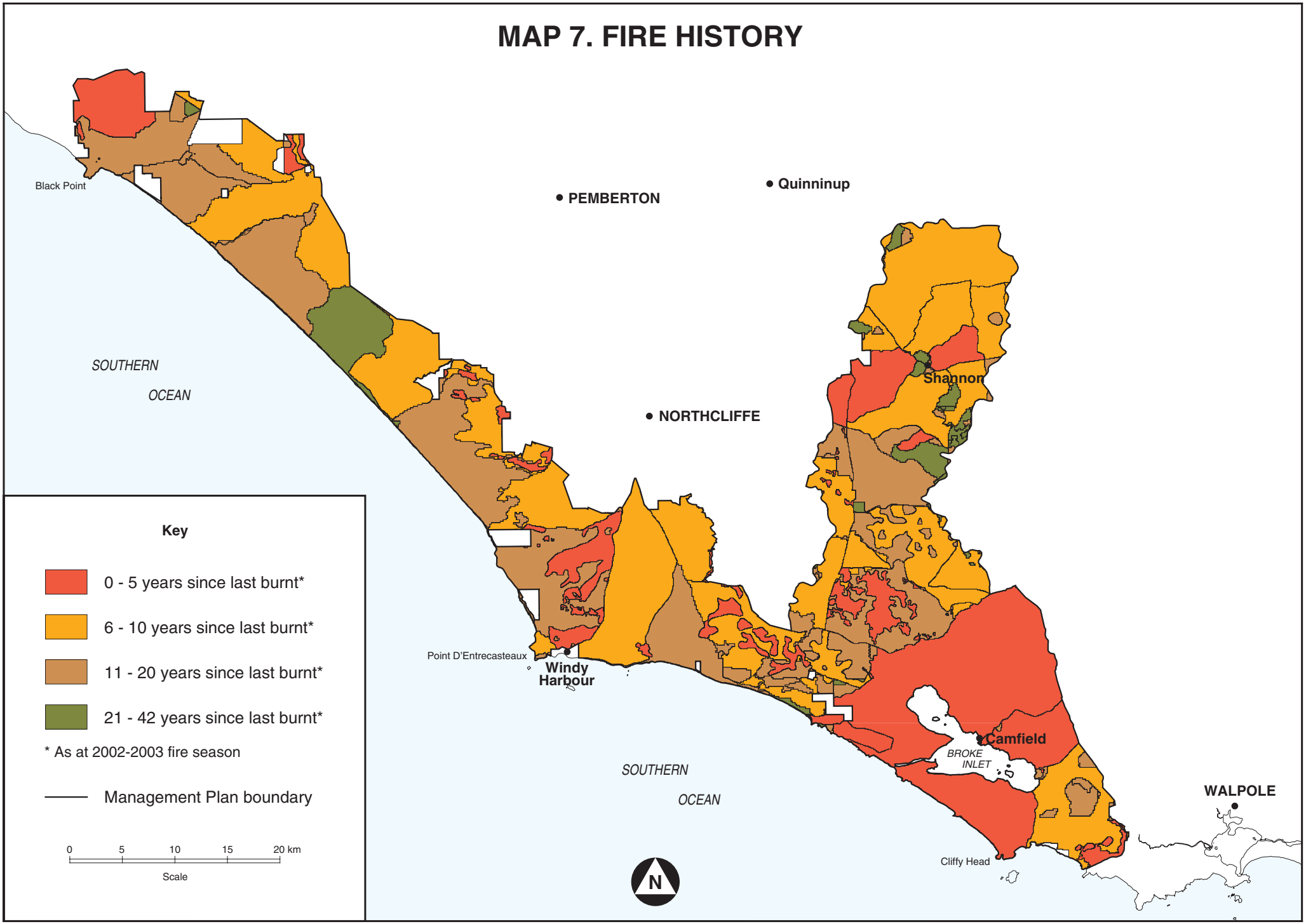

MAP 4. LANDSCAPE MANAGEMENT
4.1. Darling Uplands
5. WHEATBELT PLATEAU
5.2. Dryandra Uplands
4. DARLING PLATEAU
4.2. Pemberton Slopes
4.1. Darling Uplands
3. SCOTT COASTAL PLAIN
Black Point
PEMBERTON
Quinninup
NORTHCLIFFE
Shannon
Windy Harbour
Point D'Entrecasteaux
Camfield
WALPOLE
Cliffy Head
SOUTHERN OCEAN
SOUTHERN OCEAN
Lake Jasper
Lake Yeagarup
Donnelly River
Warren River
Meerup River
Gardner River
Shannon River
Doggerup Creek
BLACK POINT ROAD
MANGARDUP ROAD
VASSE HIGHWAY
SOUTH WESTERN HIGHWAY
MUIRS HIGHWAY
BOAT LANDING ROAD
RITTER ROAD
COAST ROAD
PEMBERTON NORTHCLIFFE ROAD
WHEATLEY COAST ROAD
CURTIN ROAD
UPPER SHANNON ROAD
MIDDLETON ROAD
LEWIS ROAD
RICHARDSON ROAD
LOWER SHANNON ROAD
DEESIDE ROAD
CHESAPEAKE ROAD
WINDY HARBOUR ROAD
BROKE INLET ROAD
BROKE INLET
Key
Management Plan boundary
Scenic Quality Classes
High Scenic Quality
Moderate Scenic Quality
Low Scenic Quality
Landscape Character Types
Type boundary
Sub Type boundary
0 5 10 15 20 km
Scale
N


MAP 5. HYDROLOGY
Blackwood River
Donnelly River
Warren River
Shannon River
Frankland River
Black Point
Point D'Entrecasteaux
Cliffy Head
PEMBERTON
Quinninup
NORTHCLIFFE
Shannon
Windy Harbour
Camfield
WALPOLE
SOUTHERN OCEAN
SOUTHERN OCEAN
Lake Quitjup
Lake Jasper
Lake Wilson
Lake Smith
Lake Yeagarup
Doggerup Lake
Lake Samuel
Lake Florence
Lake Maringup
BROKE INLET
Lake Muir
Byenup Lagoon
Tordit-Gurrup Lagoon
BLACK POINT ROAD
JANGARDUP ROAD
VASSE HIGHWAY
BOAT LANDING ROAD
RITTER ROAD
PEMBERTON NORTHCLIFFE ROAD
COAST ROAD
WHEATLEY COAST ROAD
QUININUP SOUTH ROAD
CURTIN ROAD
UPPER SHANNON ROAD
LOWER SHANNON ROAD
MIDDLETON ROAD
RICHARDSON ROAD
LEWIS ROAD
WINDY HARBOUR ROAD
DEESIDE ROAD
CHESAPEAKE ROAD
BROKE INLET ROAD
MUIRS HIGHWAY
WESTERN HIGHWAY
Barlee Brook
Carey Brook
Lefroy Brook
Dombakup Brook
Meerup River
Gardner River
Boorara Brook
Canterbury Brook
Una Brook
Doggerup Creek
Blackwater Creek
Fish Creek
Chesapeake Brook
Forth River
Inlet River
Deep River
Weld River
Wilgarrup River
Perup River
Warren River
Key
Shannon National Park
D'Entrecasteaux National Park
Proposed additions to D'Entrecasteaux National Park
Catchment boundary
Major hydrology
Management Plan boundary
Wild River Classification Rating
Priority 1 - No or minor impact
Priority 2 - Some but not extensive impact
0 5 10 15 20 km
Scale
N

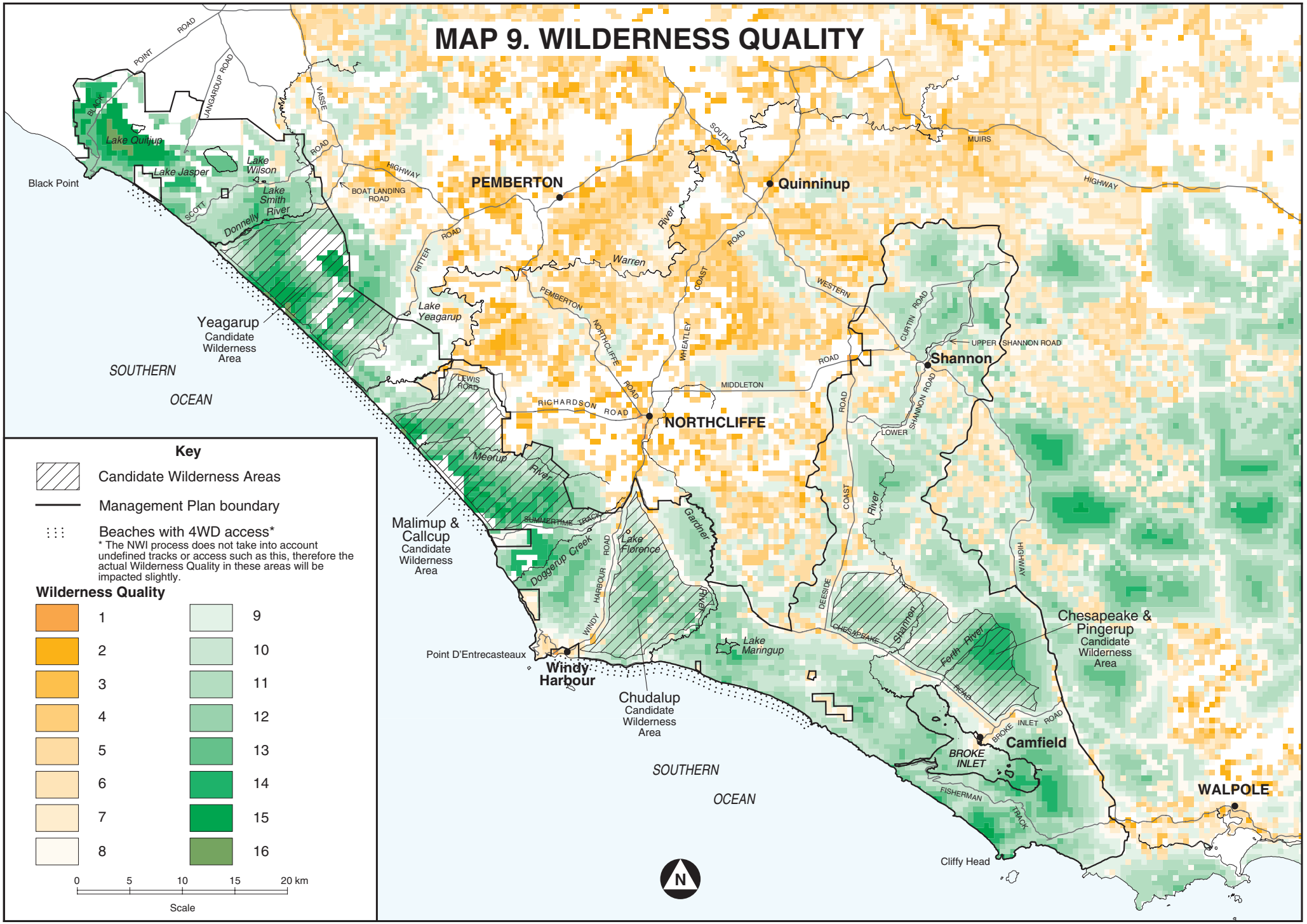
MAP 6. SPECIES RICHNESS



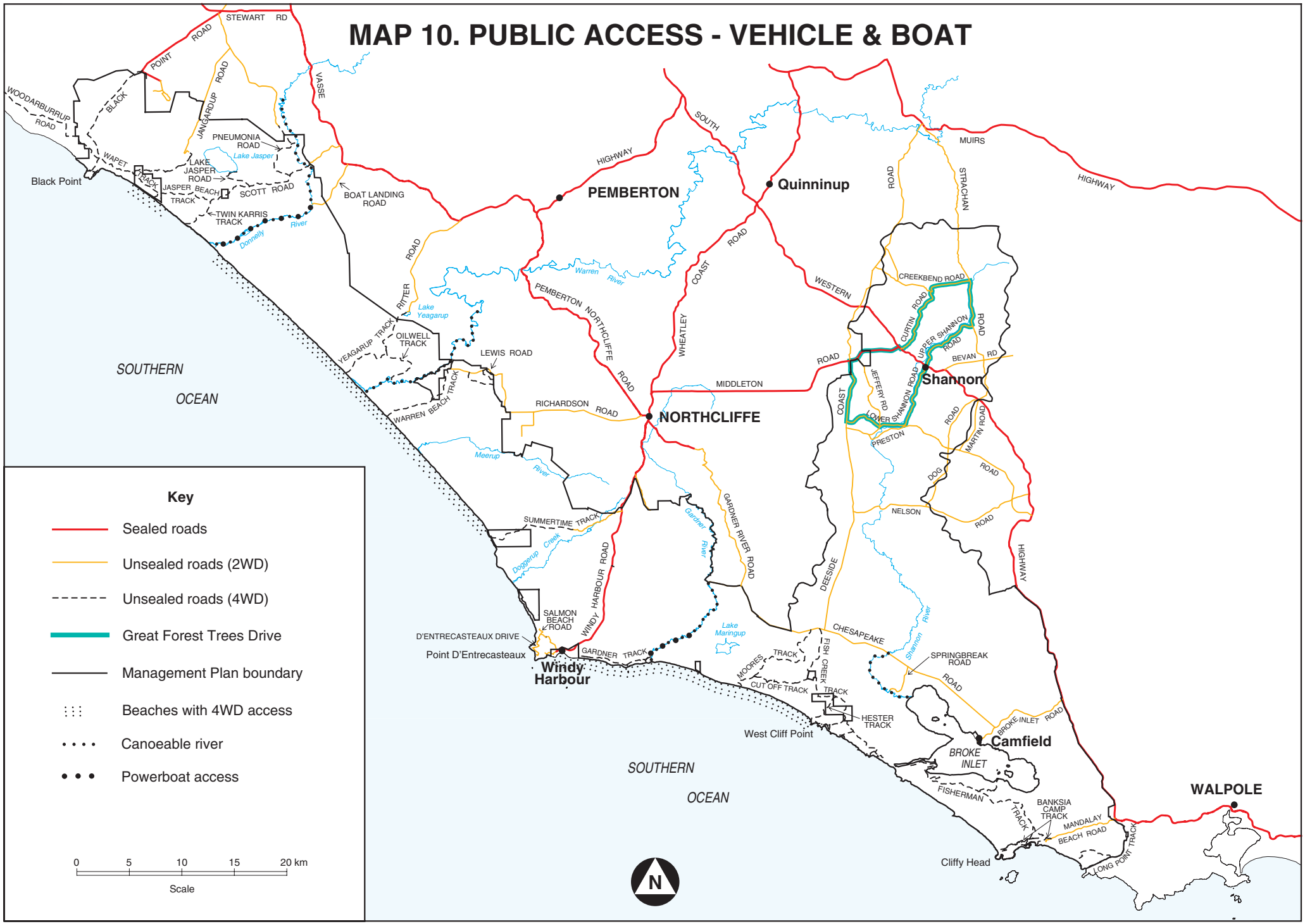
MAP 7. FIRE HISTORY



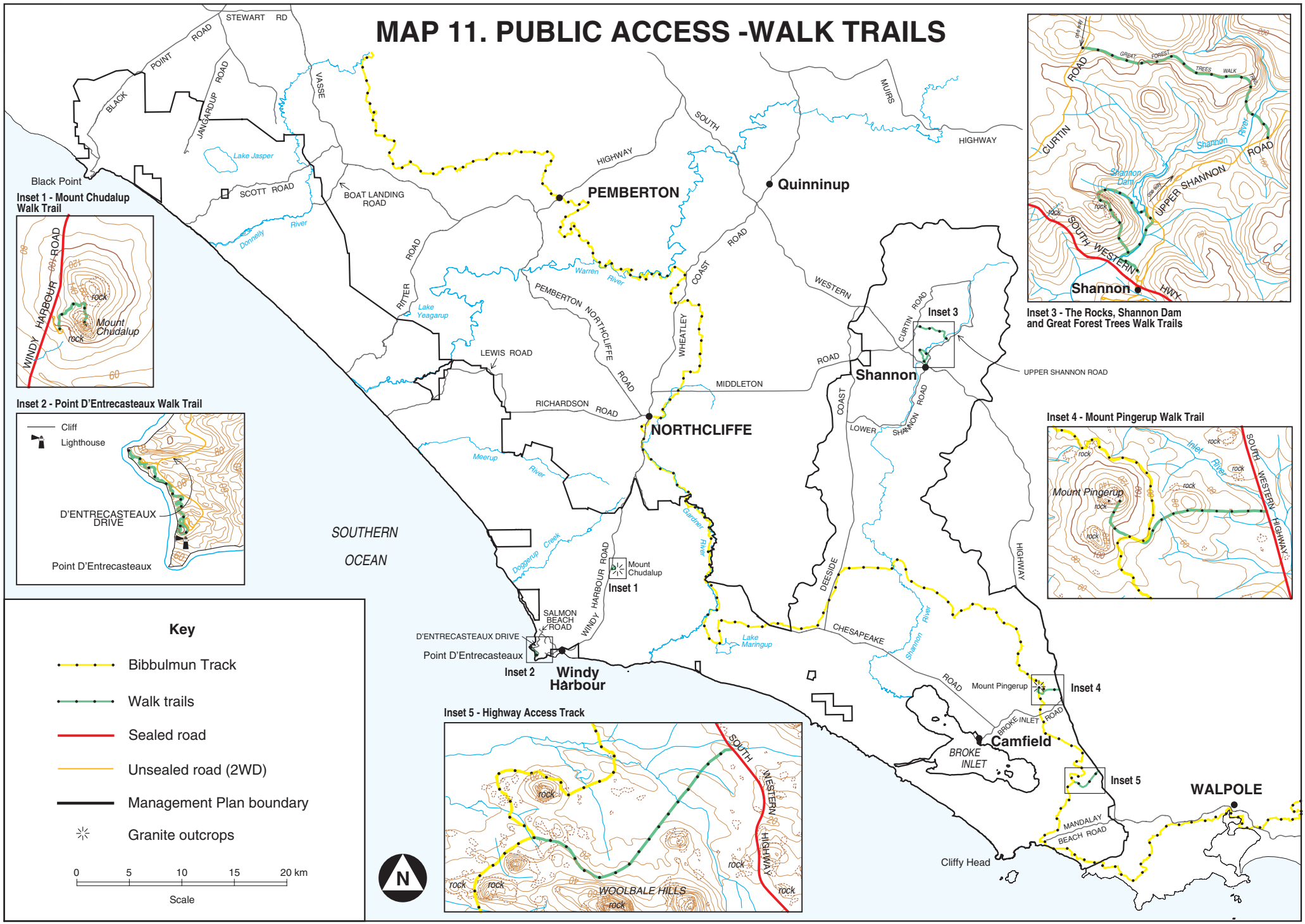
MAP 8. FIRE LANDSCAPE CONSERVATION UNITS


MAP 9. WILDERNESS QUALITY
Key
Candidate Wilderness Areas
Management Plan boundary
Beaches with 4WD access*
* The NWI process does not take into account undefined tracks or access such as this, therefore the actual Wilderness Quality in these areas will be impacted slightly.
Wilderness Quality
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
0 5 10 15 20 km
Scale
N
PEMBERTON
Quinninup
NORTHCLIFFE
Shannon
WALPOLE
Camfield
Windy Harbour
Point D'Entrecasteaux
Black Point
Cliffy Head
Yeagarup Candidate Wilderness Area
Malimup & Callcup Candidate Wilderness Area
Chudalup Candidate Wilderness Area
Chesapeake & Pingerup Candidate Wilderness Area
SOUTHERN OCEAN
SOUTHERN OCEAN
Lake Quitup
Lake Jasper
Lake Wilson
Lake Smith
Donnelly River
Lake Yeagarup
Warren River
Meerup River
Doggerup Creek
Lake Florence
Gardner River
Lake Maringup
Shannon River
Forth River
BROKE INLET
VASSE HIGHWAY
BOAT LANDING ROAD
RITTER ROAD
PEMBERTON NORTHCLIFFE ROAD
WHEATLEY COAST ROAD
WESTERN ROAD
CURTIN ROAD
UPPER SHANNON ROAD
SHANNON ROAD
LOWER ROAD
MIDDLETON ROAD
RICHARDSON ROAD
LEWIS ROAD
SUMMERTIME TRACK
HARBOUR ROAD
WINDY HARBOUR ROAD
COAST ROAD
DEESIDE ROAD
CHESAPEAKE ROAD
BROKE INLET ROAD
FISHERMAN TRACK
HIGHWAY
MUIRS HIGHWAY
SOUTH COAST HIGHWAY
SCOTT BLOCK POINT ROAD
VANGARDUP ROAD

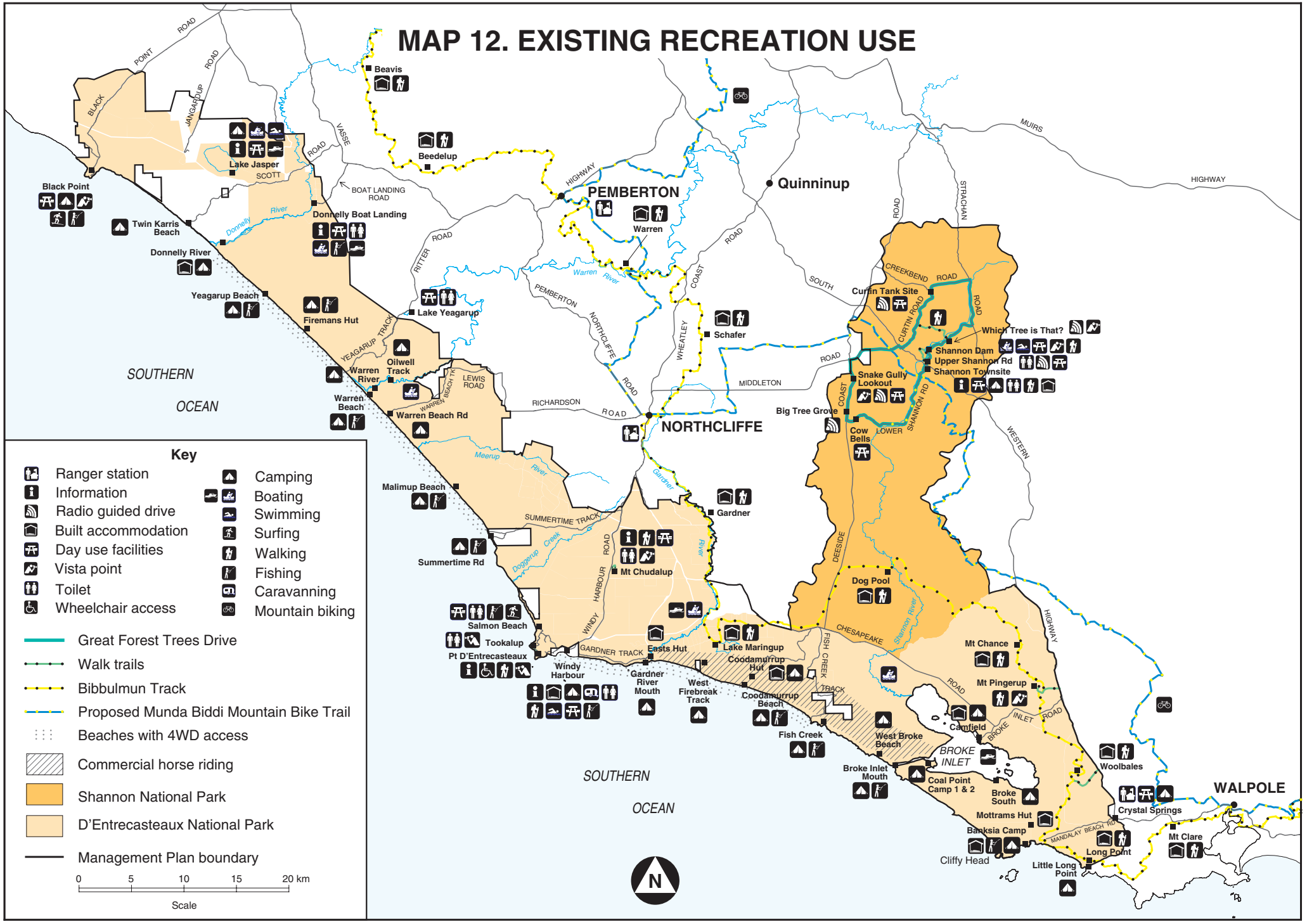
MAP 10. PUBLIC ACCESS - VEHICLE & BOAT



MAP 11. PUBLIC ACCESS -WALK TRAILS



MAP 12. EXISTING RECREATION USE



APPENDIX 1 – SUMMARY OF TENURE RECOMMENDATIONS

Key Points (see Section 3 Management Plan Area)

- The *Forest Management Plan 2004-2013* has recommended the addition of two State forest areas to D'Entrecasteaux National Park.
- Land excised from D'Entrecasteaux National Park and a private property were combined to create a 5(g) reserve to facilitate mining. In return, Cable Sands has conditionally transferred a 1083 hectare parcel of land to the Department.
- Quannup pastoral lease, which expires in 2015, remains within the boundary of D'Entrecasteaux National Park.
- There are 19 private properties within the boundaries of the parks.
- There are a number of unused road reserves within the parks that are unnecessary—in particular the 20 kilometre extension to Woodarburrup Road to connect to Scott Road.

The objective is to incorporate appropriate lands and waters within the parks where possible to consolidate the parks, preserve and enhance the values of the parks and extend the national reserve system.

This will be achieved by:

1. Incorporating the 5(g) reserve back into D'Entrecasteaux National Park either as mining and rehabilitation is undertaken (along with the land vested with the Executive Director), or alternatively if the mining proposal is withdrawn (see Section 32 Mining).
2. Purchasing the Quannup pastoral lease prior to 2015 or having the land vested in the Conservation Commission at the cessation of the lease in 2015 (see Section 11 Biogeography).
3. Implementing the recommendations in the *Forest Management Plan 2004-2013* to have 1600 hectares of State forest added to D'Entrecasteaux National Park (see Section 11 Biogeography).
4. Purchasing private property within the parks when it becomes available according to conservation value of the areas and as funds allow (see Section 11 Biogeography).
5. Negotiating with the relevant State agencies and local authorities to add important conservation and recreation reserves under their control to the parks (see Section 11 Biogeography).
6. Negotiating with private property owners, Main Roads Department and local authorities to ensure that road reserves to park enclaves are best located to protect environmental and landscape values of the parks and satisfy owners access requirements (see Section 26 Visitor Access).
7. Negotiating to cancel unnecessary road reserves within the parks and adding these to the Shannon and D'Entrecasteaux national parks (see Section 26 Visitor Access).
8. Acquire, by purchase, exchange or other means when opportunities arise and funds are available, any other areas that adjoin the parks that have significant conservation or recreational values, management benefits or that could protect areas with these values within the parks and contribute to the national reserve system (see Section 11 Biogeography).
9. Extending the boundaries of the D'Entrecasteaux National Park to the low water mark along the Donnelly, Gardner, Shannon, Forth and Inlet rivers (see Section 15 Soil and Catchment Protection).
10. Promoting compatible management of Broke Inlet with the purposes and management of D'Entrecasteaux National Park and supporting the creation of a Broke Inlet Marine Park (see Section 15 Soil and Catchment Protection).

APPENDIX 2 – PERFORMANCE ASSESSMENT

Key Performance Indicators for the Parks

KEY VALUES	OBJECTIVE	KEY PERFORMANCE INDICATOR		
		Performance Measure	Target	Reporting Requirements*
Part C Managing the Natural Environment	Section 14. Landscape Quality			
Intact and varied natural landscapes and high scenic quality	To protect and enhance the parks visual landscape qualities	14.1 Changes to areas of high scenic quality	No permanent or long-term loss of high quality scenic areas within the parks	5-yearly
	Section 15. Soil and Catchment Protection			
Reservation of almost an entire water catchment Sites of outstanding geoheritage, important for research and for understanding the formation of landscape and environment	To protect and conserve the quality and quantity of soil and water within the parks, particularly the wetland systems, the rivers and estuaries and the coastline	15.1. The area of eroded soil within the parks	No increase as a result of human activities	5-yearly
		15.2. Water quality and quantity in wetlands and rivers within the parks	No significant adverse change to water quality or quantity in the Jasper Wetland System, *Reedia* Swamps threatened ecological community, or Warren or Donnelly rivers	Annually
	Section 17. Native Animals and Habitats			
Extensive areas of intact fauna habitat and populations of rare and priority fauna	To protect and conserve the diversity and distribution of the native fauna and habitats within the parks	17.1 Changes in the range and population size of critical weight range mammals	The successful maintenance, or where appropriate increase, of self-sustaining populations subject to natural variations	Annually or as per recovery plans if applicable

KEY VALUES	OBJECTIVE	KEY PERFORMANCE INDICATOR		
		Performance Measure	Target	Reporting Requirements*
	Section 18. Species and Communities of Special Conservation Significance			
Extensive, varied, unique and nationally significant wetland systems that provide habitat for a range of endemic flora and fauna A rich mosaic of vegetation complexes representing wetland, woodland and forest ecosystems protecting restricted vegetation communities and rare and priority flora populations	To protect species and communities of conservation significance	18.1 Population numbers of threatened or restricted flora, and the number of individuals within populations	Remains stable or increases from 2005 levels subject to natural variations	3-yearly or as per recovery plans if applicable
		18.2 The range and population numbers of threatened and specially protected fauna	Maintained or increased subject to natural variations	3-yearly or as per recovery plans if applicable
		18.3 Species composition and structure within granite outcrops	Maintained subject to natural variations	3-yearly
		18.4 The number and condition of all occurrences of threatened ecological communities within the parks	Status of threatened ecological communities remain stable or improve	3-yearly or as per recovery plan as applicable
		18.5 Translocated populations	Successfully established and evidence of second generation progeny	3-yearly
	Section 19. Environmental Weeds			
	To minimise the impact of environmental weeds on park values	19.1 The number and cover of environmental weed species	Decreasing the number and the area covered by environmental weed species rated as 'high' priority over the life of the plan	5-yearly
		19.2 The populations of species and communities of conservation significance	No decrease as a result of weed invasion	5-yearly

KEY VALUES	OBJECTIVE	KEY PERFORMANCE INDICATOR		
		Performance Measure	Target	Reporting Requirements*
	Section 21. Diseases			
	To prevent introducing plant and animal diseases into disease-free areas and minimise the spread or impact where they are already present	21.1 Protectable areas within the parks	No new human-assisted infestations of disease caused by *P. cinnamomi* in protectable areas	3-yearly
	Section 22. Fire			
	To maintain conservation values while protecting people, property and recreation assets in and near the parks	22.1 The fuel age distribution within the Landscape Conservation Units	Match the defined frequency distribution model for each unit	Annually
		22.2 The area of adjacent land that is affected by wildfire emanating from the parks	A reduction in the number of fires originating from the parks that affect private property during the life of the plan as compared to the previous 5-year period	5-yearly
		22.3 The condition of nominated fire sensitive habitats and communities (e.g. granite outcrops, wetlands, *Reedia* Swamp communities)	Fire sensitive habitats and communities maintained	5-yearly
		22.4 The persistence of fire sensitive species within the parks (e.g. *Banksia verticillata*, *B. seminuda* or *Melaleuca viminea*)	Nominated populations of species maintained	5-yearly

KEY VALUES	OBJECTIVE	KEY PERFORMANCE INDICATOR		
		Performance Measure	Target	Reporting Requirements*
Part D Managing our Cultural Heritage	Section 23. Indigenous Heritage			
Aboriginal sites and landscapes of mythological, ceremonial, cultural and spiritual significance Sites, landscapes and stories of cultural and ceremonial significance to non-Indigenous people	To protect and conserve the Aboriginal cultural heritage and cultural resources within the parks	23.1 Protection of registered heritage sites	No disturbance without formal approval	3-yearly
		23.2 Involvement of Aboriginal people in management	Increased level of Aboriginal involvement in management of the parks	3-yearly
Part E Managing Recreation and Tourism	Section 25. Recreational Opportunities			
Qualities of remoteness not readily available elsewhere in the south-west A terrestrial environment that provides opportunities for a wide range of nature-based recreational opportunities including recreational driving, bushwalking, picnicking, camping, fishing and wildlife interaction Coastal day use opportunities for Shire of Manjimup	To provide the visitors with a wide range of sustainable nature-based experiences to facilitate their understanding of the natural values of the area	25.1 The range of visitor management settings over the life of the plan	No reduction in the area of remote-natural, natural and natural-recreation visitor management settings	3-yearly
		25.2 Visitor satisfaction levels of nature-based experiences within the parks over the life of the plan	Maintained or increased	3-yearly

KEY VALUES	OBJECTIVE	KEY PERFORMANCE INDICATOR		
		Performance Measure	Target	Reporting Requirements*
	Section 26. Visitor Access			
	To provide and maintain a range of access types that do not adversely impact on conservation or other values of the parks and facilitate the visitors' appreciation of the parks' natural values	26.1 Condition of four-wheel drive tracks designated for seasonal closure or permit only access and protection of values at the destination	Track/destination condition is maintained or improved from 2005 levels	Annually
	Section 27. Recreational Use			
Significant public use and active management of the parks providing opportunities for monitoring the outcomes and impacts of these activities Commercial nature-based tourism opportunities, focussing on the parks' wide range of natural and cultural values	To provide opportunities for recreational driving within the parks that do not conflict with other users, damage the environment or cause damage or injury to visitors and their vehicles	27.1 Incidence of inappropriate recreational driving	Number of incidents decrease from 2005 levels	Annually
	To provide horse-riding opportunities in the parks that minimise the impact on the environment and on other values	27.2 Condition of landscapes used for commercial horse-riding	Landscape condition is maintained	5-yearly
	To provide for boating recreation activities that are compatible with protecting and maintaining conservation values and without impairing other recreation activities	27.3 Condition of the navigable reaches of Donnelly and Gardner rivers	Shoreline condition maintained or improved	5-yearly

KEY VALUES	OBJECTIVE	KEY PERFORMANCE INDICATOR		
		Performance Measure	Target	Reporting Requirements*
	To provide a range of quality of camping opportunities in the parks whilst minimising environmental impacts and conflict between users	27.4 Tree condition at selected campsites	Less than 10% of trees with damage Less than 10% of trees with root exposure	Annually
		27.5 Cleanliness at selected campsites	Minor levels of or no litter present	Annually
	To reduce the impact of campfires on the parks' environment	27.6 Coarse woody debris	Quantities are not diminished by human usage from predetermined baseline at selected sites	Annually
	Section 29. Visitor Safety			
	To minimise risks to public safety associated with visiting areas managed by the Department while maintaining a range of visitor experiences wherever possible	29.1 Incidents reported to the Department	The number of incidents reported remain stable or decreases from 2005 levels	Annually
Part F. Managing Sustainable Resource Use	Section 37. Rehabilitation			
	To restore degraded areas to as near a natural state as possible	37.1 Area of rehabilitation	All disturbances related to wildfire suppression are rehabilitated within 12 months All disturbances related to recreation development are rehabilitated within 12 months of project completion	Annually from second year of commencement of management plan

KEY VALUES	OBJECTIVE	KEY PERFORMANCE INDICATOR		
		Performance Measure	Target	Reporting Requirements*
Part F. Managing Sustainable Resource Use	Section 37. Rehabilitation			
		37.1 cont.	All exhausted gravel pits are rehabilitated within 2 years Disturbances related to mining are rehabilitated according to permit conditions	
Part G. Involving the Community	Section 41. Information, Education and Interpretation			
An extensive range of community educational and interpretation opportunities to describe the native flora and fauna, Aboriginal and Non-Indigenous cultural heritage, fire management and ecology of the south-west and the Department's management of the area	To promote community understanding and awareness of the conservation values of the parks and engender support for effective management of the parks	41.1 The level of participation in Departmental education programs	An increase from 2005 levels	Annually
		41.2 Visitor compliance with regulations and policies within the parks	An increase from 2005 levels	Annually
	Section 42. Working with the Community			
	To facilitate effective community involvement in management of the national parks	42.1 The number registered volunteers and the level of volunteer hours contributed over the life of the plan	An increase from 2005 levels	Annually

KEY VALUES	OBJECTIVE	KEY PERFORMANCE INDICATOR		
		Performance Measure	Target	Reporting Requirements*
Part H. Monitoring and Implementing the Plan	Section 44. Research and Monitoring			
A rich diversity of relatively intact natural landscapes providing opportunities for biological and earth sciences research Extensive traces of Aboriginal use of the parks providing opportunities for investigations	To increase knowledge and understanding of flora, fauna, natural processes and visitor use to provide for better management of the parks and to measure the performance of the management plan	44.1 Research within the parks according to Departmental priorities and Government initiatives	Departmental research within the parks that is carried out is that which has been identified in this management plan	Annually

* At the time of reporting to the Conservation Commission, any target shortfall will be investigated and any further action required by the Department will be presented to the Conservation Commission.

APPENDIX 3 – GEOHERITAGE

Sites and Features of Geoheritage within the Parks

Description	Significance	Management Issues
Pre-cambrian Terrains Tors and Granite Domes		
❖ Mt Chudalup – Archaean granulites ❖ Shannon Rock ❖ Little Chudalup	❖ Examples of different forms of granite. Mt Chudalup is recognised by Geological Survey of WA and Geological Society of Australia as a Significant Geological Feature.	❖ The mineralisation of soils and micro-climates created by these tors and granitic domes often give rise to unique or restricted flora and fauna communities. ❖ Moss swards and vegetation assemblages on granite outcrops are very sensitive to disturbance. ❖ Impacts caused by human access such as tracks or redirection of run-off can have severe impacts in a short space of time. ❖ Fixing of boardwalks or fences using metal or concrete can cause damage due to chemicals contained in run-off such as the pH changes from concrete footings on Mt Frankland. ❖ These tors and domes are often steep and may pose visitor risk problems.
Pre-cambrian Terrains		
❖ Windy Harbour Granulites ❖ Windy Harbour ❖ Malimup/Doggerup (Black Head)	❖ North South trending granulites adjacent to east west regional trend. ❖ Represents possible archaean granulite belt caught up in Albany Fraser event. ❖ Unconformity with Limestone.	❖ There is potential to interpret this feature to show how the Albany Mobile Belt skews from east/west to north/south where it meets the darling fault. ❖ The area has been and will probably continue to be used as a study site and liaison may be required with relevant universities.
Quaternary Terrains		
❖ Malimup Bench (8 metres Above Height Datum)	❖ Pleistocene peats, unusual landforms.	❖ The Malimup Bench area contains some unusual and very sensitive landforms. ❖ There are large areas of peaty soil and extensive 'wet' areas and freshwater streams flowing into the ocean. ❖ This area is easily disturbed and even low levels of foot traffic have significant impact. ❖ The vegetation and fauna populations in this area are worthy of closer study. ❖ Management actions are required to ensure current and increased levels of use do not degrade this area. ❖ Fire management in this area needs to consider the organic soils present.
❖ Point D'Entrecasteaux (see also caves and karst below) ❖ Quaternary eolianites on Archaean granulites ❖ Caves, high cliffs, fossils	❖ Recognised by Geological Survey of WA and Geological Society of Australia as a Significant Geological Feature.	❖ See caves and karst, and palynology and palaeontology below.

Description	Significance	Management Issues
Bunbury Basalt		
❖ Black Point and Cape Beaufort ❖ Yeagarup Lake ❖ Donnelly River estuary	❖ Cretaceous columnar basalt. ❖ Recognised by Geological Survey of WA and Geological Society of Australia as a Significant Geological Feature.	❖ These areas of Bunbury Basalt have a high potential for interpretation (particularly Black Point). The columnar formations at Black Point are a visitor attraction in their own right. ❖ Even at the current relatively low level of visitation impacts are occurring due to inappropriately located walktrails and viewing points, particularly at Cape Beaufort. ❖ Relocation of walking tracks and hardening is required. Some of these locations are regularly used as study sites and liaison with tertiary institutions is required. They are also used as research sites. ❖ At Black Point there are significant visitor risks associated with viewing some of the Basalt formations (steep drops and large swells). ❖ Sites such as the Basalt Cave at Black Point require protection to avoid further degradation.
Palynology and Palaeontology		
❖ Pt D'Entrecasteaux	❖ Fossils of extinct land snails. ❖ New species of marine fossils, fossil molluscs outside present living range.	❖ Sites of these fossils need to be recorded and protected from recreation development and other impacts.
Caves and Karst		
❖ Cape Beaufort Cave, Black Point	❖ Sea cave in basalt , just above sea level. ❖ Possibly a volcanic dyke into which limestone has intruded. ❖ Exposed decoration outside entrance. ❖ Entrance covered in TUFA formation. ❖ Extensive flowstone decoration on walls. ❖ Cave features unique in the south-west. ❖ Straw stalactites and other calcite decorations.	❖ This cave was assessed by Hancock (1994) as having high natural value, low to moderate human use (high conservation classification). ❖ Hancock (1994) recommends signposting the entrance of the cave to highlight its high conservation values. ❖ If impacts occur gating may be required. ❖ The significance of the TUFA at the entrance needs to be determined and further special management considerations/actions may be required. ❖ The position of the cave (at sea level) poses potential visitor risk issues as wave surge often enters the cave. ❖ Periodic monitoring of the cave is required to assess condition and visitor impacts.
❖ Black Point elevated overhang/Surfers Cave	❖ Potential archaeological site. ❖ Low Natural Value, moderate to high human use, Hancock (1994) ❖ There are other similar caves/overhangs in the area	❖ Surfers and others use this cave for shelter and camping. ❖ Although the cave itself has low conservation values the tracks to and from the cave have the potential to cause significant erosion if not stabilised. ❖ Users have carried out some rudimentary stabilisation of paths. ❖ Visitor risk issues have been identified by Gordon (1998b). ❖ Activities associated with camping such as fires and firewood collection, rubbish and human waste are an increasing problem in this area.

Description	Significance	Management Issues
❖ Point D'Entrecasteaux karst from southern point of Salmon Beach, west for 2.5 km then south to Windy Harbour	❖ Pleistocene coastal limestone consisting of cemented Aoelian calcarenite and beds of kankar and leached quartz sand. The limestone is exposed along the coast where it has formed massive sea cliffs. ❖ Further inland is an inland cliff thought to be a remnant of a past shoreline. ❖ Karst area classified as of high conservation value by Hancock (1994). One cave is large (by comparison to others in the region) and contains convergent bedding planes, existence of extensive bone material and interesting cave ecosystem.	❖ Part of the karst area contains a limestone quarry (1.25 ha) and the quarry has substantially reduced the areas aesthetic values. There is potential for this impact to be extreme as the lease area extends to a highly visible zone along the inland cliffs. ❖ The large cave has high conservation value and has the potential to be highly impacted by recreation. ❖ Hancock (1994) recommends monitoring and signage of the large cave and protection of some fragile areas from trampling. ❖ Visitor risks in this area are very high due to the nature and extent of the sea cliffs. These risks have been assessed and are described in reports by Gordon (1998a and 1999). ❖ Hancock (1994) suggests that fire regimes should take account of the potential impact of fire on the karst landscape.
❖ Fish Creek karst	❖ High limestone cliffs of Aeolian calcarenite (similar to Point D'Entrecasteaux).	❖ The 'Fish Creek' coast is difficult to access. Access to the coast in most areas is by rough four-wheel drive tracks only. Visitor risks occur due to the nature and extent of the high limestone cliffs and proposed remedial actions have been documented by Gordon (1997a, 1997b and 2000). ❖ The location of the reported cave in this area should be further investigated.
❖ Malimup Cave	❖ Limestone cave in vicinity of significant archaeological deposits.	❖ No assessment/survey of the cave has been conducted to assess its heritage and conservation values.
Coastal Geomorphology		
❖ Yeagarup Dunes	❖ Megaripples, mobile dunes. Possibly the largest mobile dunefield in the south-west.	❖ The Yeagarup Dunes are the main open dune field in the park accessible by visitors. Vehicle use on the dunes can destabilise vegetation and hence increase dune movement. ❖ Main vehicle access to dunes is quickly being closed by dune movement. ❖ Potential for wetlands close to dune edge to be covered.
❖ Meerup Dunes	❖ Large open dune field	❖ Limited access – maintaining no vehicle access.

APPENDIX 4 – GUIDELINES FOR LANDSCAPE MANAGEMENT

High Quality Scenic Landscapes

- Alterations to the naturally established landscape character should be subtle, remaining subordinate to natural elements by borrowing extensively from form, line, colour, texture and scale found commonly in the surrounding landscape.
- Alterations should achieve a visually inevident condition within one year of project completion resulting in little more than natural change.
- Site specific visual landscape factors should be carefully identified and evaluated prior to any management activities such as developing new recreation sites, access tracks or conducting burning regimes.
- Facilities and activities which utilise and yet disturb very little of the natural environment should be encouraged such as walking tracks and small day use areas.
- Land uses and developments which do not require particularly scenic environments should be excluded, this includes mining/quarries, large recreation sites, large car parks, roads, telecommunication towers and powerlines.
- Roads, recreation sites and walking tracks should focus views onto distinctive features by selecting optimum siting and alignment, for example Mt Chudalup trail, Point D'Entrecasteaux lookout and Black Point day uses areas.
- Road design and construction should remain subordinate to landscape elements by utilising minimum design standards, limited cuts and fill, minimum clearing widths, undulating edges, sensitive alignment. The Great Forest Trees Drive is an excellent example of this, whereas Chesapeake Road shows the high visual impact of insensitive alignment selection.
- Interpretive and explanatory signing should be utilised before and during operations which alter landscape character such as new recreation site development, control burning adjacent to travel routes and walking trails.
- Where structures are required they should be sympathetic in design, materials and colour to complement surrounding landscape elements and be carefully sited away from major natural focal points, out of viewer sight-lines and where vegetation or landform screening can be used such as at Snake Gully lookouts.
- Essential firebreaks should follow natural landform, vegetation, or land use patterns/lines in the landscape.
- Prescribed burning should be carried out employing prescriptions that minimise impact on landscape values.
- Previously disturbed areas within high scenic quality areas should be given the highest priority for rehabilitation until the desired standard of scenic quality is attained (e.g. access tracks in the Yeagarup dunes area).

Moderate Quality Scenic Landscapes

- Alterations to the naturally established landscape character should borrow form, line, colour, texture and scale from natural elements and may result in an apparent but not dominant impact found commonly in the surrounding landscape.

Low Quality Scenic Landscapes

- Essential but visually depreciative facilities not requiring areas of scenic amenity should be accommodated in these areas first where possible such as gravel pits, quarries, mines, transmission and towers, powerlines.
- Enhancement of scenic quality through rehabilitation works should be considered to upgrade areas to a higher amenity standard (e.g. Lake Jasper camp sites and degraded four-wheel drive tracks).
- Views to disturbed landscapes may require landform and vegetation screening.

APPENDIX 5 – NATIVE FAUNA

Below is a list of native fauna (vertebrates only) compiled from a number of sources. If the habitats and vegetation complexes within the parks were used to predict what may occur then the list would be more extensive. However, for the purposes of this management plan only known occurrences (surveys and sightings) as per the reference list below were used.

Common Name	Scientific Name	Cons Code			Park	Ref
		WA	EBPC	Other		
Mammals (21)						
New Zealand fur-seal	*Arctocephalus forsteri*	SP(S4)			DE	8, 11
Western grey kangaroo	*Macropus fuliginosus*				S DE	1, 2, 8, 10
Quokka	*Setonix brachyurus*	En, T(S1)	VU	T(VU)	S DE	1, 2, 8, 10
Woylie (brush-tailed bettong)	*Bettongia penicillata ogilbyi*	P5		LR(cd)	S	8, 9
Tammar wallaby	*Macropus eugenii derbianus*	P5		LR(nt)		9
Brush-tailed possum	*Trichosurus vulpecula vulpecula*				S	8
Western pygmy possum	*Cercartetus concinnus*				DE	1, 2, 10
Honey possum	*Tarsipes rostratus*	En		LR(lc)	S DE	2, 8, 10
Quenda (southern brown bandicoot)	*Isoodon obesulus fusciventer*	P5		LR(nt)	S DE	1, 2, 4, 8, 10
Mardo (yellow footed antechinus)	*Antechinus flavipes leucogaster*			LR(lc)	DE	1, 2, 8, 10
Chuditch (western quoll)	*Dasyurus geoffroii*	T(S1)	VU	T(VU)	S	10, 11
Wambenger (southern brush-tailed phascogale)	*Phascogale tapoatafa tapoatafa*	P3		LR(lc)	S DE	10
Gilbert's dunnart	*Sminthopsis gilberti*	En		LR(lc)	S DE	1, 2, 4, 8
Bush rat	*Rattus fuscipes*				S DE	1, 2, 4, 8, 10
Water rat	*Hydromys chrysogaster*	P4			S DE	1, 2
Greater long eared bat	*Nyctophilus timoriensis timoriensis*			LR(lc)	DE	1, 2, 10
Lesser long eared bat	*Nyctophilus geoffroyi*			LR(lc)	DE	1, 2
Chocolate wattled bat	*Chalinolobus morio*			LR(lc)	S	1, 2, 10
King River eptesicus	*Eptesicus regulus*				S DE	1, 2
Western false pipistrelle	*Falsistrellus mackenziei* (previously identified as Great pipistrelle *Pipistrellus tasmaniensis*)	En, P4		LR(nt)	DE	1, 2, 10
Southern forest bat	*Vespadelus regulus*			LR(lc)	S DE	10
Birds (123)						
Emu	*Dromaius novaehollandiae*				S DE	1, 2
Hoary headed grebe	*Poliocephalus poliocephalus*				S	1, 2
Australasian grebe	*Tachybaptus novaehollandiae*				DE	1, 2
Huttons shearwater	*Puffinus huttoni*				DE	1, 2
Shy Albatross	*Diomedea cauta*	T(S1)	VU	T(VU), BC	DE	8
Australian pelican	*Pelicanus conspicillatus*				DE	1, 2, 8
Darter	*Anhinga melanogaster*				S	1, 2
Great cormorant	*Phalacrocorax carbo*				S DE	1, 2
Pied cormorant	*Phalacrocorax varius*				S DE	1, 2
Little pied cormorant	*Phalacrocorax melanoleucos*				S DE	1, 2
Little black cormorant	*Phalacrocorax sulcirostris*				DE	3
Pacific heron	*Ardea pacifica*				DE	1, 2
White faced heron	*Ardea novaehollandiae*				S DE	1, 2
Great egret	*Egretta alba*			J, C	DE	1, 2
Rufus night heron	*Nycticorax calandonicus*				DE	1, 2
Australasian bittern	*Botaurus poiciloptilus*	T(S1)		T(VU)	DE	1, 2
Little bittern	*Ixobrychus minutus dubius*	P4			DE	3
Sacred ibis	*Threskiornis aethiopica*				DE	1, 2
Straw necked ibis	*Threskiornis spinicollis*				DE	1, 2
Black swan	*Cygnus atratus*				S	1, 2
Freckled duck	*Strictonetta naevosa*				DE	1, 2
Australian shelduck	*Tadorna tadornoides*				S	1, 2
Pacific black duck	*Anas superciliosa*				S DE	1, 2
Grey teal	*Anas gibberifrons*				DE	1, 2
Australasian shoveller	*Anas rhynchotis*				DE	1, 2
Blue billed duck	*Oxyura australis*				DE	1, 2

Common Name	Scientific Name	Cons Code			Park	Ref
		WA	EBPC	Other		
Musk duck	*Biziura lobata*				S DE	1, 2
Osprey	*Pandion haliaetus*		Mig	BC	S DE	1, 2
Square tailed kite	*Lophoictinia isura*				DE	1, 2
Whistling kite	*Heliastur sphenurus*				DE	1, 2
Brown goshawk	*Accipter fasciatus*				DE	1, 2
White bellied sea eagle	*Haliaeetus leucogaster*			C	S DE	1, 2
Wedge tailed eagle	*Aquila audax*				S DE	1, 2
Little eagle	*Aquila morphnoides*					8
Spotted harrier	*Circus assimilus*				DE	1, 2
Marsh harrier	*Circus aeruginosus*				S	1, 2
Peregrine falcon	*Falco perigrinus*	SP(S4)			DE	1, 2
Australian hobby	*Falco longipennis*				DE	1, 2
Brown falcon	*Falco berigora*				S DE	1, 2
Australian kestrel	*Falco cenchroides*				DE	1, 2
Malleefowl	*Leipoa ocellata*	T (S1)	VU	T(VU)	S DE	8
Stubble quail	*Coturnix novaezelandiae*				S	1, 2
Spotless crake	*Porzana tabuenis*				DE	1, 2
Purple swamphen	*Porphyrio porphyrio*				S DE	1, 2
Eurasian coot	*Fulica atra*				S DE	1, 2
Banded lapwing	*Vanellus tricolor*				DE	1, 2
Red capped plover	*Charadrius ruficapillus*				S DE	1, 2
Hooded plover	*Thinornis rubricollis*	P4				8
Curlew sandpiper	*Caladris feriuginea*			J, C	S DE	1, 2
Silver gull	*Larus novaehollandiae*				S DE	1, 2
Pacific gull	*Larus pacificus*				S DE	1, 2
Caspian tern	*Hydroprogne caspia*			J, C	S DE	1, 2
Crested tern	*Sterna bergii*				S DE	1, 2
Fairy tern	*Sterna nerveis*				DE	8
Common bronzewing	*Phaps chalcoptera*				DE	1, 2
Brush bronzewing	*Phaps elegans*				S DE	1, 2
Forest red-tailed black cockatoo	*Calyptorhynchus banksii naso*	P3		LR(nt)	S DE	10
Red-tailed black cockatoo	*Calyptorhynchus magnificus*				DE	1, 2
Baudin's (long-billed) black cockatoo	*Calyptorhynchus baudinii*	T(S1), En	VU	T(EN)	S DE	1, 2
Carnaby's black cockatoo	*Calyptorhynchus latirostris*	T(S1)	EN	T(EN)	S DE	10
Purple-crowned lorikeet	*Glossopsitta porphyrocephala*				S DE	1, 2
Red-capped parrot	*Purpureicephalus spurius*	En			S DE	1, 2
Western rosella	*Platycerus icterotis*				S DE	1, 2
Red-capped parrot	*Platycercus spurius*				DE	10
Australian ringneck (ring-necked parrot)	*Platycercus zonarius*				S DE	10
Port Lincoln ringneck (twenty eight)	*Barnardius zonarius*				S DE	1, 2
Elegant parrot	*Neophema elegans*				DE	1, 2
Rock parrot	*Neophema petrophila*				DE	1, 2
Pallid cuckoo	*Cuculus pallidus*				S DE	1, 2
Fan-tailed cuckoo	*Cuculus phyrrophanus*				S DE	1, 2
Horsefields bronze-cuckoo	*Chrysococcyx basalis*				DE	1, 2
Shining bronze-cuckoo	*Chrysococcyx lucidus*				S	1, 2
Southern boobook	*Ninox novaeseelandiae*				DE	1, 2
Tawny frogmouth	*Podargus strigoides*				S DE	1, 2
Australian owlet-nightjar	*Aegotheles cristatus*				S DE	1, 2
Sacred kingfisher	*Halcyon sancta*				S DE	1, 2
Welcome swallow	*Hirundo neoxena*				S DE	1, 2
Tree martin	*Cecropis nigricans*				S DE	1, 2
Richard's pipit	*Anthus novaeseelandiae*				S DE	1, 2
Black-faced cuckoo-shrike	*Coracina novaehollandiae*				S DE	1, 2
Scarlet robin	*Petroica multicolor*				S DE	1, 2
White breasted robin	*Eopsaltria georgiana*	En			S DE	1, 2
Western yellow robin	*Eopsaltria griseogulgaris*				DE	1, 2
Crested shrike-tit	*Falcunculus frontalus leucogaster*	P4		LR(nt)	S DE	1, 2, 10
Golden whistler	*Pachycephala pectoralis*				S DE	1, 2
Grey shrike-thrush	*Colluricincla harmonica*				DE	1, 2
Restless flycatcher	*Myiagra inequieta*				S DE	1, 2
Grey fantail	*Rhipidura fuliginosa*				S DE	1, 2
Willie wagtail	*Rhipidura leucophrys*				DE	1, 2
Red-eared firetail	*Stagonopleura oculata*				S DE	10
Brown quail	*Coturnix ypsilophora*				DE	10

Common Name	Scientific Name	Cons Code			Park	Ref
		WA	EBPC	Other		
White browed babbler	*Pomatostomus superciliosus*				S DE	1, 2
Clamorous reed-warbler	*Acrocephalus stentoreus*				DE	1, 2
Little grassbird	*Megalurus gramineus*				DE	1, 2
Splendid fairy wren	*Malurus splendens*				S DE	1, 2
Red-winged fairy wren	*Malurus elegans*	En			S DE	1, 2
Southern emu-wren	*Stipituris malachurus*				DE	1, 2
White-browed scrub-wren	*Sericornis frontalis*				S DE	1, 2
Western gerygone	*Gerygone fusca*				DE	1, 2
Inland thornbill (broad-tailed)	*Acanthiza apicalis*				S DE	1, 2, 5
Western thornbill	*Acanthiza inornata*				S DE	1, 2
Yellow-rumped thornbill	*Acanthiza chrysorrhoa*				S DE	1, 2
Varied sitella	*Daphoenositta chrysoptera*				S DE	1, 2
Rufous treecreeper	*Climacteris rufa*				S DE	1, 2
Red wattlebird	*Anthochaera carunculata*				S DE	1, 2
Little wattlebird	*Anthochaera chrysoptera*				S DE	1, 2
Yellow-throated minor	*Manorina flavigula*				DE	1, 2
White-naped honeyeater	*Melithreptus lunatus*				S DE	1, 2
Brown honeyeater	*Lichmera indistincta*				DE	1, 2
New Holland honeyeater	*Phylidonyris novaehollandiae*				S DE	1, 2
White cheeked honeyeater	*Phylidonyris nigra*				DE	1, 2
Tawny-crowned honeyeater	*Phylidonyris melanops*				S DE	1, 2
Western spinebill	*Acanthorhynchus superciliosus*				S DE	1, 2
Spotted pardalote	*Pardalotus punctatus*				S DE	1, 2
Striated pardalote	*Pardalotus striatus*				DE	1, 2
Silvereye	*Zosterops lateralis*				S DE	1, 2
Red-eared firetail	*Emblema oculata*	En			S DE	1, 2
Australian magpie-lark	*Grallina cyanoleuca*				S DE	1, 2
Dusky woodswallow	*Artamus cyanopterus*				S DE	1, 2
Grey butcherbird	*Cracticus torquatus*				DE	1, 2
Australian magpie	*Gymnorhina tibicen*				S DE	1, 2
Grey currawong	*Strepera versicolor*				S DE	1, 2
Australian raven	*Corvis coronoides*				S DE	1, 2
Reptiles (30)						
Dugite	*Pseudonaja affinis affinis*				S DE	1, 2, 10
Black tiger snake	*Notechis ater occidentalis*				S DE	1, 2
Tiger snake	*Notechis scutatus*				S DE	10
Crowned snake	*Elapognathus coronatus*				S DE	10
Short-nosed snake	*Elapognathus minor*	En, P2			S	2, 10
Crowned snake	*Drysdalia coronata*				S DE	1, 2
Square-nosed snake (Mueller's snake)	*Rhinoplocephalus bicolor*	En			S DE	1, 2, 10
Southern blind snake	*Ramphotyphlops australis*				DE	10
Marbled gecko	*Christinus marmoratus*				S DE	1, 2, 8, 10
Fraser's scale-footed (legless) lizard	*Delma fraseri*				DE	1, 2
Marbled-faced delma	*Delma australis*				S	10
Common scaly-foot	*Pygopus lepidopodus*				S DE	2, 10
Bobtail	*Tiliqua rugosa rugosa*				DE	1, 2, 10
Mourning skink	*Egernia luctuosa*				DE	1, 2
Smith's skink	*Egernia napoleonis*	En			DE	1, 2, 10
King's skink	*Egernia kingii*				DE	1, 2, 10
Fry's skink	*Egernia pulchra pulchra*	En			DE	1, 2, 10
Red-legged skink	*Ctenotus labillardieri*	En			DE	1, 2, 10
Chain-striped skink	*Ctenotus catenifer*				DE	10
-	*Hemiergis initialis initialis*				DE	1, 2
Burrowing skink	*Hemiergis peronii peronii*	En			DE	1, 2, 10
Southwestern mulch skink	*Glaphyromorphus gracilipes*				DE	10
Slippery skink	*Lerista microtis microtis*	En			S DE	1, 10
-	*Sphenomorphus australis*	En			DE	2
New Holland skink	*Acritoscincus trilineatum*	En			DE	1, 2, 10
Sandhill skink	*Morethia lineoocellata*	En			DE	1, 2, 10
Dark litter skink	*Morethia obscura*				DE	1, 2, 8
Gould's monitor	*Varanus gouldii*				DE	1, 2
Southern heath monitor	*Varanus rosenbergi*				DE	1, 2
Long necked tortoise	*Chelodina oblonga*				S DE	1, 2, 10
Amphibians (15)						
Slender tree frog	*Litoria adelaidensis*	En			S DE	1, 2, 5, 10
Green and gold tree frog	*Litoria moorei*	En			DE	1, 2, 5, 10
Western banjo frog	*Limnodynastes dorsalis*	En			S DE	1, 2, 5, 10

Common Name	Scientific Name	Cons Code			Park	Ref
		WA	EBPC	Other		
Burrowing frog	*Heleioporus inornatus*	En			S	1, 2, 5
Moaning frog	*Heleioporus eyrei*	En			S DE	1, 2, 5, 8, 10
Sand frog	*Heleioporus psammophilus*	En			S DE	1, 2, 10
Gunther's toadlet	*Pseudophryne guentheri*	En			DE	1, 2, 10
Quacking frog	*Crinia georgiana*	En			DE	1, 2, 5, 10
Glauert's frog	*Crinia glauerti*	En			S	1, 2, 10
Bleating froglet	*Crinia pseudinsignifera*	En			S DE	10
South coast froglet	*Crinia subinsignifera*	En			DE	1, 2, 10
Nornalup frog	*Geocrinia lutea*	En, LE, P4				1
Lea's frog	*Geocrinia leai*	En			S	2, 5, 10
Roseate frog	*Geocrinia rosea*	En, LE			S	2
Nicholl's toadlet	*Metacrinia nichollsi*	En			DE	10
Fish (13 – 8 Freshwater and 5 with Marine Affinities)						
Western minnow	*Galaxias occidentalis*	En			S DE	1, 2
Western mud minnow	*Galaxiella munda*	P4, En		LR(nt), R	S DE	3, 7
Black-striped minnow	*Galaxiella nigrostriata*	P3, En		LR(nt), R	S DE	2, 3, 7
Salamander fish	*Lepidogalaxias salamandroides*	En		LR(nt), R	S DE	1, 2, 3, 7
Night fish	*Bostockia porosa*	En			S DE	1, 2, 3, 7
Western pygmy perch	*Edelia vittata*	En			S DE	1, 2, 3, 7
Balston's pygmy perch	*Nannatherina balstoni*	P3, En		pVU	S DE	1, 2, 3, 7
Freshwater cobbler	*Tandanus bostocki*	En			DE	2, 3
Big-headed goby	*Afurcagobius suppositus*				DE	6, 10
Mangrove mullet	*Mugil cephalus*				S DE	1, 2
Blue spot goby	*Pseudogobius olorum*				DE	3, 7
Western hardyhead	*Atherinosoma wallacei*				DE	3, 7
Pouched lamphrey	*Geotria australis*	P1			DE	7

References

1 = Christensen, P. *et al.* (1985)
2 = Christensen, P (1992)
3 = Jaensch, R.P. (1992)
4 = Beck C (1993)
5 = Jaensch, R.P. (1993c)
6= Gill (1993)
7 = Morgan *et al.* (1998)
8 = Ranger sightings, records and reports (R. Annear pers. comm. 2002-2004)
9 = Translocations/reintroductions
10 = Western Australian Museum records
11 = Wildlife Section database

Explanation of Codes

WA
En Endemic to the south-west

T Threatened or **SP** Specially Protected fauna declared under the Wildlife Conservation Act, and in particular:
- **T(S1)** Rare or likely to become extinct
- **T(S2)** Presumed extinct but may be rediscovered
- **SP(S3)** Covered by international threatened species agreement such as JAMBA or CAMBA
- **SP(S4)** Other specially protected fauna

Priority Fauna:
- **P1** Taxa with few, poorly known populations on threatened lands
- **P2** Taxa with few, poorly known populations on conservation lands
- **P3** Taxa with several, poorly known populations, some on conservation lands
- **P4** Taxa in need of monitoring (not considered threatened or in need of special protection but could be if present circumstances change)
- **P5** Taxa in need of monitoring (subject to a conservation program, the cessation of which would result in the species becoming threatened within 5 years)

EPBC
Under the Environment Protection and Biodiversity Conservation Act:
- **CR** Critically Endangered
- **EN** Endangered
- **VU** Vulnerable
- **CD** Conservation Dependent
- **Mig** Migatory

Other
International Conventions: **J** Jamba, **C** Camba, **BC** Bonn Convention

T Threatened according to the IUCN categories:
- **(CR)** Critically Endangered –facing an extremely high risk of extinction in the wild in the immediate future
- **(EN)** Endangered – facing a very high risk of extinction in the wild in the near future
- **(VU)** Vulnerable – facing a high risk of extinction in the wild in the medium-term future

LR Lower Risk when evaluated against the IUCN categories as does not satisfy the threatened criteria but does fit:

- **(cd)** Conservation Dependent – the focus of a taxon-specific conservation program, the cessation of which would result in the taxon qualifying for one of the threatened categories within a period of 5 years
- **(nt)** Near Threatened – not Conservation Dependent but is close for qualifying for Vulnerable
- **(lc)** Least Concern – not Conservation Dependent or Near Threatened

According to the Australian Society for Fish Biology's list of Australian threatened fishes:

- **pVU** proposed Vulnerable
- **VU** Vulnerable – taxa not presently endangered but which are at risk by having small populations and/or populations which are declining at a rate that would render then endangered in the near future
- **R** Restricted – taxa that are not presently in danger but which occur in restricted areas, or have suffered a long term reduction in distribution and/or abundance and are now uncommon

APPENDIX 6 – ENDEMIC AND CONSERVATON FLORA

There are at least 210 vascular flora taxa in the Shannon National Park and 854 taxa in the D'Entrecasteaux National Park, totalling 889 taxa in the parks, from 94 families. There are also numerous non-vascular flora but these records have not been collated other than those that are known to be rare or priority taxa.

Endemic and Conservation Flora

There are 50 species of rare and priority flora (including three mosses which are non-vascular) in 184 populations within 26 vegetation complexes. Twenty four species that occur in the parks have ranges of less than 150 kilometres and are considered narrow or locally endemic and 11 species occur only in the Warren bioregion (including five that are locally endemic as well) which also can be considered endemic. Of these 30 'endemic' species, 17 are also considered rare or priority.

There are 39 relictual species (including 27 monotypic taxa) and nine disjunct species that occur within the parks.

Family	Scientific Name	Cons Code*	Park
Adiantaceae	*Adiantum aethiopicum*	RT	DE
	Cheilanthes austrotenuifolia	RT	DE
Amblystegiaceae	*Drepanocladus aduncus*	P2, LE, E	DE
Anthericaceae	*Agrostocrinum scabrum*	RM	DE
	Hodgsonia juncifomis	LE, RM	DE
Apiaceae	*Actinotus sp. Walpole*	P3	S
	Homalosciadium homalocarpum	RM	S DE
	Xanthosia eichleri	P3	DE
Aspleniaceae	*Asplenium aethiopicum*	P4, RT	DE
	Asplenium flabellifolium	RT	DE
	Asplenium obtusatum subsp. northlandicum	R, D	DE
Asteraceae	*Quinetia urvillei*	RM	DE
Cephalotaceae	*Cephalotus follicularis*	RM	DE
Cyperaceae	*Chorizandra multiarticulata*	D	DE
	Cyathochaeta stipoides	P3	DE
	Reedia spathacea	P4, RM, RT, D	DE
	Schoenus fluitans	P2, D	DE
Dasypogonaceae	*Baxteria australis*	RM	DE
	Dasypogon hookeri	LE	DE
	Kingia australis	RM	DE
	Lomandra hastilis	D	DE
	Lomandra ordii	P3, LE, E	S DE
Dennstaedtiaceae	*Pteridium esculentum*	RT	S DE
Droseraceae	*Drosera binata*	P2, D	DE
Epacridaceae	*Andersonia amabile MS*	P3	DE
	Andersonia geniculata MS	LE	DE
	Cosmelia rubra	RM	DE
	Leucopogon gracilis	LE	DE
	Leucopogon tamariscinus	P4	DE
	Needhamiella pumilio	RM	DE

Family	Scientific Name	Cons Code*	Park	
	Sphenotoma parviflorum	P3		DE
Euphorbiaceae	*Amperea protensa*	P2	S	DE
Goodeniaceae	*Diaspasis filifolia*	RM		DE
Halogoraceae	*Meziella trifida*	R, RM	S	DE
	Gonocarpus hexandrus subsp. hexandrus	E		DE
	Gonocarpus pusillus	P3		DE
	Gonocarpus simplex	P3	S	DE
Lamiaceae	*Hemiandra australis MS*	P2, E		DE
Lindsaeaceae	*Lindsaea linearis*	RT		DE
Loranthaceae	*Nuytsia floribunda*	RM		DE
Lycopodiaceae	*Lycopodiella serpentina*	RT		DE
	Phylloglossum drummondii	RM, RT		DE
Myrtaceae	*Astartea arbuscula*	P4		DE
	Astartea sp.Mt Johnston(A.R.Annels 5645) PN	P3, LE		DE
	Astartea sp.Scott River(D.Backshall 88233) PN	P4, LE		DE
	Chamelaucium floriferum subsp. diffusum MS	P2, LE		DE
	Homalosperum firmum	RM	S	DE
	Hypocalymma cordifolium subsp. minus	P4		DE
	Melaleuca basicephala	P4		DE
	Melaleuca diosmifolia	P3		DE
	Melaleuca ringens	P3, E		DE
Ophioglossaceae	*Ophioglossum lusitanicum*	RT		DE
Orchidaceae	*Caladenia interjacens MS*	P4, LE, E		DE
	Caladenia meridionalis	LE, E		DE
	Diuris heberlei	P2		DE
	Epiblema grandiflorum var. grandiflorum	RM		DE
	Eriochilus pulchellus MS	D	S	DE
	Eriochilus scaber subsp. orbifolia	P1, E		DE
	Mictrotis globula	R		DE
	Microtis media subsp. quadrata	P4		DE
	Microtis pulchella	P4		DE
	Praecoxanthus aphyllus MS	RM		DE
	Thelymitra jacksonii MS	P3		DE
Pannariaceae	*Degelia flabellata*	P2		DE
Papilionaceae	*Bossiaea webbii*	LE		
	Callistachys lanceolata	RM	S	DE
	Euchilopsis linearis	RM		DE
	Gastrolobium formosum	P3, E, RM		DE
	Kennedia glabrata	R, LE		DE
	Viminaria juncea	RM		DE
Pittosporaceae	*Marianthus sp. Walpole*	P3, LE		DE
Poaceae	*Austrofestuca littoralis*	P1, D		DE
	Diplopogon setaceus	RM	S	DE
Podocarpaceae	*Podocarpus drouynianus*	RT	S	DE
Pottiaceae	*Calymperastrum latifolium*	P2, LE, E		DE
Proteaceae	*Acidonia microcarpa*	RM		DE
	Banksia verticillata	R, D		DE
	Dryandra sessilis var. cordata	P2		DE
	Grevillea papillosa	P3, LE		DE
Restionaceae	*Alexgeorgea ganopoda*	P2, LE		DE
	Chordifex amblycoleus	LE		DE

Family	Scientific Name	Cons Code*	Park
	Chordifex jacksonii MS	P2, LE	DE
	Hypolaena grandiuscula	E	S
	Meeboldina crassipes MS	P3, LE	S DE
	Stenotalis ramosissima	RM, RT	S DE
	Taraxis grossa	RM, RT	S DE
	Tyrbastes glaucescens	P4, RM, RT	DE
Rhacocarpaceae	*Rhacocarpus webbianus*	R, LE, E	DE
Ramnaceae	*Trymalium venustum*	LE	S
Rutaceae	*Chorilaena quercifolia*	RM	S DE
Schizaeaceae	*Schizaea fistulosa*	RT	S DE
Selaginellaceae	*Selginella gracillima*	RT	DE
Solananceae	*Anthocercis sylvicola*	P2, RT	DE
Stackhousiaceae	*Tripterococcus brachylobus*	P4	DE
Stylidiaceae	*Stylidium leeuwinense*	P3	DE
Xyridaceae	*Xyris indivisa*	LE	DE
	Xyris roycei	LE	S DE

***See Glossary for definitions of the Conservation Codes: R (rare), P1-4 (priority species), LE (locally endemic), E (endemic), RT (relictual taxanomic), RM (relictual monotypic) and D (disjunct).**

Rare and Priority Species By Conservation Code

Conservation Code	Number of Species					
	Rare or Priority	Endemic	Locally Endemic	Relictual Monotypic	Relictual Taxonomic	Disjunct
Rare	6	1	2	1	-	2
Priority 1	2	1	1	-	-	1
Priority 2	13	3	4	-	1	2
Priority 3	17	3	5	1	-	-
Priority 4	12	1	2	2	3	1
Other	-	3	10	23	13	3
Subtotal	50	12	24	27	17	9
Total	**102 different taxa**					

Rare and Priority Species By Populations

Species	Number of Populations
Actinotis sp. Walpole	1
Alexgeorgea ganopoda	1
Amperea protensa	7
Andersonia amabile	5
Anthocercis sylvicola	1
Asplenium aethiopicum	9
Asplenium obtusatum subsp. northlandicum	1
Astartea arbuscula	2
Astartea sp. Mt. Johnston	1
Astartea sp. Scott River	2
Austrofestuca littoralis	1
Banksia verticillata	2
Caladenia interjacens	11
Calymperastrum latifolium	1
Chamaelaucium floriferum subsp. diffusum MS	7
Chordifex jacksonii	9
Cyathochaeta stipoides	6
Degelia flabellata	2

Species	Number of Populations
Diuris heberlei	2
Drepanocladus aduncus	1
Drosera binata	2
Dryandra sessilis var. cordata	1
Eriochilus scaber subsp. orbifolia	7
Gastrolobium formosum	1
Gonocarpus pusillus	1
Gonocarpus simplex	8
Grevillea papillosa	5
Hemiandra australis	5
Hypocalymma cordifolium subsp. minus	4
Kennedia glabrata	8
Leucopogon tamariscinus	2
Lomandra ordii	15
Marianthus sp. Walpole	1
Meeboldina crassipes	6
Melaleuca basicephala	4
Melaleuca diosmifolia	2
Melaleuca ringens	3
Meziella trifida	5
Microtis globula	2
Microtis media subsp. quadrata	1
Microtis pulchella	2
Reedia spathacea	7
Rhacocarpus webbianus	1
Schoenus fluitans	1
Sphenotoma parviflorum	1
Stylidium leeuwinense	1
Thelymitra jacksonii	5
Tripterococcus brachylobus	1
Tyrbastes glaucescens	5
Xanthosia eichleri	2
Total	184

APPENDIX 7 – SIGNIFICANT VEGETATION COMMUNITIES

Vegetation Complexes with 15% or less than 15% of Pre-European Extent Formally Reserved (July 2003)

Vegetation Complex*	Pre-1750 Area	Extant Area		In Existing Formal Reserves		In D'Entrecast-eaux NP	In Shannon NP	Parks Represent Extant	Parks Represent of Existing Formal Reserves	Proposed Reserves	Total to be Formally Reserved	
	(ha)	(ha)	(%)	(ha)	(%)	(ha)	(ha)	(%)	(%)	(ha)	(ha)	(%)
Bevan 1 (BE1)	76 778	62 863	82	608	<1	-	588	<1	7	7339	7947	10
Corbalup (CL1)	15136	10 768	71	95	<1	-	13	<1	<1	1413	1508	10
Collis 1 (CO1)	5103	3067	60	325	6	170	93	9	38	368	693	14
D'Entrecasteaux (D5)	2838	2199	77	280	10	144	-	7	51	0	280	10
Granite Valleys (V1)	2299	2124	92	237	10	-	80	4	23	107	342	15
Wheatley (WH1)	20 322	16 508	81	539	3	11	-	<1	<1	1969	2508	12
Yanmah (YN1)	23 510	19 395	82	438	2	89	28	<1	3	3176	3514	15
Yanmah (YN2)	6749	5305	79	13	<1	-	12	<1	13	76	89	1

*Havel and Mattiske 2000

Rare and Priority Species By Vegetation Complex and Conservation Code

Vegetation Complex*	Rare	P1	P2	P3	P4	Total Species
Angove (A)	1	0	2	5	1	9
Burnett (BU)	0	0	1	2	0	3
Blackwater (BWp)	0	0	2	6	6	14
Cleave (CV)	0	0	0	0	1	1
Collis (COb)	1	0	0	1	0	2
Collis 1 (COy1)	1	0	0	3	1	6
Crowea (CRb)	0	1	0	0	0	1
D'Entrecasteaux (DE5)	0	0	0	1	0	1
D'Entrecasteaux (E)	0	0	1	2	0	3
Keystone (Kb)	3	0	4	0	2	9
Keystone (Ky)	0	0	0	2	0	2
Lakes (L)	0	0	1	0	0	1
Meerup (Mc)	0	2	0	0	1	3
Meerup (Mf)	0	0	1	0	0	1
Meerup (Mp)	1	3	2	2	1	9
Meerup (Ms)	0	0	1	0	0	1
Meerup (Mu)	0	0	1	0	0	1
Mattaband (MTb)	0	0	0	1	1	2
Mattaband 1 (Mty1)	0	0	2	2	0	4
Pingerup (Pi)	3	0	2	1	3	9
Quagering (Q)	2	0	0	1	0	3
Shallow Valleys (S3)	0	0	0	0	1	1
Scott (Sd)	0	0	1	1	1	3
Scott (Swd)	0	0	0	4	3	7
Granite Valleys (V4)	0	0	2	3	1	6
Yanmah (YN1)	0	0	0	0	1	1

*Havel and Mattiske 2000

Location of Rare and Priority Species in Vegetation Complexes

Species	Veg Complex(es)*
Actinotis sp. Walpole	Angove
Alexgeorgea ganopoda	Mattaband 1
Amperea protensa	Angove, Blackwater (Bwp), Pingerup, Granite Valleys
Andersonia amabile	Angove, Mattaband 1, Blackwater (Bwp), Granite Valleys, D'Entrecasteaux (DE5)
Anthocercis sylvicola	Keystone
Asplenium aethiopicum	Keystone, Yanmah
Asplenium obtusatum subsp. northlandicum	Meerup (Mp)
Astartea arbuscula	Scott (Swd), Pingerup
Astartea sp. Mt. Johnston	Keystone
Astartea sp. Scott River	Blackwater, Scott (Swd)
Austrofestuca littoralis	Meerup (Mp)
Banksia verticillata	Keystone
Brachyscias verecundus	Crowea
Caladenia interjacens	Blackwater, Meerup (Mc, Mp)
Calymperastrum latifolium	Keystone
Chamaelaucium floriferum subsp. diffusum MS	Keystone
Chordifex jacksonii	Blackwater, Lakes, Mattaband 1. Pingerup, Scott (Sd)
Cyathochaeta stipoides	Meerup (Mc)
Degelia flabellata	Keystone (Kb)
Diuris heberlei	Meerup (Mu)

Species	Veg Complex(es)*
Drepanocladus aduncus	Meerup (Ms)
Drosera binata	Angove
Dryandra sessilis var. cordata	Meerup (Mp)
Eriochilus scaber subsp. orbifolia	Meerup (Mc, Mp)
Gastrolobium formosum	Scott (Swd)
Gonocarpus pusillus	Blackwater (Bwp)
Gonocarpus simplex	Angove, Blackwater (Bwp), Pingerup, Scott (Swd), Granite valleys
Grevillea papillosa	Scott (Sd, Swd)
Hemiandra australis	D'Entrecasteaux (E), Meerup (Mp), Granite Valleys
Hypocalymma cordifolium subsp. minus	Blackwater (Bwp), Collis 1, Pingerup
Kennedia glabrata	Collis, Collis 1, Keystone, Pingerup
Leucopogon tamariscinus	Blackwater (Bwp)
Lomandra ordii	Angove, Collis1, Granite Valleys
Marianthus sp.Walpole	Burnett
Meeboldina crassipes	Burnett, Blackwater (Bwp), Collis 1
Melaleuca basicephala	Blackwater (Bwp), Scott, Granite Valleys
Melaleuca diosmifolia	D'Entrecasteaux (E), Meerup (Mp)
Melaleuca ringens	D'Entrecasteaux (E), Meerup (Mp)
Meziella trifida	Angove, Pingerup, Quagering
Microtis globula	Pingerup, Quagering
Microtis media subsp. quadrata	Pingerup
Microtis pulchella	Mattaband (MTb), Cleave
Reedia spathacea	Angove, Blackwater (Bwp), Keystone
Rhacocarpus webbianus	Keystone
Schoenus fluitans	Meerup(Mf)
Sphenotoma parviflorum	Mattaband
Stylidium leeuwinense	Quagering
Thelymitra jacksonii	Burnett, Collis1, Keystone, Mattaband 1
Tripterococcus brachylobus	Scott(Swd)
Tyrbastes glaucescens	Shallow Valleys, Scott(Swd)
Xanthosia eichleri	Collis (COb)

* Havel and Mattiske 2000 (see below)

Description of Vegetation Complexes in the Parks

Darling Plateau – Uplands

Wishart (WS2)
Tall open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Banksia grandis* with some *Allocasuarina fraseriana* on lower escarpment in hyperhumid to humid zones.

Bevan 1 (BE1)
Tall open forest of *Corymbia calophylla-Eucalyptus marginata* subsp. *marginata* on uplands in perhumid and humid zones.

Bevan (BEb)
Tall open forest of *Eucalyptus diversicolor-Corymbia calophylla* over *Allocasuarina decussata-Agonis flexuosa* on lower slopes and *Banksia grandis* on upper slopes of undulating uplands in perhumid and humid zones.

Bevan 1 (BEy1)
Tall open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on uplands with a low woodland of *Melaleuca preissiana -Banksia littoralis* on the scattered depressions in perhumid and humid zones.

Corbalup 1 (CL1)
Mosaic of open forest of *Eucalyptus marginata* subsp. *marginata-Banskia* spp. on well drained sites, with some *Eucalyptus decipiens* on lower slopes in southern areas, woodland of *Eucalyptus rudis-Melaleuca preissiana-Banksia littoralis* on depressions in perhumid and humid zones.

Collis 1 (CO1)
Open forest to tall open forest of *Eucalyptus marginata* subsp. *marginata* with some *Corymbia calophylla* on low undulating hills in perhumid and humid zones.

Collis (COb)
Tall open forest of *Eucalyptus diversicolor-Corymbia calophylla* on crests of hills arising above the southern coastal plain in the hyperhumid zone.

Collis (COd)
Tall open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Banksia grandis* on saddles between hills in the perhumid zone.

Collis 1 (COy1)
Tall open forest to woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Banksia grandis-Allocasuarina fraseriana* on low hills and with *Allocasuarina decussata* on slopes in perhumid and humid zones.

Crowea (CRb)
Tall open forest of *Corymbia calophylla-Eucalyptus diversicolor* on upper slopes with *Allocasuarina decussata-Banksia grandis* on upper slopes in hyperhumid and perhumid zones.

Crowea (CRd)
Open forest to tall open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on uplands in hyperhumid and perhumid zones.

Crowea (CRy)
Tall open forest of *Corymbia calophylla* with mixture of *Eucalyptus marginata* subsp. *marginata* and *Eucalyptus diversicolor* on uplands in hyperhumid and perhumid zones.

Keystone (Kb)
Mosaic of tall open forest *of Eucalyptus guilfoylei-Eucalyptus jacksonii-Eucalyptus diversicolor* on slopes of major hills rising above coastal plain with *Allocasuarina decussata-Banksia grandis-Agonis flexuosa* on slopes in hyperhumid and perhumid zones and tall open forest of *Eucalyptus brevistylis-Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* and the occasional *Eucalyptus megacarpa* near rock outcrops in hyperhumid and perhumid zones.

Keystone (Ky)
Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Banksia grandis* on mild slopes of hills in perhumid zone and open forest to tall open forest of *Eucalyptus brevistylis* on slopes below outcrops in hyperhumid and perhumid zones.

Mattaband (MTb)
Mixture of tall open forest of *Eucalyptus diversicolor-Corymbia calophylla* and woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Agonis flexuosa* 5on small hills arising above the coastal plain with some outcrops in hyperhumid and perhumid zones.

Mattaband 1 (MTy1)
Mixture of tall open forest of *Eucalyptus diversicolor-Eucalyptus guilfoylei*, tall open forest of *Eucalyptus jacksonii-Eucalyptus diversicolor* and an open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla – Banksia grandis* on hills rising above the coastal plain in hyperhumid and perhumid zones.

Darling Plateau – Depressions and Swamps on Uplands

Camballup (CM)
Mosaic of woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on slopes, and woodland of *Eucalyptus occidentalis-Melaleuca cuticularis-Melaleuca rhaphiophylla,* low woodland of *Melaleuca preissiana-Banksia littoralis* and tall shrublands of *Melaleuca viminea* on broad depressions in humid to semiarid zones.

Cormint (CT)
Open woodland of *Eucalyptus marginata* subsp. *marginata* over *Banksia littoralis* and *Melaleuca* spp. on broad depressions in the perhumid zone.

Darling Plateau – Valleys

Wheatley (WH1)
Tall open forest of *Eucalyptus diversicolor-Corymbia calophyll*a on slopes and tall open forest of *Eucalyptus patens* on valley floor in perhumid and humid zones.

Yanmah (YN1)
Mixture of tall open forest of *Eucalyptus diversicolor* and tall open forest of *Corymbia calophylla-Eucalyptus patens-Eucalyptus marginata* subsp. *marginata* over *Agonis flexuosa* and *Agonis juniperina* on valleys in perhumid and humid zones.

Yanmah (YN2)
Mixture of tall open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on slopes and low woodland of *Banksia littoralis-Banskia seminuda* on valley floors in the humid zone.

Pemberton (PM1)
Tall open forest of *Eucalyptus diversicolor* with mixtures of *Corymbia calophylla* on valley slopes and low forest of *Agonis juniperina-Banksia seminuda-Callistachys lanceolata* on valley floors in the perhumid zone.

Cattaminup (CP)
Mosaic of tall open forest of *Eucalyptus diversicolor-Corymbia calophylla* on low undulating hills and woodland of *Melaleuca preissiana-Banksia littoralis* on depressions in perhumid and humid zones.

Granite Valleys (S1)
Tall open forest of *Eucalyptus diversicolor-Corymbia calophylla* on slopes with some *Eucalyptus patens* and *Eucalyptus megacarpa* on valley floors in hyperhumid and perhumid zones.

Granite Valleys (V1)
Mixture of tall open forest of *Eucalyptus diversicolor-Allocasuarina decussata-Agonis flexuosa*, and tall open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Eucalyptus guilfoylei* on valleys at transition between granite hills and sedimentary plain with some *Corymbia calophylla* on slopes and *Eucalyptus patens* and *Agonis juniperina* on lower slopes in hyperhumid and perhumid zones.

Granite Valleys (Vh2)
Tall open forest of *Eucalyptus diversicolor-Eucalyptus patens* on slopes with *Agonis flexuosa-Allocasuarina decussata -Callistachys lanceolata* on valley floors in hyperhumid and perhumid zones.

Granite Valleys (Vh3)
Tall open forest of *Eucalyptus diversicolor-Eucalyptus guilfoylei* on slopes and woodland of *Eucalyptus rudis - Banksia littoralis* on lower slopes in hyperhumid and perhumid zones.

Granite Valleys (V4)
Tall open forest of *Eucalyptus diversicolor-Allocasuarina decussata-Agonis flexuosa* with *Eucalyptus patens* and *Corymbia calophylla* on slopes at the interface between granite hills and the southern coastal plain, with some shrublands of Myrtaceae spp. in hyperhumid and perhumid zones.

Lefroy (LF)
Tall open forest of *Eucalyptus diversicolor-Corymbia calophylla* on slopes and low woodland of *Agonis juniperina-Callistachys lanceolata* on lower slopes in hyperhumid and perhumid zones.

Southern Plains

Quagering (Q)
Mosaic of low open woodland of *Eucalyptus marginata* subsp. *marginata-Banksia ilicifolia-Nuytsia floribunda* and low open woodland of *Eucalyptus patens-Melaleuca preissiana-Nuytsia floribunda* on less undulating flats in hyperhumid and perhumid zones.

Burnett (BU)
Mosaic of tall shrubland of *Agonis linearifolia-Agonis parviceps*, open heaths of Myrtaceae-Proteaceae-Papilionaceae spp. with some emergent *Eucalyptus patens* and *Eucalyptus megacarpa* and sedgeland of *Anarthria-Lepidosperma* spp. on broad flats in the hyperhumid zone.

Angove (A)
Open forest of *Eucalyptus marginata* subsp. *marginata-Banksia ilicifolia-Nuytsia floribunda* with some *Eucalyptus diversicolor* on gently sloping sandy terrain in hyperhumid and perhumid zones.

Pingerup (Pi)
Mosaic of closed heaths of Myrtaceae spp. and sedgeland of Restionaceae-Cyperaceae spp. with occasional emergent *Eucalyptus patens* and *Melaleuca preissiana* on

broad depressions and drainage corridors in hyperhumid and perhumid zones.

Owingup (OW)
Mosaic of open woodland of *Allocasuarina fraseriana-Banksia attenuata-Banksia ilicifolia*, low open woodland of *Melaleuca rhaphiophylla-Agonis juniperina*, low open woodland of *Melaleuca cuticularis* and tall shrubland of *Melaleuca densa* on broad swamps and plains in the hyperhumid zone.

Blackwater (BW)
Low open woodland of *Agonis flexuosa-Agonis juniperina* on low rises, and a mosaic of sedgeland of *Leptocarpus* spp., open heath of Myrtaceae-Proteaceae spp., low open woodland of *Melaleuca rhaphiophylla-Banksia littoralis* on broad flats in hyperhumid and perhumid zones.

Blackwater (BWp)
Mosaic of low open woodland of *Melaleuca preissiana*, low open woodland of *Melaleuca cuticularis*, open heath of Myrtaceae-Proteaceae spp. and sedgelands of Restionaceae spp. on low lying flats in hyperhumid and perhumid zones.

Hawk (HK)
Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Agonis flexuosa* on mild slopes in the hyperhumid zone.

Quindabellup (QN)
Low woodland of *Eucalyptus marginata* subsp. *marginata* on slopes and low open woodland of *Banksia littoralis-Melaleuca preissiana* on broad depressions in perhumid and humid zones.

Shallow Valleys (S3)
Low woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on slopes, and mosaic of low open woodland of *Melaleuca preissiana-Banksia littoralis* , closed heaths and sedgeland of Cyperaceae spp. on valley floors with impeded drainage in hyperhumid and perhumid zones.

Broad Swamps (S4)
Low woodland of *Eucalyptus marginata* subsp. *marginata-Nuytsia floribunda* with some *Melaleuca preissiana* and closed heaths of Myrtaceae spp. on broad drainage lines in hyperhumid and perhumid zones.

Blackwood Plateau and Plain – Uplands

Kingia (KI)
Open forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Allocasuarina fraseriana-Banksia grandis-Xylomelum occidentale* on lateritic uplands in perhumid and humid zones.

Jangardup (JN)
Open woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on rises and low open woodland of *Melaleuca preissiana-Banksia littoralis* on depressions in hyperhumid and perhumid zones.

Blackwood Plateau and Plain – Depressions and Swamps on Uplands

Coate (CE)
Low open woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Allocasuarina fraseriana-Banksia ilicifolia* and low open woodland of *Melaleuca preissiana-Banksia littoralis* on broad depressions in upper gullies in perhumid and humid zones.

Blackwood Plateau and Plain – Valley Floors and Swamps

Darradup (DP)
Open forest to woodland of *Corymbia calophylla* with some *Eucalyptus marginata* subsp. *marginata* on slopes, woodland of *Eucalyptus rudis*4 *-Banksia seminuda-Melaleuca preissiana-Agonis flexuosa* and tall shrubland of *Agonis linearifolia-Callistachys lanceolata* on fringes of streams in perhumid and humid ones.

Scott Coastal Plain – Uplands

Scott (Sd)
Low open forest and low woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Agonis flexuosa* with some *Eucalyptus patens* and *Banksia* spp. on low dunes to low woodland of *Melaleuca preissiana-Banksia littoralis* on inter-dune depressions in hyperhumid and perhumid zones.

Scott (Sd2)
Low woodland of *Banksia attenuata-Banksia ilicifolia-Nuytsia floribunda-Eucalyptus marginata* subsp. *marginata* with occasional *Corymbia calophylla* on dunes rising above the plain in hyperhumid and perhumid zones.

Scott Coastal Plain – Valley Floors and Swamps

Scott (Swd)
Mosaic of sedgeland of Restionaceae-Cyperaceae spp. and closed heath of Myrtaceae-Proteaceae spp. with occasional *Banksia ilicifolia* on swampy depressions and stunted *Eucalyptus marginata*24 subsp. *marginata-Banksia attenuata-Xylomelum occidentale* on low sandy rises in hyperhumid and perhumid zones.

Jasper (JA)
Open forest to woodland of *Corymbia calophylla* with some *Banksia littoralis-Callistachys lanceolata* near low lying drainage areas in the hyperhumid zone.

Cleave (CV)
Woodland of *Melaleuca preissiana* on drainage areas in the hyperhumid zone.

Southern Coastal Dune System

D'Entrecasteaux (E)
Coastal complex and closed heath of *Phyllanthus calycinus – Olearia axillaris-Spyridium globulosum-Pimelea ferruginea -Rhagodia baccata* with some emergents of *Agonis flexuosa* and sedgeland of *Lepidosperma* spp. on steeper exposed dunes in the hyperhumid zone.

D'Entrecasteaux (D5)
Mosaic of low woodland of *Agonis flexuosa* and closed heath of *Olearia axillaris-Spyridium globulosum-Acacia littorea* on steep dunes on calcareous deep sands in the perhumid zone.

D'Entrecasteaux (DE5)
Coastal complex and closed heath of *Olearia axillaris* and *Senecio* spp. on recently stabilised dunes in hyperhumid and perhumid zones.

D'Entrecasteaux (Dd5)
Woodland to low forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Agonis flexuosa-Banskia grandis* with some *Eucalyptus megacarpa* on stabilised higher dunes in hyperhumid and perhumid zones.

D'Entrecasteaux (Dd)
Woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Agonis flexuosa-Banskia grandis* with some *Eucalyptus megacarpa* on recent low dunes with dense shrub understorey in hyperhumid and perhumid zones.

Meerup (Mc)
Coastal complex and closed heath of *Olearia axillaris-Spyridium globulosum-Pimelea ferruginea-Rhagodia baccata* and sedgeland of *Lepidosperma* spp. on recently developed coastal dunes in the hyperhumid zone.

Meerup (Mf)
Low woodland of *Eucalyptus megacarpa-Agonis flexuosa-Allocasuarina fraseriana* on flats between dunes some distance from coast in the hyperhumid zone.

Meerup (Mp)
Mosaic of open low woodland of *Agonis flexuosa* with some *Eucalyptus cornuta,* tall shrubland of *Agonis flexuosa* with *Trymalium floribundum* in gullies and closed heath of *Olearia axillaris-Spyridium globulosum-Acacia littorea* on stabilised dunes in the hyperhumid zone.

Meerup (Mr)
Low woodland of *Agonis flexuosa-Banksia attenuata* in gullies between beach ridges supporting coastal complex in the hyperhumid zone.

Meerup (Ms)
Low woodland of *Agonis flexuosa-Xylomelum occidentale-Banksia attenuata-Banksia ilicifolia* on oldest dunes in the hyperhumid zone.

Meerup (Mu)
Coastal complex and open heath of open *Olearia axillaris-Acacia cyclops-Acacia divergens* and sedgeland of *Lepidosperma* spp. on unstable coastal dunes in the hyperhumid zone.

Meerup (My)
Closed heath of *Olearia axillaris-Spyridium globulosum-Phyllanthus calycinus* with occasional *Agonis flexuosa* in gullies on steep sloped dunes in the hyperhumid zone.

Significant Vegetation Associations that Meet or Exceed the Criteria for Significance used by Hopkins *et al.* 2000

Veg Association No*	Beard Code	Description	Reason For Significance
37	mSc	Shrublands; teatree thicket	Poorly reserved >0 but < 15% in reserves
949	bLi	Low woodland; banksia	Poorly reserved >0 but < 15% in reserves
965	e2,3Mi	Medium woodland; jarrah (*E. marginata*) & marri *(E. calophylla*)	Vegetation association of limited extent in study area e.g. < 2000 ha in SW catchments
999	e3Mi	Medium woodland; marri (*E. calophylla*)	Poorly reserved >0 but < 15% in reserves and ≤ 30% of original extent
1111	e37Mi	Medium woodland; yate (*E. occidentalis*)	Poorly reserved or limited in extent
1112	e1Tc/e2,3Tc	Mosaic: Tall forest; karri (*E. diversicolor*) / Tall forest; jarrah (*E. marginata*) & marri (*E. calophylla*)	Poorly reserved or limited in extent
1115	e3,37Mi	Medium woodland; marri (*E. calophylla*) & yate (*E. occidentalis*)	Poorly reserved or limited in extent
1131	e37Mc	Medium forest; bushy yate (*E. cornuta*)	Poorly reserved or limited in extent

* Beard 1980

APPENDIX 8 – ENVIRONMENTAL WEEDS

Environmental Weed Strategy Rating

High Priority for control and/or research

Moderate Control or research efforts should be directed to it if funds are available in addition to reasonably high level of monitoring

Mild Monitoring and control where appropriate

Low Low level of monitoring

Based on *Environmental Weed Strategy for Western Australia (1999)*

Species	Common Name	Location	Local Management
High (6)			
Bromus diandrus	Great brome	D'Entrecasteaux NP	Control
Freesia hybrid	Freesia	Scattered, Shannon Townsite	Monitor
Lagurus ovatus	Hares tail grass	D'Entrecasteaux NP	Control
Leptospermum laevigatum	Victoria tea tree	Shannon Townsite, Windy Harbour, Coodamurrup/Fish Creek	Control, if possible eradicate
Pelargonium capitatum	Rose pelargonium	Scattered, Windy Harbour	Monitor
*Zantedeschia aethiopica**	Arum lily	Lower Donnelly River, Lake Jasper	Control, if possible eradicate
Moderate (36)			
Aira caryophyllea	Silvery hair grass	D'Entrecasteaux NP	Control/monitor
Aira cupaniana	Silvery hair grass	D'Entrecasteaux NP	Control/monitor
Anagallis arvensis	Pimpernel	D'Entrecasteaux NP	Control/monitor
Arctotheca populifolia	Dune arctotheca	D'Entrecasteaux NP	Control/monitor
Briza maxima	Blowfly grass	D'Entrecasteaux NP	Control/monitor
Briza minor	Shivery grass	D'Entrecasteaux NP	Control/monitor
Cakile maritima	Sea rocket	D'Entrecasteaux NP	Control/monitor
Carpobrotus edulis	Hottentot fig	D'Entrecasteaux NP	Control/monitor
Centaurium erythraea	Common centaury	D'Entrecasteaux NP	Control/monitor
Chasmanthe floribunda	African cornflag	Scattered, Windy Harbour Road	Control, if possible eradicate
Cuscuta epithymum	Dodder	D'Entrecasteaux NP	Control/monitor
Euphorbia paralias	Sea spurge	D'Entrecasteaux NP	Control/monitor
Euphorbia peplus	Petty spurge	D'Entrecasteaux NP	Control/monitor
Ficus carica	Fig tree	Bolghinup Hut, other stockman's huts/camps	Monitor
Heliophila pusilla	-	D'Entrecasteaux NP	Control/monitor
Holcus lanatus	Yorkshire fog	D'Entrecasteaux NP	Control/monitor
Hypochaeris glabra	Smooth cat's ear or flat weed	D'Entrecasteaux NP	Control/monitor
Isolepis marginata	Coarse club rush	D'Entrecasteaux NP	Control/monitor
Isolepis prolifera	Budding club rush	D'Entrecasteaux NP	Control/monitor
Juncus bufonius	Toad rush	D'Entrecasteaux NP	Control/monitor
Lolium rigidum	Annual rye grass	D'Entrecasteaux NP	Control/monitor

Species	Common Name	Location	Local Management
Melilotus indica	Hexham scent King Island melilot	Yeagarup, Malimup	Control/monitor
Orobanche minor	Lesser Broomrape	Scattered along roadsides	Control/monitor
Parentucellia viscosa	Sticky bartsia	Shannon NP, D'Entrecasteaux NP	Control/monitor
Paspalum sp.	Paspalum	Yeagarup, Callcup	Eradicate
Pinus pinaster	Pinaster pine	Yeagarup, Callcup, Shannon	Control, if possible eradicate
Pinus radiata	Radiata pine	Shannon Townsite	Control
Rorippa nasturtium-aquaticum	Watercress	D'Entrecasteaux NP	Control/monitor
Sigesbeckia orientalis	Indian weed	D'Entrecasteaux NP	Control/monitor
*Solanum sodomaeum**	Apple of Sodom	Lake Jasper	Eradicate
Sonchus oleraceus	Common sowthistle	D'Entrecasteaux NP	Control/monitor
Trifolium campestre var. campestre	Hop clover	D'Entrecasteaux NP	Control/monitor
Trifolium subterraneum	Subterranean clover	Shannon NP	Control/monitor
Vellereophyton dealbatum	White cudweed	D'Entrecasteaux NP	Control/monitor
Vulpia fasciculata	-	D'Entrecasteaux NP	Control/monitor
Vulpia myuros	-	D'Entrecasteaux NP	Control/monitor
Mild (8)			
Acacia dealbata	Silver wattle	Shannon Townsite	Monitor
Acacia decurrens	Early black wattle	Shannon Townsite	Monitor
Dittrichia graveolens	Stinkwort	Shannon Townsite	Control, if possible eradicate
Juncus articulatus	Jointed rush	D'Entrecasteaux NP	Monitor
Juncus microcephalus	Tiny-headed rush	D'Entrecasteaux NP	Monitor
Plantago major	Great plantain	D'Entrecasteaux NP	Monitor
Poa annua	Annual winter grass	D'Entrecasteaux NP	Monitor
Trachyandra divaricata	Branched onion weed	Windy Harbour, Malimup and scattered along coast	Control, if possible eradicate
Low (31)			
Acacia elata	Mountain cedar wattle	Shannon Townsite	Monitor
Acacia melanoxylon	Blackwood	Shannon Dam	Control, if possible eradicate
Acacia podalyriifolia	Queensland silver wattle	Shannon Townsite	Monitor
Acetosella vulgaris	Sheep sorrel	D'Entrecasteaux NP	Monitor
Aira praecox	Early hair grass	D'Entrecasteaux NP	Monitor
Amaryllis belladonna	Easter lily	Shannon Townsite	Monitor
Ammophila arenaria	Marram grass	Disturbed dunes	Monitor
Bromus hordeaceus	Soft brome	D'Entrecasteaux NP	Monitor
Cardamine hirsuta	Common bittercress	D'Entrecasteaux NP	Monitor
Cerastium glomeratum	Chickweed	D'Entrecasteaux NP	Monitor
Conyza albida	Tall fleabane	D'Entrecasteaux NP	Monitor

Species	Common Name	Location	Local Management
*Cuscuta campestris**	Golden dodder	Lower Warren River (may not be in park)	Control, if possible eradicate
Erica baccans	Berry flower heath	Shannon River	Monitor
Eriobotrya japonica	Loquat	Shannon Townsite and scattered populations usually near carparks	Eradicate
Eucalyptus globulus	Tasmanian blue gum	Shannon Townsite	Harvest
Eucalyptus saligna	Sydney blue gum	Shannon Townsite	Harvest
Gladiolus sp.	Gladioli	Scattered on roadsides, Windy Harbour Road	Control, if possible eradicate
Lolium perenne	Perennial rye grass	D'Entrecasteaux NP	Monitor
Lonicera sp.	Honeysuckle	Shannon Townsite	Monitor
Lotus suaveolens	Hairy birdsfoot trefoil	D'Entrecasteaux NP	Monitor
Mentha pulegium	Pennyroyal	Malimup track	Control, if possible eradicate
Narcissus sp.	Daffodil	Shannon Townsite	Monitor
Oxalis corniculata	Yellow wood sorrel	D'Entrecasteaux NP	Monitor
Pinus canariensis	Canary Island pine	Shannon Townsite	Monitor
Plantago lanceolata	Ribwort plantain	Shannon NP, D'Entrecasteaux NP	Monitor
Populus alba	White poplar	Shannon Townsite	Control
Populus nigra var. italica	Black poplar	Shannon Townsite	Control
*Rubus fruticosus**+	Blackberry	Warren River	Control if possible, eradicate
Stellaria media	Chickweed	D'Entrecasteaux NP	Monitor
Tropaeolum majus	Nasturtium	Scattered, not common	Monitor
Vinca major	Blue periwinkle	Shannon Townsite	Control
Unrated as of 1999 (9)			
Bartsia trixago	White bartsia	D'Entrecasteaux NP	Monitor
Cotoneaster sp.	Cotoneaster	Shannon Townsite	Monitor
Dischisma arenarium	-	D'Entrecasteaux NP	Monitor
Foeniculum vulgare	Fennel	Shannon Townsite	Control
Hedra helix	Ivy	Shannon Townsite	Monitor
Kunzea sulphurea	-	Shannon NP, D'Entrecasteaux NP	Monitor
Lophostemon confertus	Brush box	Shannon Townsite	Monitor
Romulea rosea	Guildford grass	Shannon Townsite and various locations	Monitor /control/eradicate isolated/new populations
Senecio elegans	Ragwort	Scattered along coast, not widespread	Eradicate
Various (6+)			
-	Annual grasses	Former grazing leases	Control/monitor
Cirsium sp. (Moderate to Low)	Thistle	Throughout parks	Control/monitor
Oxalis sp. (Mild to Unrated)	Woodsorrel	Scattered at disturbed sites, especially old camps, settlements	Monitor
Rosa sp (Unrated to Low)	Roses	Shannon Townsite	Monitor
Rumex sp (High to Unrated)	Docks	Scattered at disturbed sites, especially old camps, settlements	Control/monitor
Watsonia sp. (High to Low)	Watsonia	Shannon Townsite	Control

Species	Common Name	Location	Local Management
Not Listed (13)			
Acaena ovina	Bidgee widgee	Around huts used by graziers	Control
Arauicaria exelsa	Norfolk Island pine	Shannon Townsite	Monitor
Brachychiton acerifolium	Flame tree	Shannon Townsite	Monitor
Cryptomeria japonica	Japanese cedar	Shannon Townsite	Monitor
Echium plantagineum	Paterson's curse	D'Entrecasteaux NP	Monitor
Eucalyptus muelleriana	Yellow stringybark	Shannon NP	Harvest
Eucalyptus seiberi	Silvertop ash	Shannon Townsite	Monitor
Fuscia sp	Fuscia	Shannon Townsite	Monitor
Genista monpessulana	Cape broom	Shannon Townsite	Control, if possible eradicate
Impatiens sodenii	Balsam	Chudalup	Eradicate
Mulus sp.	Apples	Shannon Townsite	Monitor
Pinus illiki	Southern pine	Shannon Townsite	Monitor
Quercus sp	Oak	Shannon Townsite	Monitor

* Declared species under the Agriculture and Related Resources Protection Act (as of 14 December 2000).
\+ Weed of National Significance' (ARMCANZ and ANZECC 2000).

APPENDIX 9 – KEY PRINCIPLES OF FIRE MANAGEMENT

Principle 1
The vegetation and climate of most parts of Western Australia make it highly prone to bushfire. Fire should be regarded as an environmental factor that has and will continue to influence the nature of Western Australian landscapes and is integral to land management.

Principle 2
Species and communities vary in their adaptations to, and reliance on, fire. Knowledge of the temporal and spatial scales of fires in relation to the life histories of organisms or communities involved underpins the use of fire in natural resource management.

Principle 3
Following fire, environmental factors such as landform, topography and species' life history attributes, and random events such as climatic events, often drive ecosystems towards a new transient state with respect to species composition and structure. This may preclude the identification of changes specifically attributable to fire.

Principle 4
Fire management is required for four primary reasons, which are not necessarily mutually exclusive: a) to protect and conserve the biota, b) to reduce the occurrence of large, damaging wildfires, c) to manage and regenerate productive vegetation and c) to minimise the potential for damage to life, property and natural resource values. The biological impact of a single fire event and the rate of recovery are directly proportional to the intensity and size of the fire.

Principle 5
Fire management should be precautionary and consider both ecological and protection objectives in order to optimise outcomes.

Principle 6
Fire diversity promotes biodiversity. An interlocking mosaic of patches of vegetation representing a range of fire frequencies, intervals, seasons, intensities and scales need to be incorporated into ecologically-based fire regimes if they are to optimise the conservation of biodiversity.

Principle 7
Avoid applying the same fire regime over large areas for long periods of time and avoid seral and structural homogenisation by not treating large areas with extreme regimes such as very frequent or very infrequent fire intervals.

Principle 8
The scale, or grain-size, of the mosaic should a) enable natal dispersal b) optimise boundary habitat (interface between two or more seral states) and c) optimise connectivity (ability of fauna to cross).

Principle 9
All available knowledge, including life histories, vital attributes of the flora and fauna and knowledge of fire regimes applied by Aboriginal people should be utilised to develop ecologically-based fire regimes appropriate at a landscape scale and a scale pertinent to the local vegetation complex.

Principle 10
Fire history, vegetation complexes and landscape units should be used to develop known and ideal fire age class distributions.

Principle 11
Wildfire can damage and destroy both conservation and societal values, hence risk management must be based on a systematic and structured approach to identifying and managing the consequences of such an event.

Principle 12
Fire management should adapt to changing community expectations and to new knowledge gained through research, monitoring and experience.

APPENDIX 10 – DRAFT VISITOR MANAGEMENT SETTINGS CRITERIA

Draft Visitor Management Settings in the Parks

	Visitor Management Setting Class				
	Remote-Natural	**Natural**	**Natural - Recreation**	**Recreation**	**Developed**
Principal Purposes	Conservation, low level recreation.	Conservation, low level recreation.	Conservation, low to medium level recreation, limited resource use.	Conservation, medium level recreation, education and interpretation, some resource use.	High level recreation, education and interpretation, conservation, multiple-use.
Description	Natural areas with minimal evidence of modern human activity. Large, remote areas (8000 ha in temperate areas).	Natural areas with minimal evidence of modern human activity. No size criteria.	Predominantly natural areas, with some disturbance and modern human activity apparent at specific sites.	Mostly natural areas, but with disturbance and modern human activity apparent at some sites.	Concentrated areas of modified environment but with natural or rural background. Human activity conspicuous.
Access Access standards and type of transport used for visitors, resource users and protected area managers	Mechanised access in emergency situations only. Walking access is via natural routes formed principally by human use (AS Walking Track class 5 and 6).	Mechanised access in emergency situations only. Walking access is via natural routes formed to a minimum standard (AS Walking Track class 4 to 5).	Public mechanical access on unsealed 4WD tracks. Limited motor boat and commercial horseriding access in designated areas. Formed walk trails (AS Walking Track class 4).	Areas open to 2WD vehicles, motorbikes and motorised boats, with moderate usage levels and defined access limits. Well-built walking trails with direction signs (AS Walking Track class 2 to 4).	Areas are open to public vehicles or motorised boats, with busy usage and defined access limits. Well-built, signposted walking trails may be provided, or occur in adjoining areas (AS Walking Track class 1 and 2).
Site Modification Extent, type and design of infrastructure, facilities, amenities and the style of accommodation provided	No site modification and no facilities or structures except for reasons of visitor safety, resource protection and/or management operations. Campsites are not defined ('Wild Camping').	No site modification and no facilities or structures except for reasons of visitor safety, resource protection and/or management operations. Trail markers may be used. Campsites are not defined ('Wild Camping').	Minor modification of specific sites. Basic facilities such as toilets may be provided in specific locations. 'Basic Campsites' and 'Beach Camping' may be provided.	Modification of specific sites. Low-key facilities such as simple car parks, toilets, shelters and picnic areas may be present. 'Camping Areas', 'Basic Campsites' or 'Beach Camping' may be provided.	Modified site, with often a range of facilities. Accommodation facilities, picnic areas, visitor centres and lookouts may be present. 'Camping Grounds' and 'Camping Areas' may be provided.

	Visitor Management Setting Class				
	Remote-Natural	**Natural**	**Natural - Recreation**	**Recreation**	**Developed**
Probable Social Interaction Density of users and degree of social interaction and opportunities for solitude	Interaction between users is minimal, with usually less than two other groups encountered during a day, and no other groups within sight or sound at camp sites. Maximum group size of about six to eight people.	Little interaction between users, with usually less than about four to six other groups encountered during a day, and usually no more than about two other groups within sight or sound at camp sites. Group size approximately 8-12 people.	Moderate interaction between users, with encounters with several other groups likely along access routes and at camp sites. Group size approximately 12-15 people.	High level of contact and interaction with other users on roads and in camping and picnic areas, moderate interaction on walking tracks. Groups of more than 15 people may be expected, depending on location.	High level of contact and frequent interaction with many other groups. Groups may exceed 20 people.
Probable Recreation Experiences	Opportunities for isolation, independence, closeness to nature, tranquillity and self-reliance through the application of outdoor skills in an environment that offers a high degree of challenge.	Opportunities for isolation, independence, closeness to nature, tranquillity and self-reliance through the application of outdoor skills in an environment that offers a high degree of challenge.	Opportunities for closeness to nature, tranquillity and self-reliance through the application of outdoor skills in an environment that offers a moderate degree of challenge.	Opportunities include closeness to nature and nature appreciation. Moderate levels of social contact and some opportunity to experience tranquillity.	Opportunities for nature appreciation, and for social interaction. Facilities often support presentation of nature or access to nature-based opportunities in nearby areas.
Degree of Self-Reliance Level of support services provided	Visitors must be totally self-reliant as support services are inappropriate and are not provided. Commercial tourism and recreation operators not permitted.	Visitors must be totally self-reliant, as support services are inappropriate and are minimal or non-existent.	Visitors must be largely self-reliant as basic support services are provided in specific locations only.	Self-reliance requirements are generally low where facilities are provided, but outdoor skills will be important in areas away from roads and tracks.	Low level of self-reliance due to high level of support services and facilities present.
Style of Visitor Management Level of on-site management, site constraints and regulations	On-site visitor management is very low with controls primarily off site. All interpretation is off-site. No trail information in brochures. Boundary signage only. Very infrequent ranger presence.	On-site regimentation is low with controls primarily off site. Generally boundary signs only. Infrequent ranger presence.	Low on-site regimentation. Walking trails and campsites may be defined. Most interpretation is off-site. Along trails and at trail campsites there may be basic markers and signage with minimal management messages. Infrequent ranger presence.	Moderate on-site regimentation, including some signs and barriers. Facilities may be common and clustered. Track signs may include interpretation. Brochures and track guides often available. May be frequent ranger presence.	A high degree of on-site visitor management, including the use of physical barriers to constrain movement of pedestrians and vehicles/boats. Well-developed structures. There may be considerable interpretive signage, materials or activities. Frequent ranger presence likely.

Remote-Natural
Pristine natural areas with minimal evidence of modern human activity. Usually large remote areas over 8000 hectares. Walk-in and non-motorised boat access only. Total self reliance is required as no facilities and no interpretative signs or maps are provided.

Remote-Natural areas may also have 'wilderness' status. A statutory system applied under section 62 of the Conservation and Land Management Act will allow for enforceable regulations in these 'wilderness' areas.

Natural
Predominantly natural areas, with only slight disturbance. Inconspicuous evidence of modern human activity in small limited areas. Walk-in and non-motorised boat access only. Self reliance is very high as no facilities and limited interpretative signs or maps are provided.

Natural-Recreation
Predominantly natural areas, with some disturbance and modern human activity apparent at specific sites. Four-wheel drive, some unsealed two-wheel drive, motor bike, motor boat access along designated tracks and waters subject to environmental considerations. Moderate self reliance required with the possibility of some interpretative signs or maps, toilets, car parks and camping areas being provided.

Recreation
Still a natural setting, but with disturbance and modern activity more apparent at some sites. Two-wheel drive, motor bike and motor boat access along unsealed or sealed roads and designated tracks and waters subject to environmental considerations. More of a ranger/management presence may be expected with the possibility of interpretative signs or maps, toilets, car parks and basic shelters being provided.

Developed
Modified immediate environment but with natural or rural background. Human activity conspicuous. Usually small areas within the protected area. Two-wheel drive, motor bike and motor boat access along sealed roads and designated tracks and waters subject to environmental considerations. A high level of ranger/management presence may be expected with the possibility of a range of interpretative signs or maps, visitor centres, toilets, car parks, built accommodation, larger campgrounds and caravan parks being provided.

APPENDIX 11 – VEHICLE ACCESS STRATEGY

Introduction

As access is quite restricted and undeveloped in both parks, they display qualities of remoteness and wildness (see Sections 25 Recreational Opportunities and 26 Visitor Access). These qualities are highly valued by visitors and the community. Many of the vehicle tracks in the parks, particularly those in D'Entrecasteaux National Park, are constructed through sensitive landforms, which are infected by or susceptible to *Phytophthora*, are seasonally inundated, easily erodable, damage important habitats and/or cross Aboriginal sites (see Sections 15 Soil and Catchment Protection, 21 Diseases and 23 Indigenous Heritage).

Vehicle Access Strategy

The type of access provided affects the level and type of use of an area. A variety of access has been planned for the parks on the continuum from walking to sealed two-wheel drive vehicle access (Map 10 Public Access – Vehicle and Boat and Map 11 Public Access – Walk Trails). This appendix details the roads and tracks that will remain open for public or management vehicle access. Rationale for this strategy is available from the Pemberton District Office.

Where discrepancy exists to the nomenclature of the various roads and tracks, only those shown in Map 10 Public Access – Vehicle and Boat will remain open to the public. Any roads or tracks not shown on Map 10 Public Access – Vehicle and Boat will not be available for use by the general public. Other types of access such as walking, boating and horseriding are discussed in sections 26 Visitor Access, 27 Recreational Use – Active Recreational Use in the Parks and 28 Commercial Tourism Operations.

Where vehicle access is indicated to remain, one good track/road to end point destinations will be provided rather than multiple access roads and tracks. Before upgrading or improving access, planning and funding must also be available to establish end points facilities that are able to cope with increased use.

Proposed Vehicle Access Strategy

Track	**1987 Management Plan$^{\Delta}$**	**Proposed Management and Comments$^{\nabla}$**
Donnelly District – D'Entrecasteaux National Park West of Windy Harbour Road		
Black Point Road (part local authority road)	Close	Open 4wd – seasonal
Wapet Track	Open – upgrade to 2wd	Open 4wd – goes through private property
270 Degrees Track	Close*	Close – management access
Jasper Beach Track	Open – upgrade to 2wd	Open 4wd (mostly in grazing lease)
Jasper Beach	Open 4wd	Open 4wd
Scott Road (Shire road)	Open 2wd	Open 4wd (may have to be seasonal if no bridge)
Lake Jasper Road	Open 4wd	Open 4wd (dependent on proposed mine)
Woodaburrup Road	Close* (not sure whether this was considered as a 'various unnamed track')	Open 4wd
Jangardup Road	Open 2wd	Open part 2wd unsealed and part 4wd (dependent on proposed mine)
Schultz Track	Fire access track	Close

Track	1987 Management Plan[Δ]	Proposed Management and Comments[∇]
Quitjup Track	Close*	Closed
Jasper East fire line	Fire access track	Close – management access
Twin Karris Track	Close*	Open 4wd – current grazing lease to 2015
Pneumonia Road (local authority road)	Open 4wd	Open 4wd – dependent on Scott Road bridge
Boat Landing Road	Open	Open 2wd unsealed
Bolghinup Track	Close*	Closed – management access
Dunes Road	Close*	Closed – management access
Tracks (2) from Bolghinup Track to Charley Road	Close*	Close
Silver Mount to the beach	Close*	Close
Extension off Palm Road	Close*	Close – management access
Landslide Road	Close*	Close – management access only, possible permit access
Yeagarup Track	Open	Open 4wd – need some strategy in case of dune closure.
Oilwell Track	Close*	Restricted (permit) access only
Beaches from Donnelly River to Malimup	Open 4wd	Open 4wd – may need seasonal closures in areas due to breeding birds
Warren Beach Track	Open – realign	Open 4wd – passes through some private property
Tracks at mouth of the Warren e.g. to hut	Close*	Close when huts removed
Tracks which go into Meerup Dunes from private property and track to the west	Close*	Closed – management access only
Tracks off Ladhams Road	Close*	Close
Summertime Track	Open 2wd	Open 4wd – seasonal closure
Wheatley Coast Road – Doggerup Track	Close*	Closed
Tracks to Lake Samuel and Doggerup Lake	Close*	Closed
Various tracks off Windy Harbour Road to lakes and waterholes	Close*	Closed
Sandy Peak Road	--	As per results of Department of Environment process
Salmon Beach Road	Open 2wd	Open 2wd – progressively seal (Main Roads WA grants)
Lighthouse Road	Open 2wd but relocate	Open 2wd – has been relocated, now called D'Entrecasteaux Drive. Progressively seal (Main Roads WA grants)
Track to Chimneys	Close*	Open 2wd – now part of D'Entrecasteaux Drive
Donnelly District – D'Entrecasteaux National Park East of Windy Harbour Road		
Lake Florence Track	Close*	Close
Tragedy Track	Open	Close
Blackwater Track	Close	Closed
Beaches from Windy Harbour to West Cliff Point	Open	Open 4wd
Gardner Track	Close*	Open 4wd
Lower Gardner Road	Close	Close – management access only
Multiple tracks off Lower Gardner Road	Close*	Close
Lake Road	Close*	Close – management access only
Pingerup Road	Close	Closed – management access only
Laws Track	Close*	Close – management access only
Florence Road	Close*	Close
Moores Track (to Coodamurrup Beach)	Open	Open 4wd
Maringup Road	Close*	Close
Deeside Coast Road south of Chesapeake Road	--	Close and relocate road reserve to Moores Track, Fish Creek Road to gain access to Loc. 5273
Fish Creek Track	Open	Open 4wd – possibly relocate some sections
Cut Off Track from Moores Hut to Fish Creek	Close*	Open 4wd
Track from Muirs block to the Shannon River	Close*	Close
Hester Track	Close*	Open 4wd – goes through private property
Track from Coodamurrup Beach to West Cliff	Close*	Open 4wd – relocate

Track	1987 Management Plan[Δ]	Proposed Management and Comments[∇]
Point All tracks east of West Cliff Point and west of Broke Inlet	Close	Rationalise to one open track 4wd – possible permit entry or seasonal closure
Fire boundary south of Chesapeake Road to Broke Inlet	Close*	Close
Tracks from Moores Hut toward Gardner River (near the beach)	Close	Close
Donnelly District – Shannon National Park		
Deeside Coast Road north of Chesapeake Road (part known as the Great Forest Trees Drive)	Open	Open 2wd unsealed
Creekbend Road (part known as the Great Forest Trees Drive)	Close*	Open 2wd unsealed
Curtin Road (part of the Great Forest Trees Drive)	Open	Open 2wd unsealed
Strachan Road	Open	Open 2wd unsealed
Upper Shannon Road (part of the Great Forest Trees Drive)	Open	Open 2wd unsealed
Lower Shannon Road (part of the Great Forest Trees Drive)	Open	Open 2wd unsealed
Bevan Road	Open	Open 2wd unsealed
Dog Road north of South West Highway	Close	Close
Dog Road between South West Highway and Nelson Road	Close	Open 2wd unsealed
Dog Road south of Nelson Road	Close	Close --management access only
Jeffrey Road	Close*	Open
Preston Road (log haulage road)	Open but review	Open 2wd unsealed but try to negotiate alternative routes
Whimpy Road	Close*	Closed – management access only
Marron Road	Close	Closed – management access only
Other various tracks in Shannon National Park north of Nelson Road	Close*	Review hard surfaced roads and if no environmental or other issues then open as 2wd unsealed to public if required
Nelson Road (log haulage road – unused)	Open but review	Open 2wd unsealed but try to negotiate alternative routes
Frankland District – D'Entrecasteaux National Park		
Pingerup Road	Close	Close – management access (same as in Donnelly District)
Cliffy Head tracks	Close	Retain one access to Cliffy Head. Close and rehabilitate other tracks.
Fishermans Track (between Broke Inlet and Mandalay Beach Road)	Close	Open 4wd – seasonal closure and possible permit access
Springbreak Road	Close	Open – seasonal closure
Banksia Camp Track	Open – realign and upgrade to 2wd	Open 4wd
Fishermans Track shortcut	Close*	Close
Mandalay Beach Road	Open unsealed 2wd	Open unsealed 2wd
Track to Tumbledowns (bottletops)	Close*	Close
Track to Icypoles	Close*	Close
Inlet River Road	Close*	Close
Long Point Road	Close*	Open 4wd
Woolbales Road	Close*	Close – management access
North/South track from Banksia Camp to Fisherman Track	Close*	Open
North/South track from Fisherman Track to Broke Inlet	Close*	Close – management access

[Δ] Taken from either Map 15 Recreation Opportunities, Table 8 Rationale Behind Road Closures and Realignments or from the text of the 1987 Management Plan.
[∇]All roads/tracks not shaded will be open to the public on a permanent or seasonal/permit basis and can be located on Map 10 Public Access – Vehicle and Boat.
* Considered as "various unnamed tracks" in the 1987 Management Plan to be closed due to either duplication, seasonally inundated, disease impacts, erosion potential, landscape impacts or conservation values.

APPENDIX 12 – CAMPING AREA DEFINITIONS

Camping Ground

Camping grounds will be accessible by two-wheel drive vehicle. They will have a high level of facilities (see Table below with Classification and Definitions of Camping Areas). They may have built accommodation, group areas and shelters and will generally provide sites for caravans and campervans. Built accommodation may be provided by way of commercial concession. Individual campsites will be defined. Camping grounds will cater for up to 150 people. Camping grounds may be provided in developed visitor management settings only.

Camping Area

Camping areas will be accessed by vehicle (not necessarily two-wheel drive) and have a relatively high level of facilities, for example fire rings, tables, toilets, water and defined individual campsites. Shelters or huts may also be provided. They may cater for campervans and caravans. Group areas and facilities may also be provided. They may have facilities for up to 80 people. Fires will be permitted only in fire rings provided and wood may be provided to the site – if not, all wood must be collected from outside the parks. Rubbish collection may be provided. Campground hosts may be used at peak times. Camping areas may be provided in more developed settings only.

Basic Campsites

Basic campsites may be accessed by foot and/or vehicle. They will cater for group sizes of up to four vehicles (16 people). Some sites may only cater for one vehicle. They will cater for tents but not campervans or caravans. The extent of the campsite will be defined however individual sites will generally not. The level of facilities at these sites may vary although generally only a fire ring will be provided. Fires may be permitted in fire rings however all firewood must be collected from outside the parks. Fires may be prohibited in some areas. Toilets may be provided depending on the size and popularity of the site. There will be no rubbish collection and minimum impact camping techniques will be encouraged. Basic Campsites may be provided in more natural than developed settings.

Beach Camping

Beach camping is confined to the area between the high and low water marks. No facilities will be provided. Access may be by vehicle or foot. Camping can occur at any time in this area provided that it is safe to do so. Generally beach camping will only be allowed as an overnight stay. Campfires will be allowed, however they must be contained in a drum and all firewood must be gathered from outside the park. All coals must be removed. Beach camping group sizes will be limited to four vehicles. No beach camping will be allowed in the primary dune area. Beach camping will be permitted in the more natural than developed settings.

Wild (Remote) Camping

Wild camping will only be allowed in remote areas accessed by foot. No sites will be designated for wild camping and minimum impact camping techniques must be practiced at all times. Wild camping group sizes generally will be limited to 10 people. No campfires will be permitted. Wild camping will be permitted in more remote settings and other settings if the need arises.

Classification and Definitions of Camping Areas

	Camping Area Classification				
	Wild Camping	**Beach Camping**	**Basic Campsite**	**Camping Area**	**Camping Ground**
Visitor Management Settings					
Developed	Optional	Optional	Optional	Yes	Yes
Recreation	Optional	Yes	Yes	Yes	No
Natural-Recreation	Optional	Yes	Yes	No	No
Natural	Yes	No	No	No	No
Remote-Natural	Yes	No	No	No	No
Facilities					
Defined campsites	No	No	Optional	Yes	Yes
Vehicle access to site	No	Optional	Optional	Yes	Yes – 2WD
Resident manager	No	No	No	No	Optional
Campground host (peak)	No	No	No	Optional	Optional
Powered sites	No	No	No	No	Optional
Water – reticulated	No	No	No	No	Optional
Water – other e.g. tank, stream, dam	No	No	No	Yes	Yes
Fuel stove only	Yes	No	No	No	No
Fires allowed in container – BYO wood	No	Yes	No	No	No
BBQs or fire rings – BYO wood	No	No	Optional	Optional	Optional
Firewood supplied	No	No	Optional	Optional	Optional
BBQs – gas or electric	No	No	No	Optional	Yes
Tables	No	No	Optional	Yes	Yes
Group shelters/ accommodation and areas	No	No	No	Optional	Yes
Huts for groups (family) – Recreation	No	No	Optional	Optional	Optional
Huts for groups (family) – Natural-Recreation	No	No	No	Optional	Optional
Built accommodation – commercial concession	No	No	No	Optional Recreation – basic only	Optional
Showers – hot and/or cold	No	No	No	Optional	Optional
Toilets – septic/sewer	No	No	No	Optional	Yes
Toilets – composting	No	No	Optional	Yes or septic/sewer	Optional
Toilets – pit	No	No	Optional	Optional	No
Rubbish collection	No	No	No	Optional	Yes
Visitor centre	No	No	No	No	Optional
Visitor information	No	No	Optional	Yes	Yes
Camping fees payable	Optional*	Optional*	Yes	Yes	Yes
Site limit	10 people	4 vehicles (16 people)	4 vehicles (16 people)	80 people	150 people
Kiosk or shop	No	No	No	Optional	Optional
Sense of	Remoteness	Adventure	Adventure	Comfort	Comfort and security
Social interaction	Low	Low to moderate	Low to moderate	Moderate to high	High

* Camping fees will not generally be charged for wild or beach camping unless management inputs warrant an extra charge.

Legend
Yes = facility or service should be provided
No = facility or service will not be provided
Optional = facility or service may be provided but is not essential

APPENDIX 13 – GENERAL LICENCE CONDITIONS FOR HORSERIDING OPERATIONS

The licence holder will develop an evacuation and emergency plan to be developed and approved by the District Manager.

The licence holder will assist the Department with monitoring and research programs related to his activities in the D'Entrecasteaux National Park and the compilation of an annual report on the operation.

The licence holder will submit to the District Manager an annual audited statement showing the number of clients that have visited the park as part of the licence holders operation.

The licence holder will keep a logbook showing the date, number of clients and areas visited in the park.

The licence holder will pay a quarterly fee in arrears calculated on dollar value per person per trip for each client undertaking the activity.

The licence holder will complete quarterly log sheets showing the number of passengers for each quarter and submit them along with the payment on the dates specified above to the Department's Pemberton District office.

The licence holder is only permitted to use areas of the park as set out in the management plan and in accordance with Departmental policy. These areas are to be shown on a plan.

Proposed tethering, yarding and camping sites are to be inspected by a Department of Conservation and Land Management Officer and approved by the District Manager before being used by the licence holder.

The design and location of tethering and yarding facilities are to be approved by the District Manager and are to be constructed by the licence holder. Should the licence be terminated the licence holder will have to remove these facilities at his expense.

Access points onto mobile dunes, sand blows and the beach are to be selected carefully to minimise damage to colonising vegetation and approved by the District Manager.

All rock outcrops are to be avoided. Inundated areas are to be avoided; however access may be approved by the District Manager when they dry out.

The licence holder will be required to operate in accordance with the Conservation and Land Management Act, the Bushfires Act and National Park Regulations. The licence will be suspended if any breach of these Acts, Regulations or licence conditions occurs.

For seven days prior to entering the park and while horses are in the park only weed free feed is to be given to the horses.

The District Manager at Pemberton is to be advised on each occasion the licence holder will be operating in the park.

All vehicle access is to be confined to public access tracks. This does not include management access only tracks.

If any of the conditions within this licence are not met by the licence holder to the satisfaction of the District Manager, the licence holder will be advised in writing and if the unsatisfactory situation has not been rectified to the satisfaction of the District Manager within one month, the licence will be suspended or cancelled.

APPENDIX 14 – COMMERCIAL APIARY SITE ASSESSMENT

Criteria and Approach for Assessing Commercial Apiary Sites within the Planning Area

	Suitable	**Suitable but Conditional**	**Highly Constrained**
Approach	Maintain or increase numbers of apiary sites in these areas. Standard permit conditions would apply	Maintain or increase numbers of apiary sites in these areas. Additional permit conditions would apply such as increased hygiene control and seasonal, site location and access restrictions. Research and monitoring at these sites may be required	Close, and relocate where possible, any current apiary sites in these areas. Prevent any new apiary sites in these areas
Environmental Criteria			
1. Threatened and other conservation significant flora within a 2 km radius	No rare, priority 1 or 2 flora present that are visited by honey bees	Rare, priority 1 or 2 flora present that are visited by honey bees and impacts are seasonal or undetermined[1]	Rare, priority 1 or 2 flora present that are visited by honey bees and impact is predicted to be year-round[1]
		Rare, priority 1 or 2 flora present that are visited by honey bees but no predicted impact[2]	-
	No priority 3 or 4, endemic, disjunct or relictual flora present that are visited by honey bees	Priority 3 or 4, endemic, disjunct or relictual flora that are visited by honey bees present[3]	
2. Significant communities within a 2 km radius	No threatened ecological communities (TECs)	TEC present and impacts are seasonal[1]	A TEC present and impact is predicted to be year-round[1]
		TEC present but no predicted impact[2]	
3. Threatened fauna and other significant habitats (i.e. habitats for fauna adversely impacted by honey bees) within a 2 km radius	No old growth forest or other known habitat of hollow nesting threatened fauna present	Old growth forest or other known habitat of hollow nesting threatened fauna is present[4]	
	No fauna watering points at fauna breeding centres and reintroduction sites present	-	Fauna watering point at fauna breeding centres and reintroduction sites present[5]
	No other significant habitats or communities present	Other significant habitats or communities are present that are seasonally impacted[6]	Other significant habitats or communities are present that are impacted year-round

	Suitable	Suitable but Conditional	Highly Constrained
Management Criteria			
1. Previous use	A conservation reserve that has authorised historic use of commercial beekeeping	-	A conservation reserve that has no authorised historic use of commercial beekeeping
2. Access	Public or suitable management vehicle only access is available	-	There is no public or suitable management vehicle only access or current access is being closed
	No gazetted wilderness present	'Candidate' wilderness only	Gazetted wilderness present
3. Recreation sites or dwellings within a 500 m radius	No built accommodation/ camping/day use site present	-	Built accommodation/ camping/day use site present
4. Tracks and trails within a 200 m radius	No walk trail present (Class 1 or 2)	Walk trail present but only used infrequently or proposed walk trail (Class 1 or 2)	Walk trail present and used frequently (Class 1 or 2)
5. Disease control	Low risk of *P. cinnamomi* spread	*P. cinnamomi* present or area identified as protectable from *P. cinnamomi* spread but there is an existing site[7]	Area identified as protectable from *P. cinnamomi* spread are there are no existing sites[7]
6. Apiary sites within 3 km radius	No other apiary sites present		Apiary site present
7. Feral honey bee management within 2 km	-	Feral honey bee control program in place[8]	-
8. Weed management within a 2 km radius	No high or moderate environmental weeds present that are considered to have an increased seedset due to honey bees	High or moderate rated environmental weeds that are considered to have an increased seed set due to honey bees but flower seasonally[9]	High or moderate rated environmental weeds that are considered to have an increased seed set due to honey bees and flower year-round[7]
9. Other management concerns	No impact on Departmental operations or the requirements of other authorities controlling Crown land or Government reserves	An impact on Departmental operations or the requirements of other authorities controlling Crown land or Government reserves that can be managed	An impact on Departmental operations or the requirements of other authorities controlling Crown land or Government reserves that can not be managed

Notes

[1] Impacts are seasonal or undetermined (see Guidance for Additional Conditions – A). Where impacts are predicted to be year-round, the area will be considered to be highly constrained.

[2] Visited by honey bees, but no predicted impact. These flora and TECs are still of high conservation significance and a precautionary approach is warranted (see Guidance for Additional Conditions – B).

[3] As with note 2 above, priority 3 or 4, endemic, disjunct and relictual flora are of conservation significance and a precautionary approach is warranted. In addition, although populations of these species may be widespread and impacts on these populations may not threaten the existence of the species, there still may be some populations that should be afforded higher protection (e.g. the population may be (1) at the species' range end, (2) the largest viable population or (3) genetically significant) (see Guidance for Additional Conditions – C).

[4] If there is a current apiary site and there are feral honey bees present, then use can continue year-round. However, old growth forest and other significant habitats for hollow nesting fauna will be targeted for feral honey bee control (see Additional Conditions – D). For new sites within old growth forest see Guidance for Additional Conditions – E.

[5] Native fauna breeding centres and fauna reintroduction sites often have watering points. Commercial beekeeping in the vicinity may disturb the animals from drinking.

[6] No other significant habitat or community likely to be impacted by honey bees has been identified during the planning process however, they may be identified during the life of this management plan

Other significant habitats may be identified due to:

- new research/information;
- changes in threat status of fauna; and/or
- changes in resource availability – for example, directly after a fire, when competition between species such as honey possums and honey bees would be at its highest.

[7] Standard disease control conditions will apply. The soil dryness index may be used to restrict vehicle access to the sites. There should be no new sites established in areas that are protectable from *P. cinnamomi* (or designated Disease Risk Areas).

[8] There may need to be seasonal restrictions (see Guidance for Additional Conditions – D) when a feral honey bee control program is in place.

[9] High or moderate environmental weeds are a high priority for the Department to control (see Guidance for Additional Conditions – F).

Guidance for Additional Conditions

A. Seasonal restriction based on flowering period of flora. Site must be available for a minimum of 1 month. Placement and number of hives also may be restricted.

B. Placement (at least 100 metres from populations) and number of hives may be restricted. Monitoring of representative samples for health of adult populations and seedling recruitment or TEC to ensure there is no decline due to apiary management, taking into account other factors such as drought, disease, fire, environmental weeds and other disturbances. If unacceptable impacts are shown or observed later, then treatment will be the same as A.

C. There may be a need to review populations within the planning area to determine whether these populations are significant to the conservation of the species. If deemed significant then treatment will be the same as A.

D. When a feral honey bee program is in place, then use of the site will be restricted during periods when the queen is may swarm, such as Spring or a suitable method to restrict the queen should be implemented.

E. For new sites in old growth forest where there are no feral honey bees present, a condition may be that if during the period of the permit, feral honey bee hives are located within 2 kilometres of the site, the site will be temporarily restricted until the feral honey bees are controlled.

F. Seasonal restriction based on flowering period of environmental weed however, only until the environmental weed has been successfully eradicated.

Assessment of Current Apiary Sites within the Planning Area

Apiary sites within the planning area were assessed against the environmental and management criteria and categorised as suitable, suitable but conditional or highly constrained. Information for some of the criteria, such as disease risk and weed management were not available at the time of the assessment but should be collected during the lifetime of the management plan. The table below shows the result of the assessment and indicates what criteria require additional conditions. Some of these additional conditions have been included as guidance but should be seen as a minimum set.

	Environmental Criteria Assessment								**Management Criteria Assessment**							Additional Conditions
Apiary Site No.	Rare & Priority 1, 2 Flora Visited			Other Cons. Flora Visited	TEC			Fauna Habitat (e.g. Old Growth)	Wilderness		Rec Sites	Class 1 or 2 Walk Trail	Disease Risk	Weed Management		
	Impact Year-Round	Impact Seas-onal	No Predicted Impact		Impact Year-Round	Impact Seas-onal	No Predicted Impact		Cand-idate	Gaze-tted				Impact Seas-onal	Impact Year-Round	
Suitable but Conditional (37)																
2872								X								D
245				X				X								C, D
4031								X								D
5060		X		X				X								A, C, D
5223				X				X	X							C, D
5080								X	X							D
5300				X				X								C, D
535				X				X								C, D
4239		X		X				X								A, C, D
3471				X				X								C, D
1688				X				X								C, D
5299								X								D
5059				X				X								C, D
1687				X				X								C, D
3227								X								D
965								X								D
2751								X								D
5317								X								D
868								X								D
3945								X								D
5058								X								D
2148								X								D
1421								X								D
1702								X								D
4997								X								D
4424				X				X								C, D
5565				X				X								C, D
4028				X				X								C, D
2147								X								D
2585			X	X				X								B, C, D
4030								X								C, D
1789				X				X								C, D
1143				X				X								C, D
2911								X								D

	Environmental Criteria Assessment								**Management Criteria Assessment**							Additional Conditions
Apiary Site No.	Rare & Priority 1, 2 Flora Visited			Other Cons. Flora Visited	TEC			Fauna Habitat (e.g. Old Growth)	Wilderness		Rec Sites	Class 1 or 2 Walk Trail	Disease Risk	Weed Management		
	Impact Year-Round	Impact Seas-onal	No Predicted Impact		Impact Year-Round	Impact Seas-onal	No Predicted Impact		Cand-idate	Gaze-tted				Impact Seas-onal	Impact Year-Round	
2910								X								D
798				X				X								C, D
797								X								D
Highly Constrained (5)																
5081				X	X			X								NA
5217			X	X	X			X	X							NA
867								X			X					NA
4264			X	X				X				X			X	NA
4029				X				X			X					NA
Sites within 2 km of Planning Area (21)																
5789								X								
2871								X								
3031								X								
5787								X								
334								X								
5761				X				X								C
563				X				X								C
5065																
5763								X								
284				X				X								C
934								X								
4516								X								
5306				X				X								C
3873				X				X								C
573				X				X								C
547								X								
2134								X								
946								X								
5302				X				X								C
3201		X	X	X				X								A, B, C
5950		X	X	X	X			X								A, B, C